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World Multidisciplinary Earth Sciences Symposium 2015

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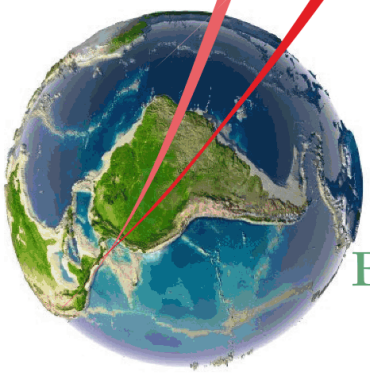
WMESS 2015 Abstract Collection Book

7-11 September, 2015



Prague (Czech Republic)

Eco-friendly Symposium - WMESS

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Preface

This Abstract Collection consists of the abstracts of papers presented in the “World Multidisciplinary Earth Sciences Symposium” in the city of romance Prague (Czech Republic) during 7-11 September 2015. The World Multidisciplinary Earth Sciences Symposium (WMESS) aims to provide a forum for discussion of the latest findings and technologies in different fields of Earth Sciences, to give opportunities for future collaborations. WMESS wants to be a platform for sharing knowledge and experiences in the fields of Earth Sciences, to lead for providing a forum for early career researchers for presentation of their work and discussion of their ideas with experts in different fields of Earth Sciences such as; Tectonics & Structural Geology; Engineering Geology; Geotechnics; Hydro-Hydrogeological Sciences; Natural Hazards; Geomorphology; Geochemistry, Mineralogy, Petrology & Volcanology; Stratigraphy, Sedimentology & Palaeontology; Geophysics & Seismology; Geodesy, Photogrammetry & Cartography; Informatics, Geoinformatics & Remote Sensing; Mining Engineering; Mineral Processing; Blasting & New Technologies; Natural Resources; Environmental Sciences; Energy, Resources & Pollution & the Environment; Environmental Legislation; Biogeosciences; Geological Heritage & Geoparks; Urban Planning; Atmospheric Sciences – Climate; Modelling and Soft Computing Techniques in Earth Sciences; Medical Geology; Occupational Health and Safety.

However the idea of organization of WMESS is quite old, the 1st WMESS was organized this year. WMESS 2015 will be one of the Annual series. However, nowadays there had been many local or international meetings related to Earth Sciences, we decided to organize a traditional style of symposium, friendlier and very fruitful alternative world symposium which is not a festival-like super-large convention, too chaotic and busy to have a chance to discuss something in deeper with other participants.

The main mission of the "World Multidisciplinary Earth Sciences Symposium - WMESS" is to lead to contribute in multidisciplinary studies related with atmosphere, biosphere, hydrosphere, lithosphere and pedosphere of the Earth and interaction of the human with them. As another mission, it provides a forum for this diverse range of studies, which report very latest results and document emerging understanding of the Earth's system and our place in it. The Scientific Committee and Institutional Scientific Partners of WMESS was completed by paying strict attention, and all members were selected from well-known, very much appreciated, productive and representatives of the different countries. We are deeply grateful to the members of the scientific committee and institutional scientific partners (International Association for Engineering Geology & the Environment – **IAEG**, International Union of Soil Sciences – **IUSS**, International Geographical Union – **IGU**, The International Association of Hydrogeologists **– IAH**, Geological Sciences of Italy – **SGI**, Czech Soil Science Society – **CSSS**, Arabian Geosciences Union – **ArabGU**, The Society of Economic Geology of Romania – **SEGR**, World Meteorological Organization – **WMO**, International Medical Geology Association – **IMGA**, Russian Mineralogical Society – **RMS**, University of Petrosani) of WMESS.

We would like to express our sincere gratitude to all 500+ participants of WMESS 2015 from 50+ different countries all over the world for their interests and contributions in WMESS 2015. We wish you enjoy the World Multidisciplinary Earth Sciences Symposium – WMESS 2015 and have a pleasant stay in the city of romance Prague. We hope to see you again during next event WMESS 2016 which will be held in Prague (Czech Republic) approximately in the similar period.

Prof.Dr. Işık YILMAZ
President of WMESS – Chair of WMESS 2015

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(listed in alphabetical order of surname)

Content

Session Title:

Tectonics & Structural Geology

Planetary lithosphere behaviours and the lid tectonic to plate tectonic transition on Planet Earth

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ABSTRACT

The search for exoplanets has stimulated theoretical and experimental studies into the constraints governing planetary lithosphere behaviours. These range through styles of Lid Tectonics expressed by stagnant lids punctured by volcanic events (Mars), episodic lids with regimes alternating between static and mobile (Venus), and Plate Tectonics as seen on present day Earth. The latter only operates under a specific range of thermal, fluid and compositional conditions but may be instigated if planetary size is sufficiently large. The onset of Lid Tectonics on Earth is determined from the palaeomagnetic record since a mobile Earth of multiple continents is recorded by diverse apparent polar wander paths, whilst Lid Tectonics is recorded by conformity of palaeomagnetic poles to a single position. The former is difficult to isolate without extreme data selection whereas the latter is a demanding requirement and therefore easily recognised. In the event, the Precambrian palaeomagnetic database closely conforms to the prediction of Lid Tectonic behaviour over very long intervals of Precambrian time (~2.7-2.2 Ga, 1.5-1.3 Ga and 0.75-0.6 Ga); intervening intervals are characterised by focussed loops compatible with episodes of true polar wander stimulated by disturbances to the planetary figure. The data from the quasi-static intervals yield continental reconstructions showing that the symmetrical, crescentric and hemispheric shape of the Phanerozoic supercontinent Pangaea typifies the way that continental crust has aggregated into supercontinents since Early Archaean times. This evidence also defines variations of continental velocity which are reflected in mobile/orogenic activity, metallogenesis and episodes of global cooling. The predicted palaeogeography also provides a solution to the “Snowball Earth” enigma. Limited signatures of Plate Tectonics appear throughout Proterozoic times but only following break-up of the lid at 0.6-0.55 Ga has it become globally-comprehensive in the familiar style evident during the Phanerozoic Eon. The transition from dominant Lid to dominant Plate Tectonics is shown by multiple environmental, geochemical and isotopic signatures and embraces the Ediacaran and Cambrian biological explosions.

Key words: Planetary lithospheres; lid tectonics; plate tectonics; palaeomagnetism.

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Continental extension and ancient sites of settlements in SW Turkey

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ABSTRACT

Southwestern Turkey constitutes a unique example of extensional tectonics on the continental lithosphere influenced by the convergent plate tectonic configuration of the African and the AegeanAnatolian plates. The interaction between these plates forces the southwestern Aegean-Anatolian block to move to the southwest relative to the Eurasian plate as indicated by GPS and SLR studies. Rates vary up to 35-40mm yr-1. In southwestern Turkey, two fault systems are evident. The first has a NW-SE orientation; the second has a NE-SW orientation. Examples of the first include the Dinar and Sultandağ Faults; examples of the second include the Burdur, Çivril, and Baklan Faults. These faults have notably segmented geometry and separate the Tertiary or older rocks from unconsolidated Plio-Quaternary or younger deposits. They are best exposed in lithologies such as metamorphics and limestones making up the hills. The plainland adjacent to the hills is underlain by Plio-Quaternary lacustrine-fluvial deposits or Quaternary alluvium, of which the thickness ranges from a few tens to several hundreds of meters. The boundary between the hills and the plainland is commonly a site of alluvial fan deposit. These faults were previously considered purely normal faults; however, the fault scarps contain superimposed directions of different slickensides. Strong seismic activity occurs episodically along the fault system. Seismic events such as the October 1, 1995 Dinar (Mw=6.2) and the February 3, 2002 Çay (Mw=6.3) (Afyon) earthquakes, and the May 19, 2011 Simav (Mw=5.7) (Kutahya) earthquake are recent examples that occurred in the area. They have the potential of providing insight into the mode of continental extension there. Preceded by foreshocks, these earthquakes produced surface ruptures observed several km along the NW-trending Dinar and Sultandağ (Akşehir) Faults. En echelon and anastomasing patterns of surface ruptures suggest displacement fields of strike and dip-slip in agreement with a constant slip vector on the underlying NW-trending faults to the WSW. These directions of slip imply interaction of a NE-trending crustal zone of sinistral deformation with the NW-trending zone of extensional faults, and this is reflected in the NNE-oriented distribution of foreshocks to the main events. The continental extensional tectonics have been influential to the development of fertile plainlands within the mountain range, leading to favorable settlement sites of ancient civilizations, such as Dinar (Kelainai-Apameia), Akşehir (Thymbrion), and Isıklı-Çivril (Eumania). On the other hand, this tectonic regime has been an important factor in the subsidence and denudation of several sites of ancient civilizations on the coastal areas of the Aegean Sea, such as Kazıkbağlar (Elaea), Sığacık (Teos), Kuşadası (Pygela), Gümüşlük (Myndos), and Bafa Lake (Heraclea).

Key words: Continental extension; fault interaction; seismicity; ancient settlement sites.

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The Prince Islands (Marmara Sea, Istanbul) and the North Anatolian Fault

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ABSTRACT

The Prince Islands, located 4 km south of the Asian coast of the city of Istanbul in the Marmara Sea, comprise closely spaced nine islands. Except for the larger five, they are small rocky masses above the sea level. A small island 'Vordonisi' which is said to host a monastery during the Byzantine times (ca 850AD) now lies submerged under several meters of water. The islands which are in close proximity, about 6 km, of the North Anatolian Fault (NAF), and the epicentre of the August 1999 (Mw=7.4) Golcuk (Izmit) event is located in a seismically very active area and must have been shaken by strong historical earthquakes such as those of 865,867, 960, 1032,1082, 1334 AD. The submergence of the 'Vordonisi' is therefore an intriguing phenomenon for earthquake geologists. Geological and tectonic features of the larger Prince Islands are subject of this investigation. Sedimentary units exposed in the islands are of Paleozoic age and comprise a range from terrestrial and shallow marine clastics to deep marine units. They are intruded by volcanics and dykes of the Cretaceous volcanism. Complex structures present along the Asian coast of Istanbul are also manifested in the Prince Islands. The sequence is extensively modified by many structural features due to the long paleo-tectonic activity, and neotectonic events linked to the North Anatolian Fault. With this study, younger structural features of the islands are distinguished. Their association is evaluated with regard to the North Anatolian Fault activity. Individual faults associated with the NAF are present. In addition, the faults with vertical movements are considered in respect to morphology of the islands. Thick unindurated colluvial deposits adjacent to these faults are evidence of their activity during the Quaternary and perhaps historical times.

Key words: North Anatolian Fault; Prince Islands; submerged coastal area; strike-slip morphotectonics.

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Major structural features of the Tefenni segment of the Fethiye-Burdur Fault Zone, SW Anatolia, Turkey

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ABSTRACT

The Fethiye-Burdur Fault Zone is one of the major breaks in the south-western Anatolia. The fault zone comprises a set of northeast-southwest trending oblique faults with left lateral strike-slip component and normal faults. It extends north-eastward from the Gulf of Fethiye on the south to Çay-Afyon on the north, a distance of about 300 km. The fault zone is divided into four segments based on their surface-trace geometry; Fethiye, Gölhisar, Tefenni, and Burdur. The NW-SE trending Düğer and Sazak faults separate the Tefenni segment of the fault zone from the adjacent segments. This research outlines the tectonic features of the Tefenni basin combining the data obtained from the detailed geological mapping and neotectonic studies. The Tefenni basin was formed by extension in a region between two strands of the Fethiye-Burdur Fault Zone. The basin is bounded by the Tefenni Fault on the northwest and the Kemer-Akören Faults on the southeast. The study area includes different rock units with characteristic stratigraphical, lithological, and structural features. The Beydağları autochthonous and the Lycian Nappes form the base of the units in the area. The Beydağları autochthonous consists of Mesozoic aged neritic limestone and the Miocene aged clastic sediments and carbonates. The Beydağları autochthonous is tectonically overlain by the Lycian Nappes. They are imbricated and include Jurassic-Cretaceous aged ophiolites and recrystallized limestones and Palaeocene-Eocene aged turbidites. All of these rocks are unconformably overlain by the middle-upper Miocene-lower Quaternary fluviolacustrine sediments. Neogene history of the region begins with the fluvial, middle-upper Miocene Gölhisar Formation composed of conglomerate, sandstone, siltstone, and claystone. It is conformably overlain by the upper Miocene-lower Pliocene Burdur Formation. It consists of limestone, clayey limestone, marl, sandy limestone, siltstone interbedded with thinner beds of coal and passes upward into lenticular beds of conglomerate and sandstone. The upper Pliocene-lower Pleistocene Tefenni Formation is composed of alluvial fan deposits unconformably resting on Burdur Formation and unconformably overlain by recent alluvium. Large scale faults in the study area include NE-SW trending left lateral, normal, and left lateral oblique-normal faults. Beside these, NE-SW, NW-SE, N-S, and E-W trending small scale faults in upper Miocene-lower Quaternary age formations have formed by left lateral, left lateral oblique-normal, and normal slip displacement. These faults represent a left lateral extensional shear strain field in the Tefenni basin.

Key words: Tefenni Basin; Fethiye-Burdur Fault Zone; left lateral oblique normal fault; Southwestern Anatolia.

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Evidence for post magmatic hydrothermal fluids circulation through granites of Nana anorogenic

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ABSTRACT

AThe alkaline complexes of the Cameroon Line are relatively more concentrated in the Tikar plain, its central part. The preliminary results obtained in one of those complexes, the Nana complex, are presented here with particular interest on the role played by post magmatic fluids. The Nana complex consists mainly of plutonic rocks (granite, diorite, gabbro) and less abundant volcanic rocks (basalt, basaltic trachyandesites, trachyandesite, rhyolites), and is then similar to the others. In the detail, the petrographic and geochemical study of the granites suggests that they suffered late to magmatic hydrothermal alteration processes. It is shown in thin sections, under polarizing microscope, by the phenomena of albitization, microclinisation, and the phenomenon of pseudomorphism. Under Scanning Electronic Microscope (SEM), the phenomenon of pseudomorphism is well represented. This is marked by the partial to total substitution of alkali feldspar phenocrystals by abundant micro–flakes of biotite (annite). We interpret the above mineral transformations as magmatic alterations likely caused by hydrothermal and metasomatic fluids. The abundance of some accessory minerals (zircon, magnetite, rutile, monazite, allanite, etc) revealed under SEM probably crystallized during this phase. The large variations range of Zr (181-1070ppm) and Y (36.2-1540ppm) content for SiO_2 content between 74.12-76.89% seem consistent with the above interpretation. These SiO2, Zr and Y contents added to the very low Mg (0-0.1), Ca (0.08 to 0.38) and K/Rb (24.97-40.89), Y/Ho (24-30) Zr/Hf (28.78-47.56) ratio are comparable to those obtained in other massifs displaying similar hydrothermal phenomena such as Strange Lake pluton in Canada, the Great Xing'an massive (Woduhe, Baerzhe) in China.

Key words: Hydrothermal fluids; transformation of feldspar.

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Geomorphologic and paleoseismologic evidence of 1914 and 1971's earthquake activities on the Fethiye-Burdur fault zone, SW-Turkey

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ABSTRACT

The African and Eurasion plates in the eastern Mediterranean region is seperated by the Hellenic arc and Pliny-Strabo trench in the west and Cyprus arc and related fault systems in the east. The NE-trending and left lateral oblique-slip Fethiye-Burdur Fault Zone (FBFZ) bounds the Isparta Angle to the west and is probably the continuation of the Pliny fault zone of the Hellenic arc. Also, the FBFZ is not a single line, but consist of discontinuous northeasternly trending fault segments developed parallel to each other between Gulf of Fethiye and Burdur Lake.Recent geodynamic analysis suggests that the Isparta Angle has very little to no motion relative to Eurasia, in contrast, Central and Western Anatolia moves in a SW-direction about 30 mm/yr. For this reason, the NE-trending en-echalon FBFZ which limits the Western Anatolia to the south has left lateral oblique in character and is exposed for 400 km in the SW-Anatolia. Locally the fault bounds several Plio-Quaternary basins within the FBFZ which are developed between the Gulf of Fethiye and the Burdur region, such as Karamanlı and Burdur Lakes.The 1914, and 1971 eartquakes occurred within the FBFZ, with magnitudes of 7.1 and 6.1, respectively. The epicenter distribution of the last century eartquakes indicates the continuation of the FBFZ under the Aegean Sea to the Rhodos island.In this study, geomorphological and paleoseismological characteristics of the Fethiye-Burdur Fault Zone have been investigated. Approximately 60 km- long left-lateral oblique rupture zone formed during the 1914 and 1971's Burdur eartquakes. The Fethiye-Burdur Fault surface ruptures have been mapped and two trenches were excavated at the Burdur and Yassıgüme sites. In addition, have been recognized the last two major earthquakes to this fault. Magnitute of these paleoeartquakes were greater than M=6 and their occurrence intervals ranged from 2000 AD and 1000AD years for the seismic cycle of FBFZ.The maximum vertical displacement during the 1914 and 1971 earthquakes were 150 cm and 70 cm have been measured in ascending order. On the other hand, in this study have been calculated the minimum vertical tectonic slip-rate of the FBFZ is 10 mm/yr during the Early Pliocene to recent period, according to geomorphological, stratigraphical, archaeological and paleoseismological data.

Key words: Fethiye-Burdur Fault Zone; active fault; earthquake; rupture zone; paleoseismology.

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Rock experiment analysis of radon concentration change in the process of compression and fracture

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ABSTRACT

Establishing a reasonable seismic abnormal mechanism pattern and using theory to guide observation and forecast have been the core and hot issues in study on earthquake forecast all the time. Research on the mechanism of the post-seismic effect helps the understanding of radon earthquake precursory process and anomaly mechanism. To study the mechanism of radon post-seismic effect, the rock samples are compressed to fracture in the laboratory, and the concentration change of radon released from the rock is observed at the same time. The experimental results show that each fracture of rock sample makes radon concentration in the observation system rise, and after stopping compression, the radon concentration maintains high value in the system. The experimental results better explain the reason of the post-seismic abnormal change of radon concentration, and provide an important experimental basis for the recognition and physical mechanism of radon anomaly of earthquake precursor.

Key words: Rock compression and fracture; radon concentration; post-seismic effect; mechanism.

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Detection of Plio-Pleistocene active faults in the Gulf of Suez Rift, West Central Sinai, Egypt using satellite images and field studies

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ABSTRACT

Satellite image and digital elevation model (DEM) analysis together with detailed field mapping and structural studies on an onshore segment of the Gulf of Suez rift in the west central part of Sinai Peninsula indicate the presence of a conjugate fault set composed of WNW-ESE striking dextral faults and NNE-SSW striking sinistral faults. The conjugate fault set cut and obliterate the Oligo-Miocene Gulf of Suez rift-related (Clysmic) NW-SE striking fault set. These conjugate faults are spatially and temporally associated and the angle between the dextral and the sinistral faults ranges between 60 and 80 degrees. The conjugate faults affect also Pliocene and Pleistocene sediments. Therefore these two fault sets are younger. Kinematic analysis of fault plain strain indicates NNE-SSW extension consistent with the present day extension regime deduced from instrumentally recorded earthquake activity in the same area. These observations indicate that the rifting is still active, however the fault activity has been transferred from the Gulf of Suez rift-related NW-striking faults to the Gulf of Aqaba rift-related NNE-striking faults.

Key words: Gulf of Suez Rift; Sinai Penisula; Egypt; active faults.

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Characterization of geological solid rock gaps case of the Socar Heliopolis - Guelma-Algeria aggregate quarry

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ABSTRACT

New quarrying techniques known concept Mine to Mill emerged in recent years, we consider that these techniques are related to rock mass breakage process with explosive, for the design of work in rock masses is one of the most difficult tasks that face geologists and operators. The structure of rock masses is an important parameter. This paper presents the description and technique methods of this structure. The discontinuities present in the rock mass are not randomly distributed, but are grouped generally in a limited number of families; they are the result of the geological history of the rock mass. The tectonics and evolution of morphology play an important role. For each surface discontinuity is determined by a number of parameters: to locate, to know its extension, to appreciate the strength between the lips of the discontinuity. These are natural geological observations, that is to say that from a necessarily limited number of elements provided by outcrops, surveys, trenching, certain geological methods, to try to define the massif Internal structure, with all the difficulties and hazards that entails. However, a careful description of the structure of a rock mass can give the engineer valuable information. Consider a few examples that show the value of such studies, the aims of this work are: to characterize the natural discontinuities (fractures) of a rock mass which are based on the method of structural geological analysis to be applied for recording the orientation of discontinuities contribution to Geographic Reference system characterized by the orientation parameters (Azimuth - Dip) by applying the direct method of measurement, according to systematic sampling lines or continuous survey recorded on standard sheets samples. At the stage of harvesting the necessary data on the orientation of discontinuities and research of the main families, the most commonly used for the representation method is the stereographic projection Lambert Schmidt has facilitated the use of Micro - Computer with the help a Software Stéreonet 2011at allows characterized stereograms contours and natural discontinuities roses and diagrams that define the rock mass is cut by three families discontinuities, a dominant primary family orientation inclined position, a predominant secondary family position vertical orientation, in a dominant tertiary family horizontally oriented position. The analysis of discontinuities network were based on classification methods RQD (Rock Quality Designation) and Geo mechanical classification RMR (Rock Mass Rating) characterized in that, the rock mass is of average quality. Analysis of the fracture network based on the classification of AFTES characterized that the solid is of average density of cracking or the spacing between the discontinuities which is close.

Key words: Rock mass; characterization; natural discontinuities; fractures; cracks; structural analysis; stereographic projection; RQD; RMR.

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Continuously monitoring creep movement at İsmetpaşa Segment of the North Anatolian Fault Zone

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ABSTRACT

The North Anatolian Fault Zone accommodates the westward motion of the Anatolian block relative to Eurasian plate with a slip rate about 20 mm/yr. The İsmetpaşa Segment of the North Anatolian Fault Zone involved faulting during the 1944 Gerede (M:7.3) and 1951 Kurşunlu (M:6.9) earthquakes. In early 1970s, it was realized that a wall across the fault in İsmetpaşa was broken and this deformation was attributed to aseismic creep on this segment. Different techniques have been using to understand the creep since it was noticed. In this study ground based LIDAR has been using to monitor creeping .In order to understand the length of the creeping section and relationship between geology and creep rate, LIDAR technique applied along the İsmetpaşa segment. Active fault trace was mapped in detail and eight new stations were constructed along the fault. Stations have been monitoring periodically with the ground based LIDAR since May 2013. Periodical measurements showed that the aseismic creep is going on between Gerede in west and Bayramören in east, for a distance of about 100 km. Present results showed that the creep rate changes between 2 and 12 mm/yr along the Gerede segment of the NAFZ. Despite this, this segment of the NAFZ is still capable of generating large earthquakes since at least 50% of the yearly slip still accumulates on the fault.

Key words: Creep; LIDAR; North Anatolian Fault Zone; İsmetpaşa Segment.

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Effects of Early Miocene-present deformation phases in the South Marmara Region, Turkey

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ABSTRACT

The North Anatolian Fault Zone (NAFZ) bifurcates into three branches in the Marmara Region which is a transition zone between the strike-slip tectonics manifested by the NAFZ and the N-S directed extensional regime of western Anatolia. The southern Marmara region is controlled by the middle and the southern branches while the northern branch dominate tectonic pattern the north Marmara region. Different deformation phases affecting southwest Marmara region were explained in four different phases: (a) The approximately N-S compressional regime, which occurred during the Early-Middle Miocene. During this phase approximately NE-SW trending extensional faults formed, (b) The earlier phase of N-S extension, which occurred during Late Miocene-Early Pliocene as a new continental basin began to form, (c) A brief phase of cessation marked by the development of a regional flat-lying erosional surface, indicating that the N-S extension appears to be discontinuous, and finally (d) The later phase of N-S extension and E-W strike-slip, which has been affecting the region since possibly the latest Pliocene-Quaternary. The main structural features of the southwestern Marmara were controlled by the latest regime. The southwestern domain is characterized by two different groups, NE-SW striking oblique-slip faults and E-W striking normal faults. However, the southeast Marmara region is controlled by approximately E-W trending rhomb-like morphologic structures bounded by strike slip-faults with normal component, striking mainly in E-W direction. The fault zone trends approximately E-W between Mudanya and Bandırma. To the west of Bandırma, it bends counter-clockwise and follows an approximately WSW-ENE trend.

This study was supported by The Scientific and Technical Research Council of Turkey (TUBITAK, YDABCAG-199Y073) and Kocaeli University Research Fund (2001/27).

Key words: South Marmara; strike-slip; neotectonic; transtensional basin; NAFZ.

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Shape preferred orientation analysis in magmatic complexes of the Ougarta belt (Algeria): Comparison with AMS data

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ABSTRACT

It is well-known that the strain markers are not easily available in magmatic rocks. The shape fabric determination in them remains then challenging. The case-study of the magmatic complexes of the Ougarta fold belt is presented here. This belt is located at the junction between the West African Craton and the Panafrican domain of the Saharan platform and it is mainly related to the Variscan orogeny. The magmatic complexes outcrop in the core of exhumed and eroded anticlines and they are constituted by ignimbritic, andesitic to basaltic volcanism and volcano-sedimentary levels. The magnetic fabric of these magmatic rocks is mainly carried by secondary hematite. The present paper focuses on the relationship between this magnetic fabric and the visible rock fabric. The latter has been determined using shape preferred orientation (SPO) analysis of opaque mineralogy, with the intercept or inertia tensor method that uses digital images of thin sections. Specifically, this SPO analysis was undertaken on photomicrographs taken on three observed orthogonal thin sections, which were obtained from the same precisely oriented hand-samples as for the magnetic fabric determination, from each studied magmatic formation. Although the one-to-one correlation between the visible and magnetic fabrics is not always clear, a relative coaxiality between the two fabrics has been found only in the intrusive doleritic dykes. No coincidence exists between these two fabrics in most analyzed ignimbrites. SPO analysis therefore confirms the composite character of petrofabric of these rocks, such as revealed by the ASM data.

Key words: Ougarta; magmatic complex; AMS; SPO.

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Post-Miocene kinematic transition in Western Central Anatolia: preliminary results

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ABSTRACT

The continental collision between the northward moving African-Arabian and the quasi-stationary Eurasian plates gave rise to westward escape of the Anatolian plate along the North and East Anatolian Fault Systems, dextral and sinistral intracontinental strike-slip faults, respectively. At the western part of Anatolia, this escape is compensated by the Aegean-Cyprian Arc where the African plate subducts beneath the Anatolian plate. This phenomenon created four major neotectonic provinces, represented by their own characteristic deformation styles. The North Anatolian and İnönü-Eskişehir Fault Systems form the boundaries of the North Anatolian (strike-slip with compression), Central Anatolian (strike-slip with extension) and Western Anatolian (extension) provinces. The study area is located at Upper Sakarya Section of the Central Anatolian Neogene Basin, between the North Anatolian Fault System, characterized by transpressional stress regime and the İnönü-Eskişehir Fault System, showing transtensional properties. The best areas where the kinematic transition can be observed between the two fault belts are the Beypazarı and Polatlı-Sivrihisar Basins from north to south. The aim of our study is to investigate the transition from transpressional to transtensional stress regime and effects of this transition to the area between them. The foresight of our study is the existence of a transitional zone between the two fault systems rather than a sharp boundary controlled by a single fault or fault set. The paleostress analyses of the fault-slip data demonstrates that N-S to NE-SW oriented tensional stress regime performs the southern part of the İnönü-Eskişehir Fault System. This section is represented by NE- and SW-dipping normal faults. At the central part (along the İnönü-Eskişehir Fault System) transtensional stress regimes are obtained from dextral strike-slip faults with normal component. The preliminary results from southern to central part of the study area (the Polatlı-Sivrihisar basin) clearly show the foresighted transition.

Key words: Central Anatolia; Inönü-Eskisehir Fault System; Polatlı-Sivrihisar basin; paleostress analysis; kinematic transition; neotectonics.

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Pencil-structures in the Central Eastern Desert, Egypt: what can they tell us?

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ABSTRACT

Large parts of the CED of Egypt comprise low to very low grade metamorphosed sediments, pyroclastics and volcanics that have experienced low strain compressive deformation (folds, thrusts and wrench faults) in the late stages of the Pan-African event. In this environment pencil structure is a widespread and well developed mesoscopic linear structural element. Pencil structure develops when a weak planar fabric (bedding or earlier cleavage) experiences shortening parallel to the planar fabric sufficient to change the oblate fabric ellipsoid to a roughly prolate ellipsoid. For pencils to form, these shortening strains are in the range 10-25% though pencils may persist to 40% shortening. In CED Hammamat sandstones the compaction effects (13% vertical shortening) and vertical tectonic thinning due to horizontal cleavage formation (at least 17%) have generated oblate fabric ellipsoids. The length to width ratio (l/w) of the pencils is known to be an indicator of the Y/Z ratio of the strain ellipse, with l/w < 13 (weak pencil structure) due to Y/Z < 1.16; l/w between 13 and 19 (moderate pencil structure) due to Y/Z between 1.16 and 1.27; and l/w > 19 (strong pencil structure) due to Y/Z > 1.27. Our preliminary work in the CED molasse basins shows weak pencils in the Zeidun and Arak basins (l/w 4.5 to 10.0); weak to moderate pencils in the Hammamat basin (l/w 5.0 to 16.1); and weak to strong pencils in the Um Seleimat and Meesar basin (l/w 10.5 to 21.8). These ranges show the same ranking as the intensity of folding in these basins. Estimates of the NE-SW shortening accompanying folding in the CED are in the range 15-20%. The pencils are generally parallel to the hinge of NW-SE plunging regional folds. These data are consistent with the NW-SE trending pencils having formed during the late NW-SE trending fold event. At these low levels of shortening the pencils develop parallel to the Y-axis of the imposed strain ellipsoid, however the CED pencil structures lie within 20o of the regional stretching lineations that are taken to represent the strain ellipsoid X axis. The simple explanation for this is that the stretching lineations (and the foliations they lie on) are a separate strain event to the folding and thrusting. This contradicts earlier claims that the foliations and stretching lineations formed during folding, thrusting and wrench faulting.

Key words: Pencil structure; Eastern Desert; Egypt; strain measurement.

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Fault termination geometry for segmentation of Kazerun Fault Zone in Zagros, Iran

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ABSTRACT

Geometry of fault termination is a criterion for segmentation of strike slip faults. Strike-slip faults terminations has 3 main types as free tip, horse tail and thrust faults. Zagros fold-thrust belt is transversely cut by several strike-slip faults. The N-trending Kazerun Fault is one of the greatest strike-slip faults in Zagros. This fault is divided into four segments as Sisakht, Yasuj, Kamarij and Borazjan from north to south. The northern segment has horse tail termination while the southern one acts as a lateral ramp to the Zagros Front Fault. The fault termination of the central Yasuj segment is investigated in this study using detailed field data and interpretation of satellite images. Detailed investigation of the Yasuj segment resulted in identification of overturning of the Dasht-e-Gole anticline southern limb by a thrust fault at the fault termination. This investigation that present a sample for study of thrust termination in strike-slip faults is utilized to differentiate the Yasuj segment from the other Kazerun fault segments. The results can also be used to distinguish transverse faults that cross cut the Zagros and similar folds and thrust belts from lateral ramps or tear faults. In addition, since almost all tear faults in fold-thrust belts displaced and end up to the belts main thrusts, the thrust termination geometry and kinematics in which strike-slip displacement along the fault changes gradually to reverse-slip toward the end of the termination, can be used as measures to differentiate these tear faults from transverse faults with thrust termination.

Key words: Strike-slip fault termination; transverse faults; fault segmentation; Kazerun fault segments.

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A comparison between resistivity pattern and deformation with sand-box equipment and special resistivity circuit

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ABSTRACT

Structural geology is interested in relationship between deformations and reasons of them. Strain, stress and physical properties (water content, thickness, grain size etc.) assign rock's behaviours and deformations. Sand-Box assembly present the most suitable laboratory experiments for modelling stress and deformation on rocks with configurable content. It is so fast and effective to find out how faults and folds form, why a crust thickening happen etc. Geologists, especially structural geologists collect most of data from field as he/she can see. But sometimes outcrop can be covered with younger units. At this time surveys continue with geophysical methods to determine under cover. D.C resistivity methods are some of the way to find out something at deep. Also this methods can inform about content (conductive minerals, ion rich fluids) or some physical properties (directly or indirectly about electricity) of rocks. As known, stress changes some properties of rocks. Simply and firstly it changes the distance between grains so effects density, water content, conductivity etc. That shows the resistivity must change with change of stress. This study is aimed to show possibility of modelling resistivity change in laboratory with sand-box equipment and a special resistivity circuit and compare resistivity pattern and applied strength, formed deformation.

Key words: Sandbox experiments; geophysics; structural geology; strain analysis.

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Structure Garet el Gueffoul: fracturing impact and oil, Ahnet Basin - Algeria

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ABSTRACT

The characterization of unconventional sandstone reservoirs, called "tightgas" is one of the technological obstacles in the coming years to be able to develop many gas fields in the world. The structure of Garet el Gueffoul is one of the most important structures in terms of size, the Ahnet basin where the Cambrian-Ordovician are the main reservoirs. Primary petrophysical characteristics of the reservoir is poor and productivity is directly related to the presence of a fracture network facilitating the drainage of hydrocarbons. To test this hypothesis, we used an approach combining several concepts namely deformation process predicting areas of high fracture density and spatial distribution across the tank. The evolution of Ahnet basin has been conditioned in its history by the deformation of the Pan base marked by ductile deformation with varying degrees of metamorphism and brittle deformation. This deformation is represented by NW-SE accidents, NE-SW lineaments and large submeridian that match lithospheric accidents. These accidents were reactivated in recess in reverse fault, normal fault according to their orientation with respect to the direction of the stress. The structure of Garet el Guefoul is in the form of a broad anticline general NS direction. To explain the current structural feature, we propose a deformation in three phases: 1-compression regime where the stress direction σ1 N040 allows the development or reactivation of a dextral strike-slip (early phase of the Hercynian orogeny). 2-rotation of the stress σ1 (N120) resulting in the shift of the axis of the fold in the southern part of the structure. The major accident EW direction which crosses the southern part of the fold corresponds to a reactivation of a normal fault-slip transpressional defining a positive flower structure observed on seismic sections. 3-stress relief represented by normal faults at the northern part of Garet El Guefoul structure. These different phases of deformation created fracture permeability which improve the qualities of the reservoir allowing better drainage of the fluids contained in the rocks.

Key words: Hercynian; transpression; stress; fracturing; permeability fracture.

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Recent transpression-transtension at the Amman-Hallabat and Shueib structures and its relation to the Dead Sea pull-apart basin, NW Jordan

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ABSTRACT

The Dead Sea Transform Fault (DSTF) is one of the longest strike-slip faults of the world, constituting the oblique plate boundary between Africa and Arabia plates. The southern part of this fault is, in turn, divided in two main fault segments, the Wadi Araba Fault (WAF) and the Jordan Valley Fault (JVF) connected through the Dead Sea continental pull-apart basin. Active tectonic studies in NW Jordan have traditionally focused on the DSTF and have discarded other prominent structures in the region like the Amman Hallabat (AHS) and the Shueib (SHS) structures, as they have been considered inactive from the Cretaceous. However some recent studies have suggested a possible local reactivation of the northern parts of these structures. In this work we carried out a detailed geological study in the NW Jordan in order to analyze the Quaternary activity of the AHS and SHS through field observations and structural analyses. Our findings have revealed that AHS and SHS structures present clear Quaternary activity and accommodate part of the transpression deformation of the southern DSTF. The deformation accommodated by these two structures and similar ones, could partly explain the slip-rates differences between the southern and northern DSFT segments. The AHS acts in the Quaternary as the northernmost continuation of the WAF, whereas the SHS is connected to the JVF by numerous kilometric-scale NW-SE normal faults with low to moderate throws. These transtensional normal faults probably constitute the northern closure of the Dead Sea pull-apart basin.

Key words: NW Jordan; Dead Sea Transform Fault; Amman Hallabat Structure; Shueib Structure; Wadi Araba Fault.

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Stress-strain analysis of the southern Dead Sea Transform Fault and adjacent structures: new episode of tectonic rejuvenation

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ABSTRACT

Stress-strain analysis based on fault-slip data was performed for two of the most important geological structures in the NW Jordan, the Amman Hallabat structure (AHS) and Shueib structure (SHS). Both structures formed in Cretaceous times under E-W to ESE-WNW maximum compressive stress and have been considered inactive in the Neogene times. We have collected data from 17 field stations in the area between the Dead Sea and the cities of Amman and AlSalt. This dataset comprises about 453 fault-slip data that include fault orientation and kinematics, striations, and joints. With the aid of the software T-TECTO 3.0 we have obtained the stress tensor for each station. Our results suggest that most of the structures are coherent with the present-day stress regime associated to the Dead Sea Stress System (DSSS). Moreover, in some of the field stations it is clear an overprint of the new striation over the older ones. This present-day DSSS has a horizontal to sub-horizontal maximum and minimum (σ1 and σ3) compressive stresses axes striking NNW-SSE and ENE-SWS respectively, and a vertical intermediate stress access (σ2). This new findings suggest a rejuvenation of the AHS and SHS in the Quaternary in the context of the DSTF tectonic activity opening the door to new hypothesis for stress accommodation in the region.

Key words: Stress analysis; tectonic rejuvenation; Amman-Hallabat structure; Shueib structure; Dead Sea Transform Fault; Jordan.

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Session Title:

Engineering Geology

The role of crystalline rock for disposal of high-level radioactive waste (HLW)

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ABSTRACT

In contrast with sedimentary rock the hydraulic conductivity of crystalline rock is high down to several hundred meters depth and successively tighter deeper down. It is mechanically stable and can allow mining to several thousand meters depth. The required effective isolation of HLW is provided by engineered barriers of which metal canisters with clay embedment are proposed internationally. The host rock is commonly taken as a barrier to migration of possibly released radionuclides but the logo of this symposium tells why this is much too optimistic: "*For eons the earth has been bending, buckling, contracting and expanding. And this unique dance gives rise to sculptures which are wonders of nature*". The ever ongoing massage continues to make discontinuities propagate, and changes the stress conditions so that new structural features evolve. Construction of an underground repository implies additional structural changes by blast-disturbance and redistribution of rock stresses so that the immediate surroundings of tunnels and large-diameter holes for installation of heat-producing waste become increasingly permeable, a problem that it shares with the organizations utilizing fracking for releasing methane gas from sedimentary rock. The altered rock stress conditions generate creep strain meaning that the barrier function to migration of radionuclides to the biosphere changes with time. The paper describes the performance of the rock adjacent to HLW according to two types of HLW repositories: very long subhorizontal holes with large diameter (1.9 m) bored at 400-500 m depth, and 4 km deep holes with clay/concrete seals in the upper 2 km parts and HLW containers separated by clay/concrete seals in the lower 2 km parts. The important difference between the two concepts is the much higher transmissivity of the rock in the shallow repository than in the deep one, and the need for rock support of both: filling the space between waste containers and rock with clay mud after installing the containers in the shallow repository, and keeping the deep holes filled with clay mud from the start of boring the holes, throughout the installation of clay/concrete seals in the deep repository. Focus is on the impact on the confining rock by waste-generated heat and on time-dependent changes of its hydraulic and mechanical performances.

Key words: Rock mechanics; rock structure; groundwater flow; stress and strain; long-term creep.

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The role of smectite clay seals for isolating high-level radioactive waste (HLW) in shallow and deep repositories

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ABSTRACT

The engineered barriers to release of radionuclides from leaking containers of HLW are primarily metal containers, termed canisters, consisting of copper, Navy Bronze (copper with 5-10 % zinc), titanium or steel, and secondly dense smectite clay seals like blocks of highly compacted Na-bentonite clay granules, surrounding and separating the canisters. Those of copper and Navy Bronze with 50 mm thickness, surrounding cast iron with space for spent reactor fuel or vitrified HLW, will not be through-corroded in less than 100,000 years but undergo partial dissolution that causes significant cation exchange of original sodium in the clay to copper and calcium, of which the latter is provided by the groundwater. The dry density of the manufactured “buffer” clay is at least 1500 kg/m^3, which corresponds to a hydraulic conductivity of about E-11 m/s after saturation with salt groundwater, and a swelling pressure of no less than 0.2 MPa, which fulfils the criterion that the effective pressure between rock and buffer clay must be at least 100 kPa. This is the condition required for guaranteeing tight contact between them. The hydraulic conductivity of the canister-embedding buffer clay, which is commonly proposed to have the clay mineral montmorillonite as dominant constituent, can be significantly and unacceptably raised by microstructural changes caused by high temperature and high temperature gradients, which generate precipitation of salt (NaCl and $CaSO_4$), and of dissolved silica in different parts of the buffer clay. These conditions also cause conversion of montmorillonite to non-expanding minerals (“illitization”) or neoformation of such minerals, contributing to cementation and brittleness that reduce the self-sealing ability and increase the risk of unacceptably high canister stresses in case of seismic activities. The impact of the degrading processes is highest for shallow repositories located in rock that is rich in potentially active fracture zones, while very deep disposal represents lower risk because of the high confining rock stresses at depth. Disposal of HLW at large depth implies temperatures of up to 150^{o}C, which makes the buffer clay stiff, but this effect is of less importance than for shallow disposal. In the paper focus is on the hydrothermal impact on the mineralogical constitution and sealing potential of the engineered barrier “buffer clay” in shallow and deep repositories in crystalline rock. A special advantage of very deep disposal is that the density of deep groundwater is very high and makes it nearly immobile, a fact that makes clay seals less indispensable than for shallow repositories.

Key words: A Hydraulic conductivity; expandability; interaction with rock; interaction with waste; long-term function.

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Analysis of well stability problem in Kutahya Gediz graben in terms of modified stress-cage drilling fluid system

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ABSTRACT

This study includes the field works to find a solution for the well stability problems during drilling serpentine formation in Kütahya Gediz graben. To minimize well stability problems during drilling serpentine, modified stress-cage drilling fluid system is improved and achieved in the serpentine section. This system is a high performance water-based drilling fluid that adds value to stabilize the serpentine formation with special wellbore strengthening chemicals involving in it. Systems fluid loss, mud cake quality and encapsulating inhibition are controlled by the special polymers and so minimize swelling, dispersing, pack-off potential of the formation. Solid and liquid lubricants are used in this application to minimize the friction between the drill string and casing / formation. With the modified stress-cage drilling fluid system; casing is set at the end of serpentine formation successfully. Usage of well strengthening and lubrication materials helped to decrease the pore pressure transmission of the rock and the friction between the drill string and formation; hydrostatic pressure and fluid loss is controlled efficiently for the stabilizing the wellbore. Special loss circulation materials are used as wellbore strengthening pills for the loss circulation problem. Frequent wiper trips, efficient solid control equipment, high reserve tank capacity, better casing design, use of top drive, PDC bit and mud motor are recommended to decrease the reaming and drilling time in order to decrease the possibility of over pulls and stuck pipe due to the nature of aged serpentine formation. Serpentine is known with its great potential in Turkey. Several companies attempted to drill off serpentine but most of them experienced stuck pipe and had to leave the field without reaching target depth. Thickest serpentine formation ever in Turkey is drilled off with the modified stress-cage drilling fluid system and added to the state of knowledge in the drilling industry by reaching to the target depth successfully.

Key words: Drilling fluid; mud; serpentine; stress-cage; well stability.

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In situ measurement of water content and colour on rammed earth walls

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ABSTRACT

The advantages of rammed earth buildings are easy to construct and needs less energy. They are also highly concerned with absorption capacity of soils on to indoor air pollutants such as chemical materials. Rammed earth buildings are have been often used worldwide and its technical skills have been researched. For example, it has been found that earth should not be trampled by human power but by larger energy such as air packers. However, there are still remained unclear; the characteristics of earth materials, the strength of walls, the physical properties such as water and chemical properties. Therefore, as the first step to reveal the characteristics or Rammed earth walls, the present study focuses to examine the water content, colour variation and hardness of the walls by using Equotip hardness tester, Minolta colourimetry and infrared absorbance meter which reflects water content.

Key words: Water content; colour measurement; Rammed earth.

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Petrophysical modelling for the Bahariya Formation, Egypt

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ABSTRACT

Lithologic laminations have great consequences on the Bahariya sandstone which are distinguished by the calculated reservoir statistical parameters. The non-laminated Bahariya studied samples have the lowest mean bulk density and specific internal surface values, while they have the highest mean porosity, permeability and S_{por} values. On the other hand, laminated samples exhibit high values. The non-laminated Bahariya samples have the lowest mean permeability anisotropy due to its relative pore-framework homogeneity. Contrary, laminated Bahariya samples have the highest mean permeability anisotropy. By the same behavior, the non-laminated Bahariya samples have the highest mean electrical resistivity value due to the lack of conductive minerals, while the laminated Bahariya samples have the highest mean electrical resistivity. The non-laminated Bahariya samples show the lowest mean magnetic susceptibility value, while the laminated samples reveal high values. Sonic wave velocity (V_p and V_s) are statistically treated while velocity anisotropy is calculated for all samples. Laminated samples display higher velocity in comparable to the non-laminated. Thin sections and SEM-micrographs were made for some selected samples in order to recognize the Bahariya sandstone forming minerals. Gluconite, micas, zircon, rutile and pyrite minerals are composing the laminas in the laminated samples, while some glauconitic sandstone are predominant in non-laminated. A number of linear regression models were performed among some measured and/or calculated petrophysical parameters in order to differentiate between laminated and non-laminated sandstones and to obtain reliable relationships permit to calculate an important reservoir parameter from others which can be outlined by routine laboratory measurements.

Key words: Bahariya Formation; electrical resistivity; porosity, acoustic wave velocity, permeability.

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Probabilistic-based rock slope stability assessment along highway cut slopes in Adilcevaz-Bitlis (Turkey)

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ABSTRACT

Rock slope instabilities may lead to casualties as well as property losses along transportation lines in highly weathered or highly deformed rock masses. In practice, stability assessments are frequently executed by analytical or numerical analyses, particularly considering the factor of safety concept. However, the rock masses, even the rock material may exhibit inhomogeneity resulting in significant variation in physico-mechanical parameters. Apart from those, discontinuity surfaces, which have a great impact on the stability, are heterogeneous as well. Furthermore, it is quite difficult to assign the most appropriate value for the design parameters to get accurate outcomes. In recent years, the probabilistic approach has been increasingly put into practice in cut slope projects to minimize uncertainties in stability evaluations. In this study, slope stability probabilities of sedimentary rock cut slopes along a state highway adjacent to the settlement of Adilcevaz-Bitlis (Turkey) are evaluated using the Slope Stability Probability Classification (SSPC) method. Moreover, the shear strength parameters of the rock mass is calculated through the same approach and compared to the results obtained from Hoek-Brown empirical failure criterion. Consequently, the probabilistic assessment indicates major slope stability problems as a result of discontinuity controlled and discontinuity orientation independent mass movements. The stability problems along the investigated rock slopes are also verified by field reconnaissance. Therefore, slope redesign and slope reinforcement at the studied locations should be performed in the form of steel mesh, shotcrete and rock bolts.

Key words: Probabilistic; slope stability; rock; uncertainty; SSPC.

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Durability assessment of porous Ahlat Stone (Bitlis-Turkey) by accelerated weathering tests

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ABSTRACT

The Ahlat Stone, geologically identified as ignimbrite, is a pyroclastic rock formed as a result of the volcanic activity of Nemrut Volcano in eastern Turkey. Due to the fact that it is effortlessly engraved thanks to its light weight and porosity, the Ahlat Stone was extensively used as a dimension stone in numerous historical structures around the Lake Van basin particularly in the period of Seljuk Empire around 1060 to 1300. Besides its widespread recent use, the most well-known monument constructed by the Ahlat Stone is the Seljuk Tombstones (Bitlis, Turkey) which is accepted to be the largest Muslim graveyard in the world and included in the UNESCO's World Heritage List. The Ahlat Stone is characterized by different colors leading to a decorative appearance where employed. In addition to color features, it reveals variable physico-mechanical properties. In this experimental research, durability against several atmospheric effects is investigated on four different Ahlat Stone sample groups with dark gray, pinkish gray, reddish brown and dark brown colors using accelerated weathering (wet-dry, freeze-thaw and salt crystallization) tests. Prior to aging tests, the physico-mechanical properties of fresh samples were identified. Accordingly, dark brown colored Ahlat Stone is the most porous with an average porosity of 32%, whereas the other three sample groups expose similar average porosity values ranging between 22% and 26%. On the other hand, the minimum uniaxial compressive strength of the dark brown colored Ahlat Stone is 2.6 MPa. Besides, dark gray specimens have uniaxial compressive strength as high as 15.4 MPa. Subsequently, the ageing tests were executed on the Ahlat Stone specimens to determine the resistance to deterioration. Hence, the wet-dry tests do not have significant impact on most of the Ahlat Stone specimens except an increase in porosity of pinkish gray samples accompanying with a slight strength decrease. The freeze-thaw cycles are accepted to be more destructive according to substantial strength reduction in all types of samples. A maximum of about 40% strength decrease was noted for pinkish gray stones after the freeze-thaw tests. As expected, salt crystallization is the most damaging test for all samples. Entire physico-mechanical properties of the samples were adversely affected after salt crystallization tests. Uniaxial compressive strength of all samples diminished at least 50%, and a maximum of 75% strength decrease was observed in reddish brown and pinkish gray Ahlat Stone specimens.

Key words: Ahlat Stone; ignimbrite; durability; accelerated weathering test.

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A new method to estimate pre-loads in rocks using Kaiser Effect

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ABSTRACT

When a rock is subjected to a load, micro-fractures initiate and propagate within the rock, generating AE. Analysis of these emissions was the key focus of this study and lead to the development of an innovative method by which the in-situ stress can be accurately predicted. This research has developed a new method of estimating pre-loaded stresses of cored rock specimens using the Kaiser Effect (KE), The University of Adelaide Method (UoA), and investigated the influence of confining pressure on the estimation of the maximum pre-load stress applied to rock samples. Unlike existing methods, The UoA Method emphasizes the energy of each acoustic emission (AE) event which is the square term of the amplitude. As the axial pre-load stress is exceeded, the micro cracks become larger than the existing fractures and therefore possess higher levels of AE energy. The UoA Method successfully estimated the axial pre-load stress in all tests, regardless of the sub-core orientation within the master core. The average Felicity Ratio is a measure of the accuracy of the estimation and was equal to one. This demonstrated that the confining pressure had no influence on the estimation of the axial pre-loads.

Key words: Kaiser Effect; acoustic energy; pre-loads.

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A fuzzy classification routine for fine-grained soils

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ABSTRACT

Soil classification is one of the most important stages in preliminary studies for design applications in geo-engineering. The classification of fine grained soils is mostly performed by using the Casagrande's plasticity chart. Owing to the factors affecting determination of liquid and plastic limits, some uncertainties are raised in fine-grained soil classification by using the Casagrande's plasticity chart. The uncertainty is raised its max particularly when the points on the chart fall on the lines (A-line and/or line of liquid limit 50%) or very close to these lines. In this study, a fuzzy classification routine was proposed in order to minimize these uncertainties. For this purpose, the spatial distances of the evaluation points on the chart away from the lines were implemented. The membership degrees which define the fuzzified soil (clay and/or silt), and plasticity (low and/or high plasticity) were evaluated by considering the sigmoidal functions. As a consequence, the soil types were obtained by aggregating fuzzified soil and plasticity by using the fuzzy operators.

Key words: Soil classification; plasticity chart; uncertainty; fuzzy set theory; fuzzy operator.

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Numerical modeling of deformation of soil foundations

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ABSTRACT

The algorithm for investigation of soil foundations under its own weight and surface loading is considered. A soil is presented as a continuous medium, which has specific physical and mechanical properties. Structurally, there are three groups of soils, the first – sand, the second – clay and the third – rocks. The main difference is a bonding strength between the individual crystal grains and the medium continuum. Kinematics of a medium continuum is described by the spatial gradient of rate tensor, the deformation rate tensor and the rate of rotation tensor. The state of stress is described by the Cauchy stress tensor and objective Jaumann rate of Cauchy stress. An isotropic elastic-plastic material is considered. The linearized constitutive equations of elastic deformation are obtained as a function of objective Jaumann rate of Cauchy stress in the current state. The theory of a flow and an additive representation of the total deformation rate on elastic and plastic parts are used. The Drucker-Prager yield criterion is applied. The research algorithm is based on the incremental method. The principle of virtual work in terms of the virtual velocity is used. After linearization the system of linear equations is obtained, where an increment of displacement in the current state is unknown. The radial return method with an iterative refinement of the current mode of deformation is applied. This procedure is based on the introduction into constitutive equations a work of the “additional stresses” in virtual deformation of the rate. The numerical implementation is based on the finite element method. An eight node isoparametric hexahedron element is used. As an example the calculation of the soil foundation is considered. The fields of displacements and stresses are obtained. The intensity of stresses and plastic deformations are shown.

Key words: Soil foundation; plastic deformation; finite element method.

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Morphometric and geological features of karstic depressions in gypsum (Sivas, Turkey)

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ABSTRACT

Gypsum covers an area of approximately 5% in Turkey and is mainly found in Sivas basin. Gypsum in the Sivas basin includes many karst structures with various sizes and has a variety of forms that present different conditions offering different morphometric features. Two basic shapes of karstic terrain are reflected in this area offering a wide variety of gypsum karst. The first of these are dissolution dolines which constitute the polygonal karst areas, and the second one is collapse dolines which is deeper karst depressions formed by roof collapse and the accompanying of solutions. The aim of this study is to determine and identify general characteristics of doline in the study area using morphometric measurements and calculations. This study describes an application of Geographic Information Systems (GIS) to examine the morphometric and geological features of gypsum karst in Sivas basin. The effect of geologic, structural and hydrogeological variables on the morphometry and spatial distribution of depressions are discussed in the study. The parameters calculated for the study area include depression length, width, orientation, area, perimeter, depth, circularity index, depression density, circularity index, length/width ratio, and major axis orientation.

Key words: Gypsum; karst; doline; morphmetry; Sivas basin (Turkey).

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Rock mass parameters based doline susceptibility mapping in gypsum terrain

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ABSTRACT

Rock in nature is observed as a rock mass which is a discontinuous medium with joints, faults, fissures, fractures, bedding planes, etc. Interaction of the intact rock blocks with the discontinuities mainly controls the rock mass behaviour under applied stress. Therefore a detailed description of the discontinuities in rocks, their structure, and their condition can provide valuable insights into potential rock mass behaviour. Although the rock mass characteristics by means of discontinuities are very important for the stability of the underground openings, they have never been considered as a conditioning factor of doline susceptibility analyses. In this article, preparation of the doline susceptibility map based on the rock mass parameters is proposed. In this article, 3 different doline susceptibility models namely conventional affecting factors based (geological, hydrological, topographical, land use factors and vegetation cover), rock mass parameters based and combined parameters based were produced and their validation performances and accuracies were compared. According to the comparison of the three models, the most realistic and accurate doline susceptibility model was implemented from the combined-parameters. However the accuracy of the model obtained from rock mass parameters based doline susceptibility map was distinctly higher than the first model which is based on conventionally used conditioning factors. Validation analyses of the maps indicated that the methodology and conditioning factors by means of rock mass parameters included in the models can be considered as satisfactory. Although a precise map was obtained in this study considering the rock mass parameters, the results of this article do not claim that the parameters considered are solitary enough to construct a precise doline susceptibility map. In addition there may be other site-specific affecting factors of doline occurrence which were not included in the analyses in this study because of the characteristics of the studied area. This article particularly points out that the rock mass parameters must be included in the doline susceptibility analyses together with the other factors.

Key words: Gypsum; doline; rock mass; discontinuities; susceptibility map; logistic regression.

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Certain landslides in Bosnia and Herzegovina, causes and consequences

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ABSTRACT

During May of the year 2014, it were observed intense rainfall in the area of the northern part of Bosnia and Herzegovina, the eastern part of Croatian and almost the entire territory of Serbia. In this region of intense precipitation have initiated large number of landslides that have damaged infrastructure, commercial and industrial buildings. It also undermined the stability of river banks, damaged bridges and culverts, as well as arable agricultural lands. Bosnia and Herzegovina was affected by floods in its northern and eastern part. In the hilly and mountainous terrain it created a large number of landslides, while the plains were affected by floods caused by overflowing rivers of its banks. Number of landslides is not fully registered, but is estimated to several thousand. From that number, some of landslides has emerged in places that are inaccessible and not interesting to use, so it would not be analysed. Other landslides that threaten facilities would be researched in order of priority. Yet there are so many that the greater number would remain unexplored or simply abandoned and endangered objects and inhabitants would be moved to a new location.

Key words: Rainfalls; landslides; floods; objects.

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Emplacement direction of the ophiolitic nappes in the Muratdağı region, northwest Turkey

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ABSTRACT

The northern edge of the Anatolide-Tauride continent experienced regional HP/LT metamorphism during the Alpine orogeny. The HP/LT Anatolides are generally subdivided into Tavşanlı Zone and Afyon Zone in the north and Menderes Massif and Lycian Nappes further south by the type and age of the metamorphism. Afyon Zone, which is made up of pre-Mesozoic basement and unconformably overlying Mesozoic cover series, is bounded in the north by the Tavşanlı Zone and in the south by the Menderes Massif. Metamorphism of these tectonic units of the Anatolide-Tauride block in western Turkey is suggested by the contractional and extensional deformations during Alpine orogeny. The stratigraphy of the study area in the Afyon Zone starts at the base with the Middle-Upper Triassic İkibaşlı Formation. The Jurassic Çiçeklikaya Formation, comprises dolomitic carbonates, conformably overlies the İkibaşlı Formation. These two formations are overlain tectonically by an ophiolitic nappe of the Muratdağı Melange along a thrust. Kinematic studies along this contact zone between the Muratdağı Melange and the underlying İkibaşlı Formation give information about the movement direction. The methodology comprises systematic definitions and measurements of the mesoscopic shear criteria in outcrops oriented normal to the foliation and parallel to the associated stretching lineation and examinations of microscopic structures in oriented thin sections. Kinematic data gathered from mesoscopic and microscobic structures preserved in the metaclastics along the boundary between the İkibaşlı Formation and Muratdağı melange suggest two deformation phases (D1 and D2) and associated foliation and lineation (S1 and L1). While the initial deformation phase (D1) is in ductile, the last phase (D2) is brittle. Linear structures trend in NE−SW direction and have a moderately plunge to NE and SW. And also we define S shaped intrafolial fold in the interclated metacarbonates of the İkibaşlı Formation. This S shaped structure also shows top-to-the-northeast shear during the tectonic transport. Similar S shaped intrafolial folds in the metaclastics of the İkibaşlı Formation have been determined in the oriented thin section and points to a top-to-the-northeast tectonic transport direction. Close to the tectonic contact, the quartz sigmoids are asymmetric in sections normal to the foliation and parallel to the stretching lineation and indicate top-to-the-NE sense of shear. Close to the tectonic contact between the İkibaşlı Formation and ophiolitic nappe, the shear band cleavages in outcrops and oriented thin sections (S/C') indicates top-to-the-NE sense of shear. These asymmetric structures point to a top-to-the-northeast tectonic transport direction. The tectonic contact between İkibaşlı Formation and Muratdağı Melange and their deformed rocks are cut by the Miocene aged (17,8±0,7–19,4±0,9 Ma) nonmetamorphosed Baklan Granite.

Key words: Northwest Turkey; Afyon Zone; ophiolite emplacement; kinematic indicators.

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A landslide induced by overloading and seepage from water supply tank: the case study from Akıncılar (Sivas, Turkey)

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ABSTRACT

The rapid and unplanned growth of many cities in the developing world, has resulted in the increased severity of urban environmental hazards, such as slope failure landslides can result in enormous casualties and huge economic losses in unplanned settlements regions. Sudden changes will be due to short-term variation in either the strength of the materials or the forces applied to the slope. The paper describes the methodological approach used for a slope stability analyses of a landslide induced by overloading and seepage water supply tank in Akıncılar area (north of Sivas, Turkey). The study area is located in the North Anatolian Fault Zone (NAFZ), which is a very important tectonic region. The stability of the landslides and the slope failures along the cross-sections were investigated with Slope 5.0 software using the values of residual cohesion and residual internal friction angle. The results indicate that the safety factor of the slopes is very low.

Key words: Slope; landslide; seepage water supply tank; overloading, Sivas-Turkey.

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Geotechnical and geological characterization and ambient vibration study of shallow geological units in Barreiro and Setúbal areas (Portugal)

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ABSTRACT

Although the Metropolitan Area of Lisbon shows a moderate seismicity due to its geotectonic location, it has been subject to catastrophic earthquakes responsible for high social and economic loss and damage. Earthquakes of 1755 (M ≥ 8), 1858 (M≈7) and 1909 (M≈6) are examples of destructive events that hit this region. Barreiro and Setúbal are two counties located in this area of Portugal which may be subject to the action of future earthquakes. During the 1858 earthquake the city of Setúbal suffered an intensity of IX (MMI). The objectives of this study were the estimation of site effects on these two areas and the evaluation of the relations between the geological and geotechnical properties of the shallower units using horizontal-to-vertical spectral ratio (H/V). The geotechnical characterization was based on the analysis of 4064 Standard Penetration Tests (SPT) compiled in 676 logs of 96 geotechnical reports. Ambient vibrations records were carried out at 249 sites using a Güralp CMG 6TD broadband station. Most recordings were performed during 30 minutes in the urban areas, between 1am and 4am. Data regarding SPT, thickness of surface units (Holocene), depths of the substrates (Pliocene and Miocene), fundamental (F0) and predominant (F1) frequencies and amplification factors were calculated. The thickness of Barreiro Holocene deposits (anthropogenic and alluvial) showed a relation with F0, F1 and SPT values. The spacial distribution of F0 and F1 allowed the definition of two surfaces. The first corresponds to the boundary between the Holocene and the Pliocene (2-34 meters deep) and the second to the boundary between the Pliocene and the Miocene (250 meters deep). Three areas prone to seismic amplification with frequencies between 2.5 Hz to 8 Hz were identified. In Setúbal, it was not possible to establish a relation between the thickness of the surface units and F0 or F1. A possible cause may be that the impedance contrast between the Holocene and Pliocene is not strong enough to cause frequency peaks in the H/V curve. In this area, the peak frequency distribution is probably controlled by the structure of the nearby Arrábida mountain ridge. Setúbal presented seismic amplification factors between 4 and 8, with F0 between 1 Hz to 3 Hz. These results are aimed to be used in land planning policies, emergency plans and definition of geographic areas for public information campaigns.

Key words: Portugal; site effects; spectral ratio; surface units.

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A simple regression based approach to estimate deformation modulus of rock masses

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ABSTRACT

Rock mass characterization has a crucial importance for many applications in rock engineering including foundation design, slope design, support design and others. For these purposes, it is necessary to obtain input parameters for design, such as deformation modulus. The practical way to obtain this parameter is to apply a rock mass classification system to characterize the rock mass and estimate the rock mass properties. Data from four different sites were employed in the present study. The values of the deformation modulus of rock masses were calculated using the existing empirical equations based on RMR classification system. Furthermore, pressure meter tests were carried out to determine the deformation modulus of rock mass in one of the sites. The relationship between RMR and deformation modulus of rock mass was obtained via simple regression analysis using deformation modulus of rock masses calculated from empirical equations based on RMR classification system. Afterwards, performance of the equation obtained from regression analyses was examined by comparing the predicted Em values with experimental values with respect to the R^2 values using the data of fourth site. Overall R^2 value was found to be as 0.75.

Key words: Modulus of deformation; Rock Mass Rating; pressure meter tests; regression analyses.

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Lab testing of method for clay isolation of spent reactor fuel in very deep boreholes

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ABSTRACT

Multibarrier concepts are commonly proposed for effective isolation of highly radioactive waste (HLW). In Sweden and Finland and some other countries, two basically different concepts for disposal of spent reactor fuel are the often cited KBS-3 methods and Very Deep Boreholes methods (VDH), on which the paper focuses. These concepts consider engineered barriers in the form of clay-embedded canisters with spent reactor fuel to be fully responsible for isolation of the waste, hence reducing the role of the host rock to be a mechanical support to the engineered barriers. The clay, placed as blocks around the canisters and between them, provides ductility for minimizing the risk of canister breakage, and for delay migration of possibly escaping radionuclides. The large-diameter VDH holes, like boreholes made for site selection and monitoring of the repository area, need to be effectively sealed, which requires tight contact with the borehole walls. The dense clay seals providing such tightness are made of smectite-rich material in combination with clay mud for stabilization of the rock in the construction phase. In this paper, clay mud of smectite-rich Holmehus clay was investigated for evaluating the physical interaction with the dense clay blocks. The possibility of solving the problem of too quick hydration of the blocks, which can make the resistance to insertion of the units of dense clay and canisters (“supercontainers”) in the mud difficult, was investigated by using prewetted dense clay blocks prepared by a new method (“DW”). The laboratory experiments, which were made to simulate the installation of supercontainers in clay mud using model versions of them, have given promising results that form the basis of a theoretical model of maturation of interacting clay blocks and mud.

Key words: Highly Radioactive Waste (HLW); very deep boreholes (VDH); disposal; borehole; clay; mud.

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Selection of the replacement building stone for the repair of the ashlar masonry plinth of St. Anna church in Vižňov

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ABSTRACT

In 2015, we participated in an ashlar masonry plinth restoration of St. Anna church in the village Vižňov. The plinth is built up from sandstones, which were probably quarried in the surrounding of the church. The sandstone blocks underwent to weathering processes and some of them were strongly damaged. Therefore, the complete exchange of strongly destroyed blocks was necessary and so the task of substitute material selection arose. First of all, a detailed survey of stone initial state was completed and then the stone plinth was described from a geological, structural and historical perspective. It was necessary to find a matching local alternative rock or a comparable one from another site for the purposes of the reconstruction. For that reason, a geological survey was made to identify and document possible historic quarries from where the stone for construction of the church plinth could be taken.

Key words: Replacement building stone; sandstone; cultural heritage; Vižňov.

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Reuse of refractory brick wastes in the high performance fiber-reinforced concretes (HPFRC)

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ABSTRACT

The main purpose of this study is to evaluate the reuse of refractory brick wastes (RBW) as a supplementary cementitious materials (by a total replacement of silica fume) to produce a high performance fibre-reinforced concrete (HPFRC). This work presents an experimental study on the formulation and physico-mechanical characterization of ultra-high performance fibre reinforced concretes based on three types of refractory brick wastes. These have been retrieved from the manufacturing unit of float glass MFG (Mediterranean Float Glass) after their use in the oven basin (ie d. they are considered waste unit). Three compositions of concrete (HPFRC) were established based on three types of refractory brick wastes (finely crushed), with the dosage of each type of bricks is kept constant, similar the dosage of silica fume used for the control concrete. While all the other components and the water/binder ratio are maintained constant with the same quantity of the superplasticizer. The performances of HPFRC were evaluated by determining the essential characteristics of fresh and hardened concrete. According to the obtained results, it was noted that all concretes have the same bulk density regardless of the nature or type of firebrick powders used by the silica fume substitution. The fluidity of studied concretes is acceptable which varies between 19 and 21 cm diameter corresponding to a UHPC. The fluidity of UHPC was slightly decreased to CRWB1 and CRWB3. The largest recorded value of compressive strength is about 120 MPa for the control concrete, and the smallest value is on the order of 82 MPa for the CRWB3. However, the CRWB1 gave a higher value of compressive strength compared to CRWB3 and CRWB2.The CRWB1 gave a higher resistance than that of CRWB2 and CRWB3, this resistance is in the order of 93 MPa. Given the cement content used for these concretes and also the W/C ratio = 0.3, the compressive strength values are acceptable

Key words: Refractory; bricks; concrete; fibre; fluidity; compressive strength; flexural strength.

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The pessimum ratio and aggregate size effects on alkali silica reaction

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ABSTRACT

Alkali aggregate reaction is a chemical reaction which occurs between the reactive component of the aggregate and alkali hydroxide from the cement used in the concrete or external source. In this study, the accelerated mortar bar tests were performed and compared their results with each other in order to investigate the ratio of reactive aggregate which causing maximum expansion in mortar and called a pessimum ratio in literature. For this purpose, the pessimum ratios of the six different reactive aggregates (Opal nodule, chert, chalcedony nodule, andesite, ignimbrite and dolomite) were determined. The effect of the particle size on the development of alkali-silica reaction was determined again by HHC experiments. Accelerated mortar bar tests were carried out with mortar bars of Opal, chalcedony and chert aggregates having 4.76 mm to 0.074 mm grain. The experimental results have shown that the highest expansion occurred in reactive aggregates, which have between 150 and 300 □m grain size.

Key words: Alkali aggregate reaction; alkali silica reaction; pessimum ratio; concrete; mortar bar test.

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Characterization and engineering properties of residual soil of Kula Geopark area (Manisa, Turkey)

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ABSTRACT

Volcanic units in the remaining region among Gediz valley, Kula, Karatas and Demirköprü Dam is very important in the western Anatolia. A large part of the volcanic field is in the town of Kula while a smaller part is located within the boundaries of Salihli. In the region, volcanic cones, lava flows, tuff covers and basalt plateaus are mainly structures of young volcanism. UNESCO has declared Kula volcanic field that has an area of approximately 300 km^2 as a Geopark in 2013. As well, arrangements of the Geopark area are ongoing for the opening of tourism. In this study, geomechanical properties of residual soil derived from basaltic lava were investigated for determining the bearing capacity of ground of new buildings that will be built in the Geopark area next year. In the region called Karatas locality, soil samplings from different locations were carried out. Natural moisture content, density, particle size distribution, Atterberg limits, direct shear and consolidation tests of soil samples were performed. The natural moisture content of soil samples was determined by an average value of 4.5% and an average natural density of 2.08. Overall, soil samples are defined as “Silty Sand” according to the unified soil classification. Consolidation Index value (Cc) and coefficient of volume compressibility (mv) were calculated as 0.30 and 0.987 m^2/MN. Cohesion values of the residual soil (c) changes between 5 and 11 kPa, and internal friction angle values vary between 340 and 390. These local variations in geomechanical properties are specific for residual soil.

Key words: Residual soil; geomechanical properties; shear strength; consolidation; Kula Geopark; Manisa.

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Mineralogical - geochemical and physico-mechanical properties of Cappadocian ignimbrites (Nevşehir, Turkey)

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ABSTRACT

Nevşehir located in the centre of the Cappadocia region, is one of the most attractive touristic sites of Turkey due to its spectacular and unique landforms; such as fairy chimneys, underground cities and other cultural heritages. The region called as Central Anatolian Volcanic Province is generally underlain by thick and extensive sequences of volcano-sedimentary units. The most important unit in the region is the Ürgüp Formation which consists of several ignimbrite members. Some of the members are also sub grouped into different levels. Because of the widespread of ignimbrite, it is used as dimension stone for decoration and construction purpose in ancient and also in recent buildings. The region is extensively studied by many researchers in order to evaluate the geodynamic model of Central Anatolian Volcanic province, the deterioration behaviour of the Fairy Chimneys etc. But limited studies are performed on the ignimbrites in order to evaluate their usage as building stones. In this study the physico-mechanical and also the petrographic and geochemical properties of the ignimbrites are evaluated. For this aim six different locations which represent the entire Ürgüp Formation are selected. At some locations samples from different levels, which belong to the member, are collected in order to define the member in detail. The study was performed in two stages: In the first stage the petrographic and geochemical properties; in the second stage the physico-mechanical properties are evaluated. According to their geochemical composition the samples are classified as trachyte/trachysdasite, rhyolite and dasite. The colors of the samples are quite variable they changes from light colors into dark (such as white, light yellow, yellow, light grey, grey, brown, black). The unit weights are changing between 11.43 – 18.68 kN/m^3. The apparent porosity of the samples changing between 18.28 – 35.14 %. Water absorption of the samples by weight and volume changing between 8.84 – 28.03 and 16.09 – 35.43 %, respectively. The P-wave velocity changes between 1231 – 3158 m/s. Uniaxial compressive strength in dry and saturated condition is changing between 5.91 – 78.65 and 1.80 – 74.29 MPa, respectively. It can be concluded that the variation of the physico-mechanical properties are controlled by geochemical composition and/or mineralogy and welding degree.

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Key words: Cappadocia; ignimbrite; phsico-mechanical properties; geochemical composition.

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The seismicity and hazard potential of the Karabük Fault, Western Black Sea region: preliminary results

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ABSTRACT

Hazard map is an essential tool for highlighting the areas that are affected or vulnerable to a particular hazard, used to minimize the possible dramatic consequences of natural disasters such as earthquakes, landslides and floods. Landslide and flood evaluations should be carried out to present the triggering factors such as earthquakes and rainfall. The western part of the Black Sea region (especially Karabük and Yenice settlements) is known to be the most hazardous areas of Turkey in terms of earthquakes, landslides and floods. Additionally, it also has extremely high potential for future hazards. This area is located approximately 55 km north of the North Anatolian Fault System, one of the most seismically active, dextral strike-slip shear zone of Turkey. Almost E-W-trending system lies between the Gulf of Saros to the west and Karlıova to the east with a length of approximately 1500 km. Another important structure, namely Karabük Fault is also located in the study area. NE-trending Karabük Fault is a thrust fault characterized by NW-dipping fault planes and high topographic relief and lies between Safranbolu –the world heritage city- to NE and Karaağaç to the SW. This fault juxtaposes Lower Cretaceous flysch deposits with olistoliths corresponding to the oldest rock exposed in the area with clastics followed by thick limestone-sandstone-claystone alternation of Lower Lutetian age. The flysch unit is widespread and known to be most available rock group for landslides in the Western part of the Black Sea region.

Our results of paleostress analysis of faults of the North Anatolian Fault System have similar characteristics with those obtained from the Karabük Fault which mention that the seismicity along the North Anatolian Fault system can also trigger the seismicity of the Karabük Fault and cause hazards. The epicentres of the earthquakes located along the Karabük Fault also support this foresight and this structure should be demonstrated as an active fault in the hazard maps.

This study is supported by TUBITAK project 113Y455.

Key words: North Anatolia; Western Black Sea; paleostress analysis; seismic activity; hazard map.

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SEM investigations of clay subjected to 200 MPa pressure

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ABSTRACT

Paper presents the results of laboratory tests of the effects of high pressure on the microstructure of clay particles. They were made of aqueous suspensions of clay, which were pressurized at 200 MPa. High pressure was obtained in the original high-pressure test stand. Microstructures were examined in the scanning electron microscope (SEM). The changes were defined by comparison of the data before and after adding pressure in the high pressure chamber. The tests results show that irreversible mechanical changes occur in the microstructure of the clay particles under the pressure of 200 MPa, manifested by cracks and disintegration of mineral particles.

Key words: Clay particles; high pressure; SEM; microstructural changes.

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P-wave velocity variation in Neogene aged sedimentary rocks in terms of the physical properties

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ABSTRACT

The ultrasonic wave velocities have been utilized for estimating physical and mechanical properties of rock indirectly. Porosity, water content, unit weight have strong relations between ultrasonic wave velocities. In this study, Neogene aged sedimentary rocks located at the north of Gediz Graben in western Turkey consisting sandstone, mudstone, conglomerate, limestone and marlstone intercalations were investigated in terms of the ultrasonic wave velocities. These lithologic layers were deformed and fractured by local NE-SW compressive stresses apart from the regional tectonism. Physical properties vary even in the same lithologic layer due to the fact that the grain size, cementation and macro or micro fracture content diversity. Obviously, this will also lead to differences in mechanical properties. Eight different rock type present in Neogene aged deposition were examined in terms of the p-wave velocities (Vp). Sound velocity tests were performed with frequency of 24 kHz for coarse-grained conglomerate, pebbly sandstone, clay and calcite cemented mudstone samples. Besides, the samples belong to other rock types were tested with frequency of 200 kHz. Within the scope of this study, it is aimed to correlate Vp with physical properties of rock samples both in dry and wet conditions. As a result, a well inverse polynomial relation between porosity and Vp was found. Although unit weight has a positive linear relation with Vp, its effect on Vp is less significant than porosity. The variation of Vp in the samples belong to same lithologic layer depends on the cracks and splitting behaviour along the cracks and grainsize. The correlation of two dependent variable is not sufficient alone. The difference between two groups should be investigated via statistical analyses. These statistical analyses were conducted by SPSS v.16 in order to compare the results for dry and wet condition. According to the non-parametric Sign test results; for conglomerate, sandstone, pebbly sandstone, marlstone samples, the difference between dry and wet rock Vp is significant ($p<0.05$). Consequently, a new equation estimating the wet rock Vp from dry rock Vp were developed for carbonate rocks by linear regression analysis with respect to the sign test results (wet rock-Vp = 0.9883*dry rock-Vp + 121.32 R^2 = 0.9483). On the other hand, for coarse grained clastic and clayey carbonate rocks the equation is; wet rock-Vp = 0.9379*dry rock-Vp + 443.85 R^2 = 0.8365. It is statistically proved that the wet Vp can be explained by dry Vp. Additionally, the effect of length to diameter ratio on the ultrasonic wave velocity was investigated and it was concluded that; as the length to diameter ratio increases the difference between the wet and dry rock Vp increases. Besides, the Vp does not significantly changes with the length to diameter ratio.

Key words: Dry p-wave velocity; length to diameter ratio; linear regression analysis; Neogene aged sedimentary rocks; wet p-wave velocity.

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Causes of landslide hazard in the Guadalquivir basin, Southern Spain Prevention and remediation

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ABSTRACT

This article deals with the analysis of landslide causes in the Guadalquivir basin (Southern Spain). Slope failures in Guadalquivir Basin are mostly linked, to the occurrence of thick marine deposits known as the Guadalquivir Blue Marly Clay, of Miocene age, which are largely distributed in the basin. A collection of more than 50 well-known historical and recent landslide data are analysed in order to better understand the key factors governing the mass-wasting processes in the basin and the effective prevention and remediation actions. The analysis reveals that, in addition to rainfall and human actions, as the main triggering factors, the Lithological, geotechnical behaviour and weathering of these sediments, with a presence of numerous microdiscontinuites, such as parallel bedding plans, semi-vertical to vertical sheared slick-lines (strong reorientation of clay minerals) and some stress release un-sheared discontinuities, are found to play a very important role in the landslide susceptibility. The dataset also shows that more than 70% of the landslides are superficial landslides of mixed (translational-flow) type and are associated to the weathered part of the Formation. The low durability behaviour of the Guadalquivir Blue Marly Clays with the wide range of temperature and seasonal rain in the area often contribute to the failure of slopes. During the physical weathering process stimulated by the presence of expansive clays, the sediment return from the initial stiff hard state to, almost normally consolidated soft clay (with a very low strength) where the main soil elements are represented by a large clay aggregates and large voids (forming an squeletal type microfabric).

Key words: Landslide hazard; Guadalquivir basin; prevention and remediation.

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The mechanics of deep-seated earthquake landslides in El Salvador

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ABSTRACT

El Salvador is located at one of the most seismically active areas in Central America. It has suffered several destructive earthquakes during the past 100 yr, which have caused severe damage and great loss of life, mainly due to the earthquake-triggered landslides. The impact of these effects has been shown during the latest earthquakes. The most common coseismic-landslides are shallow disrupted soil-slides. They occur on steep slopes. Most of them are cited in the recent mechanically weak pyroclastic deposits, which are prone to seismic wave amplification. Nevertheless, the greatest damage is produced by deep large scale landslides. Many of these are located more than 50 km away from the epicentres. This fact shows that the occurrence of earthquake-triggered landslides is independent to the near field phenomena. A detailed analysis of historical and recent coseismic-landslide, together with a location of main geological structures, has been carried out. The study reveals that the majority of the landslides, especially the large-scale ones, are not associated to a specific geological material and steep slopes. They occur near or at the El Salvador Fault Zone, independent of the distance and origin of the earthquake, indicating an important control of the existing discontinuities like faults in guiding large liberation of seismic energy. These elements can act as channels through which the seismic waves travel, resulting in an energy entrapment, and therefore in a larger ground motion that can trigger deep-based landslides even in gentle slopes.

Key words: Deep-seated landslides; landslides triggered by earthquakes; El Salvador Fault Zone; seismic energy guidance.

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Investigation of collapse potential of loess soils using geoengineering properties (Case study from Golestan province)

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ABSTRACT

Loess soils can be defined as loose, open structure and metastable soils which cause extensive engineering problems. These soils demonstrate different behavior in various conditions as they can stand high overburden stresses in dry state and may collapse under saturation state. This metastable behavior relates to disintegration of inter-particle clay, carbonate bond and pore water pressure. In this study, loess soils located in Golestan province, north of Iran, have been investigated by emphasis on geo-engineering, i.e. mineralogical and engineering, properties. The soil samples were gathered from 7 areas of the province (southern part (Seid-Miran, Ali-Abad and Agh-emam); central part (Golestan dam and Gonbad-Kalaleh); northern part (Tangli and Alagol)). These samples are as general condition representative of loess soils over the Golestan province. The mineralogical analyses including X-ray diffraction (XRD) and X-ray fluorescence (XRF) indicate that illite and chlorite are the dominant clay minerals within the studied soils. Also, these results show that carbonate content in northern areas is lower than other areas. The loess soils with higher carbonate content occasionally show lower instability and higher collapsibility. In addition, the engineering properties including Atterberg limits, grain size distribution, dry density and hydro-collapsibility have been determined. The hydro-collapsibility properties were measured by single oedometer test under different stress levels and wetting conditions. On the base of the results, the studied soils are classified as silty loess. The collapse potential (Ic) of soils shows upward trend with decreasing water content and downward trend with increasing dry density. Consequently, the collapse potential decreases from northern (Alagol: Ic=18.1) to southern (Agh-emam: Ic=1.06) part of Golestan province.

Key words: Loess soils; geo-engineering properties; single oedometer test; collapse potential (Ic); Golestan province.

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Paleo salt karst system reactivation and earthen dike bursting at the Dead Sea, Jordan

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ABSTRACT

A dike burst related to natural causes is always a serious event because it reveals that at least one significant environmental parameter was either underestimated or not detected during the design phase. Therefore, in each case, it is appropriate to understand the issue and to share the conclusions with the scientific community to avoid reproducing the same mistakes elsewhere. Early 2015, a $ 32 million salt evaporation pond of the Arab Potash Company, Dead Sea, Jordan, was “amputated” of 2.5 km of earthen dike (over 12 km) to avoid a complete destruction. 15 years before, the company had lost a $ 38 million salt pond in 30 minutes after a dike burst. 1650 meters of the embankment dam were totally destroyed. The geological context was the same. Here, we strive to understand the reasons for these failures throughout the setting up of a hydro-mechanical model deduced from space remote sensing data supported by 11 years of repeated field observations. A dedicated Geographical Information System database was set up to investigate the dikes’ environmental setting from the 1950s up to present. Thirty maps have been drawn to describe the main components of the hydro-geological system and its transformations due to both the Dead Sea level lowering and the setting up of salt evaporation ponds. From the 1960s, the rapid level drop of the terminal lake triggered the reactivation of a paleo salt karst system. Soft water coming from adjacent water tables dissolved the most fragile parts of the new emerged lands. In particular, the fractures caused by the rising of a salt diapir and the faulted zones related to the Dead Sea pull-apart basin were concerned. In the 1980s, after the building of salt evaporation ponds, the reactivated paleo salt karst system enlarged by mechanical erosion. The energy available derived from the increasing gradient between in the brine in the salt ponds and the always dropping Dead Sea base level. During the design phase of the Arab Potash Company dike system, the impacts of the Dead Sea water level drop and the cascading consequences over the dynamics of the hydro-geological system have been underestimated. It is therefore important to underline that the feasibility study of major infrastructures, such as the nearby Dead Sea hotels, should take into account the dynamic of environmental parameters that control the erosion phenomena, both at the surface and the subsurface.

This work is supported by the Arab Potash Company. Thanks are due to H.E. Eng. Jamal Sarayreh, Chairman of the Arab Potash Company, and to Eng. Brent Heiman President and CEO of APC, Dr Dureid Mahasneh and Mr. Bisher Mahasneh for their important support.

Key words: Sinkholes; subsidence; dike; embankment; dam; Dead Sea.

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Landslide-triggering factors in Korucak Creek Basin, North Anatolia, Turkey

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ABSTRACT

Korucak Creek Basin is located within upper course of the Yeşilırmak River Basin and southern Middle Karadeniz (Black Sea) section which is known to have the potential of landslide and flood risk. The purpose of identification of landslide-triggering factors is to highlight the regional distribution of potentially unstable slopes and to guide decision makers for regional planning purposes. We assessed morphometric parameters for landslide-triggering factors of Korucak Creek Basin using GIS (Geographical Information System). These parameters are Stream Power Index (SPI) and Compound Topographic Index (CTI). Moreover, slope and aspect values of the basin were classified and superposed over the geologic map. Landslide locations were identified from topographic maps and verified with field observation. The total catchment area of the basin is about 55 km^2. More than half of the total basin is covered by metamorphic rock types such as schist, which has high permeability and weakness against erosion and is one of the main causes of the landslides. The results show that the main triggering factors are slope and lithology. High slope values increase in the upper course of the basin up to values as high as 50%. In the upper section of the basin, the slopes change from 15 to 50%, and have steep topography and schist main rock especially in the southeast part of the basin. Taking into account all of these factors and susceptibility assessment, a detailed landslide inventory map was prepared. Thus, the basin was divided into five susceptibility regions such as very low, low, moderate, high and very high. This map may also be used as a basis for landslide risk-management studies to be applied in the basin.

Key words: Landslide; natural hazard; schist; risk evaluation; Tokat, Turkey.

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Probabilistic back analysis of landslides in Arakli-Tasonu Quarry, Northeast Turkey

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ABSTRACT

Based on known information, back analysis is often carried out to improve an understanding of the unknown parameters at the moment of slope failure. So in the back analysis of slope failures, if the general shape of the sliding surface and volume of the failed mass are known, the shear-strength parameters of the sliding surface, the groundwater condition, and the effect of dynamic force at the moment of slope failure can be obtained. This study evaluates the landslides that occurred on 3 October 2005, 20 March 2006, and 19 October 2006 at Tasonu Limestone Quarry, Trabzon, and Northeast Turkey. The failure plane of the three landslides occurred on the same clay layer. To assess the failure mechanism, determine the range of the shear strength mobilized in the failure plane, estimate the groundwater condition at the time of failure and evaluate the influence of blasting, back analysis using probabilistic technique were carried out. The values of c and ϕ obtained by direct shear tests were considered as prior information about the input parameters. It was determined that the results of probabilistic back analysis could be exploited in evaluating the formation conditions of previous landslides and the potential for future landslides in that area.

Key words: Rock slope; clay layer; direct shear tests; back analysis; probabilistic method.

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A new approach for evaluating durability of building stone: Fuzzy-Interaction Matrices Method

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ABSTRACT

In geotechnical practice, understanding the most effective parameters in engineering system and their relationships is important in order to obtain an optimum design for the engineering system. The applications of Rock Engineering System (RES),an approach to quantifying the intensity and dominance of parameters, method in the analysis of complicated engineering processes have been widespread. In this method, that the main parameters in the said system are located along the diagonal of the matrix and their interactions are quantified by assigning values in the off-diagonal elements. In this study, fuzzy mathematics is used in the coding of the matrix and in calculating of the weight of these parameters. This new system suggested in this study, Fuzzy-RES is used to estimate durability of the volcanic rocks used in the stone walls for landscaping which are built in 1970 in Karadeniz Technical University, Trabzon NE Turkey. The meaningful statically relationships between fuzzy durability values obtained using this new method for the samples investigated and rock durability indicators.

Key words: Fuzzy Logic; interaction matrices; durability of building stone; volcanic rocks; NE Turkey.

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Consequences of the anthropogenic alterations along the Jordanian Dead Sea coast

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ABSTRACT

The Dead Sea is a pull-apart basin forming a terminal lake (-428 m) located over the Jordan - Dead Sea transform fault. The slope of the fresh/saline interface is ten times shallower than observed near the ocean because salinity is ten times greater than in the average sea water. Underground lateral extension is acting as a high density layer over which groundwater is in hydrostatic equilibrium. Since the 1960s, a slice of brine 0.033 km x 77 km x 16.5 km vanished due to water resources over-exploitation in the catchment area. Monitoring of wells in the Dead Sea zone indicated that the water table does not drop at the same pace as the lake. The head difference is increasing with time. Groundwater moves so rapidly towards the lake to compensate for the imbalance provoking the proliferation of sinkholes, subsidence, and landslides. Since the 1980s, the emerged spaces have been covered by industrial and touristic infrastructures. Such a dynamic system provides a test bed to study Human/Environment interactions in the Anthropocene, and the setting up of an Early Warning System to help minimizing geo-hazards effects. The reactivation of a paleo-channel located below a US$ 48 M salt evaporation pond of the Arab Potash Company, Lisan peninsula, provides an illustrative case-study. Sinkholes lineaments whose orientations fit with the main structural directions highlight the role of conduit played by faults and fractures. Rapid underground water circulation explains the appearance of tamarisk in unexpected places. Time series analysis of high and very high resolution visible/radar satellite images acquired from the 1970s and on indicated major changes in the landscape. This work underlines the need of very carefully analysing all available data sources acquired prior to and during the recession of the lake level before the development of human activities along the coast.

This work is supported by the Arab Potash Company. Thanks are due to H.E. Eng. Jamal Sarayreh, Chairman of the Arab Potash Company, and to Eng. Brent Heiman President and CEO of APC, Dr Dureid Mahasneh and Mr. Bisher Mahasneh for their important support.

Key words: Anthropocene; Arab Potash Company; Dead Sea; early warning system; sinkholes and subsidence hazards.

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Is earthworm occurrence on unreclaimed spoil heaps near Sokolov, NW Bohemia, determined by soil conditions and type of litter?

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ABSTRACT

Performance of two earthworm species, common on Sokolov spoil heaps, Lumbricus rubellus Roth and Aporrectodea caliginosa on unreclaimed sites of different age (time after deposition) was studied in two field experiments. In the first experiment earthworms were kept in pots buried on sites 8, 15, 25 and 48 years old for 6 months, at the end change of biomass and number was measured. Both biomass and number of A. caliginosa increased on site 48 years old and decreased on sites 8 and 15 years old, on site 25 years old stayed the same. In the second experiment, A. caliginosa was kept in pots on sites 15 and 25 years old with a) autochtonous litter, b) litter from the other site. The number of earthworms increased (biomass being the same) in soil from site 25 years old in pots with litter from site 15 years old, containing mainly grass and forb litter, whilst litter from site 25 years old contained mostly tough leaves of Salix caprea. In the other treatments both number and biomass generally decreased. This shows that earthworm presence is highly dependent on the successional stage of the certain spoil heap community and consequent soil development.

Key words: Earthworm; spontaneous succession; soil; litter.

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Evaluation of the ability to control biological precipitation to improve sandy soils

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ABSTRACT

Biological soil improvement is a novel improvement technique in which chemical and biological processes lead to improve physical and mechanical soil properties. Since this method is environmentally compatible and applicable to various soil types using different materials, it has turned into an efficient soil improvement method in numerous ground treatment project. Microbiologically induced calcite precipitation (MICP) is one of the most well-known biological soil improvements method in which after the injecting bacterial suspension and reaction solution (cementation solution) into soil particles, calcium carbonate sediment is formed and thereby soil properties was improved. In this paper the ability to manage time and location that calcium carbonate sediments are formed biologically was investigated in sandy soil. The electrical conductivity method, unconfined compressive strength test and X ray diffraction examinations were used sequentially to determine urease bacterial activity, measure the amount of the increased strength of treated soil and determine crystal type. The results showed good ability of this method to control time and location of biological precipitating. Furthermore unconfined compressive strength of Caspian Sea coast sandy soil was increased up to 400 kPa. The ability to manage time and location of biological precipitating indicates this method can be potentially used in different application such as mitigation of liquefaction, soil erosion control, immobilizing of pollutions in soil and other soil improvement projects.

Key words: Soil improvement; biological precipitation; urease activity; calcium carbonate sediment; precipitation control.

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Modification effects of diatomite on Shanghai soil properties

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ABSTRACT

A number of organic and inorganic soil amendments are added to soil for improving its physical, chemical, and mechanical characteristics, which promote plant growth. Use of diatomite as a soil amendment is new and its effects on soil mechanical properties has not been studied. The Atterberg limits and the Proctor compaction test parameters are related to agronomy with regard to compaction hazard for soils and tillage. This laboratory study was aimed to assess effects of diatomite with different rates of 0%, 10%, 20%, and 30% (v/v) on soil consistency limits and soil compactibility parameters in soils with different textures. The results of this study showed that diatomite application significantly enhanced soil mechanical properties and reduced soil compactibility. Diatomite applications in all experimental soils significantly ($p<0.05$) increased liquid limit (LL) and plastic limit (PL) values. The effectiveness of diatomite on LL and PL was more pronounced in soils with low clay content. As compared with the control, the highest application dose of diatomite (30%) increased LL with the rates of 53.9%, 27.3%, and 14.7%, in silt, silt loam and silty clay loam soils, respectively. On the average, diatomite application increased PL by 18.3%, 30.6%, and 43.8% with 10%, 20%, and 30% application rates, respectively, as compared to the control. Diatomite application decreased maximum dry bulk density (MBD), but increased optimum moisture content (OMC). In all the soils studied, the lowest MBD and the highest OMC were obtained from the highest application dose of diatomite. As compared with the control, the highest diatomite application dose (30%) decreased the MBD with the rates of 8.7%, 10.3%, and 13.2%, in silt, silt loam and silty clay loam soils, but it increased the OMC values with the rates of 28.7%, 22.4%, and 25.3%. The results presented in this study clearly indicated that application of diatomite lead the soils more strength to mechanical forces, since increasing the water content at OMC may imply that soil is more easily tilled in higher moisture contents without any deformation which also provides higher workable range.

Key words: Liquid limit; plastic limit; plastic index; maximum dry bulk density; opimum moisture content.

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Chl. a fluorescence and colorimetry as tools to monitor algal development on stone during a biocide test

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ABSTRACT

This study aimed to test different biocide preventive treatments on stone by evaluating the algal growth with Chl. a fluorescence. Treatments were elaborated with tetraethoxysilane at low concentration to make a basis and different ingredients: chitosan and/or silver nitrate for biocide effect and/or hydrophobic silica for water repellency. A protocol for laboratory biofouling test consisted of inoculating treated and control stone slabs with a suspension of an algae culture (Chlorella vulgaris). Slabs were incubated under fluorescent lights for four weeks at 20°C. Every test week, the algal development was monitored by colorimetry and chlorophyll a fluorescence analysis. These techniques are rapid, non-invasive, and reliable. Results displayed four different patterns of algal development. The treatment containing TEOS with silver nitrate, chitosan and hydrophobic silica at low concentration completely inhibited algal development in the long term, which corresponded to a good synergy between those active components. The treatment containing TEOS with silver nitrate, chitosan and hydrophobic silica at higher concentration showed a second pattern of algal development, revealed by Chl. a fluorescence. It corresponded to a delay and a latency of the algal growth by 1-2 weeks. The third pattern was observed with stones treated with TEOS and only silver nitrate. A biocide effect was detected two weeks after the start of the experiment. The last pattern was with the stones treated with TEOS, chitosan and silver nitrate. It did not show any difference in their fluorescence signal as compared with the untreated stones (control). In the present study, chlorophyll fluorescence proved to be a valuable tool in detecting damage in the photosynthetic system of organisms and as a useful complement to other conventional measurements such as colorimetry.

Key words: Limestone; biocide; algae; chlorophyll a fluorescence; color.

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Durability of stone repair mortars used in restoration works of historic buildings from Paris: Non-destructive techniques applied on-site and laboratory analyses

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ABSTRACT

The most frequently used restoration mortars used for stone repair of historic buildings from the city of Paris (France) have been selected to study their durability and interaction with one of the most common natural stone used in the basements of these buildings. Three commercial, ready to used, mixtures of natural and hydraulic limes (NHL, HL) mortars, and the so called Euville limestone, have been chosen to determine their physico-chemical properties by means of non-destructive techniques (NDT) applied on-site of three historical buildings where this limestone was restored at the same period of time from 2007 to 2009, using these three mortars. Besides, in order to understand the on-site results, physico-chemical and mineralogical analyses were carried out on small samples collected from these buildings, and petrophysical tests were performed on specimens of fresh stone from current commercial quarries and mortars manufactured in the laboratory. Finally, the durability and stone-mortar interaction of these specimens was assessed after accelerated salt crystallization ageing tests. Moisture, temperature, permeability, ultrasonic velocity, colorimetric and salt content distribution measurements were taken with NDT on both the restoration mortars and stone. Mineralogical, chemical and porosimetric analyses were carried out on small samples collected from the buildings, and the characterization of mortar raw materials, before mixing with water, was also performed at the laboratory. Furthermore, mortar specimens elaborated and exposed to similar curing environmental conditions to the region of Paris, in order to have a final petrophysical properties as much similar as possible to those obtained in the stone, were characterized separated and together with stone specimens to determine what properties have changed after the ageing tests. Main results show different physico-chemical and petrophysical behaviours, with different porosities, pore size distributions, compression-flexural strength, permeability and capillarity values in the three type of mortars, which raw materials have chlorides, nitrates and sulphates that are also present in the samples from the buildings affected by salt crystallization processes. Taking into account the petrophysical variability of the Euville limestone and the different final properties of the mortars that can be achieved depending on the environmental curing conditions is quite difficult to match the properties of both mortars and stone at the laboratory. However, the combination of both NDT and laboratory analyses allows a better understanding of results, showing a better compatibility for those mortars that finally display the most similar physico-chemical and petrophysical properties to the stone. The lack of precise information to prepare the mortars, both on-site and in the lab, together with the lack of previous studies to match the properties of mortar and stone, give rise to a worse interaction between them. A higher durability and a better stone-mortar interaction is obtained with those mortars that were previously studied and adapted to the properties of the stone before the restoration works took place.

Key words: Durability; stone repair mortars; non-destructive techniques; laboratory analyses.
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Marble characterization by ultrasonic methods

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ABSTRACT

Ultrasonic techniques are increasingly being used in various fields such as mining, geotechnical, civil engineering, because they are non-destructive and easy to apply. These techniques are usually employed both in site and laboratory to characterize and determine the dynamic and physical properties of rocks. In cultural heritage, the characterization of marble statue by acoustic wave is a well-known non-destructive method. This paper undertakes a study of the Carrara marble that composes the statues exposed in the Château de Versailles gardens, in order to better understand the processes of deterioration affecting them. For this, 10 cm side square plates of Carrara marble are artificially aged through heating/cooling thermal cycles performed on one face of the samples. Acoustic waves such as compressive, shear and Rayleigh are generated by 1 MHz central frequency contact transducers exited by a voltage pulse generator. A laser vibrometry detection method is used in the case of Rayleigh wave detection. The transmission measurements point out a strong decrease of the wave speed as well as a dramatic decrease of the maximum frequency transmitted in conjunction with the weathering. The velocity of ultrasonic waves depends on the physical and mechanical properties of the stone (such as density, porosity, elastic constants, and structure), Therefore, correlating the changes in these properties with the measured ultrasonic velocity helps to provide classification schemes for evaluating the degree of stone deterioration. Some classical tests such as drilling resistance and water absorption (contact sponge method and water drop test) were also performed in order to complete the results obtained by ultrasonic velocity method.

This work is funded by the Foundation des Sciences du Patrimoine, LabEx PATRIMA.

Key words: Marble characterization; compressive wave; shear wave; Rayleigh wave; vibrometry laser; drilling resistance; water absorption.

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Evaluation of engineering properties of the Kayseri tuffs used in some ancient monuments around Kayseri (Turkey)

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ABSTRACT

Tuffs were extensively used in ancient monuments and many historical buildings such as such as churches, mosques, caravanserai around Kayseri city located in the central part of Turkey. Although the tuffs have variable physical and mechanical properties, they have field performances with moderate to good durabilities for many years. In this study, quarries of the tuffs used as stones in many ancient and historical monuments around Kayseri were identified. Several block samples collected from the quarries were tested in the laboratory. Engineering properties of the samples such as dry and saturated unit weights, effective porosity, water absorption, saturation coefficient, dry and saturated uniaxial compressive strengths and sonic velocities were measured. The tuffs used in the monuments and buildings were also investigated and their field performances were categorized on the basis of visual observations and Schmidt hammer rebound measurements. The laboratory test results of the tuffs were evaluated in terms of their field performances in the monuments.

Key words: Ancient monuments; engineering properties; field performances; tuff; Kayseri; Turkey.

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Colour and roughness measurements as NDT to evaluate ornamental granite decay

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ABSTRACT

Stones are widely used as building material due to their strength and durability. Some stones as granites are selected for ornamental purposes due to their texture and colour. Granites are durable materials, in terms of strength. However, all materials exposed to environment are susceptible to decay. The determination of granite durability has been slightly neglected since most of standard weathering tests have been developed for stones with more than 5% porosity. In addition, the evaluation of the decay is commonly focused in structural parameters such as loss of mass or fracturation. In this study, we assess the decay with NDT such as colour and roughness. Colour is one of the stone parameters that influences their selection with ornamental purposes. Roughness plays an important role in colour and gloss perception. Besides, there is a relation between roughness and the willingness of a material to attach particulate such as salts or pollutants. That can produce a fast decay and induce changes of colour. For this research, four granites commonly used as ornamental stones have been studied. They show differences in colour and texture, thought porosity is similar. Four weathering test were carried out: salt crystallization, freeze-thaw cycles, SO_2 exposure and heating to different temperatures. Standard test were adapted to focus the damage on the surface. Colour and roughness measurements were carried out before and after the tests. We concluded that, in the decay tests in which chemical reactions are not involved, roughness measurements give an accurate information about the decay. The detachment of mica and the crack formation can be measured and quantified with this technique. Roughness variation is identifiable in granites with fine grain size and high mica content. In the decay tests in which chemical reactions are produced, such as SO_2 interaction or mineral transformation due to high temperatures, both colour and roughness can evidence the decay, even if colour change is faster and easier to observe and measure. When colour changes are the result of the chemical damage, granites with red colours showed less visible variation respect to the sound stones than grey granites, in which this change is evident. Colour variation due to mineralogical changes are focused in iron containing minerals.

Key words: Granites; colour; roughness; NDT; weathering test.

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Comparison of 3D scanning techniques for their application to restored stones

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ABSTRACT

The replacement of natural stones is a common solution during restoration works. The effectiveness of conservation and restoration actions may be reduced by the rapid weathering of new materials if the balance between the material and the conditions of the environment is not good. Our current research focus on the early weathering forms of replacement materials in the north of France and in south of Belgium. An “in situ monitoring” was implemented in order to follow the chemical and physical surface variations due to pollution and other environmental factors such as temperature changes or rain (every six months during 3 years). In addition, simulations of polluted atmospheres and acid rain were carried out in laboratory. Three natural stones and a reconstituted stone used in these buildings were selected for these tests. Chemical variations were evaluated by colour changes, scanning electron microscopy and ion chromatography. To measure physical surface variations, 3D scanning was used. The “in situ” 3D measurements allowed us to observe and quantify the erosion and the pollution deposit of the replaced stone. The 3D measurements on surfaces exposed to acid rain and acid atmospheres were performed in order to assess the salt formation and surface dissolution. Three different 3D scanning devices were chosen for their accuracy, their acquisition speed, their cost, the size and material of digitization specimens, their handling and their ability to capture the texture/colour. Measurements were made with the technology platform NUM3D equipped with: a) a laser scanner techniques, b) a structured light scanner, and c) a Digital Images Correlation device. In order to compare the results and to be able to repeat them with time, we have developed a methodology (based on process modelling) for the 3D scanning of stone specimens. Using this methodology, we can perform 3D mapping to identify the dimensional differences caused by the technologies used. The three main parameters of these techniques when studying stone weathering are handling, speed of data treatment and resolution. For the same stone slab, the measurement takes a few minutes for all methods of scanning, however the amount of recorded data and the time needed for data treatment vary. The laser scanner is a portable device with a resolution that allows to observe the topography but not the pore dissolution or salt precipitation in detail. The structured light scanner is a non-portable device with higher resolution than the laser scan. With this device pores are clearly observed although the data treatment of each slab need several hours. The digital images correlation is a non-portable device for which the preparation of the device for the measurement may take even a few days. The data treatment takes several days but the resolution is very high. In this study we have chosen to scan our laboratory samples with the three devices before the tests, and to choose the optimal technique for the measurements after the test in relation to the observed decay.

Key words: 3D Digitization; process modelling; building stone; NDT; stone decay.

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Combined portable Non Destructive Techniques (NDT) in order to assess the decay of building stones in urban environment, the case study of St André Church (Reims, France)

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ABSTRACT

The historic building stones are vulnerable to climatic conditions and atmospheric pollutants. For that reason, the cultural, societal and economic interest to make the restorations as durable as possible is undeniable in an aggressive and evolving atmospheric environment, particularly in areas with significant human activities (traffic, housing, agriculture and industry). The Saint-André Church is a new-roman style monument built in 1865 and located close to a very busy road in the center of Reims, France. During the ongoing restoration, the Savonnières limestone, a well-known restoration's stone, is being used to replace the current damaged stones, which are mainly local limestones such as "Courville", "Euville" and "Savonnières". All these stones showed a light yellow colour, susceptible to fast darkening due to pollutants. At this precise moment, the south façade is partially restored, and consequently interesting for our study. The aim of this research is to monitor the stone decay at long-term by Non Destructive Techniques (NDT). That should allow to assess the becoming of polluants on the stone, and to record the differences in weathering kinetics between the restored and the weathered stones. The methodology carried out was firstly a lithological and a damage cartography. The soiling, crusting and material losses were the main alterations observed. 280 points were measured in the façade, 80 in the non-restored part and 200 in the restored one. In these points, NDT were used such as colorimetry, XRF, magnetic susceptibility and infrared thermography. In addition, 3D imaging was measured in individual stone slabs that were placed in the surroundings of the church and exposed to the same environment. The colorimetry was set up with a Chromameter to control and quantify the evolution of the surface colour. If a blackening is found, the traffic pollutants will be the main agent of decay, while if a greening can be observed, biological activity will be the most important decay factor. Portable XRF was used in order to bring out the presence of heavy metals and other compounds characteristic of anthropogenic pollution. Magnetic susceptibility and Infrared thermography were recorded. The measurements in each established point will be repeated every 6 months. Some results from the initial state of the church's south façade have already been analysed. The colour of the surface of the non-restored part seems to be more heterogeneous due to the soiling, with luminance values ranging from 36 to 81.This parameter ranges between 70 and 84 for the restored part. The magnetic susceptibility data are higher in areas with little or no leaching by rain water that is prone to particle deposits. These values are proportional to the concentration of Pb and As detected by pXRF. Magnetic susceptibility gives also interesting data in relation to the different materials used in the restorations. Values differ greatly from natural stone to mortars. All these techniques, their complementarity and precision allow a thorough and comparative study of the long-term evolution of the Reims historical monuments in a polluted atmosphere.

Key words: NDT; stone decay; restored cultural heritage; pollutants.

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Landslide susceptibility mapping based on the 2008 MORLE in Santa Catarina, Brazil

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ABSTRACT

An analysis of a multiple occurrence regional landslide event (MORLE) in the Itajaí valley (Santa Catarina State, Brazil) in November 2008 is presented. The nature of the event, it's conditioning factors and the effects caused are described. Over 1500 slope movements were concentrated within an area of about 300 km2, with important losses of lives and material damages. Events of a similar nature and magnitude have occurred in this state and others of southern Brazil during the last few decades. In order to assess to what extent the type and quality of data available on this event could provide the basis for prediction in the case of future events, an analysis of the relationship between landslide ruptures and conditioning factors was carried out. The approach was based on statistical correlations using an heuristic model, relying to a great extent on expert judgements, derived from the experience acquired during field surveys carried out after the event. A susceptibility model was thus obtained, and it was validated using different strategies. The output of the former model was compared with the one of more objective models, based on Favourability Functions. The results show that useful predictions can be made with the amount and type of information available. There are no time series on landslide occurrence in the area and therefore hazard maps (expressed in terms of probability) could not be obtained, but susceptibility assessments coupled with data on population centres and damage information provided the basis for a preliminary risk analysis. The methodology used and results obtained are presented and discussed.

Key words: Landslide susceptibility; model validation; MORLE; Santa Catarina (Brazil).

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Session Title:

Geotechnics

Numerical modelling of dredging of underground construction

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ABSTRACT

In the course of modelling of stage-by-stage construction of difficult elements of designs, industrial and transport constructions by drawing up power and settlement schemes for identification of being formed fields of tension, deformations and movements it is required introductions of concept of being transformed designs (mechanical systems) which at separate stages of technological process of construction pass from one class to another as previously shown by Boroday et al. (2003). Mathematical modelling of process of formation of fields of tension, deformations and movements in elements of this mechanical system also demands a problem definition of mechanics of a being transformed design. In the mechanical system described above transformation of the settlement scheme happens discretely upon transition from one stage of construction on another. On each step of transformation necessary calculations should be carried out taking into account a field of tension, movements and the deformations collecting in system on the previous steps. When modelling interaction of elements of designs with soil in some cases for an adequate assessment of nature of deformation various techniques of contact interaction of elements of designs among themselves and with soil are used. Not the accounting of contact can lead to essentially other result to some extent even contradicting common sense. The finite-element calculation procedure of strain of the soil cooperating with elastic structures located in it is constructed. For modelling interaction between deformable structures and soil continuums the special "contact" finite element is used, allowing to consider all cases of interaction of contacting continuums, including shift with slipping and detachment. As an example the problem of stage-by-stage excavation from a foundation ditch with concrete walls is solved. Necessity of the decision of a contact problem for modelling interaction concrete constructions and a soil is shown.

The reported study was supported by RFBR, research project No. 15-41-02555, 15-01-08733.

Key words: Method of finite elements; contact problems; finite strains; soils.

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Settlement prediction for staged filling construction on the PVD-improved soft ground using SPSFC method

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ABSTRACT

A new method called the SPSFC (Settlement Prediction for Staged Filling Construction) is proposed. This method is able to predict both the final settlement and the settlement during the staged filling steps from any filling stage in a PVD-improved soft ground. In order to verify the applicability of the SPSFC method, the settlement data must first be measured in the field at a specific filling stage and be analyzed to produce the soil parameters which are needed to predict the settlement in the SPSFC method. Then, using the obtained soil parameters, the settlement curve is predicted and compared with the measured one. The predicted settlement and the measured one are well matched. From the study, it can be confirmed that with the SPSFC method it is possible to predict settlement during the staged filling with only certain stage settlement data.

Key words: SPSFC; settlement; staged filling; PVD-improved soft ground; soil parameters.

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Estimation of daily soil temperature by using M5 Tree Model

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ABSTRACT

This paper investigates the potential of M5 tree model estimation of daily soil temperature at 5-100 cm depths. Tree structure of this model is able to divide total variables space to some sub-spaces and make linear models for each sub-space to predict target variable. Climatic and soil temperature data of Isfahan province located in central Iran was used for modeling process as inputs. Result showed that M5 tree model with determination coefficient of 0.98 and root mean square error 1.64 could be estimate daily soil temperature with high accuracy in 10 cm depth. On the other hand M5 tree model provides a simple linear relation to predict the soil temperature for the data ranges used in this study. Error analyses of the predicted values at various soil depths suggest that estimation error tends to increase with the depth.

Key words: Soil temperature; data mining, M5 tree model, Iran.

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Simple Additive Weighting (SAW)-GIS based-seismic microzonation model of Erbaa (Tokat-Turkey)

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ABSTRACT

Geographical Information System (GIS) is a powerful tool to gather data, perform spatial analyses and prepare maps for microzonation purposes in the computer environment. Seismic microzonation can be defined as the combination of geological, geotechnical and geophysical reconnaissance; the evaluation of the expected ground motion and the preparation of the maps with different layers. These layers may include a variety of maps such as geological and geotechnical maps, earthquake related hazard maps, site response maps, slope-aspect maps, etc. In addition, it is difficult to organize the number of layers in the seismic microzonation without using GIS-based systems which allow querying and classifying the database easily for urban areas. Each database can be kept in various formats to correlate the parameters with the other databases. Systematically, geological and geotechnical data obtained from detailed field surveys should be located into spatial objects. The selection of the parameters which is really fundamental issue for its consistency should be well-correlated with the field conditions. In this study, it is aimed to discuss how important the usage of the MCDA (Multi-Criteria Decision Analysis) techniques in the GIS-based systems for seismic microzonation purposes. An example of the seismic microzonation of Erbaa (Turkey), placed along the seismically active North Anatolian Fault Zone (NAFZ), is evaluated with different layers. Final seismic microzonation map of the study area was evaluated applying GIS-based Simple Additive Weighting (SAW) which is one of the Multi-Criteria Decision Analysis (MCDA) techniques.

Key words: Seismic microzonation; GIS; Simple Additive Weighting (SAW); Erbaa; Turkey.

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Repeated load response of soil reinforced by two layers of geocell

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ABSTRACT

This paper describes a series of cyclic plate load tests on a circular plate with diameter of 300 mm, supported on unreinforced and reinforced beds by one and two layers of geocell, to simulate the behaviour of footings or vehicle passes. According to initial studies, the depth of the uppermost geocell layer and of the geocell inter-layer spacing both were selected 0.2 times of plate diameter. The results of the testing reveal the ability of the reinforced system by two layers geocell to 'shakedown' a fully resilient behaviour after a period of plastic deformation. As the number of geocell layers increases, the loading surface deformation of the pavement foundation decreases due, in part, to better load spreading. Under the last cycle of loading at 400 kPa with two layers of geocell (Ng=2), the residual, plastic, deformation is only about 63% of the value for the unreinforced case. Likewise, with increase the number of geocell layers from one to two layers, the pressure transferred to depth of foundation bed beneath the centre of loading plate, considerably decreases. For instance, the vertical stress transferred to a depth of 350 mm beneath the centre of loading surface, under the applied cyclic pressure of 400 kPa, at the end of the load cycles is about 181, 115.1 and 96.8 kPa for unreinforced and reinforced foundations with one and two layers of geocell, respectively. On the basis of the study, the concept of multiple geocell layers is recommended for larger scale trials.

Key words: Geocell layers; repeated loading; pavement foundation; residual and resilient deformations.

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Shear characteristics of fibre-concrete

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ABSTRACT

Modern concrete is not only a composite material consisting of water, cement and filler. It was experimentally tried to add some substances, ingredients or dispersed reinforcement in order to improve some mechanical properties of concrete. Dispersed reinforcement with sufficiently high tensile strength and modulus of elasticity may contribute to upgrade some mechanical characteristics of concrete. The biggest benefit of adding dispersed reinforcement is its positive influence on fracture energy and ductility. Many of three-point and four-point bending experiments confirmed this fact. It should be noticed that bending tests lead on cracking of concrete specimen – mode I in fracture mechanics. However, it is necessary to investigate its performance in different types of failure. The intention was to create experiment in which the conditions of pure shear are realized without accompanying by other stress. In this context, it should be noted that in many real applications fibre-concrete is designed to carry effects of shear forces. Unfortunately no realized experiment investigated the performance of fibre-concrete in pure shear mode without any accompanying bending effects (from the view of fracture mechanics it is the mode II and III). Realization of these specific conditions in case of a prism beam - loaded by vertical transverse load is not possible. From this reason, it was inevitable to propose uncommon arrangement of the experiment: large-scale tubes to which pure torsion is applied. This causes pure shear in the wall of tube. During experiments there is measured not only ultimate shear strength but it is observed also the descending post-peak curve of transmitted stress. These results enable to derive the stress – strain dependence in the whole range of stress-strain diagram in pure shear mode. Experiment of this new arrangement provides results of great importance and its benefit is far-reaching.

Key words: Fibre-concrete; shear; tubes; torsion; specimen; experiment; concrete.

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Comprasion of Slake Durability Index (SDI) values of sphere and rounded marl samples

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ABSTRACT

In this study, to minimize the difficulties encountered in the surface profile and shape of testing samples in slake durability index test, a new sample preparation method which is called as Pasha Method is used. In order to apply this new sample preparation method, marl samples were collected at Tuncbilek open pit mine located at the Kutahya region in Turkey. Samples were prepared as two different profiles and shapes. First was the rounded rock test samples whose sharp sides were hammered and ground with abrasives. This first testing samples were prepared according to both the ASTM and ISRM standard. Second were equal-sized spherical test samples that are prepared according to the new method. After sample preparation, these two different samples were subjected to the Slake durability index test. The test results of two different samples are presented in this paper. According to the test results, the highest slake durability index values were obtained from equal-sized spherical test samples that are prepared according to the new method when the sphere samples were compared to the rounded samples.

Key words: ASTM; ISRM; Pasha Method; Slake Durability Index; marl.

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Computer evaluation of asperity topology of rock joints

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ABSTRACT

Grounds beneath large civil engineering structures (bridges, dams, tunnels) that are established in the terrain of rock discontinuities represent a risk of mechanical failure. The discontinuities of rock joints usually create a three-dimensional network. The surface topology of joint surfaces strongly influences shear strength of these discontinuities. It is the asperities that mainly determine the surface topologies and the asperities are characterized by the so-called joint roughness coefficients (JRC). In geotechnical practice a visual assessment of JRC introduced by Barton and Choubey (1973 and 1977) is frequently used. Their visual assessment is based on ten two-dimensional profile standards. The visual assessment is rather subjective procedure but it could be replaced by a computer procedure. This procedure consists of three main steps such as three-dimensional digital imaging, Fourier's reconstruction and classification using global indicators. (i) Three-dimensional imaging of rock joints: A new device capable producing three-dimensional (3D) digital profiles of joints have been designed and assembled. In comparison with other similar devices it is easier, cheaper and capable working in the field. (ii) Fourier's reconstruction of rock joints: The two-dimensional Fourier series was used to create analytical replicas of the surface morphologies of rock joints. Two global parameters characterizing height and shape of the relief are defined and their numerical values computed. (iii) Classification using global indicators: The numerical values of indicators of height and surface shape are compared with those of database 3D patterns and the most similar couples determined. The couple consists of the investigated surface and database pattern whose JRC is known. The JRC of the chosen database pattern is assigned to the investigated surface. All these operations are performed automatically with exclusion of the subjective visual decision.

Key words: Rock discontinuities; joint roughness coefficients; assessment of roughness coefficients; computerized procedure; civil structures in unstable environment.

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Plate load tests of multi-layered geocell-reinforced bed- considering embedment depth of footing

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ABSTRACT

This paper describes the effect of embedment depth on bearing capacity of footing supported by geocell-reinforced bed, using plate load test at a diameter of 300 mm. The embedment depth ratio of the footing was varied from zero to 0.75. The plate load tests were performed in an outdoor test pit, dug in natural ground measuring 2000 x 2000 mm in plan and 1000 mm in depth. The geocell used in the tests was non-perforated with pocket size 110 x 110 mm^2 and height 100 mm, fabricated from continuous polypropylene filaments as a nonwoven geotextile. The tests were conducted on geocell reinforced bed sand which compacted to 85% relative density. The test results demonstrate that the bearing pressure increases with increase in the embedment depth ratio and the number of geocell layers. The study also compares the embedment depth ratio of one layer geocell reinforcement with two and three layer geocell reinforcement bed with no embedment depth. These comparisons show that the performance of footing on unreinforced bed with the embedment depth ratio of 0.25 and 0.75 might be comparable to the performance of footing on geocell reinforced bed with two and three reinforcement layers.

Key words: Bearing pressure; embedment depth; geocell reinforcement; plate load test.

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Implementation of real time geotechnical monitoring at an open pit mountain coal mine in Western Canada

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ABSTRACT

The evolution of geotechnical monitoring technology for assessing slope stability issues in real time has progressed rapidly in the last few decades. The technology has advanced the safety of open pit operations and has the potential to change planning parameters, particularly in activities adjacent to public infrastructure, based on the additional confidence that operators gain from instantaneous access to information as pits are excavated and waste dumps are constructed. This paper summarizes the experience of a coal mine operating in the rugged topography of the Alberta foothills, excavating extremely structurally complex coal deposits within thrust and fold belt geology. In the last decade, the geotechnical monitoring at this site progressed from manual (daily to monthly) monitoring of a network of survey prisms and piezometer installations, to real time (hourly or less) monitoring of slopes and slope foundations by multiple robotic total stations sampling prism networks on pit walls and dumps, slope scanning radar, piezometers and some manually monitored borehole slope inclinometers. During this period, the mine experienced a number of slope failures on both pit walls and waste rock dumps. Back analysis of these failures from the monitoring data has refined the understanding of the speed failures progress at, and the best metrics and thresholds to define how alarm systems should respond to deformation. Case studies are presented for both pit foot wall and dump failures.

Key words: Geotechnical; monitoring; back analysis; SSR; StdE.

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The study of deformation index testing to the stability assessment of measures mining excavations

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ABSTRACT

In this paper, our research examines the importance of testing measure rock for the stability assessment of mining excavations. The evaluation of strength and deformation parameters of rocks has been identified and index testing of rock for appraisal of strength at a field site is critically examined. An evaluation some testing techniques for measures rocks has been realized. Analyze of index testing methods is given. These tests are necessary for quick estimation of deformation parameters of rock for the purpose the prediction of the stability performance of mining excavations.

Key words: Mining excavation; mining stability; strength; geotechnical; deformation.

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Study of the stability of underground mines Algeria geotechnical approach

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ABSTRACT

The underground working of the horizontal layers and slightly inclined by the room and pillar method generates significant buildings which can be at the origin of a subsidence on the surface. The width of this depression depends on the structure of the layer, the worked seams number, the pillars superposition, lodging depth and the degree of stripping. If safety measures and technological often prohibitory are not taken into account, the environment will be considerably affected. This study deals with a contribution being able to be brought by the numerical modelling for a pillar dimensioning applied to the case of mines (Algeria). Calculation carried out, based on the geological parameters and geotechnics deposits. The results obtained enabled us to have a rate of maximum extraction and an acceptable factor of pillar stability and 2D to quantify the subsidence bowl.

Key words: Mines of Algeria; numerical modelling; subsidence; environment.

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Improving landslide displacement measurement through automatic recording and statistical analysis

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ABSTRACT

This work illustrates some theoretical aspects concerning the accuracy and reliability of continuous measurements of underground displacements in slopes. Modular Underground Monitoring System (further referred as MUMS), is an automated monitoring system that collects and remotely sends displacements data. The main advantages of an automated monitoring system are the high acquisition frequency and the simultaneous recording of several physical entities (such as displacements, groundwater level, temperature, precipitations, pore pressure and so on). MUMS also does not require the presence of a field operator and it was designed to last longer than traditional inclinometers. Generally, all instruments are affected by different kinds of errors. The paper highlights how a large database of collected data and a statistical approach can be used for the analysis of reliability, in order to verify if accidental or systematic errors are present. It is also possible to understand the effects of spurious interference effects that can be related to temperature variations or to unexpected mechanical stresses acting on the nodes. Improvement of hardware components, enhanced processing techniques and new calibration method provide more accurate and reliable results. A comparison of few installations in different landslide is carried out with particular attention to the accuracy and repeatability of the automatic measurements. We present the results of some early generation MUMS to highlight different problems in the analysis of collected data. Finally, results obtained by a new installation are shown to highlight the achieved progresses. Current MUMS system is strongly reliable and it is useful to supervise underground displacements and to locate sliding surface, in order to predict possibly forthcoming risk situation by remote control.

Key words: Landslides; geotechnical monitoring; automated; inclinometers.

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Prediction of soil swelling parameters

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ABSTRACT

The article discusses the issue of soil swelling. Soil swelling is a process occurring when the fine soil increases its volume during water (or moisture) uptake from its surroundings – swells. The swelling is a three-dimensional problem and the volume changes are not directly related to the sorption ability of the clayey soil. The swelling intensity depends on initial water content, consistency index, plasticity index and colloidal activity index. The lower the initial water content for given plasticity and colloidal activity, the more significant and intensive the swelling is. The swelling is tested under laboratory conditions on undisturbed soil samples, usually only linear swelling is tested. Alternative procedure is to measure deformation in time in the oedometer while also measuring the swelling pressure. However, testing in stand with dynamometers where both swelling pressure and deformation are measured in time seems to be the best way to test swelling. The problem is that this test gives the values of the swelling pressure for the given initial state of the soil. But we also have to be interested in the swelling pressure for lower initial water content, because we cannot guarantee that such conditions will not occur in reality. When we focus on the swelling significance in transport engineering and its complexness (influence cut slope stability, destructive effects on pavements, the correct way of soil improvement etc.) the problems with test are clear. The duration of the test is between 160 and 210 hours. Therefore, the laboratory has to be sufficiently equipped for this type of time-demanding testing and the cost of tests is also significant. If there are any criteria for swelling in technical standards, it is only for linear swelling. But these values do not give any information about the swelling pressure (deformation is only an accompanying effect). It is shown that the swelling pressure varies with different initial conditions while the deformation may still be the same 3%. It was found by authors that the formulas for swelling pressure, time of swelling and swelling strain may be constructed after nonlinear regression analysis of the results of the basic soil tests. The advantage is that the basic characteristics are easy to determine and such tests can be done in large quantity. Then it is possible to predict swelling pressure, time of swelling and swelling strain for different initial water contents. Regression relations were developed by GeoTec-GS, a.s. using QCExpert Professional software based on the data from site investigations by GeoTec-GS, a.s. and experimental data from CTU in Prague. In order to prevent swelling effects on the road structures the modified materials are generally used. For the soil modification by lime it was not possible to determine the initial water content of the marlstone directly. Therefore on the large testing authors develop equations describing the swelling after lime addition. The authors believe the proposed relations for swelling pressure and swelling time relations are a suitable alternative for the classical calculations.

Key words: Soil swelling; swelling time; swelling pressure, soil improvement.

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Effect of polymer portland cement stabilization on geotechnical properties of sandy soils

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ABSTRACT

This experimental program was conducted to study the effects of polymer portland cement stabilization on the geotechnical characteristics of sandy (liquefiable) soils. Stabilizing agent included Portland cement, and was added in percentages of cement (10%, 20%, 30%, and 40%) and polymer (1%, 2%, 3%, and 4%) by dry weight of the soils. This analysis of the mechanical behaviour of the soil is carried out from the interpretation of results from unconfined compression tests and direct shear tests. In Duzce University laboratory, cylindrical and cube samples were prepared at optimum moisture content and maximum dry unit weight for unconfined compression and direct shear tests, respectively. The samples were cured for 7, 14 and 28 days after which they were tested. As a conclusion, based on the experimental investigations, the utilization of polymer cemented specimens increased strength parameters, reduced displacement at failure, and changed soil behaviour to a noticeable brittle behaviour.

Key words: Stabilization; polymer and portland cement; unconfined compressive strength; shear strength parameters; brittle behaviour.

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Evaluation of Atayurt town (Southern Turkey) with regards to settlement suitability

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ABSTRACT

The aim of this study was to determine suitable, provisional and unsuitable areas for settlement in the vicinity of the city of Atayurt. For this purpose, the land-bound lithological units within the geological framework and the tectonic lines were determined, and a 1/2000-scale geological engineering and settlement-suitability map was prepared. In addition, standard penetration tests (SPTs) were carried out through geotechnical boreholes for bearing capacity calculations and liquefaction potential assessment of the soil. Consolidation settlement tests and an evaluation of the physical properties of the rock and soil were also carried out. Moreover, steep slopes (α ≥ 30%) and areas susceptible to mass movement were detected and indicated on the geological engineering map. As a result of these geological and geotechnical investigations, the provisional (precautionary), suitable and unsuitable areas for settlement were determined for Atayurt and its environs.

Key words: Geotechnical properties; seismicity; settlement suitability.

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Application of low potential electric fields for improving slope stability

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ABSTRACT

The aim of this research is the application of low potential direct currents to improve slope stability by inducing the reduction of potential swelling and water content and the precipitation of carbonates in cohesive soil pertaining to a possible sliding surface. In the past some attempts to use electro osmosis for stabilizing landslides in cohesive soil have been performed by applying potential difference in the order of 1.0 V/cm. However, this technology has been soon abandoned due to the fast degradation of the electrodes, the high costs of the system, the insufficient knowledge of the induced phenomena and the side effects (soil warming, colloidal fraction reduction, induced cracking). The present study aims to verify the applicability and the effectiveness of low potential direct currents (0,1 – 0,2 V/cm) for improving slope stability in case of cohesive soil and shallow sliding surface (i.e. soil slip). Thanks to the recent scientific and technological development and the new materials, low potential electric field could become an effective tool for reducing potential swelling in active clay minerals, inducing dewatering in cohesive soils and facilitating carbonates precipitation in soils in which an alkaline environment is induced. This could allow for the improvement of soil shear strength and, therefore, of the slope safety factor. Two different types of test have been performed to verify the effects of this technology: the first one on small samples and the other one on a physical model reproducing a slope. Main results showing the effectiveness of this application are described.

Key words: Slope stabilization; ground improvement; electro osmosis.

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Finite element based investigation of backfill effects on seismic behaviour of a cantilever wall

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ABSTRACT

Although retaining systems are seemingly simple and easily constructed structures, their seismic design is a rather complicated task. This is mainly attributed to the fact that their dynamic response has not been yet completely understood, despite the numerous studies that have been carried out in the past. Moreover, cantilever retaining walls are critical geotechnical engineering structures which have become widespread during the recent decades following the introduction of reinforced concrete construction techniques, especially in connection with the protection of transportation facilities and/or residential areas. For these types of retaining walls, structural weight is not predominant as equilibrium depends mainly on backfill actions and the resistance of foundation soil. Dynamic loads have come to be forefront of attention due to a number of events that affected retaining structures all over the world, clearly indicating that this issue is important for purposes of structural design. The widespread damage to retaining structures due to earthquakes may have a substantial impact on the economy of the region in terms of both direct and indirect losses. While direct losses result from structural and non-structural damage, indirect losses accrue from business interruption due to damage and loss of transportation infrastructure. Therefore, in order to consider the economics of design and also mitigation of damage due to strong earthquakes, knowing the behaviour and seismic design of retaining walls is of great importance. In this study, a series of finite element analyses were conducted to investigate the backfill effects on seismic behaviour of a cantilever retaining wall incorporating backfill and subsoil interactions. Considering four different backfill soil conditions, the dynamic analyses of backfill-cantilever wall-soil/foundation system were carried out in time domain. The cohesionless soil was modelled as an elasto-plastic medium with viscous boundary applied on the artificial boundary of soil to simulate the wave energy absorption. Backfill-cantilever wall interface behaviour was taken into account by using interface elements between the wall and soil to allow for de-bonding. The dynamic analyses of the soil-structure model were carried out through the general purpose structural analysis computer program, ANSYS. The computational results include the lateral top displacements of the wall and stresses occurred in the critical sections of the wall. Consequently, based on the response amplification/reduction pattern observed, it is highlighted that since the earthquake behaviour of cantilever retaining walls can change considerably due to the backfill interaction, it should be considered in design criteria of cantilever walls. Furthermore, these structures must not be designed only according to the typical projects as the local soil conditions may change the system behaviour.

Key words: Artificial boundary; backfill interaction; Cantilever retaining wall; Finite Element Analysis; response amplification; seismic behaviour.

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Using of alternative methods at earthworks quality control

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ABSTRACT

This article is about assessing the quality of earth structures in terms of possibilities of using alternative methods. The contribution is focus on the possibility of using geogauge Humboldt H4140 and Clegg CIST 882 for quality control of earth structures. These methods are beneficial to engineering practice with respect to speed and smart testing. Methods described in the article are not yet included in the Slovak technical standards and their application is very rare as they are not verified in practice yet.

Key words: Earthworks quality; light dynamic deflection; geogauge Humboldt H4140; Clegg Hammer.

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Geotechnical evaluation of quaternary caliche deposits in Southern Turkey

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ABSTRACT

Caliches are described as secondary carbonate formations and calcareous, semi consolidated aragonite or early diagenetic calcite forming in loose materials such as pebble, sand, silt, and soil under semi-arid and arid climatic regimes. Caliche deposits consist of different levels in the vertical direction and do not have a homogeneous structure. Because of the reasons, the deposits are known as problematic geo-materials in geotechnical engineering. In the study area, caliche deposits are observed in/on terrace deposits and Handere formation consisting of claystone. In this study, four major types of caliche deposits were considered such as terrace, calichified terrace, carbonate crust (hardpan), and calichified soils (softpan). But in general, hardpan appears as a massive carbonate cap whose thickness is about 1 to 2 m and can be considered as a very low strength rock. Underlying this level is the softer and looser level called the softpan level. Geotechnical properties of the caliche deposits were evaluated based on field observations, geotechnical soil borings and laboratory testing. Dominant mineral type is found to be calcite in hardpan levels and it changes between 88.2 and 98.7%. Also, a very small quantity of (1.30–11.80%) quartz is detected. The most important difference between hardpan and softpan is the amount of clay minerals. Terrace deposits at different levels show variation in gradation but in general is poorly sorted. The results of sieve analysis show that the gravel and sand ratios are approximately 16 and 80%, respectively and the fine grain ratio is below 4%. Mean uniaxial compressive strength of this unit is 16.00 MPa and it can be classified as a very low strength rock. The calichified terrace deposits consist of pebbles with sandstone patches. The calichified terrace deposits have an average unit weight of about 19.85 kN/m3 and average uniaxial compressive strength of about 5.41 MPa. Calichified terrace deposits, which are classified as very low strength rock, have an average elastic modulus value of 0.63 GPa. The hardpans in the area are mainly observed on the top of terrace deposits and on the Tertiary-age Handere formation. Their average unit weight is 18.90 kN/m3. Uniaxial compressive strength varies between 2.03 and 10.41 MPa and they are regarded as very low strength rocks. Hardpans have an average elasticity modulus of 0.55 Gpa. The calichified soil (softpan) layers at some locations are overlain by the hardpan levels, while at some other locations they are observed within the recent soils, and they overlie the alluvial deposits. The proportions of clay, silt, sand and gravel are 15.86, 50.05, 22.64 and 11.44%, respectively. These units can be identified as well- or moderately-sorted sandy–clayey silt. The softpan can be identified to be in the soil class of CL–ML. When interpreted in terms of swelling and activity, the softpan is in the class of inactive clays with low swelling potential.

Key words: Geotechnical properties; caliche deposits; hardpan; softpan; Turkey.

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An examination of damage distribution patterns in Van, Turkey: geological and geotechnical considerations

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ABSTRACT

The role of ground conditions in damage distribution patterns of buildings in the city of Van during 23 October 2011 Van earthquake (Mw 7.2) has been investigated. In order to estimate the variation of surface response during the earthquake, the central districts of the city have been studied based on geological and geotechnical characteristics of the soils. The results are to be complied to develop a map showing the distribution of damage for buildings and local site conditions of soils. To estimate the variation of damage distribution, the local subsurface layers have been classified and the post-earthquake observations of the buildings have been evaluated. Accordingly, it is concluded that the buildings over soft to medium soft soil deposits have been affected from significant reductions in seismic conditions.

Key words: Earthquake; Van; damage; building.

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Multiple regression model for prediction unconfined compressive strength of jet grout columns

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ABSTRACT

Soil improvement methods are used when the soil doesn't provide required criteria for geotechnical design of any engineering applications. Improvement methods can be categorized as compaction, stabilization, reinforcement, grouting, drainage etc. Jet grouting method that is one of the most widely used grouting methods has been used for half a century in order to improve insufficient soil properties. This method has use of applications in construction of seepage barriers, reinforcement of foundations and retaining walls, tunnel supports, slope stabilizing and to get hazardous wastes under control. Jet grouting method rely on the principle of creating a column is called "soil-crete" in soil by eroding the unimproved soil with high pressured grout is generally water-cement mix. As first step, soil is drilled to the desired level and the rods push up till the requested level while rotating and injecting high pressured fluids as grout, air or water. It is possible that jet grouting columns may be generated quickly by this technique with its slight equipment in almost every kind of soils as long as it's able to erode the soil with high pressured fluids. This improvement method is possible to be classified up to the number of fluids are injected into soil. Single fluid system has just grout, two fluid system has air and grout and three fluid system has air, water and grout as injected fluids. In jet grouting method it is very important to determine optimum system to apply and the most effective values of jet grouting parameters such as injection pressure, the number and diameter of nozzles, flow rate, lifting and rotating speed for rods in order to have a successful and economic improvement process. Although jet grouting method is widely used method and it is very crucial to decide parameters and the system will be applied for jet grouting process, there is still not credible method that can predict the diameter and mechanical characteristics of jet grout columns, except extreme secured empirical rules. Because of this need, several studies performed to have an accurate prediction for diameter and compressive strength of jet grout columns relatively to any of parameter belong to process by using different methods. In this study, it was aimed to predict the unconfined compressive strength of jet grout columns and to determine the effects of grouting parameter by using multiple regression analysis by means of some parameters such as grouting pressure, rotation-lifting speed, water-cement ratio and water flow rate used in this improving method. The data used in analyses were taken from Nikbakhtan and Ahangari (2010). The results are presented and discussed as tables and graphs.

Key words: Jet grouting; unconfined compressive strength; grouting parameters; multiple regression analysis.

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Research on the liquefaction potential of Yamansız region (Antalya, Turkey)

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ABSTRACT

This study is about identifying the liquefaction potential in Yamansız Region (Antalya). The liquefaction potential is determined according to SPT-N values that are obtained from bore-hole data and laboratory experiment data. For the bore-hole data of the region 45 boring wells are opened with each boring well depth is 15 m. The study is achieved by using five liquefaction analysis which are “Acceleration Threshold Criteria”, “Periodic Shear Stress Criteria”, “Liquefaction Index Criteria”, “Tokimatsu-Yoshimi Approach” and “Seed-DeAlba Method” that are mentioned to be the most used ones according to the literature. The liquefaction potential analysis is made in 16 boring wells in which SPT-N values are found to be low saturated sand, silty sand and clayey sand layers. According to the probability of an earthquake with magnitude of M=5.9, the region has a high potential of liquefaction that can be seen from the results obtained by using these five analysis techniques. From another way, the compatibility of results shows us the reason why these methods are mostly used. In order to prevent the liquefaction potential in the region, methods such as: stabilization with cement or lime, vibroflotation and etc. should be used before making construction.

Key words: Liquefaction potential; SPT-N values; liquefaction analysis.

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State Paths of clay dominated soils of coastal marshland: scale effect and hydrodynamic behaviour

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ABSTRACT

Regarding the relationships between Cam-clay state paths and hydraulic conductivity evolution previously obtained on kaolinitic matrices tested in triaxial press, we have studied the hydro-mechanical evolution of clay dominated soils of coastal marshlands. The methodology is based on the parallel study of the microstructure of the clay matrix and the bulk hydro-mechanical characteristics measured by in situ investigation and/or laboratory mechanical tests. The scientific interest of soils of marshlands located along the west coast of France, are to present a quite constant mineralogy and texture, and a vertical evolution from solid state in surface to plastic and pseudoliquid state in depth (2 - 3 m). These characteristics allow the parallel between the shrinkage curve of the clay matrix and the vertical profile of soil structures. The soils are clay dominated to silty clay, and composed of dominant illite and kaolinite plus illite/smectite mixed layers and small quantity of pure smectite. The hydraulic conductivities calculated following the Kozeny -Carman equation applied to the microstructure state paths were confronted to hydraulic conductivities really measured by oedometer compressive tests from solid to pseudoliquid state. The progressive hydraulic management of these territories since the middle Ages led to a vertical structuration of the soil according to the deepening of the desiccation fronts. The in situ hydro-mechanical functioning of the territories is mainly governed by the very weak hydraulic conductivities of the clay material in its plastic limit. Finally, the hydrogeological functioning is similar to two superimposed reservoirs: a solid state layer of surface governed by the shrinkage phenomenon and associated shrinkage crack network and a subjacent layer in plastic to pseudo-liquid state governed by the hydraulic conductivity of the clay matrices only. The parallel between the microstructure and in situ or laboratory measurements had allowed the calculation of clay matrix shrinkage curve - hydro-mechanical parameter relationships. Thus the microstructure profile behaviour may be quantitatively characterized and modelled according to the hydraulic management of the territories. The loggings of water content, shear stress, resistivity and hydric potential profiles throughout the seasons are applied to the modelling of hardness of soil and settling. They also allow the model of available water capacity profiles regarding the reaction of pedodiversity to eventual potential climatic changes.

Key words: Clay matrix; microstructure; hydraulic conductivity; desiccation.

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Stiff overconsolidated clays of continental origin: first steps towards the geomechanical, mineralogical and microstructural characterization of the Dueñas facies

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ABSTRACT

We present the first results of our preliminary approach to the geomechanical, mineralogical and microstructural characteristics of overconsolidated clays of continental origin. The facies Dueñas has been chosen, as it is one of the most representative facies in the central region of the Duero basin, located in the NW sector of Spain, where an intense construction activity has been developed recently. This facies is considered in the projects as a material having a soil behaviour, but, as it is evident in the field and as it is shown in this study, it also includes rocky behaviour materials. We selected a recently open outcrop in the border of the centre area of the Duero Basin, where this facies is four meters thick, and on it, we have identified eight different levels. Sampling has been carried out across the stratigraphic column described, and also in two trenches excavated for intact block samples. And with them information concerning mineralogy, microstructure and basic geotechnical properties has been obtained (the latter mainly in the clayey sections).

Key words: Stiff clays; continental; microstructure; cementation; overconsolidated; facies Dueñas.

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The undrained elastic modulus of overconsolidated clays determined on the basis of confined and unconfined laboratory tests

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ABSTRACT

The paper presents the results of the laboratory Unconfined Compressive Strength Test (USC) and Triaxial Shear Tests (TX) of the undrained elastic modulus Eu50. Tests were conducted on samples of clay and silty-clay taken from great depth - 100 and more meters below terrain level. The USC tests were carried out on intact soil samples. Triaxial tests were conducted in triaxial apparatus following TXCIU procedure. All samples selected to TX were tested in overconsolidation state of stress (OC). The OCR ratios ranged from 3 to 28. The values of undrained elastic modulus Eu50 were established for each OCR ratio. The normalization procedure was done and the normalized values of parameters were estimated. The normalized Eu50/σ'vc ratios (where σ'vc was the ratio between effective preconsolidation stress σ'p and OCR value: σ'vc = σ'p/OCR) were used to analysis. The results showed that there is some logarithmic correlation between OCR values and undrained elastic modulus Eu50 values. The equation obtained from the analysis can be used for natural, heavily overconsolidated clayey and silty-clayey soils.

Key words: Undrained elastic modulus; overconsolidated soil; clay soil; unconfined compressive strength test; triaxial test.

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Sensibility of sandy soils shear strength parameters on the size of spread foundation

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ABSTRACT

The paper deals with sensibility of sandy soils shear strength parameters on the size of spread foundation. Minimal, intermediate and maximal values of shear strength parameters of 5 classes of sandy soil (SW, SP, S-F, SM and SC) introduced in the old Slovak Technical Standard STN 731001 had been used to design model spread foundation, similar with this one, posted by Orr (2005). The foundation has square shape, thickness 0.8m, founded in the depth D = 1.5 m. The foundation is loaded by centrically acting vertical permanent load G = 900 kN and variable load Q = 600 kN. Underground water level is at foundation base. The spread foundation was designed by design approaches mentioned in Eurocode 7, Part 1 (DA1-C1; DA1-C2; DA2 and DA3) and also by the old and new Slovak Technical Standard STN 73 1001. It will be shown that for all values of sandy soils shear strength parameters; the size of foundation is the biggest when designed by the DA3 and the smallest when designed by the DA1-C1. Concerning the old and new Slovak Technical Standard, for all values of sandy soils shear strength parameters, the size of foundation designed by the new Slovak Technical Standard is smaller in comparison with this one design by the old Slovak Technical Standard. It will be also shown that small difference in angle of internal friction (4o) of soil SW causes difference in foundation size up to 35.2%; small difference in angle of internal friction (2.5o) of soil SP causes difference in foundation size up to 19.2%; and small difference in angle of internal friction (1.0o) and cohesion (5kPa) of soil SM causes difference in foundation size up to 19.2%.

Key words: Sandy soils; shear strength parameters; Eurocode 7; STN 73 1001; spread foundation.

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Overconsolidation ratio and overconsolidation pressure of the Poznan Clay from the region of SW Poland

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ABSTRACT

The main topic of the study was characterize the overconsolidation state of stress the Poznan Clays and estimate the average overconsolidation ratio OCR and preconsolidation pressure s'p values for different depth of deposits. The Poznan Clays occurs on large area in region of SW Poland. The shallow occurrence of analysed soils makes them very often the subsoil of the engineering structures. The overconsolidated characteristic was done on the basis of the heavy oedometric laboratory tests conducted on the intact samples taken from different depth. Based on the laboratory test results the OCR and s'p values were estimated using the Casagrande method. The study showed that the overconsolidation ratio OCR is changing with depth. The comparison of the estimated OCR values with other values estimated for soil from other European countries might suggest that the overconsolidation value of clays depends on the mechanical overload but may also be related to the age of the deposition of the soil.

Key words: Overconsolidated soil; OCR; clays; Poznan Clay; preconsolidation pressure.

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The impact of distance between shallow twin tunnels on the tunnel Convergence

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ABSTRACT

Subway construction in all developed cities is essential for passenger transportation, Tunnels excavating in urban subway are usually double. Most of the tunnel on parallel excavation of twin tunnels had located near the surface .Twin tunnel excavation would influence through the convergence of each tunnels. In this paper, the simplified equations have been developed to achieve the optimum distance from centre to centre tunnels for minimizing the effect of the twin tunnels convergence. In this study, the numerical modelling has been performed. Five different scenarios were defined for different distance between twin tunnels. Then the convergence of each tunnel was investigated. Finally, by means of statistical approach, two equations have been developed to determine tunnel convergence based on distance between twin tunnels.

Key words: Numerical modelling; twin tunnel; convergence; tunnel design; statistical approach.

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Comparison of biotic and abiotic sorption of copper and zinc by goethite and hematite

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ABSTRACT

In the present work, the abilities of natural and synthetic samples of goethite and hematite to remove copper Cu(II)) and zinc Zn(II) ions from aqueous solutions were studied. Addition of bacteria were investigated in enhancing sorption properties of iron oxides. The samples were denoted as natural goethite (GP), goethite synthesized (GS), natural hematite (HP), hematite synthesized (HS). Synthetic samples were prepared in laboratory conditions. Goethite was prepared by hydrolysis of $FeNO_3$ by KOH in a closed polypropylene flask in a 70°C oven for 60 hours. Hematite was prepared by forced hydrolysis of Fe^{3+} solution from chlorine system ($FeCl_3$) at temperature close to 100°C under strongly acidic conditions (pH 1-2). The main mineral phases were confirmed by the powder X-ray diffraction, Mössbauer spectroscopy and infrared spectroscopy method. The specific surface area of the samples was studied by the low temperature nitrogen adsorption measurement. Bacterial strain Bacillus cereus was isolated from the contaminated locality by heavy metals and used for adsorption experiments. All experiments were carried out by batch adsorption technique in 100 ml Erlenmyer flasks on a rotatory shaker at 150 rpm. The concentration of added sorbents was 10 g/l. For biotic sorption 5 ml of bacterial suspension was added with concentration of bacteria 8 g/l (wet weight). The effect of initial pH and initial metal ion concentration on adsorption of copper and zinc onto the iron oxides has been studied. The sorption data were represented by the linearized Langmuir model. Comparing the values of adsorption capacities, there were differences between the natural and synthetic samples, natural and synthetic goethite had higher sorption capacity for both metals than hematite. The copper ions showed higher affinity than zinc ions to all samples. The GS achieved the maximum adsorption capacity 2 mg/g for copper at pH 5, and GP maximum sorption capacity 1 mg/g for copper at pH 6. The adsorption of Cu(II) and Zn(II) on Fe-oxides slightly increased with the increasing initial metal ion concentration up to 20 mg/l, then the equilibrium was established, except of copper on goethite samples and also for zinc on GS sample. Addition of bacteria increased the sorption capacity in average of 1 mg/g. The next study will be focused on examine of other parameters which can influence the sorption process like temperature, ionic strength and adhesion of bacteria onto mineral surfaces.

Key words: Sorption; copper; zinc; goethite; hematite; bacteria.

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Numerical modelling of slope instability

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ABSTRACT

This article is dealing with stability of the highway cut in Eastern Slovakia. The cut is situated in rock environment of the Carpathian flysch which in area of the cut mostly consists of shale with different degree of weathering. The cut is supported by the anchored pile wall. Rock environment is changing from the surface to the depth from alluvium clays, sands and completely weathered shale to fresh shale. The potential slip surface was investigated after evaluation of data from geotechnical monitoring, so there were doubts about the stability of the wall. Finite element analysis was done and two material models were compared with results of geotechnical monitoring. Deformation analysis and the safety factor are discussed. Two models were compared in these terms: Mohr - Coulomb material model and jointed rock material model. These models are introduced because of the anisotropy of shale and simplification of behaviour model via jointed rock model. Jointed rock model was introduced as an anisotropic model, and required geotechnical parameters for calculations are discussed in comparison with the Mohr – Coulomb material model. Anisotropic behaviour of shale will be discussed and analysed. Short recommendation for the use of these models are presented in the paper. Last but not least, an outline of further research and work will be made.

Key words: Mohr-Coulomb mode; jointed rock model; slope stabilty.

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Plate load tests of multi-layered geocell-reinforced bed- Considering embedment depth of footing

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ABSTRACT

This paper describes the effect of embedment depth on bearing capacity of footing supported by geocell-reinforced bed, using plate load test at a diameter of 300 mm. The embedment depth ratio of the footing was varied from zero to 0.75. The plate load tests were performed in an outdoor test pit, dug in natural ground measuring 2000 x 2000 mm in plan and 1000 mm in depth. The geocell used in the tests was non-perforated with pocket size 110 x 110 mm2 and height 100 mm, fabricated from continuous polypropylene filaments as a nonwoven geotextile. The tests were conducted on geocell reinforced bed sand which compacted to 85% relative density. The test results demonstrate that the bearing pressure increases with increase in the embedment depth ratio and the number of geocell layers. The study also compares the embedment depth ratio of one layer geocell reinforcement with two and three layer geocell reinforcement bed with no embedment depth. These comparisons show that the performance of footing on single layer reinforced bed with the embedment depth ratio of 0.25 and 0.75 might be comparable to the performance of footing on geocell reinforced bed with two and three reinforcement layers.

Key words: Bearing pressure; embedment depth; geocell reinforcement; plate load test.

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Standard Penetration Test correlation for Karabük, Turkey

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ABSTRACT

In geotechnical researches, the Standard Penetration Test is one of the very widely used field tests. Standard Penetration Test constitutes one of the main parts of almost every ground investigation program in our country, too. In addition, the parameters to be determined in the ground examination sometimes cannot be obtained due to various reasons. In this case, from the correlations of Standard Penetration Tests, soil parameters are obtained. Up to the present day, many researchers have done Standard Penetration Test correlations. However; because they work in different areas, each correlation gives different results. In this study, the correlation was made between the values obtained from the Standard Penetration Test made in soil examinations which were done in Karabük (Turkey's western Black Sea part) and laboratory tests. In the first stage of this study, the fieldwork done in the ground examinations in Karabük (Turkey) has been analysed. The parameters obtained as a result of soil mechanics tests on disturbed and undisturbed samples taken from drills huddled together. These parameters are liquid limit, plastic limit, compression index, cohesion and internal friction angle. The SPT-N value obtained as a result of Standard Penetration Test done on each borehole and these soil parameters were matched. In the second stage of this study, by performing regression analysis between determined parameters, correlations were obtained between Standard Penetration Test and cohesion. In this way, special Standard Penetration Test correlations for Karabük (Turkey) were obtained. Soil parameters which couldn't be obtained in this way are determined more accurately by Standard Penetration Test results.

Key words: Soil shear strength parameters; cohesion; soil investigation; soil mechanics laboratory test; unconfined compression test.

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The behaviour of clayey soil reinforced with waste aluminium pieces

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ABSTRACT

There are huge amounts of the waste metal pieces produced from the processes of the metal industry, the disposal of these waste materials have financial and environmental difficulties. The present study aims to investigate the effect of the industrial waste aluminium pieces to the stress-strain behaviour and compaction characteristics of clayey soil. A series of the unconfined compression and modified compaction tests were conducted during the experimental work. Four different amounts of the waste aluminium pieces were used during the experimental work, namely 0%, 5%, 10%, 15%, and 20% by the dry weight of the specimens. Generally, from the analyses of the test results it was observed that there are increases in the maximum dry unit weight and decreases in the optimum water content of the soil. In addition, the unconfined compression strength increases significantly as the amount of the waste aluminium pieces increase until 10% and then decrease.

Key words: Clay; waste aluminum pieces; compaction; unconfined compression strength (UCS).

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Analysis of analytical design methods for piled embankment

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ABSTRACT

Design of embankment foundation on soft subsoil can be solved using various types of approaches. Combination of geosynthetic reinforcing elements with soil structure brings advantages such as simplicity of construction, cost-effectiveness, the ability of better resistance against non-uniform subsoil deformations and the ability of realization in complicated geological conditions. Additionally, resistance to extreme situations (seismic loading, floods, etc.), as well as resistance to dynamic load effects from traffic and non-uniform settlements is another benefit of this type of structures. Recently, there are many theories and design recommendations by several authors, but only a few of them were adopted in to the standards. However, now developed methods are allowed by the standards and they are mostly based on the physical or numerical modelling. British Standard BS8006 contains two analytical design approaches in last revision. Design method based on the Marston theory is wide spread and was included in first revision of this standard. Hewlett and Randolph method is more advanced method and takes into account the internal friction angle of the embankment backfill. Recommendations contained in EBGEO add the ability to consider the subsoil as a support for the reinforced base of the embankment.
Comparison of mentioned analytical methods shows some restrictions in determination of required values. On the other hand, Hewlett and Randolph method is capable to provide the results close to the results from EBGEO recommendations despite the different approach to the problem. Method based on the Marston theory shows significantly distance from other results. EBGEO as a most advanced of the common accepted methods is still developing to bring the results closer to reality.

Key words: BS8006; EBGEO; Hewlett and Randolph; Marston; piled embankment.

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3D Finite Element modelling of pile load test

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ABSTRACT

Despite the various design approaches, the design of the pile foundation needs to be still verified by the in-situ load tests to check the project assumptions. The resistance of the pile depends on the soil properties and soil-pile interaction. Calibration of the numerical calculation model is usually based on the in-situ pile load tests and the geotechnical survey of foundation soil. It is obvious, that variation of soil characteristics acting on the interaction between pile and soil and the numerical model can meet the test results if boundary conditions are solved. Numerical modelling represents the most advanced design method for designing the pile foundations more accurately with identification of potential risks during the construction and service. Settlement obtained during the pile load test serves as an input value for the first limit state calculation. Thus, settlement was the comparison parameter for calibration of the model created using finite element code Plaxis 3D Foundation. Mohr-Coulomb material model was utilized because of less demandingness on input data and possibility of practical application in engineering practice. Use of advanced material model for foundation soil requires wider range of input data from survey and related laboratory tests. Additional data are more time-consuming and less cost-effective, but usually geotechnical survey is only a minor part of the overall budget of the project. Basic material models, such as Mohr-Coulomb model, are still capable of providing outputs with sufficient accuracy for engineering practice. The results from modelling are very close to the test outputs after calibration. However, another research in the field of data collection for advanced material models and numerical models calibration is required. The research should consider variable geological conditions and various structure and load scheme configurations.

Key words: Pile load test; displacement pile; 3D FEM; soil-pile interaction.

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Determination of advanced parameters of constitutive models of soils using Cone Penetration Test (CPT)

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ABSTRACT

Design The actual trend in geotechnical engineering is use of computer software to solve geotechnical problems more complex. Numerical analysis implemented in codes such as Plaxis, Flac, ZSoil, Abaqus, Crisp or Midas, require adequate input parameters. In addition to conventional laboratory procedures, the main reason to support the use of field testing is continuous recording of the testing profile, immediate evaluation of the soil characteristics and determination of geotechnical parameters needed for constitutive models of soils. In geological environments with clayey and silty soils, static penetration tests CPTm, CPTu with piezocone, and seismic cone SCPT are very suitable. Estimation of soil properties based on the results of the penetration tests is reliable only if the probe is realized with near situated boreholes, supplemented by laboratory testing. The possibility to determine advanced geotechnical parameters for constitutive models from the static penetration test is an indisputable benefit. For the improvement of sounding technique, new modifications of CPT cones are tested – seismic CPT, Visual CPT or cone for continual measurement of moisture content CPTTDR. However, these surveying methods need to be calibrated to ensure their sufficient reliability. Recent correlation relations can be improved and expanded so the additional required parameters of soils for advanced numerical material models can be determined using CPT sounding. The knowledge of local fine soil deposits obtained from CPT testing is unique, but it is applicable to similar localities at similar boundary conditions. Experience from numerous soundings can help to improve the process of soil stratum evaluation and then the geological conditions can be determine in real time in-situ. This can be then helpful for risk management and geo-hazards assessment such as liquefaction potential at seismic loading, over-consolidation effect or swelling when fast evaluation of situation is needed.

Key words: Cone Penetration Test (CPT); correlation; field testing; numerical modelling; piezocone.

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Empirical rock mechanical site-descriptive modelling for the Korea Atomic Energy Research Institute underground research tunnel

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ABSTRACT

The Korea Atomic Energy Research Institute (KAERI) constructed the first stage of the KAERI underground research tunnel (KURT-1) in 2006 to test and verify the performance and safety of their geological disposal technologies and with the ultimate aim of disposing spent nuclear fuel waste in Korea safely. In preparation for plans to construct the second stage of KURT (KURT-2) for future research, KAERI carried out site investigations to characterize the rock mass for KURT-2, and developed a rock mechanical site-descriptive model (RMSDM) for the safe design and construction of KURT-2 based on site data. The rock mass at the study site was divided into six rock units depending on rock type and fracture developments using data measured during site investigations. Rock mass qualities in each rock unit were classified using rock mass classification systems, such as the rock mass quality system (Q-system), rock mass rating (RMR) and rock mass index (RMi). Mechanical properties of rock units were also estimated using empirical relationships with rock mass classification systems covering the deformation modulus, uniaxial compressive strength, and cohesion and friction angles. Finally, a three-dimensional RMSDM of the KURT-2 domain was developed using rock unit distributions and mechanical properties. The RMSDM was used to visualize rock mass qualities and mechanical properties for the tunnelling area, and was used as a basis for the design and safe construction of KURT-2. Predicted rock mass qualities at the tunnel excavation were relatively consistent with the distribution of in-situ rock masses that were investigated by face mapping during construction. The RMSDM may be important in the geoscientific understanding of the site and the safe design and construction of KURT-2, and as a contribution to several tests and experiments for future research and development of KAERI.

Key words: KAERI underground research tunnel (KURT); rock unit; rock mass classification; mechanical properties; rock mechanical site-descriptive model.

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Evaluation of different approach filling type performance used on fast train railways by numerical analysis

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ABSTRACT

In order to provide a transportation with safely and comfortable on fast train construction is necessary not to yield ondulation and settling of line bedding. Especially, some problems derived from different settling on rigid structures and unrigid fissured filling transitions are widely felt on high speeds. We have met all these negative situations with respect to safe and comfortable. In this study, approaching filling types used on fast train railways on world have been examined. Their behaviours on rock, sand and clay environments have been explicated. By this purpose, French and Italian approach filling types have been analysed by using computer aided Finite Element Method (FEM) programmes (Plaxis 2D V.8.2). Result of analyses considering 9 meters filling load indicates an importance terrain under approach filling types, in contrast approach filling types are not important on rigid environment. Italian modal types show a high performance than French modal type on high plasticity environment.

Key words: Approach filling type; railway; finite element method (FEM); plaxis.

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Ground Improvement of the Tank Terminal in Amsterdam - The Netherlands

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ABSTRACT

In the western part of the Port of Amsterdam, a new storage terminal for oil products is being built. The site investigation revealed that underneath a single tank, the thickness of the compressible layers could differ in up to 3 meters. It was concluded by the client that ground improvement was required to avoid excessive differential settlements of the storage tanks and associated maintenance costs. The initial ground improvement design proposed by the client consisted of the application of dynamic replacement (DR). A trial showed that the traditional DR method as well as the CDC technique (Cofra Dynamic Compaction®) did not achieve sufficient improvement. Therefore, a full ground improvement was made, with large excavations of up to a depth of 8 meters below the surface, removing more than 1,000,000 m^3 of material. The excavations were backfilled with sand. This very loose sand was compacted in one phase using the CDC technique. This paper presents an overview of the initial trial results and the final work method with a focus on the method of compaction and the compaction results.

Key words: Dynamic replacement; dynamic compaction; soft ground; ground improvement.

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In situ determination of load bearing capacity of soils on the airfields

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ABSTRACT

The article presents the results of the earth structures' bearing capacity evaluation and objectification for airfields by means of CBR (California Bearing Ratio) parameter. In order to quantify actual terrain conditions, in situ testing methods are advancing against laboratory testing. However, the optimal solution is to combine precise laboratory testing with in situ measurements. A correlation between CBR values and moisture content values of the backfilling soil of runway strips from earth structure of Žilina Airport was made within the frame of author's research activities. The CBR tests were performed on the clayey gravel specimens, which were prepared in the test cylinders used for a Proctor modified test. It has been found that the correlation allows determining of the moisture level to meet requirements of the RWY recommended by Aerodrome Design Manual. The newest results of CBR in situ measurements on the aerodrome earth structures are also presented. CBR in situ values were objectified by the CLEGG device WS 32830. This device quantifies the value of rate of compaction from in situ tests based on CIV values (Clegg Impact Value).

Key words: Earth structures; airfields; in situ CBR; Clegg impact value; compaction.

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Frost index from aspect of design of pavement construction in Slovakia

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ABSTRACT

This article focuses on the changes of climatic characteristics used in highway engineering following global climatic changes and the effect of these changes on pavement design. Along with traffic load, the climatic conditions belong to the external factors affecting the physical and mechanical properties of pavements. The climatic characteristics are defined by the average daily air temperature, the average annual temperature and the frost index (during winter period). In this article, measurements of air temperature from five meteorological stations in Slovakia during the period from 1971 to 2011 are evaluated. The calculated values of frost index provide good correlation dependence of frost index for a height above sea level. Using calculated values of frost index based on the long-term temperatures measuring can leads to reduction of pavement thickness. The using of the objectified correlation dependence of frost index is precondition for creating successful objectification of spending money on building roads, which belong to the financially demanding civil engineering structures.

Key words: Climatic characteristics, air temperature, frost index, pavement design.

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Advanced progressive road network diagnostics method used to monitor changes in the quality of the pavement surface

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ABSTRACT

The surface properties of pavements are a basic factor of their serviceability and one of the most important factors of their safety. For the prediction reasons of incoming reconstructions, repairs or any services, it is very important to know the development of particular parameters of surface properties in dependence on the traffic load and time aspect. An important factor of the road quality, firstly by asphalt pavements, is a transverse evenness expressed by ruts depth and skid resistance characterized by friction coefficient. In order to determine the development, these factors were analyzed the measurements of test sections on the highway and selected roads of first and second class every year. Constantly exchanging values of data, deficiencies in data collection, but also in the process of evaluation suggest to the need for further research. Within the Research Center of the University of Žilina, people are dealing with scanning of the pavement surface in order to monitor the individual parameters of pavement serviceability. This paper deals with the creation, analysis and evaluation of a 3D road surface model in terms of two properties of pavement serviceability – the rut depth and its texture. Measurements are realized on an experimental field with accelerated straining on the pavement-loading wheel. The long-term accent should be mentioned predictions functions of selected pavement serviceability parameters.

Key words: Road surface; univeness; road diagnostic; pavement surface.

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Creation of 3D geological models using interpolation methods for numerical modelling

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ABSTRACT

Geotechnical engineers need access to the best scientific data available that describe the geological environment and processes in it. This article describes the development of conceptual model of geological environment in landslide areas. Landslide areas are environments where the interests of science and society meet. Numerical modelling of various phenomena in anisotropic conditions may require the spatial interpolation of scattered measurements in order to obtain values at computational mesh nodes. This paper examines the various spatial interpolation methods and gives overview on transformation process by preparing conceptual model of the geological environment.

Key words: Numerical modelling; interpolation; lithology; 3D geological model.

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Limestone quarry reserve estimation by Laser Scanning and GIS tools

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ABSTRACT

The article presents the 3D survey of the open-pit mine in order to develop a 3D digital model for identification and quantification of the limestone deposits. The main principle of 3D laser scanning are explained and presented. The computer GIS techniques for data processing and creation of 3D digital model are presented and quantification 3D analysis tool are used to classify deposits in the area of interest.

Key words: 3D scanner; estimation; resources; GIS; laser scanning.

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Hydrogeological survey data analysis of landslide area by GIS tools

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ABSTRACT

The benefits of GIS application methods for analysis and numerical model preparation of hydrogeological surveys are summarized in the presented article. The article is focusing on the problem of connection between geographic information system and methods of hydrogeological survey, especially hydrogeological modelling in terms of input data preparation, creation of analyses and visualization of the results. It also describes a methodology of the work in the frame of creating local GIS for landslide.

Key words: GIS tools; data analysis; hydrogeological survey; model preparation.

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Non – invasive GPR investigation of spread footings

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ABSTRACT

A non-invasive GPR survey was carried out in order to investigate spread footings of reinforced concrete skeleton building with basement. The GPR survey was performed in 2D geometry around support columns using a ground coupled antenna with central frequency of 400 MHz. The processed data allow very detailed interpretation of spread footings. This type of geophysical survey confirms its suitability and usability in such non – invasive investigation.

Key words: GPR; ground coupled antenna; 400 MHz; spread footings.

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Repeated GPR measurements carried out on a test field facility

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ABSTRACT

The repeated GPR measurements are carried out in order to investigate the internal changes in road construction after some time of usage. For this purpose, a test field constructed at the University of Žilina is used. The test field is investigated by GPR system with 2 GHz horn type antenna. Based on the survey, the best degradation model and prediction of future pavement degradation will be set. Two results of GPR investigation are presented in this article.

Key words: GPR; horn antenna; 2 GHz; test field; GPR profiling.

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GIS based methodology for the geotechnical evaluation of landslide areas

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ABSTRACT

Nowadays, information about possible land use and the future stability of soil is highly demanded by contractors or insurance companies. GIS based applications offer quick survey, evaluation and prognosis. Real conditions for construction and other activity is require further study, but it is a quick and useful solution to help in the decision-making process. The article is dedicated to the problems of landslides, as risk factors in urban areas. The benefits of GIS application for methods of geotechnical survey and monitoring are summarized. It focuses on the following aspects: data obtaining and processing, stability analysis and its results and final data presentation and visualization. The article proves that GIS can be used even in complicated conditions of landslide areas.

Key words: GIS tools; data analysis; hydrogeological survey; model preparation.

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The negative impact of endogenous factors on the foundation soil of buildings

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ABSTRACT

Foundation soil properties are influenced by many factors. Endogenous processes are one of these. Foundation soil and building constructions are exposed to a number of factors, which can be influenced to a greater or lesser extent. Endogenous processes are factors that cannot be avoided. Construction works interact with these processes and have to cope with its effects. If we are unable to predict their occurrence, its impact strength and possible consequences, we are not able to confront these phenomena. Tectonic movements that cause subsidence, landslides, erosion, earthquakes, waterlogging, flooding areas and many others belong to endogenous processes. An earthquake is an endogenous process as well. An earthquake causes quakes, destruction of buildings, landslides, soil liquefaction, subsidence and changes in relief. The last phenomenon covered in this publication is volcanic activity. Volcanic activity causes a change in relief, destruction of buildings, earthquakes, landslides and fires. Endogenous processes cannot be separated from exogenous processes. Exogenous and endogenous factors are interconnected and together affect terrain morphology, rock properties, groundwater, and many others. Speech endogenous processes is often much greater, more destructive, but at a significantly smaller area.

Key words: Endogenous factor; tectonic movements; earthquake; volcanic activity; buildings.

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Selected unsuitable problematic rocks in geotechnics

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ABSTRACT

The aim of this publication is to highlight some selected case studies that relate to issues of interaction of the geological environment with engineering construction. This is an issue of flysch sediments, karst areas, liquefied sand, loess sediments and basalt rocks. This geological environment is causing many problems. This can cause problems during the construction process, or in trying to preserve the long life of these constructions. Mentioned problematic rocks can complicate future or existing construction through landslides, low bearing capacity, differential settlement, karstification, filtration faults and many other disorders. Labelling the rock as problematic rock is debatable. Each geological environment is affected by a large amount of geofactors. These geofactors input to deciding about the appropriateness or unsuitability of the foundation soil and their risks. Generally, the unsuitability of the foundation soil is determined by a combination with geofactors such as ground water, earthquakes, sloping terrain and many others. Therefore, it is necessary to designate "problematic rocks" understood as an environment with many problems. That means problems with foundation engineering and existing constructions at a high rate. This designation also includes an environment where the consequences of construction failure have unforeseen consequences. Problematic rocks also include soft rock, which is dedicated to a number of other publications. Although each environment is completely unique, learning from mistakes and lessons learned from other countries is very important.

Key words: Liquefied sand; karst; flysch; loess; basalt.

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The issue of soft rocks causing problems in foundation engineering

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ABSTRACT

Heterogeneity of the geological environment causes different problems related to foundation engineering. Every engineering geological condition requires specific solutions. The occurrence of soft rock is a risk, especially in interaction with other actors. Among the so-called soft rocks are organic soil, clay and loam (silt), lacustrine sediments, but also soft soils in connection with phase changes in frozen or defrost environments. In connection with these problematic soils, questions of low bearing capacity, different settlement, landslides, heterogeneity of the geological environment and others are solved. The aim of the publication is to highlight the possible occurrence, the most common risks during interaction of this type of geological environment with engineering construction. A series of case studies and investigations of different countries are mentioned in this publication. Creating a simple scheme of soft rock and summarizing the basic problems of soft rock serves as a generalization of this problem. However, it should be understood that each foundation soil is located in a different environments, which is also influenced by other factors.

Key words: Soft rock; clays; loam; organic soil; lacustrine sediments.

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The fracturing of rock mass and its risks to engineering objects

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ABSTRACT

Good knowledge of the fracturing rock environment is an essential boundary condition in the event that it will be used as foundation soil. Each fault is a sign of deterioration in physical-mechanical parameters of rock, reducing uniaxial compressive strength and a number of other negative effects that we will have to deal with during construction work. Also important is the prediction of changes in the rock environment that occur during the implementation of excavations, tunneling, etc. Predisposition stress in the rock environment causes instability of the slope or bulging at the bottom of the excavation. The rock mass is a heterogeneous environment that is at each moment influenced by a number of factors and is characterized by the action of normal and tangential stress components. The rock massif is able to rearrange its composition to more or less resist environmental influences. This is the effect of mechanical weathering, chemical weathering, stress-deformation changes and the effect of geodynamic processes. A rock massif can develops surfaces of discontinuity to varying extents and points may be affected by tectonic failure. This can cause the accumulation of groundwater, acceleration of groundwater or deep weathering. Unsuitably orientated fissure systems can be a significant influence as well. This can cause slipping out of the massif in open cuts of roads or tunnels. Wrong filling can be also very problematic. It may cause permeability through the geological environment or accumulation of water. The aim is to characterize the factors, which influence the behavior of the rock mass, like foundation soil. Understanding this issue is important in realizing each construction work. It is very difficult to generalize individual factors. A simplification of this problem is used to study this issue in greater depth. Without an awareness of the basic issues and their description, it is not possible to perform a deeper analysis.

Key words: Weathering, building construction, geodynamic processes, discontinuity.

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Sensibility of sandy soils shear strength parameters on a size of spread foundation

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ABSTRACT

The paper deals with sensibility of sandy soils shear strength parameters on the size of spread foundation. Minimal, intermediate and maximal values of shear strength parameters of 5 classes of sandy soil (SW, SP, S-F, SM and SC) introduced in the old Slovak Technical Standard STN 731001 had been used to design model spread foundation, similar with this one, posted by Orr (2005). The foundation has square shape, thickness 0.8m, founded in the depth D = 1.5m. The foundation is loaded by centrically acting vertical permanent load G = 900 kN and variable load Q = 600 kN. Underground water level is at foundation base. The spread foundation was designed by design approaches mentioned in Eurocode 7, Part 1 (DA1-C1; DA1-C2; DA2 and DA3) and also by the old and new Slovak Technical Standard STN 73 1001.

Key words: Polyester fibres; soil improvement; random reinforcement; direct shear test; angle of internal friction; cohesion.

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The effect of exogenous factors on building construction

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ABSTRACT

The foundation soil is influenced by many factors that have an impact on the realization of building structures. A large group consists of exogenous factors. Exogenous factors are acting on the earth surface at any moment. The dynamic and strength effects of each individual exogenous factor differs in each location. Understanding the basic exogenous factors and their effects on building construction is essential in the realization of any construction. Exogenous processes determine the process of weathering, which are applied as erosion and abrasion. In addition, landslides, whose destructive power is determined by the speed of movement and real extension. Furthermore, the process of karstification causes the creation of cavities. They also included the collapsibility of soils who, like the previous factors, have a negative impact on construction. They occur mostly in mutual interaction, although individual exogenous processes are presented separately. The publication presents problems of exogenous factors, their effects on building construction and changes in physicomechanical parameters. Good knowledge of the fundamental problems occurring in connection with exogenous factors allows us to ensure measure and expect a number of complications early.

Key words: Erosion; abrasion; slope movements; karstification; collapsibility.

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The history of pyrope extraction and processing in the Czech Republic and its significance for geotourism

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ABSTRACT

The Bohemian garnet belongs the among minerals that have been for centuries favored for their beauty all around the world. This gem used to be a valuable souvenir in the past and has remained so until today. The current jeweler's production observes the latest trends while building on a successful past. The paper describes some of the ways through which a tourist may meet this symbol of Bohemia to be admired in the mineral kingdom.

Key words: Bohemian garnet, extraction, processing, jewel-making, geotourism..

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Possibility of mine waste dump remediation with thermal activity

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ABSTRACT

The use of mine waste dump after coal mining causes a number of practical problems. The most important problems to resolve is the thermal activity. Since the mine waste dump contains residual amount of coal, this geological environment is susceptible to thermal activity. The thermal activity must be eliminated so the mine waste dump can serve as a foundation soil. The aim of this publication is to analyze the possibility of mine waste-dump remediation. Water injected into the soil can be used to extinguish the thermal activity. To eliminate the thermal activity may be used water. Another possibility is the application of CO2 or other gases. The application of these methods depends on the number of boundary conditions such as suitable terrain morphology and good sealing area. Grouting high quality blends is another way to prevent the spread of thermal activity in the affected area. A modern method, suitable for the termination of thermal activity is the Deep Soil Mixing. Interlacing rock material with inert material that will serve as the seal is another possibility.

Key words: Coal waste dump; thermal activity; grouting; deep soil mixing; remediation..

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Nature conditions of waste dumps in the Czech Part of the Upper Silesian coal basin

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ABSTRACT

In the Czech parts of the Upper Silesian Coal Basin, tens of waste dumps of gangue material are located. These waste dumps were created during the mining of hard coal in the Czech part of the Upper Silesian Basin. It was an underground mining. As part of the mining process of opening, preparation and extraction, a large amount of gangue material remained after the extraction works and had to be deposited at waste dumps. Waste dumps are becoming a very common source of secondary raw materials, but also become a relatively common foundation soil in the Ostrava-Karvina coal district. The aim is to define the natural conditions of these waste dumps and to characterize the geological environment of these engineering geological specific districts. In terms of mining, gangues are located in the Ostrava-Karvina coal district. From the viewpoint of morphology, it is part of the Ostrava pan, which is composed of a large amount of Quaternary sediments, located on Miocene sediments external Carpathian depressions.

Key words: Waste dumps; Ostrava-Karvina coal district; natural conditions; Upper Silesian coal basin; geological environment.

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Proposal for classification of diversity structure in geoscience and montanistic tourism

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ABSTRACT

A characteristic feature of natural and anthropogenic objects is their heterogeneous construction, organized into a hierarchical structure. This diversity is the basis for the selection of objects for the needs of geoscience and montanistic tourism. Geodiversity and biodiversity are defined on topical, choric, regional and supra-regional level. In the case of technological diversity, which is the basis of montanistic tourism, a similar approach is designed, leading to the structure technotope, technochore and technome.

Key words: Diversity; hierarchical structure; technotope; technochore; technome..

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Analysis of possibilities of reclamation waste dumps after coal mining

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ABSTRACT

In the Ostrava-Karvina coal district is located approximately 281 dumps and 46 waste dumps. These are anthropogenic embankments of gangue formed at different times during the approximately 200-year tradition of coal mining in Czech parts in Upper Silesian Coal Basin. The aim of this publication is to analyse the possibility of reclaiming these waste dumps. Basic boundary condition of reclamation gangue material is composition and shape of the embankment. The publication defines the different possible shapes of gangue bodies and the possibility of rehabilitation. Waste dumps may have the following shapes. It may be a conical waste dump, pile type of shape of, board shape of, shape of the terrace, shape of slope, ridge shape, straight shape, or may take the form of flat coverings. Reclamation Types are closely tied to land use planning. Waste dump body can remain in their original deposit with no, or minimal intervention on its surface as needed. Another possibility is partial excavation waste dump to the body of, thus modification to its geometry according to the needs of the land use planning. Option how reclaim of territory is also the variant of full excavation waste dump of the body and planning a completely new surface.

Key words: Ostrava-Karvina coal district; hard coal; waste dumps; shapes of waste dumps; reclamation.

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An overview of CCS road map and identification of a suitable CO_2 disposal site in Eastern Zagros (Fars Area) in Iran

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ABSTRACT

Global warming and is a worldwide concern raised due to emissions of anthropogenic greenhouse gases. Oil & gas producing countries which are the members of the Kyoto Protocol, including Iran, have held a committee to reduce these gases, especially CO_2 emissions. One way of reducing emissions is using carbon capture and storage technology in geological formations, known as Carbon Capture and Sequestration (CCS). Having a strategic roadmap to implement the CCS projects in Iran is essential. Also, there is a close and direct relationship between the number of oil and gas reservoirs and amount of CO_2 emissions in Zagros area in Iran. The objective of this paper is to present and discuss the CCS roadmap provided for Oil & Gas operations in Iran with focus on gas-industry related features. Also, an appropriate geological structure in Zagros region suitable for CCS operation is proposed and discussed. The recognized aquifer at a depth of 1500 meters below the sea level in Fars area in Zagros, which is covered by Nar cap rock, maybe a good choice for CO_2 injection. This aquifer is located in Lower-Dalan with appropriate reservoir property that is investigated in this paper. We'll present the CCS roadmap in Iran, followed by the key features of CO_2 disposal into this formation.

Key words: CO_2 emission sources; CO_2 injection in aquifer; CCS Roadmap; Fars area; Zagros stratigraphy.

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Geological identification and storage capacity of suitable formation for CO_2 disposal in Eastern Zagros, Iran

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ABSTRACT

The climate change is one of the major global concerns. Emissions of anthropogenic greenhouse gases are main causes of climate change. One way of reducing emissions is application of carbon capture and storage (CCS) in geological formations. In this study, feasibility of CCS is studied in an Iranian gas production area located in the northern Persian Gulf coast in the south of country. There is a close and direct relationship between the number of oil and gas reservoirs and amount of CO_2 emissions in Zagros area in Iran. Therefore, finding an appropriate geological structure, i.e. site selection, in Zagros region is the first priority for the injection. The recognized aquifer at a depth of 1500 meters below the sea level in Fars area in Zagros, which is covered by Nar cap rock, show a good prospect for CO_2 injection. This aquifer is located in Lower-Dalan with appropriate reservoir property that is investigated in this paper. Simulation studies indicated that one ordinary reservoir in this area is capable of capturing at least 68 million ton CO_2 over 10 years of injection.

Key words: CO_2 emission; carbon capture and sequestration; saline aquifer; Zagros stratigraphy; storage capacity.

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A conceptual hydrogeochemical model for intermediate groundwater circuits in Hercynian granitic rocks

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ABSTRACT

The present study focuses on the hydrogeochemical evolution in hercynian granitic rocks in the North of Portugal where a new underground hydraulic circuit for a hydropower plant is being developed between the reservoirs of Venda Nova Dam (Montalegre) and Salamonde Dam (Vieira do Minho), which is close and surrounds another existing and operating underground hydraulic circuit. Geological monitoring of excavations confirms that the new hydraulic circuit is globally integrated with a massive predominance of syntectonic porphyroid granites, medium to coarse grained, with two mica, but essentially biotitic. The affluence of water into the underground excavations was circumscribed, with low abundance, and usually emerging from geological joints. Groundwater sampling points were selected inside the tunnels (nine points), as well as at the surface (five points) and on Venda Novaâ€™s reservoir (one point), for comparative purposes. These points were biweekly monitored for physical and chemical parameters between December 2012 and July 2013, and in addition 2 campaigns of sampling for laboratory analysis were made (in April and July 2013). Laboratory results were used for univariate and multivariate statistical analyses, characterization of hydrochemical facies (piper diagram) and determination of minerals saturation index. Three distinct groups of waters with different physicochemical characteristics were established, and a conceptual model for hydrogeochemical evolution is proposed. Thus, as the waters of Group 1, slightly mineralized, surface chloride-bicarbonate-sodium-calcium waters, percolated through the granitic rocks, they dissolved the minerals and enriched the water content in the larger elements, such as sodium, bicarbonate, calcium and silica, assuming features of Group 2 and 3 (bicarbonate-sodium-calcium or calcium-sodium waters). Groundwater from Group 3 differs from Group 2, by presenting a major evolution from surface waters, presenting higher levels of various substances, aspect that is shown by multivariate analysis. Group 3 groundwater are inserted into a geo-structural environment that seems to favor water-rock interaction, conditioning any water refills from the existing circuit, unlike the samples of Group 2, inserted in a context where major faults may favor the flow of water between underground circuits. Field measurements over time of physicochemical parameters support the distinction between the waters of Group 1 from waters of Groups 2 and 3. Furthermore, electrical conductivity and temperature field measurements along time seem to support the distinction between the waters of Groups 2 and 3.

Key words: Granites; groundwater; hydrogeochemistry.

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Hydrogeology and the declaration of protection area of the Tavra Springs (Sivas - Turkey)

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ABSTRACT

The basin of Tavra Springs located in the7 km North of Sivas Province has a drainage area of 101 km^2. Sivas City provides a portion of the drinking and potable water with the average flow (Q) of 880 l/s from groundwater (underground drainage) in the valley. The springs in this valley are generally located in the northwest and south of valley. So there is no single exit point of Tavra Springs. Some of springs flows in the form of surface stream (surface water). The flow mentioned above was measured in the collection chamber is in the downstream of valley. This study was conducted to determine the spring field and the protection of the borders of the Tavra Springs in accordance with ‘‘The Communication about Drinking Water Supply and the Aquifer Protection of Sources’’ which was published in 10 th October, 2012. According to the above-mentioned notification in this type of springs, ‘‘Absolute Protection Area’’ is accepted to be 50 meters. Additionally, ‘‘First Degree Protection Area’’ is defined as an area beginning from ‘‘Absolute Protection Border” to the distance which is equal to the distance travelled in 10 days by the infiltrated water into the aquifer. In order to calculate the border of ‘‘First Degree Protection Area’’ of the Tavra Spring, 1 borehole having 35 meter in depth was drilled in location 130 m away from upstream springs. The salt solution (500 kg salt/ 2000 l water) with electrical conductivity (EC) value of 222000 µs/cm was injected and the changes in the electrical conductivity was then tested and monitored in downstream springs. And also, this area was estimated by using the empirical equations derived from Darcy’s formula. The results of these two methods (testing-monitoring, empirical estimation) were then compared. As a main result of this study, the distance between “Absolute Protection Area” and “First Degree Protection Area” was determined to be 437 meters.

Key words: Karstic aquifer; protection area; springs; monitoring.

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Case studies of geogenic groundwater contamination in southwestern Anatolia, Turkey

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ABSTRACT

Groundwater pollution is a growing problem in the world. The principal source and cause of groundwater pollution are related to human activities like municipal, industrial and agricultural. However, geogenic contamination is a significant risk for groundwater quality. It refers to naturally occurring elevated concentrations of certain elements in groundwater (such as arsenic, fluoride, etc.). Geogenic contamination of groundwater might be a result of geochemical characteristics of the aquifer material-high concentration of contaminant in rock matrix dissolved during rock-water interaction or occur due to environmental conditions. The present study provides an overview of geogenic contamination in Southwestern Anatolia based on the origin, occurrence and impacts. Isparta, Çeltikçi, Tefenni, Çöl, Sandıklı groundwater basins which are determined geogenic contamination are considered in this study. Quaternary alluvium and Pliocene units are the most important aquifers. Groundwater is widely used for drinking, domestic and irrigation purposes in these basins. The increase of Al content in groundwater is originated from water-rock interaction as related to feldspar, kaolin and mica minerals within volcanic rocks. Weathering and dissolution of arsenic minerals, water–rock interactions, and geothermal processes cause groundwater to be enriched in As contents in the study area. The increase of Fe and Mn contents in groundwater are responsible for magmatic rocks and sandstone levels of the Elmalı formation which have iron and manganese ores due to water–rock interaction. The increase of F content in surface and groundwater originated from the solution of apatite and more commonly from the solution of fluoride- bearing micas and amphiboles within Miocene clastics, Gölcük pyroclastics and volcanic rocks in Isparta region. The increases of temperature, electrical conductivity, Na, SO4, Cl, B, Al, As, Fe, Mn, Ni and F parameters in the cold groundwater as locally are related to hydrothermal contamination from Hüdai geothermal field and water-rock interaction in the Sandıklı basin. Groundwater quality is supremely important for people's health. In these basins, Mn, Al, Fe, As and F contents of groundwater reached up to 0.433 mg/l, 3.54 mg/l, 6.19 mg/l, 0.0218 mg/l and 5.62 mg/l, respectively. When compared to drinking water guidelines established by WHO, Turkey and the EPA, these elements are above the critical values in the different sampling time as locally.

Key words: Geogenic; contamination; groundwater; trace elements; Turkey.

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Electrical resistivity and hydrogeochemical studies of some selected Hand Dug Wells and a borehole in North Western Parts of Bauchi Metropolis, Nigeria

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ABSTRACT

The study area lies between latitudes 10.2931390 and 10. 3251110N and longitudes 09.7408890 and 09.7943060E, in the northwestern parts of Bauchi Metropolis, Nigeria. The area is underlain by migmatites, migmatite gneiss, quartzite complex, granite gneiss and the charnockitic rocks (Bauchites). The migmatite gneiss and granite gneiss complex form the oldest rock group of presumably Late Pre–Cambrian to Early Paleozoic. The research was aim at assessing water quality through hydrogeochemical study. A total of forty Vertical Electric Soundings (VES) using Schlumberger electrode array configuration across an area of 3.5 km^2 were carried out. Two to four geo-electric layers were encountered and delineated which comprise of top soil, weathered layer, fractured basement and fresh basement with resistivity range of 200 – 1000 ohmms, 80 – 500 ohmms, and less than 200 ohms for the three layers respectively. Fourteen (14) hand dug wells and a borehole were studied for flow direction, while at some places the water sampled. Those sampled include nine (9) from hand-dug wells and one (1) from a borehole. Static water level within the study area varies from 4.58 – 10.15 meters. Standard methods were used for determination of physical, chemical and microbial characteristics of the water samples. The data showed the variation of the investigated parameters in water samples as follows: Temperature 27.0-30.0^oC, Electrical Conductivity (EC) 310 - 1210, µs/cm, Turbidity 1.0 - 162 NTU, pH 6.7-8.2 and Total Dissolved Solids (TDS) 155-600 mg/L. Other parameters include: Total hardness (as $CaCO_3$) 125-360 mg/L, Mg^{2+} 1.43-15.87, Fe^{2+} 0.00-4.15, Cu^{2+} 0.00-0.61mg/L, F^- 0.02-0.681 mg/L, Zn^{2+} 0.00-1.043 mg/L, NO_3^- 20.41-189.0 mg/L, Pb^{2+} 0.00-0.001 mg/L, SO_4^{2-} 49.0-227 mg/L, Cl^- 47.5-282.5 mg/L, Cr^{6+} 0.00-0.02 mg/L. The water samples contain high concentrations of some major, minor and trace cations and anions which fall above the maximum permissible limits of the National Standard for Drinking Water Quality (NSDWQ) of Nigerian Industrial Standard (NIS, 2007). Ca^{2+}, SO_4^{2-}, Cl^- and Mg^{2+} have the higher concentrations at Wuntin Dada and Kyaure respectively, which exceeds the maximum permissible limit of NIS (2007). Cu, Zn and Pb in all samples in all the stations were below, while the samples in Kyaure is within the maximum permissible limit of NIS (2007). Concentration of Fe in Rafin Tambari exceeds the maximum permissible limit NIS (2007). F^- and NO_3^- have their highest concentration in Lafiyari respectively. Total hardness of all the samples except sample BH9 exceeds the maximum permissible limit set by NIS (2007). This indicates that the water is hard, may reflect the presence of Ca^{2+}, Mg^{2+}, CO_3^{2-} and HCO^{3-}. Physical and microbial parameters indicate that the water is turbid, with high Electrical Conductivity, Total Dissolved Solids and also contain a high total Coliform and faecal Coliform above the NIS (2007) set for maximum permissible limits: this may be attributed to proximities of soak ways and dumpsites to the wells which may need to be monitored from time to time.

Key words: Resistivity; water quality; Nigerian Industrial Standard (NIS).

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Groundwater assessment of the Bléone Catchment Karst Aquifer in Southern France

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ABSTRACT

Karst aquifer is an important water resource in southern France. It is the main source for agriculture and for domestic water supply. Hence, it is necessary to assess the quantity and quality of water in the Bléone Catchment. In order to achieve this aim, a groundwater chemistry analysis and regional numerical groundwater flow modelling using MODFLOW were conducted. Groundwater samples from springs and wells analysed for water quality in the Bléone Catchment demonstrate different water types dominated mostly by fresh water, which is of moderate alkalinity and contains calcium and magnesium as major cations and bicarbonate as a common anion. The saturation indices for calcite and dolomite reveal that dissolution of calcite and dolomite can still take place. In addition, there is a very complex interaction between surface water and groundwater in the catchment.

Key words: MODFLOW; karst aquifer; dissolution.

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Lattice Boltzmann modeling for fluid flow and heat and mass transport applied in geothermal reservoirs

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ABSTRACT

Recently, Lattice Boltzmann Modelling (LBM) techniques attract many scientists in various fields of research. This work shows the capability for LBM to simulate the fluid flow and solute transport in porous and fractured media, additionally, how to study behavior of nanofluids submitted to a temperature gradient, which it is an important process in natural aquatic environments, water treatment, and other water related technologies. LBSim is used in this work as Lattice Boltzmann Model simulator software. In this article, a series of cases using the lattice Boltzmann method are presented, showing the capability of the method in simulating phenomena with fluid flow and heat transfer in porous media. Results show that LBsim the lattice Boltzmann method delivers more reliable and helpful simulations for the interpretation of the results analyses of processes in water related technologies. Thus, LBSim is a recommended tool for simulating fluid flow at laminar and turbulent condition, and heat and mass transport under complex geometry and boundary condition and parameter values.

Key words: Lattice Boltzmann Model; LBSim; fractures media; porous media; nanofluids.

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Application of decision-tree model to groundwater productivity-potential mapping in Boryeong city, Korea

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ABSTRACT

This study analysed groundwater-productivity-potential using a decision-tree approach in a geographic information system (GIS) in Boryeong city, Korea. The model was based on the relationship between groundwater-productivity data, including specific capacity (SPC), and its related hydrogeological factors. Data about related factors, including topography, lineament, geology, forest and soil data were collected and input into a spatial database. From the spatial database, the groundwater productivity related factor such as Ground Elevation, Ground Elevation within 300 m, Ground Slope, Ground Slope within 300 m, Stream Power Index, Watershed Area, River Density, Distance from River, Geology Bedrock, Hydrogeology, Lineament Length Density, Lineament Frequency Density, Lineament Length , Density Weighted by its Length, Lineament Frequency Density Weighted by its Length, Density for Lineament Cross Points, Soil, Forest Density, Groundwater Depth and Groundwater Gradient were calculated or extracted. SPC data were collected, corresponding to a yield of 300 m^3/d from 124 well locations. Using decision-tree and frequency-ratio models, relationships between groundwater-productivity-potential likely training dataset and each factor were calculated quantitatively and groundwater productivity-potential maps were created based on these relationships. The decision trees were constructed using the chi-squared automatic interaction detector (CHAID) and the quick, unbiased, and efficient statistical tree (QUEST) algorithms. Because the QUEST algorithm supports only nominal categorical data, related factors used for analysis of groundwater-productivity-potential were classified by the value of the frequency ratio. The decision trees constructed using the two algorithms were applied to each grid cell of the study area. For groundwater-productivity-potential mapping, predictors can be considered as factors and the probability (p-value) in the leaf node as the productivity potential of groundwater. Leaf nodes were then calculated. Then, the probability in the leaf node was considered as the groundwater-productivity-potential index. To obtain a groundwater-productivity-potential map, index values were re-classified into different productivity potential classes. The index was classified into three classes based on area for easy visual interpretation: high, medium, and low index ranges, respectively. The resulting groundwater productivity-potential maps were validated using area-under-the-curve analysis with the well data that had not been used for training the model. The decision-tree models using the CHAID and QUEST algorithms had accuracies of 83.31% and 79.47%, which were somewhat better than the result for the frequency-ratio model (82.09%). Results indicate that decision-tree models can be useful for development of groundwater resources. The model proposed and resultant groundwater-productivity-potential maps can be applied to the establishment of development and management plans for the use of groundwater resources, such as for regional groundwater-development planning, decisions about promising areas for groundwater development, and control over the water supply system.

Key words: Groundwater; productivity; GIS; decision tree; Korea.

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The investigation of seasonal variation of groundwater levels in Tefenni Plain (Turkey)

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ABSTRACT

The Tefenni (Burdur) plain is an important closed plain in the Eastern Mediterranean Region. This plain is one of the rare regions which are not observed of groundwater scarcity in the Turkey. Groundwaters are densely used for different purposes such as drinking, domestic, irrigation and industrial without taking into account availability in the Tefenni plain. Therefore, groundwater level is steadily decreased in the plain. This study aims to evaluate seasonal variation of groundwater level in the Tefenni plain. For this purpose, groundwater levels were measured in 26 wells located the alluvial aquifer in four periods for wet and dry periods (May – September 2009/2010). Alluvium which is the most important aquifer in the basin has an area of approximately 174 km2. The well logs indicated that the thickness of the alluvium ranged from 5 to 130 m in the Tefenni plains. The groundwater in the study area occurs under unconfined conditions. The seasonal variation of groundwater level is controlled with natural factors such as precipitation, evaporation, runoff and artificial factors such as withdrawing groundwater from wells and recharge with irrigation from Lake Karatas. Rainfall is the main recharge source of groundwater in the plain. The maximum and minimum groundwater level indicated fluctuations seasonally in May and September. The depth to groundwater level varied between 3.75 and 50.05 m in May 2009, 5.20 and 49.90 m in October 2009, 3.70 and 49.06 m in May 2010 and between 7.75 and 48.35 m in October 2010, below the ground level. The general groundwater flow direction in the porous aquifer was toward Burdur Lake which is located in the north of the plain in both wet and dry seasons. According to the measurement results compared to May of the static level in October is observed that at lower values. This is directly related to water withdrawal for irrigation purposes. In general, the groundwater level is observed in 2010 to be higher compared to 2009 in the plain. This case is associated with the increase of precipitation in 2010.

Key words: Groundwater; groundwater levels; seasonal variation; Tefenni plain.

* Corresponding Author

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Determination of stable isotope and natural radioactivity for drinking water in Sandıklı Basin (Afyonkarahisar, Turkey)

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ABSTRACT

The Sandıklı basin is located in the south-western part of Turkey and an important drinking water reservoir. Therefore, the origin, quality of groundwater and the health effect is important characteristics. For this, the stable isotope (δ2H, δ 3H and δ18O) and natural radioactivity (gross alpha and gross beta) analyses were made in two periods (August -April 2010) in the basin. The δ18O and δ2H contents of cold groundwater from the Sandıklı basin range from -10.44 to -7.41 and from -74.38 to -52.49, respectively. The stable isotope data of sampled sites lie generally above the Global Meteoric Water Line (GMWL) and above the Meteoric Water Line of Koçbeyli (KMWL) indicate its meteoric origin. As a rule, the isotopic composition becomes more depleted in δ18O and δ2H at higher elevations. Groundwater in the research area are recharged from medium elevations in the basin. The deuterium content of the water samples from the basin ranges from 0.00 to 4.20 TU in the dry period and from 0.30 to 5.40 TU in the rainy period. These δ3H values of waters could be represented that this waters recharged by local rainfall in the low altitude and are shallow aquifer waters and rapid circulation. The determination of the natural radioactivity in drinking water is important in terms of human health. The gross-alpha and gross-beta activity concentrations varied between 0.029–0.162 Bq L−1 and 0.07–0.33 Bq L−1, respectively. The results has shown that gross α and gross ß activity concentrations in drinking water in the basin are relatively low and suitable the World Health Organization (WHO) regulations for drinking water.

Key words: Drinking water; stable isotope; natural radioactivity; Sandıklı basin.

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Prioritization of sub watersheds from flooding viewpoint using the SWAT model

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ABSTRACT

Flood is a natural phenomenon that makes heavy humanistic and economic damages every year. In this research, to predict the flooding of Araz-Kose watershed, the SWAT model was used. The main goal of this research is to prioritize of sub watersheds from flooding viewpoint using the SWAT model. The swat model has been presented by agricultural research service in US and has been used as a tool for investigating the effects of different water management actions, sediment and chemical pollutions in cropland in grate watershed scale. The necessary data for this research such as topography, land use, pedology, hydrology (including daily precipitation, temperature and discharge) were provide. To calibrate the model, SUFI2 was applied. After model calibration and optimization in study area, model validation was done. Model calibration and validation were done for 1991-1998 and 2001-2009, respectively. The result analysis indices such R^2, bR^2 and Nash-Sutklif coefficient were used. These indices (R^2, bR^2 and NS) were estimated equal to 0.81, 0.81 and 0.73 for calibration and equal to 0.81, 0.78 and 0.64 for validation. The sensitivity analysis results showed 13 effective parameters that curve number is most effective parameter. Furthermore, groundwater lag time and necessary water storage for base flow have most sensitivity, respectively. To investigate the flooding in watershed, cure number parameter was used. The Araz-Kose watershed divided to six regions. Based on the obtained results (running the SWAT model with different CN), sub-watershed 6 by decreasing the peak flow (22.4%) is the most effective region in flooding. Also, the other sub watersheds (4, 1, 3, 5 and 2) have more flood potential, respectively. Finally, using the changing the CN in any sub-watershed, all parts of watershed was prioritize from flooding viewpoint.

Key words: Flooding prioritization; SWAT model; curve number; Araz-Kose watershed.

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Multi-scale water content distribution imagery in stone heritage using Electrical Resistivity Tomography (ERT) and Infra-Red Thermography (IRT): application to masonry of a Gallo-Roman site (Genainville, France)

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ABSTRACT

Water content distribution in masonry is a determining factor in the frame of the weathering processes, in particular for built heritage where the base of the masonry is often in direct contact with the water contained in the soil. The water content variations in the porous medium influence the salt concentration and hence the crystallization / dissolution processes; the latter being recognized as an important alteration mechanism. In the valley of Vaux-de-la-Celle (Genainville, North West of Paris basin, France), Gallo-Roman masonry are subject to weather and their basement to water from the water table where capillary rise takes place. A variation of water content within the masonry could be induced by seasonal variations of the water table and / or barometric pumping due to atmospheric pressure oscillations. Such periodic behaviour is an important factor in long-term damage due to crystallization / dissolution of salts. The purpose of this research is to characterize and track the distribution of the water content in the masonry of Genainville site over several months, to better understand the effects on the long-term damage. We propose to couple two imaging methods of the distribution of the water content, both in situ (metric scale) and in laboratory (centimetre scale). Imaging surface by IRT would be complemented by an in depth imaging of ERT. In the laboratory, initially, petrophysical characterizations of the studied materials will be conducted; in a second step, we will consider experiments in analogue conditions to in situ ones with ERT and IRT methods. In situ monitoring of key meteorological parameters and piezometric monitoring of the water table will also be implemented. Weekly measurements should therefore allow us to map the distribution of the water content in the masonry over several months and to better understand the influence of variations of this parameter on the long-term damage to the Gallo-Roman built heritage site of Vaux-de-la-Celle.

Key words: Water content; 3D imagery; multi-scale; IR Thermography; electrical resistivity; stone; heritage.

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Hydrogeochemistry and statistical analysis of water discharging from rocks of different origin: a case study from Sivas, Karabük and Bartın (Turkey)

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ABSTRACT

The present study was conducted in Sivas, Karabük and Bartın regions of Turkey, which have rocks of different origin, agricultural activity and mining activity. Correlation, Principal Components, Hierarchical Cluster and Multidimensional Scaling Analyses was applied in order to determine the processes controlling the chemical composition of groundwater. The findings show effects on the physicochemical composition of groundwater of the dissolution, weathering, agricultural activities, the oxidation processes of sulfide minerals, mining activities, alteration of volcanics, and progressive silicate hydrolysis and coal level within the study areas. Principal Components and Multidimensional Scaling Analyses were provided excellent visual representations of the groupings of the waters. The significant variables in the first factor are SO_4, Mn, Fe, Al, and pH. The factor represent the groundwater reached by these elements via the dissolution and oxidation process of sulfide minerals (expecially pyrite). Ca, EC and HCO_3 are generally grouped under the second factor representing the dissolution of carbonate rocks. The third factor, represented by Na, CO_3 and pH is mostly related to alteration of volcanics, progressive silicate hydrolysis and dissolution, and probably ion exchange between Ca and Na. The fourth factor of NO_3 and Cl is strongly influenced by agricultural activity. This results caused in contamination by NO_3 of water discharging from clastic rocks in areas where intensive agricultural activities are conducted; by Al, Fe, Mn, SO_4 of water discharging from volcanics consisting of Pb-Zn-Cu ore deposits; by Al, Fe, Mn of water discharging from coal levels and altered volcanics. Some of these waters are used by surrounding towns for drinking, domestic and irrigation purposes.

Key words: Hydrogeochemistry; statistical analyses; water contamination; Turkey.

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Are heavy rainfalls in central Italy influenced by climate changes?

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ABSTRACT

In recent years there is a growing concern by the community, scientific and not, about global warming and climate changes. The fact that the global temperature is growing up after the increase of the greenhouse gases emissions is already known, but there is still wondering about its effect on the hydrological cycle and most of all on rainfalls. Many studies supported by the Intergovernmental Panel on Climate Change (IPPC) showed that there is a general increase of heavy rainfalls also in areas where total annual precipitation is not prominently changed. Changings about frequency, intensity, duration in rainfalls and in weather events in general are still object of wonderings and past studies referred to different regions don't give an unanimous answer about their trends. Mediterranean Area, which includes Italy, is supposed to be one of the most reactive to the climate changes and strong effects of them are expected. This paper deals with the rainfall tendencies in Umbria Region, Central Italy, since almost all the regional territory is included in the Upper Tiber River Basin and many areas are prone to risk of flooding. The climate of Umbria region is variable from areas to areas, in fact the weather is cold and wet in the East areas, near the Apennine Mountains and hotter and drier in the West, close to Tuscany region. Because of this variability a lot of raingauges had been placed in the last 10-15 years and nowadays a very dense raingauge network is present (more than 90 raingauges for a regional area of 8464,33 Km2, about one station each 90 Km2). The aim of this paper is to analyse if the climate changes caused effects on the rainfalls' intensity in Umbria. Three meteorological stations have been selected: Città di Castello, Todi and Orvieto. They provide the longest series of data and the best quality in their measurements because raingauges have never been relocated. Rainfall measurements began in the thirties and have gone on until nowadays even if there are some interruptions (most of all during the years of the Second World War). For each year there are maxima for 6 durations:1, 2, 3, 6, 12 and 24 hours. The analyses of the data of the three stations, and most of all the one referred to Todi, whose geographical position is barycentric in the regional territory, show that there are not considerable changes in rainfall maxima and intensities in the last seventy years.

Key words: Climate changes; heavy rainfalls; Central Italy.

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The IAH Coastal Aquifer Dynamics and Coastal Zone Management website

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ABSTRACT

This website of the IAH Coastal Aquifer Dynamics and Coastal Zone Management (CAD-CZM) Network has been set up to collect and organize data and information on coastal aquifer characteristics from all over the world and let them available to researchers, professionals, and stakeholders. The IAH Network aims at promoting the improvement of tools for gaining a better understanding of the specific hydrological process dynamics in coastal areas and for improving the assessment, development and management of water resources endangered by saltwater intrusion. The network tries to satisfy the interest expressed in the recommendations issued on different occasions by UNESCO and IAEA for studying coastal areas in the frame of joint programs in cooperation with other international agencies. The www.iah.cad-czm.net has been organized to collect information coming from any kind of source, as technical as scientific, and its target is make them available to let them taken under control the rate of exploitation and the management state of these vulnerable groundwater resources. The website organization is like that anyone could find the specific coastal zone, he is interested in gaining information, only looking for it on the google earth link, present inside the website. Once the coastal zone has been found, it is possible to download, if present, the specific sheet including all the information collected, checked and uploaded, by the scientific committee of the website. The life and utility of this website depend on the capacity of all technical and scientific people involved in coastal aquifers studies and management to feed it by updated information on this important subject.

Key words: Coastal aquifers; seawater intrusion; coastal zone management; groundwater resources.

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Distribution of trace metals in the surface water Bordeaux Lac, France

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ABSTRACT

Trace metals (Cd, Co, Cr, Cu, Ni, Pb, and Zn) were determined in the surface water of Bordeaux Lac in France. The sampling regime can be considered valuable as it was done last 2011. During this time, France experienced unusual metrological condition as the season of spring was recorded as particularly hot and dry (driest year observed since 50 years). Measurements were done using Diffusive Gradient in Thin Films (DGT) samplers immersed for 1, 7 and 14 days. To take into account the vertical profile of the lake, samplers were positioned at 1meter and 6meter deep. Maximum concentrations detected are as follows: Cd: 0.05 µg/L; Co: 0.11 µg/L; Cr: 3.05 µg/L; Cu : 6.80 µg/L; Ni : 0.21 µg/L;Pb : 0.84 µg/L; and Zn : 6.67 µg/L. During spring which is a dry period this time, vertical profile of Bordeaux Lac in terms of trace metal concentration did not vary. All trace metals' concentrations decreased through time. However, with the input of precipitation during summer season, higher concentrations of trace metals were observed at 1m depth. There is also a decreasing trend through time (except for Ni). Compared to the European recommended water quality criteria (dissolved), Cr, Cu, Pb, and Zn are above the threshold.

Key words: Bordeaux Lac; DGT; trace metals.

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Groundwater geochemical characterization in the karst aquifer feeding the Pertuso spring (Italy)

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ABSTRACT

The present study deals with the geochemical characterization of Pertuso karst spring, the main perennial outlet of the karst aquifer in the Upper Valley of Aniene River, which is an important source for drinking water in the southeast part of Latium Region, in Central Italy. This paper deals with the supervisory monitoring plan related to the catchment project of the Pertuso spring which is going to be exploited to supply an important water network in the south part of Roma district. In order to identify the hydrogeochemical processes governing the evolution of groundwater and its circulation patterns, a multi-tracer approach was used to describe the hydrogeology of this karst system with the aim of achieving proper management and protection of this important resource due catchment works. To investigate the evolution of groundwater compositions, groundwater from different parts of the aquifer was sampled. Groundwater samples were collected from Pertuso karst spring and from four monitoring wells between July 2014 and January 2015 and analysed for major and trace elements. Physico-chemical parameters (e.g., temperature, pH, Eh, EC etc.) were also measured. A detailed analysis provides that all of groundwater samples have the same origin, associated lithologies, and mineral-solution reactions related to hydrodynamic responses. Piper diagram reveals higher bicarbonate and calcium suggests interactions with carbonate rocks, yielding increased Ca concentrations in the groundwater. Groundwater are characterized by low mineralization and low Mg/Ca ratios and represents the flux of rapid infiltration of surface waters through sinkholes and well-developed karst conduits network. Results from geochemical interpretation of groundwater chemistry using PHREEQC and the measured pH and Eh of groundwater sampled indicate that most of the samples were saturated with respect to calcite and aragonite, however all sampled waters were undersaturated with respect to dolomite and gypsum. Geochemical modelling showed that spring water and groundwater are made of surface water, providing quantitative information on the vulnerability of groundwater to potential surface water contamination.

Key words: Karst aquifer; geochemical modelling; Pertuso spring; Upper Valley of Aniene River.

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Isotopic and hydrogeochemical properties of mineral water in Hopur (Kahramanmaras, Turkey)

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ABSTRACT

In this study, Kahramanmaras Şerefoğlu in the village, the minerals Hope isotope geochemistry and hydrogeochemical characteristics of water resources aimed to determine. The study area Serefoglu Kahramamraş province is located in the southeast of the village, 2 km. A large part of the field is located cretaceous aged Kocali. According to the results of chemical analysis of anions and cations in the source water origin are described. With the help of this data Schoeller, piper, USA salinity, Wilcox, Pie drawing diagrams, relations with the lithologies of the chemical composition of water is introduced. Obtained as a result of the analyses conducted in the U.S. Salinity Laboratory diagram C3-S1 is in high salinity waters Scheller II class diagram is very good. According to the pie chart in the spring water intensive calcium bicarbonate, sodium, chlorine, sulfate and magnesium ions, respectively, said. According to Piper diagram of water resources in the region where 5 was put orataya. Carbonate hardness greater than 50% in this case water enters into groups. Heavy metal analysis of sulfur (S) ions are recognized and other heavy metal ions was not observed. According to the chemical analysis of water facies Ca - HCO3-Cl what has been demonstrated is. Hope mineral water source is precipitation / on water samples collected during dry periods; under the IRMS method for the 18O isotope analysis, 2H (deuterium) and the IAEA by the method of 3H (Tridy) analysis were performed. Hope Minerals meteoric origin of the water source is the old water (before 1952) are classified.

Key words: Hopur; isotope; hydrogeochemical; geochemistry; Kahramanmaras.

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Study of the water releases impact from Defla reservoir on groundwater recharge of the Chebika basin (Central Tunisia) using chemical and isotopic methods

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ABSTRACT

In semi-arid area of Central Tunisia, surface water resources are limited, and therefore groundwater constitutes the main source of water supply for domestic and agricultural purposes. Within a national water management strategy several dams and hill reservoir have been built in order to increase the overall water availability in central Tunisia, in particular in Chebika basin. This research has been carried out to delineate the impact of the artificial recharge from Defla reservoir on groundwater flow and geochemistry of Mio-pliocene aquifer in Chebika basin. The hydrogeology investigation showed a gradual decline in static water level during the artificial recharge operations as a result of intensive over–pumping. Chemical data indicate a large spatial variability of chemical water type induced mainly by cation exchange reactions. Data inferred from 18O and deuterium isotopes in groundwater samples indicated recharge with modern rainfall. The investigated surface water samples collected from the Defla reservoir are affected by a significant evaporation and reveal large seasonal variations which could be controlled by the water volume changes in the open surface reservoir and the meteorological conditions during evaporation, condensation and precipitation. The geochemical information is comparable to the isotopic results and illustrates that the chemical and isotopic signatures of reservoir waters differ clearly from those of groundwater. These data confirm that the contribution of the artificial recharge operations from the reservoir water is very limited, especially when the water releases volume did not exceed 900000 m3 during the period (December 2002-March 2007).

Key words: Artificial recharge; geochemical; isotopes; groundwater; Central Tunisia

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Trends in precipitation and river flow in the Raba catchment (Poland's Western Carpathians)

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ABSTRACT

Climate changes, regardless of their cause, whether natural (volcano eruptions, changes in the activity of the Sun) or anthropogenic (human induced changes in land cover and use, and changes in the atmospheric concentrations of gases and aerosols), may lead to significant changes in the existing natural conditions on Earth. These changes might include changes in water resources in a certain place or a region of the world. The goal of this study is to examine trends in precipitation and river flow in an average-size mountain catchment (approx. 1500 km^2) over the last 60 years. The selected research period coincides in time with the period of climate changes observed since the 1950s in different regions of the world. It is interesting from a scientific point of view, and also socially important, to verify whether, and to what degree, the globally observed (small) increase in the average air temperature over the last several decades, noted also in Poland, translates into statistically significant trends in precipitation and river flow in a relatively small mountain region in the Polish Western Carpathians. The whole region of the Carpathian Mountains in Poland, which encompasses slightly more than 6% of the country's total area, is an important one in terms of fresh water availability in Poland. The conducted analysis involves sequences of monthly precipitation totals and mean monthly flow rates observed in the catchment of the Raba River (a right-bank tributary of the Vistula River). The data relate to the hydrological years 1951-2010. As the World Meteorological Organisation recommends, the measurement sequences encompassing classical 30-year periods are analysed. In order to fully benefit from the available information provided by the data, the 30-year periods with a 10-year shift are studied, namely 1951-1980, 1961-1990, 1971-2000 and 1981-2010. Statistical tests for trend detection along with an evaluation of their statistical significance were performed. The null hypothesis relied on assumption that a linear trend in time does not exist for the considered monthly precipitation totals and mean monthly discharge values. A trend was judged to really exist there, where a tested hypothesis had to be rejected at an assumed test significance level $\alpha = 0.05$. Statistical tests performed for the sequences of monthly precipitation totals and of monthly discharge in the Raba catchment have shown that there are statistically significant linear trends in every 30-year research period, at least in some months. Focusing on the years 1981-2010, the number of revealed linear trends present in the whole multi-annual sequences, in comparison to the earlier periods, is exceptionally high and it is associated with the same growing tendency. Positive linear trends in precipitation have been identified in March and/or September for the entire 60-year period (1951- 2010).

Key words: Precipitation; river flow; Raba catchment; Poland.

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Artificial recharge by implanting water supply basins in dune massif of Bouteldja (North-East Algeria)

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ABSTRACT

Artificial recharge is an emerging practice that seeks to increase the volumes of water favouring by artificial means its infiltration into the aquifer. The dune massif of Bouteldja an important groundwater reservoir intensively exploited for water needs wilaya of Annaba and El Tarf. The implementation of catchments areas within this dune is an effective way to solve the problem of over fishing. It is therefore essential to assess the technical feasibility of artificial recharge, to select the most favourable areas for the recharge and develop the most suitable devices to perform an artificial supply and therefore sustainable.

Key words: Dune massif of Bouteldja; overexploitation; artificial recharge; supply basin.

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Hydrochemistry of the Lake Van drainage basin, Eastern Turkey

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ABSTRACT

Lake Van and its drainage basin is situated in a tectonically active area, has active volcanoes on a high plateau in Eastern Anatolia. Lake Van catchment area exceeds 15000 km2. Three climate systems (Monsoon System, Midlatitude Subtropical High Pressure System and Siberian High Pressure System) cause continental climate (cold and wet winters, warm and dry summers) for the region of Lake Van. Lake Van was drilled by International Continental Scientific Drilling Program (ICDP-PaleoVan Project) in 2010 about several hundred meters for to understand paleoclimatic, paleoenviromental and paleotectonic history. Besides to learn about 600000 years history of Lake Van, it is also important to understand hydrochemistry of its drainage basin. Geology and climate is the main factor to determine the water chemistry as well as the the type of lake sediment. The main goal of this work is to find the water chemistry and seasonal differences (spring and fall) on hydrochemistry of rivers which discharged into the lake. With this aim water sampling was done on all of the rivers (Karasu, Bendimahi, Delicay, Zilan, Muradsu, Karmuç, Kotum, Engil) which discharge into Lake Van. Chemical analysis (ICP-MS and Ion Chromatography) was done of the river waters. According to the analysis there is no obvious change in the chemical composition which is seasonally. The chemical composition of the rivers in the study area is affected by mainly geology of the catchment area. The hydrochemical characteristics of river water based on the %meq/l of anions and cations can be illustrated by Piper Diagram. According to Piper Diagram all of rivers except Bendimahi River has the chemical composition Ca-HCO3, and Bendimahi River has the chemical composition Na-HCO3 because of the geology of catchment area.

Key words: River; chemistry; piper diagram; catchment.

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Analytical and numerical approaches of the effects of artificial recharge by treated wastewater in the semi-arid system: a case study in Cap Bon, Tunisia

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ABSTRACT

A The Korba-Mida coastal aquifer is located in the east of the Cap Bon peninsula in the North East of Tunisia. Arid climate, prolonged periods of drought and intense pumping for irrigation has affected the natural flow system since the 1960s. Consequently, seawater is continuing to invade a large part of the aquifer induces the deterioration of the water table quality. Crucial for agriculture, aquifer management in Tunisia led to the implementation of artificial recharge with treated wastewaters in December 2008 at the north of the treatment station Korba. Since this date, measurements of piezometers in situ, pH, temperature and conductivity are measured to see the impact of this recharge at the surrounding area of the recharge site. Firstly, this study reviews the fluctuation of Korba-Mida groundwater resources by comparison of piezometric and salinity maps collected during the last fifty years. The present study aims to evaluate the impact that would have the reuse of treated waste water for the recharge of the local aquifer in Korba. Artificial recharge seemed to influence some piezometers at vicinity but had low impact, if any, on close farmers' wells. In terms of quality, recharge waters were salted and poorly contributed to refresh the system. For this purpose, the Groundwater Modelling System has been used to model the groundwater flow and to simulate the artificial recharge. The main objective is to simulate regional groundwater changes under permanent regime and transient conditions and also to trace the progression of recharge in groundwater. The calibration of model is based on the groundwater level from 1963 to 2004. After that, numerical model was used further to discuss some issues on the management of the regional groundwater resources. The artificial recharge used in the model Salinity at the recharge site generally decreased from 10 g/L in 2004 to 2-3 g/L in 2011; here attention must be paid to the role of the fresh groundwater body whose refreshing effect must not be confounded with that of the recharge waters. It is spatially and temporally displaced; possibly under the piston effect due to the infiltration of 6,000 to 37,000 m3 of wastewater per month was an average of 56 mm/year. Different scenarios of recharge consider reviewing the additional contribution of Wastewater in Korba. In addition to that, the model allowed considering two new sites for recharging artificial in order to select the location and the necessary injection volume to solve the problem of medium-term intrusion. This amelioration on strategies in the recharge site shows the role of the recharge such as hydraulic barrier to mitigate the problem of marine intrusion and to limit its geographical expansion.

Key words: Korba-Mida coastal aquifer; seawater intrusion; groundwater modelling; artificial recharge.

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On the use of DPSIR model to two basins in the Northern of Algeria: socio-economic pressions

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ABSTRACT

This research has an objective to determine the effective variables in socioeconomic category of Integrated Water Resources Management for Saf-Saf and Seybouse basins characterized by fast growing demand of urban and rural populations and the demand of economic sectors including industry and agriculture. In this paper, the artificial neural network models were used to model and predict the relationship between water resources mobilization and socioeconomic variables. The results indicate that the feed-forward multilayer perceptron models with back-propagation are useful tools to define and prioritize the most effective variable on water resources mobilization and use. The model evaluation shows that the correlation coefficients are more than 94 % for training, verification, and testing data. The model aims to link the water resources mobilization and driving forces variables with the objective to strengthen the Integrated Water Resources Management approach.

Key words: Saf-Saf basin; Seybouse basin; water resources mobilization; multilayer perceptron network; socioeconomic variables; integrated water resources management.

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Sea water intrusion in Pondicerry east coast of India: a scientific modelling approach

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ABSTRACT

The natural quality of ground water along the Pondicherry coastal region is under stress due to overexploitation. In this research an attempt has been made to investigate the factor of groundwater salinity and their intrusion potential along the coastal aquifer. The study aims to identify the regimes with excess concentration of EC levels as per irrigation standards which indicates the measure of salinity along the coastal region. Data included in the model are electrical conductivity, pump test covering three significant stratigraphic formations (quaternary alluvium, tertiary and cretaceous formations), annual precipitation, water table depth, elevation/ topography of the region , lithological cross section of exploratory/ observatory bore wells, aquifer thickness, their porosity, permeability, specific storage and specific yield etc. Three different boundary conditions were specified in the model as an input. The visual mudflow modeller (MT3DMS) is used to predict the concentration of EC µS/cm for the actual pumping rate and at an annual recharge of 40% along with the longitudinal dispersion value of 10 m. The model has a highest correlation coefficient of above 94% for first 20 years and then reduced to 85% for the next 20 years. The model results indicated that the southern portion of the Pondicherry region which extends to a distance of ~14 km towards west is influenced by seawater intrusion. Hence the study recommends the Government of India to take necessary steps to improve the recharge conditions of the aquifer and to reduce the rate of pumping based on recuperation rate.

Key words: Seawater intrusion; MT3DMS; coastal aquifer; electrical conductivity.

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Analysis of hydrologic components for increasing water resource in watershed, Eastern Korea

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ABSTRACT

The importance of water resources around the world has been emphasized because the persistence of drought increases possibly due to rapid changes in earth environments. Hence there is a need for the solution on how optimal water resources that can afford to meet the demand of the present and the future can be secured, which is one of the important notions in water resources management of Korea. The construction of surface water dam for securing water resources in Korea may bring about many environmental problems such as changes in ecosystem and climate due to its limited, narrow territory, along with surface water contamination. The change in groundwater level due to construction of the groundwater dam was evaluated using a SWAT-K model that integrates surface water and groundwater. The feasibility of the construction of groundwater dam was also assessed by analysing the water level duration curve. Based on the analysis, there is little change in groundwater level and discharge quantity at the downstream region due to the construction of groundwater dam. We calculated cell volume using groundwater level with surface area of each cell (100 m×100 m) and height. Total volume was calculated by addition of the volumes of 91 cells except cells with an increase of 2.85 m in groundwater level at the uppermost region of the river. According to hydrologic tests, the effective porosity ranges from 21 to 27% and the total volume calculated indicates that water securement ranging from 71,358 m^3 to 91,746 m^3 is possible.

Acknowledgments: This study was supported by the GAIA Project (contract number: 2015000530003), Ministry of Environment, Republic of Korea.

Key words: Water resources; groundwater; SWAT-K; groundwater level.

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Evaluation of the effects of climate change on catchment scale surface and groundwater balances

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ABSTRACT

This research has focused on evaluation and determination of water balance components in semi-arid catchment of Toyserkan in Hamedan province in Iran. To be able to complete this research, different physical and experimental and computer based models and procedures have been used for evaluation and estimation of both surface and groundwater components. HEC-HMS was found to be suitable for rainfall-runoff simulation and estimation of flow discharge and volume in ungauged tributaries. For simulation and analysis of zonal groundwater budget GMS model was calibrated and implemented. To map annual real evapotranspiration, surface energy balance algorithm of land (SEBAL) was employed with the help of satellite time series data. Then the models were coupled with AOGCMs to project climate change impacts on water balance components for the future time periods. Furthermore, some management scenarios including higher efficiency of water use and therefore less extraction of groundwater as well as the effects of cloud seeding on water balance components were evaluated and discussed as alternatives for alleviation of water shortage especially in drought periods in such a region. Results showed a general negative trend of both for surface and groundwater resources in Toyserkan plain with a total value of -21.6 MCM for the year 2008-2009 as a sample. The results also show that with a probability of 80% and under both A1B and B1 emission scenarios, the water balance becomes more negative in the future shifting water resources of the plain to an intensified harsh condition. In this condition, the annual storage for 2011-2030 will reach -39.7 and -40.7 MCM respectively for the scenarios A1B and B1.

Key words: Water balance; Toyserkan; surface water; groundwater.

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Stochastic forecast of flow

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ABSTRACT

The main advantage of stochastic forecasting is fan of possible value, which deterministic method of forecasting could not give us. Future development of random process is described much better by stochastic then deterministic forecasting. We can categorize discharge in measurement profile as random process. Contents of article are development of forecasting model for managed large open water reservoir with supply function. Model is based on linear autoregressive model, which forecasting values if average monthly flow from linear combination previous values of average monthly flow, autoregressive coefficients and random numbers. Autoregressive coefficient was calculated from Yule-Walker equations (Yule, Walker, 1927, 1931). The model was compiled for forecast of 1 to 12 month with backward correlation from 2 to 11 months. Data was got rid of asymmetry with help of Box-Cox rule (Box, Cox, 1964), value r was found by optimization. In next step were data transform to standard normal distribution. Our data were with monthly step and forecasting was recurrent. We used 90 yearlong real flow series for compile of the model. First 75 years were used for calibration of model (autoregressive coefficient), last 15 years were used only for validation. Outputs of model were compared with real flow series. For comparison between real flow series (100% successfully of forecast) and forecasts, we used as values of forecast average, median, modus and miscellaneous quintiles. Results were statistically evaluated on monthly level. The main criterion of success was absolute error between real and forecasting flow. Results show that the longest backward correlation did not give the best results. On the other hand flow in month, which were forecasted recurrently from forecasting flow give smaller error than flow forecasted from real flow. For each length of forecast even for backward size of correlation were reached different values of quintiles, for which forecasting values gave the smallest error. Flows forecasted by the model give very fine results in drought period. Higher errors were reached in months with higher average monthly flows. This higher flow is caused by floods. The floods are very complexly predictable. If we evaluate all months together, we will decreased precision of outputs, but in months with higher average monthly flows is enough water. This is reason, why we could not give this time period same importance as drought periods. Due to good results in drought periods we can use the model for managed large open water reservoir with supply function.

Key words: Stochastic; forecasting; average; flow.

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Hydrogeology of Kaklik (Denizli) aquifer in Turkey

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ABSTRACT

The purpose of this study is to determine the geological and hydrogeological properties of aquifers, groundwater potential, water quality and to form a groundwater model of the Denizli-Kaklık region. Kaklık aquifer is located at upper part of the Çuruksu basin covering 1234 km^2 drainage area and is recharged from 3 subbasins; Yokuşbaşı subbasin (60 km^2), Emirçay subbasin (300 km^2) and Alikurt subbasins (180 km^2). Annual precipitation is about 260.4x106 m^3/year, Evaporation is 183.6 x 106 m^3/year, streamflow is 45.57x106 m^3/year, discharge from the irrigational wells is 3.3 x 106 m^3/year and residual of 27.93 x 106 m^3/year is groundwater reserve. The main aquifers are Çökelez Limestone and Sazak formation and Alluvium. The Çökelez Limestone and Sazak formation are Karstic aquifer. Malıdağ fm, İnceler fm, Karadere fm and Bayıralan formation are impervious rocks. Kızılburun formation is semi-permeable aquifer. Alluvial fun and alluvium are the permeable clastic aquifer. Thickness of aquifer at Yokuşbaşı region varies between 10 to 60 m. Transmissivity contours ranges between 150 and 250 m^2/day and Hydraulic conductivity contours ranges between 0 and 20 m/day in Kaklik Aquifer. The water table fluctuations shows a decreasing of 4 m from 1995 (32 m) to 2003 (36 m) year. Water table in 42999a well increases from year 2003 to year 2005 and decrease from 2005 to 2008 year again. 42721 well shows an increasing trend from year 1998 to year 2004 year and a decreasing trend from 2004 to 2008. Whereas the water table of 45192 shows a fluctuating of 1,5 m from 0,5 m to 2 m between years 1994- 2001. Water table of 42720 well shows an increasing from year 1997 to year 2004. Potentiometric surface maps for the years 2008, were constructed for the Kaklık aquifer and it also shows the directions of groundwater flow. Potentiometric surface varies from 630 m at Alikurt (east) to 380 m OSM (west) in the flowpath of 20 km. Hydraulic gradient is about h= 0,0125. Flow directions generally incline from east to west. According to the water quality investigations; pH ranges between 6.7 and 7.2, the groundwater are fresh (TDS< 1000 mg/l and EC<1500 µS/cm) and soft (Hardness as $CaCO_3$ < 60 mg/l). After the 34220 no well, because of 2 faults, the lithology changes to Sazak Formation from Karadere formation and a water quality degradation occurs. The gypsum and halite dissolution occurs in the Sazak formation while the groundwater temperature is increasing along the main graben fault systems.

Key words: Hydrogeology; hydrology; water quality; groundwater.

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Hydrogeochemical evaluation of thermal, mineral and cold water in Bursa Aquifer, Turkey

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ABSTRACT

Groundwater potential of Bursa aquifer, hydrogeochemistry of groundwater and hot springs, and new areas were researched for geothermal potential. Catchment area of Bursa aquifer has a 793,317 km^2, and the aquifer area is of 208 km^2. Geological units have been estimated according to the hydrogeological properties. The units are called as primary porosity high permeable, primary porosity less permeable, secondary porosity high permeable, secondary porosity less permeable, less permeable and impermeable. There are 187 boreholes opened in Bursa aquifer. Groundwater flow direction is from east and south to west. In addition, diminish of groundwater level was determined in arid periods. According to chemical analysis of groundwater is Ca-HCO_3 and Na-HCO_3 facies; according to SAR classification well waters are 'excellent for irrigation'. According to %Na classification very good, good and available; USA salinity laboratory classification depends on C2S1 ve C3S1 and very good-good usable water according to result of Wilcox diagram. Groundwater is generally comply with drinking water standards. Geothermal systems in Bursa are Uludag granodiorite heating source, Uludag marble reservoir rock, offering karstic structure, Uludag Mountains and major faults recharges to the aquifer, with Karacaoba formation Quaternary rich deposits of old clay forms cover rocks. These are the product of many hot springs geothermal system. The types of thermal waters are Ca-HCO_3 in Çekirge and Na-HCO_3 in Kaynarca. Çekirge and Kükürtlü group thermal waters temperature is between 42,6-45,1 °C and 56,3-79,3 °C, respectively. According to Bogomolow, thermal waters are very hot water class. The temperature of the thermal waters increase the value of the EC increases, decrease the value of the pH. Thermal waters are saturated calcite and dolomite and shows that limestone water supply and reservoir rock. Na-K-Mg triangular diagram is situated in the raw water portion consisting of a mixture of hot and cold water are accessible to the surface before reaching equilibrium. Thermal waters are mixed with groundwater, therefore they are temperature and chemical characteristics of the changes that were observed. Low Na/K ratio is observed with thermal waters to the surface they tend to rise quickly. Both thermal waters group don't indicate the directly deeply nutrition that have high HCO_3 value. As a result of CO_2 measurement in the soil to determine the geothermal potential, especially in the western and southern areas of Soğanlı, in the southeast of Odunluk, in the northeast of Dobruca CO_2 gas is available in higher values.

Key words: Bursa Plain; aquifer; hydrogeology; geothermal; hydrogeochemistry.

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Investigation of hydrogeological and hydrogeochemical properties of Muradiye-Çaldıran (Van) geothermal field, Eastern Turkey

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ABSTRACT

The study area which is situated in northeast of the Lake Van contains hot and cold waters in the Muradiye-Çaldıran basin. There are Paleozoic-Mesozoic metamorphic units on the basis of the stratigraphic sequence in the region and that units include reservoir rocks in the geothermal field. There are Quaternary alluviums, Plio - Quaternary volcanic rocks such as basalt, basaltıc tuff, tuff-basalt, basalt with gravel and Late Paleozoic metamorphic series in the field from top to base, respectively. Quaternary alluviums and Plio-Quaternary volcanic rocks show the cap rock features. Structurally, there are right-lateral faults with NW-SE directional which constitute in Neo-tectonic period, Middle Miocene in the field. Aim of this study is investigation of hydrogeological and hydrogeochemical properties of a geothermal field, eastern Turkey. In this study, samples were taken from 34 points including springs and wells and analysed in Muradiye-Çaldıran geothermal field. 8 of them are hot waters, 1 of them is mineralized water and 25 of them are cold waters. Geothermal springs are parallel to the faults. Also, physical measurements such as pH, EC and temperature were applied in-situ and as a result of measurements temperature changes between 8.8 °C and 34.7 °C, pH changes between 6.80 and 8.81 and EC changes between 60 and 3420 µS/cm. When geophysical studies examined which are carried out in the centre of the field (Çaldıran-Ayrancılar) for the purpose of investigation of geothermal energy resources, is seen a little geothermal activity zone, is not seen very active tectonic and detected a geothermal field with low enthalpy. In geophysical studies which are carried out for the purpose of detecting spread of aquifer and layers in the general of the field, thickness of alluviums are nearly 25 meters and volcanic rocks nearly 120 meters and thickness of metamorphic series is not known. Hydrogeochemical investigations were evaluated by using semi-logarithmic Scholler, Piper and Durov diagrams. As a result of the evaluation, waters in study area include HCO_3+CO_3 at the high levels, Cl level is low at the most of the samples and only a few samples have high chlorine. According to the ion content, hot and mineralized waters are Ca - HCO_3 type waters and cold waters are Mg-HCO_3 and Ca-Mg- HCO_3 type waters.

Key words: Muradiye; Çaldıran; geothermal; hydrogeology; hydrogeochemistry.

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Scirpetum radicantis in limnocrenic karst spring – first locality in Europe

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ABSTRACT

Rush community Scirpetum radicantis HEJNÝ in HEJNÝ et HUSÁK 1978 was first recognized in the south of the Czech Republic in the littoral zone of fishponds. Subsequently, it was found in Germany, Slovakia, Austria and in Poland. This association occupies clayey and sandy soils in mesotrophic fishponds and oxbow lakes, usually abundant in peat sediments in the littoral. Scirpetum radicantis is considered to be a very rare and endangered plant community in Europe. First locality in limnocrenic karst spring was recorded in south-western Poland.

Key words: Scirpetum radicantis; limnocrenic karst spring; first locality; Europe.

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Geomorphological and geotechnical analysis of the December 3, 2013, Ontescaglioso landslide (southern Italy)

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ABSTRACT

The In the second half of 2013, the area between Apulia and Basilicata (southern Italy) was struck by severe rainfall events that produced many effects on the environment, including slope movements, sinkholes, and floods. Beside the severe economic losses, four fatalities had to be recorded. The town of Montescaglioso, located at the top of a prominent hill in a highly-prone to landslides setting, was in particular interested on its south-western slope by a large landslide on December 3, 2013. The phenomenon, that covered a total area of some 3.0 × 105 m2 as a whole, started rapidly, accordingly to eyewitness accounts, and in a time span of 15-20 minutes destroyed more than 500 m of the main road connecting the town of Montescaglioso to the Province Road SP175, and involved a few warehouses, a supermarket, and private homes. Soon afterward the landslide activation, the main consequences of the slope movements were evaluated through detailed field surveys, which allowed, at the same time, to compile a map of the surface deformations in the affected area, aimed at identifying zones within the landslide body that showed different kinematics. The field surveys were aided by the visual analysis of post-event terrestrial photographs and photographs taken during helicopter flights. Many different geomorphological features were identified and mapped, including, but not limited to, single fractures, sets of fractures, tension cracks, trenches up to 6 m in depth or width, and pressure ridges. This first surveys, and the deriving map, were of crucial importance, since many of the geomorphological features mapped immediately after the landslide event were few days later destroyed, due to the first remediation works. Based upon the geomorphological data thus collected, and the outcomes of a campaign of boreholes and geophysical surveys, a geotechnical model of the area affected by the large landslide was produced. In particular, a transient seepage finite element analysis, coupled with limit equilibrium analysis, was developed to explore the role of the rainfall history as the main triggering factor of the instability process. Also, a three-dimensional finite element analysis was carried out in order to investigate the overall failure mechanism and the directivity of the landslide movement. The modelling results highlights the role of a pre-existing landslide surface, so that the landslide process recently occurred can be identified as a slope reactivation. Moreover, the numerical results are consistent with the landslide displacement mapping derived from both the field observations and the application of interferometry techniques.

Key words: Landslide; mapping; geotechnical modeling; Montescaglioso.

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Sinkhole problems at Rome and in the surrounding territory

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ABSTRACT

The city of Rome is among the main sites in Italy affected by occurrence of sinkholes produced by underground cavities. The high frequency of these phenomena is due to a combination of the local geology, characterized by rocks belonging to two different volcanic districts and by the alluvial deposits of the Tiber and Aniene rivers as well, and of the long history at the site, covering more than three thousand years of human presence. The effects caused on the built-up environment by sinkholes are therefore very severe, and have produced casualties in several occasions. The most common typology of underground artificial cavity at the origin of the sinkholes is represented by old quarries, used in the past to extract the building materials for the town. Once abandoned, processes of degradation of the rock material started at these sites, favoured in many cases by anthropogenic actions; the resulting instabilities that occurred underground often had an upward evolution, until developing a sinkhole at the surface. This situation is definitely the most frequent in Italy as concerns anthropogenic sinkholes, as resulted from the analysis of a national chronological catalogue of sinkholes managed by CNR-IRPI (the catalogue includes some 900 events at present, 160 out of which are located in Latium, the region where Rome is). The present article deals with analysis of sinkholes in selected areas of the city of Rome, where recent events resulted in evacuation of some buildings, with many problems for the local inhabitants. Further, the case study of Palestrina (the ancient Praeneste, in the province of Rome) is also described, with particular reference to the event of October 21, 2014, when a two-story building was destroyed by a sinkhole. Luckily, two days before the building had been evacuated, which resulted in damage being limited to economical issues, without any loss of human life.

Key words: Sinkholes; hazard, risk; anthropogenic cavities; Rome.

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Quay wall stability considering earthquake and tsunami overtopping forces together

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ABSTRACT

This study investigates the stability of a quay wall subject to the combined effects of tsunami wave overtopping and seismic action of an earthquake using the limit equilibrium method. The tsunami's force was calculated using a numerical program. More specifically, the force of the tsunami's waves acting on the front, top, and back sides of the quay wall was estimated. The backfill material behind the wall was assumed to be permeable coarse sand. The stability of the quay wall was assessed for both sliding and overturning in the active condition. When an earthquake and tsunami were considered together, the stability of the quay wall decreased significantly. In addition, the stability of the wall varied significantly before the wave hit, upon the initial arrival of the wave, and after overtopping by the wave. Once the tsunami hit the wall, the factors of safety for both sliding and overturning increased significantly since in this active condition, the tsunami acted as a resisting force rather than a driving force. However, after the tsunami overtopped the wall, the factor of safety decreased until it reached its minimum value. The overtopping tsunami increased the driving force on the back of the structure, which decreased the factor of safety.

Key words: Tsunami overtopping; active condition; quay wall; stability; earthquake.

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Geodynamic processes in the lithosphere under catastrophic earthquake Tohoku-Oki

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ABSTRACT

Earthquake Tohoku-Oki, 11.03.2011 happened near the island of Honshu, has attracted attention not only for its energy capacity and catastrophic consequences of tsunami and the destruction of three nuclear reactors, «Fukushima-1», but also a unique experimental data on the co-seismic and post-seismic vertical and horizontal displacements of Earth's crust in the area of the Japanese archipelago, which were received on geodynamic network GEONET (GNSS Earth Observation Network System). In this connection, based on the analysis and synthesis of evidence on the kinematics of upper lithosphere during and after the earthquake Tohoku-Oki as the subject for discussion Alternative hypotheses about the sources of power such catastrophic earthquakes occurring in the area of Japanese islands. A hypothesis on the origin of power sources geodynamic Japan earthquake type which, without explaining the reasons for internal model (as is usually done), repelled from the actual material. 1. Elastic energy accumulation occurs in the deep parts of the continental plates where the maximum stresses exist, as rocks retain their elastic properties. This depth can be evaluated by the maximum depth of earthquakes - 700-600 km. Indirectly, this confirms the earthquake that occurred May 24, 2013 in the Okhotsk Sea at a depth of 600 km of M = 7,7. 2. Causes of the excess energy can be different and require separate consideration. We can only say that there is an asymmetrical distribution of the ratio of the horizontal and vertical components of the stress tensor when a layer at a depth of horizontal stresses is growing at a faster rate than vertical. This leads to the creation of efforts upwards at an angle of 45-550 depths of the continental plate, and not by the PP, as it has traditionally been considered. 3. This force effect leads to the formation of zones of increased stress or denser rocks (set according to seismic tomography). When exceeding some threshold voltages failure occurs at the boundary of the medium plates in the form of reverse faults and displacement of large blocks in the upper crust in the direction of least resistance. According reconstruction earthquake focal that main axis of compressive stress change their orientation is approximately 900 in the oceanic region for the gutter plate. 4. On the eastern border of the continental plate uplift occurs with dextral shear component. In this part of the plate «leans» on the western part of the ocean, making it sub-horizontal tensile stress. Such destruction occurs at intervals of about once every 40 years in the seismic gap. Continental plate like a crocodile «devours» the oceans, causing it to sink down the edge portion. This may explain a series of faults and grabens lying in a gutter part of the oceanic plate.

Key words: Geodynamic; lithosphere; earthquake.

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Geotechnical science and the management of landslide hazards

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ABSTRACT

Increasing population brings human development closer to slopes and into conflict with landslide hazards. Societies around the world face the double challenge of minimizing landslide risk and optimizing land use to suit the needs of expanding and developing communities and their infrastructure. Geo-technicians and Engineering Geologists play a key role in meeting the challenge by providing predictions of slope stability and landslide behaviour. Their first task is landslide recognition and typology which determine the methodology of hazard and risk assessment. The second is the determination of landslide susceptibility or slope stability under a variety of conditions. The third is prediction of landslide runout and the delineation of hazard zones. The fourth is the determination of hazard intensity parameters, such as velocity of movement and the qualitative or quantitative determination of risks. The fifth is assisting other stakeholders in setting risk tolerance criteria and, finally, the sixth is input into the design of remedial measures. This general process has many variations in different parts of the world and these will be described, with relevant examples.

Key words: Landslide hazards risk.

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Earthquake-induced geological and geomorphic ground deformation

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ABSTRACT

Moderate-sized and strong earthquakes (magnitude ≥ 5.0) are often associated with ground deformation, throughout the world. The ground effects include fault surface ruptures (coseismic ruptures) and secondary geological/geomorphologic effects such as liquefaction, landslides and rock falls as well as deformation affecting soft sediments (seismites). Such effects have been largely studied during the last decades because (i) it constitute a hazards for human lives and properties and (ii) May have a scientific interest by allowing to retrieve traces of paleo-seismic events that occurred repetitively along a given fault in the past. We discuss in this work the state of the arts and examples from different seismotectonic contexts.

Key words: Ground deformation; earthquakes; geological effects; geomorphic.

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Environmental changes and Natural Disasters: 5 decades of disruption in South America

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ABSTRACT

Catastrophic episodes recorded between 1960 and 2009 in the South American countries were evaluated, considering the disaster database maintained by Em-Dat (Emergency Events Database). During this period, urbanization grew explosively and disorderly in the area and the insertion of the countries in a globalized market became larger, aspects which brought in turn substantial changes in the environment. As a result, 863 events were recorded over the 5 decades, and following the worldwide trend, the number of natural disasters and affected people has increased in South American nations, although the number of deaths has reduced. Serious deficiencies in information on economic losses do not permit very precise conclusions, but indicate intensification in damages. The largest number of natural disasters occurred in Brazil, which is also the largest country in size and in number of inhabitants, but other nations presented much higher disaster density, such as Ecuador, Uruguay and Colombia. Hydro-meteorological and climatic disasters have been the most common in the area (78%) and also affected more people (88%) and caused more economic losses (78%), in special, floods; however, geophysical events, which affect the Pacific nations only, promoted more deaths (59%). The biggest disaster of South America, ranked so due to the huge number of fatalities, was an earthquake in May 1971 in Peru. Various catastrophes have put South American nations on the top of the list of disasters; for example, in the case of both dry and wet mass movements. The major changes in the South-American environment in view of increasing the competitiveness of the countries' economies in a globalized world has had little effect to lead these nations to a level of greater importance in the global context, but have contributed to enlarge the risk to their populations which are, in fact, the most valuable assets of these and of any other country.

Key words: Natural disasters; South America; globalization; urbanization.

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Rainfall induced landslide susceptibility risk assessmentat the Chongren area (China) using frequency ratio, certainty factor and index of entropy model

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ABSTRACT

Landslides like other natural hazards are dangerous to human, recently, there has been a lot report about landslides in Jiangxi province, China. The main objective of the study is to apply and compare a frequency ratio, certainty factor and index of entropy model in Chongrenarea, China using geographic information system and remote sensing technology. First, a landslide inventory map was constructed from field surveys and interpretation of aerial photographs. Landslide factors such as elevation, slope, aspect, plan curvature, profile curvature, stream power index(SPI), sediment transport index(STI),topographic wetness index (TWI), distance to faults, distance to rivers, distance to roads, land use, NDVI, lithology, and rainfall were analysed in landslide susceptibility modelling. Then landslide susceptibility maps were produced using frequency ratio, certainty factor and index of entropy methods. Finally, the maps were validated and compared using known landslide locations. The AUC plots showed that the training accuracy were 79.12%, 80.34% and 80.42%, for FR, CF and IOE models, and the prediction accuracy were 80.14%, 81.58% and 81.73%, respectively. The map produced by IOE model exhibited the best result for landslide susceptibility mapping in the study area. The models used in this study is important for government management and land use planning.

Key words: Frequency ratio; certainty factor and index of entropy model; landslide; GIS.

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A comparison of feature and expert-based weighting algorithms in landslide susceptibility mapping

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ABSTRACT

Landslides are destructive natural disasters affecting a large number of people and properties. In Turkey, landslides have been the most effective disasters after the earthquakes. Landslide susceptibility maps are important sources for disaster plans and mitigation studies. In this respect, landslide susceptibility maps are required to reduce loss of life and property by lessening the landslide impact. The production of landslide susceptibility maps requires considering many conditioning factors related to landslides. So far, many landslide conditioning factors have been considered in the literature for landslide susceptibility mapping, but it is not certain which factors would be more effective and suitable for a specific case. The number and type of factors used in such analyses have not been researched in the context of feature weighting. In most studies, factor weights have been determined by expert judgments as in the application of analytical hierarchy method. Varying degrees of success have been reported by considering different expert views in parameter weighting. Determination of factor weights for landslide susceptibility mapping problem should be performed by some intelligent approaches instead of personal choices when a large number of factors are available. In this study, the quality of factors and their effects on the production of landslide susceptibility maps were assessed using Chi-square and Fisher weighting methods. Process of factor weight determination was automatized employing feature weighting algorithm with user-based AHP approach. In order to produce the most accurate and precise susceptibility maps, factors were integrated into the GIS environment using the factor-weighted overlay method. In this study, Arakli district of Trabzon Province, Turkey is considered as the study area. Due to its topographical and climatic conditions the region is highly prone to landslide activities. Most landslide activities are associated with heavy rainfall in that region. Mean annual precipitation within the study area is 840 mm. Also, many factors have influence on the landslide activity in the study area. The primary focus in this study is to determine the weights of landslide causative factors using Chi-square and Fisher algorithms. On the other hand, AHP method was used as a benchmark method to compare and validate the performances of the landslide factor weights. All weighted factor sets were tested on factor-weighted overlay method for producing landslide susceptibility maps. The quality of susceptibility maps was assessed using overall accuracy measure and success rate curve analysis. Statistical analysis showed that the weights determined by Chi-square and Fisher methods outperformed the conventional AHP method by about 6%. Results clearly indicate the effectiveness and robustness of feature weighting algorithms in comparison to the expert based weighting approach.

Key words: Landslide susceptibility; feature weighting; Chi-square; Fisher; AHP; weighted overlay.

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Application of support vector machine and sensitivity analysis for landslide susceptibility mapping in Pyeongchang area, Korea

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ABSTRACT

For mapping of landslide susceptibility, support vector machine (SVM) were applied and validated using geographic information system (GIS). To test SVM, the two study areas were selected. The study areas were the Pyeongchang in Gangwon Province, Korea, where a great deal of about 2,000 landslides occurred in 2006 by heavy rainfall and where the 2018 Winter Olympics are to be held. The spatial data, such as landslides, topography, geology, soil, forest and land cover were detected, collected and compiled in a database using aerial photographs and GIS. From the database 18 factors such as slope, aspect, plan curvature, slope length, soil topography type, Stream Power Index (SPI), Topographic Wetness Index (TWI), geology, distance from fault, soil depth, soil drainage, soil material, soil texture, timber type, timber diameter, timber age, timer density and land cover were extracted and used input data for the SVM. Then detected landslides were randomly split 50/50 for training and validation of the models and SVM, which is a type of data-mining classification model, was applied using radial basis function kernels. Finally, the resulting landslide-susceptibility maps were validated and sensitivity analyses were performed using area-under-the-curve (AUC) analysis with the landslide area data that had not been used for training the model. As the results, the SVM had accuracies of 81.36%. To assess the sensitivity of factors, each factor was excluded from the analysis, and its sensitivity validated using the landslide location data. According to the validation of the landslide susceptibility maps by sensitivity analysis in sequence, Aspect, Land use, SPI, Slope, TWI, Geology, Plan curvature, Distance from fault, Timber type and Soil depth had a small positive influence on the landslide susceptibility maps. In contrast, Soil topography, Soil drainage, Soil material, Soil texture, Timber diameter, Timber age and Timber density had a small negative influence on the landslide susceptibility maps. These results indicate the SVM can be useful for landslide-susceptibility analysis.

Key words: Landslide susceptibility; Support Vector Machine; sensitivity; GIS.

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Integrated approaches to evaluate the susceptibility to natural and artificial sinkholes in hard and soft carbonate rocks of the Apulian karst (southern Italy)

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ABSTRACT

Apulia region (southern Italy) represents the foreland of the southern Italian Apennines. It is mostly made up of a 6-7 km-thick succession of Mesozoic shallow-water limestones and dolostones, locally covered by thin and discontinuous Tertiary and Quaternary carbonate and clastic deposits. Mesozoic rocks are well-bedded and form a hard bedrock affected by several families of tectonic discontinuities; poorly deformed Tertiary and Quaternary deposits unconformably overlie the Mesozoic rocks. Due to the long subaerial exposure of the Mesozoic succession, the carbonate bedrock recorded the development in the subsurface of a dense network of karst cavities, mostly controlled by tectonic discontinuities. As a result, the Apulia region presents a strong susceptibility to natural sinkholes. To this hazard of natural origin, the possibility of occurrence of other problems related to the high number of man-made cavities has to be added in the region. As a matter of fact, a great variety of different typologies of artificial cavities is present, including underground quarries, worship sites, oil mills, civilian settlements, etc. These cavities were excavated mostly in the Plio-Pleistocene soft calcarenites. As a consequence of the huge urban expansion recorded in the last century in Apulia, several natural and anthropogenic cavities lie nowadays below densely populated neighborhoods or roads with heavy traffic. These conditions represent the main geomorphological hazard for the human society in Apulia, which requires a careful evaluation, aimed at protecting and safeguarding the human life, and at providing the necessary information for a correct land use planning and management. It is worth to be noted that the Federazione Speleologica Pugliese (the association that includes all the caving clubs in the region) has already surveyed and mapped in Apulia, respectively, 2200 and 1200 natural and artificial cavities. In recent years, a worrying increase in the number of sinkhole events has been registered in Apulia that reached a peak in 2009 and 2010. Following such circumstances, several research activities were started by the Institute of Research for Hydrological Protection of the National Research Council (CNR-IRPI) and the Basin Authority of Apulia. The main activities have been: i) the collection of information on natural and anthropogenic sinkholes in Apulia, ii) the construction of a detailed chronological catalogue of sinkholes, iii) the implementation of numerical analyses for modelling the instability processes, and iv) monitoring activities of selected natural and artificial cavities. Choice of the latter was dictated by their location below densely populated urban areas. Two distinct approaches were established to take into account the different petrographic, structural and geotechnical features of the hard and soft carbonates. The approach dealing with hard carbonate rocks (for natural karst cavities) is based on speleological and geometrical surveys of the caves and on an integrated geological and geomechanical characterization of the carbonate rock mass, aimed at individuating the main critical aspects of the karst caves in terms of likely effects on the society. On the other hand, the approach to verify the stability of soft rocks where artificial cavities have been excavated is mostly dependent upon the peculiar petrographic and geomechanical characteristics of the calcarenite rock mass, typically massive and unaffected by tectonic

discontinuities. As a consequence, the traditional analytical methods of rock mass classification fail in these materials, since the rock strength of soft calcarenites is mostly dependent upon sediment texture, porosity type and distribution and degree of cementation. The fluid circulation into the rock mass is also important because the removal of the rock matrix may induce a rapid deterioration of the mechanical behaviour of the rock mass. The approach to the calcarenite is mostly based on the characterization of petrographic and geotechnical parameters by means of direct sampling from the rock walls and in situ surveys (wells, trenches, etc.). Through implementation of the two described approaches, our goal is to reconstruct accurate geometrical, geological and geotechnical models for both natural caves and artificial cavities. Starting from these models, it will be possible to plan specific monitoring activities in order to understand the development of underground instability, and the related evolution through the rock mass, possibly threatening the urban areas and infrastructures above.

Key words: Sinkholes; karst; hazards; cave.

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Theoretical and experimental studies of flexible barriers under debris flow impacts

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ABSTRACT

The aim of this work is to provide simple guidelines to safe design barriers to mitigate channelized debris flow risk. In particular, the Authors analysed the most relevant aspects that influence the interaction between debris flow phenomena and protection barriers. Both the barrier dimension and location have to be determined in the design process. The location of the barrier is governed by the vulnerability of the territory and consequently they are often located with the precise aim to protect a specific structure or a village; however, part of the design process is to identify the optimum barrier location along the entire length of the channel. The volume of the debris and its lithological nature are conditioning the barrier size and strength. This system is often complicated by environmental and climate influences that need to be taken into consideration as well; therefore, a correct design of a protection barrier system in an alpine basin is a complex procedure that needs to be rationalized. This paper will concentrate on the barrier dimension design proposing the Rock Engineering System (RES) as a rational scheme of study of the global problem. RES has been used to identify the most relevant aspects and to suggest some theoretical approaches to be applied in the different design phases
.

Key words: Debris flow; impact analysis; protection systems; flexible barriers.

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Using bivariate, multivariate and ANN methods in landslide susceptibility assessment

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ABSTRACT

The study was realized in the Western Carpathians, in north part of Slovakia. The main objective is to assess landslide hazard in the region. For assessment three statistical analyses had been applied: bivariate using the weights of input parameters, multivariate conditional analysis and artificial neural networks. The methodology of landslide hazard assessment using statistical methods in a GIS environment is based on an appropriate choice of the factors affecting the stability of slopes. In the study four input parameters are evaluated which entered to statistical processing in the form of parametric maps. Statistical evaluation was executed in ArcGIS and Matlab environment. The outputs of this study are three prognostic landslide hazard maps. Applying bivariate statistical analysis was founded that the most favourable conditions for the development of slope deformation create the combination of slope sediments, south-oriented with slope angle from 11 to 17° in areas where land is used as a transitional woodland-shrub. Applying multivariate conditional analysis few possible combinations of input parameters with a 100% probability of slope failures was identified. As an example is provided a combination of 4.5.2.17, which represents the combination of slope sediments in the natural grasslands area with slope angle from 7 to 11° oriented to the North. For artificial neural network, a suitable combination of the conditions for landslides occurrence represents flysch sediments in the area of pastures, northwest oriented with slope from 9 to 15.To verify the degree of success of created prognostic landslide hazard maps receiver operating characteristic (ROC) curves were used. Using bivariate statistical analysis the AUC is 0,852, for multivariate 0,919 and using NN the result is 0,924. The results shows that bigger degree of success has the prognostic landslide hazard map created using NN and it is equal to 92.4%.

Key words: Bivariate; multivariate; neural network analyses; landslide susceptibility assessment; northern Slovakia.

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Importance of statistical tools and real-time database for seismo-geochemical studies along different fault zones of Taiwan

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ABSTRACT

Over the last few years, we focused on the temporal variations of soil-gas composition at established geochemical observatories along the Hsincheng fault in the Hsinchu area, Hsinhua fault in the Tainan areas, and at Jaosi in the Ilan areas of Taiwan. As per the present practice, the data from various stations are examined synoptically to evaluate earthquake precursory signals against the backdrop of rainfall and other environmental factors. For the earthquake prediction the efficiency of an operation system depends not only upon its logical correctness, but also upon the response time. The database has been developed by the established network of continuous soil-gas monitoring stations along different faults covering NW, SW & eastern Taiwan. The data processing includes a low-pass filter to reduce the noise level. It filters out the high frequency noise and daily variation caused by different parameters like measurement uncertainty, background noise, environmental parameters and earth tides. The rolling average and normalization were used to quantify the probability distribution of variation in the data. In recent years manually operating real-time database had been developed and efforts were made to improve data processing system for earthquake precursory studies by changing the operating system from manual to automatic. We tried to replace the business package software "Visual Signal" to an open source programming language "R" for the data computing work. “R” is a free software programming language and software environment for statistical computing and graphics. To upgrade our working procedure to integrate our data with the popular and famous open source web application solution stack "AMP" (Apache, MySQL, and PHP) has been used.

Key words: Soil-gas; meteorological parameters; statistical filters; earthquake precursor; Taiwan.

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Determination of the landslide risk by Geographical Information Systems (GIS) on the North Anatolian Fault Zone, Turkey

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ABSTRACT

Landslides not only causes loss of lives and economic damage, but also harm urbanization, agriculture and quality of forest and river areas. Most of the time while predicting the landslide damage, the reason behind these landslides are considered only as earthquakes and the rainfalls, which are the main factors of an occurring landslide, but still the landslide damage is predicted lower than it has to be. However landslides can occur without the natural trigger elements like heavy rainfalls and earthquakes. Determining the surface movements of the earth and displacements caused by other forces are the easiest way to monitor a landslide's development. To monitor these displacements, besides the commonly used Geological and Geophysical methods, PS-INSAR and GNSS methods are used widely. At the same time, a GIS based system can be used to gather and stack the present and the obtained data, and also to query and analyze them in order to predict landslide risks. In this study, Koyulhisar town which is located on North Anatolian Fault Zone (NAFZ) (Turkey) is selected as a pilot area. A GIS based system has been created in order to reduce the effects of the landslides or even remove them completely and to predict landslide risks in the study area. In this system, geological formation, digital terrain model (DTM), fault, 10 periodic measurements from 52 GNSS points stationed in the study area and periodic PS-INSAR data are used. PS-INSAR, GNSS and other data are combined in ArcGIS 10.1 software. By using this software, a user interface created with the usage of slope, aspect, geological formation, PS-INSAR and GNSS data to determine the risk areas. With this interface, landslide risk areas and also areas suitable for settlements are detected with a fully automated process.

Key words: Landslide; risk; GIS; PS-INSAR; GNSS.

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The application of HVSR microtremor survey method in Yüksekova (Hakkari) region, Eastern Turkey

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ABSTRACT

The horizontal to vertical spectral ratios of microtremor (HVSR) analysis of Yüksekova and its surroundings is carried out using the results of field investigations, local soil conditions and seismotectonic features of the region. Soil-structure interaction is one of the most important reason for building damage ratio. The effects of soil conditions on probably damaged building units were determined, by conducting HVSR microtremor measurements. In this study data collection is handled during 30 minutes using three component seismograph measurements at 40 points in the Yüksekova region. HVSR peak period map shows that the fundamental period range between 0.4 and 1.6 s in the soft sediments units. Rock sites of the northern coast of Yüksekova period range between 0.1 and 0.2 s. HVSR peak amplitude values are in the interval 1.5 to 6.0.

Key words: Yüksekova (Hakkari-Turkey); earthquake; ambient noise; HVSR; soil conditions.

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Effect of soil-structure interaction on structural damages in rural areas after October 23rd 2011 Van Earthquake

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ABSTRACT

A magnitude of 7.1 Mw earthquake struck Van city on October 23rd, 2011. Although, construction practices of all rural housing units are similar in the region, the earthquake caused massive damage to villages located on soft soils in northern region of the city. In this study, the effects of soil conditions on damaged housing units were determined by conducting horizontal to vertical spectral ratios of microtremor (HVSR) measurements. The level of damage in the severely damaged villages that are settled on lacustrine and stream sediments has verified that the damage correlates well with comparatively high HVSR peak period and HVSR peak amplitude values in the range of 1.0-1.6 seconds and 6-9, respectively. The HVSR peak period and HVSR peak amplitude levels on rock units are in the range of 0.1-0.2 seconds and 1.5-2, respectively. It is important to note that hillside effect is found to be another key factor that increased the level of damage to the housing units in some villages.

Key words: Van-Turkey; rural areas; earthquake; ambient noise; HVSR; soil conditions.

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Damage due to liquefaction during the 1999 Duzce Earthquake for suburban part of Duzce city, NW of Turkey

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ABSTRACT

Liquefaction is one of the important problems in geotechnical engineering. High groundwater and the alluvial soils have a high potential risk for damage due to liquefaction. Duzce urban area is investigated in this study and is situated within the first degree earthquake region on the seismic hazard zonation map of the Turkey. Geotechnical investigations were carried out in two stages. Field and laboratory stages are performed. In the first stage, 17 boreholes in different locations were drilled. In the second stage, experimental studies were performed to determine the Atterberg limits and physical properties of soils. Then, seismic soil liquefaction is evaluated for urban part of Duzce city in terms of the factors of safety against liquefaction (FS) along the depths of the soil profile for different moment magnitudes of earthquakes calculated by deterministic approach using Standard penetration test (SPT) based simplified empirical procedure. The earthquake magnitudes MW=7.2 produced by Duzce Fault Zone, and was used in the calculations. Analysis were carried out for PGA levels 0.52g. The results of the analyses indicate that presence of high ground water level and alluvial soil increase the liquefaction potential due to seismic properties of region. The Spatial distribution of soil liquefaction potential is presented in the form of contour maps of liquefaction potential index (LPI), values. As a conclusion, the vulnerability of liquefaction is observed to be very high for the local seismic condition

Key words: Building damage/Duzce earthquake; liquefaction index.

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Filtrations and appraisal of the environmental parameters on radon data using singular spectrum analysis for earthquake precursory study in Taiwan

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ABSTRACT

In the present study, characteristics of temporal variability of soil-gas radon concentrations at Hsinhua and Hsinchu monitoring stations in Taiwan has been examined using Singular Spectrum Analysis. In order to make continuity and regularity of the data before applying the Singular Spectrum Analysis, the radon data were carefully edited for rare duplicate sampling, gaps and discontinuous jump following intervals of malfunctioning of equipment. Digital filter has been applied in eliminating the long term trend in the data and retains variations of less than 30 days. Singular Spectrum Analysis has been used for the identifications/removal of diurnal and semidiurnal variations in soil gas radon time-series data for earthquake precursory study. Periodic (Daily Variations) and Aperiodic (> 1 day to 30 days) variation have been isolated. Pressure and Temperature variation do not appear to influence radon concentrations at Hsinchu monitoring station in any strong manner. Radon emission is strongly influenced by rain events such that peak enhancement occurs ~ 12-15 hours after the rainfall impulse (capping effect). Recovery of radon following rainfall sequence is controlled by exponential decay of capping effect as well as natural decay of radon itself. The radon variations at Hsinchu monitoring station exhibit dominant daily variations, which are controlled by atmospheric temperature inducted evaporation in surface water saturated soil (Capping Effect). The causal relationship is marked by a clear phase lag of 2-3 hours in the sense that peak in daily variation of radon succeeds the peak in temperature. Aperiodic variations in soil radon intensity in the range of 2-10 days are negatively correlated with temperature whereas positively correlated with pressure. However, the negative correlation of the soil radon with temperature is found to be pseudo effect arising due to parallel variation in pressure.

Key words: Radon time series; diurnal and semidiurnal variations; Singular Spectrum Analysis; earthquake precursor.

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Susceptibility to rock coast failures along the stretch between Otranto and Santa Maria di Leuca (Southern Apulia, Italy)

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ABSTRACT

In this paper the main rock cliff instability phenomena along the Southern Adriatic coast of Apulia are described for qualitative and quantitative assessment of the susceptibility to failures. The rocky cliffs are affected by erosional processes and characterized by different types of instability processes, ranging from slides to rock falls, which are worsened by complex mechanisms of interaction between the gravitational forces and the sea actions, leading to coastal retreats. The coast comprises sub-vertical or overhanging cliffs, gently sloping rock shores, wave cut platforms and sand beaches. The steep plunging cliffs are cut mostly into Cretaceous limestones and Pleistocene calcarenites. The sloping coasts and the cliffs are the most widespread morphological types. The wave actions attack the weak part of the rock, often leaving the more resistant areas to stand as protruding features. Processes of erosion and weathering are more active along joint systems forming caves and arches which are continually widened. Headlands form in areas of alternating hard and soft rocks; bays develop where calcarenites crop out and draw up on either side the boundaries of the headlands which sticks out into the sea. Caves, arches stacks and stumps are the results of the erosion processes of the headlands. All the factors that trigger the instability phenomena, both in the long and in the short term, have been taken into account. Based on our observations, it seems that along the calcareous cliffs, affected by karst landforms (include caves, karst conduits, sinkholes) and representing areas of weakness for the presence of arches, stacks and coastal quarries, the main instabilities are ascribable to rock falls, toppling, slides and wedge failures. Falls of blocks and big slices of rocks are triggered by undercutting at the base of the cliff due to the strong impact of the sea erosion. In this case the presence of wave-cut notches must be pointed out, especially when there is no wave cut platform. Different joint systems with various orientation and correlated tension cracks are present, so that the rock mass can be classified as highly fractured. Toppling of blocks mainly occurs along failures parallel to the coastline causing cliff retreats, with tension cracks and fractures controlling their detachment. Weathering and meteo-marine conditions, due to rainfall, sea and wind erosion including abrasion, corrosion, marine spray and thermal stresses are the prevailing factors of the erosional processes on the calcarenite coasts. All these actions worsen the quality of the rock masses. The risk posed to the anthropogenic presence is not negligible when dealing with these problems. The touristic activities, taking place above all on summer season, and the intensive development of infrastructures (properties, roads, etc.) along the coastline interferes with the natural coastal processes. This condition heavily affects the top of the cliffs also contributing to accelerated slope failures. Stress-strain analysis (FEM method) aimed at assessing the failure mechanisms of the cliffs and the role of specific geometrical and geo-structural factors on the evolution of the stability conditions have been carried out for some particular areas of the coast examined as a valid support for predicting the possible occurrence and modelling the coastal morphological evolution. The numerical results are in good agreement with the evidences of the instability mechanisms already occurred, as derived from field surveys.

Key words: Rocky coast; instability; erosion; weathering.
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Combining slope-stability assessments and probabilistic analysis to produce landslide susceptibility models of roadway slope cuts

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ABSTRACT

Combinations between advanced geotechnical and probabilistic modelling are scarce in the specialized literature. Here, we present the stability and susceptibility analysis carried out over the cut slopes of the A-328 road (Granada, SE Spain). This analysis compare and combine different geotechnical and probabilistic techniques for studying the instability phenomena that extensively damage the mentioned road. A stretch 18 km long of this road was affected by 116 landslides in the winter 2009-2010. Such event was considered excellent for carrying out a complete risk analysis implementing methods from different disciplines. Firstly, we introduce the information of the landslides and the available geological and geotechnical information of the road in a spatial database. This information was also completed by new field surveys that provided important structural data. Secondly, kinematic and stability analyses were carried out using the structural and geotechnical data in combination with multi-temporal information of high resolution Digital Elevation Models (DEM) (≤ 2m) gathered by Terrestrial Laser Scanner (TLS), Laser Imaging Detection and Ranging (LiDAR) and Photogrametrical techniques. This DEMs were also used in the subsequent steps of the analysis. Thirdly, multiple susceptibility models combining conventional variables like slope orientation, slope gradient, land use, etc. with geotechnical variables resulted from the kinematic and stability analyses were produced. The evaluation of these models through different cross-validation techniques provided information about the forecast capacity of the models and the results were used for selecting the best combination of variables and producing a definitive susceptibility model. This model will be utilized for developing advanced risk analyses and helping in the search of solutions for managing landslide risk in this vulnerable infrastructure.

Key words: Landslide; probabilistic; geotechnics; susceptibility; roads.

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Application of geophysical techniques to sinkhole detection

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ABSTRACT

Extensive dissolution of the Florida carbonate platform displays some of the best examples of surficial karst development such as dolines (sinkholes), uvalas, poljes, and sinking streams. Sinkhole development in Florida has been of major concern especially with the recent population growth in the state. These natural windows to underlying carbonate rocks provide critical pathways to the Floridan aquifer, pausing great risks of groundwater contamination. They also bring about ground instability and structural damage in buildings. As such, there have been increasing efforts to detect underground cavities in urban areas before they develop into sinkholes. In this paper, application of Electrical Resistivity and Ground Penetrating Radar techniques to underground karst development is discussed. Case studies comparing the SuperSting 8 Earth Resistivity and a 100 MHz Ramac X3M in subsurface karst detection are presented.

Key words: Karst; sinkholes; electrical resistivity; ground penetrating radar.

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Stability analysis of slope cuts in roads using back-analysis based on multi-temporal 3D data from TLS, UAV and LIDAR technologies

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ABSTRACT

In most of highlands of Andalusia, the road network represents the only admissible way for transportation. Therefore, it is essential to conduct a comprehensive analysis of the relief on slopes, promoting a new methodology that using satellite techniques, aerial photographs and the aerial and ground LIDAR, performs an assessment of the pathologies. This paper analyses the failure mechanisms, controls movement rates and offers a methodology for early detection of landslides. This work analyses the period 2014-2015 and the period 2007-2010 because this period includes a particularly rain water year. Laser techniques, LIDAR (air and ground) and classical photogrammetric techniques are used, allowing to reach high accuracy (using unmanned aerial devices). A section of road from Torvizcon to Cádiar (Granada, Spain) is chosen due to the importance of their landsliding. Two LIDAR flights are conducted during the months of March-April 2014 and March-April, 2015, that will allow to obtain results with resolutions above 1.5 Pixel/m2 and a direct comparison of the movements occurred over a full year. In addition, to analyse possible differences in the soil, the satellitia techniques of remote sensing on images of LANDSAT and SPOT satellites and interferometric images on ENVISAT and ALOS satellite (L-band) are used. Finally, relationships between the different parameters that govern the instabilities are set to weight and correlate these parameters.

Key words: TLS; UAV and LIDAR technologies.

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A study of indoor radon, thoron and measurement of average inhalation dose in Fazilka district, Punjab, India

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ABSTRACT

In the present study, indoor radon and thoron measurements have been carried out in 100 dwellings of 20 villages situated in the Fazilka district of Malwa region of Punjab. These measurements were done using LR-115 type II based Radon-Thoron discrimating twin-cup dosimeters. These dosimeters were hanged for a period of four months of winter season i.e. from October 2014 to February 2015. The radon concentration varies from 26.6 Bq/m3 to 65.3Bq/m3 which lies well within the safe limits recommended by ICRP. The average inhalation dose was also assessed which also lies below the recommended safe limits.

Key words: Indoor radon; thoron; dose; India.

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Estimates the impacts of climate change and the prolonged drought of the Middle East on the economy of Europe

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ABSTRACT

Middle East is entered into a long period of drought. The Period may last several decades. This study noted that the drought will change the landscape of many Middle Eastern countries, including Iran, Pakistan, Iraq and Syria. Perhaps similar to the changes in climate and environmental conditions experienced by the sub-Sahara and the horn of Africa that caused most of the political and economic infrastructure to be destroyed the in less than thirty years and by the expansion of poverty and political instability the region is facing radical fundamentalism and unbridled terrorism. The prolonged drought in the Middle East could have an effect on Europe's political and economic landscape in various forms. For example, we can refer to: 1- Social effects: increasing waves of immigration from the Middle East to Europe, 2- Political impact: spreading of political tensions in the Middle East and the rise of fundamentalism and spreading international terrorism, 3- The economic impact: strong volatility in the energy economy. This study has discussed about the quantitative model to measure these effects, And has attempted answer the question that with continuing drought and climate change in the Middle East, how much can effect on the economy of Europe?

Key words: Climate change; Middle East; prolonged drought; human-induced drought; economic effects.

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Classifier ensemble of instance based learning algorithm with rotation forest technique for mapping of rainfall-induced shallow landslides using GIS

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ABSTRACT

High quality of landslide susceptibility maps is useful for land-use planning to reduce landslide risks. Prediction capability of landslide models that used for producing these maps is not only dependent on quality of input data but also methodology used. The main objective of this study is to attempt a new machine learning methodology approach for mapping of rainfall-induced shallow landslides. A new using methodology approach proposed in this study is a combination of an instance based learning algorithm and Rotation Forest ensemble technique (IBL-RF) with Information Gain technique is used for the feature selection. IBL and RF are state of the art soft computing techniques that have seldom explored for the mapping of landslide susceptibility. The Lang Son city area (Vietnam) is selected as a case study. First, a Geographic Information System (GIS) database was constructed using ArcGIS 10.2. The database consists of 172 landslide locations and twelve causal factors (slope, slope length, aspect, curvature, valley depth, stream power index, sediment transport index, NVDI, topographic roughness index, topographic wetness index, soil type, and lithology). Then, 120 landslide locations (70%, 3973 landslide pixels) were used to train the classifier ensemble whereas the remaining landslide locations (1664 landslide pixels) were used for the model validation. Finally, the overall performance of the resulting model were assessed using several statistical metrics such as classification accuracy (ACC) area under the receiver operating characteristic curve (AUC), kappa index (K), positive and negative predictive values. The results were compared with those obtained from various soft computing techniques using the same data such as Random Forest (RF), J48 Decision Trees (JDT), Logistic model trees (LMT), Backpropagation Neural Network (BPNN), Naïve Bayer (NB), IBL based Bagging, IBL based Adaboost. The results show that the proposed model has a high goodness of fit with the training data (ACC =85.82%, AUC = 0.948, kappa index =0.716). Using the validation data, the model has a good prediction capability (ACC =76.14%, AUC = 0.848, kappa index =0.233). Overall performance of the classifier ensemble of instance based learning algorithm with Rotation Forest (IBL-RS) is better than those obtained from RF (AUC =0.744), JDT (AUC =0.821), LMT (AUC = 0.744), BPNN (AUC = 0.809), NB (AUC = 0.757), IBL-based Bagging (AUC = 0.833), and IBL-based Adaboost (AUC = 0.787). Therefore we conclude that IBL-RS is powerful and promising techniques that should be considered to be an alternative for the mapping of landslide susceptibility.

Key words: Classifier ensemble; instance based learning; rotation forest; landslide; GIS; Vietnam.

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A methodology for a preliminary risk assessment of slope instability along coastal cliffs

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ABSTRACT

A two phased methodology for a preliminary assessment of the risk associated to the occurrence of rock falls and landslides along coastal cliffs is proposed. In the first phase, work should encompass a surveying of potential risk areas resorting to desk studies as well as field campaigns directed to visual inspection of the geological, geotechnical geomorphological characteristics of the cliffs. This approach consists, therefore, of a semi-quantitative risk assessment that aims to produce a simple and rapid prioritization of the identified risks by applying a numerical categorization of the terms of the following equation, allowing the determination of a preliminary “Risk Index” (RI). "RI"= (HPO * HM * PD) / RC. In this equation; HPO – Hazard probability of occurrence, HM – Hazard magnitude, PD – Potential damage, RC – Response capacity, and PD/RC corresponds to the vulnerability of the affected area. Each term of this equation is categorized in a 1 to 5 scale (low to high) which, according to the equation, generates the RI values corresponding to the preliminary risk index associated to the occurrence of mass movements. The matrix of the RI values for all possible outcomes varies between a minimum of 0.2 and a maximum of 125, yet these values are recalculated to a [0;1] interval in order to allow an easier understanding of their significance. The obtained matrix is then categorized in to five equal amplitude classes corresponding to non-significant, low, medium, high or very high slope instability risk. In the second phase of this methodology, resources should be centered on the most unfavourable cliffs by promoting a detailed assessment of the geomechanical behaviour of the outcropping rock masses, namely by joint properties characterization, Schmidt Hammer field trials and sampling for laboratory characterization. The collected data is used for slope stability kinematic analysis, resulting in a geomechanical zonation of the cliff faces. The “Risk Index” can then be re-evaluated and used in the implementation of an adequate monitoring and/or mitigation plan.

Key words: Risk assessment; slope stability; rocky cliffs; Portugal.

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Conservatory objects and its threat by slope instabilities in the Czech Republic area

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ABSTRACT

Slope movements are the most widespread environmental hazards. Forasmuch as its occurrence is connected to slope existence, means bow terrain, they represent a big risk for the extensive area of the regional surface. The problems of the origin and evolution of the slope movements is based on complicated interaction between the climatological situation, geological structures in the area, terrain geomorphology and human activities. In the local conditions the starting mechanism mainly is an extreme precipitation, intense snow thaw, mining activities and inconvenient building foundation. During the long term slope movements operation usually an extensive devastation of the cultural environment and conservatory objects comes in, as well as historical city landmarks, and castles. The Czech Geological Survey in addition to other services systematically studies the origin conditions of the slope instabilities, those they threat our cultural heritage and also is responsible for its mapping in the field as well as its documentation. The most long-term threatened conservatory protected localities in the Czech Republic are the castles Házmburk, Jezeří, villa Tugendhat in Brno, the city of Znojmo conservatory reserve and Jewish quarter in the city of Třebíč. The assessment of the slope instability predisposition plays now a bigger importance in the territorial planning, in the critical management because of an extreme climatic phenomenon increase during the last two decades and connected increase of the slope instabilities, not only new ones but also some old and newly reactivated ones. The slope instabilities threat not only some individual buildings but also the regional infrastructure (the traffic construction, distribution grid and product lines etc.), including the historic landmarks. The primary step during the process of prevention related to slope instabilities negative outcome is territory delimitation and areas and surfaces with inclination to slope transgression, documentation and registration of the slope instabilities and its evaluation, categorization and classification in the Register of slope instabilities of the Czech Republic (RSN ČR).

Key words: Conservatory objects; slope instabilities; historical city landmarks and castles; critical management.

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Control variables for boulder transport through high energy marine wave events: examples from South Saurashtra, Western India

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ABSTRACT

Occurrences of scattered, imbricated, submerged and cliff top boulders on rocky coasts have been used as indicators of past extreme wave events and their dimensions and density along with local gradient are mathematically analysed to build hazard history, largely in terms of the height of wave responsible for their transport. There are several mathematical equations available which take into account submerged, subaerial and joint bounded block scenarios for boulder transport to estimate the wave height required to transport the boulders to their final position. However, there are limited studies which validate these equations using modelling and observational analysis. Navabandar coast, situated in western India provides an excellent opportunity for such analysis as there exists three boulders derived from shore platform during the November 1982 storm. We present the analysis of these boulders and event history of region to conclude that all the mathematical equations overestimate the wave heights required to dislodge and transport these boulders by at least 5 times the actual event. We emphasize that there is a vital need to re-evaluate and improve the existing equations considering the local control variables for better visualization of ‘paleo’ tsunami/storm events.

Key words: Tsunami; storm; boulders; Arabian Sea; India.

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Rock fall risk assessment on some churches through the Ihlara Valley (Aksaray, Turkey)

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ABSTRACT

Since there are five thousand churches take place in The Ihlara Valley which is the second grand canyon on earth and especially the demand of tourists coming from all over the world to the churches is remarkable, preventing the hazards caused by mass movements is significant. The purpose of this study is to determine the rock fall risks above the Kokar, Pürenli Seki, Ağaçaltı (Daniel Pantonassa), Sümbüllü, Harabe Karagedik, Kırkdamaraltı (Saint George), Bahattin Samanlığı, Karanlıkkale and Yılanlı Churches in the valley. Detailed joint features like type, condition, discontinuance, continuity, rift, orientation, density and number of joints, filling material, roughness and waviness of the joint surface, water leakage and block dimensions data was collected thanks to crop survey and guideline investigations. In- situ rock falling and strength tests to adjust the coefficient of restitutions to use in the rockfall analysis, tilt tests in the laboratory to assess the friction angle of the slopes are carried out. Rock falls expected through The Ihlara Valley are modelled via two dimensional rock fall analysis and different falling scenarios are created considering varied block dimensions. Probable impacted territories are assigned by interpreting the endpoints of the falling blocks, horizontal velocity and total kinetic energy values obtained from the analysis and risk maps are produced. Suggestions are given to prevent the rock falls likely to happen upon the mentioned churches. Thus a major contribution will be made for a safer tourism activity in the churches and nearby where tourist density is in its peak level.

Key words: Ihlara Valley; rock fall; risk map; two dimensional modelling.

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Probabilistic seismic hazard assessment of Egypt

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ABSTRACT

A new and updated probabilistic seismic hazard assessment has been conducted for Egypt. To carry out this appraisal, new data and models has been incorporated, as well as a new treatment of the involved uncertainties in this type of studies. An updated and unified earthquake catalogue (2200 BC - 2013) has been compiled specifically for this assessment. A new seismic source model has been developed, including 28 shallow seismic zones (h < 35 km) for the Egyptian territory and its surroundings, 53 shallow seismic sources (h < 20 km) for the Eastern Mediterranean region after Seismic Hazard Harmonization in Europe (SHARE) project, and 7 intermediate seismic sources (20 < h < 100 km) covering the intermediate-depth seismicity in the Eastern Mediterranean region. These seismic sources were defined including all available data, some of them specifically compiled for this work (seismicity and focal mechanism catalogues). After a sensitivity analysis, a logic tree design was used in order to consider the epistemic uncertainty both in the b-value and the maximum expected magnitude of the Gutenberg-Richter recurrence relationship, as well as in the ground motion attenuation model. Using the CRISIS 2014 software, seismic hazard computations for rock site conditions and different return periods were performed. Here we show some of these results, in fact, peak horizontal ground acceleration (PGA) and spectral acceleration (SA) values for spectral periods of 0.2 and 1.0 s, and for return periods of 475 and 975 years. Moreover, uniform hazard spectra (UHS) have been computed specifically for some selected cities. All these results are compared with those included in the current Egyptian regulation. Maximum hazard values are obtained at Nuweiba city, located at the Gulf of Aqaba, around the location of the November 22, 1995, Mw 7.2 Aqaba earthquake. Values of 0.74 g and 0.98 g for a spectral period of 0.1 s, are obtained for return periods of 475 and 975 years, respectively. In Cairo, computed maximum values are 0.32 g and 0.44 g for the same return periods, also obtained for a spectral period of 0.1 s.

Key words: Seismic hazard; Egypt.

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Landslide susceptibility mapping using ASTER and SVM considering clay minerals

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ABSTRACT

Clay materials can cause substantial damage to slopes and landslides, especially during extreme rainfall. Landslide susceptibility was evaluated by the analysis of the geological characteristics including clay minerals, together with ASTER satellite image and spectroscopic properties in landslide areas of Korea. We used field measurements to define the quantification for clay mineral parameters. The study was conducted based on the field survey with XRD (X-ray Diffraction), XRF (X-ray fluorescence), and spectroscopic analysis on soil samples obtained from landslide sites and ASTER satellite image. The results of XRD and XRF show that illite considered as one of the most important clay mineral groups is predominated over any of the other minerals in soils on slopes. Illite image was extracted using band math of SWIR Illite. From these results, we confirmed the applicability of ASTER satellite image using identification of swelling clay minerals to the landslide study. The SWIR Illite model of landslide-related parameters was established through image processing and visual interpretation of ASTER multi-spectral and topographic data. Our results suggest that ASTER allows clay mineral mapping via the six spectral bands in its short-wave infrared domain, particularly wavelengths between 2.145 and 2.43㎛ at high level of landslide hazard. This study highlights the importance of the clay mineral between slip surface within susceptibility assessment and helps us identify the locations where the possibility of landslide prone zones is higher.

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Key words: Landslide; ASTER; SVM; clay.

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Landslide susceptibility assessment in Yenice Region (Karabük, NW Turkey): comparison of Artificial Neural Network with Logistic Regression

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ABSTRACT

In Turkey, damages and losses caused by the landslides are the second destructive natural hazard following the earthquakes. The Western Black Sea region is one of the regions in Turkey where these losses and damages frequently occur. In this study, landslide susceptibility assessments and mapping studies were carried out in a selected region at the north of Yenice (Karabük) at which the landslides mostly affected the settlements in Turkey. This study aims to investigate the performances and the effects of different landslide susceptibility methods such as logistic regression and artificial neural networks on the resulting maps. The study area was divided into two basins as training and test sites, and assessment and the performance evaluations were performed in both training and test sites. A total of 75 rotational earth slides were mapped during the study. Topographic elevation, slope, aspect, plan curvature, profile curvature, distance to drainage, stream power index, topographic wetness index and NDVI parameters were produced to be used in analyses. The performance assessments of the landslide susceptibility maps were performed both in training and test sites. AUC (Area Under Curve) values were calculated by means of ROC (Relative Operating Characteristic) technique, and the best performance AUC=0.873 was gathered from the map produced by artificial neural network method. Based on these results, it was concluded that the susceptibility map produced by the ANN produced high and satisfactory performance results.

Key words: Landslide; landslide susceptibility; artificial neural network; Yenice (Karabük).

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GIS-based landslide susceptibility mapping using Fuzzy Logic in Rize (Turkey)

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ABSTRACT

Landslides are substantial natural hazards because of in many area, large numbers of casualties and huge economic losses have been occurred by the reason of landslides all over the world. The main purpose of this study is to produce landslide susceptibility maps of a landslide-prone area (Rize) in Turkey by using fuzzy logic model. At first, landslide inventory data had been collected from previous studies, institutions archives, orthophotos and field surveys, and a total of 241 landslides were mapped from various sources. Then, the landslide inventory was randomly split into a training dataset 70 % (169 landslides) for training the model and the remaining 30 % (72 landslides) was used for validation purpose. Eight data layers, as the landslide conditioning factors, are exploited to detect the most susceptible areas. These factors are as elevation, slope, aspect, lithology, soil map, and proximity to the road, proximity to the river and land use. Geographical information system (GIS) is used as basic tools and ArcGIS is used for the processing data analysis and final map preparation. Subsequently, landslide susceptibility maps were produced using fuzzy logic. For verification, receiver operating characteristics curve and area under the curve approaches were used. The areas under the prediction-rate ROC curves (AUC) value of the produced landslide susceptibility map has been obtained as 89.2%. According to the results of the AUC evaluation, the produced map has exhibited a good enough performance. The produced susceptibility maps can be used for general land use planning and hazard mitigation purpose.

Key words: Landslide; Fuzzy Logic; Geographical Information System; Rize.

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A new research and development project in Turkey about disaster risk index calculation

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ABSTRACT

Turkey is a disaster prone country, and geology, active tectonics, topography and climate make it vulnerable to various natural catastrophes. The disaster management in Turkey became an issue of priority for national and local authorities within the last decade, a new disaster management model has been introduced, shifting the priority from “crisis to risk management”, Disaster and Emergency Management Presidency (AFAD) started a new research and development project named as Turkey Disaster Risk Management System Project (TAF-RİSK) . This project aims towards becoming a disaster ready country using more research and development activities to learn the exposure status and to predict the risk of disasters (earthquakes, floods, landslides, etc.) existing in the provinces in advance. Various statistical analysis will be made after the determination of the population and buildings that vulnerable to disaster regions. As a result of this analysis the disaster risk index in the provinces exposed to the dangers is intended to be prepared. In TAF-RISK project's scope disaster and emergency analysis work will to be done in Earthquake, Flooding, Mass Movements (landslide, rockfall, avalanches), Forest Fires, Storms, Drought, Mining Accident, Travel and Transportation Accidents (Air, Rail, Road, Sea), Marine Pollution Causing Accidents, Major Industrial Accidents, Events CBRN (Chemical, Biological, Radioactive, Nuclear), Population Movement (Migration, Asylum), and risk algorithms will be developed and impact analysis will be carried out in 4 specific types of disasters (Earthquake, Flooding, Mass Movements (landslide, rockfall, avalanches), Major Industrial Accidents) in the selected pilot province. Thus, the project results to be obtained from the output (disaster risk indices, risk models, throughout the country will be targeted to create an infrastructure that will serve the assessment of disaster risk. In the second leg of the project; sensor technologies for disasters will be investigated. The sensor is the general name given to the devices measuring the natural variables and converting the signal for human reading or for other machines. For different types of disasters what sensor type could be used for what disaster, types of data that can be collected from the sensors, in what way this data can be analysed, sensors usage in areas of estimation and early warning systems, use of the specified types of sensors in applications of disaster management in other countries, and universities' academic studies on the subject will be studied. Within this study, usage possibilities will be explored in the main fields of activity of the various sensor types: An AFAD Sensor Data Integration Software prototype will be developed for the integration of different sensor data as an early warning for project deliverables.

Key words: Disaster; risk index; research and development; risk sensor; Turkey.

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Centralization or peripheralization: elaborating a methodology for determining the socio-economic dimensions of vulnerability

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ABSTRACT

The uneven development of a certain territory, especially the existing disparities between urban centres and rural areas can greatly determine the population's vulnerability in the face of natural hazards. The increasing importance and attention given to natural hazards in numerous papers at national and international level towards the end of the 20th century and the beginning of the 21st century is largely due to the increasing impact of natural phenomena on society as well as the environment, generating at the same time major dysfunctions. Understanding the mechanism and origins of hazardous phenomena and their relation to other factors they influence are indispensable when studying natural hazards and risks, but the socio-economic and environmental dimension of vulnerability which could be influenced by policy interventions and through adequate planning are important as well. The paper examines the social dimension of vulnerability in Romania using exploratory spatial data analysis in order to determine the presence and location of socially vulnerable groups. The main reason for choosing the mentioned area is given by its agricultural profile and hence the fact that almost all economic activities are related in one way or another to the area's natural resources, often subject to adverse natural conditions induced by natural hazards.

Key words: Peripheralization; vulnerability; Romania.

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Sinkhole collapse hazard in the Camargo valley (northern Spain)

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ABSTRACT

The municipality of Camargo (Cantabria, northern Spain), is an area where dominate the calcareous materials (Aptian age), constituting an intensely karstified relief crossed by a network of underground galleries that allow water circulation. This area is frequently affected by cover collapse sinkholes, called locally soplaos, which affect buildings, infrastructures and terrain properties producing significant economic losses and social concern. The work aims to develop tools to predict the areas prone to collapse, in order to reduce damage, as well as to improve our knowledge on these processes in a calcareous karst context. A data base has been constructed in a GIS, including the 88 inventoried collapses and 11 data layers representing the conditioning factors of the process; these layers have been selected by visual analysis, a principal component analysis and the comparative study of validation rate curves that best explain the sinkholes occurrences. Several sinkhole susceptibility models have been produced by means of spatial data analysis techniques (favourability functions and simple spatial statistics) and using different variable combinations on the basis of principal component analysis. From the independent evaluation, all models show a good prediction capability when 5 (lithology, elevation, rivers distance, roads distance and buildings distance) or more variables are used. According to the results, sinkhole processes in the study area are strongly related to the proximity of fluvial channels. Models obtained are useful to identify areas where mitigation efforts will be most cost-effective. They allow identifying priority areas for the implementation of actions to reduce vulnerability (elements) or hazard (processes). Also, the procedure can be used as a preventive tool, through its application to Strategic Environmental Impact Assessment (SEIA) of land use plans.

Key words: Collapse sinkholes; subsidence hazard; prediction modeling and validation; northern Spain.

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Landslide hazard and risk scenarios development (LAHARS project)

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ABSTRACT

This project intends to develop a set of methods and techniques to design landslide hazard and risk scenarios, with the aim of making better predictions to reduce the risk due to this type of process. The approach is founded on the hypothesis that it is possible to conceive those scenarios on the basis of a detailed knowledge on landslides occurred in the recent past, their causes and consequences. Hazard predictions, as any hypothesis on the future behaviour of the processes, must be based on several assumptions materialized in what is commonly termed scenarios. It is necessary to obtain long series of past landslide occurrences to deal with cause-effect relationships between landslides and triggering factors (precipitation, seismicity, human activity on the basis of the analysis of sedimentation rates and coastal erosion), in order to define hazard scenarios by extrapolating into the future. These hazard scenarios, which will not be only based on the uniformitarian assumption sensu stricto, will be proposed either directly, through extrapolation from observed trend of past landslide occurrences, or indirectly from the return period of the triggering factors. Risk scenarios and models, based on the previous hazard models, will also integrate estimates on vulnerability and exposure. This will make the development of quantitative prediction models for landsliding possible. Afterwards, the risk models obtained will be validated in order to know the prediction capability. Moreover, the prediction improvement will contribute to reduce the economic losses due to this type of process and to better develop land planning and management. On the other hand, cost/benefit analyses will be accomplished by comparing risk models with and without mitigation measures. The investigation is being carried out in western Guipúzcoa (northern Spain) where different types of mass movements will be analysed, mainly shallow slides and flows. The results will improve the understanding of slope processes, their occurrence, activity and their relationships with their principal triggering factors, which will benefit landslide hazard and risk assessment and mapping, facilitating a better anticipation and matching of the society in a context of Global Change.

Key words: Landslides; triggering factors; risk scenarios; susceptibility and hazard models.

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River drainage response to tectonism: Evidence from Chaliyar River basin, southwestern India

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ABSTRACT

Integrated morphometric, morphostructural and geomorphological analyses are used to unravel the modifications that affected Chaliyar River basin particularly due to active tectonics. Morphostructural analysis allowed qualitative evaluation of the relation between geometry of drainage network and tectonic structures. The correspondence between the directions of the drainage of different orders with lineaments was evaluated by comparing the rose diagrams of drainage directions and lineament trend. Detection and characterization of geomorphic anomalies in the Chaliyar River basin have provided an additional tool for recognizing the subtle tectonic movements in the region. Such morphological manifestations identified in the terrain are the result of active strike-slip faulting. The deflected and beheaded streams, shutter ridges, river ponding, faults scarps, small horst and graben, compressed meander and landslides suggest tectonic creep which had occurred in the past few thousand years. It is assumed that two tectonic phase existed in the study area. The first, a compressive phase responsible for the development of folded structures, over thrust, reverse faults and strike slip faults. This deformational phase occurred in a regional scale. The second, a neotectonic phase connected with general uplift produced normal faults which displaced the geological structures, formed during the compressive tectonic phase. This has displaced the fluvial terraces and is responsible for the sharp channel deviation within the basin. Block fault sequel with the evolution of Western Ghat escarpment with subsequent reactivation along the lineaments and circum-denudation of the faulted blocks resulted in the evolution of the Nilambur valley. Morphological adjustment of stream channels over a short period of time and location of the basin in a tectonically active region has played dominant roles in changing the morphology of the Chaliyar River basin.

Key words: Active tectonics; morphostructural analysis; geomorphic indices; geomorphic markers.

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Glacial control of volcanism in shaping Isparta Region (SW Turkey)

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ABSTRACT

Isparta Plain (IP) in Southwestern Turkey contains many geomorphological features which were likely created under simultaneous influence of both glaciation and sub-glacial volcanic processes. Volcanism and the last glacial maximum (LGM) coincide in the IP region. Volcanism has been studied extensively, but studies on aspects of glaciation and volcanism-glaciation interaction are rare to non-existent. This study investigates the effects of glaciation and volcanism-glaciation interaction by studying geomorphological features around IP; such as conical hills, and glacio-mechanical markers left on the limestone base rocks by glaciation events. The study focuses on two hills for data: the volcanic Çünür Hill (a hyaloclastite dome) and the Söbü Hill (well-developed, glacial marks on limestone bedrock). Investigation of overall morphology, surface-rock morphology, and mechanical loads necessary to cause such morphological change, marks of glacial movements on base rocks (e.g., stria), and presence of other glacial features on the Sobi Hill indicates it was formed under thick glacial loads. The evidence also suggests that glacial load provided a controlling role for the magnitude and extent of the Gölcük Volcanism. The timing of events, existence of a perfect-conical volcanic hill within a few kilometers of glacial marks, and morphology of the glacial marks indicate that an interactive glacial-volcanic process was instrumental in shaping the IP. This provides a new insight into genesis of overall stress regime in the region, and has significant implications when studying climatic issues, foundation design, groundwater exploration, and oil exploration.

Key words: Glaciation; glacio-tectonics; glacio-mechanical effects; ice-volcano effects; hyaloclastite ridges.

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Identifying the topographic features of landslides and the formation of natural dams

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ABSTRACT

Global climate change has increased the frequency of abnormal rainfall and high rainfall intensity in recent years in the mountainous areas in Taiwan. This study identifies historically earthquakes and typhoons-induced landslide dams in Taiwan, and is focused upon landslide characteristics in the Laonong River basin. The analysis methodologies include spatial analysis using ArcGIS 9.3 and the topographic features are modelled using a 20 m * 20 m digital terrain model (DTM). The Spot 6 satellite images after Typhoon Morakot are used for an interpretation of the landslide areas. The multivariate statistical analysis is also used to find which major factors contributed to the formation of a landslide dam using SPSS. The selected 13 topographic features include the following: landslide area, slope, aspect, elevation difference, length, width, runout distance, average height, form factor of the landslide area, river width, stream power index (SPI), topographic wetness index (TWI), and elevation. The features of the 28 landslide dams in the Laonong River basin and 59 landslides that did not form a dam are put into SPSS for a Fisher Discriminant analysis and Logistic Regression analysis. The Principal Component analysis screens out the four major topographic features of runout distance, landslide slope, shape factor, and river width. The verification shows that the correctness by the Fisher Discriminant analysis is 71.7% and 79.2% by Logistic Regression analysis. Results of the analysis show that the Logistic Regression analysis is superior to the Fisher Discriminant analysis. This study suggests using Logistic Regression analysis as the assessment model to identify the potential location of a landslide dam for disaster prevention and mitigation.

Key words: Landslide dam; discriminant analysis; topographic index; principal component analysis; logistic regression analysis.

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The beach and the coastal dunes of Tangier (Morocco): lessons from a 100 years of evolution

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ABSTRACT

The Tangier coast is famous for its beach, one of the most extensive and attractive in the region. But it is also the part of the Tingitane peninsula that has experienced the most important managements and suffered from the effects of human interventions. Various scientific publications have been devoted, in last decades, to the geomorphology and the sedimentological dynamics of this coast. But the focus was on recent beach erosion and on the modifications of the shore position. In fact, the beach is only part of a more extensive sand body largely covered by the recent buildings and absent in the recent literature. Fortunately, the town and its area have benefited from an undeniable interest in ancient documents. The beach and especially the dunes caught the attention of some of the explorers who have succeeded in the country, especially in the early twentieth century. The beach and dune field are also found in different categories of photographs and artistic paintings inherited from the time during which it wasn't yet invaded by the town. The exploitation of these documents is very instructive; it sometimes permits significant information about the morphology and the history of the coast. It also helps in understanding some important environmental aspects as well as some characteristics of the relationship of man with his natural environment. This contribution draws attention to the value of the ancient documentation and therefore the importance of the establishment of archives for natural units. It is also an attempt to contribute, by a geomorphological approach, to overcome some gaps in our knowledge about the consequences of the recent evolution and hence the lessons to be learned from it. The direct field work done during the last years is used to give more precisions on the beach mobility and the coastal landscape mutations as well as the modifications in the characteristics of the beach sediments.

Key words: Coastal beach and dunes; geomorphology; old documents and archives; management; environment; Morocco.

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An example from the Suğla Lake (Valihüyük, Konya, Middle-Southern Turkey) for relationship between topography and geology

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ABSTRACT

The shaping of topography around Suğla Lake, is directly related to rock units and geological structures. The study area can be subdivided into tree main sections on the basis of topography. 1-) The Rugged High Fields (Folded-Fractured Mesozoic Structures): The eastern and south-western parts of the study area typically exhibit high karst topography with generally altitudes ranging from 1250 to 1464 m. This area consits of strong folded and fractured Mesozoic limestones made up Late Cretaceous cherty and less clayey limestones. This type terrain is characterized by distinctive and common anticline-syncline structures with faults and joints. 2-) The Less Rugged, More Or Less Flat Areas (Slight Corrugated Neogene Structures): Akkise town, Sarayköy and Balıklava villages located in the centre of the study area were represented by the less rugged terrain with altitudes varying from 1150 m to 1250 m. This region contains pancake-flat ridges and broad-based mounds and is made up Late Miocene-Early Pliocene, less inclined conglomerate, sandstone, clayey limestone and tuffite strata generally showing wide-angle slight folds and fractured structures. 3-) The Flattened Terrains (Horizontal Plio-Quaternary Structures): The western-south western half of the study area, which is characterized by mainly a flattened plain, with altitudes in the range of 1089 m and 1130 m, contains the Suğla plain, bordered by gravity faults from the north-eastern and south-western sides, is a depression area (graben dish) that is overlain by Plio-Quaternary deposits. The sediments of the Suğla plain in the Central Taurides Belt consist of Upper Pliocene-Pleistocene less diagenetic and horizontal beds and Holocene alluviums.

Key words: Topography; geology; karst type of topography; Suğla Lake; Konya.

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Characteristics and economic damages of gully erosion in I.R.Iran

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ABSTRACT

In this research, gullies located in Mazandaran, Ilam, Zanjan and Khuzestan provinces were compared. In each province, gully erosion was determined based on topographic maps aerial photos, satellite images and field surveying. Climate, morphometric characteristics of gullies, geology, soil, past and recent land uses, control measures and economic damages due to gully erosion were investigated. The results of this research indicated that 65% of the studied gullies were located on the valley slopes and the remaining were formed on the valley floors. Gullies are distributed on slope gradients between 5 and 56 percent and most of them were continuous.82% of gullies have dendretic general view plans indicating the effect of surface runoff in their initiation and/or development. 41% of these gullies had vertical headcut profile. Most of the gullies except Mazandaran province are formed on Miocene marl formation and have a cross- sectional shape of U and/or trapezoid. More than 210,000 hectares of croplands and rangelands have experienced gully erosion. Gullies have the most frequency in Semi-arid (53%), Arid (29%) and Mediteranean (12%) climates respectively and are formed mostly in cold and warm sub-climates. Gullies are mostly distributed in two rainfall classes, 200-299 (47%) and 400-499 (29%). Although gullies are distributed between 200 and 1000 meters from the sea level, 47% of them are located in altitude class of 200-299 meter and 29% in 400-499 meter of the sea level. Most of the studied gullies were formed due to rangeland destruction and/or rangeland change to rainfed farms, irrigated farms, improper construction of roads and oil and gas pipes. Dominant soil texture of the gullies are loam (34%), clay loam (14%), and silt loam (10%). 63% of the gullies have EC less than 2 ds/m. 86% of the gullies have ph between 7.5 and 8.5. 88% of them have sodium absorption rate less than 13. The average volume per length and depth of gullies are respectively equal to 16.55 m^3/m and 3.10 m. The average length and volume of gullies equals to 692.76 meters and 17544.52 m^3. In some provinces such as Ilam and Zanjan, measures for gully control were applied in 50% of the studied gullies but it was one third In Khozestan and Mazandaran provinces. Ranking of the studied provinces based on economical damages due to gully formation and/or development indicated that Khozestan province had the first rank with 21.5million dollars(1US$=28000 rials) due to rangeland devastation, breakage of oil and gas pipes, power and communication piles and rural roads. Mazandaran province with damages equal to 0.93 million dollars is in the last rank due to rangeland deterioration and house deconstruction. Ranking provinces respect to sediment production due to gully erosion indicated that Mazandaran province with 37.1 m^3/m of gully length produced two times of the average of the produced sediment in phase 2 (16.55 m^3/m) while Ilam province with 16.85 m3/m was around four provinces and Khozestan gullies with 10.01 m^3/m and Zanjan gullies with 10.71 m^3/m were below the average produced sediments. Comparison of W/D of gullies revealed that the average of this index was 3.3.

Key words: Gully erosion; Iran; economic damages; characteristics.

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Multidisciplinary analysis of the Balteni Landslide (Romania)

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ABSTRACT

An old landslide is being reactivated in June 2005 on the right slope of Topolog River, affecting the entire grassland of Balteni village. The process was initiated retrogressing, alternating in thin layers of Pontian clay and sand, because of lateral erosion of the right river bank. Nearby of Balteni village, lateral erosion has undermined the old front landslide, imposing a rotational mechanism of chain displacements towards the toe of slope. A detailed geomorphologic and geologic survey allowed to be distinguished the different landslide characteristics; a. the surface of rupture is discontinuously and placed at different depths, b. the main aims of development of landslide is the regressive and lateral motions. Resistivity data by electrosounding cross-sections and geomorphic information are corelated in order to increase the complex image of the morphodynamic process. The geomorphic investigations consisted in direct and indirect field surveys, mappings and measurements and landslide observation cards the consultation and the mapping of the old features of the landslide based on topographic maps 1:25.000 and plans 1:10.000, a. performing low depth drilling with the hand drill, b. geoelectric investigation methods in order to establish the lithofacies, the lithologic boundaries, the fractures and aquifer layers and the slide plane. In the first stage, this process was developed linear and subsequently, at the base of a steep slope (cuesta), reaching the unstable zone in structural saddle; in secondary stage, the sliding mass surface has extended laterally, migrating towards up slope of the lateral landslide scarp, partially affecting structural surface which represents a continuous source of hydrological and material input. The landslide is formed out of three distinctive sectors distinguished by topographic survey and geomorphic mapping. The upper sector has the characteristics of a translational movement through an extension mechanism formed on clayey sand bedding. The geoelectrical cross-sections reveal two sliding surfaces on bedding, in conformity with inclination of topographical and hydrostatic surface. As a result from differential rotational movement, acting in horizontal plane of this mass, the sliding mechanism becomes complicated downstream because of concentration and infiltration of rain water into the sliding mass. Middle sector has an accentuated dynamics pointed in chaotic shape of surfaces with varied slope gradient, up to 20º. This is the sector with the highest humidity in rock mass; in fact the speeding up of landslide in 2006 was produced in this sector. This part of landslide is characterized by humidity excess, it presents an active dynamics due to the fluidity of water sources from hydrostatic levels which discharges on layers surfaces. Sliding is in shape of mud flow due to compressive forces. Lower sector is represented by the landslide toe which entered in Topolog course. Failure surface has a reduced gradient which means that the slide is generated by pushing along the landslide rock mass. Joining multidisciplinary methods led to identify in detail the peculiar causes and dynamics of the process of landslide Balteni. As a result a NV – SE fault was identified which determines an active infiltration in the middle sector of landslide.

Key words: Landslides; geomorphological mapping; electriosoundings; self potential; fault; geotehnical parameters; Balteni.

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Analysis of the river anomalies in the Tortuguero plain (Costa Rica)

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ABSTRACT

The Tortuguero plain is a low-relief area that corresponds to the North Limón sedimentary basin located in the back arc region of the Caribbean side of Costa Rica. This plain is characterised by rivers that show complex patterns represented by sudden river diversions and shifts in channel directions. The preliminary observations carried out over the main river anomalies seems to be related with the tectonic activity that affects this region. In many locations, anomalies suggest that buried outer thrust fronts could disrupt the natural drainage pattern such as it was observed in the Po Plain (N Italy). Here, we adopted a geomorphological approach combined with geomorphometric techniques to analyse in detail the drainage network patterns and to interpret the mentioned river anomalies. The main challenge of this study is to filter the influence of active volcanism in river patterns for distinguishing the anomalies produced by active tectonics. Active volcanism produce within a short time, in geological terms, high reliefs which are also rapidly eroded generating a large volume of sediments that may disrupt the common equilibrium between erosion, tectonics and climate. We characterized the river stretches according to channel type, orientation, slope changes and incision and combining this information we identified river anomalies and proposed their possible origins taking into account the volcanic setting. The next step will be to compare the recognized anomalies with historical seismicity, available sub-surface information and the regional geodynamical setting. The objective is to recognize if buried active geological structures influence Tortuguero plain rivers or the volcanism mask the tectonic activity.

Key words: Drainage pattern; active tectonics; volcanism; geomorphometry; river anomalies.

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Controls on the Mediterranean Karst Development in Turkey

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ABSTRACT

Heavily deformed Mesozoic carbonates of Turkey's Mediterranean region exhibit spectacular surficial and subsurface karst features. In an attempt to determine the extent of structural control in the evolution of karst, a comprehensive GIS database of spatial data including karstic depressions and caves was created. Morphometric and spatial distribution analyses of some 100,000 depressions in GIS platform, compared to that of cave and structural data provide valuable insight to the evolution of karst in southern Turkey.

Key words: Karst; sinkholes; caves; GIS.

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A continent-wide analysis of sediment yield in Africa

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ABSTRACT

While several studies compiled and analyzed measured contemporary catchment sediment yield (SY) for various regions of the world, Africa remains strongly underrepresented in these studies. We therefore conducted a review on published SY data for Africa, explored the spatial variability of these SY data and examined which environmental factors explain this variability. We collected SY measurements of at least one year for 682 African catchments across the continent (> 8340 catchment-years) from 84 publications and reports. Catchment areas ranged from 0.02 km² to > 3,800,000 km². Observed SY values range between 0.2 and 15,699 t/km²/y (median: 160 t/km²/y, average: 634 t/km²/y). Correlation and partial correlation analyses showed that spatial variation of SY in Africa is mainly explained by differences in seismic activity, topography, vegetation cover and annual runoff depth. Other factors such as lithology, catchment area or reservoir impacts showed less clear correlations. Based on these findings we propose a simple regression model that allows simulating the observed regional patterns of SY in Africa fairly well. This model predicts an average SY of 42 t/km²/y for the entire African continent, a value that corresponds closely to earlier estimates of the sediment output of the African continent to oceans. The fact that SY shows the strongest correlation with seismic activity, while climatic variables explain little of the observed variation can be considered surprising as Africa is relatively inactive in terms of seismic activity and is characterized by a very large climatic variability. This suggests that processes such as tectonically related rock-fracturing and earthquake-induced landslides may have a stronger influence on contemporary SY-values than previously assumed.

Key words: Data compilation; reservoir sedimentation; seismic activity; land use; climate; topography.

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Modelling earthquake-induced landslides and assessment of their impact on the sediment yield in the Siret basin, Romania

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ABSTRACT

There is a growing interest in the impact of earthquake-induced landslides (EIL) on catchment sediment yield (SY). Nonetheless, exploring these impacts requires estimates of both the spatial pattern of landslides and the total landslide volume (LV) generated by an earthquake (EQ). We therefore compiled a global dataset of 240 earthquake events with published information on the EIL. 75 EQ (moment magnitude: Mw 4.7 to 9.5) were retained from the dataset to construct models that allow assessing the total landslide volume and the total landslide number (LN). Based on information of 23 EQ, we developed a model that simulates the spatial distribution of these EIL. Integration of these models allows to simulate LV associated with a given EQ in a spatially distributed way; based on the EQ magnitude, the EQ epicentre and the local topography. Uncertainties on the LV, LN and landslide distribution were estimated using a Monte Carlo simulation approach. Analyses show that our model allows for crude, but robust estimates of volumes and patterns of EIL. A major source of uncertainty are the potential errors on the compiled landslide inventories. Nevertheless, our LV model explains about 77% of the variation in reported LV, while 85% of the predicted LV deviates less than an order of magnitude from the reported LV. Depending on the setting, simulated landslide patterns show moderate to very high degrees of correspondence to the mapped pattern of landslides. However, in all cases, our model clearly performs better than a random allocation procedure. The integrated model was applied to the Siret basin (Romania), which encompasses the seismic active Vrancea region. Simulated EIL masses per catchment strongly correlate with corresponding long-term SY. Area-specific landslide erosion rates are mostly larger than the SY for catchments in the Vrancea region and mostly smaller than the sediment yield for catchments outside this region. According to our simulations, the largest EQ during the considered period, a Mw 7.4 EQ that occurred in 1977, contributed only 0.4-10% to the LV for catchments in the Vrancea. This could explain why previous studies revealed that this EQ had no clear impact on the catchment SY: smaller (Mw 4-6), but more frequent earthquakes could have a much larger geomorphic impact than very large but rare earthquake events on a decadal time scale.

Key words: Data compilation; total landslide volüme; landslide distribution; seismic activity; mass movements; sediment export.

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Reconstruction of the Holocene beach ridge plains development in Danube delta using optical stimulated luminescence (OSL) dating

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ABSTRACT

Sandy beach ridge plains from Danube delta display various morphologies and different progradational patterns due to variations in the interaction of control factors such as fluvial sediment supply, wave regime and eolian processes. This study focuses on the beach ridge plains development through the detailed reconstruction of paleoshorelines. We use geomorphological, sedimentological methods together with newly obtained OSL dates and ground-penetrating radar (GPR) scanning for better understanding of such sedimentary systems in terms of internal architecture, depositional processes and driving mechanisms.

Key words: Beach ridge; Holocene evolution; OSL dating; deltaic processes.

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Beach Profile change due to storm in embedded Beach

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ABSTRACT

The Haeundae Beach in Korea is suffering from chronic beach erosion, so the wide beach is maintained by periodic beach nourishment. This study analyses the performance of a large nourishment project in order to reduce the amount and frequency of the periodic beach nourishment. The KIOST (Korea Institute of Ocean Science & Technology) measured beach profile along 27 survey lines. The beach profiles were surveyed five times from 17 June 2014 to 10 October 2014. The distance between the two adjacent lines is approximately 50 m. The placed sand is fairly sorted and its median diameter is 0.23 mm. For this duration, a wave gauge (AWAC) was installed at a depth about 23 m off the coast of Haeundae Beach. Severe four storms attacked Haeundae Beach for this duration and these storms lasted about 1~2 days with a peak significant wave height of 2.5 ~ 4.0 m. In this study, the numerical model CSHORE is used to predict the beach profile evolutions during four periods. The cross-shore numerical model CSHORE consists of the combined wave and current model coupled with the transparent formulas for suspend sand and bed load transport formulas. The numerical model resulted in a comparable prediction for the berm erosion above MSL, but the dune erosion is under-predicted. The beach profile evolution depends on the small difference between the onshore bed load transports and the offshore suspend sand transport. However, numerical simulation of the sand transport in the swash zone is not easy to estimate accurately. This limitation needs to be investigated in future study.

Key words: Beach profile change; wave; storm; current and sand.

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Magmatic complexes of the Urals that may belong to LIPs

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ABSTRACT

Petrogenetic, geochemical studies and age correlation of picrite-basalts, dolerites, trachybasalts, trap basalts, rapakiwi granites, layered mafic-ultramafic intrusions and also alkaline and carbonatite magmatic complexes of the Urals, with magmatic complexes of adjacent and faraway territories permits to put forward a preliminary list of objects – “candidates” at attribution to Large Igneous Provinces (LIPs). Their petro-geochemical properties distinguish them from MOR and subduction types; they are characterized by wide areas of development, very short periods of activity and independence from earlier geological structures. Exact dating of the magmatic rocks is of a special importance because it permits to correlate synchronous magmatic episodes over wide territories of the world. In the Bashkirian meganticlinorium of the Southern Urals near the base of the Lower Riphean (Uppermost Paleoproterozoic and Lower Mesoproterozoic), covering crystalline Taratash complex dated as Archean and Lower Paleoproterozoic, there are volcanic deposits of the Navysh Subformation, represented mostly by trachybasalts. The age of the unit was determined as 1752±11Ma (SHRIMP, VSEGEI, zircons) (Krasnobaev et al., 2013). It turns out that volcanic rocks of the age level of 1750−1780 Ma are developed not only in some other places of Baltica, but also in the Northern Africa, Siberia, Laurentia and North China. Therefore they may belong to a LIP. Higher up the section of the Riphean, at the base of the Middle Riphean (Mid−Mesoproterozoic), rhyolites of the Mashak Formation were dated by SHRIMP and CA-IDTIMS U−Pb methods in three isotopic laboratories as 1380−1385 Ma. The same ages have also rapakiwi granites, layered gabbro, carbonatites and dolerite dykes developed at a considerable area of the Southern Urals and encountered in boreholes of East European platform; magmatic rocks of the same age are traced to Greenland, Laurentia and Siberian craton and date the beginning of Nuna (Columbia) supercontinent break-up. The study of dykes in the western slope of the Urals has revealed two main Paleozoic volcanic events. The first one, represented by trachytes, was dated (SHRIMP, zircons) between 435 and 455 Ma. It can be correlated with the early stage of development of Vishnevogorsk plume-related carbonatite complex. The younger complex is Devonian in age and is traced along the western slope of the Urals via Pay−Khoy to the Novaya Zemlya islands. They match excellently with the Mid-Upper Devonian volcano-intrusive complexes of the East European platform including traps, dolerite dykes, alkaline and carbonatite intrusions and kimberlites, and belong to the marginal part of the LIP called Kola−Dnieper. The late, reliably dated stage of the Devonian magmatism of the East European platform and Urals−Novosemelian belt is Frasnianin in age. It is well correlated with the Yakutsk−Vilui LIP of the Siberian platform. The last but not the least are the Lower Triassic traps traced from the easternmost parts of the Southern and Middle Urals to the western margin of the Polar Urals. It became evident that they belong to the Uralo-Siberian LIP and “African” superswell.

Key words: Urals; magmatic complexes; large Igneous Provinces (LIPs); Late Precambrian; Paleozoic.

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Geochemical characters of the gabbroic rocks in ophiolite sequences North Hatta Area, United Arab Emirates

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ABSTRACT

The ophiolite sequences of United Arab Emirates as a part from Oman ophiolite represent of both mantle section and crustal section. The crustal part of the ophiolite sequences consisting of a layered series (cumulate peridotites and gabbros). This paper aims to overview geochemical characters and some mechanical and physical features of the gabbroic rocks. The gabbros comprise troctolite, olivine gabbro, normal gabbro, gabbronorite, and uralitized gabbros. Geochemical features indicate that they are tholeiitic and are formed in an arc-related tectonic setting. On NMORB normalized pattern of gabbros the HFS-elements (P, Zr, Sm, Ti, and Y) show a flat pattern parallel to NMORB. In contrast, the LIL-elements (Rb, Ba, Th, Sr) are relatively more enriched than NMORB. The enrichment of LIL-elements over the HFS-elements and the depletion of Nb relative to other HFS-elements suggest involvement of subduction component in the depleted mantle source, and suggest that they are formed in a supra-subduction zone tectonic setting.

Key words: Oman Ophiolite; gabbros; petrology; geochemistry; tectonic setting.

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Redox sensitive element geochemistry: Implications for depositional conditions of the late Devonian dolostones in the Hadim-Konya area, Central Taurides, Southern Turkey

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ABSTRACT

The redox-sensitive trace element concentrations and some appropriate elemental ratios show slightly changes from bottom to top among the four different dolostone sections (A, B, C, and D) of the Gölboğazı Formation. Most of the samples from the B and C sections have low Mn/Sr ratios of less than 3, indicating an important scale of preservation of primary geochemical signatures, while the samples of the A and D sections have Mn/Sr ratios of slightly higher than 3, but still close to 3, nearly 4. Consistently, average Er/Nd ratio of the studied sample groups ranges from 0.09 to 0.13 indicating that the marine character of the Gölboğazı carbonates has been preserved during the geological time periods. Geochemical proxies like Ni/Co, V/(V+Ni), and Mn* anomaly values indicate considerably consistent paleoredox conditions for the carbonate sections of the Gölboğazı Formation. The Ni/Co ratios of the sample groups show effectivelly dysoxic to anoxic and lesser oxic conditions during the precipitation of A, B, C and D with average of 4, 9, 7, and 8, in the inner to outer shelf environment, repectively. However average V/(V+Ni) ratios ranging from 0.57 to 0.99 (mean=0,78, n=25) point to almost entirely anoxic and lesser euxinic environmental conditions on the basis of the previously determined standart values. Consistently all of the sample groups show strong negative Mn anomaly values (average -2,5, n=25), suggesting that anoxic environmental conditons during the deposition of a great portion of the Gölboğazı carbonates in mainly outer shelf environment of the Paleo-Tethys Ocean. These data are also supported by authigenic pyrite occurrences in the Gölboğazı Formation, which were especially occured in the dark gray to black carbonate levels. Most of the sample groups show no or considerably positive Ce anomalies (from 0.82 to 1.23, mean=1.01, n=25) in the shale-normalized REE+Y patterns that are consistent with dysoxic to anoxic depositional conditions. Furthermore, most of the samples have Pr/Pr* anomaly lower than 1.05 standart value after Bau and Dulski (1996), while a few samples with slightly negative Ce anomalies have Pr/Pr* anomaly higher than 1.05 that indicate dominantly anoxic and lesser oxic environmental conditions in the outer shelf and subtidal/intertidal zones, respectively.

Key words: Dolostone; geohemistry; redox sensitive element; Gölboğazı Formation; Late Devonian.

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Depositional setting and reservoir quality of the Fahlian Formation in two wells at the Dezful Embayment (Zagros Fold-Thrust Belt, SW Iran)

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ABSTRACT

The Neocomian Fahliyan Formation (middle part of the Khami Group), is one of the important reservoir rocks in the Zagros Fold-Thrust Belt. The Zagros Fold-Thrust Belt is located on the boundary between the Arabian and Eurasian lithospheric plates and formed from collision between Eurasia and advancing Arabia during the Cenozoic. In these studied wells, the Fahliyan Formation with a thickness of 406 and 423 m, consists of carbonate rocks (limestone and dolomite). This formation overlies the Garau Formation and underlies the Gadvan Formation in this studied area. In this study, several aspects of this formation including depositional environments, microfacies, diagenesis, and petrophysical characteristic have been investigated. Thin sections prepared from two exploration wells at the Dezful Embayment were studied. Moreover, reservoir characteristics of the Fahliyan Formation were investigated using petrophysical logs. In microscopic analysis of thin sections, fourteen microfacies were recognized that can be ascribed to a carbonate platform. These microfacies were deposited in the open marine, bar and lagoon. The lagoon microfacies are the most widespread facies. Important diagenetic processes that affected reservoir quality from deposition to deep burial were: cementation, neomorphism, dissolution, compaction, dolomitization, and phosphatization. Cementation reduced petrophysical properties while dissolution enhanced the reservoir quality. The chemical compaction (pressure-solution), stylolites and dolomitization reduced the reservoir quality. According to the calculated reservoir parameters (porosity and volume of shale) this formation shows suitable 2-6 percent porosity.

Key words: Fahliyan Formation; microfacies; carbonate platform; diagenesis; petrophysical log; porosity.

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Redox sensitive element geochemistry and depositional conditions of the late Cretaceous limestones in the Seydişehir-Konya area, southwestern Turkey

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ABSTRACT

The redox-sensitive trace element concentrations and some proxial elemental ratios show generally consistent behaviours to each other in the both limestones of the Cenomanian Katrangediği (KF) and Senonian Doğankuzu Formations (DF). The Er/Nd ratio of the studied limestones ranges from 0.08 to 0.19 in KF (Av.=0,13), from 0.10 to 0.32 in DF (Av.=0,22); which supports protection of marine character of the limestone samples. The most KF and some DF samples show Er/Nd ratios close to 0.1 that indicate slightly influence of detrital materials. The Mn/Sr ratios of the sample groups are entirely lower than 3 that primary marine nature were dominantly preserved during the geological time periods. Indicative elemental ratios such as Ni/Co, V/(V+Ni), and Mn* anomaly values Show very consistent paleoredox conditions for the both carbonate samples from the Katrangediği and Doğankuzu Formations.The Ni/Co ratios of the sample groups show effectivelly anoxic,rarely oxic and suboxic conditions during the precipitation of the KF and DF with average of 15.6 and 14.5, respectively. Very chorently V/(V+Ni) ratios of the KF and DF samples also indicate dominantly anoxic with average 0.61 for the KF and 0.73 for the DF, lesser euxinic (mean=0.89) and rarely oxic (mean=0.21) environmental conditions. In addition to these data, average V/(V+Ni) ratios (0.21 to 0.98) point to almost entirely anoxic environmental conditions on the basis of the previously determined standart values.Consistently all of the sample groups show strong negative Mn* anomaly values ranging from -1,8 to -3,6 that these limestones have been deposited under anoxic conditions, except a few levels. These evaluates are also consistent with the authigenic pyrite precipitationin the limestones of the KF and DF, which were especially observed in the lower parts of the DF and some levels of the KF. Furthermore, most of the samples from the KF and DF show pronounced positive Ce anomalies in the shale-normalized REE+Y patterns, which are consistent with anoxic depositional conditions in the dominantly outer shelf environments of the Neotethyan Ocean. However tree samples from the middle and upper parts of the KF have strong negative Ce anomaly, suggesting that oxic conditions in high-energy subtidal/intertidal zones and two samples from the upper parts of the DF exhibit slightly negative Ce anomalies, indicating that suboxic, partially oxigenated environmental conditions in the inner shelf. This anoxia recorded by Late Cretaceous KF and DF limestones in the southwestern Turkey may be related to Cretaceous–Paleogene extinction event.

Key words: Limestone; geochemistry; redox sensitive element; Late Cretaceous; Mortaş-Seydişehir; Konya; southwestern Turkey.

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Experimental study of CO_2 saline aquifer-carbonate rock interaction during CO_2 sequestration

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ABSTRACT

Combustion of fossil fuels, as well as exploration and production operations in petroleum industry is a source of greenhouse gases, mainly CO_2, which has been accounted for increasing concern over global warming. Deep saline aquifers are proposed as a promising sink for disposal of greenhouse gases in order to mitigate the air pollution. In this work, carbonate cores saturated with saline aquifer samples were exposed to CO_2 to investigate the role of geochemical reactions during CO_2 sequestration. Experiments were conducted for 91 days at 40 and 62 bar with brine samples containing Na^+, Ca^{2+}, Mg^{2+}, Fe^{2+}, and K^+ ions present in the system, and in the present of dolomite rock and CO_2. Comparison of CO_2 - treated and untreated cores and analysis of brine samples taken during experiments revealed that dolomite was dissolved during experiments and concentration of Mg^{2+} and Ca^{2+} ions in the brine increased. In addition, the permeability and porosity of all cores increased after experiment. Meanwhile, analysis of SEM and XRD images showed there is no secondary mineralization, therefore, solubility trapping is the dominant mechanism of CO_2 trapping in carbonate reservoir. The results of this study will provide an insight into future development of full-field sequestration of CO_2 into saline aquifers.

Key words: CO_2 sequestration; geochemical reaction; carbonate cores; saline aquifer; porosity; permeability.

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Major, trace and REE element behaviors during the weathering of phyllite to tremolite, albite-chlorite schist in the Kadınhanı-Konya area, Central Anatolia, Turkey

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ABSTRACT

An insitu weathering profile developed on the Devonian-Early Permian Bağrıkurt Formation consisting of mainly phyllite, tremolite-chlorite schist, albite-chlorite-quartz schist with granolepidoblastic and porphyroblastic textures, This profile consisting of parent rock (PR), Coarse saprolite (CS), Fine saprolite (FS), and Laterite (L) horizons is locted in the Kadınhanı-Konya region, Central Anatolia, Turkey. In this study, selected samples from the PR, CS, FS, and L have been analysed for major, trace, and rare-earth elements (REE) to understand the element mobility and mass transfer during the weathering processes. PAAS-normalized REE values of the sample groups show MREE enriched, LRE and HRE depleted and nearly flat prominent similar REE patterns with pronounced positive Eu anomalies, suggesting an insitu weathering profile and a common source. The CaO, Sc, and Cu are enriched, K2O, TiO2, Al2O3, and the other trace elements are depleted with respect to the PAAS. The ΣREE concentrations show a regularly increasing trend from the parent rock to CS, FS, and L with increasing weathering influence and decreasing carbonate contents. When normalized to the parent rock, the CS, FS, and L horizons were enriched in Al, Fe, K, Ti,Cr, Ba, Cs, Hf, Nb, Rb, Ta, Th, U, W, Zr, Y, Ni, As, Au and all REEs and depleted in Ca, Mg, P, TOTC, Mn, Sn, Mo, Cu, Pb, Zn, Cd, Sb, Bi, Ag, Hg,Tl, and Se. Based on the Zr immobility, mass balance calculation show that the all major and most of the trace elements, even MREE and HREE were leached out of the system, but Cs, Th, As, La, and Ce were preferentially retained in the all sample groups. Some elements such as MREE, LREE, Pr and Ba also show diverse behaviors in sample groups from the different horizones that were enriched in the CS and FS, but depleted in the L horizones. The Zr, Cr, Hf, Nb, Ta, Tm, Lu, and Tb also exhibit immobile behaviour during the weathering processes.

Key words: Geochemistry; element behavior; mass balance; weathering profile; schist; Kadınhanı-Konya; Turkey.

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Trace and RE element goechemistry and genetic investigation of the terra-rossa occurrences in the Mortaş-Seydişehir (Konya) area, Soutwestern Turkey

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ABSTRACT

Recent terra rossa (TR) occurrences consisting of mainly kaolinite, quartz, calcite, sericite, boehmite, hematite, lepidocrocite, goethite, rutile, and anatase commonly developed on the carbonate outcrops, especially in the form of karst fillings with thickness of several meters (3-4 meters) in the Cenomanian Katrangediği Formation (KF). A total of fifty two samples from the terra rossa and their host rock carbonates of the KF, metaclastic sediments of the Seydişehir Formation (SF) and metamarl interlayers (MM) of the SF were analysed for major, trace and rare earth elements (REEs) to understand parent rock of the terra rossa, source of the REEs, and controlling factors on the element distributions during the weathering and karstification processes. The REE concentrations of the Katrangediği carbonates (mean=104.92 ppm) are much more than in the normal marine carbonates and MM (75.07 ppm) that may be related to their content rather than terrigenous material. Katrangediği carbonates exhibit dominantly high (Sm/Yb)SN ratios (average 2.21) from pure marine carbonates, mostly chondritic Y/Ho ratios (average 26), and strong to modarate positive correlation of ΣREE with total silicate abundance, Y, Al, Zr, Cr, Sc, Mo, Cu, Sn, Pb, Ni, As, Bi, Tl, Be, Cs, Ga, Ta, Th, Ti, Fe, Mn, Si, U, V, W, Hf, and Nb, and strong negative correlation to total carbonate contents suggesting that the distribution of the major, trace and RE elements, except Ca and Mg are controlled by mainly shale contaminant including Fe and Mn colloids in the KF. The Fe2O3 concentrations of the most samples from the KF are however lower than in the average carbonate (0.38%, Veizer, 1983), indicating that the Fe has not a significant role in controlling REE distribution. Terrigenous materials in the KF have been sourced from the SF exposed on the coastal plain during the deposition of the KF in the Neo-Tethys. Chondrite normalized LREE enriched but HREE depleted and nearly flatt HREE patterns with negative Eu anomaly and also some critical elemental ratios like La/Sc, Th/Sc, Cr/Th, Eu/Eu*, La/Lu, Co/Th, La/Sc and Sc/Th show that the TR occurrences have been derived from intermediate to felsic source rocks. Moreover PAAS-normalized REE patterns of the TR with the SF and of the KF with the MM, except Ce anomaly, show an excellent similarity to each other, indicating that a close genetic relationship among them and a common source for the REEs. Consequently, all data suggests that the SF may be dominant source of the TR, which was derived from the terrigenous materials in the KF by means of weathering and karstification processes. The SF has also been sourced from the Neoproterozoic magmatic rocks and metaclastic sediments with intermediate to felsic origins of the Sandıklı–Afyon Basement Complex (SBC) and deposited in an Andean-type retroarc foreland basin during the Late Cambrian–Early Ordovician period.

Key words: Terra rossa; REE geochemistry; source of REE; provenance of terra rossa; Seydişehir-Konya; Turkey.

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The mass-balance calculation and behaviour of major, trace and RE elements during the weathering and karstification processes of the vein type iron carbonates into karstic iron oxy-hydroxides in the Attepe-Feke-Adana area, Southern Turkey

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ABSTRACT

Late Paleocene-Early Eocene vein-type hydrothermal-metasomatic iron carbonates consisting of mainly siderite and ankerite are hosted by Early-Middle Cambrian metacarbonates in the western part of the Eastern Taurus Belt, Southern Turkey. Secondary ıron oxy-hydroxides comprising dominantly earthy limonite and shaped as stalactites and stalagmites, reniform, and crusty goethite ores are associated with secondary euhedral calcite crystal agregates and calcite occurrences shaped as stalactites and stalagmites. These weathering products formed from the primary ores and their host rock carbonates by the combined effects of weathering and karstification processes were re-deposited in the karstic cavities developed along the fault zones in the iron carbonates and nearest carbonate host rocks. In this study, the primary and secondary ore, karstic calcite occurrence and their host rock samples have been analysed for major, trace, and rare-earth elements (REE) to examine element mobility and mass transfer during the weathering and karstification processes. Compared with the primary ores, both of the secondary limonite and goethite ores were enriched in Si, Al, Na K, Ti, P, Mn, Cr; and depleted in Mg, Ca, and TOTC. In the each of the ores, almost all of the trace elements (REEs, HFSEs, LILEs, and TREs) were enriched in the limonite ore, while only Mo, Pb, Zn, Ni, Au, U, and W were enriched but the other trace elements were depleted in the goethite ores. Host rock normalized major and trace element patterns of the karstic calcite samples show that Al, Na, K, Ti, Hg, Ba, Th, Y, Zr, REEs, HFSEs, LILEs were enriched but Fe, Mg, P, Mn, S, and TREs were depleted. On the basis of the PAAS, the karstic calcites were enriched in Ca and strongly depleted in the other major and all of the trace elements including REEs over to PAAS. According to the mass-balance calculations, major and trace element behaviours in the sample groups are highly variable. The elements of Cr, Cd, Ag, Ta, Tb, Dy, Ho, Er, Tm, Yb, and Lu exhibit more or less immobile behaviour and were effectively conserved during the weathering and karstification processes. The Si, Fe, Al, Mn, Na, K, Ti, P, some REEs and TREs were enriched or depleted in different sample groups under the same environmental conditions. Furthermore, the HFSEs, LILEs, MREEs, Zr, and Th were enriched but As and Sb were depleted in the all sample groups. These geochemical data show that many elements known as immobile have been more or less mobilized under the appropriate weathering and karstification conditions.

Key words: Geochemistry; iron carbonate; REE; supergene alteration; mass balance; Attepe; Turkey.

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Remote sensing, geochemical and geophysical data for detection of hydrothermal mineralized zones associated with massive sulphide, South Eastern Desert, Egypt

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ABSTRACT

Massive supplied are highly altered ultramafic rocks that are possibly associated with economic mineralization. The present work deals with the utilization of ASTER imagery, combined with geological and aeromagnetic data for the identification of sulphide-mineralized zones at Wadi Allaqi area, in South Eastern Desert of Egypt. The study area is underlain by Neoproterozoic island arc metavolcanic rocks and their equivalent gabbro-diorite rocks and intruded by granodiorites. The developed band rationing, Principal Component Analysis (PCA) and the Spectral Angle Mapper (SAM) supervised classification and image processing techniques applied on the ASTER data set have proved their capability for better interpretation and identification of hydrothermally altered rocks and associated mineralization. The hyperspectral tools (Minimum Noise Fraction (MNF), Pixel Purity Index (PPI) and nD-visualizer) extracted endmember spectra and SAM classification clearly show the occurrence of minerals and their spatial distributions. The spatial data analyses of the lineaments and lithology map derived from ASTER data and field work revealed the presence of a number of effective Cu-Au mineralization in the NW-SE trending lineaments, including the well-known Um Garayat and Marahiq gold mines. Aeromagnetic map (total intensity reduced to the pole) of the study area was digitized and replotted using Geosoft program to produce a total intensity magnetic map reduced to the pole. Low and high pass filtering as well as the Eulier deconvolution technique were used to determine the fault elements occurred at different depths and have NW-SE, NNE-SSW and NE-SW trends The depths and widths of magnetic bodies were detected by using (Magmap-Geosoft program) where, the depths of the magnetized bodies are at shallow depths and ranged from 33.9 to 139 m. The interpretation of aeromagnetic map correlated with the geological map and Landsat TM image of the study area, revealed the occurrence of magnetic anomalies coinciding with subsurface massive sulphide bodies. The geochemical analysis for some representative samples from the alteration zones capping these sulphide zones indicates that the copper content reaches up to 4.5% and the gold content reaches up to 3.2 g/t. This promising results indicates that Wadi Um Rican El Ashen massive sulphide deposits is the most promising area and need more detailed geological and geophysical studies. The hyperspectral tools applied on ASTER satellite data show that these can be used as a powerful tool to explore the massive sulphide and the potential associated mineralization in other arid geographical regions worldwide.

Key words: Massive sulphide; hydrothermal mineralized zone, ASTER Spectral Angle Mapper.

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New $^{40}Ar/^{39}Ar$ ages in two alkaline complexes of the Tikar Plain, central part of the Cameroon Line, continental sector (Central Africa)

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ABSTRACT

The Tikar Plain, located at the central part of the Cameroon Line (continental sector), is characterized by the concentration of numerous alkaline complexes roughly aligned SW–NE. The common features of those complexes is the coexistence of plutonic and volcanic rocks and the scarcity of radiometric data. Only the Sabongari complex has been dated, rendering difficult the chronology of emplacement between the different isolated and aligned complexes. The available ages along the whole Cameroon Line, were obtained mostly by Rb/Sr and/or K/Ar methods and range between 70 and 30 Ma for alkaline complexes and from 51 Ma to Present for Volcanic massifs. A $^{40}Ar/^{39}Ar$ campaign of dating has been initiated in the Tikar Plain and the Sabongari and neighbouring Nana complexes were chosen. Dating experiments were performed at the ^{40}Ar-^{39}Ar laboratory of the Istituto di Geoscienze e Georisorse, CNR, Pisa. The dated samples include a peralkaline pyroxene – amphibole granite (SA89) and a metaluminous trachyte (SA63) from the Sabongari complex and a microdiorite (NA223) and a basaltic trachyandesite (NA231) from the Nana complex. The pyroxene–amphibole granite yielded an amphibole age of 57.70±0.44 Ma and the associated trachyte a groundmasss age of 56.75±0.28 Ma. The microdiorite gave a plagioclase age of 52.39±0.82 Ma and the associated basaltic trachyandesite, an groundmass age of 49.31±0.40 Ma. The following conclusions can be drawn: i) volcanic rocks post–date plutonic rocks in both complexes; this is consisten field relationships, ii) the Sabongari complex is older that the Nana complex, iii) there is a close consanguinity between plutonic and volcanic rocks in a given complex, iv) such volcanic activity should be distinguished from those at the origin of the more voluminous Cameroon Volcanic Line lavas; indeed, the age of 56.79 Ma obtained in the trachyte of Sabongari is higher than the oldest age of 51 ± 1.2 Ma (K/Ar method) so far determined for the Cameroon Volcanic Line, in the olivine free transitional basalt of Bamoun plateau. The ages obtained in the Nana complex are similar to those already published in at least two other complexes in North (52±2 Ma, granite from Mboutou complex) and West (51±1 Ma, granite from Bana complex) Cameroon. This result is consistent with the ongoing interpretation considering the Cameroon Line as a huge lithosphere crack tapping a hot deep asthenospheric zone, and more globally as the result of complex interactions between hotspots and lithospheric fractures during African plate motion.

Key words: Tikar Plain; Sabongari complex; Nana complex; Cameroon Line; $^{40}Ar/^{39}Ar$ ages, Central Africa.

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Rare-earth element distribution in the Kozbudaklar W-skarn deposit (Bursa, Western Anatolia, Turkey)

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ABSTRACT

Rare earth elements (REE), which are often used in the petrologic classification of magmatic and metamorphic rocks, are also helpful for determination the degree of rock-fluid interactions, character of metasomatic fluids, the change in oxidation conditions and temperature in alteration zones. The Kozbudaklar W-skarn deposit is developed at the contact between Eocene Topuk Pluton and Mesozoic İnönü Marble in Tavşanlı Zone, Turkey. According to type of substituted rocks, both endo and exoskarn zones are occurred in this area. The endo skarn zone is represented by plagioclase-pyroxene zone and exoskarn zone is characterized by pyroxene, pyroxene-garnet, garnet and garnet-pyroxene zones. In the AFC [(Al_2O_3+Fe_2O_3)-(Na_2O+K_2O) – (CaO-3.3P_2O_5) – (MgO+MnO+FeO)] diagram, skarn zone rocks plot into the area of Ca-silica minerals (e.g., anorthite, garnet, vesuvianite, diopside, wollastonite). In pyroxene and pyroxene-garnet zones tungsten and molybdenum abundances vary between 433.7-5507 ppm (mean 2330 ppm) and 7.8 - 90.2 ppm (mean 40.28 ppm). In the garnet and garnet-pyroxene zones, concentrations of these elements are 107.9 - 7615.5 ppm (mean 2308.07 ppm) and 40.1 - 492.5 ppm (mean 129.63 ppm), respectively, showing that molybdenum abundance is increased. REE contents of the Topuk Pluton, endoskarn, exoskarn and İnönü Marble are 59.1 - 128.6 ppm (mean 105.0 ppm), 75.8-171.5 ppm (mean 114.6 ppm), 3.5-290.8 ppm (mean 53.65 ppm) and 2.3-15.3 ppm (mean 6.06 ppm), respectively. REE contents in the skarn zone are higher than those of the Topuk Pluton and İnönü Marble. However, the REE contents of tungsten-rich samples are significantly depleted. Topuk Pluton, which is the source of skarn mineralization, has an enriched LREE pattern with (La/Yb)n= 4.66 - 11.34 (mean 6.48)) and slight negative anomaly (Eu/Eu*= 0.67 - 0.83 (mean 0.76)). As for the İnönü Marble, there is a more stable HREE ((La/Yb)n= 5.22 - 7.70 (mean 6.57)) and variable Eu (Eu/Eu*= 0.00 - 0.92 (mean 0.55)) pattern. In areas of scheelite mineralization, REE trends and Eu anomalies display two different patterns. REE trends of pyroxene and pyroxene-garnet zones are similar to those of Topuk Pluton and HREEs are increased and Eu exhibits a negative anomaly as a result of interaction with the İnönü Marble. In these zones, tungsten-rich samples are represented by Ce depletion and low Eu/Eu* (Eu/Eu* = 0.56-0.88). Garnet and garnet-pyroxene zones are characteristic with LREE convex trend, maximum Pr and Nd and positive Eu anomalies. Ce enrichment and high Eu/Eu* ratios (Eu/Eu* = 1.05-4.18) are observed in tungsten-rich samples. Considering the varying molybdenum abundances and REE pattern, scheelite mineralization in the Kozbudaklar W-skarn deposit must have been taken place at two different phases that are dominated by high temperature. In the first phase scheelite mineralization was formed by early magmatic fluids and in the second one scheelite was formed under oxidizing conditions with increasing rock-fluid interactions.

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Key words: Rare earth elements; scheelite skarn deposit; Western Anatolia; Turkey.

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40Ar/39Ar age from the sub-ophiolitic rocks of the Muratdağı Melange, northwest Turkey

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ABSTRACT

The Muratdağı region, comprising metamorphics, carbonates, ophiolitic remnants and Neogene aged sedimentary, volcanic and plutonic rocks, is located in between Kütahya and Uşak in western Anatolia. The stratigraphy of the investigated area starts at the base with the Middle-Upper Triassic İkibaşlı Formation. The Jurassic Çiçeklikaya Formation, comprises dolomitic carbonates, conformably overlies the İkibaşlı Formation. All these Mesozoic formations are tectonically overthrusted by the Muratdağı Melange with a low-angle. The Muratdağı Melange, composed of Neotethyan ophiolitic rocks, represented by ultramafic rocks and a melange (volcanic-sedimantary rocks) in the study area. Sub-ophiolite metamorphic rocks are tectonically located between the ultramafics and melange of ophiolites of Western Anatolia. Sub-ophiolite metamorphic rocks have been extensively used to unravel the tectonic and P–T history of the associated ophiolite sequences. In the investigated area, these sub-ophiolitic metamorphic rocks observed at the northwest of the Kazıkbatmaz Hill. The thickness of these rocks doesn't exceed 100 m. The ages obtained from these rocks enable us to determine the age of the subduction of an oceanic litosphere and consequently to determine the closure age of Neotethyan Ocean. For this aim, 40Ar/39Ar age analysis was performed on hornblendes of metamorphic rocks and the plateau age of 100.7±1.3Ma was determined. This obtained 40Ar/39Ar age indicates the time of the closure of the oceanic lithosphere consequently closure of the Neotethyan Ocean in Upper Cretaceous. The Baklan Granite, composed of mainly biotite, hornblende, plagioclase, K-feldspat and quartz, intruded into Mesozoic rocks after the emplacement of the ophiolitic nappe. The Lower Miocene aged Kürtköyü Formation, comprises Mesozoic rock gravels in a reddish cement, and discordantly overlies the older formations. The Kürtköyü formation is conformably overlain by Early-Middle Miocene coal bearing lacustrine Yeniköy Formation. Miocene aged sedimentation of Yeniköy Formation is accompanied by volcanism and named as Karacahisar Volcanics. The Karacahisar Volcanics are composed of rhyolite, trachyte, dacite and pyroclastic materials.

Key words: Northwest Turkey; sub-ophiolitic rocks; Neo-tethys ocean; 40Ar/39Ar.

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Mineralogical and geochemical properties of the late Mesozoic magmatism in Cappadocia Region (Nevşehir, Central Anatolia, Turkey)

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ABSTRACT

In Cappadocia Region, Bayramhacı, İdişdağı, Karadağ, Akçataş Plutonic and/or sub-volcanic rocks and Acıgöl plutonic rocks in the north and south of Nevşehir are found within the Central Anatolian Granitoids. Upper Cretacous İdişdağı and Akçataş Plutonic rocks at north of the Nevşehir were intruded into the Paleozoic Tamadağ metamorphites whilst Acıgöl Pluton comprises the bedrock. Holocrystaline and porphyritic plutonic rocks are in contact with hypocrystalline sub-volcanic rocks. Plutonic rocks are cut by younger products such as aplite and quartz dikes and contain spherical/ellipsoidal mafic microgranular enclaves (MME). In northern part of Nevşehir, plutonic and sub-volcanic rocks are in quartz monzonite, quartz monzodiorite, monzonite and latite composition, respectively. Plutonic and sub-volcanic rocks are composed of quartz, plagioclase, K-feldspar, amphibole, biotite as the main constituents. Accessory and secondary minerals are comprised by pyroxene, sphene, apatite, opaque and epidote, chlorite, sericite, calcite, respectively. Some aplitic dikes, which cut the İdişdağı Pluton, are in tephriphonolite composition and contain leucite and pyroxene minerals. In south of Nevşehir, granitic rocks are composed of quartz, plagioclase, K-feldspar, amphibole, biotite, sphene, apatite and opaque minerals. In the Cappadocia Region MME's have quartz monzodiorite - monzodiorite composition. In Harker diagrams, all the plutonic and sub-volcanic rock samples display negative and positive linear trends of Al2O3, Fe2O3, MgO, CaO, TiO2, P2O5 and K2O with increasing SiO2. Monzonitic and latitic rocks exhibit compositions ranging from sub-alkaline to alkaline, whereas granitic rocks are in sub-alkaline character. All the plutonic rocks in the region are consistent with post-COLG granitoid suites of Central Anatolia in regards to their calc-alkaline, metaluminous and I-type melt character. In rare earth element patterns, light earth elements (LRE) are found to be more enriched than heavy earth elements (HREE). Ocean ridge granite normalized element distributions show that the plutonic, sub-volcanic rocks and dikes and MME's have similar patterns. A significant enrichment of LIL (K, Rb, Ba and Th) elements and relatively depletion of HFS (Ta, Nb, Ce, Hf, Zr and Y) elements are indicative of formation from hybrid magma in a subduction environment. However, monzonitic and latitic rocks are represented by enrichment patterns of LIL (Rb, Th, U, K and Sr) and HFS (Ta, Nb, Hf, Zr and Ti) elements. In tectonic discrimination diagrams (Nb-Y, Rb-Y+Nb and Rb/Zr- SiO2), all of the plutonic and sub-volcanic rocks plot into the volcanic arc granite (VAG) field which is characteristic to post-collision granites. In Cappadocia Region, petrographic and whole-rock chemistry data show that the plutonic and sub-volcanic rocks were formed by the interaction of post-collisional, calc-alcaline, metaluminous and I-type coeval felsic and mafic magmas at shallow depths.

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Key words: Rare earth elements; scheelite skarn deposit; Western Anatolia; Turkey.

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Geochronology, geochemistry, and petrogenesis of the high-K volcanism: implications for the Late Cretaceous geodynamic evolution in the Central Pontides orogenic belt, north Turkey

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ABSTRACT

Major, trace element, Ar-Ar age and Sr-Nd-Pb isotopic datas are presented for the Late Cretaceous volcanics in the Central Pontide (Turkey). The rocks are consist mainly of basalt, andesite and associated pyroclastics (volcanic breccia, vitric and crystal tuff). These rocks contain plagioclase (An47-84), Ca-clinopyroxene (Wo41-49En37-49Fs4-17), phlogopite, analcime phenocrysts and magnetit/titanomagnetite and apatite microphenocrysts. 40Ar-39Ar ages data from 72±0.5 to 79.0±0.3 Ma, within the Late Cretaceous (Campanian) contemporaneous with the subduction of the Neo-Tethyan Ocean beneath the Pontides. The volcanic rocks show alcali-calc-alkaline affinities and have high K contents. They are enriched in large ion lithophile (LILE) and light rare earth elements (LREE), with pronounced depleted of high field strength elements (HFSE). The chondrite-normalized REE patterns (Lacn/Lucn=6-17) show low to medium enrichment, indicating similar sources for the rock suite. Initial 87Sr/86Sr values vary between 0.70615 and 0.70796, while initial 143Nd/144Nd values change between 0.51228 and 0.51249. Initial 206Pb/204Pb values vary between 18.001 to 18.349, 207Pb/204Pb values 15.611 to 15.629 and 208Pb/204Pb values 37.839 to 38.427. The main solidification processes involved in the evolution of the volcanics consist of fractional crystallization with minor amounts of crustal contamination±magma mixing. All evidence supports the conclusion that the parental magma(s) of the rocks probably derived from an enriched mantle, previously metasomatized by fluids derived from subducted slab in extension-related geodynamic setting.

Key words: Central Pontides; Ar–Ar, Sr–Nd–Pb isotope; shoshonite; subduction-related magmatism; Sinop; Turkey.

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Mass change calculation of hydrothermal alteration in Kaletaş-Söğütağil Area (Gümüşhane, NE Turkey)

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ABSTRACT

The study area is located in the southern zone of the eastern Pontides orogenic belt. Kaletaş-Söğütağıl alteration field is hosted by basaltic-andesitic rocks of the Eocene Alibaba Formation. This autochthonous unit cut by the late Eocene Dölek Granitoid. In this area, the alteration is mainly controlled by E-W and NE-SW trending fracture zones. Alterations are observed in the andesitic lithologies of Alibaba Formation as silicification, argillitization, hematitization and limonitization. MINSQ calculations suggest that the most commonly alteration minerals are quartz ± feldspar ± sericite ± kaolin in ore zone and albite, chlorite ± epidote in propylitic zone. The relative (%) and net (g/100g) mass changes calculated using Zr-Hf immobile elements indicate that there is mass loss (m>1) in propylitic and mineralization zone. According to net and relative mass change calculations, increase in the amounts of gold and lead is remarkable in ore zone. The relative and net mass change increase in Au elements in the mineralization zone is 278 % and 207g/100g respectively. Besides Pb and Au are concentrated in the same region at the anomaly maps.

Key words: Kaletaş; Gumushane; alteration; mass change; gold.

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Correlation of the Upper Cretaceous ophiolite massifs in northwest Iran and southeast Turkey

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ABSTRACT

The Neoproterozoic m1 basement unit of the Eastern metamorphic complex of the Khoy ophiolite in NW Iran was part of a larger continental block in Late Triassic that included the basements of the Central Iran micro-continent, the northern margin of Gondwana, and the Anatolides-Taurides in Turkey. The crustal block was split in a rifting ocean in northwest Iran-southeast Turkey after the formation of the oceanic crust and related supra-subduction series during Late Triassic-Early Jurassic. The subduction of the eastern margin of the oceanic crust under Central Iran led to the metamorphism of the ophiolite and supra-ophiolitic series to the greenschist-amphibolite facies and formation of Khoy's Eastern metamorphic complex during Middle Jurassic-Late Cretaceous. The meta-ophiolitic part of the Eastern metamorphic complex in Iran correlates with the Berit mountain meta-ophiolite in Turkey. Continued subduction in the east and accretion onto Central Iran led to the injection of Upper Cretaceous-Lower Paleocene granitoid masses. The oceanic crust formed an extensive plutonic sequence and the thickest (>1000 m) extrusive sequence among Iranian ophiolitic massifs during Late Cretaceous. The Upper Cretaceous Khoy ophiolite is non-metamorphic and can be correlated with the ophiolite massifs in the northern ophiolite belt in southeast Turkey such as Berit (Göksun), İspendere, Kömürhan, and Guleman. In contrast to the ophiolites of the northern belt in southeast Turkey that show the supra-subduction geochemical characteristics, the Khoy extrusive sequence displays T-MORB-like and N-MORB-like patterns, and is cut by diabase dikes with supra-subduction zone characteristics, indicating a geodynamic transition from the MORB to supra-subduction setting before the injection of the dikes. The Khoy supra-ophiolitic series which evolved in a trough along the eastern margin of the Late Cretaceous Ocean correlates with the Elazığ volcano-sedimentary rocks in southeast Turkey. The Eocene volcano-sedimentary rocks in the Khoy area are among the post-ophiolitic units that can be correlated with the Maden group in Turkey. Upper Miocene quartz monzodiorite masses with the subduction geochemical signature are the youngest intrusions that cut the supra-ophiolitic series and Upper Cretaceous ophiolitic rocks.

Key words: Ophiolite; Neoproterozoic; T-MORB; N-MORB; extrusive.

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Significance of the Plio-Quaternary volcanic activity in the east of Mahabad, north western of Iran

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ABSTRACT

The young volcanic lavas which distribute in northwest, north, northeast, southeast and east of Iran expose as extensive or small outcrops. This studied volcanic rocks exposed in the east of Mahabad, west Azerbaijan province, NW of Iran, have been developed in the northern part of Saveh-Mahabad volcanic belt. The Saveh-Mahabad volcanic belt comprise of lavas and pyroclastic deposits which outcrop in N-S to NW-SE trends. The Saveh-Mahabad volcanic belt has been arisen between Sanandaj-Sirjan structural zone in west and Urumieh-Dokhtar magmatic arc in the east. This volcanic activity arose on Pliocene follow to Quaternary. The Plio-Quaternary volcanic products formed the high mountain of Kuh-e-Soltan/Almaludag are rhyolitic in composition. In these mountains, Pliocene volcanic activity produced pyroclastic deposits and lahar which extended in a large area. The rhyolitic lavas exposed at passing upwards of sequence and formed summit of the Kuh-e-Soltan/Almaludag Mountains. The Quaternary volcanic products are basaltic to alkali basaltic in compositions. The Quaternary volcanic products occurred as basaltic lava flows, follow as scoria and ejected bombs which formed small cinder cone, respectively. In petrographic studies olivine is the main phenocryst set in a hyalophyric to microlitic groundmass are mostly in porous. The fine-grained minerals of sodalite group observe in alkali basalt. In the spider diagrams of the basaltic samples normalized to primitive mantle and chondrite values of Sun & MacDonough (1989), the patterns display enrichments of LILE relative to HREE. These patterns do not exhibit any signatures of subduction components such as depletion in HFSE (Nb, Ti, Zr, Ta, Hf). In tectonomagmatic diagrams the studied samples tendency plot in the fields of within plate. It seems that the Mahabad Quaternary volcanism occurred in an extensional regime which occurs after collision of Neotethys subducted slab with Central-Iran micro continent in NW of Iran.

Key words: Basalt; Quaternary; volcanic; rhyolite; lava flow.

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Distribution behaviours of rare earth elements in hydrothermal system in Manza hot springs, Gunma, Japan

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ABSTRACT

There are a large number of sulphurous springs with various water chemistries and temperatures in the Manza hot spring area located in the southwest of the Kusatsu-Shirane volcano, about 3 km away from its summit. The wide variety of water chemistry observed in this area make the hydrothermal system and geological/geochemical settings in this area complicated. The composition of rare earth elements (REEs) in geochemical samples is a useful tool for the studies on geological and geochemical processes. The REE abundance patterns of spring waters thus provide us information concerned with water-rock interactions in the subsurface geothermal system. In this study, we measured the REE compositions in the spring waters and their related samples like rocks and secondary minerals collected in the Manza hot spring area, and then discussed the distribution behaviours of REEs associated with water-rock interactions to understand the hydrothermal system in this area. The REEs concentrations in the collected samples were measured by ICP-QMS after the pre-treatment with solid phase extractants. We then obtained the chondrite-normalized REE patterns. In addition, we conducted laboratory experiments on the REE distribution accompanying formations of double sulphates of alkali metals and REEs, since alunite, a hydrated aluminium potassium sulphate mineral, is one of the dominant secondary minerals in the Manza hot spring area. In the experiments, the PTFE sealed containers containing aqueous solutions of sodium and/or potassium sulphates and REE sulphates were kept standing at designated temperatures for predetermined periods. The wide variety of shapes in the REE patterns of spring waters were observed. Some spring waters showed flat REE patterns similar to that of the bedrock in the area, and the others showed the patterns depleted in light REEs although they were different from each other in details. On the other hand, altered rock samples containing alunite group minerals like alunite, natroalunite and minamiite showed the patterns enriched in light REEs. These results suggest that the REE patterns depleted in light REEs observed in some spring waters may be caused by the formation of the alunite group minerals. In addition, the results of our laboratory synthesis experiments suggest that the double sulphates of REEs with alkali metals are possible precursors of those alunite group minerals, since the lighter REEs formed double sulphates more substantially than the heavier ones, which was inferred based on the apparent distribution coefficients of the REEs between the precipitate and aqueous phases in the experiments. In short, the formation of such double sulphates from hydrothermal fluids could cause the aqueous phase to lack in light REEs as observed in some spring water in the Manza hot spring area.

Key words: Rare earth element; water-rock interaction; alunite group mineral; double sulphate; Manza hot spring area.

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Detrial zircon ages and whole-rock geochemistry of the Demirözü Upper Paleozoic succession, Sakarya Zone, Turkey: evidence for a short-lived basin after Variscan deformations

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ABSTRACT

Located in the eastern part of the Eastern Sakarya Zone, Turkey, the Demirözü (Bayburt) Upper Paleozoic sedimentary succession is one of the rare otocthonous units recording geological events post-dating the Variscan deformations. The succession unconformably covers the Variscan metamorphic and granitic rocks and is overlain disconformably by the Lower Jurassic volcani-clastic rocks. At the base of the succession lies 610 m thick Çatalçeşme Formation, which consists of sequential alternations of quartz sandstones and carbonates. Upward conformably comes 880 m thick Hardişi Formation, which starts pebblestones at the base and passes upward reddish sandstones and shales. U-Pb ages of detrial zircons from sandstones and whole-rock geochemistry are used to deduce their provenance and to provide a contribution to understanding the post-Variscan tectonic evolution of the Sakarya Zone. In turn, 80 and 196 detrial zircons from sandstones from different stratigraphic positions within the Çatalçeşme and Hardişi formations were dated by U-Pb LA-ICPMS technique. The zircon dating restricts the provenance for both the formations to the Variscan and Paleoproterozoic (~300- ~2200 Ma), except for three grains with Neoarchean ages (~2600- ~2870 Ma). Main peaks of age populations for both the formations are at Variscan (300-350 Ma). However, seven detrial zircons from the Çatalçeşme sandstones were dated to Permian with an age range from 298 to 258 Ma. These ages significantly post-date the Variscan events and refer to the Late Permian and possibly Early Triassic as minimum deposition age for the Çatalçeşme Formation. Feeding from a felsic provenance is inferred from the whole-rock geochemistry of the rocks, which is consistent with the Variscan rocks of the region. The CIA values vary in between 75-81 for the Çatalçeşme sandstones and in between 58-65 for the Hardişi sandstones. These CIA values point out, in turn, an intensive and then a moderate chemical alteration in the source area during the deposition of the Çatalçeşme and Hardişi formations. The Çatalçeşme sandstones present geochemical features typical for passive margin setting that is characterized by recycling and maturation of earlier sediments, whereas the Hardişi sandstones carry the geochemical features of subduction related settings, such as active continental margin, continental arc and oceanic island arc. Overall these data indicate that the Upper Paleozoic sediments of the region were deposited in a short-lived basin opened following the Variscan deformations.

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Key words: Sakarya zone; Upper Paleozoic sediments; U-Pb detrial zircon ages; tectonic setting.

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Late-Proterozoic to Paleozoic history of the peri-Gondwana Calabria-Peloritani Terrane inferred from a synthesis of zircon chronology

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ABSTRACT

Amalgamation and break up of supercontinents and superterranes (Rodinia, Gondwana, Pangea) characterize the history of the Earth between Neoproteozoic and Palaeozoic times. All geological processes known today, starting with Rodinia fragmentation and culminating with the assemblages of Pangea, have been the focus of research in recent decades. Records of magmatism, sedimentation, metamorphism and anatexis accompanying the evolution of the superterrane Gondwana are preserved in some tectonic units of the nappe structured Calabria-Peloritani Terrane reworked by the Variscan and Alpine orogenies. This exotic terrane, according to the most recent paleogeographic reconstructions, was one of the peri-Gondwanan blocks comprising the “Galatian superterrane”. A large number of geochronological data obtained using microbeam techniques, together with previous data collected through traditional methods are today available on different rock types exposed in Calabria-Peloritani Terrane. These data, together with the zircon grain growth textures revealed by SEM imaging (cathodoluminescence -CL and variable pressure secondary electron -VPSED) and the REE-U-Th distribution in the zircon domains were considered in this paper. In particular, U-Pb analyses of zircon from 10 samples of augen gneisses, 8 mafic and intermediate metaigneous rocks and 6 metasediments from some tectonic domains along the Calabria-Peloritani Terrane (Southern Italy) have been considered to define the peri-Gondwanan evolution from Late-Proterozoic to Paleozoic times. All samples were equilibrated under amphibolite to granulite facies metamorphism during the Variscan orogeny. The zircon grains of all considered samples preserve a Proterozoic memory suggestive of detrital, metamorphic, and igneous origin. The available data fit a frame involving: (1) Neoproterozoic detrital input from cratonic areas of Gondwana; (2) Pan-African/Cadomian assemblage of blocks derived from East and West African Craton; (3) metamorphism and acidic -basic magmatism between 593 Ma and 526 Ma, within an active margin setting; (4) rifting and opening of Ordovician-Silurian basins fed by detrital input from the assembled Cadomian blocks recording provenance from both East and West Gondwana cratonic areas. The Paleozoic basins evolved through sedimentation, metamorphism and magmatism until the Variscan orogeny involving Palaeozoic and pre-Paleozoic blocks. The Proterozoic records decidedly decrease in the high grade metamorphic rocks affected by pervasive partial melting and high temperature of metamorphism.

Key words: U-Pb zircon ages; Pre-Cambrian to Permian tectonothermal events; detrital provenance; Calabria-Peloritani Terrane.

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Geochemical characteristics of the Quaternary Kavakköy Travertine (Konya, central Turkey)

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ABSTRACT

At the Kavakköy region (W of Konya, Turkey), there are four Quaternary travertine mounds which are roughly aligned along the Seydişehir fault zone extending NW-SE. They lie disconformably upon the Seydişehir formation comprising Upper Cambrian-Lower Ordovician interbedded metasandstone- shale and phyllite. In these travertines, six different facies were identified: Crystalline crust travertine facies, Paper-thin raft travertine facies, coated bubble travertine facies, Pisoid travertine facies, Lithoclast travertine facies, and Shrub travertine facies. There are also two sites of recent travertine deposition taking place around the output of an artificial artesian well (230 meter deep) and a spring which are 2 km apart from each other. The temperatures of water from the well and spring are about 390C and 190C, respectively. In this study, chemical analyses results of samples taken from different facies of the Quaternary Kavak formation were evaluated. All travertines samples are composed of almost pure calcite. CaO(%) content travertines ranges between 44.92 and 55.86 and the MgO content of travertines changes between %0.17 and 0.98.The trace element contents of the travertine are generally in the range of 0.1 (ppm) to 1293 (ppm). There are positive correlations between Al_2O_3, Fe_2O_3, SiO_2 and REE contents, whereas there are negative correlations between REE and MgO, CaO content. δ18O values of older travertine vary between -14.5 and -6.8 ‰ (PDB) and δ13C values between +2.5 and +8.2 ‰ (PDB). The analyses results show no significant differences in the rare element content and isotopic values of different facies. But On the diagrams drawn by using CaO versus trace element content (Sr, Ba, As, Zr, Y, Zn, Rb), we obtained two separate clusters. These groupings are interpreted as being related to the temperatures of travertine formation water. But this interpretation needs more data from different setting. The calculated δ 13C values of travertine in Kavak region by means of Panichi and Tongiorgi's equation range from -10.3 to -0.7 (PDB) values and point mantle to be the main source of CO_2 with little mixture of CO_2 from metamorphism of limestone.

Key words: Trace elements; Kavakköy; Quaternary; travertine; Isotope.

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Investigation of helium isotope variations of alkaline volcanic rocks in Western Anatolian (Kula) Region

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ABSTRACT

Because noble gases are represented by various compositions in different reservoirs in the earth, they provide valuable information on the evolution of bulk earth, understanding of processes (e.g. crustal contamination) contributing to the magma formation and estimating the depth of magma plumes. Although the alkaline volcanics in the western Anatolia (Kula) region have been studied in detail by several works by means of trace element variations, radiogenic dating and isotope systematics, noble gas isotope compositions that could significantly contribute to dynamics of volcanism have not been investigated yet. In this study which aims to fill the deficiency of such data, helium isotope compositions of olivine-basalts in western Anatolia (Kula) are measured. The Quaternary alkaline volcanism of Kula is located in a western Anatolian E-W trending graben system that resulted from an Aegean extensional regime. Kula alkali volcanic lavas are distinguished in three different sequences, namely Burgaz, Elekçi, Divlittepe. The samples of Kula volcanics belong to the silica under saturated alkaline suite with SiO2 <50%. Burgaz and Elekçitepe samples are basanite and tephrite in composition, the Divlittepe volcanics are of phonotephrite. Olivine minerals from alkaline volcanic rocks in Kula region was separated with heavy-liquid method. Helium isotope analysis of olivines was carried out at Scottish Universities Environmental Research Centre (SUERC) laboratories. R/Ra ((3He/4He)sample/(3He/4He)atm) values of gas inclusions in olivines separated from thirteen discrete basalt lavas in the Kula region are in the range of 5.86 to 8.04. Such high helium isotope values, which are close to the mean MORB ratios, are most probably indicative of an asthenospheric mantle source.

Key words: Alkaline rock; olivine; helium isotope; crust-mantle interaction.

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Geological and isotopic features of Hayriye and Arapdede mineralizations in (Inegöl-Bursa)

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ABSTRACT

Western Anatolia (Turkey) experienced widespread Cenozoic magmatism after the collision between the Sakarya and Anatolide–Tauride continental blocks in the pre-middle Eocene. The widespread magmatic activity in NW Anatolia postdates this continental collisional event in the region. The following magmatic episode during the Oligocene and Early Miocene is known to have produced the widespread granitic plutons. Many skarn mineralization associated with plutons formed in the region (such as Hayriye and Arapdede Mineralizations). The study area is located at 30 km southeast of Inegöl (Bursa), includes Hayriye and Kozluca villages. The Paleozoic aged Devlez Metabasite is the oldest unit of the study area. This unit includes amphibolite, glaucophane-lawsonite schist, muscovite schists. The unit has widely spread in area. This units are overlain unconformably by the Geyiktepe Marbles. Paleocene aged Domaniçgranitoidic intrusives cut other rock series and located as a batholite. Magmatic units present porphyric and holocrystalline textures. Granitoidic intrusions are represented by tonalite, tonalite porphyr, granodiorite, granodiorite porphyr, granite, diorite, diorite porphyries. The $\delta^{34}S$ values of sulfides range from 2,95 to 3,5 ‰ (CDT). These suggest that origin of mineralizations is magmatic source. These suggest that origin of mineralizations is magmatic source. Pb^{208}/Pb^{204}, Pb^{207}/Pb^{204}, Pb^{206}/Pb^{204} ratios of sulphide minerals are 38.21-40.06, 15.50-16.01, 18.66-19.19 respectively. Most of the Pb isotopic compositions of ore minerals fall on the upper crust evolution curve.

This study supported by ESOGU BAP (2011150321).

Key words: Skarn deposits; mineralization; Cu-Pb-Zn deposits; Inegöl (Bursa).

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XRD investigation of salt from the Ocnele Mari deposits, Valcea County, Romania

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ABSTRACT

The Ocnele Mari deposit lies in the Getic Domain of the Southern Carpathians, Romania. The molasse-type sediments are accumulated during Paleogene and Quaternary in different facieses (coastal, deep sea, brackish, lake) that succeed both from north to south and over time. The Ocnele Mari Salt massif is situated between the Badenian Globigerina-bearing Tuffs and the Radiolaria Shales Formation, where the Upper Salt-bearing Formation is found. There is an elongated E-W and N-S body of salt with the general form of a lens with a thickness of 7.5 km and 3.5 km respectively. It consists of compacted, sometimes weak cemented alternated centimeter layers of large crystals of pure white salt, dark grey and black salt with impurities. The mineralogical study of exploitation boreholes drilled in the Ocnele Mari deposit reveals the presence of halite (cca 94.5 %), anhydrite, gypsum, kieserite, schoenite, clay minerals and coal material. The three types of salt were analyzed using X-ray diffraction. For the entire mineralogy the samples were made in powder and then measured. For clay minerals the treated samples were measured with X-ray PanAnalytical X' Pert. In the pure salt the X-ray analyses detected halite, polyhalite, gypsum and plagioclase feldspar. In the dark grey salt, quartz, halite, plagioclase feldspar and clay minerals (kaolinite, illite) were identified. Dark color interbedded layers consist of quartz, plagioclase feldspar and clay minerals (kaolinite, illite and chlorite). The exploitation of the Ocnele Mari salt deposit started from 1954 by the salt dissolution technology, but the +226 horizon were fitted out as a touristic salina.

Key words: X-ray; halite; gypsum; clay minerals.

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The geochemistry and comparison of Alaçam Granite (NW, Turkey) with World Skarn Granitoids

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ABSTRACT

Most of the skarn deposits are directly related to magmatic activity. Many studies indicate systematic correlations between the composition of plutons and the metal contents of associated skarns. In the study area, skarn formation is developed at the contact between Alaçam granite which is located in the north of E-W trending Quaternary Simav Graben, and limestone. Although small bodies of Fe-skarn mineralization have been known in around studied area, there have not yet been any attempt to find out type of mineralization and whether Alaçam granite can produce skarns with potentially different metal content. In this study, the aim is to compare with the geochemistry of Alaçam granite, and the geochemistry of granitoids associated with skarns worldwide, in order to reveal the metal content of skarns Alaçam granite can produce. Alaçam granite cuts metamorphic rocks of the Menderes Massif and rocks of İzmir-Ankara suture zone. Alaçam granite is classified as granodiorite and granite in composition. Alaçam granite is defined by I-type calc-alkaline, peraluminous and high K formed in post-collisional setting based on geochemical characteristics. In the primitive mantle normalized trace element patterns of Alaçam granite show enrichment of large ion lithophile elements (Cs, K2O, Rb, Ba, Th etc.) and depletion of high field strength elements (Nb, Ti2O). Chondrite-normalized rare earth element patterns of Alaçam granite show enrichment of light rare earth elements relative to medium rare earth element and heavy rare earth element, with negative Eu anomaly. According to recent studies petrological and geochemical characteristics and tectonic setting of other skarn related Koyunoba and Eğrigöz granites, including Fe, Cu, Pb-Zn mineralization, in the eastern edge of the Alaçam magmatic complex show similarities to those of Alaçam granite, indicating the importance of skarn zones associated with Alaçam granite. This study shows that Alaçam granite has similarities to average geochemical values of granitoids associated with Cu and Pb-Zn skarns, suggesting new prospects for copper and lead-zinc in Alaçam district.

Key words: Granite; skarn; geochemistry; Alaçam; Turkey.

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Geology and alteration mineralogy of Kesikköprü (Bala-Ankara) iron-oxide deposit

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ABSTRACT

The Kesikköprü iron-oxide deposit as a skarn type deposit, is one of the important iron-oxide deposits in Turkey with grades of 32-54 % Fe and total reserve of 13,6 million tonnes, is located in the northwestern part of the Central Anatolian Crystalline Complex (CACC). Mineralization in the deposit occurred at the contact between granitoids consisting of granite, granodiorite, monzonite and their porphyry, and crystalline limestone (locally dolomitic) and/or mafic-ultramafic rocks composed of gabbro and pyroxenite. The general trends of the mineralized zones are observed in parallel with granitoid-wall rock contacts. In this respect, the iron-oxide mineralization in the study area appears to be controlled dominantly by lithological features rather than structural ones. In this study, the aim is to define key mineralogical characteristics, alteration zoning, and relationship between alteration zoning and mineralization of Kesikköprü (Ankara-Turkey) iron-oxide deposit. Alteration zones in the study area are divided into two groups. The first is defined by small and limited endoskarn formation, the second group is characterized by more widespread exoskarn formation. In general, endoskarn zones are determined by garnet-pyroxene, while exoskarns are classified as garnet±pyroxene, pyroxene±garnet, epidote-garnet and epidote from granitoids to recrystallized limestone and mafic-ultramafic rocks, respectively. The skarns in the study area are mostly calsic skarn, rich in garnet-pyroxene-epidote; whereas magnesian skarns are also observed at contacts with dolomitic rocks and mafic-ultramafic rocks represented by pyroxene and phlogopite mineral association. Garnet and pyroxene minerals are dominant minerals in endoskarn zones. In addition to these minerals, epidote, calcite, quartz, magnetite, hematite, pyrite, phlogopite, titanite and tremolite-actinolite minerals can also be seen in this zone. Garnet, pyroxene and epidote minerals are dominant minerals in exoskarn zones. Moreover calcite, quartz, magnetite, hematite, pyrite, chalcopyrite, phlogopite and tremolite-actinolite minerals are present in this zone. In this study, mineralization in Kesikköprü area is classified as a Fe-skarn based on alteration mineralogy and time-space relationship of mineralization with granitoid and recrystallized limestone, and significant amounts of magnetite (± hematite) mineralization. Magnetite mineralization seems to be associated with epidote-garnet and epidote rich zones in exoskarns. Decrease in garnet and pyroxene minerals and increase in epidote and magnetite minerals towards the wall rock indicate a relationship between magnetite mineralization and retrograde alteration causing the alteration of garnet and pyroxene.

Key words: Skarn; alteration mineralogy; magnetite; Kesikköprü; Turkey.

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Weathering and pedogenesis in loess deposits from Costinesti Ramnicu Sarat and Turnu Magurele, Romania

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ABSTRACT

The three loess deposits analysed in this study are located in the south-east and south part of Romania. To observed the similarities and differences between the degree of alteration in the studied section the alteration index (chemical proxy of alteration (CPA), chemical index of alteration (CIA), chemical index of weathering (CIW), plagioclase index of alteration (PIA) and index B) were studied separately. For Mircea Voda section the CPA index was studed by Buggle et al (2013). CIW values are high in paleosol levels, especially in the older ones. The highest values appear in the S3, S4 and S5 paleosol horizons, indicating a high degree of alteration. In the loess levels the CIW values are lower than paleosol horizons and indicate poor postdepozitionale alteration processes. CPA values are high in paleosol and lower in loess levels. This indicates that in the paleosols the intensity of the alteration processes is higher than in the loess. CPA values are high in paleosols and low in loess levels. In the four sequences it can be observed a tendency of increase of the CPA values starting with paleosol S1 to S5 paleosolul, suggesting an increase in the intensity of alteration processes. The intensity of the pedogenesis and alteration can be observed and in grain size. In all the studied section in the S3, S4 and S5 paleosols it can be observed a large amounts of <5μm fraction, suggesting a high degree of weathering and pedogenesis. CIA index has values higher in paleosol, indicating a higher degree of alteration. High values can be observed in paleosols S3, S4 and S5. Values of B index suggest a decrease of cations solubility during alteration. The loess levels L3, L4, L5 and L6 ratios are higher than the levels of paleosol. PIA index values are high in paleosol S3, S4 and S5 levels and indicate a high degree of alteration. The lowest values are in loess levels and suggest a low degree of alteration. PIA values in loess levels are lower than in paleosols and suggest weak postdepoziţional alteration process. Pedogenesis in loess levels is very low but not completely absent in general the degree of alteration of loess is very low. This incipient pedogenesis probably contributed to the stabilization and preservation of loess deposits.

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Key words: Loess; CIW; CPA; CIA; PIA; index B.

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Mineral chemical investigation of the Dağbaşi skarn occurrences (Trabzon, NE-Turkey)

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ABSTRACT

Dağbaşı area is a typical example of skarn type deposits in the northeastern region of Turkey. The basement around the Dağbaşı Granitoide is dominated by Jurassic-Lower Cretaceous andesite, basalt, syphilitic basalt and their pyroclastites, including interbeded dolomitic limestone lenses and blocks. Intrusion of the Upper Cretaceous Dağbaşı Granitoide in the volcano-sedimentary unit resulted skarn type occurrences along the granitoid-dolomitic limestone contact and nearby. The ore is associated with exoskarns and skarnization in the area is characterized by intensive epidotization, chloritization, sericitization and silicification along the granite border of volcano-sedimentary units, including pyroxene, garnet epidote, tremolite-actinolite, plagioclase, orthoclase, biotite, amphibole, chlorite, quartz and calcite minerals. The presence of hydrous minerals such as biotite, amphibole and epidote indicates that retrograde stage was developed in the skarn mineralization. The primary ore minerals are composed mainly of magnetite, specularite, pyrhotite, pyrite, chalcopyrite and sphalerite with minor amount of galena around the contact. Pyrite, marcasite, hematite, goethite, lepidocrozite are the secondary ore minerals. Secondary ore textures such as colloform, spheroidal, bird's eye and martitic have been observed characteristically in the investigated skarns, representing oxidation of primary sulphides. Pyrhotite minerals are characterized by a considerable amount of deviation of sulphur stoichiometry (up to 10 wt.%), and chemical formula calculated as Fe (1-0.1)S (1+0.1). Pyrite minerals contain up to 1.42 wt.% Zn and 4.3 wt.% Pb. Poorly defined elemental substitution have been determined between Zn and Fe in chalcopyrite composition, with a Zn content up to 2.16 wt.%. Considerable amount of silver (up to 1.43 wt.%) was detected in all measured galena inclusions. In addition to Fe (1.57-5.02 wt.%), significant amount of Cu (0.04-3.18 wt.%) were detected in sphalerite minerals. Low FeS content of the sphalerite (< 12 mol %) in skarn type deposit caused by either high pressure or low temperature conditions. The lowest emplacement depth of Dağbaşı granitoide (0.3 kbar) indicate that low FeS content of the sphalerite considered to be due to low mineralization temperature.

Magnetite minerals were found to be rich in silica content having up to 3.4 wt. %. In addition to silica, they also contains up to 0.72 wt.%, Al, 0.57 wt.% Ca, 0.50 wt.% Mn, 0.34 wt.% Mg, and 0.11 wt.% Na. Magnetites with a lower abundances of Ni and Co (lower than 0.1 wt.%) are clearly linked to felsic magmatic source. All measured grains show zonation from core to rim by decreasing silica content. This zonation most likely represents changes in fluid composition and physiochemical conditions during magnetite precipitation. Well defined negative correlation (r=0.91) between Fe and Si have been determined in the magnetite as an indication of elemental substitution with a higher portion of silica content. Taking into account of lower homogenization temperature (162-466 °C) of fluid inclusions and swallow emplacement depth of Dağbaşı Granitoide, it is understood that the solubility of silica in the magnetite does not require high temperature and pressure in the nature.

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Key words: Skarn deposits; mineral chemistry; magnetite chemistry; Dağbaşı (Trabzon, Turkey).

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Mineral chemistry and fluid inclusion properties of the Sivrikaya Fe-skarn occurrences (Ikizdere-Rize, NE-Turkey)

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ABSTRACT

The basement around the Sivrikaya is dominated by Jurassic-Lower Cretaceous aged andesite, basalt and their pyroclastites, including interbedded tuff, sandstone, shale and dolomitic limestone lenses. Intrusion of the Upper Cretaceous İkizdere Granitoide in the volcano-sedimentary unit resulted Fe-skarn occurrences along the granitoid-dolomitic limestone contact and nearby. The ore is associated with exoskarns and skarnization in the area is characterized by intensive epidotization, chloritization, sericitization and silicification along the granite border of volcano-sedimentary units. Skarnization in the area is characterised by pyroxene, amphibole, plagioclase, biotite, epidote, quartz, calcite and chlorite. The presence of hydrous minerals such as biotite, amphibole and epidote indicates that retrograde stage was developed in the skarn mineralization. The primary ore minerals in the skarns are composed mainly of magnetite, specularite with minor amount of pyrite and chalcopyrite inclusions. Pyrite, marcasite, hematite, goethite, lepidocrozite are also observed as a secondary origin. Liquid-rich two phases fluid inclusions were observed in the epidote, quartz and calcite minerals. During the microscopic investigations, none of the fluid inclusions were found to containing solid and CO2 phases. Homogenization temperatures (Th) and salinity data vary between 289-412 oC and, 6.6-15.2 % NaCl equ. in the epidote minerals. However, Th and salinity values are much lower than those in quartz (between 174-388 oC and 0.3-7.5 % NaCl equ.) and calcite (232-296 oC and 0.5-3 % NaCl equ.) minerals. Measured eutectic temperatures (Te) between -33 to -37 oC correspond to presence of MgCl2 and FeCl2 at the high temperature primary fluid inclusions, whereas eutectic temperature ranging between -49.8 to -55 oC suggest the presence of CaCl2, MgCl2 and KCl at the much lower temperatures. Some Te values ranging between -55.6 – 57.2 °C indicate that hydrothermal solutions may contain small amount of CO2, although this phase have not been observed in the room temperature. Mineral chemistry analysis indicate that magnetite in the Sivrikaya ore contain significant amount of Si (up to 2.97 wt.%). The highest content of the Al, Mg and Ca are in order 1.88 wt.%, 0.64 wt.% and 0.60 wt.%, whereas Na, K, Ti, Cr and Co content are almost below detection limit. In addition, Mn and Ni content also measured in the range of 0.02-0.28 wt.% and 0.01 and 0.12 wt.%. Well defined negative correlation r = 0.89) between Fe and Si have been determined in the magnetite chemistry as an indication of elemental substitution between these elements. This substitution may be evidences of higher portion Si solubility in magnetite minerals in the low temperature environments. Lower Ni and Co content of the magnetite suggest that magnetite in the ore related to the felsic magmatic source. On the other hand low salinity fluid inclusions imply that meteoric water involved in the hydrothermal solutions. Taking into account of low homogenization temperature and low salinity content of the fluid inclusions it is believed that swallow depth of granitic intrusion were responsible for the skarn mineralization in the area.

Key words: Skarn deposits; mineral chemistry; fluid inclusion; Sivrikaya (İkizdere-Rize); Turkey.

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Trace element in three indicator minerals (corundum, chrysoberyl and zircon): application to mineral exploration and provenance of the western Mamfe gem clastic deposits

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ABSTRACT

Trace element abundance in three indicator minerals (corundums, chrysoberyls, and zircons) from the western Mamfe gem placers, as determine by Laser Ablation Inductively Coupled Plasma Mass Spectrometry analytical techniques, are shown to be sensitive to their source rock type, and their crystallization condition. Corundum is dominantly composed of Al (standardized at 529300 ppm), Fe (2496-12512 ppm), and Ti (26 - 7070 ppm). Among element ratios, Fe/Mg (73.0-1107), Fe/Ti (0.6-245), Ti/Mg (1-175) and Ga/Mg (4-90) range into high value whereas, Cr/Ga (< 0.05) is very low. The high Fe (up to 12512 ppm) and Ga (up to 392 ppm) values, and low Mg (2-59 ppm) and Cr (≤ 25 ppm) mostly suggest a magmatic origin for these corundums; although, some are metamorphic affiliated. They were mainly crystallized from a Ga and Fe-enriched aluminous alkaline magma. Chrysoberyl is dominantly composed of Al (standardized at 425000 ppm) and Be (62701-64371 ppm). Iron (7605 - 9225 ppm), Sn (502- 3394 ppm) and Ti (33 to 2251 ppm) are significantly high. Trace elemental values are typical of chrysoberyl crystallized in granitic pegmatite with some being probably sorted from primary tin-titanium ores. Zirconium oxide (ZrO2) is the major elements, standardized at 66.1 wt.% in analyzed coarse-grained zircons. Within the minor elementary suites: Hf (4576-12565 ppm) and Y (48 to 2805 ppm) are significantly high. The trace elementary suites include Th (7.8 to 1565 ppm), U (13.4 to 687 ppm), and ∑REE (50 to 2161 ppm) whose values are significantly low. The calculated (Yb /Sm)N, Ce /Ce*, and Eu/Eu* respectively range from 1.9 to 227.0, 0 to 308, and 0.08 to 1.7. They are Hf-Y-enriched and Hf-Y-REE depleted zircons mainly crystallized in magmatic oxidized environments. They were sorted from granitoids, syenites and kimberlites.

Key words: Cameroon; western Mamfe; gem placer; indicator minerals; geochemistry; genesis; origin.

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Hydrothermal alteration and clay mineralogy of Eocene Canca volcanics (Gümüşhane, NE Turkey)

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ABSTRACT

In the Canca (Gumushane) area, the late Carboniferous Gümüşhane Granitoid consisting mainly of granite, diorite and granodiorite is covered by Eocene Alibaba Formation that starts with basal conglomerates and grades upward basaltic-andesitic volcanic and associated pyroclastic rocks. Alterations are observed in the andesitic lithologies of Alibaba Formation as silicification, argillitization, hematitization and limonitization MINSQ calculations suggest that the most commonly alteration minerals are Fe-chlorite, epidote, K- feldspar and albite in propylitic zone and quartz, sericite and kaolin in the mineralization zone. Zr and Hf is defined as immobile elements in the calculation of the mass changes. The relative (%) and net (g/100g) mass changes calculated using these immobile elements indicate that there is mass loss (m>1) in propylitic, ore zone and all line zone. The increase of concentration in Pb and Au are determined according to both the net and relative mass change calculations. The percent relative increase in Pb and Au elements in the mineralization zone are 2125 % and 2734%, respectively. In addition net mass changes (g /100g) are defined as 74446g/100g and 2114g/100g. Pb and Au are concentrated in the same region at the anomaly maps. As the main clay assemblages were identified kaolinite, illite and chlorite according to altered rock made on the result of X-ray diffraction. Has been identified as non-clay component is quartz, and plagioclase. The amount of illite and kaolinite alteration is increasing closer to the center of alteration. The clay mineral assemblage of the observed hydrothermal alteration in the Canca region, similar to with regard to in lithology, hydrothermal alteration and clay mineral assemblage both Arzular epithermal Au (Gumushane) and Mastra epithermal Au-Ag which showed that Kermut alteration area may be a potential epithermal gold mineralization.

Key words: Canca; Gumushane; alteration; clay mineralogy; mass change; gold.

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Mineralization of Kopuz Fe-skarn deposit (Gümüşhane, Turkey)

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ABSTRACT

Kopuz Fe skarn deposit is located in the NE Black Sea region of Turkey belonging to the Alpin metallogenic province and it is situated about 84 km northwest of Gümüşhane. The Kopuz Fe skarn deposit is contained in carbonate rocks (members of the Late Cretaceous volcano-sedimentary series) and covers an area of ~125 m × 250 m around Kopuz village. The Late Cretaceous (?) aged granitoidic Kopuz pluton has an elliptical metaluminous calc-alkaline body, with long axis trending SW-NE, intruded Late Cretaceous limestones. Mineral paragenesis of Kopuz Fe skarn deposit are determined as diopside, garnet, epidote, quartz, magnetite and hematite, and with lesser pyrite. Pyrite and magnetite formed in the first and second phases. Hematite is decomposed from magnetite and pyrite, and sometimes found as a result of the mafic mineral alteration after second phase. Magnetite is generally massive and sporadically banded with some martitization. Pyroxene is a gang mineral near the granitoid between endoskarn and exoskarn zones. There are fewer amounts of the garnet, epidote and quartz together with pyroxene from endoskarn to exoskarn zones. The presence of anhydrous minerals such as garnet (andradite) and clinopyroxene (diopside) are indicative of prograde stage in the mineralization. On the other hand, presence of hydrous minerals such as epidote indicates that retrograde stage was developed. The type of garnet and clinopyroxene, and abundance of magnetite with minor pyrite suggest that Fe skarn deposit at Kopuz formed under oxidized conditions.

Key words: Skarn; garnet; diopside.

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Mineral and whole rock geochemistry of early-middle Eocene aged I-Type granitoids in the Tavşanlı Zone, NW Turkey

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ABSTRACT

The Tavşanlı Zone which is bordered by the İzmir-Ankara suture at north and rocks of the Afyon Zone to the south is characteristic with WNW-ESE extending widespread intrusive bodies of early-middle Eocene. They are namely, from east to the west, Günyüzü granitoids (~45 km^2; Karacören granodiorite, Tekören granodiorite, Dinek porphiroid granodiorite, Kadıncık granodiorite), Sivrihisar monzonite (~4 km^2), Kaymaz granite (~6,5 km^2), Topkaya granodiorite (~4,5 km^2) and Yürükcaören granodiorite (~1 km^2) which all comprise the Tavşanlı Zone Granitoids. These masses occurring in five different regions are of medium-high K, calc-alkaline, metaluminous, I-type, post-collisional character. The Tavşanlı Zone Granitoids intruded basement metamorphic rocks and are covered with upper Pliocene sedimentary units. Granitoids contain some special textures indicating homogeneous mixing (magma mixing) and heterogonous mixing (magma mingling) of coeval mafic and felsic magmas such as mafic microgranular enclaves (MME) and they are often cut by felsic and mafic dykes. These plutons displaying different mineralogical and textural characteristics are of mostly granite, granodiorite, monzonite/quartz monzonite and quartz monzodiorite composition. The ages of granitoids by K-Ar method are 51.2-59.3 Ma (hornblende), 47.6-52.5 Ma (biotite) and 45.3-54.0 Ma (feldspar) which indicate that post-collisional granitoids in mid-west Anatolia become younger from east to the west. Felsic plutonic rocks contain plagioclase, orthoclase, microcline, quartz, hornblende, biotite, clinopyroxene and trace amount of titanite, apatite, zircon, opaque minerals and secondary chlorite and epidote. Mineral chemistry analysis shows that plagioclases are in albite-labrador (Ab29-98) composition with low-intermediate temperature character. Amphiboles are in calcic composition (mainly magnesiohornblende, chermakite and ferrous chermakite) with Mg/Mg+Fe^{+2} ratios of 0.41 to 0.74. K-feldspar is recorded in the composition of orthoclase and microcline with Or85-99, Ab0-15 and An0-3. Biotites with Fe^{+2}/(Mg+Fe^{+2}) ratios of 0.37-0.60 are typical to calc-alkaline orogenic rocks. Composition of pyroxenes in the Sivrihisar monzonite is between diopside and augite. Emplacement depths estimated from Al-hornblende geobarometer are 4-11 km for Topkaya granodiorite and 9-23 km for the other granitoids. Temperature and pressure ranges found from the amphibole-plagioclase geothermometer are 600-850°C and 1-7 kbar. Emplacement depths corresponding to these pressure values (assuming 1 kb = ~ 3.3 km) are 11-22 km with the exception of Topkaya granodiorite (7-11 km, shallow seated). Pressure values calculated by the Al-hornblende geobarometer are in the range of 9-22 kbar (4-11 kbar for the Topkaya granodiorite).

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Key words: Turkey; NW Anatolia; Tavşanlı Zone; mineral chemistry; geothermometry.

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Trace element and REE geochemistry of the Davulalan Granitoid, northwestern of Central Anatolia, Sivas, Turkey

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ABSTRACT

The Central Anatolian intrusive rocks were subdivided into I-type, S-type and A-type granitoids. Some ore deposits are located within them and/or along the contact zones with carbonate bearing rocks. This study deals with the geochemical characteristics of the Davulalan granitoid (SW Sivas, Turkey) and enrichment of the trace and rare earth elements (REE). Petrographical investigations indicate that this granitoid body consist of an early granitic intrusion and transformation to syenite by alkalis metasomatism. Geochemical data indicate that this plutone has A-type origine and post-collisional emplacement into the region in Palaocene. Flourite, quartz, calcite and little amount of topaz occurences along fissures with stockwork structures besides the recrystallization of the rock forming minerals point out the graisenation processes by hydrothermal fluids. In addition, albitization, sericitization, silification and argillization types of alterations were developped. Galena, chalcopyrite, pyrite, limonite, hematite, Mn-oxide minerals and little amonth of scheelite and native gold occured within the flourite and quartz bearing veins and veinlets. Geochemical analyses showed the enrichments of Pb, Mn, Cu, Zn, W, Mo, As, and Sb. In addition, the rocks have high contents of alkalis, REEs (except Eu), K, Th, U, Zr, and show depletions in Ba, Nb, Sr, P in the spider diagrams; high ratio of Fe2O3/MgO. Mass change calculation by isocon analysis showed that granitic rocks have 58% mass gain and 6% mass loss, syenitic rocks have 30% mass gain and %23 mass loss. Quartz-monzonite, highly metasomatic rocks and vein rocks have only mass gain 20%, 61% and 98% respectively. These results indicate that mass gain and mass loss occurred during the hydrothermal alteration of the rocks. Hydrothermal fluids caused sericization, silisification and enrichments of metals and REEs (granitic rocks except). Enrichment of metals and REEs in quartz monzonitic and higly metasomatic rocks were controlled by Na-metasomatism and chloritization processes.

Key words: A-type granitoid; post-collisional magmatism; REEs; trace element; mass change; hydrothermal alteration; Sivas-Turkey.

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Petrographical and petrochemical characteristics of Kütahya (Western Anatolia, Turkey) area Miocene volcanics

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ABSTRACT

In Western Turkey, considering the extensive volcanism and the main compressional-extensional tectonics, a close relationship can be established. In the Kütahya area within the horst-graben structure, effective and widespread volcanic activities that started in the Eocene and even continued in the Holocene are in question. Calc-alkaline volcanism was effective and volcanic rocks occurred such as and latite, dacite, rhyolite, trachyandesite during the Upper Oligocene-Middle Miocene. Andesitic lava flows and tuffs are widespread among them. Volcanism in Kütahya and surrounding areas took place in the Neogene lakes containing lignite and borate bearing deposits. Therefore, it can be suggested that volcanism started in the Miocene around Kütahya area. Miocene basaltic-andesitic lava flows in Kütahya area are examined in Örenköy, Kızılkayatepe and Fındıkköy areas. The studied volcanics are generally represented by greyish black coloured andesite, trachyandesite, basaltic andesite and basaltic trachyandesite. The rocks show generally hyalomicrolitic, microlitic porphyric, hyalomicrolitic porphyric and rarely glomeroporphyric and sieve textures. The volcanic rocks contain plagioclase as phenocrysts and microlites, olivine, augite and biotite as phenocrysts, opaques and glass. They also exhibit disequilibrium crystallization textures such as oscillatory zoning, sieve texture and corrosion in plagioclase phenocrysts. The studied volcanic rocks exhibit alkaline to calc-alkaline affinity with high-K to shoshonite in character. Major oxide and trace element Harker variation diagrams indicate augite, plagioclase, biotite, Fe-Ti oxide and apatite fractionation during the evolution of the rocks. Besides, they have high LILE (Sr, K_2O, Rb, Ba) and LREE (La, Ce), and low HFSE (Nb, Zr, Y, TiO_2) contents, revealing an evolution from parental magma(s) derived from enriched lithospheric mantle. Furthermore, the volcanic rocks have evolved by dominantly fractional crystallization and lesser assimilation ± magma mixing processes.

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Key words: Western Anatolia; Kütahya; calc-alkaline volcanism.

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Main types of weathering crust of the east of the Russian plate and its mineralogical-geochemical characteristic

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ABSTRACT

The long continental period in the east of Russian plate (the upper Proterozoic – the middle Devonian) caused formation of the weathering crust on the crystalline basement rocks. Over the weathering crust is blocked by rocks of a sedimentary cover of Devonian, Carboniferous, Permian and Cainozoic age with thickness from 1500 to 2500 m. In the geological and tectonic relation the research area is localized within the Tatar arch - massive structure of the east of the Russian plate. The object of the research is geological and core material of the numerous deep wells drilled within the territory of the Tatar arch. Data of the research testify that weathering crust formation proceeded as a result of consecutive change of weathering processes: disintegration, hydration, leaching, hydrolysis, oxidation. Therefore, zonal distribution of the crust is established on existence and transition from the bottom up a profile of weathering zones that are various on a mineral and chemical composition: disintegration, cementation, hydration and leaching, oxidation, zone of secondary hydration. Migration of some components on a weathering profile is also established. For example, in the top zones there was an aluminium oxide accumulation and carrying out of iron, alkaline and alkaline earth metals. Other feature of the core formation of this region is development of an incomplete core profile which is in most cases presented only by the lower zones. In pre-Devonian time due to the washing-out and the subsequent processes of redeposition of substance two types of weathering crust were formed: displaced and non-displaced. As a result the thickness of areal crust with the reduced weathering profile varies for different sites of the Tatar arch: from 1,0-5,0 m in the central parts to 20,0-25,0 m on the periphery of the Southern Tatar arch. Development of the linear type of the weathering crust with a thickness more than 50,0 m is also indicative for this region and is connected with zones of the basement faults of various degree. The widespread weathering crust of the crystalline basement of the east of Russian plate is the unique object for studying of the mineral forming processes of ancient weathering. Such crust contains an important information which can be used for climatic, tectonic and geographical reconstruction of the past of the earth crust. Besides, rocks of the weathering crust have higher filtration and capacitive properties and oil evidences that allows to refer them to nonconventional reservoir zones of big depths. Complex mineralogical and geochemical studying of the weathering crust is of an important practical value for creation of full picture of development of deep horizons of earth crust and forecasting of mineral deposits.

Key words: Weathering crust; crystalline basement; Tatar arch.

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Assessment of the CO_2 storage potential in the Mesohellenic trough, NW Greece, through geochemical modelling

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ABSTRACT

A useful way to study geochemical processes, linked to CO_2, water and rock reactivity is through geochemical modelling applied to the lithology encountered in the Mesohellenic Trough (MT) in NW Greece. The MT is a basin with a length of over 200 km and a width of 30-40 km in NW Greece. It is characterised as the largest and most important basin of the last orogenic stage (molasse basin) of the Hellenides. The associated batch reactor experiments that were run, provide us with further insight into the processes involved and a better understanding of these geochemical processes. Preliminary results show that we have perfect correlation between analysed and calculated values of total inorganic carbon (TIC). After CO_2 injection, chlorite, anorthite and anorthoclase are being dissolved. Dolomite, muscovite and calcite precipitate and illite and magnetite do not react. Possible secondary minerals, formed after reaction of sandstone with the solution, such as $Al(OH)_3$, kaolinite, $Fe(OH)_3$, and goethite, may also precipitate. Current work includes the carrying out of inverse modelling. Simulations of the reactions with NaCl 0.5M fluid are mixed with the sandstone sample, prior to CO_2 injection. Only the initial mineral phases are used as reactants. We expect to obtain qualitative results of the possible dissolution reactions. In this context, we expect only dissolution/precipitation reactions and no cation exchange, oxidation or sorption to take place. Further studies will focus on the simulation of chemical reactions and transport processes in the prevailing autoclave experiment. More precisely, in the mineralogy field, we plan to carry out also 2 sets of XRD analyses aiming at mineral identification and the use of the Rietveld method for quantitative determination of each mineral phase in the sample. We will also use electron microscope with micro-analysis (SEM-EDS) to verify the mineral phases and to obtain a chemical determination of each mineral phase. The findings will be correlated with the determined mineralogy of the samples, carried out by XRD and SEM analyses.

Key words: Geochemical processes; CO_2 storage; modelling.

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The origin of analcime phenocrysts from the Kalecik ultrapotassic alkaline rocks, Ankara, Central Anatolia, Turkey

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ABSTRACT

The Kalecik region, located in the northeast part of Ankara city (Central Anatolia, Turkey) consists of ultrapotassic volcanic rocks carrying analcime phenocrysts. Analcime is very abundant in samples and occurs as globular crystals up to 2 cm in diameter in some samples. The electron microprobe analyses for clinopyroxene, mica and analcime are presented for these rocks. The clinopyroxene-liquid compositions yield temperatures between 1110 °C and 1160 °C and estimated crystallization pressures are in the range 5.4-6.3 kbar for these rocks. These pressures correspond to crystallization depths of 20-23 km. However, the mineralogical, microstructural and geochemical investigation of these analcime phenocrysts indicate that they are of secondary origin. Although the euhedral shapes of these analcime crystals and the fresh host rock sign a primary origin, the absence of other hydrous minerals such as amphibole, mica in the samples reinforces the idea of secondary origin. In order to support this opinion, I examined the freshly fractured surfaces of analcime crystals by scanning electron microscopy (SEM). All of them have a characteristic microporous texture supporting a secondary origin. Besides this, geochemical signatures of the Kaleceik ultrapotassic rocks are interpreted to be of secondary origin and formed by the transformation of leucite to analcime (analcimization). This analcimization process causes changes in the K_2O/Na_2O ratio and fractionation of LILE. During this alteration, an increase of LOI and Na_2O and a decrease of K_2O and Rb contents occurred. Troughs at K and Rb in spider diagrams, low K_2O/Na_2O and elevated Na_2O contents are apparent in these analcime bearing ultrapotassic volcanic rocks, an effect expected from analcimization. Based on these signatures, it could be revealed that the analcime phenocrysts of Kalecik ultrapotassic volcanic rocks are formed by ion-exchange processes from leucite.

Key words: Analcime; ultrapotassic rocks; origin; Kalecik; Ankara; Turkey.

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Geochemical comparison of Cappadocia (Nevşehir) ignimbrite and Hatunsaray (Konya) ignimbrite

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ABSTRACT

Very severe volcanic events had been occurred in the Central Anatolia region since Middle Miocene and as a result of these various types of products of these activities covered a wide area. These Miocene volcanism is observed around Afyon, Kırka, Konya, Nevşehir, Kayseri and Ankara. Besides that Quaternary volcanism is observed around Ceyhan, Karapınar, Hasan Mountain, Acıgöl and Erciyes Mountain. Andesitic and dacitic type of lavas, s, tuffs and quaternary aged volcanics has been formed at Middle Miocene- Quaternary period in Central Anatolia region. Cappadocia ignimbrites (Kavak, Zelve, Sarimaden, Damsa, Cemilköy, Tahar, Gördeles, Sofular, Topuzdağ, Kızılkaya, Valibaba İgnimbrites) had been formed Upper Miocene and Pliocene violent explosion of the volcano Mount Erciyes, Hasandağı, Acıgöl. Hatunsaray ignimbrites had formed by andesite, dacite, riyolite type lavas and pyroclastic which had been created by Miocene, Pliosen Erenlerdağı volcanism in the western Konya.

In this study, Hatunsaray ignimbirite and Cappadocia, classification diagrams and tectonic discrimination diagrams have been drawn and they bare compared to each other geochemically. According to the geochemical analyzes of the ignimbrite samples in the region are subalkaline and calc-alkaline character. Hatunsaray s are described as andesite, dacite, rhylolite composition according to $Na_2O + K_2O$ -SiO_2, Cappadocia ignimbirite are described as rhyolitic and dacitic composition. According to geochemical data Cappadocia and Hatunsaray ignimbrite are observed VAG (volcanic arc granite) + syn COLG (collision granite) areas in the Rb - Y + Nb and Nb - Y tectonic discrimination diagram Cappadocia and Hatunsaray ignimbrites are LREE rich in Chondrite-normalized rare earth element diagram. This enrichment is common in calk-alkaline.

Key words: Ignimbrite; Cappadocia; Hatunsaray, geochemistry.

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Petrographical and geochemical features of the enclaves and their relation to the dacitic host rock and alkali basalt in the Yükselen area, NW Konya-Turkey

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ABSTRACT

The Neogene volcanic rocks are represented by the OIB-type sodic alkaline basalt and enclave-bearing, metaluminous, orogenic-type calc-alkaline dacite in the Yükselen area, NW of Konya, Turkey. The basalts are slightly olivine and clinopyroxene-phyric, but dacites are strongly porphyritic with phenocrysts of plagioclase, quartz, biotite and amphibole. The mm-dm sized enclaves are oval-shaped and have sharp contacts with the host rock dacite. According to textural features and mineral contents, the enclaves can be separated into at least two types as cognate enclaves and magma mixing/mingling enclaves or mafic magmatic enclaves (MME). The cognate enclaves have medium-grained igneous texture. They are holocrystalline, and consist of plagioclase + clinopyroxene + opacitic (pseudomorphic) amphibole + biotite ± orthopyroxene + apatite and opaques. On the other hand, MME are fine-grained, and contain amphibole + plagioclase ± quartz + apatite + opaques. Acicular apatites, quartz ocelli, resorbed and zoned plagioclases typify this type of enclaves. The MME are basaltic andesite, but cognate enclaves are trachyandesite according to TAS (total alkali vs. silica) classification scheme. Both are calc-alkaline and metaluminous in character. Both enclaves are characterized by orogenic-type incompatible trace element patterns with high LILE/HFSE ratios and negative Nb-Ti anomalies in N-MORB-normalized diagram, resembling to their dacitic host rocks. The basaltic rocks in the investigated area and enclave-bearing dacitic rocks have different major element characteristics and variable incompatible trace element patterns and ratios (i.e., Nb/Zr, Zr/Ce, La/Zr, Rb/La), suggesting that the dacite and its enclaves cannot be derived from associated basalts via fractional crystallization and/or magma mixing/mingling processes.

Key words: OIB; dacite; calc-alkaline; enclave; magma mixing/mingling.

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Petrological geodynamic model for evolution of the crystalline basement of the Eastern Russian plate

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ABSTRACT

East of Russian plate is a typical platform area of the Earth crust. Geological, geophysical, seismic studies show active geodynamic processes within the region. Due to the active geodynamic processes subhorizontal tension is formed in the crystalline basement rocks. It leads to subhorizontal displacements – “disruption” of large blocks of rocks which are associated with occurrence of decompressed zones – zones of destruction. Formation of destruction zones in the Eastern Russian plate is associated with the general course of platform formation. According to geodynamic, mineralogical and petrological studies of deep and ultra-deep drilling there are the following stages of geodynamic development of the region: I. Initial (nuclear) stage. Formation of primary protocrust folded by poorly differentiated ultramafic material, which was later transformed by high temperature metamorphism (Katarchean period). II. Stage of the early differentiation and occurrence of aluminous and mafite silicate strata. There was an active developing of sialic crust by products of internal mantle differentiation (Archean period). III. Stage of the late differentiation and granitisation under inhomogeneous thermal field through active processes of heat and mass transfer in deep horizons (Late Archean, Proterozoic periods). IV. Stage of consolidated basement development. At this stage there was inception of extensive rifts limited by regional faults. As a result, stable basement elements - Tatar arch and Perm-Bashkir arch were jammed between the rift zones. Lowering of rift zones by system of inclined faults contributed to the horizontal stress and “disrupt” of individual plates of the basement. This was the cause for destruction zones – zones of compression and decompression. In the future, in times of geodynamic activities there was a renewal of these zones in the next Caledonian, Hercynian and Alpine tectonic genesis.

Key words: Crystalline basement; geodynamic processes; destruction zones.

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Morphology and radiation-induced centres of technogenic gypsum

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ABSTRACT

Gypsum crystals were formed from a saturated solution of produced water remaining in the horizontal section of the discharge pipe and cause undesired (side) man-made phenomenon as clogged pipe. However, for scientific purposes, this fact has become a unique and revealed the typical defect centres, and study the effect of thermal and radiation effects on the crystal structure gypsum. Single crystals of gypsum at room temperature may gradually lose water of crystallization. Its absence is compensated by the change of coordination number, calcium, and sulphur, which leads to the formation of point defects, which become paramagnetic during irradiation. It was found that the morphology of single crystals of gypsum corresponds to setting I2/a monoclinic system. The faces of the crystal are allocated on a well-developed cleavage plane (010) perpendicular to the axis b. Face, elongated along the [100] direction, was used to identify the orientation of the crystal in the resonator of electron paramagnetic resonance (EPR) spectrometer. In this paper, parameters of the spin Hamiltonian of paramagnetic centres and their models in a crystal of technogenic gypsum were presented. They are suitable for reliable ESR dating and reconstruction of the environment.

Key words: Gypsum; annealing; electron paramagnetic resonance; X-rays; ion-radicals.

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Features of structural changes like travertine barite influenced by X-ray irradiation and thermal exposure

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ABSTRACT

Results of research travertine - like barite by the electron paramagnetic resonance (EPR) are presented. The growth of these crystals was held in continuous motion of gas-water solutions at a constant radiation exposure of nuclei 226Ra, 232Th, 40K. The objective of this work was to identify the crystal-structure features travertine - like barite associated with growth conditions and influence of radiation exposure. Radiographic studies barite samples have shown that the aggregates are virtually monomineral formations. It has a compressed unit cell lower volume and higher density compared with the parameters sedimentary barites. In the natural sample of barite was fixed only weak lines of the EPR spectrum of the ion-radical SO2-. Therefore, laboratory experiments were carried out with X-ray ionization of samples, not only the original rock, but also samples exposed to thermal annealing. EPR spectra of the following ion radicals: O- (gxx =2.0186; gyy =2.0121; gzz =2.0093), SO2- (gxx =2.0033; gyy =2.0126; gzz =2.0105) and two type - SO3- (I)(gxx =2.0034; gyy =2.0024; gzz =1.9995), SO3-(II)(gxx =2.0076; gyy =2.0022; gzz =1.9979) were detected after X-ray irradiation. The intensities of the lines of the observed EPR spectra ion radicals change with the annealing temperature. Paramagnetic centers form an integrated system with the structure of the crystal. Within the system, is observed the transfer of electrons and holes.

Key words: Travertine barite; electron paramagnetic resonance; X-irradiation; annealing; ion-radicals.

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Soil geochemical prospection for possible gold mineralization in the Canca alteration area (NE Turkey)

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ABSTRACT

Canca (Gumushane-Turkey) alteration area is situated at the Black Sea Tectonic Unit in east-northern Turkey. This region hosts several epithermal gold deposits. Study area is located in 10 km of West of Gümüşhane and high degree alteration is observed in the area. Because of the presence of intensely alteration and acidic to neutral intrusions in the area, it was thought that the region has an important potential for epithermal gold mineralization. Objective of this study is to use soil geochemistry surveys with tested using various statistical methods for the exploration of possibly buried gold mineralization in the area. For this purpose, 196 soil samples were collected from the B horizon in the area and were analysed for 12 elements (Mo, Cu, Pb, Zn, Ni, As, Au, Ag, Ba, Co, Rb, Sr). Element concentration of soil were ranged from 0,9 to 49,98; 0,33 to 41,34; 1,99 to 224,50; 20,87 to 189,69; 5,97 to 199,947; 0,38 to 26,71; 0,1 to 28,948; 0,02 to 2,85, 0,68 to 20,20 and 13,68 to 857 respectively for cobalt (ppm), nickel (ppm), copper (ppm), zinc (ppm), arsenic (ppm), molybdenum (ppm), silver (ppm), cadmium (ppm), gold (ppb) and lead (ppm). Gold contents were detected in low value and has no correlation with other elements. However, it was observed high positive correlation between Cu and Co, Zn and Co; Zn and Cu; Mo and As; Cd and Zn. In general meaning, Cu, Zn, As and Mo were widely used as pathfinder elements for exploration gold mineralization. So this elements were accepted pathfinder elements for gold in this study. And also some statistical procedures such as factor analysis were applied to elements in soil. The obtained data confirmed the results above. The anomaly map for these element were prepared. In the anomaly maps for pathfinder elements were observed remarkable zoning for pathfinder elements in west part of the study area with related to tectonic lines. It was concluded that this part in area needs to be investigated in detailed with geophysics and drilling methods.

Key words: Soil geochemistry; gold mineralization; alteration area; Gümüşhane.

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Mineralisation in Ghar Roubane (Ouest Algeria)

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ABSTRACT

The Ghar Roubane Ba (Pb-Zn) district, western Algeria, includes mineralized veins in the Palaeozoic basement and in the Liassic carbonates cover. The purpose of this study is to highlight the relationship between Ba mineralization occurring in the basement and cover by combining geologic, tectonic, mineralogical and fluid inclusion studies. This region is characterized by horst and graben structures and comprises deformed Palaeozoic sedimentary and magmatic rocks overlapping by Mesozoic sediments. The Palaeozoic basement rocks contain mineralization occurring as veins, veinlets and disseminations. Two ore fields have been identified: (i) Beni Abir, comprising Ba and Cu -Pb sulphides; (ii) Beni Snouss, containing Au, Pb-Zn and Ba – Pb-Zn deposits. The Liassic carbonate platform sequence contains Ba (Pb-Zn) sulphide deposits occurring mainly as strata bound, and open space filling. Thermometric investigations indicate that homogenization temperatures (Th) for primary and pseudosecondary fluid inclusions performed in the barite from basement and Liassic carbonate cover range from 130-160°C; whereas those for primary fluid inclusions in quartz range from 120 to 225°C. The mean salinities measured are 15 and 21% equivalent NaCl for fluid inclusions in quartz and barite, respectively. Interpretation of these data in their geologic context favours a mixing process between a predominant basinal fluids and basement fluids.

Key words: Barite; fluorite; mineralization; Pb; Zn; basement; carbonate; fluid inclusion; Ghar Roubane; Algeria.

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Major and trace element geochemistry of the Seydişehir Formation in the Fele (Şarkikaraağaç-Isparta) and Seydişehir (Konya) areas, SW Turkey

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ABSTRACT

Metapelite (MPL), metapsammite (MPS) and metamarl (MM) samples from the Cambro-Ordovician Seydişehir Formation in the Çaltepe and Fele areas were analysed for major, trace and the rare earth elements (REE) to investigate their geochemical distributions. The bulk-samples of the Çaltepe and Fele MPL, MPS and MM rocks contain high Al_2O_3 (11-19 wt. %), intermediate SiO_2 (53-74 wt. %), and a wide range of Fe_2O_3 (2.16–11,61wt %) and TiO_2 (0.46–1.77 wt %), but low Na_2O (0.89-1.58), CaO (0.67-3.42) and K_2O (1.84-4.02) (Table 2). The partially low values of the alkaline and alkaline earth element point to the considerable source area weathering, in a good agreement with the moderate to high CIA and CIW values. Except for Ba and Sr, the other LIL elements, especially Th, La, Ce and Rb display strong positive correlations with Al_2O_3 that their distributions are mainly controlled by phyllosilicate phase. Positive correlation between Sr and CaO in the all sample suites points to the presence of Sr is related to carbonate mineral phases. In contrast, Ba has negative or no correlation with Ca and Mg that its abundance is not controlled by carbonate phases in especially MM and MPS sediments. Almost transition trace elements (TTE) are positively correlated with Al_2O_3 in the all sample groups. The strong correlations were determined between Al2O3 and those of Sc, Cr, Ti, with exception of the MPS) and V indicative of they are mainly concentrated in the aluminosilicate phase, Cr- and partially Ti-bearing minerals. The total REE abundances of the MPL and MPS sample groups are higher than those of the MM, PAAS and UCC. Chondrite-normalized REE patterns of the all sample groups show the typical sub parallel LREE-enriched and relatively flat HREE pattern with negative Eu anomalies as similar to those of the PAAS and UCC. The higher REE contents of the MPL and MPS sample suites and the wide range of TiO2-Zr ratios indicate that the recycling and sorting processes in the Çaltepe and Fele source areas were probably more intense than in the both PAAS and UCC. REE also show strong positive correlation with mainly Ti, Cr, Al and K, suggesting their possible association with clay fraction, Ti- and, Cr-bearing minerals. The statistical data show that almost all trace elements are positively correlated with Al, Fe, and Ti, but negatively correlated with Mg, Ca, Na and some trace elements like Hg, Ba and Sr. This geochemical phenomenon suggests that the distribution of them are probably controlled mainly by clay fraction, Fe- and Ti-bearing minerals such as hematite, magnetite, pyrite, titanite, tourmaline, and topaz.

Key words: LILE; TTE; HFSE; REE; geochemistry; Seydişehir-Fele (Konya-Isparta); SW Turkey.

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Stratigraphy, geochemistry and genesis of the manganiferous nodules in Carletonville area, North West Province of South Africa

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ABSTRACT

The Carletonville manganiferous ore-deposit is a Neogene weathered nodule deposit which developed on the Early Proterozoic Malmani dolomite succession of the Transvaal Supergroup in Carletonville area, North West Province of South Africa. The deposits were formed from surficial weathering of the underlying Mn-rich dolomites of the Malmani Subgroup and some formed from weathered Mn-Fe rich Tertiary alluvial-fluvial sediments. These deposits are now mineralized and hosted within the modern Mn-Fe rich soil profiles and exposed directly on shallow surface, thus the ore is suitable to be mined by open cast mining. The study herein was carried out in an open cast mine where there is access to open exploration pits which enables easy sampling and field measurements. The study dealt with stratigraphy, mineralogy, geochemistry, diagenesis and the origin of the ore deposit. Mineralogical analysis with X-Ray Diffraction and petrographic study indicates cryptomelane (KMn8O16) as major manganese constituent, whereas pyrolusite occurs as minor manganese mineral in the mine. Other mineral phases include hematite, clay minerals, muscovite, quartz, calcite, limonite with minor amount of heavy minerals and they form gangue minerals. Based on the geochemical studies, different manganese classification schemes were adopted in this study and inferences were made from geochemical data which indicated supergene and hydrogenous source for the Carletonville manganiferous nodules suggesting precipitation from weathering residues of Malmani dolomite at passive continental margin, with temperate and hot to humid climatic conditions. The stratigraphic profile of the manganese ore-deposit was subdivided into 8 zones, namely the (A, B, C, D, E, F, G, and H) zones from the surface downwards. On the basis of variation in mineralogical and chemical composition, nodule grain sizes and the zonation colour, the above mentioned zones were further integrated into the Upper (A and B), Middle (C, D and E) and Lower (F, G and H) Zone, with the I zone, the basement zone, representing the underlying Malmani Subgroup stromatolitic dolomite. The Upper Zone represents organic rich, fine grain silty soil which caps the stratigraphic succession in the mine area. Mineralogically, these zones are depleted in manganese and comprises of hematite, kaolinite, micas and quartz grains, with Mn-Fe coated terrigenous clasts concentrate at the lowermost portion of the B-zone along the contact with the underlying zones. The Middle Zone is characteristically medium-fine in grain sizes with reddish colour due to intense weathering of iron minerals to hematite and is depleted in Ca, Na and Mg bearing minerals as a result of dissolution and leaching and is highly concentrated in quartz and caliche fragments. The Lower Zone is coarse grained with dark, reddish-brown colour. The Middle and Lower Zones comprise mainly of Mn and Fe oxides, clays, quartz, limonite, micas and caliche patches. The concentration of manganese is however, not consistent in these zones from one borehole to the next, it deviates with topography and depth. The overall stratigraphic succession in the mine area can be described as characterizing of basal stromatolitic dolomite of the Malmani Subgroup, overlain by zone of black, powder-like manganiferous wad which is in turn overlain by weathered Mn-rich Tertiary alluvial-fluvial sediments hosting manganiferous nodules. The whole succession is covered by Quaternary sands.

Key words: Stratigraphy; geochemistry; genesis; Mn nodules.
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Preliminary rare earth element geochemistry of the shales and limestones of the Keana area, middle Benue trough, Nigeria

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ABSTRACT

A preliminary rare earth element (REE) geochemical study of shales, noodles and limestones from the Asu River Group, the Awe Formation, the Ezeaku Formation and the Agwu Formation in the Central Benue Trough was carried out with a view to determining the provenance and depositional environment of the formations. A total of seventeen (17) samples were collected and geochemically analysed using Inductively Coupled Plasma Mass Spectroscopy (ICP-MS. The chondrite-normalized REE plots show enrichment in the LREE over the HREE and negative europium (<1) and positive cerium (Ce/Ce*) (>1) anomalies for all the rocks analysed. This is an indication that they were formed from intermediate to felsic igneous provenance under anoxic conditions. The results obtained from this study are similar to those obtained on shales and limestones in the Northern, and Southern Benue Trough, Nigeria.

Key words: Middle Benue trough; rare earth element; provenance; anoxic environment.

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Major and trace element contents in coaly units of the Pliocene Dursunlu Formation (Ilgin – Konya, Turkey)

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ABSTRACT

The study area is located in eastern Ilgın, Konya – Turkey. The purpose of this study is to characterize the major and rare element contents in the coaly units in northern Ilgın (Konya – Turkey). Pliocene Dursunlu Formation, which is characterized by sandstone, siltstone, marl, mudstone and coal in the region. Lignite layers where coals are found and has a varying thickness between 100 – 300 m. Dursunlu Formation coal samples have high contents of trace elements. Si, Al, Fe, Mg, Ca, Na, K, Ti, P, Mn, Cr of the major elements and Ni, Sc, Be, Co, Cs, Ga, Hf, Nb, Rb, Sn, Sr, Ta, Th, U, V, W, Zr, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Er, Yb, Mo, Lu, As of trace elements were found to be more enriched with respect to world coal. Remainder elements are either lower or equal to the average values of elements in coaly units of Dursunlu Formation. Among the trace elements considered to pose a threat to the environment and human health following values were determined, average As 93,95 ppm, Be 2.37 ppm, Cr 2.99% , Hg 0.10 ppm, Mn 0.02%, Mo 1.35 ppm, Ni 21.06 ppm, P 0.01%, Th 8.96 ppm, U 5.46 ppm, V 26.98 ppm, Zn 8.89 ppm, Ba 126.40 ppm, Co 8.68 ppm, Sn 3.24 ppm.

Key words: Dursunlu Formation; Ilgın; coal, Pliocene.

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Organic facies characteristics of the Triassic Ispartaçay Formation, Antalya Nappes, western Taurus, Turkey

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ABSTRACT

In the Antalya Nappes (SW Turkey), the Triassic Ispartaçay Formation consists of radioaria, chert, turbiditic limestone and sandstone. Detailed data from thick Triassic sediments (Ispartaçay Formation) made it possible to construct an organic facies framework using different zonations. Organic matter is composed predominantly of woody material, with a minor contribution of planty and amorphous material. Kerogen in the deposits is type III, as indicated by organic petrographic observations and Rock-Eval data. Total organic carbon (TOC) values are generally between 0.16 and 1.36 %, but reach 5.24 % in the formation. Tmax values vary between 331 and 602 0C, confirming the increase in maturation trends indicated by vitrinite reflectance data. Organic facies type D was identified in the investigated units. Organic facies D is related to sandstone and limestone lithofacies. This facies is characterized by average values of HI around 19 (equivalent to type III kerogene), TOC around 0.85 %, and an average of S2 of 0.19 mg HC/g of rock. The organic matter is highly oxidized, decomposed and reworked. Organic facies D is nongenerative.

Key words: Western Taurus Belt; Antalya Nappes; organic facies; organic geochemistry; rock-eval.

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The environmentally significant element contents of Eynez-KM2 Coals in Western Anatolia, Turkey

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ABSTRACT

Coal is one of the most significant energy sources in many countries such as Turkey. Coal deposits of Turkey especially located in Western Anatolia are important. Eynez (Soma-Manisa) coal field is located within Western Anatolian extensional province characterized by numerous E–W grabens and NNE-trending basins. The lower coal seam (Eynez-KM2) in the Soma formation from the southern part of the Eynez coal field is of Lower-Middle Miocene age and was deposited in alluvial fan to ephemeral lacustrine and forest lower mire system, resulting in a lignite-subbituminous coal, which averages thickness of ~25-30 m and the field is planning to be mined by underground method. A series of experiments on 30 coal samples from Eynez-KM2 seam was carried out to determine the content of major and trace elements. 60 major and trace elements were determined as the result of these experiments. The mode of occurrence of major and trace elements in coal are an important factor influencing the behavior of the element during mining, coal-fired power plants, domestic and industrial coal combustion in cities. The ranges and arithmetic means of concentrations of these elements were compared with Upper Continental Crust (UCC), World and Turkey coal values. Results showed that some environmentally sensitive elements in the coals of Eynez-KM2 are highly enriched: As (77.29), V (60.98), Cu (17.29), Ba (233.87), Pb (11.05), Th (4.06), U (20.36), Ni (10.72), Mo (2.20), Hg (0.12); of which As, Hg, Pb, Ni, Th and U are identified potentially Hazardous Air Pollutants (HAPs).

Key words: Coal; trace elements; environmental impact; Eynez-KM2 seam; Western Anatolia.

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Possibility of mineral determination by visible spectra - an application of colour measurement

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ABSTRACT

To inquire possibility of the spectral-reflectance spectrum was examined as the technique of performing non-destroying mineral species specification at the spot. Colour measurement of various samples some was performed using colorimetry. Samples are reagents and standard samples, such as a argillitei.e., quartz, common feldspar, sodium feldspar, white mica, calcite, hematite, magnetite, Limonite, a sulphide of iron, calcium sulfate, kaolinite, bauxite, Calcium carbonate, sodium sulphate, red iron ore, limonite, aluminium sulphate, sodium chloride, sodium hydrogensulphate, potassium alum, the salt extracted to the oval monastery, moss adhesion rock extracted to the oval monastery, salt extracted in Yoshimi-hyakuana. In order to examine the possibility of mineral specification by a colour spectrum, (1)To measure colour of a standard sample.(2) To measure colour of the mineral extracted on the spot.(3)To specify minerals by another methods, such as SEM-EDS and XRD. After the examination it turned out that the spectrum of the sample extracted on the spot and the spectrum of a corresponding standard sample are very alike. It was also suggested that the colour spectrum can describe a very small quantity difference, more than the L*a*b* value. It is concluded that the spectrum reflectance spectrum that specification of a mineral kind is possible. However, there are many subjects, such as construction of a database and examination of an error of measurement.

Key words: Colour measurement; visible spectra.

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Role of soil organic matter on the potential denitrification of volcanic ash soils in Chile

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ABSTRACT

Nitrous oxide (N_2O) is a major greenhouse gas that contributes to global warming. There is little information on N_2O emissions from volcanic soils of Chile. Preliminary results show that soils under grassland have low N_2O-N emissions, ranging between 0.1 and 0.4% of N added. This could be associated to the expression of total denitrification in these soils, i.e. N_2 instead of N_2O, associated to soil organic matter (SOM) and N cycle characteristics. Thus, the aim of this study was to understand the effect of soil organic matter and its physic-chemical-biological properties on the denitrification process in Chilean volcanic soils. To assess the role of soil organic matter concentration, 100 g of sieved and dried soil was placed in 1 L glass jars specially adapted for gas collection, and incubated for 28 days. We tested five soils with SOM ranging from 4 up to 45 g 100 g-1, in combination with three soil water holding capacities (70%, 80%, 90%, WHC), and the addition of N (KNO_3) and carbon (C, $C_6H_{12}O_6$) amendments (0, 200, and 600 kg N and C ha-1 equivalent, alone or in combination) (n=5). Nitrous oxide was determined in a Clarus 600 gas cromatograph, fitted with ECD and autosampler (HeadSpace Turbomatrix 40-110, Perkin Elmer), and while N2 was determined in an Autosystem XL equipment fitted with TCD (manual injection). Gas samples were collected from individual jars periodically during the experimental period. Parallel determinations included soil available N (NH^{4+}, NO^{3-}), soil available C (soluble carbohydrates), and molecular determinations (denitrification gens expression). Results were analysed by ANDEVA using Genstat 12.2 as statistical software ($p<0.05$). Results showed an interaction between SOM concentration, WHC and N and C amendments on N_2O and N_2 emissions, with increasing fluxes up to SOM of c. 20 g 100 g-1 ($p<0.05$). The N_2O/N_2 ratio was also related to SOM concentration, suggesting that in soils with low SOM (<10 g 100g-1) partial denitrification would be the main pathway, while in soil with high SOM (c. >20 g 100 g-1), total denitrification would predominate. When no amendments were applied, the N_2O/N_2 ratio decreased with increasing WHC, suggesting a transformation from partial to total denitrification. The addition of either N or C resulted in a similar decreased, associated to a higher NosZ gene expression. Nevertheless, when N and C were added simultaneously, a higher N_2O/N_2 ratio, was observed associated to soil available N and soluble C availability and its effect on bacteria abundance. High SOM soils had a lower N or C consumption rate, associated to the relatively low natural soil available N and C pools, and thus, limited bacterial activity. Results suggest that the impact of N and C availability on N_2O and N_2 emissions could mask the role of SOM on these processes for Chilean volcanic soils under grassland, so that the agricultural management of these soils would be more relevant for N_2O emissions than the original soil physic-chemical characteristics.

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Organic geochemical and organic petrographic characteristics of Miocene coals of the Eastern Anatolia (Çayirli-Erzincan), Turkey

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ABSTRACT

This study provides organic geochemical and organic petrographic data on Tertiary subbituminous coal of the Çayırlı area, eastern of the Erzincan, Turkey. The investigated area is one of the best examples of a continental collision zone in the world and located in a North-south converging collision zone between the Eurasian and the Arabian Plates. Tertiary sedimentary units occupy a significant part of the geological features. Around Çilhoroz-Çayırlı, the average thickness of the coal seam is approximately 4 m and this is currently being exploited via open-cast mining methods. Rock-Eval analysis results show type II/III and III kerogens. The T_{max} (^{o}C) values range between 426 and 432 ^{o}C, with an average value of 428 ^{o}C, indicating that the samples are immature to early mature. The high proportions of long chain C_{27}-C_{31} *n*-alkanes relative to the SOM contents of the *n*-alkanes are typical of higher terrestrial plants, while short chain *n*-alkanes (<C_{20}), detected in minor amounts, occur predominantly in algae and microorganisms. The organic geochemical data (TOC) of the studied coaly and organic-matter-rich samples indicate the presence of sufficient organic matter and that these are of the appropriate type, but that the rocks are characteristic of the early-mature and diagenetic stages. All parameters indicate a low-grade transformation of organic matter as a consequence of unsufficient burial. Thus, this coals was classified as subbituminous, corresponding to a low rank coalification. Petrographic analyses of investigated coals are show that the humic coals have high huminite contents, relatively low liptinite contents, and low inertinite contents. The most abundant macerals of the huminite group are ulminite, densinite and gelinite, and of the liptinite group, sporinite and resinite. The most abundant maceral of the inertinite group is macrinite. Clay dominates in the mineral matter, while carbonate phases, pyrite and mineral bituminous groundmass are less abundant. On the basis of these data, the studied coals are believed to have been deposited in a limnic environment which was periodically influenced by marine and fresh-water sources.

Key words: Çayırlı; Tertiary coals; organic geochemistry; biomarker; organic petrography.

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Mineralogical and morphological characterization of deposits in Guadiana Basin and definition and homogenization of the units

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ABSTRACT

The Guadiana Basin is an intraplate inermountain Cenozoic basin located in SW of the Iberian Peninsula, covering an area close to 6000 km2. It generated on Palaeozoic and Neoproterozoic metasediments and igneous rocks from the Iberian Massif. The Guadiana is a complex basin divided in two sub-basins by successive tectonic phases Vegas Altas (VA) to the east, and Vegas Bajas (VB) to the West. The tertiary sedimentary record in the basins consists of less than 200m thick of sediments and they lack coherent chronological allocation given its disconnection and dating absence. Present approach pursues their integration and synthesis within the morphotectonic frame, establishing some criteria of correlation and interpretation between both sub-basins within its Iberian context. Two depositional sequences separated by a regional unconformity are defined, with a distinctive unit between both deposits characterized by carbonated duricrusts rich in paligorskite. The clay mineralogical assemblages together with the presence of some carbonates indicate different sedimentary successions that can be correlated with the lithostratigraphic units defined in the basin: a) illite (predominant)-smectite-kaolinite assemblage characterizes the Lower Depositional Sequence (SDI); b) the presence of carbonates and smectite (predominant)-illite-kaolinite assemblage characterizes the Upper Depositional Sequence (SDS); the palygorskite-dolomite mineral assemblage characterizes the base of the Upper Depositional Sequence and it is considered as a regional unconformity. This last unit can be used as a reference criterion not only between the two sub-basins but also for others nearby, although it presents identification problems by its local convergence with a lacustrine limestones unit at the top of the Upper Sequence. According to its facies, duricrusts and phyllosilicates a correlation with other Iberian Massif basins might be established, and we can attribute the base of the Upper Sequence to Eocene-Oligocene age, and therefore the Lower Sequence corresponds to the Lower- Medium Paleogene.

Key words: Guadiana Tertiary basins; depositional sequences; carbonate duricrusts; phyllosilicates; dolomite; paligorskite.

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Investigation of rapid lateral facies changes in fault controlled coal-bearing Neogene basins around of the Afyonkarahisar district, in West of Turkey

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ABSTRACT

The continental Neogene basins of Western Turkey are mostly controlled by the NE, NW and E-W trending growth faults. The synsedimentary growth faults are generally influenced the thickness and spreading of the sedimentary facies and coal seams in Afyon Neogene basins. The sedimentary sequence of the continental basins consists mainly of alluvial-fan, fluvial, fluviyo-lacustrine, and lacustrine and volcanoclastic sediments. These sedimentary facies interfinger with another in lateral direction within the basins. The fluvial sediments are characterized by channel-fill conglomerates, cross-bedded and rippled sandstones with mudstones and claystones intercalations. The lacustrine facies consists mainly of mudstone, shale, calcerous shale, freshwater limestone, and pyroclastic volcanic constituents. Varve-like regular laminations, bituminous shale intercalations, beds with freshwater fossils (gastropods, algae, etc.) and the pyroclastic volcanic interbeds are the main sedimentary types. The sequence of the fluviyo-lacustrine facies consists mainly of alternations of fluvial and lacustrine sedimentary constituents due to formed of seasonal water level changes of lacustrine systems. Within the Western Anatolian coal exploration project, approximately 10 000 m. search drills has been completed in Neogene basins around of Afyon district by Turkish Coal Enterprise, during the last 2 years. According to field observations and drill results, the coal seams in the Afyon Neogene basins was deposited mainly in fluvial and fluviyo-lacustrine environments. Fluviyo-lacustrine coal seams mainly deposited in well-drained floodplain marshes related to fluvial systems. According to correlation of drill results, the fluvial coal seams are mainly discontinuous, and grade abruptly both vertically and laterally into fine-grained clastic sediments of the levee and well-drained swamps of the fluvial system. In some places, the fluvial and fluviyo-lacustrine lignite seams are missing due to initial peat erosion with channel scouring.

Key words: Continental Neogene basins; West Anatolia; sedimentary facies; exploration drills; coal.

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Biostratigraphy of upper Jurassic-early Cretaceous units in Central Pontids Region (Turkey)

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ABSTRACT

Upper Jurassic-Lower Cretaceous aged units of the investigation area located at the Central Pontides Zone usually represented with thin bedded of micritic limestones developed in Tithonic facies. Measured stratigraphic sections were obtained in order to make the calpionel biostratigraphy at these units. Tintinnopsella sp., Crassicollaria sp., Calpionella sp., Calpionellopsis sp. and Remaniella sp. systematical determination of 12 species belonging to the genus Calpionel were made with the detailed work. Crassicollaria intermedia, Calpionella alpina, Calpionella elliptica, Calpionellopsis simplex, Calpionellopsis oblonga included 5 calpionel biozones have been identified with this identification. Calpionel biozones defined with the Roman Standard Zones comparison were made and between the boundaries of these calpionel biozones and Rome Standart Zones were observed the correlated significantly.

Key words: Jurassic-Cretaceous; biostratigraphy; Central Pontids; Turkey.

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The biostratigraphic data on unit of Upper Jurassic-Lower Cretaceous age in the Amasya Region (Northern Turkey)

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ABSTRACT

This study includes paleontological and stratigraphical features of Upper Jurassic-Lower Cretaceous unit in the Amasya region. The cover units overly unconformably the basement sequences and begin with Liassic clastics and Dogger deposits composed of metamorhic and volcanic originated conglomerates and recristalized limestones. Dogger units are overlain by the lower part of Upper Jurassic-Lower Cretaceous sequences and represented by shallow marine limestones including Mesoendothyra sp. Pseudotextulariella sp., Quinqueloculina sp., Textularia sp., Protopeneroplis sp., Miliolidae. This study was focused especially on the upper level of Upper Jurassic-Lower Cretaceous unit which is represented by limestones of Tithonic facies. Within sequence, following calpionellids were identified; Tintinnopsella carpathica (Murgeanui & Filipescu), Crassicollaria intermedia (Durand Delga), Crassicollaria parvula Remane, Crassicollaria massutiniana (Colom), Calpionella alpina Lorenz, Calpionella elliptica Cadisch. The calpionellid biozones such as Crassicollaria intermedia, Calpionella alpina, Calpionella elliptica were described. The boundary of these biozones were correlated with Rome Standard Calpionellid Zones. It was observed that offer similar of these biozones. The Upper Cretaceous is represented by sandstone, marl alternated and limestones including planktonic foraminiferas. The upper part of this unit is represented by volcano-flysh facies and characterized by planktonic foraminiferas indicating Maastrichtian age.

Key words: Biostratigraphy; calpionellid; biozones; tithonic facies.

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Geology of Erbaa and Niksar vicinity (Turkey)

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ABSTRACT

The study area located between Erbaa and Niksar region which situated in the mid Pontides tectonic unit of Anatolia. In this study, lithostratigraphic units included which tectonics and especially Upper Jurassic-Lower Cretaceous aged chronostratigraphic and biostratigraphic characteristics developed in Tithonic facies has been investigated in detail. Basement rocks in the study area consists of the Permo-Triassic rocks. Complex characterized these basic rocks covered by unconformity with younger lithostratigraphic rocks. These younger lithostratigraphic rocks are Lower-Middle Jurassic aged marine clastics; Upper Jurassic-Lower Cretaceous aged neritic and pelagic limestones; Upper Cenomanian aged submarine volcanics and volcano sedimentary rocks are accompanied to flysch characterized lithologies; Santonian-Campanian aged sedimentary rocks; Maastrichtian-Paleocene aged limestones are composed. Units of the Lower-Middle Eocene aged clastic, pyroclastic rocks and nummulitic limestones and the Upper Eocene aged terrestrial and submarine volcanics, pyroclastics and clastic sedimentary lithologies are located with unconformity on the older units. Deposited sedimentary rocks on the Permo-Triassic aged basement rocks are named as "the primary cover units". The primary cover units were deposited in depression area and terrestrial environments throughout the North Anatolian Fault Zone. The primary cover units are covered with Quaternary aged deposits of alluvium-talus-alluvial fans as secondary cover units. Tintinnopsella carpathica (Murgeanui & Filipescu), Crassicollaria intermedia (Durand Delga), Crassicollaria brevis (Remane), Crassicollaria parvula Remane, Crassicollaria massutiniana (Colom), plenty of radiolaria and sponge spicules were identified and Crassicollaria intermedia Calpionel biozone has been defined at the Upper Tithonian aged levels. Crassicollaria parvula Remane, Calpionella alpina Lorenz, Calpionella elliptica Cadisch species were identified and Calpionella alpina and Calpionella elliptica biozones were determined at the Lower Berriasian aged levels. Upper Berriasian aged levels are characterized with Calpionella elliptica Cadisch, Calpionellopsis simplex (Colom), Calpionellopsis oblonga (Cadisch), Remaniella cadischiana (Colom) and Remaniella murgeanui (Pop) community and Calpionellopsis simplex and Calpionellopsis oblonga biozones have been identified with biostratigraphic studies. The study area located in the Pontides suture zone have been influenced by north-south compressional forces. Thus, east-west trending thrusts and depressions were formed between these thrusts at the south of related area. Pliocene aged sediments that form the second cover unit is composed of continental clastic sediments are deposited in depression areas. The depression areas took shape associated with the formation and development of the North Anatolian Fault Zone in the Neotectonic period. Niksar-Erbaa line is developing as pull-apart basins by activity of the North Anatolian Fault Zone.

Key words: Central Pontides; Niksar; tithonic facies; biostratigraphy; tectonics; geology.

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Middle Eocene benthic foraminiferal biostratigraphy of the Darende Basin (Malatya, Eastern Turkey)

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ABSTRACT

This study was carried out to define the benthic foraminiferal biostratigraphy of Middle Eocene aged formations which well exposed in the Darende Basin. The basin is situated in the northwest part of Malatya in east Anatolia. Darende basin is comprised of Mesozoic, Tertiary and Quaternary units. Eocene consists of Korgantepe formation with conglomerate, marl and sandstone; Yenice formation with sandstone, marl and limestone; Asartepe formation with limestone and marl alternations and finally Darende formation that is mainly composed of sandstone, siltstone and marl alternations with gypsum interbedded. In this study, eight stratigraphic sections were measured from the Korgantepe, Yenice, Asartepe and Darende formations which are marine units. As a result of the examination of oriented thin sections from hard rock and grain samples which are obtained from the stratigraphic sections, 15 genera and 27 species were identified to characterize from Upper Lutetian to Upper Bartonian sequence, systematically. Upper Lutetian is defined by the presence of Assilina exponens (Sowerby), Nummulites aturicus (Joly ve Leymerie), N. beaumonti d'Archiac ve Haime, N. discorbinus (Schlotheim), N. maximus d'Archiac and Discocyclina cf. discus (Rutimeyer), Lower Bartonian is represented with the existence of Alveolina elliptica elliptica (Sowerby), A. cf. elongata d'Orbigny, A. fragilis Hottinger, A. fusiformis (Sowerby),, Planorbulina cf. bronnimanni d'Orbigny, Fabiania cassis (Oppenheim), Halkyardia minima (Liebus), Eorupertia magna (le Calvez), Gypsina carteri Silvestri, G. mastelensis Bursh , Sphaerogypsina globula (Reuss), Assilina exponens (Sowerby), Asterigerina rotula (Kaufman), Eoannularia conica Sirel, Silvestriella tetraedra (Gumbel), Nummulites beaumonti d'Archiac ve Haime, N. biaritzensis d'Archiac ve Haime, N. lyelli (d'Archiac ve Haime), N. maximus d'Archiac ve Haime, N. perforatus (Montfort), N. ptukhiani Kacharava, Operculina alpina Douville, O. schwageri Silvestri and Discocyclina cf. discus (Rutimeyer). Planorbulina cf. bronnimanni d'Orbigny, Fabiania cassis (Oppenheim), Halkyardia minima (Liebus), Eorupertia magna (le Calvez), Gypsina carteri Silvestri, G. mastelensis Bursh, Sphaerogypsina globula (Reuss), Asterigerina rotula (Kaufman), Eoannularia conica Sirel, Chapmanina gassinensis (Silvestri), Silvestriella tetraedra (Gumbel), Operculina alpine Douville and O. schwageri Silvestri are indentified to characterize the Upper Bartonian. According to the defined benthic foraminifera associations the benthic foraminifera zones of SBZ 16, SBZ 17, SBZ 18, corresponding to Upper Lutetian- Upper Bartonian were derived. The benthic foraminiferal composition of the studied sections and lithological aspects indicate a shallow-marine environment for the depositional environment.

Key words: Benthic foraminifera; shallow benthic zone; Eocene; Turkey.

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Sedimentary environments of the Neogene Inegöl basin, Western Turkey

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ABSTRACT

The Neogene İnegöl basin is situated at the north-northeast part of Eskişehir fault zone in western Anatolia. This basin formed under extensional tectonic regime, beginning in Early Miocene and is a northeast part of the West Anatolian horst-graben system. The Paleozoic schist, crystalline limestone, Mesozoic ophiolitic rocks and Lower Tertiary granitoids form the basement. The Neogene succession is unconformably underlain by the pre-Neogene basement units. The Miocene-Pliocene aged basin fill with more than 1000 m thickness rests unconformably on the basement rocks and includes fluvio-lacustrine deposits. The Neogene İnegöl basin contains in various levels coal bed of the Miocene Gülbahçe formation and the Miocene Çayyaka formation. The coal-bearing Miocene aged fluvial-lacustrine deposits in the basin was unconformably on the basement rocks. Neogene sediments of the İnegöl basin can be correlated with the coal-bearing sediments in Tunçbilek-Tavşanlı basin and the coal-bearing sediments in Alpu-İnonü basin. However, the coal-bearing sediments in the İnegöl basin, due to basin-bounding faults; talus, travertine and are covered by alluvial deposits. These fault-controlled basin is filled with thick series of Neogene terrestrial deposits. Sedimentary lithofacies and facies were distinguished and grouped into facies associations to represent seven depositional environments, as follows: alluvial fans, gravel-dominated fluvial channels, sand-dominated fluvial channels, flood plains, lake margins, lakes, and swamps. The Neogene İnegöl basin is shaped by a number of subparallel normal faults with considerable amounts of strike-slip component. The origin of the Neogene İnegöl basin can be classified as a half graben.

Key words: Neogene basin; coal-bearing sediments; fluvial-lacustrine sediments; half graben; Turkey.

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Depositional environments of the coal-bearing Danişmen Formation in the Thrace Basin, northwest Turkey

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ABSTRACT

The Thrace Basin of northwest Turkey is a triangular-shaped Cenozoic depression, whose Eocene to Pliocene sedimentary fill reaches up to 9000 m in thickness. In this basin the Danişmen Formation of Oligo-Miocene age consists of interbedded shales, marls, siltstones, silty sandstone and numerous coal seams intercalations in the central and southern part of the basin. The coal seams at the north of Malkara, which were developed within deltaic deposits, have been extensively exploited both by underground and mainly open-cast mining methods. The Oligocene-Miocene age coal-bearing units exhibits different facies in the Thrace Basin. Sedimentological features of coal bearing sediments in study area may be known, makes this research important for terms in coal searches. Lithofacies and facies of the Danişmen Formation at the north of Malkara indicated that they were deposited in a series of elongate, fluvial-dominated deltas in a highstand succession. Facies that define the depositional framework in this deltaic succession include channel-mouth bar, distributary channel, crevasse splay, interdistributary bay, swamp and delta plain.

Key words: Deltaic facies; coal-bearing sediments; Oligo-Miocene; Thrace Basin; northwest Turkey.

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High resolution geochemical analysis of recent sediments collected from Lake Bafa (Western Anatolia) and pollution risk assessments

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ABSTRACT

Lake Bafa is characterized as an inland lake basin along the Aegean coast and exhibits water surface of 315 km2, maximum depth of 20 m, and volume of 692 hm3. In this study, sedimentological and lithological characteristics of Lake Bafa deposits were investigated. Within the aim of the study, two cores were taken from the lake (Baf37:126; Baf35:130m). These core sections contain sediments, accumulated during the last 150 years. Mainly, lithostratigraphic definitions were performed according to the macro characteristics such as color, water content and fossil contents. Grain size analysis is applied to define the physical conditions of the environment and performed by sedigraph analyser for clay and silt size fractions. Within the aim of the study, multi sensor core logger (ITRAX) radiography and laser particle size analyser were used. Sedimentological (grain size) and geochemical analysis (ITRAX) were applied in to the sediments in 1mm resolution. ITRAX analysis is used for the determination of elemental composition of the sediments (Al, As, Cr, Cu, Mn, Co, Ni, Zn, V, Pb). Furthermore, sediment pollution in terms of relative enrichment of metal concentrations is investigated. Sedimentary record of the centre part of the lake (Baf 37) consist homogenous clays in the uppermost 0-90cm part. Consolidated clays were observed in 90-115cm interval and 115-126cm interval indicates organic matter rich dark colured clays. Sedimentary record of the South part of the lake (Baf 35) consist green homogenous clays in the uppermost 0-50cm greenish homogenous clay. Sediments contain sand, silt and clay size fractions within the average value of 2%, 56%, 43%. Dark greenish clays were observed in 50-130 cm and dark banded or laminated clays. Higher values of Cu, Pb, Zn elements are observed in recent sediment layers than lower parts of the core. Such time dependent enrichment of Zn concentrations in sediments suggests pollution effect forced by anthropogenic input. However, down core fluctuations of the other selected metals, such as Cr and Ni, suggests detrital transportation and deposition progress are also forced on the enrichment of these elements.

This study is supported by the TUBITAK (project number: 113Y070) and Istanbul University (28942 and 17828) research foundations.

Key words: Lake Bafa; geochemistry; pollution.

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Stable isotopic data of Middle-Late Eocene Planktonic Foraminiferal around Incesu (Northwest of Isparta, Turkey)

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ABSTRACT

In western Taurides, the Eocene units that belongs to Kırdağları Series that are formed with alternation of sandstone, claystone and marl unconformably overlies the Late Cretaceous neritic platform type carbonates. In this study, the sea level changes, water temperature and paleosalinity were defined by doing stable isotopic analysis of δ-13CV-PDB (‰) and δ-18OV-PDB (‰) from planktonic foraminiferal tests that belonging to samples taken from 3 measured stratigraphic section of the Eocene sediments in Kırdağları Series around İncesu Village.

Key words: Stable isotope; planktonic foraminifera; Middle-Late Eocene; Kırdağları series; Turkey.

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Planktonic Foraminiferal biostratigraphy of the Paleocene sediments in the north of Isparta (SW Turkey)

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ABSTRACT

In the foothills of Söbüdağ that is approximately 10 km. north of Isparta province, Paleocene calcareous marl whose colour is cream at the bottom and claret red towards the top and limestone unconformably rests an Late Cretaceous limestone and is overlaid by the Middle Eocene units. In this study as a result of laboratory studies done with marl and clay samples taken from Late Paleocene sediments, plenty of well-preserved planktonic foraminiferal assemblages belonging these samples, were observed. By using biostratigraphic distribution of 13 species belonging to Acarinina, Globanomalina, Igorina, Morozovella and Subbotina from identified planktonic foraminiferals, in Late Paleocene (late Selandian- Thanetian) two planktonic foraminifer biozone was defined. These are; Acarinina subsphaerica Subzone (P4a) in late Selandian-early Thanetian and Morozovella acuta Subzone (P4b) in Thanetian.

Key words: Late Paleocene; biostratigraphy; planktonic foraminifera; Isparta; Turkey.

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An application of the ITRAX scanner and Multi Sensor Core Logger to sediment cores taken from the Lake Bafa (Western Anatolia)

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ABSTRACT

A high resolution sedimentological and geochemical study was performed on Lake Bafa sediments (core: BAF37; core: BAF35), covering the geological archive of the last 2500 years. The study area of Lake Bafa is a brackish residual lake located in Menderes Basin is one of the major recent lake in the Aegean cost of the Western Anatolia. Recent characteristics of the lake basin exhibits a water surface of 315 km2, volume of 692hm3 and a maximum depth 20 m. Basically, laser diffraction for particle size analysis, Multi Sensor Core Logger (MSCL) and ITRAX micro-X-ray fluorescence (XRF) core scanner were applied for investigation of physical and chemical characteristics of the lake sediments. Chemical properties of the sediments are defined in respect to the fluctuations of 30 variables (Al, Si, P, S, Cl, Ar, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Rb, Sr, Y, Zr, Rb, Mo, Ba, Pb, Th, U). The geochronology was determined using Accelerator Mass Spectrometry (AMS) radiocarbon method. The aim of the study is to define the main external effects which control the depositional environment of Lake Bafa, in terms of energy level variations, changes of the main transport mechanisms and their sources. Homogenous thick mud layers of the uppermost 1 m of the core, in a permanent lake phase. The main sedimentary characteristic of the lowest part of the core is high energy environment producing the mass flow events. Furthermore, simultaneous variations of the grain size distributions, are also observed for this characteristic layers. This layers points to a marine-lake transition phase, indicated by a characteristic layer, enriched in Cardium shells. After the deposition of this characteristic layer, a permanent lake sedimentation phase is proposed. Therefore, during the last 100 years, a tendency through the higher energy environment have been existed.

Acknowledgements: This study is supported by the TUBITAK whit the project number of 113Y070 and Istanbul University research fund (project number of 28942 and 17828).

Key words: ITRAX scanner; Multi Sensor Core Logger; sediment cores; Lake Bafa; Turkey.

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Shallow water benthic foraminiferal assemblages from the Marmara Sea, Turkey

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ABSTRACT

The Marmara Sea is a permanently stratified small basin, receiving brackish water from the Black Sea (upper layer) via the Bosphorus and saline water from the Mediterranean Sea (lower layer) via the Dardanelles. Benthic foraminiferal composition and abundance (undifferentiated living and dead) in 19 surface sediment samples taken from water depths between 15 and 67 m from the northern Marmara shelf was studied as tracers of these two water masses. Foraminiferal analysis was carried out on 10 g of subsamples of dry sediments and benthic foraminiferal fauna was identified and counted in the size fraction coarser than 125 μm. The number of individuals per 10 g of dry sediment ranged between 974 and 9753. A total of 156 benthic foraminiferal species including 13 agglutinated and 143 calcareous ones were recognized in samples. Twenty-four species showed a relative abundance higher than 5% in at least one station. A distinct faunal change occurs at about 40 m water depth. Samples taken from shallower than 40 m include Asterigerinata mamilla (Williamson), Lobatula lobatula (Walker and Jacob), Neoconorbina terquemi (Rzehak), Miliolinella subrotunda (Montagu), Rosalina bradyi Cushman, Elphidium macellum (Fichtel and Moll), Porosononion subgranosum (Egger), Quinqueloculina laevigata d'Orbigny, Cribroelphidium poeyanum (d'Orbigny), Neoeponides bradyi, Sigmoilinita costata (Schlumberger), Ammonia parkinsoniana (d'Orbigny), Nonionella turgida (Williamson). At depths deeper than 40 m, the fauna is represented mainly by Brizalina spathulata (Williamson), Cassidulina carinata Silvestri, Bulimina aculeata d'Orbigny, Discorbinella bertheloti (d'Orbigny), Globocassidulina subglobosa (Brady), Rectuvigerina phlegeri Calvez, Gyroidina umbonata (Silvestri), Valvulineria bradyana (Fornasini), Hyalinea balthica (Schröter), Asterigerinata adtriatica Haake and Brizalina dilatata (Reuss). Cluster analysis also provided the identification of two main assemblages, including the species higher than 5% relative abundance. They are the Asterigerinata mamilla-Lobatula lobatula-Neoconorbina terquemi assemblage (Shallower assemblage) at 20-38 m water depth and Brizalina spathulata-Cassidulina carinata-Bulimina aculeata-Discorbinella bertheloti assemblage (Deeper assemblage) distributed at 43-67 m. Comparison between the depth distribution of representative species and basin-averaged salinity profile indicate that distribution pattern of the assemblages is associated with the general hydrography of the Marmara Sea.

Key words: Benthic foraminifera; surface sediments; shallow water; marginal marine environment; Marmara Sea.

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An ecosystem model for the western coast of the Great Menderes Valley (Western Anatolia): plant leave and soil chemistry

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ABSTRACT

The total catchment area of the meandering river system (Great Menderes River) covers about 24.300 km2, forming the natural lake (Lake Bafa), swamp and lagoon environments. A numerical modelling application for the western coast of the Great Menderes Valley was performed using analytical data sets, obtained from the organic/inorganic geochemical analysis of the plant leaves and soil samples. More than thirty different plant samples collected from the western coast of the Great Menderes Delta plain. The collected leaves are belong to, Oaks (Anatolian and Quercus aucheri), Pine speices (mainly Red pine and Pinus nigra), Olives (Natural olea, Olea Europa var sylvestris, Olea Europa var Europaea), Vitex agnus-castus, Tamarix parvifloa, Ulmus laevis, populus, Cretonia siliqua, pisticia (terebinthus and lenticus) Hedera helix, Sedge, Salix, Nerium oleander plants. Additionally, black moss and macrophyte types were retrieved for the chemical analysis. The soil and plants types have been investigated, in terms of organic/inorganic geochemical properties. Here, Total organic carbon measurements, elemental analysis of carbon, hydrogen and nitrogen elements and ICP-Ms analysis were applied. The sum dataset were used for the reconstruction of recent ecosystem characteristics are modelled via netcad applications. Such characteristic environmental phases were also illustrated as geological mapping, vegetation mapping and element data curve illustrations. Additionally, plant and soil sample locations and elemental enrichment tendencies are presented via topography and geology maps of the surrounding region. Furthermore, plant and soil sample locations and elemental enrichment intensities were also illustrated on the topographical and geological maps, supplementarily.

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Key words: Ecosystem modelling; soil; plant leaves; Western Anatolia.

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Sedimentology and stratigraphy of tertiary evaporitic sediments in the south of Ulukisla (Nigde)

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ABSTRACT

This study includes the research of Tertiary aged and mostly evaporitic sedimentary basin which is located in the district Ulukışla(Niğde) and Northern of Mount Bolkar of Middle Taurus(Toros) Mountains. This region, is an inner marine basin which begins to be formed after Paleocene in the North of collision zone of an old ocean in the southern branch of the Neo-Tethys which is closed between Upper Cretaceous and Lower Paleocene. In the south of the region, the Upper Cretaceous units were thrust with reverse faults on Paleocene units towards south. Within the borders of our study field, there are deformations indirectly caused by these over thrusts. In this study, it is tried to research and explain the sedimentological features of sediments which are between Paleocene-Pliocene aged sediments around Ulukışla (Nigde) and the sedimentation mechanism of evaporates with environmental conditions during this forming and geological evolution of the region. The oldest unit in the study field is Şimşim formation (Alihoca ophiolite) which is Upper Cretaceous aged, ophiolithic and dark grey-green colour. Sansartepe Formation which is Paleocene aged and represented by pillow lavas stays discordantly over this formation (because deformation in the pillow lavas is less than the deformation in Şimşim Formation and according to stratigraphic rules it must be an unconformity between them). Then, Serenkaya Formation which is Lower-Middle Eocene aged and generally represented by the sediments with coarse, angular, sub-angular fragments and blocks concordantly overlies Sansartepe Formation. The most of the material of Serenkaya Formation are from Sansartepe Formation. After Serenkaya Formation Güney Formation which is Middle-Upper Eocene aged comes concordantly. This formation is represented by pebbly sandstone with lots of pebbles at the bottom in white, greyish color and it is cross bedded sometimes. The middle of this formation is represented by fine-middle laminated reddish sandstone-siltstone repetition. The upper levels of this formation is completely consist of fine-middle bedded reddish, greyish sandstone-siltstone repetition. Güney Formation is overlaid by Zeyvegediği Formation which is Oligocene aged and completely consist of evaporate discordantly. Zeyvegediği formation is overlaid by, Kurtulmuştepe Formation which is Lower Miocene aged and represented by clayey, sandy limestone bedded concordantly and transitively as well Kurtulmuştepe formation is covered by Kızılöz formation which is Middle Miocene aged and formed by completely red color continental sandstones concordantly. Kızıltepe travertine which is Upper Miocene aged covers Kızılöz Formation discordantly. Kızıltepe Travertine is also overlaid by Kızılbayır formation which is with coal layers at the bottom and pink, greyish sandstone-siltstone repetition at the middle levels towards top discordantly. Katrandedetepe formation which is consist of Pliocene aged carbonate sediments overlies Kızılbayır formation concordantly. Beştepeler formation which is represented by terrestrial clastic sediments also overlies conformable them. Finally there are old and recent terrace deposits.

Key words: Sedimentology; stratigraphy; Ulukısla; Tertiary; Taurus; Alihoca; ophiolite; Zeyvegediği.

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Upper Permian faunal assemblage of Oman Exotic limestones in the Hajar Mountains, UAE-Oman: paleogeography and implications for NeoTethyan rifting

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ABSTRACT

The Hajar Mountains of the UAE-Oman region represent an oceanic crustal slice (Semail Ophiolite) that was obducted onto the SE Arabian continental margin at the end of the Cretaceous. The ophiolite overlies allochthonous thrust-stacked deepwater deposits of Paleozoic to Mesozoic age that accumulated in the NeoTethys ocean basin. The deepwater sediments include marine basaltic volcanics that erupted during the NeoTethys rifting events. These oceanic volcanics are associated with shoalwater reefal limestones of Late Permian and Late Triassic age. Both are referred to as the Oman 'Exotic' limestones. The Upper Triassic megalodont-rich 'exotic' limestones were probably carbonate build-ups on basaltic oceanic seamounts. The much rarer Upper Permian 'exotics' form large blocks enclosed within the lower sections of the basalts. An area to the east of Al-Ain city, UAE exposes examples of richly fossiliferous Upper Permian 'exotics' within Upper Triassic marine basalts. The limestones were probably platform deposits which subsided to oceanic depths on horsts rifted during the opening of NeoTethys. Syn-rifting lavas intruded normal faults and engulfed these subsided reefal limestones. The 'exotics' of the study area preserve a diverse assemblage of benthonic foraminifera of latest Guadalupian to early Lopingian (Wuchiapingian) age, including fusulinids Verbeekina, Tetrataxis, Sichotenella, Neostaffella, Dunbarula, Colaniella and Pseudoendothyra, lagenids Geinitzina and Pachyphloia and miliolids Valvulina, Parareichelina, Hemigordius, Hemigordiopsis, Baisalina, Agathammina and Midiella. In addition, the calcareous alga Mizzia velebitana is present. The assemblage can be correlated with the Saiq Formation and Bih Formation of the NeoTethyan shelf deposits in Oman and UAE. The 'exotics' of the study area display a wackestone/packstone lithofacies and lack ooids. These features are consistent with an original foreshoal/ offshoal paleogeography for these limestones. In contrast to the Upper Permian shelf carbonates, the 'exotics' of the study area show minor dolomitization, with resulting excellent preservation of the fossils. This is taken to indicate that rapid rift-related subsidence of the limestone capped fault blocks began soon after the deposition of the limestones, ie during the Lopingian, in this part of the NeoTethyan margin.

Key words: Upper Permian; Oman 'Exotics'; UAE; benthonic foraminifera; NeoTethys.

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Conodonts versus Triassic climatic and eustatic changes

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ABSTRACT

From astronomical, sedimentological, paleo-geographical and geochemical points of view, there is a general agreement that the Triassic period was exceptionally warm. The 51 MA long Triassic period started during the Siberian Traps and ended at the height of the Central Atlantic Magmatic Province activity. It is comprised between End Permian and End Triassic mass extinctions. Conodonts survived the former but got extinct by the end of the latter. Three major waves characterise the evolution of Triassic conodonts: I. The 5 MA long Scythian recovery by intensive speciation (23 S/MA); II. The 10 MA long Dinarian of intensive radiation (8.5 S/MA); III. The 16 MA long Julian - Lacian survival (2S/MA) and 20 MA of Alaunian – Rhaetian decline (1S/MA or less) until extinction. The major causes of stress affecting the evolution of Triassic conodonts are environmental, such as marine regressions, anoxic episodes, and thermal or trophic (nutritional) stress. These stressful episodes caused dwarfing and extinction of larger forms (r-selection). Smaller forms with a short life span and rapid proliferation are the result of heterochrony such as proteromorphic retrogradation (Atavism). The disappearance of the conodonts was not caused by a single mass extinction event, but the result of summing up stress factors from hostile environments over a long time.

Key words: Triassic; conodonts; phylogeny; progenesis; proteromorphosis.

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Effects of heavy metal concentrations on Foraminifers in current sediments of Erdek Gulf (South of Marmara Sea, Balıkesir-Turkey)

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ABSTRACT

In this study, effects of heavy metal concentrations on foraminifera in current sediments in seabottom of Erdek Gulf (South of Marmara Sea, Turkey) are researched. Within this scope, sediments from an off-shore drilling in Erdek Gulf and grap samples taken from 15 different points are investigated. Core samples from offshore drilling have been divided into parts of 40 centimeters and benthic foraminifera groups and heavy metal content of 20 off-shore drilling samples and 15 grap samples have been investigated. Perpendicular heavy metal concentration changes have been determined with off-shore drilling samples and horizontal changes have been determined with the help of grap samples. Benthic foraminifera from these samples have been specified taxonomically and their morphological differentiation has been determined after taking SEM photos. For heavy metal analyses, concentration analysis of 12 heavy metals (Co, Fe, Pb, As, Cr, Cu, Zn, Al, Mn, Ni, Hg ve Cd) has been conducted in sediment samples taken from the levels in which foraminifera are collected. Moreover, pH value, saltiness and conductibility of salt water and clay have been measured and assessed. 15 grams of dry sediment sample, taken for benthic foraminifer's content, have been washed in 125 µm of sieve and benthic foraminifera spesifications, present in each sample, have been made. As a result of this study, foraminifera types of "*Adelosina cliarensis, A.dutcharsi,A.mediteranensis, A.pulchella, Ammonia compacta, A.parkinsionia, A.tepida, Coscinospira hemprichii, Cribroelphidium poeyonum, Cycloforina contorta, Elphidium aculeatum, E.complanatum, E. crispum, E. galvestonense, Lobatula lobatula, Massilina secans,Miliolinella subrotunda, Pseudotriloculina oblanga, P.rotunda, Quinqueloculina lamarciana,Q.seminula, Q.polygona, Spiroloculina angulosa, S.excavata, Textularia* sp*., Triloculina marioni*" have been determined. No morphological alterations have been observed in foraminifera of *Elphidium crispum, Massilina secans and Ammonia compacta*, seen in grap samples taken from Erdek Gulf. In these locations, where morphological changes have been observed, excessive increases in Zn, Pb and Cd concentrations have also been monitored. Heavy metal concentrations in upper levels of off-shore drilling samples turned out to be more than those of lower levels. Moreover, it has been understood that average Zn, Pb and Cd concentrations of grap samples representing upper levels of sediments in sea bottom are higher than average of off-shore drilling samples. These elements are thought to have played roles in morphological alterations seen in foraminifera and the source of these elements has been determined as agricultural activities (disinfection and dressing).

Key words: Heavy metal; Marmara Sea; Erdek; Çanakkale; Foraminifera.

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Climatic changes of Late Pleistocene-Holocene sedimentary records in Lake Hazar, Eastern Anatolia, Turkey: sedimentological and geochemical parameter evidences

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ABSTRACT

Lake Hazar, which is a pull-apart basin situated along the East Anatolian Fault Zone (EAFZ) with an NE-trending elongated-shape and displays intra mountane basin characteristics. Recently, it has a elevation of 1248 m, and is a 25 km-long and 7 km-wide. We investigated Holocene sedimentary sequence in our seismic and core data taken from Lake Hazar. These data show that lake level changes and tectonic evolution influence of sedimentary unit. We observed that the most important sedimentary unit both in seismic and core is deltaic-complexes which were deposited as superimposed units. These wide deltaic units probably sourced from the Kürkçayı River, which is the biggest drainage system flowing in the lake. In this study, we examined sedimentological and geochemical properties of the core sediment with grain-size, magnetic susceptibility, TOC, XRF analysis. Each of proxies indicate that Lake Hazar sedimentary sequence influenced by climatic shift which consist of dry and humid climate period. The temperature increase occurred at the beginning of the Holocene resulted in the lake level rise from -73 m to well above -45 m by 7.5 ka BP, when the oldest deltaic-unit (Delta-1) was formed at the mouth of the Kürkçayı River. This deltaic-unit continued to deposition until 4.2 ka BP, when high sediment supply into the lake. Younger deltaic-unit (Delta-2) occurred during the Bronze Age between 3.8 ka BP and 2.9 ka BP, which characterized wet climate and high-river discharged. The youngest deltaic-unit (Delta-1) occurred before, the most remarkable lake level was seen at 2.9 ka BP that can be documented by a formation of a prominent truncation surface in seismic profile. Late Holocene is associated with formation of the youngest deltaic-unit (Delta 3). To find out the hydrologic and sedimentary processes at the mouth of the Kürkçayı River, the youngest deltaic unit of Lake Hazar examined by grain size analysis. According to Sk-So and Passega diagram produced by grain-size parameters, the main sedimentary processes include rolling at the bottom of the lake floor, on the other hand worse-sorted and finer grains settled by turbulent eddies. Result of grain-size parameters together with low TOC content at the time of youngest deltaic-unit indicate that occurrence of turbulent mixing at the mouth of the river. Such vertical and horizontal mixing at the Kürkçayı river mouth during the deposition of youngest deltaic unit was related by hyperpycnal mode. Moreover, paleoshorelines of Lake Hazar are determined by using core depth, wave-cut terraces and minimum reflection depths, foreset/topset transition in the seismic profiles which set light to schematised old Hazar Lake situation.

Key words: Lake Hazar; Holocen; paleo-climate; delta deposition; grain-size.

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Cretaceous-Paleogene sequences of Lycian nappes, W Turkey: new palaeontologic rudist, foraminifer, nannoplankton) and stratigraphic data

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ABSTRACT

Lycian nappes is located between metamorphic rocks of Menderes Massif and platform-type carbonates of Bey Dağları Autochthon in western Turkey. It consists mainly of, in ascending order, Mesozoic cherty, platform-type carbonates and overlying flysch-type rocks with different type of limestone and magmatic rock blocks. Previous studies suggest very limited palaeontologic datas and controversial stratigraphic arguments between the rock units. Present study is based on the detailed palaeontologic data of rudists, planktonic and benthonic foraminifers and nannoplanktons from the measured-stratigraphic sections in all parts of the Lycian nappes such as Tavas, Fethiye, Köyceğiz, Karabörtlen, Ören, Bodrum, Bozburun and Datça. The rudist associations from Berriasian, Barremian-Aptian (Lower Cretaceous), upper Cenomanian, upper Turonian, Santonian-Campanian and middle-upper Maastrichtian (Upper Cretaceous) is described in the Lycian nappes for the first time. Planktonic foraminifers suggest middle-late Cenomanian-Turonian, Campanian-Maastrichtian age for the carbonate successions and Maastrichtian-Paleocene-Eocene for the flysch-type rocks. Benthonic foraminifers indicating a middle-late Maastrichtian age are described from the uppermost part of the platform-type carbonates and a Paleocene-Eocene age from the overlying micritic limestones. Nannoplankton gives especially data for the flysch-type rocks like Campanian-Maastrichtian, Danian, Ypresian-Lutetian and Oligocene age. Integrated biostratigraphy allowed us to better understand the age and the relationships of the platform-type carbonates and flysch-type rocks than previous studies.

Key words: Lycian nappes; Cretaceous; Paleogene; rudists; foraminifers; nannoplanktons.

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Geological evolution of Çan (Çanakkale-Turkey) lignite basin and sedimentologic properties

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ABSTRACT

This study intends to determine sedimentological properties and lithofacies changes of the Çan Lignite basin by means of stratigraphic sections measured at different locations and the data obtained from drillings. The Çan Lignite basin is located in Çan-Etili depression an approximately NE-SW trending to the north of the Kazdağ High in the Biga Peninsula. This basin contains significant economic reserves of lignite, and has geomorphological and sedimentological differences from other lignite bearing basins. The oval-shaped Çan-Etili basin was formed during Early–Middle Miocene, is approximately 35 km long and 8-10 km wide, and is geographically located 200-250 m below its surrounding areas. Tectonic activities has played a major role synchronous calc-alkaline volcanism widely exposed in all the Biga Peninsula Oligocene-Lower Miocene period in geological and morphological development of the basin. Therefore the basin is a caldera type depression area. Sedimentary units representing the fill of the Çan basin consist of Lower-Middle Miocene terrestrial clastics named Çan Formation. This formation overlies unconformably Oligocene-Lower Miocene Çan Volcanics. The Çan formation contains lignite and consists of 6 lithofacies representing alluvial, fluvial, marsh and lacustrine environments. These lithofacies are the lower volcanogenic conglomerate, the claystone, the lignite, the laminated organic claystone, the tuff intercalated sandstone-siltstone and the upper volcanogenic conglomerate. Lignite zone is between claystone and organic claystone lithofacies consisting of marsh and lacustrine clastics. The average thickness of lignite seam is 17 meters and has a different thickness from place to place. The lignite seam in the basin is limnic and indicates flooded marsh, flood plain, marsh-lacustrine environments.

Key words: Çan; lignite; sedimentology; lacustrine.

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Investigation for best parameters of data acquisition and processing in fields with surface plastic formation

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ABSTRACT

This research describes a spatial designing for Gachsaran 3D Seismic field test in existence of Gachsaran formation for future acquisition operations and also this research describes processing performance, tests, analysis and conclusion of Gachsaran field test in order to find the best array of source and receivers in existence of Gachsaran formation for future acquisition operations. Acquiring good images is a challenging issue in seismic acquisition and processing. The problem is more serious in our areas where anisotropy is high and surface plastic formations such as Gachsaran Formation are present. In existence of these problems, high attenuating formations will reduce the energy content of received signals at the surface, so it is necessary to utilize more recent approaches in data acquisition program to overcome such problems. One of the most problematic lithologies in seismic acquisition and processing operations is surface plastic formation. They cause several problems due to their properties such as high attenuation and high surface velocity formation. After so many test and different analysis of shot gathers and comparisons between stack sections, results show that three parameters can be more effect on quality of seismic data. 1. Source array: Different analysis of shot gathers and comparisons between stack sections shows that the array with 1 hole depth and 16m hole depth and 12 kg charge size has the best quality and gives the optimum stack results. 2. Receiver Interval: As spatial aliased energy occurred in line with longer receivers intervals (40m) and it makes it more difficult to separate the data from linear noises in these lines and because of that, the stack section of these lines has poor quality compare to the lines with 20 m receiver intervals. Refraction statics of the lines with 20 m receiver interval also have shown better results. 3. Offset: In comparison between different offset stacks it was observed that after 4500 m offset there is no valuable data acquired by receivers, so 4500m 0ffset is recommended as maximum offset for acquisition operation.

Key words: Plastic formation; data acquisition; data processing.

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Icequake in the East Artic Region as induced by the 2011 Fukushima event

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ABSTRACT

The permanent monitoring of the sea ice oscillation activity in the Arctic Ocean, which was proceeded at the drifting research camp North Pole 38 in 2011, covered a period of time after the 9.3-Fukushima earthquake that occurred on 11 March 2011. A posterior analysis of seismograph records in the frequency range 0.01 to 8 Hz revealed a series of vertically polarized peaks at 24-th, 46-th, and 57-th minutes after the event. This polarization is typical for seismic waves coming along a vertical water column from the seafloor. The distance from the camp to the 9.3-Fukushima epicentre was about 5000 km. In accordance with the traveling times, the polarized peaks were assigned to passed P-, S, and Rayleigh waves, respectively. In the period of time 57 min to 94 min, a few irregular, high-intensive, non-polarized oscillations were detected in the range of lowest frequencies (< 0.1 Hz), which, as suggested, could be triggered by the 57-min surface wave that travelled along the seafloor. The statistical analysis of the energy distribution in various oscillation excitations showed the random (exponential) energy release in all detected bursts before 57-th minute, and the Gutenberg-Richter-type (power law) energy distribution in the period of time from 57-th to 94-th minutes.

Key words: Fukushima earthquake; Arctic Region; icequake; time series; energy distribution.

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Velocity structure of Izmir, Aegean region of Turkey: Preliminary results from local earthquake tomography

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ABSTRACT

Considering the population density and contribution to the national economic growth, Izmir is third biggest city of Turkey after Istanbul and Ankara, and the capital of the Aegean region of Turkey. The region exhibits complex tectonic and geological structure, and is well known with its active horst and graben fault systems. Many destructive earthquakes have been reported during the historical and instrumental period. Knowledge of the seismic velocity structure of the study area is poorly known, and needs to conduct a 3D study to reveal the underground velocity characteristics. For this purpose, a 5 years earthquake dataset obtained from the IzmirNet local station network (Polat et al. 2009) has been used to pick the P- and S-waves arrival phases. We have selected more than 800 events that occurred between 2008 and 2013. A relocation procedure has been applied by using HypoDD in order to improve the location accuracy. VELEST algorithm was used to determine the one-dimensional P-wave crustal structure after testing several trial models. As a final stage, 3D tomographic inversion was performed to reveal 3D velocity structure of Izmir and surrounding areas. Preliminary results indicate a low velocity zones along the E-W trending tectonic features.

Key words: 3D velocity structure; local earthquake tomography; Izmir; Aegean region.

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Influence of groundwater flow on subsurface thermal pattern of southern Norway

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ABSTRACT

We have investigated the main characteristics of the subsurface temperature distribution in the Fyllingsdalen, the Ullrigg and the Årvollskogen boreholes, which are located near Bergen, Stavanger and Moss, respectively. The results of thermal measurements demonstrate that the temperatures are higher in the Årvollskogen borehole compared to the Ullrigg and Fyllingsdalen ones. Based on 2D density and magnetic modelling, the lithosphere-scale 2D structural models have been derived for the Bergen, Stavanger and Moss areas. These data-based 2D models were used during the 2D conductive thermal modelling and 2D modelling of coupled groundwater flow and heat transfer in order to understand major features of thermal regime within the upper crustal rocks of the areas under consideration. According to the results of the purely 2D conductive thermal modelling, a significant decrease of the Earth's surface temperatures during the two last Weichselian and Saalian glaciations still affects the subsurface thermal field of the study areas in terms of the reduced heat flow densities within the uppermost part of the crystalline crust. Furthermore, results of the modeling of coupled groundwater flow and heat transfer indicate that the advective cooling due to groundwater flow is also one of the important factors for the reduction of temperatures in the Ullrigg and Fyllingsdalen boreholes within southwestern Norway (the Bergen and Stavanger areas) where the normal annual precipitation is one of the highest in Europe, reaching locally more than 4000 mm/year on the western (windward) side of the 1000-2000 m high Scandes mountains. On the other hand, the influence of the groundwater flow on subsurface temperatures is most likely relatively low within the Moss area which is located in the rain-shadow area with light precipitation and is characterized by smoothed landforms.

Key words: Thermal modelling; groundwater flow; precipitation.

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Interpretation of the Black Sea gravity data

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ABSTRACT

Black Sea is surrounded by Alpine Orogenic structures and is located between the Europe and Asia continents. Geomorphologically, the Black Sea basin resembles a miniature ocean. The aim of this study is to determine the geological structure and physical properties beneath the Black Sea by using gravity data. For this purpose, three separate gravity profiles, which will define the basic tectonic structures, were taken on the gravity map of the region. Directions in cross-sectional profiling were selected so as to reflect the general tectonics of the Black Sea. One of the gravity profiles is located perpendicularly on the Eastern Black Sea Basin and the second profile on the Western Black Sea Basin. The third profile is throughout the east-west direction of Black Sea. Gravity inversion method was performed on all these three gravity profiles. The results obtained from gravity inversion were compared with those of seismic reflection and gravity studies formerly investigated. For the inversion applications, the inputs of gravity modelling were defined by using the density values collected from previous gravity studies. According to the inversion results, sedimentary rocks were show to go down to 10-12 km depths under both the Eastern Black Sea and the Western Black Sea Basin. Depth of sedimentary basin under the Central Black Sea was seen to be about 8 km. This study showed that the inversion results conform to previous data obtained from seismic reflection and other studies, particularly those of Eastern Black Sea Basin.

Key words: Black Sea; gravity data, inversion; seismic reflection, geological structure.

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Continental motions of Western Turkey the years between 1988-2011

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ABSTRACT

Western Anatolia is one of the most active continental zone in the world. In this study, the movements of Western Anatolia occupying great importance in the world was investigating by using GPS observations. The GPS observations of four national projects; the first one, "Multi-Disciplinary Earthquake Researches in High Risk Regions of Turkey Representing Different Tectonic Regimes" (TURDEP) which realized the years between 2009-2011 by Marmara Research Center, Earth and Marine Science Institute, secondly, GPS data were belong to the years between 2009-2011 by General Directorate of Land Registry and Cadastre, Map Department which is named “Continuously Operating Reference Stations-Turkey” (CORS-TR), as the third; Turkish National Fundamental GPS Network (TNFGN) of The Republic of Turkey Ministry of National Defense, General Command of Mapping the years of 2000, 2001, 2004 and 2005) and The Scientific and Technological Research Council of Turkey (TUBITAK) project No:108Y285 which realized by Dokuz Eylul University, Department of Geophysical Engineering between the years 2009-2011 were used. The velocities of these stations were processed respect to Eurasia fixed frame by using GAMIT/GLOBK software and the velocities were found as approximately 20-25 mm per year towards W-SW directions. These velocities were compared with the previous GPS studies and the tectonism was interpreted. Therefore, any significant change was not seen on the directions and amplitudes of velocities from 1988 to 2011. At the same time, on the study area, the local differences on directions and amplitudes of velocities were noticed; therefore, the area was grouped into four areas. Additionally, for investigating the interplate motions of the region, the Anatolian and Aegean block solutions were calculated and the differences on directions and amplitudes of velocities were observed particularly in Anatolian block solution. Consequently, these results were compared with the geophysical data.

Key words: Western Turkey; continental motions; GPS/GNSS; geophysics.

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Examination of subsurface loading: a case from Western Turkey

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ABSTRACT

Microgravity is a geophysical method which describes the density changes within the subsurface. The method is affected directly by the density distribution within the subsurface and particularly by the presence of voids that create mass loss in proportion to the surrounding density value. The monitoring of geothermal reservoirs, groundwater levels and volcanic activities, the determination of fault systems and their mechanical relations, the observation of collapse-uplift areas and subjects like their stress-deformation are evaluated by using GPS measurements together with microgravity method. In this study, for investigating the subsurface mass changes of Western Turkey which is one of the most active continental region in the world, the GPS/GNSS and microgravity network system observations of "Multi-Disciplinary Earthquake Researches in High Risk Regions of Turkey Representing Different Tectonic Regimes" Project (TURDEP), which were realized between the years 2007 and 2009 by The Scientific and Technological Research Council of Turkey (TUBITAK) in Western Turkey were evaluated together. In that project, for 3 years (2007-2008-2009) data of the continuous GPS stations and microgravity were obtained simultaneously in six points. The GPS observations were processed with GAMIT/GLOBK software and the Up values of solutions were used for comparing with the microgravity data. After performing base corrections on microgravity data, the graphics were prepared for GPS and microgravity data. The relations between the changes on the graphics were tested by statistical method. The positive, negative or non-relation between two data sets were examined. As the last step, the results were interpreted with the earthquake distributions occurred in the study area. Additionally, some approaches developed for the geodynamic structure controlling the seismic activity of the region by examining obtained findings with seismological data. Consequently, crustal movements of the research points on Western Turkey, the surface and subsurface loadings were put forwarded as in compensation or uncompensation concept, geothermal features, high/low seismicity region as by using both microgravity and GPS measurements.

Key words: Western Turkey; GPS/GNSS; microgravity; mass changing.

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Analysing horizontal and vertical movements and modelling of subsurface structures in Izmir and its vicinity

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ABSTRACT

The study was focused on the South of Izmir which is located on a complicated area of Western Anatolia Region and achieved under the scope of The Scientific and Technological Research Council of Turkey (TUBITAK 108Y285) project. Izmir is located at the NE-trending strike-slip dominated weakness zone known as Izmir–Balıkesir Transfer Zone. This zone is constrained by the Izmir Fault, Seferihisar Fault Zone, Orhanli Fault Zone, Gülbahçe Fault, Karaburun Faults. In the study area, GPS/GNSS and microgravity network measurements were taken simultaneously at 21 stations along three years for explaining the mechanism which controlled the tectonics and creating the probable underground models of South of Izmir. 3 years (2009-2010-2011) GPS/GNSS observations were processed by GAMIT/GLOBK software respect to Eurasia fixed frame, Anatolian block and Euler vector solutions. According to Eurasia fixed frame solutions, the velocity of the study area found approximately 20 mm per year towards to SW. Secondly, the vertical changes were interpreted by comparing the height changes of three-year GPS measurements with the gravity values of microgravity network measurements in the study. As the last step, the microgravity measurements were taken along the profiles for determining the microgravity changes of the area. The parameter estimation methods were applied to the microgravity data and the probable parameters of the subsurface structures were attempted to be determined. Finally, the subsurface models of the study area in critical mechanism were generated by modelling methods. As a result, the outputs were evaluated together and then they were interpreted by using the previous study results and seismicity of the area.

Key words: Izmir; GPS/GNSS; microgravity; parameter estimation; modelling.

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Application of innovative high-frequency magnetometric probe (HFMP) on light UAVs in geology, archeology and related fields

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ABSTRACT

In 2014, first field test versions of airborne geophysical complex with high-frequency magnetometric channel (HFM Channel), were created by IPGG SBRAS, based on lightweight UAVs. Sensitivity of the magnetometric sensor is 70 pT, and sensitivity of the whole complex is about 1 nT. Level of magnetic noise during surveying in the natural magnetic field of Earth, away from industrial facilities and power lines, is no more than 0.2 nT. Measuring frequency of a generated magnetic channel is 1.5 kHz, while the number of significant bits is 22. All experimental work using HFM Channel based on light UAVs was conducted in parallel with standard ground magnetic survey using proton or quantum magnetometers. Weight of the whole complex including the UAV never exceeded 9 kg and could be carried in a backpack. Studies at the archaeological barrow in Vengerovsky District of Novosibirsk Region, have shown that using the UAV complex allows to confidently find artefacts with anomalous field of more than 5 nT. All anomalies found using HFMP on UAVs, were confirmed by standard surveying with POS-1 magnetometer, GSMP-35G magnetometer-gradiometer and magnetic-variation station MV-07M. Following objects in Khakasia were studied inside geological and geophysical training areas of SFU, TPU, NSU: Cu-Mo deposit «Alekseevskoe», «Erbinsky» nekk of alkaline ultrabasic rocks, «Sohochulskoe» manifestation of bitumen, «Legostaevskoe» gold deposit. Magnetic field data obtained by UAVs' HFMP generally coincide with the ground survey data obtained using proton or quantum magnetometers. Comparison of the matching profiles at different sites showed that the magnetic field data obtained by HFMP has significantly more complex structure with larger amplitude extremum. It allows for creation of more complex geological models of studied object structures. Possibility of magnetometric survey at different heights, as well as using adapted gradiometer, allows to chart complex geological and geophysical models of surveyed objects. Practical field tests of UAVs' HFMP shown it to have a significantly higher performance and efficiency, compared to conventional methods of magnetic surveying. Application of HFMP is also possible in related industries, where there is a need for precise large-scale mapping of magnetic field. Lack of infrastructure requirements allows use of the complex in a variety of conditions and for a wide range of tasks.

Key words: Magnetometer; aerogeophysics; UAV; unmanned aerial vehicle; archeology.

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Crustal earthquake instability in hard intact rocks adjoining pre-existing faults

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ABSTRACT

Earthquakes at shallow depths are normally related to pre-existing faults, which implies an essential role of faults in earthquake activity. Today the major earthquake mechanism at shallow depths is considered as frictional stick-slip instability on pre-existing faults, along which the frictional strength represents a lower limit on rock shear strength determining the lithosphere strength. This paper proposes a new approach in understanding earthquake activity on pre-existing faults based upon a recently identified fan-structure dynamic shear rupture mechanism. An extraordinary feature of the fan-mechanism is the ability to develop dynamically new faults in intact rock mass at shear stress levels significantly less than frictional strength. Another important feature is that for the initial formation of the fan-structure (representing the head of the developing rupture) a high local shear stress is required corresponding to the fracture material strength. According to the new approach, pre-existing discontinuities play the role of stress concentrators, providing the high local stresses in the adjoining intact rock mass (e.g. on asperities) necessary for the initial formation of the fan-head. After that the new fault propagates dynamically in the intact rock mass at the general field stresses (normally below the frictional strength) that give rise to the earthquake. The direction, attitude and extent of the fault are determined by the prevailing stress field. Extremely low shear strength of intact rock provided by the fan-mechanism determines the transient strength of the lithosphere in the zone of instability and favours the generation of new faults in the intact rock mass in preference to frictional stick-slip instability along the pre-existing fault. However, the proximity of the pre-existing fault to the area of instability caused by the fan-mechanism creates the illusion of frictional stick-slip instability on the pre-existing faults, thus concealing the real situation. The varying efficiency of the fan-mechanism with depth determines upper and lower cut-offs and explains the typical depth distribution of earthquake hypocentre frequency. The new approach clarifies the instability reasons on pre-existing faults and advances the understanding of earthquake activity and lithospheric strength at shallow depths.

Key words: Earthquake mechanism; shear rupture mechanisms; conditions of instability.

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FEM simulation of traffic seismicity effect in viscoelastic halfspace model

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ABSTRACT

The important area of the research is to find the ways to implement Finite Element Method (FEM) simulation of the technical seismicity effects due to transport. As dynamic load can be used the vibration time histories records measured at a point on the surface of the ground. As the dynamic load was used the passage of the vehicle and also the impact impulse-induced seismic load. The measurements were performed in various locations spaced at variable distances. The results of FEM simulation were compared with experimental results. This two solution were exported in the same points. FEM model allows to tune used basic material and geometric parameters. The way of tuning is also possible to compare the dominant frequency of the model using spectral analysis of the measured results. The tuned model can be used for further analysis and prediction in relation with technical seismicity.

Key words: Vibrations; technical sesmicity; FEM simulation; natural frequency; spectral analysis.

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Theoretical analysis of traffic seismicity effect on most important historical building in Modra town

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ABSTRACT

Vibration problems of the building structures caused by technical seismicity are becoming an increasing topic. The aim of this paper was to realize the numerical analysis of soil-structure interaction (SI) in the area Modra - Slovakia and FEM simulation of the vibration wave s propagation from mechanical impact. For this purpose the variants of model by computing program Scia engineering has been created. These models are important for the assessment of the dynamic vibration transmissibility due to mechanical impact load properties. We focus on two case studies, namely Upper gate built in 1610 – 1646 and King Stephen's Parish Church built in 1873 – 1876. Another objective of this paper was to receive results from vibration wave's propagation FEM simulation mechanical impact involved which causes structural vibration in buildings including a process of the system SI due to accelerometers. Using of the theoretical analysis and FEM simulation of the vibration waves it seem to be the practical application for engineering practice in prediction and assessment buildings vibration due to seismicity induced by traffic.

Key words: Vibrations; technical sesmicity; FEM simulation; natural frequency; spectral analysis.

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Defining the soil behaviour of Northern Part of Izmir (Western Anatolia) by using multi approach geophysical methods and GPS/GNSS measurements

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ABSTRACT

Izmir is the third most populous city in Turkey where located at western side of Anatolian plate. The Anatolian block is formed by the effects of the movements of Arabian and African plates together with North Anatolian fault zone. While Anatolian plate escapes from east to west, Aegean block is formed by North-South extensional tectonic mechanism. Therefore, Izmir and its surrounding are threatened by possible active earthquake zones. Recently, Menemen district located in the North of Izmir becomes a new industrial area of Izmir has been selected as the study area. As a geological feature; Menemen which is the largest sedimentary area of Izmir, has been shaped depending on the effect of Gediz River, generally during geological periods and undergone the effect of sea from time to time. Particularly, determining engineering bedrock is very significant case in the buildings located on possible active earthquake zones like as Menemen. Building earthquake resistant structures is a very important factor to reduce the damages and losses of life. Defining the relationship between the soil and buildings is important in this type of areas. The other important parameter causing earthquake damages is the soil amplification. The soil amplification is related to the change in the magnitude, the frequency and travel time of seismic waves passing from engineering bedrock to the ground within the period of time passing until reaching to the ground surface. In this scope, for defining the underground structural geometry and physical parameters of the Menemen, multi approach geophysical methods, which are included microgravity, microtremor, MASW (Multichannel Analysis of Surface Waves), measurements, well-logs and vertical electrical sounding (VES) studies were applied at study area. As a result, depth of the engineering bedrock was obtained and basin model was created for the study area. Additionally, vertical deformation was obtained for surrounding area of Menemen with the help of GPS/GNSS measurements.

Key words: Microgravity; MASW; microtremor; GPS/GNSS; engineering bedrock; Izmir.

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Investigation of tectonic and structural features of Marmara Region by using aeromagnetic anomalies

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ABSTRACT

Turkey is located in Alpine-Himalayas tectonic belt, which is one of the most significant earthquake regions of the Earth. As a result of the crash of Arabic and Eurasian plate along Miocene, Anatolian Block moves to the west. Northeast Anatolia is divided into a fair number of geological zones in east-west direction. These zones contain various stratigraphic, magmatic/metamorphic structures. In addition, due to the deformations formed after the aforementioned crash, fractures occurred in Anatolia. One of the biggest fracture/deformation zones is the North Anatolian Fault Zone (NAF). To be able to explain the behavior of the fault in the region as well as the deep geological structure, resorting to geophysical methods is essential. Within the scope of this research, tectonic structure of Marmara region was studied by using the magnetic anomalies. RTP and upward continuation transforms were applied to the magnetic data, respectively. RTP transform was used on the data of the aeromagnetic anomalies of Marmara region and magnetic anomalies were located on the original locations. Upward continuation transform including several values (2, 5, 10, 14 km) was applied to RTP magnetic anomalies. Therefore, the effects of shallow structures in the magnetic data were removed and the effects of the deepest structures were revealed. To the magnetic data, which was exposed to upward continuation transform, analytical signal and tilt angle methods were applied and the boundaries of the structures were detected. The results were associated with the tectonic features of the region.

Key words: Marmara Region; tectonic structures; analytic signal; tilt angle.

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Comparison of gravity and pseudogravity anomalies to determine the ratio of magnetization to density by using RMS method

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ABSTRACT

According to surroundings of magnetic and gravity fields are potential fields generated by mass having a density (ρ) and susceptibility (J=k x H). Gravity anomalies compared with pseudogravity anomalies derived from magnetic anomalies over the same area. The same geological mass may indicate the cause of both types of anomalies. Comparison of gravity and pseudogravity anomalies provides additional information about the causative body. Relative amplitudes of these fields can provide a value for ratio of intensity of magnetization to density (contrast). In this study, a method is developed for determination the ratio of intensity of magnetization to density (contrast) of body causing anomalies from the gravity and pseudogravity anomalies. This method is based on the correlation between the gravity and pseudogravity anomalies by using maximum root mean square (RMS) method. In this method, gravity, and pseudogravity anomalies were generated by using synthetic models. Maximum correlation between gravity and pseudogravity anomalies is directly searched by using different the ratio of intensity of magnetization to density (contrast) (ρ/j) values. The developed method has been successfully tested on synthetic models with and without errors. It also has been successfully tested on field data. The results suggest that the method can be reliable for estimating the ratio of intensity of magnetization to density (contrast) of body causing anomalies.

Key words: Gravity anomalies; pseudogravity anomalies; ratio of intensity of magnetization to density (contrast); RMS method.

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2,5 and 3 Dimensional gravity modelling of Niksar and Taşova-Erbaa Pull-Apart Basins, North Anatolian Fault Zone, Central Turkey

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ABSTRACT

In this study, tectonic features and depths of Niksar and Taşova-Erbaa pull-apart basins located in the central part of North Anatolian Fault Zone (NAFZ) were investigated by using gravity data. The North Anatolian Fault Zone, starting from Karlıova in the east and extending to the Gulf of Saros in the west, is a 1200 km-long dextral strike-slip active fault. The North Anatolian fault is one of the best known strike–slip faults in the world, and has a number of basins with different origins on it. The Tasova–Erbaa and Niksar basins are two adjacent pull-apart basins along NAFZ. The gravity data which were obtained from the General Directorate of Mineral Research and Exploration (MTA), Turkey, were modelled in three (3-D) and two and a half dimensional (2,5-D) methods. Gravity data of the basins were modelled 2,5 and 3 dimensionally. We obtained 3-D depth model of study area and also determined 5 cross sections to obtain 2,5-D models, with a density difference of -0,270 g/cm^3. To compare 2,5-D and 3-D models. We obtained 3-D cross sections which are in the same location of 2,5-D models. Afterwards, all of 3 and 2,5 dimensional models and also previous geological surveys were compared. When we investigated the gravity anomaly map of the region, we observed that, sedimentary units which form the basins have lower density compared to surrounding structures. In 3-D depth model map, we obtained the thickness of sedimentary units of Niksar and Taşova-Erbaa Basins are approximately 8-9 km and also according to our 2,5-D models of 5 cross sections, depths of Niksar and Taşova –Erbaa Basins are approximately 7 km. All of our 3-D and 2,5-D models correspond with each other. It also means, 2,5-D models strengthens the interpretation of 3-D models.

Key words: North Anatolian Fault Zone, Taşova-Erbaa and Niksar basins, Basin modelling, Strike-slip faulting, Pull-apart basin.

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Application of Artificial Neural Network (ANN) to microgravity data: an example of Seferihisar Fault (Izmir)

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ABSTRACT

Artificial Neural Networks (ANN), which are getting increasingly widespread in geophysics and require no initial model, are used to determine the model parameters, such as inversion of gravity, magnetic, seismic methods. Levenberg- Marquardt (LM) algorithm, which uses quite commonly inverse problems, requires good starting model to converge to the true solution. In this study, ANN and LM methods were utilized for inversion of gravity anomalies of the semi-infinite horizontal thin-layer. Firstly, synthetic model was created from forward solution and then %5 Gaussian noise was added to gravity anomaly. In inversion process, the top depth of the fault and fault slip were determined with acceptance of other fixed parameters. Root mean square error (RMSE) and relative error were calculated from the inversion results of the theoretical anomaly and the results show that YSA yielded better solution to the theoretical model with the lower RMSE according to conventional and global method. At the final stage of this study, the data, which are collected with the microgravity method in Seferihisar fault, were used in field studies. Fault top depth obtained from inversion processes was compared with the depth obtained from power spectrum. The depths obtained from these two different methods were found to be compatible with each other. The inversion results are considered to be consistent with true structure. Consequently, in this study, LM and ANN methods were applied successfully in both synthetic and field studies. The slip of the Seferihisar fault was found to be approximately 1 km and its upper depth was approximately 4 km.

Key words: Artificial Neural Network (ANN); microgravity; Seferihisar Fault.

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Investigation of shear-stress behaviour in alluvial soils where static and dynamic conditions by 2D soil-bedrock models: case study of Izmir

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ABSTRACT

There is a purpose for the review of local soil conditions in suitable to settlement area. The aim is to determine the dynamic response of the floor opposite the earthquake with different size of time and frequency. The investigation of the local soil characteristics, experimental studies to based on the laboratory and field surveys should be made for each project area. In each project area, the loading conditions should be considered. In this study, the alluvial soil area, located in east of Izmir Bay, north-south trending sections were taken. Stress - shear deformation, stress - strain characteristics were analysed. Accordingly, the horizontal and vertical replace are analysed under static and dynamic conditions with computer-aided numerical analysis methods. The models used with Midas GTS NX and Phase2 programs were created based on data obtained from the joint evaluation to geophysical studies, drilling of shallow and deep soil. According to analysis by Phase2 and Midas GTS NX, no earthquake case, shear deformations, the effects of external loads zones depending on the load force and depth was shown. By including in the calculation of seismic loading, distribution of shear deformation is distributed depending on the direction of the geological and seismic loads. And this, geological structure, layer thickness, elastic and dynamic characteristics of layer are also play an important role in the distribution of deformation. In the analysis program NX Midas GTS, total displacements that occur in soil, distribution on the model of shear deformation and 1.20 m diameter and 60 m deep in the pile, the behaviour of the static and dynamic conditions, the earthquake took place in Izmir, acceleration using the time record in time-domain analysis made. Dynamic load effects of pile head is determined to be the maximum lateral deformation level at 1.95 cm.

Key words: Soil dynamic analysis; earthquake resistant building design; microgravity; modified spatial auto-correlation.

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Geophysical in-situ investigations for analyze soil-structure interaction: case study of TRNC-Nicosia (DEU-EBAMER, NEU, AFAD Common Project)

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ABSTRACT

Cyprus is situated in the Mediterranean-Himalayan seismic belt. This seismic belt extends from the Strait of Gibraltar to the Indonesian island generation. In the past century, earthquakes did not cause any major damage. It is observed that there is a significant increase in the seismic activity in the part of the Helenic Cyprus Spread between Antalya Bay and Cape of Albian through the Aksu Thrust Fault. The average S-Wave velocity values change between 350-450 m/sec for the 30 meters depth in the general of Lefkosia where the workplace of this research is. This means that the place defined as bedrock is deeper than the 30 meters in the general Lefkosia. That is why the design spectrums defined in the regulations cannot be used for this research area and soil-bedrock models must be prepared in-situ. For that purpose, at first, in the 49 different locations the microtremor measurements were done for the Lefkosia and surroundings. By this way, the observational soil transfer functions were obtained. With the Soil Transfer Functions, the pre-estimation studies were done for the possible changes in the amplitude and frequency contents of the earthquake waves and acoustic impedance difference depth. In addition, the period sensitivity regions (acceleration, velocity, migration), which is obtained from the soil transfer functions and also describing the soil-structure joint behaviour, is defined. According to the obtained results, the acceleration and velocity sensitivity regions are dominant in the general area. Furthermore, in the pre-research, for the Intense Soil Movement station places managed by AFAD, the pre estimation studies were done for the period sensitivity regions by studying with the noise data in the general KKTC. Generally, it is observed that the bedrock is deeper than 30 meters long.

Key words: Acoustic impedance; microtremor; soil-engineering bedrock model.

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Determination of tectonic structures of East Anatolia by using gravity and magnetic anomalies

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ABSTRACT

East Anatolia is a region of high topography and Neogene and Quaternary volcanics overlying the subduction-accretion complex formed by the process of collision. This area has a lot of tectonic activity and faults. East Anatolian Fault (EAFZ) and the North Anatolian Fault (NAFZ) Zones are very active in East Anatolia. The East Anatolian Fault Zone (EAFZ) is a major fracture in eastern Turkey. It forms the transform type tectonic boundary between the Anatolian Plate and the northward-moving Arabian Plate. The North Anatolian Fault (NAF) is an active right-lateral strike-slip fault in northern Anatolia which runs along the transform boundary between the Eurasian Plate and the Anatolian Plate. The aeromagnetic and gravity data surveyed by the Mineral Research and Exploration (MTA) of Turkey have been used to interpret the characteristics of the near-surface geology of the region. To remove distortion of magnetic anomalies caused by the Earth's magnetic field, reduction to pole transformation was applied to the aeromagnetic anomalies using the magnetization angle of the induced magnetization. In this study, upward continuation has been applied to 1-2-3-4-5 km for gravity and 1-2-3-4-5-10-15 km for Reduced to Pole aeromagnetic anomalies in order to remove effects of topography and shallow structures. Then, Analytic signal and Tilt angle transforms are applied to upward continued gravity and aeromagnetic anomalies in order to determine of structures edges. Earthquake distribution (M > 3) of the region for the period between 1900 and 2015 also were overlaid on the Analytic Signal and Tilt Angle maps of gravity and aeromagnetic anomalies. The results show good correlation between earthquake distributions and Tilt Angel maps of gravity and magnetic anomalies.

Key words: East Anatolia; tectonic structures; analytic signal; tilt angle.

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Investigation of soil-structure relationship by using geophysical methods

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ABSTRACT

Cumhuriyet University Campus which is study area is a region located at a remote distance from seismic sources. However, remote distance earthquakes show amplification effect of ground in the alluvial soils. This situation occur a potential risk. Geophysical investigations of cities provide a basis for site-specific hazard analysis in urban settlements. The selected of faculty buildings were investigated soil-structure relationship in Cumhuriyet University Campus in the frame of this study. Primarily geophysical surveys were conducted by using GPR, MASW, ReMi and Microtremor methods for determining properties of placed on the floor of the buildings. The location of the underground layer and potential weak zones were determined by using GPR and was uncovered S wave velocity variation of underground layers by using MASW and ReMi methods. The dominant periods were determined faculty buildings by performing microtremor measurement on the each floor. Dominant periods were determined data between 0,26 – 0,42 seconds and between 0,44-0,56 seconds in faculty buildings and soil, respectively. Soil-structure relationship was combined to obtained results. Vs^{30}; Shear wave velocity was determined between 250 - 366 m/sec by using data obtained from MASW and ReMi methods evaluated together in study area. These velocities are not fully compatible with the specified layers by found GPR method because the layers are saturated with water. Finally, the risky areas were determined that by comparing derived dominant period values from the soils and on the each floor and ground that consist of alluvium units and this situation may occur risk although the buildings located in the safe zone. In addition, soil classification was made for each area using Vs30 shear wave velocity according to the criteria of NEHRP soil classification. Soils were uncovered to consist from class C for area 3 and class D for area 1 and 2 soils that located in the study field according to this classification.

Key words: Soil-structure relationship; GPR; microtremor; MASW; ReMi.

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Estimation of possible structural damage: the case study of Balçova, Izmir

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ABSTRACT

Earthquakes which most important natural disaster, bear upon our life and property security directly and we cannot prevent to exist earthquakes. It is possible to non-damage form earthquake can be possible earthquake resistant buildings. For earthquake resistant building design, horizontal deformations/ displacements must be calculated before earthquakes occur by using theoretical processing. There are three main cause structural damage during the earthquakes which are local soil conditions, earthquake parameters and structural specialities. Earthquake source parameters and local soil conditions will play an active role in determining the damage. Soil transfer functions (Quasi Transfer Functions-QTS) can be determining such that; the changes will occur on frequency and amplitude of earthquake waves which travels between the seismic bedrock to soil surface. Hence, Acceleration, Velocity or Displacement parameters which Structure will be affected can determine by using soil transfer functions. In this topic, microtremor data were processed depends on Nakamura's horizontal/vertical ratio technic and found that the Quasi Transfer Spectrums can be affected on earthquakes displacement and velocity component by using Geopsy software which generated by Sesame project. Also vulnerability indexes were calculated and mapped from Quasi Transfer Spectrums. Multi Channel Analysis of Surface Waves (MASW) method was applied at study area and Vs changes were mapped. According to the obtained results vulnerability indexes higher than 25, soil resonance frequency values higher than 1 second and Vs30 values lower than 760 m/sec. Also microgravity method was applied at study area for obtaining soil-bedrock models. This results which determined microtremor, vulnerability indexes, MASW and microgravity methods has been interpreted together.

Key words: Vulnerability index; QTS; MASW; microgravity.

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Evaluation of reliability under dynamic conditions of airport runways: a case study of İzmir/Gaziemir Air Military base

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ABSTRACT

The most important parameter which is horizontal earthquake force for earthquake resistant building design. Shear-Strain changes why occur earthquake force at soil must be associate with soil-structure common behaviour. Because of that reason; static load of structure, structure height and soil-engineering bedrock models should be interpreted together and investigate shear-strain changes which depends on earthquake force. Study area at Air Technical Schools Command in Gaziemir-Izmir is 1st degree earthquake hazard zone and situated on the old Quaternary alluvial unit. To investigate the earthquake-site-structure relations at existing structures (residential areas and runway) microtremor, microgravity and Multi-Channel Analysis of Surface Waves (MASW) studies were carried out. In this context, microtremor data at 35 points, MASW data at 4 profiles and microgravity data at 60 points were collected. Maximum amplitude and frequency values which are read from the Quasi Transfer Spectrum obtained by using microtremor measurements and S wave velocities obtained by using MASW measurements are evaluated together to reach the site thickness. By examining the 2D engineering bedrock and depth model obtained by using the microgravity method data the soil layers which can change the amplitude and frequency of the earthquake waves were investigated. Initial results for the study area indicate that a thick layer of soil is located at the study area. This situation is also supported by predominant periods which are greater than 1 second. In addition, being greater than 25 of the vulnerability index values which is calculated for the study area, indicates high lateral deformation values during a potential earthquake.

Key words: QTS; microgravity; MASW; engineering bedrock.

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Multidisciplinary model of borehole environment and formation evaluation

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ABSTRACT

While and after well drilling effective stress is changing, and subsequently the structure of pore space is evolving. Parameters of pore space like porosity, absolute and effective permeability, water and oil saturations are changed also. If unequal component natural stress field exists around borehole, then porosity and permeability are varied by different way in different radial directions. Therefore, mud filtrate invasion and salt transfer become asymmetric and assume another character. Water saturation, salt concentration and electrical resistivity distributions are complicated and 3D simulation is need for their characterization. Coupled mathematical model and software system GEHM for joint 3D computer simulation of electromagnetic, hydrodynamic and geomechanical processes in the borehole environment have been constructed. Proposed multidisciplinary model includes main factors of generation and evolution of near well zone. Mechanical impact on reservoir by well, flow of multiphase fluids, salt transfer, lithologic characteristics of reservoir, mud cake growth and destruction were jointly analyzed and simulated. Distributions of water saturation, salt concentration and electric resistivity, radial curves of porosity and permeability in different azimuthal directions, mud cake thickness, pressure, stress and strain fields are calculated by developed software system. Input parameters of multidisciplinary borehole environment model (MBEM) were determined from data of geophysical and geotechnical study in well and core analysis. Theoretical logs of electromagnetic well sounding (by high frequency induction isoparametric wireline logging tool) and electrical well sounding (by lateral log and Russian lateral log) are simulated for calculated electrical resistivity distribution. Set of MBEM in conjunction with calculated logs is content of Database, which will be additional tool of interpretation taking into account geomechanical processes. Computational power of Siberian Supercomputer Centre is used for multitudinous simulations. Created multidisciplinary model is assumed to use for formation evaluation by joint inversion of data of geophysical and geotechnical study in well when consideration of stress-strain state is essential. Computations by GEHM demonstrated, that for some real values of lateral pressure factor, internal friction point, ultimate stress permeability varies many times for cases with or without consideration of geomechanical processes while drilling. Authors have suggested interpretation technique taking into account deformation processes while drilling and their influence on the hydrodynamic processes near the borehole. Joint multidisciplinary mathematical and computer model of borehole environment make it possible to improve the interpretation of well data and reservoir evaluation.

Key words: Electromagnetic; hydrodynamic; geomechanic; logging; interpretation.

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The investigation of absorption of the Northern Tian-Shan Crust

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ABSTRACT

At At transition from stationary spectrum to source one it is very important to know the absorption properties of the medium. Previously, Zemtsova considered the seismic waves absorption in the crust of the studied region in her work with the aid of analogue station data. In 1991 the national seismological network KNET (Kyrgyz Network) was established on the north of Kyrgyzstan (Northern Tian-Shan). It consists of 10 digital wide-band stations which allow collection of big massive of data. Using those data a researcher is able to consider a number of Earth science problems including the problem of precision computation of the Earth Crust absorption g properties of the Earth's crust. To investigate the damping properties of the Earth's crust (Q- factor) The record of local earthquakes registered by KNET for the period 1999 - 2014 were used to investigate the absorption of the Earth's crust (Q- factor). The events occurred within 100 km circle around each station were chosen for research. The duration of each record is 310 sec., data records started in 10 seconds before the focal time. Three components of the records (E, N, Z) were used. The single scattering model was used to calculate the *Q*-factor (Q_c) This model considers the coda waves as a superposition of body (volume) waves reflected from random non-homogeneities. Code waves consist of tail parts of seismic records. Signal amplitude attenuates as waves are propagating from source due to volume attenuation and geometrical spreading. The code waves of various lengths (t_c) 20, 30, 40 and 50 seconds were considered in the work. Two stage computations were used to estimate the dependence of Q_c variation on frequency. At the first stage the narrow band pass filters were applied, with central frequency f and band width Δf. This allows selection the given frequency range from the spectrum/ Thereafter Hilbert transform was used for subsequent building of the envelope of code waves. The values of absorption were obtained for every frequency, and this allowed construction of Q factor dependence on frequency for every station explored. The power coefficient in the frequency dependence of Q factor $Q_c(f)=Q_0 f^n$ (frequency index n) describes the medium, it rises with regional tectonic activity. Index n for the region considered varies within the bounds corresponded to tectonically active regions ($n>0,8$), this is the case of the territory of the Northern Tian-Shan. For example, for t_c =20 sec., changes in the value of n for KNET stations occurs within the limits $n=0.85\text{-}0.94$. The obtained estimates of Q factor can be used for construction of focal spectrum of earthquakes occurred in the territory of the Northern Tian-Shan. After computation of focal spectrum of seismic event one can determine its dynamic parameters.

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Key words: Seismogram; coda-wave; q-factor.

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Geophysical study of the Hammam Bouhdjar hydrothermal area (north-west of Algeria)

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ABSTRACT

Situated at north-west of Algeria (North Africa), the thermalism of “Hammam Bouhdjar” area is located in the narrow depression drawing the plain of “M'léta”. It’s renowned as a fallen geologically space, spared after the establishment of the Tellian nappes, between Oran coastal mountains, in the north, and the Tessala mountains, at the south. His history is heavily related to tectonic post-nappes structures (essentially faults and incidentally volcanic), responsible of the Neogene subsidence that characterize this region. In order to know the hydrothermal potential of this area, geophysical studies were conducted (electrical, Audio-Magneto-Telluric and gravity methods). The combined interpretation allowed to constrain the results of each prospection method. The electrical prospection, composed of forty five (45) electrical soundings (Schlumberger type, AB = 1000 m), with spacing of ~ 1 km, did not show the presence of sandstone lentil up to 200 m depth. The more interesting results of the electrical prospecting are the confirmation of the Riedels fault system. For information at greater depths, we used the Audio-Magneto-Telluric data; the basement conductivity high has allowed the investigation to 400-500m. The presence of a potential reservoir is not highlighted too by the Audio-Magneto-Telluric method. Recently, a gravimetric study was conducted in order to confirm the position of the process (in space and in depth) and distinguish, if there occurs, a magma chamber at depth. More than 400 gravity points, with spacing of the order ~ 300 m, were realized. The results based on various filtered maps (horizontal derivative, upward continuation) of the gravity data were used to make a structural map of the study area.

Key words: Electrical prospection; gravity field; hydrothermal activities; Algeria.

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Use of the structure tensor in edge detection and enhancement of potential field data

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ABSTRACT

Edge detection and edge enhancement techniques provide important knowledge to potential field geophysicists to interpret the potential field data. For this purpose, many techniques have been developed. Most of these techniques are based on horizontal and vertical derivatives of potential field data. Image processing techniques have been frequently used in interpretation potential field data. The structure tensor is one of the image processing techniques and represents a local orientation in an n-dimensional space. In this study an improved structure tensor is presented, and eigenvalue analysis of the improved structure tensor are used to recognize the edges of the subsurface lineaments. The edges and corners of causative bodies were extracted using its eigenvalues. The smallest eigenvalues of the structural tensor provide information about the corners of the subsurface structure such as prism bodies while the local maxima of largest eigenvalues provide information about the edges of linear structures as faults or contacts. In contrast to traditional derivative based methods, the structure tensor has a property which reduced noise in the data while enhancing discontinuity boundaries. The eigenvalues of the structure tensor were recognized the edges of the sources more clearly and precisely. Based on noise-free and noisy synthetic potential data, the technique was tested and satisfactory results were obtained. Gaussian envelope is used to smoothing the potential field data. The method were analysed for different standard deviations of Gaussian envelope. The large value of the standard deviation is effective in balancing the amplitudes of the different anomalies consist of large and small amplitude anomalies. The method is also applied real gravity and magnetic field data. All of the results have shown that the technique provides beneficial information to geoscientists for determining the horizontal location of subsurface structures.

Key words: Eigenvalues; structure tensor; potential field; edge detection.

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Kinematic finite-fault model of the October 23, 2011 Van, Eastern Turkey Mw 7.1 earthquake obtained from regional and teleseismic P Empirical Green Function Analysis

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ABSTRACT

A kinematic source model for the Mw 7.1 October 23, 2011 Van Earthquake was generated for both regional and teleseismic distance by employing the Empirical Green's Function Method proposed by Hartzell (1978) using the STF inversion approach of Dreger (1994). We chose the Mw 6.0 aftershock as the EGF event which occurred 10 hours after the main event and had the similar focal mechanisms and locations with the mainshock. We performed the analysis for two distance ranges; regional (1◦-20◦) and teleseismic (30◦-90◦) and selected the stations which have good azimuthal coverage, high S/N levels and similar waveforms for the main shock and the EGF event. We determined the rupture parameters such as rupture velocity and the rise time as well as slip distribution for the Van earthquake by comparing the regional and teleseismic data where the models have high variance reductions. We found the best-fit range of rupture velocity between 1.5 and 2 km/s and the rise time between 1 s and 2 s. The slip distribution is primarily up-dip towards southwest and the maximum slip is about 3.5 meters. Our results show that the source models obtained from teleseismic and regional data are in agreement with each other. The rupture velocity obtained for the Van Earthquake, about 50% of the shear wave velocity is a characteristic for dip slip earthquakes. The rise time of 1.5 seconds implies 2 m/s slip rate inside the largest asperity.

Key words: Kinematic modelling; Van earthquake; Empirical Green Function; Eastern Turkey; seismicity.

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Coda wave attenuation estimated for North Anatolian Fault Zone (Turkey)

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ABSTRACT

The North Anatolian Fault Zone, where major earthquakes have regular migrated from east to west in the last century, is one of the world's most active faults. The purpose of this study was to estimated frequency dependent attenuation of coda wave (Qc(f)) by using single backscattering model. The zone is divided five sub-regions in view of the earthquakes rupture. We have analysed 654 local earthquakes, magnitude ≥ 3.0, recorded by 37 stations during 2009-2014. Coda waves filtered at six different bands, centred at 1.5, 3, 6, 9, 12 and 18Hz, and lapse time of 20-30-40 s. The average Qo(quality factor at 1Hz) and n(frequency parameter) was obtained as: from 160±15, 0.87±0.01 to 219±32, 0.73±0.02 for Karlıova-Tokat region; from 171±18, 0.81±0.02 to 258±24, 0.73±0.015 for Tokat-Çorum region: from 191±22, 0.76±0.01 to 283±35, 0.74±0.02 for Çorum-Adapazarı region; from 212±28, 0.79±0.03 to 287±27, 0.73±0.012 for Adapazarı-Yalova region:from 188±17, 0.88±0.02 to 330±29, 0.74±0.02 for Yalova- Gulf of Saros region at 20s to 40s lapse time respectively. The obtained Qc value has differenced by region. The apparent depth is strongly affected by the length of lapse time window. The result show that the low values of regional Q0 exhibit high intensity of scattering along the fault. The n value shows accordance with tectonic activity of the study area. Especially, values Qc of upper crust layer very low in all sub region compared to the lower lithosphere. The Qc values have interpreted that stress accumulation, tectonic activity, fluid saturated structure and the degree of heterogeneity change with depth and sub region.

Key words: Attenuation; North Anatolia Fault; Coda wave.

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Seismic parameters re-determined from historical seismograms of 1912- Murefte-Sarkoy, 1935-Erdek-Marmara Island and 1963-Cinarcik earthquakes

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ABSTRACT

Marmara Region has witnessed many devastating earthquakes where some of them caused tsunami. Many geological field surveys and geophysical studies indicated that 1912, Sarkoy-Murefte event, occurred on the Ganos Fault Zone, was one of the largest earthquake in the western Marmara Sea and caused tsunami. The same is also valid for 04.01.1935, 14:41, M=6.4 and 16:20 M=6.3 Erdek-Marmara Island, and 18.09.1963, 16:58, M=6.3 Cinarcik earthquakes. The aim of this study is to contribute to the seismotectonics of this region by examining the source parameters of these shocks using seismic waveforms, which were previously not carried out by modern techniques. In this study, the original seismograms from various countries for 1912 Sarköy-Mürefte, 1935, Erdek Marmara Island and 1963, Cinarcik earthquakes were digitized. The magnitude Mw, seismic moment Mo, the radius of circular source zone R and stress drop values were redetermined from displacement spectra of the digitized seismic waveforms. A large number of seismic station bulletins have been consulted for the instrumental information to remove the instrument response. In addition, the epicentral locations have been calculated using available readings from original records and ISS bulletins for the 1935 and 1963 earthquakes. For the 1912 event, the magnitude Mw=7.13 and radius of the fault area R=41 km were determined. Also, 04.01.1935-14:41 and 16:20 earthquakes showed a fault radius of about 15 km with magnitudes Mw=6.0 and Mw=5.9, respectively. The epicentre determinations showed that the first event in 04.01.1935 was located at 40.72 N- 27.72 E while the second one occurred at 40.61 N-27.43 E. Another finding is of the 1963 event, which gave a fault radius of approximately 13 km with a magnitude Mw=5.9. The 1963 event was located at 40.80 N-29.18 E. Furthermore; moment tensor inversion method was applied on these earthquakes by using original seismograms collected from various observatories. The fault mechanisms for 04.01.1935-14:41 and 16:20 earthquakes were determined using moment tensor inversion from the original seismic waveforms for the first time. Likewise, fault mechanism for the 1963 Cinarcik earthquake was also obtained. The results showed that these earthquakes have normal fault mechanism.

Key words: Marmara region; seismic parameters; historical seismograms.

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Determination of correlation between physico-mechanical properties of intact rocks and P-wave velocity in Kocaeli Area, Turkey

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ABSTRACT

Construction of projects such as foundation on rocks, underground structures, infrastructure works, tunnels, dams, etc. is substantially influenced by physical and mechanical properties of rocks. The reason of the most of the hazards is the inaccurate evaluation of these rock properties. Especially specimen preparation for laboratory testing to determine the mechanical properties are expensive, difficult to be carried out and time consuming. In addition, the accuracy is mostly dependent on the specimen dimension, human errors, instrument calibration and internal factors. The P-wave velocity which depends on density and elastic properties of rocks has been used for many years to determine the physico- mechanical properties of different rocks. In this study, the rock samples were collected from five areas in Kocaeli area. Core specimens of rock samples collected from five different rock types were cored in NX size (54 mm diameter) by coring machine. The both ends of the specimens were trimmed as 110 – 115 cm and smoothed using a lathe to avoid end effects. The specimens were dried at 105 C° for 24 hours to remove moisture The physico-mechanical properties of five different intact rock types including sandstone, arkoses and limestone were determined through standardized laboratory tests. Laboratory tests were performed on 96 rock specimens, including 10 of which are volcanic and 86 of them are sedimentary rocks. The specimens were tested to obtain the relationships between P-wave velocity, dry unit weight, uniaxial compressive strength, point load index, indirect tensile strength, porosity, and Schmidt hardness. Statistical equations have been determined for estimating the physico-mechanical properties of rocks using non-destructive and indirect test methods. Results of regression analyses showed satisfactory correlations. The test results were interpreted statistically and reasonable good linear relationships were determined with P-wave velocity (ranging between 1890m/s and 6340m/s) to the physico-mechanical properties. This result denotes that P-wave velocities could be used in determination of the physico-mechanical properties of intact rocks.

Key words: P-wave velocity; physico-mechanical properties; intact rocks; correlation.

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The 2012-2013 seismic swarm in the Eastern Guadalquivir Basin (S Spain)

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ABSTRACT

The aim of the present work is a detailed study of a recent seismic swarm happened in S Spain, in the Eastern Guadalquivir Basin, named the Torreperogil-Sabiote seismic swarm/sequence, with specific temporal and spatial clustering properties. On the basis of the daily activity rate, three main phases are identified and analysed. The performed analysis combines different seismological relationships to improve our understanding of the physical process related to the event occurrences. The released energy is estimated from the seismic moment, and each one of the phases is characterized by its cumulative seismic moment. Moreover, the events of the sequence, initially located by the Spanish IGN, have been relocated using the well-known HypoDD code. Three clear clusters are identified, and a finite Markov chain model is used to study the migration of events between clusters. To derive the frequency-magnitude Gutenberg-Richter recurrence relationship, a comprehensive analysis of the completeness magnitude, for which all events with magnitude above this value are reported in our data, is performed using different approaches. It is found to be around 1.5. The slope in the former recurrence relationship, called b-value, is a critically important parameter used in different seismological researches (e.g., seismic hazard and forecasting studies). Moreover, this parameter is linked to the extent of ground fragmentation in a given area. In this study, this parameter was estimated using the maximum likelihood method. Values of 1.11, 1.04 and 0.90 for the three considered phases were obtained. To test retrospectively the hypothesis of b-value decreasing as precursory phenomena before the occurrence of a large event, we have studied its temporal variation using the overlapping moving window technique. These changes are analysed and correlated to the regime style of the rupture; it is accepted that the b-value is an indicator of the stress regime, influencing the size of the rupture. The spatial analysis is performed using the fractal dimension, estimated using the Grassberger and Procaccia (1983) method. The cumulative Gamma and Beta distribution functions are also used to study the inter-event distances behaviour of the seismic swarm sequence.

Key words: Seismic swarm; Gutenberg-Richter relationship; b-value; Markov chain model; fractal dimension.

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Seismic damages in Lagina Sacred Area on the Mugla Fault: A new understanding on obliquely situated subsidiary faults of western Anatolia

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ABSTRACT

Western Anatolia extension region consists of E-W-trending major normal faults and numerous subsidiary faults which run obliquely to major systems. In this paper, the NW-SE trending Mugla Fault was studied with archeoseismological projection of the Lagina sacred area supporting geological and geomorphological field evidence along the zone. The sacred area is cut by fractures which caused extensive deformations and displacements on relics along the fault. Orientation of collapsed columns, folding on the grounds, dilatation and tilting on the walls are systematic and axis of this deformations could be related with direction of the strong ground shaking are perpendicular to the Mugla Fault. Although there are no historical records of a large earthquake on the Mugla Fault, TL and radiocarbon dating in Lagina sacred area concludes that a large event (Io= VIII-IX) occurred in 4th c. AD or just later. Considering the field evidence on the Mugla Fault, thus, it can be concluded that subsidiary faults which run obliquely to major normal fault systems has strike-slip component and compensate significant portion of the recent extension dynamics as well in western Anatolia.

Key words: Western Anatolia; archaeoseismology; AD 365 earthquake; Lagina.

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Advanced seismic and well log interpretation techniques for identifying better reservoir properties: used for exploriation of oil and gas fields in South Moravia, Czech Republic

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ABSTRACT

LAMA GAS & OIL s.r.o. is a private company focusing on exploration and production of oil and gas on its three licences situated in South Moravia, Czech Republic. The company owns three exploration licences: licence Břeclav I is situated in north-eastern edge of Vienna basin and Salaš and Strabenice licences are situated on so called Slopes of Bohemian Massif. Total area of all licence represents 122 sq.km. 3D seismic techniques and directional drilling based on results of 3D seismic are used for exploration of oil and gas fields and for geological interpretation and modelling. Interpretations of final products of basic 3D seismic processing give information about general structural and stratigraphical relationships and possibility to define an explorational prospects in an areal and local scopes of interests. 3D seismic inversion technique is an advanced methodology which goes into the details beyond the resolution of conventional 3D seismic. Main key of the technique is putting acoustic and petrophysical data from wells into the seismic. We use this technique for better understanding of difficult lithological relationships of reservoirs within the mapped traps, better targeting of directional drilling and calculation of hydrocarbon potential of traps. Wireline well logging is a conventional technique for identifying and interpretation of lithology in general and reservoirs including their basic petrophysical parameters and oil/gas saturation. Wireline logging is usually measured after the drilling of open hole. Measured data are often affected by mud and its filtrate and consequently can give misleading results. Mud is used as the important technical liquid for drilling. To avoid the affection of mud and mud filtrates in reservoirs we used logging while drilling (LWD) technique to measure logs as early as possible after the reservoir had been drilled. Combination of both seismic inversion and logging while drilling techniques yields higher resolution of geological models and eliminates risks in exploration of hydrocarbons. 3D seismic inversion was done in several steps by Fugro-Jason and Jason-CGG companies in years between 2007 and 2014. The geological interpretations and modelling was made on Petrel by Schlumberger. For logging while drilling we used measurement by Baker-Hughes. To all of that companies belongs our kind acknowledgement.

Key words: Seismic; attribute; exploration; well logging; oil; gas; reservoir.

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Seismically induced soft sediment deformation structures (seismites) in Quaternary lacustrine deposits of Lake Van (eastern Turkey)

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ABSTRACT

The Eastern Anatolia Plateau is located at the north of the collision zone between quasi-stationary Eurasian and northward moving Arabian plates. The Lake Van Basin is one of the most seismically active region located at the south of the plateau formed by the post collisional contraction tectonics. The basin has the largest sodic lake of the world (Lake Van) which was formed 600 kyr ago. Ancient lacustrine deposits of the Lake Van, related to high period of water level, intensely observed at the eastern part of the lake. Soft-sediment deformation structures (seismites) formed by liquefaction and/or fluidization of unconsolidated sediments due to seismic shocks are frequent in the Quaternary lacustrine deposits of the Lake Van. They are present in both marginal and deep lacustrine facies. According to morphology and formation mechanism, the seismites are classified as fluid-escape structures (dish and pillar structures, flame structures and sand volcanoes), contorted structures (simple and complex convolutions and ball-and-pillow structures) and other structures (disturbed layers and slump structures). October 23rd, 2011 Van-Tabanlı Earthquake (Mw 7.2) was provoked the formation of most recently structures. The existence of seismites at various stratigraphic levels in the lacustrine deposits is significant indicator of tectonic activity that occur by earthquakes with magnitudes of 5 or more, affecting the Lake Van Basin.

Key words: Seismites; soft-sediment deformation structures; earthquake; Lake Van; Turkey.

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Reservoir Induced Seismicity (RIS) at reservoirs of two hydro electrical plants

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ABSTRACT

For the last eighty years, a number of cases of seismic activity related to: construction of dams and formation of large water reservoirs, exploitation of thermal waters, injection of fluids into rock masses, exploitation of mines as well as big underground explosions. RIS occurrence is very complicated and with insufficiently known triggering mechanisms, causing earthquakes with magnitudes in range from micro-earthquakes to M = 6.5. Seismic activity caused by filling of a water reservoir (RIS) was first identified in the early 1940-ties: 1938 Marathon dam, Greece, 1939 Mead Lake on Colorado River. The causal connection between the filling of a reservoir and seismic activity was than established. RIS manifested near dams of different heights, structure and different maximum reservoir depths. The strongest RIS earthquake took place at the Koyna dam, India, in 1967, with M=6.3 occurred. In order to identify RIS, data on the background seismicity should be provided through seismic monitoring of the area of the future reservoir. The RIS mechanism is very complicated depending on different geological, tectonic, seismotectonic and seismological conditions of the region below and around the reservoirs. This paper consideres two dams Grancarevo (1968), 123 m high arch RC dam in BiH and Kozjak (2004), 125m high embankment dam in Republic of Macedonia. The general setting of both dams regarding the seismotectonic and geomorphological features, yielded with pre-construction monitoring of the seismicity of the area. The close monitoring was continued during the filling of the reservoirs and continues to present. For Grancarevo dam the long term (10 years) of correlation between reservoir water level and earthquake incidence was analysed. Interesting fact is that in 2009 when the precipitation during autumn-spring period was intense, the seismic activity was increased (Fig. 1) with earthquakes with higher magnitudes than usual.

Key words: Induced seismicity; water reservoir dam.

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Subsurface electrical resistivity imaging applied to the investigation of causes of structural failure indices on a set of administrative blocks

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ABSTRACT

Electrical resistivity imaging has been employed to investigate the causes of structural failure related cracks on a set of administrative buildings in south-western Nigeria. The goals were to image the distribution of subsurface lithologies and geologic structures beneath the set of buildings and to infer the relative strengths and load bearing capacities of the lithologies. Data were acquired along four geo-electric traverses in 2D imaging mode using the ABEM1000 Terrameter unit. Field data were processed and inverted to obtain 2D subsurface resistivity structure using a 2.5D finite-element modelling inversion algorithm which utilizes an active constraint balancing algorithm to optimize between robustness and smoothness of inversion results. Results indicate that the north-eastern half of the site is underlain by unweathered basement rocks overlain by thin (generally < 4 m) soil cover, while the south-western region is dominated at depths beyond 4 m by low-resistivity water-saturated clays and some weathering tills. The clays apparently receive abundant supply of water from a seasonal stream channel adjacent to the most westerly administrative block. The block presenting with the most damage has been built out over the edge of the shallow basement scarp onto these less competent higher-compressibility water-saturated clays in the south-eastern region resulting in cantilever-mode differential settling of the southern section of the building. A second damaged block is situated entirely on low resistivity water-saturated clays. Differential settling on this second block is likely related to the difference in thicknesses of the clays between the sites of the north and south facing walls of the building. Beneath the north facing wall, the clays are thinner and could be expected to compress less than at the south facing wall. Though uncalibrated to core or log data, the results allowed a first insight into possible causes of structural failure on the buildings and it is hoped that palliative measures will benefit from these results.

Key words: Electrical resistivity imaging; water saturated clays; basement scarp; engineering site investigation.

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The archeogeophysic and archeogeological study of Antiokheia Hipodrom in Antakya, Turkey

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ABSTRACT

Research area is, placed on Küçük Dalyan which is near to the shore of Asi river in Antakya city. In this work we did do some Geophysical (GPR, Geomagnetics and Geoelectricity) research around the slaughterhouse of veterinary center of Antakya and its garden for finding the position of the walls and base which belong to the antic city. (GPR, Jeomanyetik ve Jeoelektrik) çalışmalar yapılmıştır. Today we can say that there is an hipodrom in Ada mevkii which belongs to Antiokheia antic city placed on Küçük Dalyan town today. The remnant of the hipodrom such as wall, some colomns and stears. Unfortunately the remnant of the hipodrom mostly is destroyed althought the many demage still it is possible to to recognized some remnant today. At the same time there are some ancient buildings such as bath, hipodrom and temple. The largest hipodrom (Antiokheia) which belong to Rome term is waiting for to be uncoverness and we did research fort his aim geophysical methods such as GPR, geomagnetics and geoelectrics. In georadar method we did use different frequencies and süit antene (500 MHz Shealded) Most of the time in the field we prefer to measure in rectangular areas. By this way we did get two or three dimensinal view. With this shapes it is possible to see some linear sahapes as a wall or some high buildings undergraund. Anomalies shows the indicates clearly We did measured total compenent of geomagnetic area of the Earth by using geomagnetics method using two sensor. By this way we had geomagnetic map of the area. To study these maps shows that there is connections between the anomalies and buildings undergraund. Geoelectrics measurements was made using multiple electrode rezistivity equipments. We had some tomographic view from the data we measured. With this rezistivity profiles it is seen some rectangular shapes which are parallel with ancient structures underground clearly. All data indicate that if we use together three methods all of them say the same thing. There is certainly some architectural structures underground in this area and around. Hipodrom and its around we have some geoarcheological research as well. In this study We did collect some samples from the antic city and hipodrom to compare with geological samples which was collected from around area. By this way we studied to find connect with the building material and geological around. Both samples from antic city and around arae, was researched by petrographical, paleontological and geological methods. Bu kapsamda gerek antik kentten gerekse çevre alanlardan litolojik örnekler alarak petrografik, paleontolojik ve jeolojik incelemeler yapılıp karşılaştırılmıştır. It was understand that during the antic city was built some rock materials come from near area but some of them come from far area. Anlaşılmaktadır ki: ae uzak antik kent inşa edilirken çok farklı ve uzak alanlardan da taş malzemeler getirilmiştir. By this way we can see that there were many commercial contact with near and far.

Key words: Antakya; Asi; GPR; archegelogical; Antiokheia; archeophysic; resistivity; Georadar.

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Integrated geophysical-thermomechanical modelling of the lithosphere in the east Marmara region, Turkey

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ABSTRACT

The seismically active Marmara region in the NW Turkey, lies on the westward end of the major fault zone called North Anatolian Fault Zone (NAFZ). The seismic gap has long recurrence interval in the southern part of east Marmara region. In this study, we examine the reason of the southern seismic gap in the context of lithospheric structures using EGM08 Bouguer gravity data, steady state thermal modelling, seismic velocities (Pn and Sn) obtained from temperature and pressure, and effective elastic thickness (EET). At first, radially averaged logarithmic power spectrum of EGM08 Bouguer anomalies has been calculated to estimate the average depths of the density interfaces and critical cut-off wavenumbers for filtering operations. The average depths of the basement, crustal-lithospheric mantle boundary (Moho) and lithosphere-asthenosphere boundary (LAB) have been calculated as 5 km, 35 km, and 50 km for the linear segments of the spectrum, respectively. Then the Moho and LAB undulation with the gravity inversion, based on the Parker-Oldenburg's algorithm have been constructed. Gravity inversion indicates these interfaces are less undulated and deeper in the southern part of east Marmara region. Thus in this region the Moho depressions are almost compensated via thickened crust. On the other hand, the reason for the LAB to be in shallower has been explained by thermomechanical erosion of the lithosphere. The EET map of lithosphere representing the thickness of crust and lithospheric mantle rocks that behave elastically, have been obtained from the depths of Moho and LAB using Burov and Diament's method. After determining the rheological strength of lithosphere controlled by its depth-dependent rheological structure from Byerlee's law, the relations between rheology, EET variations, and earthquake distribution have been analysed.

Key words: Lithosphere; Bouguer anomalies; thermomechanical modeling; effective elastic thickness; rheology.

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Scope of enhanced data interpretation using geothermal response test data

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ABSTRACT

A (enhanced) Geothermal Response Test is commonly used to determine geophysical parameters (i.e. thermal conductivity and volumetric heat capacity) of the subsoil. Such data can be utilized to get additional information on the subsoil. Using different heat source approaches enables to evaluate measurements for different heat exchanger designs (e.g. u-tube heat exchangers, piles, baskets, etc.). It is important to choose the right approach to avoid misinterpretation and wrong values. Analogue to hydro-geologic methods, time to distance calculations show the depth of the thermal investigations into the surrounding rock. Knowledge on grout and rock properties is preferable. Using this method through high resolution fibre optical measurements (enhanced GRT) allows determination of local rock properties, as well as localizing of grouting failures. Furthermore, the Darcy velocity of the groundwater affecting the heat exchanger during measurements can be calculated. Temperature profiles vs. depth, pre and post (e)GRT, can be used to identify vertical groundwater flow through incomplete backfilling for a borehole heat exchanger (BHE). Serial profiles vs. depth over time post GRT show the quality of contact for the BHE to the surrounding rock. Determination of groundwater influence and grouting failure is also feasible. Various information can be obtained from one data set without additional measurements. The more information available the more precise geothermal array can be designed.

Key words: Geothermal response test; data interpretation; fibre optic; OFDR; geophysical properties.

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Tsunami scenarios based on stochastic seismic sources

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ABSTRACT

A large seismic gap lies along northern Chile and could potentially trigger an Mw ~ 8.8-9.0 mega thrust earthquake. The 2014, April 1st, Iquique earthquake broke the middle segment of the mega thrust. Some slip models suggest that it ruptured mainly from a depth of 30 to 55 km along dip and over 180 km in length, reaching a magnitude Mw 8.1-8.2. The northern and southern segments are still unbroken, thus, there is still a large area that could generate an Mw > 8.5 earthquake with a strong tsunami. To better understand the effects of source parameters on the impact of tsunami in the near-field, as a case study, we characterize earthquake size for a hypothetical and great seismic event, Mw 9.0, in northern Chile. On the basis of physics-based earthquake source models we generate stochastic k-2 finite fault slips taking into account the non-planar geometry of the mega-thrust in northern Chile. We analyse a series of random slip models and compute vertical co-seismic static displacements by adding up the displacement field from all point-sources distributed over a regular grid mesh on the fault. Under the assumption of passive generation, the tsunami numerical model computes the run-up along the shore. The numerical results show a maximum peak run-up of ~35-40 m in the case of some heterogeneous slip models. Instead the minimum run-up along the coast, from the suite of heterogeneous slip models tested, almost coincides with the run-up computed from the uniform slip model. This latter assumption underestimates the run-up by a factor of ~6 at some places along the coast, showing agreement with near field run-ups calculated by other authors using similar methodologies, but applied in a different seismotectonic context. The statistical estimate of empirical cumulative distribution functions conducted on two subset of slips, and their respective run-ups, shows that slip models with large amount of slip near the trench are more probable to produce higher run-up than the remaining subset. The simple separation criterion was to choose slip models that concentrate at least 60 % of the total seismic moment in the upper middle part of the non-planar rupture fault.

Key words: Tsunami; run-up; early warning.

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Source characteristics of a destructive earthquake in south-west of Caspian Sea

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ABSTRACT

Southern Caspian Sea is almost an active block in Alpine Himalayan Belt that is surrounded by active and Seismic Belts such as Kopeh Dogh, Talesh and Mid-Caspian. The region that is being discussed in this study is located at 36 to 40 degrees northern latitude and 46 to 51 degrees eastern longitude. Astara region, which is located at the south of the Sabalan volcano and southwest of the Caspian Sea, respectively, is always accompanied with seismic events. The 9 July 1998 Astara Earthquake with magnitude mb=5. 8, is the largest earthquake that occurred in Astara region during the past 100 years. The obtained source mechanism is reverse movement and is in agreement with the fault system in the region. The observed teleseismic body waves of mainshock were modeled in order to obtain the source process. The source process fitted with a multiple source model having at least two major subevents with reverse mechanism, although a single source could explain the first 40 seconds of telseismic waveforms. The results of waveform modeling indicate that rupture during the mainshock initiated in the epicentral area and extended towards south in a unilateral manner. The total seismic moment was calculated to be M0= 6.7×1017 Nm. The calculated fault length is about 20 – 30 Km. The 1998 Astara Earthquake is a rare earthquake with magnitude 6 in Astara region. Regarding that the epicentral area is located in the vicinity of major cities, additional studies and investigation of active faults is recommended. From the engineering point of view, Astara Earthquake, which provided ground-motion characteristics of a rare large event in the affected area, was the controlling event for the design of structures with high safety requirements.

Key words: Seismicity of south Caspian Sea; seismicity of Astara; focal mechanism; waveform modeling; Earthquake mechanism; seismotectonic.

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Infrared thermography as a tool to assess salt crystallization

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ABSTRACT

Infrared thermography is a non-destructive and non-invasive technique that allows to detect temperature or emissivity changes. Thus, it is widely used in the moisture detection or in the evaluation of structural problems in buildings. In the field of cultural heritage, the use of infrared thermography goes from the detection of humidity and moisture transfer to the differentiation of materials and restoration phases. Last researches focused on weathering processes detection, such as salt crystallization. IRT is already very useful in the salt detection but not in salt identification. Because infrared thermography detects temperature variations, it can be expected that the thermodynamic processes such as crystallization (exothermic process) or evaporation (endothermic process) should be detected. The aim of this research is to study with infrared thermography the crystallization kinetics and thermodynamics of the main salts found in building walls in order to be able to identify them in situ. Evaporation of salt droplets was recorded with passive infrared thermography. Several salt types were studied: NaCl, $MgSO_4$, KNO, $Ca(NO_3)^2$ and Na_2SO_4.These salts were chosen since they are commonly found in weathered parts of buildings. All these salts were studied in different volumes, concentrations and temperatures, depending on their crystallization thermodynamics. The droplets were placed on black adhesive tape (3M), which served as a reference material and was stuck to a glass slide. Its emissivity was determined to be 0.96 in the wavelength analysed by the camera. The glass slides with the solution droplets were placed on a cooling plate that could keep stable temperatures from -30 to 80ºC. In addition to entire image observation, variations in the TS were recorded throughout the study in several points of the droplets and compared to the black tape reference. Heat released by crystallization was not always observed. However, the different shapes of crystals and crystallization processes were recorded. Some spectacular processes that were identified with IRT were the dendritic growth of KNO, the crystallization and fusion of $Ca(NO_3)^2$ due to its low fusion point when tetrahydrated, the creeping phenomenon of NaCl efflorescence growth or the increase of temperature of Na2SO4 during crystallization. In some cases, the difference of emissivity between solid and liquid or simply the crystal shape were the determinant parameters to observe the crystallization phenomena.

Key words: Infrared thermography; salt crystallization; crystal shape; emissivity; non-destructive technique.

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Session Title:

Geodesy, Photogrammetry & Cartography

Vertical reference system over territory of Bulgaria- activities and problems on implementation

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ABSTRACT

Bulgaria is part of realization of European Vertical Reference System – European Vertical Reference Frame 2007 by levelling connections with Romania. The realization of EVRF2007 over territory of Bulgaria is made through First order levelling network. In paper are discussed matters related to the transformation of levelling data from previous network realizations connected to Kronstadt pegel for transition to recent one. Upon defined standards are discussed necessary corrections needed in processing of measurements for proper implementation of the European Vertical Reference System on the territory of Bulgaria. General conclusions based on calculations and processing of First order levelling network lines of Bulgaria are applied. Detailed analytical comments referring on results from calculations is presented, which are forming final recommendations and conclusions.

Key words: EVRS; EVRF07; levelling network; levelling corrections.

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Registration process of Laser Scan Data in the field of deformation monitoring

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ABSTRACT

Terrestrial laser scanning is a new method for monitoring deformation of complicated objects. But in contrast to the classical technology no discrete identical points are available to compare. This problem can be solved if parts of the point cloud are grouped and the points in these groups are seen as representatives of a parametrizable surface. An example for such a proceeding is the use of target spheres for the registration of scans. The radius of the spheres is known and the center point coordinates can be calculated by a best fit algorithm. These coordinates then can be introduced in a classical transformation calculation using identical points. But such an approach has crucial disadvantages. First it is necessary to use artificial targets and it can be of high effort to place these targets. Secondly only a very small part of the redundancy contained in overlapping scans is used for the calculation. The resulting accuracy of the orientation parameters is therefore often not sufficient for detecting deformations. In this study however, we compare scans of an object, where the possible deformation is in the order of the measurement noise. For that reason registration of point cloud data is from a great importance. Accuracy of different methods for registration and co-registration are presented

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Key words: Terrestrial laser scanning; point cloud data; deformation monitoring.

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Investigation of dynamic and kinematic landslide processes by borehole tiltmeters and extensometers

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ABSTRACT

Landslides cause a lot of damages both in properties and in human life. Development of early warning systems can play an important role in mitigation of damages. The observation of landslide movements together with geophysical, hydrological and environmental parameters helps to reveal the relationships between movements and the different parameters and it is indispensably necessary to the development of early warning systems. In contrast with the intermittent geodetic measurements (GPS, EDM, precise levelling) the continuously-recording, highly-sensitive borehole tiltmeters and extensometers are especially suitable for the investigations of these relationships. The high loess banks along the River Danube are the most susceptible areas to mass movements in Hungary. Two test sites, one in Dunaföldvár and the other in Dunaszekcső, were chosen for the investigation of the kinematic and dynamic movement processes of the high loess banks due to tectonic, hydrologic and environmental effects. On both test sites more landslides occurred in the last century. In Dunaszekcső the latest landslide took place in 2008. Here a new landslide has been developing since 2010. In Dunaföldvár borehole tilt and borehole extensometric measurements have been carried out since 2002. In Dunaszekcső the borehole measurements began in the autumn of 2007, thus both the large landslide formed in 2008 and the newly developing landslide could be observed. Comparison of tilt data with rainfall data, ground water level changes and the stage of the River Danube resulted in new knowledge of the landslide development processes of the high loess banks. The measurements made evident that the ground water level changes have two orders of magnitude larger effect on the high bank stability than the water level variations of the River Danube. The characteristic tilt processes during a 3-4 weeks period before the slump can be used for early warning of landslides. The tilt measurements also revealed connections between the small movements of the high bank and temperature, precipitation and vital processes of the vegetation.

Key words: Borehole tiltmeter; borehole extensometer; landslide movements; hydrological data; meteorological data; vegetation.

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3D model of the Hittite Koylutolu Arch Dam with UAV Close Range Photogrammetry

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ABSTRACT

The importance of landscape and heritage documentation with photogrammetric techniques have been widely used. Three-dimensional visualization techniques as preserving cultural heritage are becoming more important. In this paper, we examine the 3D digital model of Koylutolu arch dam which is the biggest known dam built by Hittites in around 1600BC. The dam's 3D digital model was created by using close range photogrammetric technique. We performed close range photogrammetric technique with an unmanned aerial vehicle (UAV). Aerial photographs were taken by a digital camera attached to underneath of the vehicle. By the help of the predetermined control points on the dam's surface, the all other coordinates which are needed to lay out the dam were established, therefore the dam was scaled and georeferenced. 800 meters in arch crest length and 20 meters in height were calculated from the georeferenced model of the dam in the order of centimeter accuracy. The dam's surface was put on the model for the reconstruction of the dam as a heritage recording.

Key words: Close Range Photogrammetry; documentation; UAV; 3D modelling.

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Second order ionospheric effect in precise point positioning during solar maximum and minimum periods in Turkey

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ABSTRACT

T This paper investigates the second-order ionospheric effect on the estimated coordinates with using GIPSY 6.3 research software. Four IGS (International Global Service) stations were selected to perform precise point positioning (PPP) for the three different days. Three of these stations are in Turkey (ISTA, TUBI, ANKR) and the other one is in CYPRUS (NICO). The chosen days are within the solar maximum and the solar minimum periods which are the 294th day of year 2001 (DOY 294, 2001, solar maximum), 82th day of year 2014 (DOY 82, 2014, solar maximum) and the first day of year 2009 (DOY 1, 2009, solar minimum). Vertical Total Electron Content (TECV) was determined for the chosen IGS stations in these days. Approximately 5 TEC unit (TECU) changes for DOY 1, 2009 and 50-60 TECU changes for DOY 82, 2014 and DOY 294, 2001 were observed. 24 hours rinex observation files with 30 seconds sampling interval for each station and each day were processed with and without correcting the second-order ionosphere effect by GIPSY 6.3. The second-order effect is obtained from the difference between the two processes. The differences of XYZ Cartesian coordinates were transformed to topocentric coordinates (north, east, up) in order to analyze the second-order effect on the positioning more conveniently. The results show that the north component is affected significantly larger than the east and up components from the second-order ionospheric effect for each processed day. Maximum values of the north component between the two processes were observed in ANKR station (1.47mm) for DOY 294, 2001. East and up components are in the order of sub-millimeter level for each station and each day. The results of the difference between the two processes show that the impact of the second-order correction on positioning has a southward tendency for each station. This study, once again, clearly emphasized that the second-order ionospheric effect should be taken into account especially during the high solar activities period if high accuracy is needed.

Key words: JPL; PPP; TECU; TECV.

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Creating 3D model in urban regeneration projects: the case of Mamak, Ankara (Turkey)

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ABSTRACT

Rapid population growth in our living space is spread by needed urban renewal and the city's social, economic, and physical improvement. Urban regeneration in the context of solving urban problems is an important tool which contains a lot of different policies and procedures in our country as well as the world and has been widely discussed, monitored, and implemented. “Urban regeneration can be summarized as a comprehensive vision plan which tries to provide a permanent solution to economic, physical, social, and environmental problems and as the realization of this plan”. In this study, the physical condition before the urban regeneration projects in Ankara (Turkey), Mamak district is mapped. Infrastructure maps in GIS environment are generated by 3D modelling which covers urban regeneration areas.

Key words: Urban regeneration; simulation; relief map; 3D modeling.

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The validity of the stochastic models in noise analysis of GPS time series

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ABSTRACT

Previous studies have been shown that the best stochastic model for the analysis of permanent GPS time series is consist of white noise and random walk noise. However, several studies have also recognized random walk noise in GPS time series which might be due to the types of pillar monuments. Therefore, in many situations, we are faced with the problem of estimating three types of noises in time series, simultaneously. Correspondingly, due to the lack of knowledge of noise characteristics, improper stochastic model might lead to negative estimation of amplitudes. Here, we represent an idea based upon the using the functions whose range was the set of all positive real numbers, for unknown variance components in stochastic model instead of using variance components themselves. This concept was re-parameterized on the restricted maximum likelihood (REML) with no effect on the un-biasedness of the scheme. The numerical results showed the successful estimation of non-negativity estimation of variance components (as positive values). Furthermore, this method may reveal the improper choosing of the stochastic model.

Key words: Stochastic models; GPS time series; noises.

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A case study: documentation method with close range photogrammetry of muqarnas which is to be an ornamentation type specific to the Islamic architecture

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ABSTRACT

In order to ensure sustainability, the safeguarding of cultural heritage is defined as the protection cases to live cultural values of the anxienty to transfer from the past to the future generations. Architectural protection which is to sustain cultural, physical and social values accommodate cultural heritage and transfer to the future can be regarded as all of the actions. The first and most important step in the protection is accurately and reliably determination and documentation studies. Developing the scope of protection makes it necessary to do versatile determinations at correct documentation, identification and understanding of the cultural assets. Encountered difficulties, in traditional documentation (survey) studies which have been implemented until last the years revealed the need to develop the new methods and tools depending on technological developments at determination and documentation of cultural assets. However sensitive you work on a traditional survey, some details and points, which is necessary taken the measure, cannot be measured for some reasons such as, size of the object, different geometrical structure of surface and restrict access to object. Difficulties in traditional architectural survey work affect the accuracy the necessarily of architectural conservation and documentation. In the recent years the developments in software and computer technology, it is possible to be documented by 3D modelling in the digital enviromented of the difficult objects. In this context, close range photogrammetry technique has been used as one of the most effective and efficient methods with the development of digital technology towards conservation and documentation working of cultural heritage. This technique is based on creating 3D model via 2D analogue/digital image pairs and geodetic coordinates measured in the ground. The field works which take quite some time and effort has become easier with the use of close-range photogrammetry in architectural survey studies. The photogrammetric method allows to make more rapid and practice without compromising sensitivity of the survey process that is required a meticulous study aim to conservation and documentation. In our country as in the whole world the photogrammetric survey techniques are used instead of traditional architectural survey techniques which are in trouble taken to survey on architectural elements. Muqarnas is one of the most important detailed elements that Islamic art gained to architecture. The muqarnas having both ornament and carrier property are especially used as the crown door, minaret balcony, mihrab, nice, column. They are three dimensional and a rather complex structure elements and it is also difficult to reach them due to take place at high. Muqarnas survey working requires long, precision, a dangerous and hard process. At this point, photogrammetry studies go on and is to make short, safe and faultless to the survey process. In the content of this study, the survey of the muqarnas and crown door which are to be a type of ornamentation specific to Islamic Architecture located in Konya city center belongs to the Anatolian Seljuk period were obtained using close-range photogrammetry technique. The crown door and muqarnas of Alaaddin Mosque, Taş Mosque, Selimiye Mosque and Karatay Medresseh were selected as the field study. This study is intended to contribute that will be make for the conservation and documentation of these valuable artifacts belongs to the Anatolian Seljuk period.

Key words: Cultural heritage; conservation; documentation; photogrammetry; 3D Modelling.
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The Autonomous Surveying Boat (ArıBot): System configuration and first survey

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ABSTRACT

The usage of unmanned surveying vehicles has been rapidly increased in the last decade. The projects which are carried out via unmanned aerial vehicles (UAVs), unmanned surface vehicle (USVs), unmanned undersea vehicle (UUVs), and robotic systems have become widespread method whole the World. The Autonomous Surveying Boat (ArıBot) is developed by TUBITAK (The Scientific and Technological Research Council of Turkey) project as the number of 113Y310 and named as “Bathymetric Mapping via Autonomous Survey Boat”. It is important to know the current underwater topography to use the area is covered with water efficiently. The boundary of a hydrographic study is a shoreline. However, some details are measured on the shoreline and coast to ensure the connection of hydrographic map with the land. Within this scope, bathymetric and topographic measurements are the most important measurements to determine correctly the sediment analyze, shoreline change, morphological development in the coastal areas. Profiles must be defined in the coastal areas with the most frequently possible. Coastal areas have varied geography. Conditions in these areas may lead to seasonal, monthly or even daily changes. Therefore, monitoring of the selected characteristic areas is necessary for the detection of changes. Hence extremely time-consuming with the conventional methods of these operations has increased the importance of remote sensing technology. The aim of the study is to produce bathymetry map and to take photos of coastline via low-cost autonomous surveying system (ArıBot), to analyze in depth, all the error sources affecting the accuracy of the surveying system, to evaluate the quality of the derived bathymetry map in order to use for hydrographic, morphologic, ecological and geodetic applications, and to encourage new studies in this field. The study is carried out simultaneous photos, GPS/IMU and bathymetry measurements via autonomous surveying boat. Independent sensor calibration of each other and interdependent sensor calibration are done for the surveying system. The collected data are subjected to post-processing and producing a bathymetric map. This process includes georeferencing the points, orientation and mosaicking of photographs. The future work is to mount a laser scanner onto ArıBoat and to scan the coastline in order to create accurate digital elevation model and digital terrain model of coastline.

Key words: Bathymetry; autonomous; surveying; coastal; GPS/IMU.

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Determination of plate tectonics using least squares spectral analysis of daily GPS time series: case study of Southern California Integrated GPS Network

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ABSTRACT

GPS is a useful tool for continuous monitoring of plate tectonics. The obtained measurements from permanent GPS sites provide their displacements as a daily position time series. For analysing of GPS daily position time series, which include data gaps and noise characteristics, different techniques can be used. In this contribution, we present the least squares spectral analysis (LSSA) to assess noise characteristics and hidden periodicities in daily position time series of permanent GPS stations. The LSSA method overcomes the problem of equally spaced and equally weighted data with no gaps and shifts. The experimental study of the proposed method is used for analysing the coordinate time series of selected GPS stations of Southern California Integrated GPS Network (SCIGN), which were active during January1, 2000 to December 30, 2007. The main scope of the work is to compute velocities – rates and directions of motion for analysed GPS stations, located in the southern California, with realistic uncertainty. After extraction of all significant frequencies, the root mean squares scatter of residuals for the best fit model decreases up to factor two and the signal to noise ratio increases up to factor two. We can conclude that the velocities are estimated with lower uncertainty after extracting underlied significant periodicities. The obtained horizontal velocity field shows the anti-clockwise rotation of surface movements of the southern California area along the San Andreas Fault. The region movement has an approximately orientation N65°W. Vertical velocity field shows that most of the sites have insignificant rates.

Key words: Frequency analysis; GPS coordinate time series; plate tectonics; SCIGN; velocity field.

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Determination of 3D landslide movement from Multi Temproral ENVISAT ASAR Images

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ABSTRACT

Monitoring and determining the amount of Landslide movement is very important. Recently PS-InSAR method is generally used to determine deformations caused by slow motion landslides. The movement of landslide in the direction of the line of sight (LOS) was obtained by Permanent scatterer Interferometric Synthetic Aperture Radar (PS-InSAR) method. The velocity values obtained by PS-InSAR method are only one dimensional. Because of this, PS-InSAR based velocity values' directions must be converted into the 3D (North,east and up directions). According to this purpose for the Koyulhisar landslide region the different four frame ENVISAT ASAR images have been evaluated with STAMPS software. The movements of Koyulhisar landslide in the direction of LOS have been obtained by PS-InSAR method. For conversion process from direction of 1D (LOS) to 3D, point data obtained from PS-InSAR methods were used to create interpolated maps of the landslide region. Then the amount of movements in the direction of 3D (north, east, up) were obtained from using Least Square Estimation (LSE) method. As a result of this 3D movements of Koyulhisar landslide area were obtained from SAR images and the results were evaluated.

Key words: Landslide; deformation; PSInAR; Koyulhisar, Sivas (Turkey).

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Orthometric correction evaluation using measured gravity

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ABSTRACT

The algebraic sum of the height difference between points of the closed levelling loop is theoretically zero. But in the actual levelling it does not usually happen, even the measurements are highly accurate. This indicates that there is an external factor which causes an error and does not depend on the accuracy of the measurements themselves. The external factor is the inhomogeneous gravity of the Earth. In fact, the gravity field gradient accumulated from point to point along a levelling loop can have a significant impact on the measurement of height. We used the simplified formula of (Hwang and Hsiao, 2003) for the heights correction between points A and B, where gA, gB are the values of the gravitational field at the corresponding points, HA is the orthometric height at the point A, delta(nAB) is a height difference resulting from levelling. The result of the orthometric correction using levelling, elevation and gravity measurements is presented. Precise levelling was conducted using more than 45 loops, including two thousand points of measurements in different areas of topography in Israel. Small loops were incorporated into 12 large loops that cover the entire country. The closed loops did not exceed allowed errors. We used about 50 thousand gravimetric points measured over decades. For the purpose of the gravity field calculation at the levelling point and identifying gross errors we used the Kriging interpolation method. We also used databases of DEM (Digital Elevation Model) with a grid of 50x50 m and the height accuracy of + \ - 2 meters for topographic map construction. The relationship between the gravitational field and the height at the different topographic areas was obtained. There is a substantial difference in this dependence for positive and negative heights in the different areas. The orthometric correction is essential for heights over 300 m above sea level, as well as in negative heights. A difference between levelling points of 10 mGal in the gravitational field adds a correction of about 4 mm to the height. Due to the orthometric correction we were able to reduce the error of the levelling to acceptable values for the negative heights (at the Dead Sea and at the Sea of Galilee area).

Key words: Levelling; orthometric heights; gravity.

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Map design for pedestrian navigation systems: a case study at Selcuk University campus (Konya, Turkey)

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ABSTRACT

Location Based Services (LBS) are information systems which determine the location of users through mobile devices and addresses to various location based needs of the users using this determined location. Due to advanced technologic possibilities and wide-usage of mobile devices, the use of LBS applications also rapidly increases. Navigation applications are one of the most common areas where LBS applications are used. Orientation applications refer to the software which is used to provide a variety of information to the user to ensure that the users reach from one point to a destination point in optimum manner. LBS applications are most commonly used in car and pedestrian orientation systems. Orientation software produced today generally address to the navigation of cars. However, navigation needs of pedestrians are different from those of drivers. Particularly, the usage of landmarks is vitally important in human navigation. For this reason, number of studies on orientation services for pedestrians has rapidly increased in recent years. In the last decade there has been a growing interest in geo-mobile applications for pedestrians. However, most important issue is the usability of these applications. In view of the very special and dynamic use and user contexts of geo-mobile applications, location-based information has to be collected and processed, presented and interfaced with the user in efficient, effective and satisfactory ways. Presentation is in this case one of the most difficult tasks, as properly scaled, visualized, and context - aware information should be provided to the user, regardless the small size of mobile device. The aim of this study is the design a cartographic interface that supports navigation of pedestrian to unfamiliar areas using landmarks and evaluation of this geo-mobile application by usability testing. In this study, an orientation system design for pedestrian orientation system developed using LBS technologies in Selcuk University campus will be explained in detail. In this context, four stages are determined for pedestrian navigation. At the first stage, the user enters an unknown urban area and tries to understand where he/she is. At the second stage, the user strives to identify of destination, after this stage, the user endeavors to control the route and the last stage the user tries to confirm destination. After determining these stages, usable forms in which the spatial information should be presented on map and cartographic interface for each stage are discussed. At this point, an approach for landmark orientation based on Voronoi diagram, which is the decomposition of the plane into maximally connected regions that have the same set of closest sites, is proposed. Furthermore, the developed mobile application which uses this approach and Open Street Map data is explained in detail. The results of user tests are also given.

Key words: Location based services; landmark orientation, pedestrian navigation.

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Learning scale factor: a case study with the help of the 6th grade pupils in Konya, Turkey

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ABSTRACT

An important aim of the social studies and geography courses in the primary and secondary school are to gain the ability of reading, analysing, understanding maps and map concepts. In addition to this Cartography in Geography teaching is important to help in the analysis and in the development of observation, perception and space representation abilities. Pupils should be able to use maps (relate features on a map directly to features on the landscape); make maps (encode information in map form); read maps (decode successfully the elements of map language); and interpret maps (be able to relate prior geographical knowledge to the features and patterns observed on the map). Pupils in our education system learn map concepts in primary school between 4 (10 age) and 7 grade (13 age) in social studies courses firstly. There are many maps regarding as geographical and historical themes in social studies textbooks that is designed or developed by Turkish Ministry of Education. In addition to textbooks there are workbooks which have more exercises about cartographic knowledge and map concepts. It is important that, if these maps can be used effectively and can be percepted accurately or not. To analyse current maps and map use in social studies courses, a study been done with social study course teachers in earlier research. By this study we have concluded that children could not understand scale factor mostly. Beside on this result a study has been done by using an exercise attached in 6th grade social study textbook with 21 pupils. Before these exercises we have applied pre-test which contain some questions about maps and scale factor. We have evaluated if pupils know scale factor or not before exercise. And we asked some questions about map in pre-test. We obtained some results related to why pupils could not understand scale factor easily. In this paper we are going to analyse results in terms of the quality of exercise, maps and teaching method.

Key words: Educational cartography; map use; map design.

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Precise orbit determination for low earth orbit satellites

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ABSTRACT

The precise orbit determination (POD) of satellites in Low Earth Orbits (LEO) has become a key technology for space missions. Especially, the contribution of LEO satellites to the recently developed gravity field models is significant. The orbits of these satellites can be tracked owing to the fact that satellite missions for gravity field determination such as CHAMP, GRACE and GOCE which are equipped with GPS. In this study, kinematic, dynamic and reduced dynamic models have been used for the determination of the satellite orbits. Although the kinematic orbit model depends on the satellite geometry and GPS data quality, the dynamic orbit model usually relies on the dynamical parameters of the forces acting on satellite. Finally, the reduced-dynamic orbit model is established on the combination the advantages and reducing the disadvantages of the previous models. Thanks to these models, kinematic (KIN), dynamic (DIN) and reduced-dynamic (RD) orbits for LEO satellites have been calculated. They have been validated by two different methods, internally and externally. Although the internal validation has been based on comparisons with each other of the obtained orbits, the external validation has been based on comparisons to the publications of different institutions/agencies (RSO, GNV1B) and Satellite Laser Ranging (SLR) observations. After obtaining the orbit errors based on the internal and external validations and the differences between kinematic (KIN) and reduced dynamic (RD) orbits have been produced. The RMS values have been computed 1-3 cm for CHAMP, GRACE and GOCE. Furthermore, RD orbits were directly compared with RSO (Rapid Science Orbit for CHAMP) and GNV1B (GPS Navigation Data Format Record for GRACE) orbits. As a result of RD-RSO comparison, the rms value about 6-7 cm has been reached. Similarly, the rms value for RD-GNV1B comparison has been obtained about 4-5 cm. In addition to these comparisons, RD orbits have been validated using the SLR observations. According to the validation using the SLR observations, the mean RMS value has been calculated between 1.5-12.2 cm for LEOs.

Key words: Precise orbit determination; kinematic model; reduced-dynamic model; SLR; GPS/GNSS.

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Monoscopic image sequence analysis for monitoring glacier lake outburst floods

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ABSTRACT

The sudden drainage of glacier lakes in alpine terrain often causes catastrophic flooding downstream the glacier, accompanied by destruction of nature and infrastructure. The phenomenon is called glacier Lake Outburst flood (GLOF) which has increased significantly in many parts of the world due to the persistent glacier retreat. In terms of the rising potential danger and the lack of suitable monitoring systems there is the increasing need for concepts of reliable GLOF detection. Common tactile gauging systems, for instance GPS buoys or pressure probes, may be affected by ice falls, landslides or the lake drainage itself. In contrast, a photogrammetric system consisting of an autonomous observing camera combined with an image sequence analysis monitors the water level of the glacier lake from a safe distance. Furthermore, an image based system can observe a wide area of the lake at the same time. The workflow of evaluating monoscopic image sequences consists of the compensation of camera movements caused by wind effects, the water line detection in the images, and finally the transformation into metric water level heights by spatial intersection with an accurate terrain model. Refereeing to an automatic extraction of the waterline in image sequences major challenges are varying light and visibility conditions in the course of the day. Promising approaches will be discussed and presented. In this context, the use of specific image data in terms of wavelength can affect the result significantly. Regarding to an automatic waterline detection, the potential of sensors with different spectral sensitives (VIS, NIR, MIR) will be described and compared.

Key words: GLOF; image sequence analysis; water level detection; NIR.

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Second and third order ionospheric effect on GPS signals along equatorial IGS stations

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ABSTRACT

Ionosphere is the major source of error for geodetic applications despite the fact that it's possible to remove most of the effect using its dispersion nature. However, it's only the first order of the ionospheric effect that can be removed using dual frequencies signal observations. The second and third order ionosphere effect cannot be removed though we can model their effects on geodetic applications such as their effects on Global Positioning System (GPS) signals. The study mainly focuses on the assessment of higher order (second and third) ionosphere effects on GPS for accurate positioning along the equatorial regions. Some stations at higher latitudes were also included in our GPS data processing for comparison purposes. GAMIT/GLOBK software was used to processes the GPS data including a suite of other ancillary information. The time series of the residuals from the final GAMIT/GLOBK result were compared with the geomagnetic field effects and solar cycle (sunspot activities). High ionopheric effects on the GPS signals from stations along the equator were observed relative to stations at higher latitudes due to the fact that total electron content density is high along the equator. In addition to this, the contribution of Equatorial Electrojet (EEJ) to ionospheric disturbances is higher along the equator. Higher total electron content was also observed for the stations from the equatorial region in particular on years 2002 and 2012 as these are the years where solar activity were at maximum.

Key words: GNSS; ionosphere; sun activities.

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Geodetic point generation based on precise point positioning method

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ABSTRACT

The constituent which has the most effective use among the positioning technologies based on the artificial satellites at the present time is GNSS (Global Navigation Satellite Systems). These systems are used intensely in a number of scientific and engineering studies of different qualities nowadays. The geodetic studies taking into consideration, cadastral measurements, deformation studies, hydrographical measurements, tectonic studies, photogrammetric practices are the areas in which GNSS has an effective use. Taking position accuracy for these geodetic practices into consideration, the use of different positioning techniques in GNSS is in question. Precise point positioning (PPP) technique, which has stood out among these techniques in recent years and is becoming more and more popular, has become an important alternative to relative positioning technique in evaluating GNSS data (post-processing) in terms of position accuracy it provides. The comparison of conventional relative positioning technique used for studies requiring high accuracy and precision with PPP technique providing absolutely high accuracy has been the subject of many researches CORS(Continuously Operating Reference System) reference stations belonging to CORS-TR (TUSAGA-Active) network operating nationally in Turkey and İSKİ-UKBS network operating locally have been chosen as test points. Weekly (repeatability for 7 days) data of this station which has the data for 24 hours have been separated for sets of 2 and 3 hours and assess separately with relative positioning and PPP technique. Data set, having repeatability for 7 days and obtained for 2-hours and 3-hours observations during the evaluation, has been evaluated using Topcon Tools v7.0 software based on the GNSS reference stations named ISTN, SLEE, and TERK for the principle of relative positioning. Precise orbit information (final, sp3) provided by IGS has been used in relative positioning approach, so repeatability analysis for 3 test points has been obtained. RTK-LIB open source software has been used in the evaluation of the related test points for observations of 2 and 3 hours with PPP technique. Precise orbit information (final, sp3) provided by IGS once more and clock correction information have been used in evaluation process with PPP technique. In this way, repeatability and accuracy analysis of static GNSS observations of 2 and 3 hours has been performed according to two different positioning techniques in terms of geodetic studies, and their performances have been tested according to each other.

Key words: GNSS; CORS; PPP; IGS.

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Determination of plate tectonics using least squares spectral analysis of daily GPS time series: case study of Southern California Integrated GPS Network

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ABSTRACT

Global Positioning System represents one of the measurement systems in understanding the movement of the Earth's surface. The accurate determination of station velocities – rates and directions as geophysical parameters of plate tectonics, requires that positional offsets and systematic effects in coordinate time series are correctly found and compensated. In our study we use least-squares spectral analysis to compute and extract significant periodicities in GPS coordinate time series. The method was implemented on 125 continuously operating GPS stations of the Southern California Integrated GPS Network.

Key words: Frequency analysis; GPS coordinate time series; plate tectonics; SCIGN; velocity field.

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Spatial distribution of changes in rockwall surface at Yoshimi-Hyakuana cave, central Japan, revealed by repeated terrestrial laser scanning

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ABSTRACT

For the understanding of processes of weathering, detection and quantitative evaluation including volume estimation of surficial changes in rocks are fundamental issues. We perform repeated measurement of wall surface morphology at a test site of Yoshimi-Hyakuana cave in Saitama Prefecture, central Japan, using terrestrial laser scanning (TLS). The registration of point cloud time series was carried out using iterative closest point algorithm for points in stable surfaces, resulting in millimetre-scale accuracies. The distances between the point clouds were then computed using multi-scale model-to-model cloud comparison method. Although some scan errors derived from the laser scanner itself was found, locations of centimetre-scale changes in the wall surface by detachment, likely induced by salt weathering, were successfully detected. Though limited, some portions seem to have opposite change (bulging), potentially showing floating process before the detachment. The spatial distribution of such surficial changes will be further assessed by continuous measurements together with sampling of materials detached from the wall surface.

Key words: Terrestrial laser scanning; weathering; detachment; point cloud; digital elevation model.

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The use of spatial data in granite deposit life cycle assessment

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ABSTRACT

This paper discusses the possibilities of using spatial data coming from geographic information systems – systems which acquire, store and process spatial data – to assess selected stages in the life cycle of a granite deposit, i.e. deposit exploration, development and post-mining management. The unit processes occurring in the particular stages in the life of a granite quarry were described on the basis of the literature on the subject. For each of the processes the categories of mining impacts on the particular environmental and human components were specified. Spatial data acquired from many sources (indicated in the paper) were used in the analyses. Analytical results are presented for only for the selected stages in the life of the granite deposit. The result maps show, among other things, the impact of the mining activities on three groups of objects: environmental objects, social objects and technical objects and indicate the objects located in a debris scatter danger zone around the places where blasting works are carried out, and in a ground seismic vibration hazard zone. Moreover, it is shown that using basic data acquired from geological documentation one can create a terrain model with wireframe models of stratigraphic layers in the deposit and on this basis built a deposit block model and then use it in further deposit life cycle assessment to acquire data, such as the overburden volume, the resource volume and the output volume. An example of the application of the geoprocessing tools in excavation post-mining management planning to highlight environmental qualities and enhance the attractiveness of the area for its future user is presented.

Key words: GIS; environmental protection; LCA.

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GIS as a support tool in regional management of rock mineral resources – experiences from SW Poland

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ABSTRACT

Mining and subsequent transport of rock minerals may cause environmental and social conflicts. Distribution of documented rock mineral deposits, being a derivative of geology, is usually uneven and inconsistent with demand areas. With the aim to facilitate modelling of potential conflicts and analysing spatial distribution of source and demand areas, procedures have been developed in geographical information systems (GIS). These tools can be used by public administration authorities, responsible for mineral resource management, to plan optimum development of available of rock minerals resources taking into consideration costs and benefits in accordance with sustainable development requirements. A pilot geoinformation system for selected two counties (Swidnicki and Wroclawski) in the Lower Silesia region (SW Poland) characterised by large and differentiated rock mineral resources has been developed, based on the proposed methodology and functionality. The system facilitates storage, management and distribution of spatial data related to rock mineral resources, mining and transport and the implemented functions can be used to solve planning, environmental and logistic problems connected with rock mineral management in a given space. The presented studies have been carried within the frames of the “Strategies and Technological Scenarios of Management and Utilization of Natural Stone Deposits” Project financed from European Regional Development Fund within the Innovative Economy Operational Programme.

Key words: GIS; rock minerals; management; SW Poland.

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Remote sensing study of the chromite-bearing serpentinized ultramafic rocks of Logar Massif, Afghanistan

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ABSTRACT

Chromite is widely distributed in the west and southeast of Afghanistan, especially in Logar Province. Chromite mineralization is podiform-type and is hosted in the stratigraphically lowest ultramafic rocks of the Logar Ophiolite Complex. This ophiolite complex represents a remnant of an early Cretaceous oceanic crust that was thrusted over a late Permian to Mid-Jurassic platform-type sequence of the Kabul Terrane during the Himalayan Orogeny. The ultramafic rocks are composed mainly of dunite and harzburgite, which are variably serpentinized. Chromite mineralization of the Logar area ranges from massive chromitite pods to disseminated chromite crystals in the ultramafic rocks. Microscopically, the chromite exhibits granular texture and is generally fresh; however, some magnetite and/or ferritchromite are formed along the fractures of some chromite grains. The primary interstitial silicate minerals of the massive chromite and the silicate minerals surrounding the disseminated chromite grains are completely altered to serpentine along with some chlorite. Thus, serpentinite is most likely the host of the chromite in the Logar Province and it will be discriminated using the Landsat 8 Operational Land Imager (OLI). The serpentinite of the Logar Province is separated by the combination of bands 7, 5 and 2, principal components, and band ratios (bands 6/7, 6/5, 4/2, bands 7/6, 6/5, 4/2, and bands 6/4, 6/2, 7/6 in RGB) techniques.

Key words: Landsat 8 OLI; band ratios; PCA.

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Gold prospecting in tropical regions using satellite remote sensing data: case study from Malaysia goldfields

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ABSTRACT

This study presents a remote sensing approach for geological mapping aimed at the detection of hydro-thermal alteration minerals and structural features for initial stages of gold exploration in tropical environments. Recent challenge is to utilize the most suitable recent generation of remote sensing data and innovative image processing approaches for detecting hydrothermal alteration zones and structural features associated with epithermal and polymetallic vein-type mineralization in tropical environments. In this investigation, two gold mining districts in Malaysia were selected as case studies, namely the Bau gold mining district in the State of Sarawak, East Malaysia, on the island of Borneo and Penjom goldfield in the state of Pahang, Peninsular Malaysia. The climate of both study regions is tropical with persistent cloud coverage and very dense vegetation cover. Gold mineralization in these areas is structurally controlled and associated with hydrothermal mineral assemblages. Various types of remote sensing data were tested for hydrothermal alteration mapping and structural analysis associated with gold mineralization in the study areas. The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), Landsat Enhanced Thematic Mapper+ (ETM+), Hyperion and Phased Array type L-band Synthetic Aperture Radar (PALSAR) data sets were used in this study. Processing of the image data was performed using some developed methods that could reduce or remove the spectral effects of vegetation to detect alteration mineral zones and geological structures associated with gold mineralization in the study areas. Vegetation, mineral and lithological spectral indices have been applied to ASTER bands. Directed principal components (DPC) analysis was implemented to four special band ratio images of ETM+, including 3/1, 4/3, 5/7 and 5/4. Linear spectral unmixing (LSU) was applied to visible and near-infrared radiation (VNIR) and shortwave infrared (SWIR) bands of Hyperion. Directional filters were applied to PALSAR data. Results of the DPC analysis of four appropriate ETM+ band ratios produced DPC images, allowing the removal of spectral effects of vegetation from ETM+ data and the detection of iron-oxide-rich rocks or gossan and clay-rich zones. Results derived from VNIR and SWIR bands of Hyperion represented iron oxide/ hydroxide and clay-rich zones using LSU technique. Numerous tectonic lineaments with consistent variations in trend, length and density associated with different lithological units outcropping in the study areas were detected using PALSAR data. Geological tectonic structures such as faults, fractures and anticline were detected in the PALSAR resultant image derived from directional filters (N-S, NE-SW, and NW-SE). Structural features associated with fault-related rocks and hydrothermal alteration zones were identified as highly potential areas for prospecting gold mineralization. Of particular importance to exploration are the intersection of ENE and NNE structure element in the Bau area and N-S, NE-SW, NNW-SSE and ESE-WNW mineralized trends in the Penjom region, respectively. Results of this study demonstrate the applicability of integrated satellite remote sensing data to assist more feasible gold exploration plans in the study regions and reduction of exploration costs for epithermal or polymetallic vein-type mineralization in tropical environments.

Key words: Gold exploration; satellite remote sensing data; tropical environments.

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Application of remote sensing data in assessment land cover changes, land use patterns, and land capabilities in Al-Qassim region, Saudi Arabia

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ABSTRACT

Land use/land cover mapping is important for conservation of natural resources and also for sustainable land management practices. Remote sensing techniques provides promising possibilities for mapping land use/land cover classes since remotely sensed data cover a large area, in a periodic manner. The Qassim region of central Saudi Arabia is one of the most important agricultural regions in the country especially for date cultivation. In the present study, landsat TM and ETM+ data for the period 1999-2013 are used to study the land use, land cover changes in the area. Satellite images from path/row 168/042 constitute the study area. Three major land use/land cover classes are considered: hilly areas (364,407 ha), vegetated land (1,776,698 ha), and sand dunes (1,523,669 ha). The vegetated land constitutes the class 1, which is comprised of the wadis mainly devoted used for date production. Sand dunes are designated the class 11 and covered a large portion of the study area whereas the Hilly areas are unproductive and constitute as class 111. The vegetative land are surrounded by sand dune which is the most fragile system of the area and leads to damage some productive lands in the area. It is necessitates to study the area for suitable land management practices and for possible approach to stop the sand drifting or sand encroachment in the area. The land use capabilities classification of the study area includes three main classes: LUC I, LUCII, and LUC III. Slopes ranging between 0° and 20° correspond to areas that are flat, gently undulating, undulating, rolling, strongly rolling, moderately steep and steep, respectively. The slope categories dictate the usage patterns of the lands in the study area, which range from suitable to unsuitable to productive lands.

Key words: Remote sensing; satellite images; land use; land cover; land capability; NDVI Mapping; Al-Qassim region; Saudi Arabia.

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ASTER and Landsat TM remote sensing data application for chromite prospecting: case study from south Iran

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ABSTRACT

Chromite deposits in Iran are located in the ophiolite complexes, which have mostly podiform types and irregular in their settings. Exploration for podiform chromite deposits associated with ophiolite complexes has been a challenge for the prospectors due to tectonic disturbance and their distribution patterns. Most of Iranian ophiolitic zones are located in mountainous and inaccessible regions. Remote sensing approach could be applicable tool for choromite prospecting in Iranian ophiolitic zones with intensely rugged topography, where systematic sampling and conventional geological mapping are limited. In this study, Landsat Thematic Mapper and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite data were used for chromite prospecting and lithological mapping in Neyriz ophiolitic zone in the south of Iran. Image transformation techniques, namely decorrelation stretch, band ratio, principal component analysis (PCA) were applied to the datasets. The RGB decorrelated image of Landsat TM spectral bands 7, 5, and 4, and the principal components PC1, PC2 and PC3 image of ASTER VNIR-SWIR spectral bands showed the occurrence of major lithological units in the study area. The band ratios of 5/3, 5/1, 7/5 and 4/7, 4/1, 2/3*4/3 applied on ASTER VNIR-SWIR bands were used discriminate all rock types in the study and delineation of the transition zone in the ophiolitic complex. Spectral Angle Mapper (SAM) technique was used to detect minerals of rock units. Additionally, image processing results were verified by comprehensive fieldwork and laboratory analysis. Result of this investigation indicate that the integration of Landsat TM and ASTER datasets is one of the most effective tool for chromite prospecting and lithological mapping in mountainous and inaccessible regions such Iranian ophiolitic zones.

Key words: Chromite prospecting; ASTER; Landsat TM; Iranian ophiolitic zones.

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Earth Observing-1 (EO1) remote sensing data for porphyry copper and epithermal gold exploration

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ABSTRACT

This study evaluates the capability of Earth Observing-1 (EO1) Advanced Land Imager (ALI) and Hyperion data for lithological and hydrothermal alteration mapping. Several image processing methods have been tested on two ALI and Hyperion images covering the Meiduk and Sar Cheshmeh porphyry copper mining districts, SE Iran for regional and district scales mapping. Feature-oriented principal components selection, different band ratioing and Minimum Noise Fraction were applied for enhancing the hydrothermally altered rocks associated with porphyry copper mineralization, lithological units and vegetation using ALI data at regional scale. Spectral angle mapper, linear spectral unmixing and mixture-tuned matched-filtering were tested to discriminate the hydrothermal alteration areas of porphyry copper mineralization from surrounding environment using shortwave infrared bands of ALI at regional scale. Analytical imaging and geophysics (AIG)-developed hyperspectral analysis processing methods were applied to visible and near infrared and shortwave infrared bands of Hyperion for mapping iron oxide/hydroxide minerals and clay mineral assemblages in hydrothermal alteration zones at district scale. Results indicated that the tested methods are able to yield spectral information for identifying vegetation, iron oxide/hydroxide and clay minerals, lithological units and discrimination of hydrothermally altered rocks from unaltered rocks using ALI data at regional scale. Supergene altered areas consisting of iron oxide/hydroxide minerals such as hematite, limonite, jarosite and goethite were detected using visible and near infrared bands of Hyperion. Phyllic, advanced argillic and propylitic alteration zones associated with porphyry copper mineralization were discriminated based on the identified alteration minerals such as sericite, kaolinite, illite, alunite, chlorite, epidote and calcite using shortwave infrared bands of Hyperion. It is shown that the integration of the ALI and Hyperion data can yield significant information to identify lithological units and hydrothermally altered rocks associated with porphyry copper and epithermal gold mineralization at both regional and district scales. The achievements of this investigation indicate considerable implications for geologists to use Earth Observing-1 (EO-1) data for geological purposes.

Key words: EO-1; ALI; Hyperion; Hydrothermal alteration minerals.

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Lithological mapping of igneous and metamorphic rocks in the Central Eastern Desert of Egypt using remote sensing data

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ABSTRACT

The Central Eastern Desert (CED) of Egypt is composed mainly of Precambrian metamorphic and intrusive assemblages including serpentinites-talc carbonate rocks and metavolcanics of basic to acidic composition, they are intruded by syn to late to post orogenic gabbro-diorite and granitoids. This study is focused on the Um Gheig area which comprises El- Sibai-Um Gheig and Kadabora-Suwaqat areas in the (CED) of Egypt. The integrated remotely sensed processed data together with the field study have been used to discriminate the exposed metamorphic and magmatic basement rock assemblages as well as to modify the previously geological mapping for the study area. These rocks have been successfully discriminated on Landsat-8 images including, Minimum Noise Fraction MNF (4, 3, 7), Principal component analysis PCA (PC6, PC2, PC7) and various band ratios (b6/b2, b6/b7 b6/b5xb4b5) and (b7/b6, b7/b5, b5/b3). ASTER TIR data with various ASTER indices e.g. clay index (5x7/6) and silica index (10/13) successfully discriminated the varieties of granitoid rocks, while the serpentinite-talc carbonate and metavolcanics (particularly banded iron-bearing varieties) are clearly distinguished on the ASTER images of amphibole index (6+9/7+8) and (6/8). The present study produced a geological map with accurate lithological discrimination and lithological contacts, comparing with the previously published geological maps for the study area.

Key words: Precambrian; Kadabora; Um Gheig; ASTER; Landsat-8; Egypt.

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Soil salinity prediction, monitoring and mapping using modern technologies

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ABSTRACT

In arid and semi-arid regions of the world, soil salinization is one of the most crucial environmental problems due to its adverse effects on agriculture productivity and long-term sustainable development. Since these areas with harsh climatic conditions are under high pressure to supply the required food and fibre for their rapidly increasing population; monitoring, evaluating and predicting soil salinization is of utmost importance in those regions in order to lessen or prevent future increase in soil salinity. Besides, salinization is a worldwide problem, particularly in irrigated lands, which are extensively irrigated and are poorly drained. Unconscious irrigation and practising old irrigation techniques extremely damage the fertile land and accelerate water logging and salt accumulation in soil. Moreover, irrigating agricultural land with water rich in salt, land clearing and using fertilizer containing nitrogen and potassium salts are among the other human-induced activities that cause soil salinity. In addition, natural factors such as parent material in soil structure, closeness of salty groundwater table to the surface, weathering of the parent rock and sea water intrusion exacerbate soil salinity occurrence. Therefore, it is an important concern to predict and monitor soil salinity in order to take protective measures against further deterioration of the soil particularly if it is used for agricultural activities. In this study, emphasis is given to the techniques used for the predicting and monitoring soil salinity throughout the different regions of the world in a chronological order. Examples of soil salinity mapping will also be referred to alert especially the soil scientists and farmers. Traditionally, soil salinity prediction and monitoring are often carried out with intensive field work and sampling. Most previous studies have focused on differentiating salinized and non-salinized soil qualitatively by analysing the salinity distribution and monitoring its dynamics. In recent years, Remote Sensing (RS), Geographical Information Systems (GIS) and modelling have outperformed the traditional methods. Soil salinity mapping has progressed from qualitative to quantitative mapping due to large area coverage, multiple spectral information and nearly constant observation of RS systems. The salinity at the landscape surface can be distinguished from remotely sensed data either straightforwardly on exposed soils or indirectly through the biophysical attributes of vegetation as these are influenced by saltiness. In zones of thickly vegetated soils, using vegetation indices in the evaluation and mapping of soil salinity will yield promising results whereas soil salinity indices will be the appropriate method in the case of exposed soils or soils with low scattered vegetation. Accordingly, this study reviews the application of satellite images from MODIS, SPOT, IKONOS, IRS, Landsat TM, Landsat7, Landsat 8 and Landsat MSS which have been used for different studies in order to deliniate soil salinity maps by conducting either salinity indices generated by combination of spectral bands or vegetation indices such as Soil Adjusted Vegetation Index (SAVI), Enhanced Vegetation Index (EVI), Normalized Differential Vegetation Index (NDVI) and Ratio Vegetation Index (RVI).

Key words: Soil salinity; prediction; monitoring; mapping; Remote Sensing; GIS.

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Application of innovative high-frequency magnetometric probe (HFMP) on light UAVs in geology, archeology and related fields

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ABSTRACT

In 2014, first field test versions of airborne geophysical complex with high-frequency magnetometric channel (HFM Channel), were created by IPGG SBRAS, based on lightweight UAVs. Sensitivity of the magnetometric sensor is 70 pT, and sensitivity of the whole complex is about 1 nT. Level of magnetic noise during surveying in the natural magnetic field of Earth, away from industrial facilities and power lines, is no more than 0.2 nT. Measuring frequency of a generated magnetic channel is 1.5 kHz, while the number of significant bits is 22. All experimental work using HFM Channel based on light UAVs was conducted in parallel with standard ground magnetic survey using proton or quantum magnetometers. Weight of the whole complex including the UAV never exceeded 9 kg and could be carried in a backpack. Studies at the archaeological barrow in Vengerovsky District of Novosibirsk Region, have shown that using the UAV complex allows to confidently find artefacts with anomalous field of more than 5 nT. All anomalies found using HFMP on UAVs, were confirmed by standard surveying with POS 1 magnetometer, GSMP 35G magnetometer-gradiometer and magnetic-variation station MV 07M. Following objects in Khakasia were studied inside geological and geophysical training areas of SFU, TPU, NSU: Cu-Mo deposit «Alekseevskoe», «Erbinsky» nekk of alkaline ultrabasic rocks, «Sohochulskoe» manifestation of bitumen, «Legostaevskoe» gold deposit. Magnetic field data obtained by UAVs' HFMP generally coincide with the ground survey data obtained using proton or quantum magnetometers. Comparison of the matching profiles at different sites showed that the magnetic field data obtained by HFMP has significantly more complex structure with larger amplitude extreme. It allows for creation of more complex geological models of studied object structures. Possibility of magnetometric survey at different heights, as well as using adapted gradiometer, allows to chart complex geological and geophysical models of surveyed objects. Practical field tests of UAVs' HFMP shown it to have a significantly higher performance and efficiency, compared to conventional methods of magnetic surveying. Application of HFMP is also possible in related industries, where there is a need for precise large-scale mapping of magnetic field. Lack of infrastructure requirements allows use of the complex in a variety of conditions and for a wide range of tasks.

Key words: UAV; UAVs in geology; airborne geophysical complex; high-frequency magnetometer; magnetometric probe; magnetometric survey; magnetic field.

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An implementation for building detection from LiDAR derived nDSM via Co-occurrence measures

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ABSTRACT

Today, more than 50% of the world population live in urban areas due to mainly economic reasons. Depending on this fact, urbanization has become a problem to solve. There are a few main elements of a city such as roads, water areas, green areas and as well as buildings. Any kind of information about buildings are very important for many applications such as updating building information's for government agencies or private companies, tourism, mapping, civilian and military emergency planning and even video games need this kind of information. In this context, building extraction and reconstruction has been a hot topic among the researchers for many years. The goal of this paper is to present a new approach for automatic extraction of building footprints by using only LiDAR derived normalized Digital Surface Model (nDSM) as an input and textural analysis with two selected Haralick parameters (correlation and dissimilarity) that depend on the Grey-Level Co-occurrence Matrix (GLCM) as a detection method. The application is carried out successfully and buildings are detected with this analysis. By using a general method of image segmentation, the building boundaries are extracted. The reference shape file of the study area is used for evaluation of results. The results of dissimilarity is better than correlation in an area range between 4.65 to 184.8 m2. The outcomes of application are very promising for building extraction.

Key words: LiDAR; nDSM; building detection; Haralick parameters; Co-occurrence matrix.

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A new band ratio for detecting ultramafic rocks using ASTER Satellite Image and Spectral Measurements Data

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ABSTRACT

A new efficient band ratio for lithology discrimination of ultramafic rocks using the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) image and spectral measurement data are established and tested. In this study, we aimed to determine the spectral behavior of ultramafic rocks to adopt a new band ratio. Because of this, in field study on the area, we collected the ultramafic rock samples. Then geological thin sections of the rock were prepared. Furthermore, microscopic observations were made to determine the type and mineral content of the samples. Three different kinds of ultramafic rock types were determined according to the mineral contents of the rocks. The optimal band selection for ratio images depends on the spectral properties of the surface material of interest and its abundance relative to other surface cover types was made. Spectral measurements of the rock samples were made to combine the spectral signatures of the ultramafic rocks with ASTER SWIR band regions. After merging spectral signatures and ASTER SWIR Band regions, according to the spectral behavior of samples in band regions, we determined the ASTER bands that used for band ratio. Our approach of adopting a new ASTER bands-ratio images and band combinations with enhanced images data leads to effective mapping of ultramafic rocks in the study area. We used a new band-ratio of ASTER SWIR bands and RGB band combinations of the ratio image and the principal component analysis image. Our approach of integrating ASTER band-ratio images and band combinations with geological field data leads to effective lithological mapping in the study area. This article deals with the evaluation of ASTER data for mapping the varied ultramafic lithology that include the dunite, serpentine and pyroxene rocks exposed on the south-eastern edge of the Sivas Basin, Turkey.

Key words: Ultramafic rock; band ratio; spectral measurement.

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3D architectural surveying of Diyarbakir Wall's Ulu Beden Tower with Terrestrial Laser Scanner and Creating 2D Drawings

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ABSTRACT

Turkey is one of the country which has been host many historical monuments extends from past to present. Lots of historical heritage from different cultures has been left out from prehistorically ages to the present, leaving rich traces of civilizations in Anatolia. Although having historical heritage is important, it is also very important to protect and revitalize these sites. Keeping historical artifacts and documentation of these works is of great importance both living and protecting of these heritage. Technological progress changed the methods of surveying applications in our present day. Those changes in the methods of surveying applications reflected in building survey applications too. Traditional surveying methods give their place to digital photogrammetry and then to laser scanning methods. This work is contained of the building survey of the Ulu Beden tower which is part of Diyarbakir walls. Diyarbakir is a province in south-eastern Turkey, the city has been home to many civilizations and ruled by many of them. Hittites, Persia, Macedonian and Seleucid Greeks, Rome, Byzantium, Arabs, Seljuk Empire, Mongol Empire and Ottoman Empire are among these civilizations and the city has still contain traces of them. Diyarbakir walls are one of these structures and it is second longest wall after Great Wall of China. Hundreds years after the construction of the walls, it is needed to protect and restore to the walls due to corruption and demolition along the time. For architectural survey with laser scanner, 45 stations were built in total and the gathered point cloud data are combined together within computer environment, to obtain 3D model of the structure. By using this model we obtained profiles, aspects and 3D models of the structure.

Key words: Architectural survey; Diyarbakir walls; laser scanning; photogrammetry; remote sensing.

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Using Laser Scanner to architectural survey in street rehabilitation projects

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ABSTRACT

Street rehabilitation projects are preserve façade facing street of cultural assets and architectural elements with original street texture and it is allowing the participation of modern life and revitalize them. Furthermore, it involves the restitution, restoration and survey intended to protection and documentation of all elements that describe the texture of street. This study is contained of documenting by measuring the terrestrial laser scanning technique of facades all the buildings along the Hükümet Street in Sille neighbourhood within street rehabilitation project. The origin of the Konya-Sille neighborhood goes back 6000 years ago, where is one of the numerous historical heritage in Turkey. Sille has been an important religious centre for the being on the Roman-Byzantine-Jerusalem route. Sille has never lost its importance due to take place on the Silk and Spice routes during Ottoman period in history. Although its historical texture is great deal of damaged, restoration projects are trying to keep alive and revitalize of old texture of Sille in nowadays. For this purpose, restitution and restoration projects of several registered and unregistered structures have been implemented and these projects are still continues. Today, when compared to classical measurement methods it is more accurate and precise with remote sensing techniques and these methods can be performed in a short time. In recent years, laser scanning technique has been the most preferred technology by surpassing the terrestrial photogrammetric techniques in architectural projects. Laser scanning technologies allow to transfer of accurate three dimensional model and documentation of this structure to computer environment besides that this technology provide drawing the architectural surveys according to original models in order to supply base data for restoration projects in future. In this work 107 stations were built in total for the survey with laser scanner and gathered data are combined together on the computer to obtain 3D model of the structures in street. By using this model we obtained silhouette of street, profiles, aspects and facades of the structures.

Key words: Architectural survey; laser scanning; photogrammetry; remote sensing; street rehabilitation.

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A novel approach in monitoring oil palm related land use and land cover change in the Tropics

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ABSTRACT

The increasing demand for bioenergy has promoted the expansion of a number of agricultural commodities including oil palm (Elaeis guineensis) and led to increased competition with food production as well as to environmental degradation, causing one of the major issues confronting many governments around the world. Moreover, oil palm cultivation has increased greenhouse (GHG) gas emissions through deforestation, which contributes to climate change. Monitoring and modeling regional land cover transformation using Landsat images over the Tropics has been a great challenge due to the influence of cloud cover. To date, the Roundtable on Sustainable Palm Oil provided insufficient guidance on how to map and quantify oil palm related land cover change. Especially now the pursuit for energy change is intense with respect to the challenges above. The impact estimation of oil palm related land use change requires spatiotemporal land use maps. Remote sensing and geographical information systems are known for technological robustness to meet challenges of spatial and temporal monitoring of land cover, land use maps, and observing changes at a regular interval of time. To date, remote sensing methods are the privileged tools, but still suffer from methodological deficits linked to the cloudiness of tropical regions. In this regard, a novel approach in mapping land cover and land use change in a tropical region is presented using Google Earth Engine cloud-based platform and SAGA GIS. The study assesses spatiotemporal land use and land cover changes in relation to oil palm using a median composite mosaic of Landsat 5, 7 and 8 image scenes of the time periods 1999-2005 and 2009-2015. We analyzed the biases of chosen classifiers through the analysis of its error matrix and kappa coefficient. Using this approach, we were able to get an overall accuracy and kappa coefficient of 70.33% and 0.62 for the first image composite period, 84.5% and 0.80 for the second image composite period respectively. Therefore, the approach could serve as a baseline in monitoring oil palm related land cover and land-use change in the tropics on a regional scale using Landsat images.
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Key words: Oil Palm mapping; Google Earth Engine; SAGA GIS; Land use/Land cover; Landsat image.

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A pipeline level 0 Processor for imaging Fourier transform spectrometer

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ABSTRACT

The Fourier transform spectrometer (FTS) is an important instrument for remote sensing spectral applications. The measurement is an interferrogram (IFG), a Fourier transformed spectrum. In the recent past a new class of FTS were developed, the Imaging Fourier transform spectrometers (IFTS). AN IFTS use a two dimensional detector array like a camera instead of a single detector. This enables a high spatial and spectral resolution. The new technique of IFTS brings new challenges and advantages for the data processing. Because of optical, electrical, and mechanical effects, the raw data need to be processed such that every IFG is sampled on the same sampling grid and has similar properties like linearity or detector response. This processing is called level 0. The Gimbaled Limb Observer for Radiance Imaging of the Atmosphere (GLORIA) is an airborne IFTF and designed to improve the knowledge of the upper troposphere / lower stratosphere region. The large data structures of GLORIA measurements causes that the file I/O and the memory footprint for an in memory level 0 processing are huge (around 17GB allocated memory for a single measurement). Under this condition, it was necessary to change the architecture of the processing chain. We introduce a pipeline level 0 processor. Instead of loading the whole data into the memory, the data is streamed and processed online by processing nodes. The measurement can be red and processed simultaneously. Each node will receive a data package, process it and send it to the next node. Since only the memory in the node is allocated the resource consumption is static and independent of the actual signal length. Level 0 contains also methods which are not local such as the Whittaker-Shannon resampling which requires the whole signal. In that cases we use a ring buffer which store a larger part of the data. The ideal size of the ring buffer, keeping a good balance between performance and error level, has determined through a series of performance studies. The studies shows that for a moderate buffer length (around 80 sampling points) the error is below the noise level. The new architecture reduces the usage of memory to a constant of only a few MBs for the whole level 0 without loss of performance. For the future work the pipeline level 0 processor can be used to perform level 0 while the measurement is taken.

Key words: FTS; pipeline; signal analysis; remote sensing.

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Estimation of corn and soybean yields in the US Midwest, 2001-2012

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ABSTRACT

Crop yield estimation is of great importance to food security and economic development. In South Korea, the self-sufficiency rate of grain crop is 26.7 % in 2010[2], and the corn and soybean as major grain except the rice show very low self-sufficiency rate of 0.5 % and 8.7 % respectively and most of them depends on import. In these reasons, it is necessary for the long-term and continuous monitoring for crop yield of major importers or interest countries to prepare for the instability of food provision. Thus, we perform the statistical modelling for corn and soybeans in US Midwest which is the world's largest grain exporter over the long period, and examine for accuracy of crop yield results through the comparison and validation with statistic data. In order to estimate the corn and soybean yields, we constructed a database for satellite imagery acquired from Terra MODIS (Moderate Resolution Imaging Spectroradiometer), climate dataset provided from PRISM (Parameter-Elevation Regressions on Independent Slopes Model) climate group, and soil properties of HWSD. Then, we perform the statistical modelling for corn and soybean yields between 2001 and 2010 after correlation analyses and multicollinearity tests. Results of comparisons with the US yield statistics provided by NASS (National Agricultural Statistics Service) of USDA (United States Department Agriculture) showed the RMSEs (Root Mean Squared Errors) of 0.909 ton/ha and 1.160 ton/ha for corn yields in 2011 and 2012 respectively, and those of 0.327 ton/ha and 0.418 ton/ha for soybean yields. Through these results, explanatory variables were identified as suitable for the crop yield estimation, and if additional data such as irrigation and fertilizer are applied to the study, the accuracy is expected to increase more.

Key words: Crop yield; satellite imagery; climate dataset; soil properties; corn; soybean.

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Satellite based optimal aggregation techniques for the COMS level 3 products

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ABSTRACT

A Since 2011, the COMS(Communication, Ocean and Meteorological Satellite) has been providing data that are information of atmosphere, land and ocean over East Asia and Oceania. Its MI(Meteorological Imager) consisted 1 visible and 4 infrared channels is producing level 2(L2) meteorological products including land surface temperature, sea surface temperature, aerosol optical depth, total precipitation water using CMDPS(COMS Meteorological Data Processing System). The L2 products have been used in meteorological analysis and numerical weather prediction. The COMS level 3(L3) products should be composed an available spatial-temporal resolutions, because the accumulated L2 should be conducted comparative study with other satellites for utilization in climate change researches. The COMS MI, one of optical sensor has generally many missing values and outliers occurred by cloud/noise or natural/artificial error. If a time series distribution is appeared one side bias from their grouping effect, it can have a bad influence on producing the L3. Solve the problem, the MODIS(Moderate Resolution Imaging Spectroradiometer) weighted following pixel count or QA(Quality Assurance) to aggregate time series. Other satellites including the COMS have no reasonable method they have been depending on the arithmetic average method yet. This paper described comparison 4 temporal aggregation techniques for the COMS L3 monthly SST which are arithmetic average, timeslot average, moving average, and mean ensemble of them targeted around South Korea. Our research suggested optimal aggregations for the COMS L3 using the Aqua MODIS L3 monthly SST as verification data between April 2011 and March 2014. In the verification, accuracy of 4 temporal aggregations were compared following spatial distribution, season, data quality, missing value for their day/night using solar zenith angle. The optimal aggregations for the COMS L3 appeared differences according to their spatial-temporal characteristics. Thus, when we select an optimal aggregation techniques for the COMS L3, should consider for the effects of spatial-temporal characteristics.

Key words: COMS; level 3; optimal aggregation; sea surface temperature; timeslot average.

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Sinkhole susceptibility mapping using a frequency ratio method and GIS

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ABSTRACT

There are several hundred big and small sinkholes (locally known as obruks) in the vicinity of Karapınar. Agricultural irrigation, which is dependent on the level of ground water that falls over, has accelerated the formation of sinkholes. About 20 big sinkholes occurred within the territory of the Obruk Plateau between 1970 and 2012. Many geologic, geomorphologic and hydrogeologic studies have been conducted on the formation of sinkholes at the Obruk Plateau. All of these studies were performed in relation to sinkhole formation in this area, but there have not been any studies on the sinkhole susceptibility of this region. The purpose of this study is to produce a sinkhole susceptibility map of the Obruk Plateau in central Turkey, based on a frequency ratio method within a Geographic Information System environment. Using field surveys, the locations of the 182 sinkholes were determined in the study area. In this study, 35 sinkhole-related factors were determined and used in the analysis. The values of the susceptibility were estimated using frequency ratio analysis and were used to calculate the sinkhole potential for the entire study area. For model validation, the constructed sinkhole occurrence potential map was overlaid onto the 182 observed sinkholes, showing that 169 sinkholes (93 % of all sinkholes) were determined to be in the high and moderate sinkhole occurrence potential areas. In addition, the predictive capabilities of the models were determined by the area under the relative operating characteristic (ROC) curve. The area value under the ROC curve was 0.953. These results indicate that the model is a good estimator of the sinkhole potential in the study area. The sinkhole potential map shows that the areas of very low or no, low, moderate and high sinkhole potential classes are 712.31 km2 (30.13%); 641.15 km2 (27.12 %), 572.45 km2 (24.21 %); and 438.01 km2 (18.56 %), respectively. The interpretations of the potential map showed that geology (lithology), elevation, aspect, fault density, distance to fault, and decline of the groundwater level play major roles in sinkhole occurrence and distribution in the Obruk Plateau. In this study, the frequency ratio method was used to locate potential zones for sinkholes in the Obruk Plateau. The evolved model was found to be in strong agreement with the available sinkhole test data. The resulting sinkhole potential map can aid planners and engineers in development plans and land-use planning.

Key words: Doline; obruk; sinkhole; susceptibility; GIS.

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Analysis of relationship between GPP variation and drought indices over cropland of North Korea, 2000-2012

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ABSTRACT

The occurrence of drought cause many problems about food, human life, economy and so on. For monitoring drought, drought indices based on observation data such as meteorological data have been used. But this way has the limit in providing a continuous spatial information because observation data used for generating drought indices can be easily influenced by the number of observation points. Recently satellite remote sensing is used to monitor drought. It has provided environment information about area where human is difficult to access and enables the spatio-temporal analysis by periodic observation in the wide area. Moreover various drought indices based on satellite data have been developed. They reflect variation characteristics of albedo, vegetation, surface temperature and so on when the drought is occurred. But because each of them have different features, it is difficult to select one of them and needs to be careful. Our study aims at investigating what drought index based on satellite well reflects the spatio-temporal relation between drought and vegetation growth. For this, correlation analysis between drought indices and gross primary productivity (GPP) is carried out. GPP means the amount of light which is converted into organic matter by photosynthesis. In other words, it represents plant's activities. Plant is a sensitive organism to water and focuses on minimizing water loss in a body by inducing to close stomas when water stress is high. So plant's productivity tends to decrease when drought is occurred. In this study, NDDI (Normalized difference drought index), VCADI (Vegetation condition albedo drought index), NMDI (Normalized multi-band drought index) and VTCI (Vegetation temperature condition index) are used as drought indices. Study area is cropland of North Korea. Study period is from 2000 to 2012. All satellite data used in this study is provided from MODIS operated by NASA. As a result, NDDI among them has the highest correlation to GPP. It means that NDDI reflects variability and relationship between drought and vegetation growth well. NDDI-GPP correlation is also higher in the spring and the fall than in the summer and is higher in the plain area than in the non-plain area. In a conclusion, these results mean that the spatio-temporal features of each environment should be considered carefully when drought index is selected and these results can be useful to select drought index used for evaluating condition of drought in the agricultural land or vegetation area.

Key words: Drought; drought indices; plant productivity; spatio-temporal analysis.

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Data assimilation of multi-sensor sea surface temperature using Bayesian Model Averaging

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ABSTRACT

Sea surface temperature (SST) is used with an important parameter for understanding climate system and many marine application. So measuring accurate SST is demanded. In addition to various in-situ observations by moored and drifting buoys, ships, and airplanes, a series of satellite-borne instruments provide global coverages of SST with the optical and microwave remote sensing. While in-situ measurements of SST generally yield higher accuracies in spite of the irregular point-based observation, the satellite remote sensing can provide spatially continuous detection for a more consistent dataset. But SST products derived from satellite-borne instruments have some different value. Because they have uncertainty retrieved by different sensors and algorithms. Also, each product has different size of uncertainty. To reduce the uncertainty, data assimilation based on ensemble is needed. Bayesian model averaging is weighted averaging method using posterior probability as the weight. Using training data, the posterior probability distribution of each data are calculated, and the weight for each ensemble member is derived from Expectation-Maximization (EM) algorithm. EM algorithm estimate MLE by iteration process to find out hidden data or missing data. The objective of this study is to create a multi-product ensemble of monthly SST using BMA for accuracy improvement. The monthly SST products of the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor and Advanced Microwave Scanning Radiometer for EOS (AMSR-E) sensor of Aqua and Advanced Very High Resolution Radiometer (AVHRR) sensor of National Oceanic and Atmospheric Administration (NOAA) were used as the ensemble member products. Advanced Along-Track Scanning Radiometer (AATSR) SST product of Environmental satellite (Envisat) was used for training data and validation. Using the BMA and EM algorithm, we calculated the weight and monthly BMA ensemble SST. And to validation about the accuracy of the BMA ensemble, we compared RMSE with each ensemble member, ensemble mean and ensemble median by using one-leave-out validation method. As a result, BMA ensemble presented the lower RMSE than ensemble member and others ensemble method.

Key words: SST; data assimilation; BMA; EM algorithm; ensemble.

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3D visualization system for ocean model data using WebGL and array database

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ABSTRACT

Recently, as types and quantities of database which can be adopted for Web GIS (Geographic Information System) have been varied and increased proportionally, geo-visualizing methods of web GIS for those 'Big' data have been also diversified. A typical instance of this change is appearance of HTML5 Canvas which enables web clients to describe multidimensional data easily on the web and web services for disseminating interchangeable data. And these changes make existing Web-GIS models which used to be static to be more dynamic. In case of ocean industry which has emerged as a Blue-ocean industry in South Korea, huge forecasting data produced by ocean modelling is noticed as useful information as much as in-situ information acquired periodically. Although, in many cases, modelling data can have inaccuracy on some part than observation data, but in respect of probability, it is true they can be reference for general users of ocean resources. In this paper, to support various ocean users' activities by visualizing this huge forecasting data on the web, a Web-based 3D geo-visualization system for ocean information produced by model forecasts is implemented. Firstly, point based data such as temperature, salinity and so on produced by coastal ocean model is interpolated by IDW (Inverse Distance Weighting) algorithm and is converted as image database. Secondly, vector based data such as current vector is classified by hierarchical boundary and is stored on distributed DBMS (Database Management System) to relieve loads on web GIS system. Thirdly, image database produced in first procedure is stored as raster array database in RASDAMAN. Finally, web service for providing database which has pixel and directional vector as their own attribute to web application is realized and all database is visualized as 3D information on canvas of web GIS system by WebGL.

Key words: WebGL; ocean model data; array database; 3D visualizing.

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The key role of PSI techniques in the monitoring and study of ground oscillation related to ground water level change

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ABSTRACT

The recent development of the persistent scatterers interferometry techniques (PSI) allow to measure ground deformations on wide areas with millimetric precision. These techniques show excellent results in the monitoring of subsidence or uplift in urban areas where the SAR data provides high density of measurements. Many ground oscillations are usually related to fluid variation: groundwater or oil extraction, injection of gas. PSI techniques allowed to map strong deformations which were already known but also, and more important, to monitor unknown deformation phenomena characterized by very slow deformation rates. Therefore, PSI techniques have been consolidated as a powerful tool to have an indirect control of groundwater resource and exploitation. In this work we illustrate three case studies of ground subsidence related to groundwater oscillation measured with PSI techniques and using data acquired by different SAR sensors: a. Lorca, in the Guadalentin river basin (Spain) affected by one of the strongest subsidence in Europe caused by extreme overexploitation of groundwater. b. Otura town in Granada basin (Spain) where PS data allow to discover a small subsidence caused by increase in groundwater extraction related to a rapid urban growth in the last 20 years. c. Pontecurone a village in the Southern Po Plain in Italy where the PSI data detected seasonal and long terms cycle of ground subsidence and uplift related to groundwater level variations. The results show that in all the cases presented the PSI data, integrated with traditional hydrogeological studies, are essential instruments to study groundwater related subsidence.

Key words: Groundwater; InSAR; overexplotation; subsidence; PSI.

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Effectiveness indicator for mining loader based on pressure signal measured at bucket's hydraulic cylinder

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ABSTRACT

Nowadays, the utilization of the monitoring systems and advanced IT technology in order to support maintenance management in complex machinery systems is widely-used at all levels of the maintenance. One of the purposes for using such systems in a copper ore underground mine is to assess the performance of self-propelled machines, e.g. loaders. Effectiveness of the loader operation might be estimated taking into account different sources of information and evaluation criteria. This paper presents a method for identification of loader operation regime: loading, haulage and unloading of ore. It is expected that such a cycle should be repeated during single shift. The proposed algorithm is based on measurements of hydraulic pressure acquired on the bucket's hydraulic cylinder. This signal is very noisy, thus further analysis based on it requires it's smoothing. We propose to incorporate the Kalman filter in order to smooth the signal. Kalman filtering is commonly used in optimal filtering of nonstationary signals. Further steps of the proposed algorithm indicate moments of basic loader's routines. Finally, the information about the number and duration of loading and unloading cycles is provided. The algorithm is illustrated by analysis of real data from the monitoring system that describes the pressure measured on the bucket's hydraulic cylinder during the entire 6-hour-long shift.

Key words: Self-propelled machine; loader; Kalman filter; monitoring system.

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Effectiveness indicator for mining loader based on pressure signal measured at bucket's hydraulic cylinder

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ABSTRACT

Nowadays, the utilization of the monitoring systems and advanced IT technology in order to support maintenance management in complex machinery systems is widely-used at all levels of the maintenance. One of the purposes for using such systems in a copper ore underground mine is to assess the performance of self-propelled machines, e.g. loaders. Effectiveness of the loader operation might be estimated taking into account different sources of information and evaluation criteria. This paper presents a method for identification of loader operation regime: loading, haulage and unloading of ore. It is expected that such a cycle should be repeated during single shift. The proposed algorithm is based on measurements of hydraulic pressure acquired on the bucket's hydraulic cylinder. This signal is very noisy, thus further analysis based on it requires it's smoothing. We propose to incorporate the Kalman filter in order to smooth the signal. Kalman filtering is commonly used in optimal filtering of nonstationary signals. Further steps of the proposed algorithm indicate moments of basic loader's routines. Finally, the information about the number and duration of loading and unloading cycles is provided. The algorithm is illustrated by analysis of real data from the monitoring system that describes the pressure measured on the bucket's hydraulic cylinder during the entire 6-hour-long shift.

Key words: Self-propelled machine; effectiveness indicator; monitoring system; maintenance.

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GIS apply to the mapping of Land Use/Land Cover and Vulnerability of the Guarani Aquifer System

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ABSTRACT

This study presents the vulnerability mapping of Guarani Aquifer System (GAS) in the municipality of Ribeirão Bonito, central region of the state of São Paulo - Brazil, through the application of Pesticide DRASTIC index. Based in the data integration in Geographic Information System (GIS), the seven spatial parameters (Depth to water table, net Recharge, Aquifer media, Soil media, Topography, Impact of vadose zone, and hydraulic Conductivity), enabled the vulnerability mapping, subsequently being associated to the land use and land cover (LULC). The main LULC found in the municipality, refers to Agricultural Areas of Temporary Crops, almost corresponding to 210 km² and 40.67%. The principal activities mapped, confirm the agricultural potential in the municipality of Ribeirão Bonito, justifying the implementation of Pesticide DRASTIC methodology. The parameters DRASTIC Pesticide Index, were pondered with its respective weights and rates, based on the weighted Multicriteria Analysis, with objective to produce cartography of synthesis, was used the Weighted Overlay tool of ArcGIS 10.1 to finalized the vulnerability map elaboration of the study area, being calculated the referent values to the percentage that represent each parameter on the weighting and the vulnerability index results. According to DRASTIC Pesticide Index, proposed by Aller et al. (1987), the study area showed vulnerability index comprehended between 26 and 151.6, subdivided on the following classes: low 9.5% (<71), moderate 30.2% (71 – 126) and high vulnerability 60.3% (126 – 180), not showing extreme vulnerability. The results indicate to the high levels of vulnerability (126 – 180) are situated mostly in outcrop areas of GAS, located mainly under alluvial sediments with presence under the Triassic period formation (Pirambóia Formation) and Jurassic (Botucatu Formation), comprehended by fine and medium sandstones, which exhibit moderate hydraulic conductivity (values between 1.53 – 3.4 m/d), and the larger rates of recharge (465 mm/year). Situated mostly, under soft surfaces with low percentage of slopes (0 – 1), the found soils are characterized, mainly as quartz sands and Latosols, where the Unsaturated Zone thickness, ranged between 0 and 23m. The vulnerability mapping of Guarani Aquifer System (GAS) was integrated to the LULC areas, the results indicated the need of better management of Agricultural Areas of Temporary Crops, Areas of Not Identified Use and Reforestation, due to the huge pollution potential, by ammonia, pesticides and mostly nitrates, considered the most common pollutant found in soil, responsible for great part of human cases contamination, may be released to surface waters or by infiltration and achieve the GAS, in both cases are derived from the intensive application of fertilizers and nitrogen agricultural supplies. GIS analysis and data integration, presented several advantages, that includes, from the integration benefits of digital processing techniques in the elaboration of an unique information, to the use of remote sensors and thematic classification based on the object, allowing to support the optimization and implementation of futures land use/land covers, by means the knowledge of provides areas to the implementation of social-economics activities, with view to GAS protection and contributing to environmental preservation and maintenance of the population quality life.

Key words: GIS; Guarani Aquifer System; aquifers vulnerability; land use; land cover; Ribeirão Bonito.

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The concept of Hayek's Machine for control robots Khepera IV

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ABSTRACT

This article presents the concept of a dissertation thesis that is currently in development. The article results from previous studies that were devoted to the application of fuzzy logic in multi-agent systems. Thanks to the hitherto discovered information and applied programmatic data libraries we are now capable to adjust the motion simulator currently under development in a way that the robot itself may be managed not only in abstract environment but mainly the robot in a material form. Using the material robot we are capable to embark into the development of the application in more complex dimensions. The article shall present the workflow of our efforts to accomplish artificial intelligence capable of remote control of the robot. We expect an occurrence of new situations that the robot may and may not get into in the abstract environment together with a limited set of states of the world. For our research we have chosen the robot Kheper IV. These robots are equipped with ultrasound and infrared sensors which we are going to use in order to establish a base of knowledge and an environmental model.

Key words: Robots; AI; fuzzy logic; knowledge base; application; simulator of motion.

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Contribution of watershed hydro-morphometric spatial-based modelling for the assessment of runoff water harvesting potentialities in Wadi El-Arish, Sinai

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ABSTRACT

Water in Sinai regions is the critical resource needed for the different developmental activities. The present work introduces a detailed hydro-morphometric analysis for Wadi El-Arish Watershed in North and Central Sinai to throw lights on new potential or priority areas suitable for the runoff water harvesting (RWH). The sub-watersheds' boundaries and hydro-morphometric parameters were delineated using the ASTER DEM and Spot-4 satellite image mosaic by the WMS 8.0© Software. Subsequently, six thematic layers were used to construct a multi-parametric weighted spatial probability model (WSPM) by the ArcGIS 10.2© software. These thematic parameters which include the linear, aerial, and relief aspects were determined for the seven sub-watersheds of W. El-Arish. They are represented by the bifurcation ratio (Rb), drainage density (Dd), drainage texture (Dt), stream frequency (Fs), length of overland flow (Lg) and infiltration number (If). The WSPM had been run three times for three scenarios: i.e. (1) Criteria' weights assigned by the authors' judgments; (2) Equal weighting of criteria, and (3) Criteria' weights justified by the sensitivity analysis. The resulted prioritization map classified W. El-Arish Watershed into four classes ranging from the poor to very high for the RWH. Accordingly, El-Fetahy El-Aqaba, Geraia, Yarqa Abu Taryfya and Heridein sub-watersheds were categorized as high-very high in water holding capacity (for the RWH), because they have high values of Dd, Rb, Lg and low values of Fs,. Based on scenario 3, the high-very high RWH priority classes in these sub-watersheds occupy most of Wadi El-Arish Watershed, with an area of 16,492 km^2, which constitutes about 70 % of its total area. In comparison, scenario 1 designated these classes as representing about 15,878 km^2 of total W. El-Arish area, which constitutes 67.91% of its total area. In scenario 2, the high-very high RWH priority classes occupy about 12587 km^2, which constitute 53 % of the total W. El-Arish Watershed area. Accordingly, the WSPM justified model has proven a high credibility in its results, which encourages its application on the ground.

Key words: Sinai; remote sensing; watershed morphometry; GIS; weighted spatial probability modelling; runoff water harvesting.

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Multi-platform web-GIS based geoscience information system for simple field data collection

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ABSTRACT

The purpose of the study is to develop a multi-platform web-GIS based geoscience information system for providing a geoscience spatial map data (geological maps, coal mine geological maps, submarine geological maps, geochemical maps, geochronological maps) and sharing the location based field picture and simple memo captured by the mobile devices such as smart-phone and smart-pad in the field. We have developed the multi-platform web-GIS based geoscience information system for multi-purpose using responsive web design technologies (such as HTML5, CSS3, Javascript) and open source GIS tools (Geoserver, PostGIS, PostgreSQL, OpenLayers and etc). The main functions of the developed system are as follows; creating surveys with a web based editor, capturing photos, text, GPS locations, submitting results to a spatial database for searching, reporting, and accessing on mobile devices, publishing surveys to share with other people and posting surveys to the social network service. The survey data is stored directly in a centralized spatial database, so that the survey data can be accessed via mobile device anytime, anywhere. The web design of the new system is simple and the graphical user interface is very comfortable to use. The developed system is useful for field data collection and sharing them through the social network service. In the future, we will add a set up function of automatic email notification to colleagues to collect high-quality data so that you gain actionable insights and address issues that require attention.

Key words: Web-GIS; field data collection; geoscience information.

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Estimation of nearshore currents induced by wave breaking on an embayed beach using optical remote sensing

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ABSTRACT

This study proposes an optical imaging-based method that can measure spatial velocity fields of currents in the surf zone from coastal optical image data by tracking the movement of advecting foams formed by breaking waves. The foam patches in the optical image appear to move while locally maintaining irregular array characteristics of image pixels. Here, local invariant feature points are extracted by using scale invariant feature transform (SIFT) and velocity fields in the surf zone are calculated by tracking these invariant feature points over time. In order to reduce errors shown in extracting invariant feature points, upper and lower limits of velocity are applied to the extracted vector results. In addition, the instantaneous vector fields averaged in time and space with a certain interval. Velocity results measured through this SIFT method are compared to the results measured by optical current meter (OCM) proposed earlier, in terms of the long shore-current component. The comparisons show that the results are well matched in the inner surf zone. On the other hand, difference of the measurements by the two methods is larger in the outer surf zone. This is due to lack of the formation of foams, i.e. unsaturated wave breaking. Unlike the OCM, the SIFT method can observe both long-shore and cross-shore currents.

Key words: Wave breaking; surf zone; currents; video; embayed beach.

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Assessment of DEM accuracy generated from different Lidar system and flight altitude

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ABSTRACT

Nowadays, an important part of the engineering and infrastructure studies are needed high accuracy and resolution Digital Elevation Models. DEMs has been used as a base map in many different studies, such as 3D city modelling, hydrographic modelling, surface analysis, identification and management of forest structure, object extraction, classification of soil structure and volume calculation. Due to the acquisition of the widespread use of DEM, modern technologies such as Lidar, which allows accurate and fast production of DEM have been gaining importance. Lidar is an emerging technology that composed of Global Positioning System (GPS), Inertial Measurement Unit (IMU) and laser scanner unit. Lidar system can capture high-density and high-accuracy three-dimensional terrain point data. In this study, we investigate DEM accuracy generated from LIDAR data. These data obtained from different systems and flight altitude. Two different Lidar system used in this study. These are Pegasus HA-500 system of Optech Company and LMS-Q1560 Lidar system of Riegl Company. These data have been acquired by General Command of Mapping in the area of 156 km^2 in Bergama district of Izmir province of Turkey with two different altitude. Flights were performed with Optech and Riegl systems from 1200 and 2600 m altitude. After the flights, 4 different data set have been achieved. From each data set, 4 different area were selected according to slope, structure and characteristics of land. Two of these regions were divided into two different sub-set of data for detailed accuracy analysis. In addition, 5% of the data is selected as the test points. From each subset of data DEM was created using the triangulation method. Height differences between interpolated values and actual values of test points were calculated. As for the other two regions sensitivity between high values in certain direction by creating profiles were examined. In addition, using the same data derived from different sets of height and systems DEM generated. Accuracy analysis were made between DEM.

Key words: Lidar; DEM Accuracy.

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Development of a model in GIS for the analysis of traffic accidents in Turkey

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ABSTRACT

According to world report by World Health Organization (WHO), an estimated 1.2 million people are killed in road crashes and as many as 50 million are injured each year. Besides about 300.000 traffic accidents have occupied each year in Turkey. These accidents are concluded with nearly 4.000 died and 200.000 injured people. These outcomes show that, traffic accidents are the most important problem threatening human lives. It is necessary to identify blackspots and got precautions for decreasing damage's. In this study, the data collected from 2005 to 2013 are analysed to detect blackspots. The data that we used have obtained from the Turkish National Police (TNP) and Republic of Turkey General Directorate of Highways (GNH). The database consist of crash records that includes detailed information about the roadway and crashes, including such factors as the number of lanes, the speed limit, number of accident, number of death and injured, crash severity, and other factors. In recent years, for modelling of traffic accident are used different statistical methods. Poisson regression, Negative Binomial regression and Empirical Bayesian (EB) approach are used in this research. Depending on the data, a Poisson model may not always be appropriate because the Poisson distribution restricts the mean and variance to be equal (E[ni]=VAR[ni]). If mean does not equal variance (dispersion parameters), then, it will be more appropriate using NB distribution. The Poisson regression is a limiting model of the NB regression. One of the most common approaches for identifying hazardous locations on road networks is the Empirical Bayes Method (EB). The method has combined observed and expected accident frequencies to provide unbiased estimates of the safety performance at specific sites. As a result, in order to model traffic accident, we deal with comparison of the models to evaluate the most appropriate one. The model determination and visualization steps are realized with Geographical Information Systems (GIS) software.

Key words: Traffic accident; Poisson; Negative binomial; empirical bayes; GIS; AADT.

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Automatic detection of damaged buildings after earthquake hazard by using Remote Sensing and Information Technologies

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ABSTRACT

The effects of earthquake can be devastating which may cause significant loss of life and property damage especially in urban regions. Observation of damaged buildings is vital for emergency management professionals, helping them for directing the rescue teams in short time to right location. Remote Sensing (RS) and Geographic Information Technologies (GIS) are an efficient tool for rapid monitoring of damaged buildings in urban regions following an earthquake. An approach was developed to determine automatic detection of damaged buildings through analysis of change with the aid of integrated Remote Sensing and Information Technologies in the case of Van Ercis earthquake which occurred on 23 October 2011. In this study pre and post event Normalized Digital Surface Models (nDSM)'s generated by subtracting the pre and post event Digital Elevation Model (DEM) and Digital Surface Model (DSM) for the years 2010 and 2011. The image differences between pre and post event DEM and DSM provide the pre and post event database for building patches. A change analysis was then applied to Normalized Digital Surface Models (nDSM) in order to detect the damaged buildings. The performance of the analysis was evaluated by an object based accuracy assessment method referencing ground truth raster data. The results indicate that the proposed approach is satisfactory for detection of damaged buildings and it is a time saving method for monitoring collapsed buildings after earthquake.

Key words: nDSM; DEM; DSM; automatic building extraction; object based accuracy.

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A GIS technique for the monitoring of civil structures subjected to earthquakes

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ABSTRACT

The recent seismic events (Italy 2009 and 2012, Japan 2011, Chile 2014, Nepal 2015) have animated the necessity to invest more resources in the study of prevention against the earthquake effects and pushed the scientific research to develop new techniques for the data acquisition representing the dynamic responses of civil structures in order to identify their modal parameters useful for the structural monitoring and damage assessment. This work wants to show a preliminary research relating to the development of an innovative technique for the data acquisition of dynamic structural responses. The technique is based on a Web Geographic Information System (WebGIS) in Remote Desktop for the monitoring and territorial planning as well as for the modal parameters identification, the monitoring and damage assessment in civil structures subjected to seismic actions. The main steps useful to the realization of such a system are: a) creation of a GIS to storage data (e.g. cadastral maps, topographic maps, morphological data, geological and urban planning) and database association; b) design and installation of monitoring systems consist of transducers; c) creation of a viewer which, by connecting to a server, regularly updates in real-time the dynamic data of structures subject to earthquakes (the database is related to a single index that allows to trace the structure related to the noticed seismic event that is detected and that is displayed in real-time on a georeferenced card inside the GIS); d) interrogation and data management of structure by creating relational DataBase; e) modal parameters identification of the structure; d) structural damage assessment. The technique is under experimental validation. The overall study objective is to create a geodatabase easy to find and to read.

Key words: GIS; structural monitoring; earthquake.

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Practical applicability of satellite-based SAR interferometry for detection of landslide activity

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ABSTRACT

After two decades of existence of SAR satellites, their data processed by interferometric techniques (InSAR) allows a sensitive detection of terrain movements. Various projects have risen towards detection of landslide activity and thus possibility of early warning based on SAR data. The ability of InSAR techniques to detect a slope stability is limited and depends on an orientation of slope, a rate of movement, ratio of vegetation cover and temporal and spatial resolution of SAR images. This paper presents common issues found in past projects of the team of authors observing landslides using available satellite SAR data processed by various InSAR techniques. It is demonstrated that in some cases the basic differential InSAR combining two images only provides more valuable information compared to advanced multi-temporal InSAR techniques. The paper aims at providing guidelines for maximally successful detection of landslide activity and to introduce pros and cons of the InSAR as a method often discussed in geology and geophysics circles. We prove the doubtless potential of techniques using satellite-based InSAR to identify creeping movements of structures built at moving slopes and limited possibility to detect movements at moderately vegetated slopes by especially using L-band or by combination of winter-season SAR images and images within very short temporal difference. It is possible to overcome misinterpretation of results by proper understanding of sources of InSAR phase component at slopes, including phase due to SAR geometrical distortion, vegetation movement (vegetated mass movement) and atmosphere pressure changes correlated with height differences. Theoretically, an InSAR-based system to evaluate slope vulnerability to landslide can be combined with a flood prediction system to provide an early warning against threat of landslides. However the applicability of such system cannot be generalized - InSAR evaluation should be performed at site-to-site basis with detected movements checked on site. Deliverables can be maps of active slope movements as vulnerable areas, available to incorporate into national geological topical maps, and early warning can be provided only in case of detected accelerated rate of movements of buildings or other InSAR-monitored structures at the slopes.

Key words: Landslides; InSAR; early warning; deformation monitoring.

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Consideration of channel combination from remote sensing data in Mediterranean forest classification

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ABSTRACT

Development of short and long term comprehensive management planning is heavily dependent on a wide range of data. The traditional way of collecting and analysing the data is limited, due to the dynamic entity of the ecosystems, which are constantly changing and the large volume of the data available. To improve efficiency, reduce cost and make timely management decisions, new methods and techniques which must be structured with the best available technology should be adopted. Remote sensing techniques, using satellite data, offer much potentiality for the produce of such information. Landsat OLI-8 data acquired over the peninsula of Halkidiki, Greece in summer 2013, was analysed to determine, qualitatively and quantitatively, their utility and potential to classify natural resources categories based on the determination of channel combination, which can used to classify the various categories, based on their higher overall accuracy assessment. Spectral information contained in each of the utilized channels of Landsat OLI-8, statistics defining 12 cover type classes of interest were calculated and used as a basis for classification of the designated study area. Channels combinations (4-5-6/ 3-4-5/ 3-4-5-6/ 4-5-6-7) fulfil the requited accuracy for forest purpose as they conducted overall accuracies ranging between 7.85% and 96.29%. The highest overall accuracy was conducted by the channel combination 3-4-5-6-7 (98.15%). The poorest results were obtained from analysis of channels combination 4-6 (68.52%). Single channel 6 conducted the best overall results, however, channels 5 and 6 seemed to be the most useful ones as they appeared in the best, for each category, channels combination. The channel combination can be sued for the best classification of the categories maquis, maquis +rocks, broadleaf's, urban areas and olive trees. For cost-effective purposes, the channel combinations 4-5-6 is introduced as the best channel for forest resolutions similar to this research.

Key words: Channel combination; classification: Mahalanobis dstance; maximum likelihood; Mediterranean forest; remote sensing data.

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Multi-scale temporal analysis integrating different remote sensing techniques for detecting active landslides. Application to the road-network in a mountainous region (Las Alpujarras, SE Spain)

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ABSTRACT

Remote sensing techniques have become a critical and universal tool for natural hazards and specifically for landslides studies. They offer the ability to provide consistent measurements of landscape condition, allowing detection of both abrupt changes and slow trends over time range. Remote sensing allows carrying out a landscape dynamics monitoring over large areas, including those areas where access is difficult or hazardous, such as mountainous regions. In the present work we show a multi-scale and multi-temporal analysis integrating a variety of remote sensing techniques applied in the Alpujarras, a mountainous region located in SE Spain and in the southern slope of Sierra Nevada range (Granada), with the aim to detect active landslides not only at regional scale, but also a small one, focusing on road cuttings and natural slopes. The exploited techniques can be summarized as follows: (1) DInSAR analysis processing SAR images derived from ENVISAT (2003-2009) and ALOS PALSAR (2007-2011); (2) different digital scales of aerial photography since 1956; (3) Landsat and SPOT imagery in order to detect land use changes; (4) high resolution imagery from Unmanned Aerial Vehicles (UAV) for the rainy period spanning 2009-2010; (5) Multi-temporal (2008, 2010, 2013, 2014) ground-based LIDAR and low-flying helicopter LIDAR acquisition for design high resolution DEM in order to quantify changes in the road cuttings geometry. The combination of all these techniques allows identifying active landslides at different scale, from large landslides detected in both sides of the main river (Guadalfeo) to small flows and landslides (more than 200 cases) in road embankments. Temporal analysis allows correlating landslide activity with triggering factors, mainly intense rainfall events and long rainy periods, as well as to quantify ground deformation and displacements. This contribution aims to support landslide prevention and mitigation measures in the road network of this hazardous region and contribute to its organization management.

Key words: Landslides; DInSAR; LiDAR; UAV; photogrametry.

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Nanocomposites by adiabatic shock wave compaction

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ABSTRACT

The explosive compaction of powder materials is used in particular cases, when the traditional methods of powder metallurgy and materials sciences are inapplicable for densification of compacts near theoretical density and required phase composition, structure and desired properties. Fabrication of dense compacts from refractory and hard powders using conventional methods is problematic, because require high pressure, high temperature, vacuum or special inert media and etc. For realization above conditions it is necessary design high costly equipment and finally the technology economically is not reasonable and attractive. Other difficulties are related with limitations on sizes of compacted samples. The last one is very important in point of view of industrial application of the laboratory results. In most cases the explosive compaction technology solves above problems. The advantages of explosive compaction for obtaining of bulk nanostructured materials are discussed in the paper.

Key words: Nanocomposites; nanopowdwers; shock wave; explosive compaction.

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Explosive fabrication of Cu-C and Cu-W materials

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ABSTRACT

The possibility of fabrication antifriction composites based on copper-graphite precursors using hot explosive consolidation technology is studied in presented paper. Application of explosive consolidation technology provides obtaining of high dense billets near to theoretical density without cracks and porous. There are investigated the structure of fabricated billets depending on parameters of detonation front. As investigation showed, the preliminary density of precursors is one of the important parameter in offered technology. In case of low density under the shock wave front, there takes place changes of geometry of container and obtaining of high dense billets becomes impossible. The porous, cracks and cavities were observed in whole volume of these samples too. Cu – (10-30%) W powder mixtures were formed into cylindrical rods using a hot shock wave consolidation (HSWC) process. Different type of Cu - W precursor composition containing 10, 20 and 30% of nanoscale W were consolidated near theoretical density under 900°C; the loading intensity was under 10 GPa. The investigation showed that the combination of high temperatures (above 800°C) and two-stage shock wave compression was beneficial to the consolidation of the Cu -W composites, resulting in high densities, good integrity and good electronic properties. The structure and property of the samples obtained, depended on the sizes of tungsten particles. It was established that in comparison with Cu-W composites with coarse tungsten the application of nanoscale W precursors and depending of content of W gives different result.

Key words: Explosive consolidation technology; hot shock wave consolidation (HSWC).

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New suppression system of methane explosion in coal mines

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ABSTRACT

At present mines in different countries use immovable or moveable passive water trough barrier for the protection from methane explosion. The protective water barrier is created in the process of the spill of water from 40-90 litre volume troughs. The protective system activates and water disperses exclusively at the expense of blast pressure. The requirements to the passive water trough barriers are provided in the Standard EN-1459-2 (2007). According to the Standard, the distance between the barriers should not exceed 75m for concentrated water trough barrier and 30m for distributed water trough barrier. Water concentration at barrier location should be at least 5l/m3 and 1 l/m3 respectively. Experiments (L.M. Pejic et al, 2011) conducted according to the Standard show that the time for passive water trough barrier activation varies from 0.52 s and 0.78 s. They also reveal that passive barriers protect effectively against the spread of flame, but they are not capable to ensure the attenuation of blast overpressure. Apart from that, the implementation of mining works together with the installation of different equipment as required by EN 14591-2 is very difficult or even unfeasible, especially in small cross-section galleries. Due to its limited effectiveness and a long period of time required for the activation, water trough barriers fail to meet contemporary challenges. An automatic explosion extinguishing system activated by means of a blast or flame detector has advantages over passive or active water trough barrier. An automatic system enables for the use of dispersed water as an extinguishing agent and enables an immediate formation of a water mist barrier. This paper presents the results of the testing of the Automatic Protecting System from Methane Explosion in Coal Mines. The new high-speed suppression system activated at the command of the initiation signal produces tailored dispersing water mist with droplet sizes in the range of 25-400 micron along selected sections of a tunnel and that has the following properties: a. the time of absorber activation from the moment of blast: 11 ms; b. speed of a damping agent discharge from an absorber: 60-80 m/s; c. volume of discharge: 80-150 litre; d. reduction of shock wave overpressures by means of an absorber: 1,80-2,98 times; e. minimum overpressure for activation of an absorber: 12 kPa.

Key words: Methane explosion; coal mines; suppression system.

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Production of industrial explosive substances on the basis of the powders and solid rocket fuel released from the utilization of the expired ammunition

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ABSTRACT

Disposal of obsolete munitions is a permanent process, during which gunpowder and solid rocket fuel are liberated and accumulated. Especially large quantities of such materials were accumulated in the countries of the former Soviet Union, including Georgia. Warehousing and storage of such materials and / or direct application may cause a serious threat / risks in terms of ecological and unauthorized use. Therefore, they are subject to unquestionable recycling or destruction according to international conventions and agreements. There are lots of efforts of their reusing, including manufacturing of household materials (varnishes, paints, etc.). But the existing technologies of chemical processing contain high risk of environmental pollution and development of uncontrolled processes, of which there are plenty of examples. That is why the existing technologies of recycling are prohibited by the relevant agencies. There are two ways of their destruction: explosion or burning. Explosion and burning in open environment are accompanied by a large concentration of poisonous gases and emissions of toxic solid detonated products, which is prohibited by the environmental laws / regulations. Therefore, today utilized gunpowder is mainly stored and the expenses of their storage permanently increase, in addition, there is a permanent threat of their unauthorized use, because they belong to the class of explosives. So, this problem is urgent at the local and global levels. The laboratory and polygon researches carried in advance by the specialists of LEPL “Delta” and LEPL “G. Tsulukidze Mining Institute” demonstrated that after the processing (recycling) and the correction of the composition of the above-mentioned powders and solid rocket fuel, it is possible to produce cheap and comparatively safe explosive substances for industrial usage. It has been determined as well that only powders and solid rocket fuels released from chemically stable expired ammunitions will be involved in the secondary utilization. Powders having signs of dissolution will be destructed due to the danger of their self-explosiveness.

Key words: Industrial explosive; rocket fuel; utilization; ammunition.

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Low temperature oxidation of GaAs by UV stimulated plasma anodizing

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ABSTRACT

In this paper we offer low temperature technology receiving GaAs oxide. For this purpose we use plasma anodizing with ultraviolet irradiation. It is well known that achieve native oxide of GaAs is a problem. Solving this problem is a low temperature technology. The scientific essence of the plasma anodizing is as following: in the general case plasma anodizing is performed under positive voltage applied to the material to be oxidized, which leads to oxidize samples with negatively charged oxygen ions extracted from the plasma. In this process, oxidation current contains many electrons, compared to negatively charged oxygen ions and therefore the process efficiency becomes low. For this reason and for increasing process efficiency in the process of anodizing simultaneously is switched on UV irradiation. UV irradiation acts as a stimulation of plasma anodizing process. Formation of oxide films in the world happens in a high temperatures (11000C). At this temperatures take place diffusion of unwanted impurities, increasing porosity, becoming worst adhesion to the substrate and etc. All of this influences badly on the parameters of nano-scale devices. Progress in the development of nanotechnologies the high temperature became unsupportive process, because reducing the size of the nanostructures it changes physical and chemical properties of the material. The processes, which are related to the low-temperature technologies, requires expensive and high budget technologies. For example, for thermal formation of silicon dioxide (SiO2) is needed about 11500C and 40 minutes to get the 100 nm thick dielectric film. Such silicon dioxide are distinguished by good physical and chemical properties and still widely used in microelectronic devices. However, formation same thickness silicon dioxide by plasma anodizing can be taken 3-5 minutes at a temperature 4000C and the study such materials properties is the scientific challenge. In this paper we suggest the mechanism of oxidizing metals and semiconductors by stimulated plasma anodizing. We have studied electrical, optical and structural properties of GaAs oxide. Electric properties were characterized by Capacitance-Voltage measurement, for structural - XRD diffractometer, Auger spectroscophy, SEM measurements.

Key words: Catalityc; plasma; semiconductor.

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Blast identification device

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ABSTRACT

The statistics of last years show that the fatal results and injuries caused from the blasts from various sources are serious. The list of spaces that has to be protected from the blast negative effects includes the underground and aboveground infrastructures of civil and military applications with different functions. Besidees, among the top problems of security are connected to the increased explosions in coal mines. The described wide scale security problems increases the importance of scientific researches in that direction and consequent designing and improvement of existing systems. One of the main problems of security is fast and accurate analyses of different threats in above ground and underground structures of different applications. Among the most dangerous threats, that may end with fatal and destructive results are blasts and blast-dangerous environment. Modern threat identification systems must be quick-acting and reliable. The development of contemporary detection devices is oriented to the creation of integrated systems ensuring monitoring of all possible threats as well as respective measures for threat prevention. A comprehensive security system enables identification of emergency and pre-emergency conditions and have WiFi modes of operation. This paper describes results of experimental investigations to identify and process information signals from different sources. The described works are necessary for designing the device integrated module of identification which is based on the constant monitoring on potential threat that may take place in manufacturing sites and tunnels. The potential threat, discussed in the paper, is explosion, which is based on the monitoring of overpressure and methane concentration control in the media; besides the reliable identification and generation of the emergency signal, the proposed multifunctional device will ensure also the activation of the protective systems to reduce the damage and fatal consequences after explosion and/or fires. The research works has been conducted at G. Tsulukidze Mining Institute (TMI) of Georgia for developing the multi-threat identification module.

Key words: Blast; signal transmission; pressure; methane explosion.

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Prediction of maximum explosive charge used per delay in surface mining using intelligent approach

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ABSTRACT

The exploitation of economic minerals from earth crust is increasing day by day at a faster pace since last decade to fulfill the increasing demand of minerals. When an explosive detonates in a blast hole, a tremendous amount of energy, in terms of pressure (up to 50 GPa) and temperature (up to 5000 K), is released. Although, significant developments have taken place in explosive technology, the explosive energy utilization has not made much progress due to the complexity of the various rock parameters. Only a fraction of explosive energy (20-30%) is used in the actual breakage and displacement of the rock mass, and the rest of the energy is spent in undesirable effects like ground vibrations, fly rocks, noises, back breaks, over breaks, etc. Out of these Ground vibrations are matter of great concern as it causes damage to the existing surface structures and nuisance to the residents in the closer vicinity of the mine. As the ground vibration is the most important environmental effect of blasting operation some regulations related to structural damages caused by ground vibration have been developed. The regulations are primarily based on the peak particle velocity (PPV) resulted from blasting operations. To come out with proper amounts of Maximum Charge per Delay which produces limited ground vibration, several empirical conventional vibration predictors are available proposed by different researchers. These conventional predictors are normally used for estimating PPV of ground vibration by blasting. All the predictors estimate the PPV mainly based on two parameters (Maximum charge used per delay and distance between blast face and monitoring point). For the same excavation site, different predictors give different values of safe PPV vis-Ã -vis safe charge per delay. There is no uniformity in the predicted result by different predictors. It is well known that the PPV is influenced by various geological, geotechnical, blast geometry and explosive parameters, which have not been incorporated in any of the available predictors. It seems that there is a great need to evaluate the efficiency and credibility of various empirical conventional predictors to calculate Maximum charge per delay. Progress has been made in recent years in ability to predict the Maximum safe charge per delay (QMAX), but the state of the art is deficient in many ways. On the basis of detailed investigation, a viable approach for the prediction is necessary, and an Artificial Intelligence (AI) comes in handy to fulfill this approach. In the present paper, an attempt has been made to predict the safe charge of explosive per delay using artificial neural network (ANN) by incorporating peak particle velocity (PPV) and distance from blast face to monitoring point (D). Prediction capability of ANN is also compared by various available conventional predictors based on coefficient of correlation, mean absolute error and mean squared error.

Key words: Safe explosive charge used per delay; peak particle velocity; distance between blast face to monitoring point; conventional vibration predictors; artificial neural network.

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Thermomechanical characterization of mortars elaborated with aggregates of waste refractory brick high alumina (HTA)

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ABSTRACT

This work aims to study the physico-mechanical and thermal properties of mortars elaborated with refractory brick waste (HTA) to replace sand and cement type CEMI for its valorization. According to the results obtained, it can be concluded that the use of this refractory brick waste (HTA) as aggregates positively influences the mechanical behavior of mortars. The mechanical strengths of the mortars are superior (61 MPa for the compressive strength and 3.6 MPa for flexural strength) than the normal reference mortar (54 MPa for the compressive strength and 2.83 MPa for flexural strength). This waste also contributes to good thermal stability since its mass loss is 5.35% lower compared to the reference (break from 600 °C) and refractory mortar formulated with high alumina cement with standard sand (5.92%) after 07 days of a heating cycle of 600 ° C to 1200 °C. The resistance losses of these mortars at the end of the heating cycle are also lower (54%) than the refractory mortar 60%. The results obtained in this study give us a very good reason to think about a possible use of waste as aggregates in the thermo-resistant mortars.

Key words: Refractory bricks waste; high alumina cement; refractory mortar; thermomechanical properties; mass loss.

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The effect of physical properties on thermal conductivity of lightweight aggregate

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ABSTRACT

There are many studies about thermal conductivity coefficient of lightweight concrete using lightweight aggregates such as perlite, pumice, vermiculite, diatomite earth, expanded clay aggregates. However, researches which have been conducted the thermal conductivity of lightweight aggregates is limited. The lightweight aggregates are the main raw materials of lightweight construction material. In addition, the usability of lightweight aggregates as core material have been investigated in recent years. Thermal conductivity of lightweight aggregate is significantly affected to the thermal insulation performance of such composites. The thermal conductivity coefficients of lightweight aggregates are related to many of physical properties of aggregates such as specific gravity, porosity, particle size etc. In this study, the effects of specific gravity, oven-dry grain density, porosity and grain size on the thermal conductivity of lightweight aggregates was investigated. Limestone aggregate (normal aggregate) were also used for comparison in the study. At first, all of the aggregates were divided into 4 different grain groups (2-1 mm, 1-0.5 mm, 0.5-0.1 mm and <0.1 mm). The specific gravity and oven-dry particle density values of aggregates were determined according to TS EN 1936 and TS EN 1097-6 standards for each grain group, and then the open and closed pore rates of aggregates were calculated with obtained data. Then, each aggregate group were filled into (airtight) transparent polyethylene barriers with vibration using a special method. After the filling process, the aggregates within the barrier were vacuumed at 1 mbar level. The dimensions and mass of produced lightweight aggregate panels were determined precisely. Afterwards, the thermal conductivity coefficients at 1 mbar and atmospheric pressure of the lightweight aggregate panels in 300x300x25 mm sized were measured according to DIN EN 12664 standard. By analyzing data, the thermal conductivity coefficients of lightweight aggregates were associated with the physical properties of them. As a result, the empirical formulas were proposed in order to estimate the thermal conductivity coefficient depends on the physical properties of lightweight aggregates.

Key words: Lightweight aggregate; physical properties; thermal conductivity.

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Rock fatigue damage evaluation under cyclic loading using acoustic emission

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ABSTRACT

Rock mass are usually subjected to repeated loading during mining operations as function of e.g blasting, hauling or track movement. These cyclic loadings create fatigue damage due to the accumulation of micro-cracks during each loading process and rock fails prematurely. Therefore, in design of the rock structures fatigue damage needs to be considered to avoid any premature rock failure. In this research, we investigated rock fatigue behavior under various cyclic loading conditions using different load amplitude and various maximum load levels in the laboratory. Acoustic emission (AE) and deformation during cyclic loading were simultaneously recorded to evaluate and develop damage model. Fatigue damage model based on cumulative strain and cumulative AE hits were developed. The model shows 3-stage fatigue evolution clearly. The model uses b-value as a function of acoustic hits, volumetric strain as well as Poisson's ratio. It was found that the b-value evolution over cyclic loading can be divided into four phases with two peaks corresponding to two transition points in strain-based fatigue damage evolution. It is suggested that b-value can be used to quantify accumulated fatigue damage in rock materials.

Key words: Acoustic emission; cyclic loading; rock fatigue; damage accumulation; B-value.

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Method for scale blasting

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ABSTRACT

The rock breakage by chemical explosive is a complex process involving the physical properties of the rock mass, the detonation properties of the explosive and blast parameters. A method for model scale blasting in cement mortar blocks with dimensions 90 x80 x 55 cm has been studied and the results from a single shot experiment instrumented with accelerometers, strain gages and pressure gages are given. Results from static and dynamic materials testing of the cement mortar are also given. The stress time and strain time determined by the different methods are compared.

Key words: Rock blasting; borehole; model; fragmentation; blast parameters.

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A model scale study on the effect of discontinuities on rock blasting

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ABSTRACT

The geological discontinuities such as joint are the most common discontinuities present in the rock mass. A model scale study was carried out to evaluate the effect of joints on rock blasting. Single hole tests at three selected burdens (optimum, less than optimum and more than optimum) were done on six different joint orientations. The joint orientation angles were 0°, 30°, 60°, 90°, 120°, 150° rotating in anticlockwise direction from the floor of the bench in a plane perpendicular to the free face. Bench models of dimensions 450x375x150 mm with a bench height of 50 mm were prepared by binding sandstone slabs of 25 mm thickness with an adhesive. The models were blasted by n° 6 electric detonators. The bench crater formed and the fragmentation produced were predominantly influenced by the position of charge with respect to the joint orientation. Severe toes were noticed in models with vertical joints and with joints dipping away from the face. Over breaks were observed in horizontally bedded models and in models with joints dipping towards the free face. Over breaks were observed in horizontally bedded models and in models with joints dipping towards the free face. The size of the broken fragments at 20 mm burden was found to be finer than the fragments obtained at 30 mm and 40 mm burdens for all joint orientations except vertical.

Key words: Fragmentation; model rock blasting; discontinuities; rock mass; bench.

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Condition monitoring of textile belts in the light of research results of their resistance to punctures investigations

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ABSTRACT

There are good tools, different magnetic scanners, for diagnosing condition of steel cords in belts. For textile belts however few firms propose only different kind of visual inspection (based on video, linear cameras or lasers) and only one core scanner. Experience gathered in the Belt Conveying Laboratory (LTT) at the Faculty of Geoengineering, Mining and Geology in Wroclaw University of Technology during many years of the research of conveyor belt resistance to punctures has shown that it is definitely not enough. The laboratory has developed its own methodology of research, there are no standards governing research procedures, in which after several punctures of stretched belt the belt cover is taken of and the core is precisely investigated in order to find out the size and scale of damages and correlate them statistically with different factors such as size, shape and energy of striking head, construction of belt etc. A big surprise for the new observers of the experiments is always the big difference between size of cuts on belt cover and much bigger damages observed inside the belt after the cover is removed. It is hardly to notice small signs or cuts in impact place and small density around it which is much smaller than real core damage within the belt. Therefore it is obvious that diagnosis of textile belt condition based only on registered damages on belt surface (what is not so easy task to find all of them on dirty belt surface) is insufficient and can lead to underestimation of threats to safety caused by cumulative core damages and too optimistic forecasts of belt remaining life. In the Internet we could find only one device for scanning textile cores. Its price, due to its uniqueness on the market, is too high in comparison to relatively cheap and rarely reconditioned textile belts (a kind of contradiction). Therefore for belt users it is frequently better to take of a textile belt from conveyor relatively earlier in order to avoid emergency standstills. Further development of textile belt scanners in order to reduce their cost is required as well as more precise correlation between covers state and core condition analysed in laboratories and their changes with belt ageing.

Key words: Experiments; conveyor textile belt; puncture resistance.

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Instrumented model rock blasting

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ABSTRACT

A method for model scale blasting in sandstone blocks with dimensions of 515x335x215 mm^3 has been studied and the results from a blast experiment instrumented with pressure gage are given. The dynamic and static properties of the sandstone are also given. The instrumented tests in such blocks using pressure gauges, the effect of blast and fragmentation parameters on peak p-wave stress are studied.

Key words: Sandstone; blasting operation; model blasting; borehole; stress wave; rock mass.

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Study of powder factor in surface bench blasting

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ABSTRACT

Study rock mass characterization helps in selection and optimum usage of explosive in bench blasting. There are various methods to characterize the rock mass but use of Schmidt hammer in rock characterization before blasting may be a good option. Schmidt hammer, since its simplicity and capability of instant data production, has so far been a powerful tool utilized by many researchers to predict compressive strength of rocks. In this light the present study was conducted in opencast coal mines to see the effect of Schmidt hammer rebound number or transformed compressive strength of rocks on powder factor. The correlation was found sufficiently reliable to enable the determination of optimum powder factor for surface bench blast in different rock types maintaining the required blasting results in terms of fragmentation.

Key words: Sclerometer; rebound number; ccorrelation; rock characterization; bench blasting.

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Strength properties of naturel sandstone

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ABSTRACT

From testing machine, stress-strain curves were obtained in which the uniaxial compressive strength, Young's modulus and the brittleness index were measured for specimens prepared from a single block of sandstone. To see how the strength properties were affected by changes in moisture content such likely to occur on site. The specimens were divided into three groups which were prepared for testing under different conditions of moisture equilibrium.

Key words: Sandstone; compressive strength; stress strain; brittleness index.

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Study of influence some factor on rock blasting

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ABSTRACT

Study rock mass characterization helps in selection and optimum usage of explosive in bench blasting. There are various methods to characterize the rock mass but use of Schmidt hammer in rock characterization before blasting may be a good option. Schmidt hammer, since its simplicity and capability of instant data production, has so far been a powerful tool utilized by many researchers to predict compressive strength of rocks. In this light the present study was conducted in opencast coal mines to see the effect of Schmidt hammer rebound number or transformed compressive strength of rocks on powder factor. The correlation was found sufficiently reliable to enable the determination of optimum powder factor for surface bench blast in different rock types maintaining the required blasting results in terms of fragmentation.

Key words: Fragmentation; rocks; modelling; blast hole; demolition; explosive.

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Experimental tests of selected constituents of movement resistance of the belt conveyors used in the underground mining

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ABSTRACT

During the designing of conveyor belts, the optimization attempts are taken aimed firstly to reduce the energy consumption, what is obtained by reducing the main resistances of the conveyor. The biggest savings of energy may be expected in rational belt and idlers selection, and in some cases in unconventional solutions of the route, stretching and spillover equipment. The tests on movement resistance of belt conveyor, carried out over the recent years in Machinery Systems Department of the Wroclaw University of Technology, allowed to define precisely the impact of many construction and operational factors on energy consumption of transport. At present, the research works are carried out, oriented to find the optimal solutions dedicated for the belt conveyors used in underground mines, since due to different capacity values, more compact construction, more difficult installation and operation conditions, the solutions developed for open-pit mining, cannot be directly adopted. The paper proposes the stand test methodology on identification of key constituents of belt conveyor movement resistance and presents the results of pilot experimental tests aimed to define the optimal construction features of energy saving conveyor belt, having low resistance of rolling on idlers and bending resistance on pulleys, under underground mines conditions.

Key words: Belt conveyor; energy saving conveyor belt; experiments.

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Significance of sustainability in coal mining

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ABSTRACT

Coal still makes an important contribution to many national economies particularly in developing countries. Coal production is the key economic activity in many communities. It directly provides more than eight million employments worldwide and supports many more millions. By the year 2014, approximately 10 billion US dollars were invested in the coal sector globally mostly in underdeveloped or developing countries. Not only does it provide employment, export and wealth for the domestic economies, but also makes a substantial and affirmative improvement in the livelihoods of many populations. On the other hand, sustainable development has been an important part of public policy debate for the last two decades. It has evolved into a widely subscribed ideal for how mining practices and society should interact and function. The concept of sustainable development was defined for the first time in a book which is entitled “Our Common Future” following the assembly of World Commission on Environment and Development in 1987 as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. There are three objectives of sustainable development such as economic prosperity, social welfare and environmental conservation. In this context, it is not wrong to state that coal already makes a contribution to economic and social pillars of sustainable development. Since the environmental performance of coal has steadily increased through the years, environmental concerns should be prioritized by coal industry and governments to enhance this third leg of sustainable development. Governments should accept that coal will continue to play a major role in the upcoming decades for the energy supply of the world because today it cannot be ignored that there are about 1.3 billion people across the globe without access to electricity. Therefore, governments, coal mining companies and communities should collaborate to accelerate environmental remediation and necessary policies should be implemented to encourage deployment of cleaner coal technologies.

Key words: Mining; coal; sustainable development; environment; economy.

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Presenting an applicable model to predict rock fragmentation

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ABSTRACT

Rock fragmentation is result of blasting operation and has direct effects on the cost of drilling, blasting, loading, hauling and crushing. Rock fragmentation depends on many variable and parameter such as intact rock and rock mass properties, explosive properties, blast geometry and technical parameter. Several empirical methods for the prediction of rock fragmentation have been developed. So far the purpose of this research is to consider effective parameter in the presented models and presenting a simple and more applicable model to prediction of X50. Suggested formula has suitable correlation coefficient for the data which obtained from Sungun copper mine and Akdaglar quarry. In order to investigate the validity of the proposed model, six blast site in Chadormalue iron ore mine and one blast site in Porgera gold mine were compared with the new formula. Results show a small variance values between the calculated X50 by the new model and the obtained X50 from image processing.

Key words: Rock fragmentation; empirical models; effective parameter; proposed model.

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Laboratory tests of idlers rotational resistance – selected issues

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ABSTRACT

Idlers rotational resistance has a significant impact on energy consumption of belt conveyors. The conducted analyses showed that this component can reach 30% of total belt conveyor resistance to motion. The causes for idlers rotational resistance including structural factors were precisely determined by Gladysiewicz L. and Krol R. in 2005. Since then many works have been carried out with the aim to assess the quality of idlers and to acquire the knowledge necessary to optimize belt conveyor haulage process. It was due to, inter alia, that the calculations of belt conveyors being designed are based only on empirical relationships which give a good approximation for laboratory tested idlers but, are imprecise in relation to new construction solutions of idlers. The results of research and development works carried out at the Wroclaw University of Technology have shown that one of the conditions for achieving results in terms of reducing the energy consumption of belt conveyors drives is using high-quality idlers characterized by low rotational resistance under a wide range of working loads. The carried out studies allowed to refine knowledge about idlers rotational resistance and about the impact of working loads on belt conveyors resistance to motion and shown that idlers rotational resistance depends also on value of the idlers radial loads caused by transported masses. A series of laboratory and operational tests based on using advanced analytical tools and modern measuring technique have been carried out and, allowed to obtain dependence between instantaneous mass output of belt conveyor and loads of individual idlers in set. It allowed to determine the dependence of idlers rotational resistance as a function of random loading of a transported bulk material which is defined as instantaneous mass output of a belt conveyor.

Key words: Belt conveyor; idler; measurement; rotational resistance; strain gauge.

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Defining mineral exploration works

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ABSTRACT

When mineral exploration starts, a number of problems arise and have to be dealt with. They refer to the density of sampling (samples, drill-holes, drifts) so as to have a reliable estimation of the reserves, the decision to extend the exploration campaign, especially with works of high cost, when the first results are interesting and of course the risk that is taken when investing in this venture. When exploration has been carried out with state funding, in some countries' legislation it is stated that it has to be a call for tender if the explored deposit is to be rented and if mineral exploration works have been carried out.
The paper attempts to introduce a method of estimation of ore reserves during the various phases of exploration, how to deal with the decision of extending the exploration and to define the notion of "mineral exploration works". The attempt aims to the point all involved in mineral exploration and mining to have a common understandable language.

Key words: Mineral exploration; ore reserves estimation; ore reserves classification;

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Some mineral exploration problems that can be solved by mathematics and geostatistics

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ABSTRACT

Geological data bases usually consist of information drawn from drill hole and similar data. These data very often present some problems which can be solved by using mathematical and geostatistical methods. The present paper deals with the problems of estimating the proportions of lithological types within selective mining units, the problem of the addition of new drill-holes in an explored deposit and the results in the estimation of its quality or quantity and the problem of safe sampling of gold deposits. For the first issue, the paper gives an account of how indicator kriging can be used to make estimates of the proportions of the various lithologies within blocks of ground, given the lithologies occurring in the samples. The present paper deals with and answers the questions that arise when evaluating an ore deposit after the completion of a drilling or sampling campaign. With the aid of geostatistics one can justify or reject a supplementary sampling program at the same deposit, with all the consequences of such a decision. One of the problems of the sampling procedures during a mineral exploration campaign is the size and the weight of the samples to be taken. The problems become bigger when the deposit to be sampled is a gold deposit, due to the rarity and the high value of the mineral. Departing from Gy's sampling formula, this paper presents the mathematical considerations and transformations to eventually produce a mathematical formula that enables the exploration personnel to safely sample a deposit of valuable ore.

The paper was prepared in the framework of the Project "Exploration and Evaluation of Selected Indigenous Non-Energy Mineral Raw Materials, Aiming at the Sustainable Opera-tion of the Extractive Industry" of the "National Strategic Reference Framework" (NSRF) of the EU.

Key words: Geostatistics; lithological types; drill-holes; sampling; gold.

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Determining the locations of bodies in mineral exploration with the ratio of potential data derivatives

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ABSTRACT

The magnetic and gravity are the geophysical methods which are used in the mineral explorations for examining the location of the body. The derivative is one of the method for determining the gravity and magnetic data. In the derivative method, analogue and logarithmic changes and differences are calculated. The sources of the magnetic and gravity anomalies cannot be controlled, therefore, determining the locations of the source created the anomalies are very significant case. For great interpretation of the magnetic anomalies, it is required to know the magnetization features of the source that created this anomaly with the location and the depth. Dykes, thin sheets and similar intrusions are the models which used in magnetic investigations. Dyke model which has an importance in geophysical model widely used in mining and petrol explorations since this model is convenient for various geological structures. In this study, in magnetic application, magnetic thin dykes anomalies were analysed for one body and two bodies models in a profile. Additionally, the same applications were realized for the vertical dyke and two-dimensional dyke anomalies. The anomalies were obtained for the selected models and then first derivatives of the analytical equations of the models were created. In gravity application, profile-based theoretical studies were realized with the equations known for sphere, cylinder and one horizontal sheet models. Therefore, the anomaly values, the first horizontal and vertical derivatives were obtained with the help of the equations of the models. Then, same application was realized for two-dimensional body. Finally, the location of the body was determined by using the ratio of the anomalies obtained from the vertical and horizontal derivatives of the model equations for gravity and magnetic applications. As the final step of both applications, the findings were examined with results of the method. Consequently, it can be said that using the ratio of first horizontal and vertical derivatives of magnetic and gravity anomalies is useful in mineral explorations for defining body locations.

Key words: Gravity; magnetic; first derivatives; mineral exploration.

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Feature matching developments in open source Geographic Information Systems

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ABSTRACT

Producing and sharing spatial datasets are rapidly increasing in information and high-tech age. To analyse, combine or sometimes create datasets, decision makers and researchers need data from different sources. During combining spatial datasets several shape problems (i.e. offset, direction, topology and geometry) may occur depending on different projections, scales, accuracies or dates. Feature matching deals with all these problems. It is a crucial issue in data integration, updating, fusion, attribute transfer, and map conflation. Generally, in a matching process, links are established between corresponding pairs representing the same objects in different datasets. The links build a bridge between the pairs by connecting and identifying them. It makes different datasets more interoperable. There have been developed many approaches to achieve matching challenges since map conflation was first implemented by Lynch and Saalfeld (1985). However current matching algorithms only present better results with the data it is created for. These results may differ with regard to pattern type or similarity between datasets. Some tools are also developed for open source geographic information systems (GIS) (e.g. Matching and RoadMatcher plug-ins). This paper demonstrates recent matching developments in open GIS within algorithm framework. A case study was carried out to compare six different matching methods taken from two different plug-ins. Two road networks representing the same area were used to test these plug-ins. In this study, firstly, it is aimed to point out correct, deficient and incorrect matching rate from the specified area. Secondly, complex situations, such as junction problems and unmatched geometries are handled in detail. Finally we suggest specific requirements to make these methods more efficient.

Key words: Feature matching; open GIS; conflation.

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Stability analysis of underground mining and their application of the mine Chaabte El Hamra Algeria

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ABSTRACT

Method room and pillar sizes are key factors for safe mining and ore recovery in open-stop mining. This method is advantageous because it is simple and requires little information to use, is probably the most representative method among the total load approach methods. Although it also remains a safe design method. Using a finite element software (PLAXIS 3D), analyses are carried out with an elasto-plastic model and comparisons are made with methods based on the total load approach, of presented as the optimization for improving the ore recovery rate while maintaining a safe working environment.

Key words: Room and pillar mining; total load approach; elasto-plastic.

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Prediction essential amount of exploration drilling in primary stage of open pit mine planning

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ABSTRACT

Open pit Mine planning and initial production scheduling of open pit mine are considered as the complicated issues in mining engineering. The high capital investment in mining projects, requires more accuracy in preparing base data. A reliable estimation of grade and tonnage of a mineral deposit has a considerable impact on the success of a mining project and initial capital cost prediction. These estimations depend on number of samples are taken from exploration drilling, therefore it is, necessary to determine the proper amount of drilling to reach rational confidence level of grade and tonnage estimation. In this paper, essential amount of drilling for reaching an acceptable confidence level of grade and tonnage estimation has been investigated. In that regard, at feasibility, due to multiple sampling and numerous checks, the average mining grade of some declared tonnage is likely to be known within acceptable limits, say ±5%, and verified by standard statistical methods. For this condition, 5 different sampling grids, were generated from the geological block model of Sungun copper mine, the grades of Sungun copper mine block model, were considered as the actual grade of each block. Then the block model was re-estimated with regards to different sampling grids. The Sequential Gaussian Simulation method was applied for re- estimating and considering the grade uncertainty of each block. Finally, seven factors were considered for investigation of the proper amount of drilling. These factors are 1) Drilling Factor (DF), 2) Percentage of block model means grade error 3) Global estimation variance 4) Percentage of correct estimated blocks as ore 5) Percentage of correct estimated blocks as ore with less than 30% error 6) Percentage of estimated metal content error 7) Percentage of estimated ore tonnage error. According to these factors, 4 statistical models have been developed to calculate the essential amount of exploration drilling with respect to the specified confidence level of grade and tonnage estimation.

Key words: Sampling grid; drillhole spacing; geostatistical simulation; tonnage and grade estimation; geological uncertainty.

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Production scheduling in multi-element deposits considering different destinations for ore blocks

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ABSTRACT

In multi-element deposits such as iron ore, limestone, coal and bauxite, the quality of the product is affected by multiple inter-correlated elements, and the interactive effects should be considered. The efficiency of an ore processing unit depends on the raw material characteristic consistency, entering the plant. For these kind of minerals, there is an inherent task of blending the run-of-mine materials in such a way that the resulting mix, meets the quality and quantity specifications of the processing plant or the customers demand. Blending of ores can improve the efficiency of the processing plant, minimizes the need for selective mining, increasing mine production, extends the ore reserve and contribute to the grade control process. It is possible to consider more than one customer for mine products. Therefore, different blending plans are involved. Considering more destinations for products, helps to have more alternatives in production scheduling. In this paper, the production scheduling of an iron ore mine has been investigated. In the model, three different destinations with specific requirements are pointed and it is solved using MIP (Mixed Integer Programing) with the objective of maximizing NPV. The results of the model show that it is possible to blend more suitable blocks to meet the plants and customers' requirements. Consequently extending pit limits and mine life.

Key words: Multi-element deposits; iron ore mines; blending; production scheduling.

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Ventilation requirements for mechanized underground metal mines

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ABSTRACT

Ventilation is a basic part of all underground mine operations. The main objective of underground mine ventilation is to provide sufficient quantities of air to all the working areas. Ventilation provides a flow of fresh, cool air to the underground workings of a mine to dilute and remove dust and noxious gases (typically NOx, SO2, methane, CO2 and CO) and to regulate temperature. Air enters the mine from surface via a shaft, ventilation raise or adit and it is distributed through the mine via internal ventilation raises and ramps, and flows are controlled by regulators and permanently mounted ventilation fans. Today, in modern mechanized underground metal mines, diesel-powered mobile equipment are extensively used for high production rates. For these type of mines, amount of airflow required for an underground mining depend on several factors, including ambient temperature, mining method, mining depth and airway type. Basically, ventilation requirements are based upon the power of the diesel equipment fleet, with a multiplier being applied in order to determine the total airflow volume requirements of entire mines and/or individual sections or working areas. After implementation of Stage IV Emission Standards for nonroad diesel engines, it is getting more complex to determine airflow quantities required for underground based on diesel equipment fleets. Required amount of airflow for a mine is obtained by ventilation fans and the largest cost aspect in mine ventilation is the power costs of running the ventilation fans which can reach as high as 50 percent of a mines entire electrical power cost. That is why it is getting more important to determine proper ventilation design for underground metal mines.

Key words: Mine ventilation; underground; mechanized mining; diesel equipment.

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An automatic procedure for multidimensional analysis of Temperature Signals from SCADA system: application to belt conveyor components

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ABSTRACT

In the paper a problem of interpretation and analysis of multidimensional temperature data acquired using an online monitoring system is presented. It is highlighted, that apart from data acquisition system there is a strong need to use automatic decision making rules. Classical if then else approach i.e. comparison of current value of temperature with a priori assumed threshold is not possible due to cyclic nature of machine operation and influence of external factors as ventilation system or bulk material stream conveyed on the belt. Moreover, these thresholds are unknown and might depend on mentioned factors. It should be also noted, that in industrial data acquisition systems there is a high probability of external disturbances which means that signals should be validated and pre-processed first. Indeed, we have noticed outliers related to DAQ system operation. Cyclic variability of temperatures have no diagnostic meaning and makes the interpretation of data and decision making difficult. In the paper we propose a framework how to extract diagnostic information and present it in a user friendly manner. Analysed example come from belt conveyor used in an underground mine.

Key words: Belt conveyor; condition monitoring; data analysis; maintenance.

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Effective approach in prioritizing sustainable development criteria affecting open pit mine design

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ABSTRACT

With growing awareness of sustainable development and worldwide interest in corporate sustainability, the mining is under increasing pressure to design and planning not only based on geological, economical and technical factors, but also in accordance with sustainable development principles. Sustainable mining, covers environmental, economic and social aspects of operations. In order to internalize sustainability in mine design process, this paper attempts to quantify sustainable development criteria. Initially 77 indicators of sustainable development affecting the open pit mine design were identified. By means of a preference voting system (PVS), the weight of each criterion was calculated. To reach this purpose, 4 importance levels: {Really Important, Quite Important, Not Very Important, Not Important} have been defined, where these importance levels represent the importance from the most to the least. It is clear that the votes in the last importance level (i.e. Not Important) should not influence the total score of each criterion. So, the weight of this importance level was considered equal to zero and then applied a DEA model based on 3 importance levels as ranking places to calculate the weights. Then the score and normalized weight of each criterion was calculated. Thus, the amount of compatibility of mine design and sustainable development issue, can be measured via the sum of satisfied criterion weights.

Key words: Sustainable development; open pit mine design; preference voting system; data envelopment analysis.

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Study of mining potential in Nigeria

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ABSTRACT

Nigeria in the early 20th Century was a major producer of Coal and Tin in the mining sector, but the evolving of Oil deposit in the country in late 1950s has shifted the government attention from the mining sector to the exploration and exploitation of the Oil sector as the basic Revenue generation of the country thus, resulting in the abandonment of the solid mineral resources which are still economical viable and available for economic stimulation of the nation economy. This study highlights the progress made in the sector, the challenges and set-backs, the geology of the mineral deposit, the attractive government investment incentives and the Strength Weakness Opportunity Threat analysis of investment in the Nigeria Mining sector. However the output of this study shows that the country appears to be Virgin territory with exploration in brown and greenfield extensively dominating mining activity.

Key words: Nigeria; mining sector; SWOT.

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Examining the geothermal areas around Aydin-Denizli (Western Turkey)

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ABSTRACT

Turkey and particularly Western Turkey Region locate in tectonic belts wherein geothermal systems improved. Recent tectonic systems in the region have created a rich geothermal potential. Aydın and Denizli cities exist in the Büyük Menderes graben which is the one of the significant grabens in Western Turkey and bordered by active faults. In this study, the geothermal sources in these cities were examined by using gravity methods. Applying the gravity methods on geothermal systems are cheaper than detailed geological studies, other geophysical and well logging studies, therefore, the application areas of gravity methods have increased in Turkey and in the world day by day. Gravity is a method based on density differences so it is affected by hot regions, buried volcanic and intrusive structures. The Bouguer gravity anomaly values change between -40 and -110 mgal in the study area. When considering the geothermal sources in the region, such a large decreasing in gravity anomaly values are thought that the high temperature factor is most likely dominate on this density decreasing. As the second step, in order to investigate the structures caused the anomalies, Normalized Full Gradient (NFG) method was applied to the Bouguer gravity anomalies of Büyük Menderes graben in Western Turkey wherein Aydın and Denizli cities are located. According to the NFG results, it can be said that the structure of region is not uniform from east to west. In the last step, the earthquakes occurred in the study region were compared with the vertical and horizontal structure borders obtained in this study. According to the temperature values of the wells in the region, the western sides of Aydın, Denizli and its eastern sides have high temperature geothermal basins. Meanwhile, the seismic risk of these regions is high. Therefore, there results are verified the idea that the significant geothermal basins have high seismic activity.

Key words: Aydın; Denizli; geothemal; gravity; NFG.

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The study statistical of relationship between Schmidt hammer rebound number with impact strength index, slake durability index and P-wave velocity of different rocks

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ABSTRACT

The object of this paper is to establish statistical relationship between Schmidt hammer rebound numbers with impact strength index (ISI), slake durability index (SDI) and P-wave velocity. These are important properties to characterize a rock mass and are being widely used in geological and geotechnical engineering. Due to its importance, Schmidt hammer rebound number is considered as one of the most important property for the determination of other properties, like ISI, SDI and P-wave velocity. Determination of these properties in the laboratory is time consuming and tedious as well as requiring expertise, whereas Schmidt hammer rebound number can be easily obtained on site, which in addition is non-destructive. So, in this study, an attempt has been made to determine these index properties in the laboratory and each index property was correlated with Schmidt hammer rebound values. Empirical equations have been developed to predict ISI, SDI and P-wave velocity using rebound values. It was found that Schmidt hammer rebound number shows linear relation with ISI and SDI, whereas exponential relation with P-wave velocity. To check the sensitivity of empirical relations, Student's t test was done to verify the correlation between rebound values and other rock index properties.

Key words: Geotechnical; statist; Schmidt hammer rebound number; impact strength index; slake durability index; P-wave velocity.

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Mechanical behavior and breaking mode of the self-compacting mortars containing seashells as a fine aggregate

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ABSTRACT

The seashells have a multilayer structure and composed of calcium carbonate crystals having tailored structures giving its better mechanical properties. Taking account of the geometric shape and mineralogical nature of seashells, they can have a great influence on the mechanical properties and failure mode of a material. For this purpose, an experimental study was conducted on serial samples of self-compacting mortars containing seashells as a fine aggregate. The compressive strength, mechanical behavior and the breaking mode, were studied on the mortar samples, with partial and total substitution of sand (S) by seashells (Sh) crushed at different ratio (Sh/S = 0, 10, 20, 50 and 100%) by weight. The results obtained show that the crushed seashells (0/5mm class), have an importance effect on the mechanical behavior and the rupture mode of studied mortars. as the fine aggregate for self-compacting mortar, without affecting the essential properties of mortar. However, the flowability of mortars based 100% of seashells, was better and is suitable for a fluid concrete (as a self-compacting concrete). Also, up to 100% replacement of sand by crushed seashells caused slight reduction in compressive strength and elastic modulus of studied mortars. The angular form of seashell has significantly improved the distribution of grains in the cementitious matrix.

Key words: Seashells; mortar; compressive strength; mechanical behavior; elastic modulus.

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Laboratory tests of idlers rotational resistance – selected issues

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ABSTRACT

Idlers rotational resistance has a significant impact on energy consumption of belt conveyors. The conducted analyses showed that this component can reach 30% of total belt conveyor resistance to motion. The causes for idlers rotational resistance including structural factors were precisely determined by Gładysiewicz and Król in 2005. Since then many works have been carried out with the aim to assess the quality of idlers and to acquire the knowledge necessary to optimize belt conveyor haulage process. It was due to, inter alia, that the calculations of belt conveyors being designed are based only on empirical relationships which give a good approximation for laboratory tested idlers but, are imprecise in relation to new construction solutions of idlers. The results of research and development works carried out at the Wroclaw University of Technology have shown that one of the conditions for achieving results in terms of reducing the energy consumption of belt conveyors drives is using high-quality idlers characterized by low rotational resistance under a wide range of working loads. The carried out studies allowed to refine knowledge about idlers rotational resistance and about the impact of working loads on belt conveyors resistance to motion and shown that idlers rotational resistance depends also on value of the idlers radial loads caused by transported masses. A series of laboratory and operational tests based on using advanced analytical tools and modern measuring technique have been carried out and, allowed to obtain dependence between instantaneous mass output of belt conveyor and loads of individual idlers in set. It allowed to determine the dependence of idlers rotational resistance as a function of random loading of a transported bulk material which is defined as instantaneous mass output of a belt conveyor.

Key words: Belt conveyor; idler; measurement; rotational resistance; strain gauge.

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The modelling of roof loads on self-advancing support in longwall

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ABSTRACT

Powered roof supports provide safe working conditions in face, protect humans from coal and rock collapse from roof, and, enable a fulcrum for advancing the transportation systems in face. For these reasons, well support selection and application are required for successful longwall mining. Because too many powered roof supports are required in a longwall face, the cost of those support units comprises almost more than half of the cost of longwall. Thus, powered roof supports are the most important equipment in longwall. In this study, a longwall model is carried out taking into account the properties of formation that surround the coal seam by using Phase2 finite element analysis program. The roof loads that affect the canopy are calculated by using Phase2 program, and which can be used under these conditions a suitable powered roof support capacity is proposed.

Key words: Modelling; roof loads; self-advancing support; longwall.

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Evaluating the slope movements with inclinometer in open pit mines – a case study: Soma Lignite Basin (Turkey)

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ABSTRACT

In open pit mines, regional or overall slope movements may be occur depending on increasing of pit depth. Particularly, in a lignite mine which is composed result of bedding in sedimentary basins, mechanical properties of seams are important factor for determining the depth of open pit mines. Upper and lower layers of lignite beddings which are formed in early geological period are also consist of unhardened rock units. Regarding this issue, to determine the safety depth for mining which limited with faults, mechanical properties of excavated rock have to be considered with economical evaluation. A serious slope stability problem has been observed at Soma-Isiklar open pit mining area in Turkey. Mesozoic aged crystalized limestone and greywackes are the base rock in the area which overlying it with angular discordance Neogene aged sedimentary rock include lignite (called as KM2 and KM3 coal). KM2 lignite seam is lying along North-South and has average 20 m thickness and 25 degrees inclination. Open pit mining operations are produced as panels at basin. The panels which are analysed in this study were performed between +520 and +275 m elevation. Regional slope instability was observed between the elevation +372 m and +314 m and also tension cracks were observed at South region of basin during excavation. 30 pieces of piles were driven on risky surface. The location of piles was measured periodically for monitoring the movement of sliding mass at x and y axis and also 28 meters borehole was drilled at instable area and inclinometer readings were taken from this borehole to monitor the movement of sliding mass. 34 mm/days displacement was measured at the end of study. Also 28.9 mm displacements were observed at 20 m elevation with inclinometer readings. The study exposed that the slope height has to be reduced due to two different monitoring results to provide the slope stability. After the mining company reduces the slope heights it was observed that the slope movements in the region were decelerated and became stable. In conclusion, the depth of the slope movement and rate of displacement of sliding mass were revealed by inclinometer and pile measurements. Then the instability of slope were became stable with reducing the slope height.

Key words: Inclinometer; stripping slope; coal; open pit mine; lignite.

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Relationship between breakage parameters and HGI

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ABSTRACT

In this study empirical relationship of HGI was established in terms of breakage parameters. While modelling of particle breakage behaviour either in a crusher or a mill, breakage parameters and HGI (grindability) of material should be taken into consideration. HGI has long been researched and empirical equations evaluating coal characteristics data has been proposed. In addition to these, empirical equations of product fines and multicomponent breakage model has also been proposed In a crusher or a mill, basically knowing the feed size distribution of the material and obtaining an experimental product size distribution after process could help to model the environment of the crusher or mill. Having good reflection of the crusher or mill environment via model, breakage parameters can be evaluated. Breakage processes had been modelled namely as π-breakage process, π, κ-breakage process and π, κ, ω-breakage process. Setting up the breakage model, relation between breakage parameters and HGI could be established. Proposed empirical relationship between HGI and π (proportion selected for breakage in an assembly) was in good agreement with the experimental results.

Key words: Grindability; HGI; brekage parameters; coal characteristics.

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Empirical Relationships of HGI and UCV in terms of proximate analysis of coal

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ABSTRACT

In this study empirical relationship of HGI (Hard Groove Grindability Index) and UCV (Upper Calorific Value) was established in terms of proximate analysis of coal. Determination of HGI and UCV experimentally takes time and studies address on the estimation of them in an easier way. Estimation of HGI and UCV of coal would be helpful to field engineers. HGI is important parameter at mining applications such as excavation, crushing, grinding, dust generation, while UCV is important parameter which characterize the energy content. HGI has long been researched and empirical equations evaluating coal characteristics data has been proposed. In addition to empirical equations of coal HGI, UCV is also estimated in terms of proximate analysis data. Proximate analysis of coal is easily evaluated and coals are classified with respect to their proximate analysis results. That is why, with the help of proximate analysis data, method can be developed to estimate both HGI and UCV. .In this study user friendly methods were proposed to predict HGI and UCV and this could be helpful tool for the initial estimates of these parameters. This user friendly method was proposed and applied on the data taken from previous studies. Proposed estimation methods of HGI and UCV are in good agreement with the previous studies' results.

Key words: Grindability; HGI; UCV; proximate analyis.

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Physico-chemical characterization and processing of sandstone used for glass and ceramics production: case of Africaver factory, Jijel (Algeria)

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ABSTRACT

The glass industry meets many quality problems of silicaraw material. The latter is extracted from sandstone from the deposit of El Aouana Jijel. The sandstone contains harmful inclusions such as hematite, rutile, tourmaline, pyrite, limonite, illite, with higher contents in glass manufacturing standards. So the purpose of this work is to testify the sandstone processing possibility for improving the silica quality by using the gravity and magnetic separations. First, we opted to gravity separation in jig machine, than it is followed by a high intensity magnetic separation by using a magnetic drum separator, of course before starting these processes, we should identify our material by using mineralogical, particle size and chemical analysis. The obtained results showed that the silica content has been increased from 97.82% to 99.10%. However, we mentioned a decreasing of iron "Fe2O3" Clay "Al2O3" and rutile "TiO2" respectively from0.15% to 0.09%, from 0.95% to 0.11% and from 0.27% to 0.05% and lower. Consequently, the adopted processes allowed to have satisfactory results for the glass manufacturing and especially for flat, laminated and coloured glasses.

Key words: Sandstone; silica; characterization; enrichment; glass.

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Study of magnetic properties of iron ore Sidi Maarouf-Jijel for a enrichment by magnetic separation

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ABSTRACT

Mine Sidi Maârouf has recoverable reserves of around 55 million tonnes; all these parameters are that the ore is intended to cement the various eastern Algeria, under the tutelage of SPA SOMIFER Tebessa used as adjuvant the manufacture of cement (clinker). The aim of this work is the study of magnetic properties to magnetic separation enrichment. In this work a study was conducted on the magnetic properties of minerals composing the iron ore Sidi Maarouf, to optimize the key parameters influencing the magnetic separation. Across the pool, the average grades are as follows: Fe total = 44, 18%, SiO_2 = 13, 66%, CaO = 5, 35%.Finally, satisfactory results were recorded during the summers of magnetic separation in terms of iron content.

Key words: Sidi Maarouf; iron ore; magnetic suscebility; separation; enrechment.

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Second pilot-plant bioleaching verification of the iron removal from quartz sands

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ABSTRACT

Bioleaching process of silicate industrial minerals using heterotrophic bacteria is a technology has been not applied in industrial scale already. The laboratory experiments of iron mineral removal from quartz sands were verified during the second pilot - plant bioleaching by using of big bags. The composition of medium, change pH of leachates, concentration of oxygen, presence of active bacterial species, granularity and bounds of iron minerals as well as the mineralogical composition of the quartz sands were the important factors of the pilot - plant bioleaching. Fabric construction of big bags ensures leachate permeability, which is of great importance for the bacterial iron releasing. It was observed any inhibitory effect of the bacterial dissolution during the bioleaching of quartz sands in big bags against the bioleaching without using of big bags in basins. The zeta-potential measurement of quartz sands before and after bioleaching was comparable to the surface charge of particles. Apparently the shift reflects a loss of Fe-ions from the surface of quartz particles in leachate which leads to a more negative surface of the particles after bioleaching. In this way it was possible to remove iron from the quartz sand from 0.26% to 0.13% Fe_2O_3 by the pilot – plant bioleaching in basins. Bioleaching resulted in a 50% decrease in Fe content of quartz sands after 83 days bacterial treatment. The industrial washing process removed the fine fraction formed by bioleaching with decreased Fe_2O_3 to 0.09% and the subsequent magnetic separation decreased Fe_2O_3 to 0.07%. The second pilot plant bioleaching with big bags was comparable with the first pilot plant tests and also with laboratory tests of the iron removal. This bioleaching pre-treatment may be used for the removal of fine unrequested iron minerals from the surface of industrial minerals particles under the stationary solution conditions.

Key words: Quartz sands; bioleaching; pilot – plant; iron removal; heterotrophic bacteria.

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Inovation methods of materials treatment by microwave energy

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ABSTRACT

Microwave energy represents the perspective method for the intensification of different ways of treatment and processing of minerals, ores, rocks, wastes as well as coal and biomass. The interaction of microwaves with materials is mainly dependent on their dielectric properties, conductivity loss, and intensity of the electric field, specific heat, density and thermal conductivity. The condition for the efficient use of microwave energy for treatment is the absorption of electromagnetic radiation in heated materials. In the submitted paper the attention was devoted to the application of microwave energy in the treatment of energetic raw materials in the pyrolysis of biomass after pressing of rape (lat. Brassica napus). There were studied the possibility of use of liquid products after biomass pyrolysis and their application in the flotation process. These products will be used as collectors for coal flotation. The laboratory research was focused in optimization of pyrolysis processes for obtaining of optimal liquid product, which will be suitable as the replacement of commercial flotation reagents. In the next part the influence of microwave heating on the melting of andesite rocks is described. It was confirmed the heating rate. It was observed the melting of samples after 10 minutes of microwave heating at frequency of 2.45 GHz and output 900 W. The achieved temperature of melt was above 1200 ºC. The rate and selectivity of microwave heating are the most important advantages of microwave energy utilization in various processes, not only in mineral processing. Microwave energy has been applied also in many waste treatment processes. In this paper, microwave vitrification was used for stabilisation of nickel leaching residue (NLR), which was used as model carriers of heavy metals (Cd, Pb) from wastewater treatment. The mixture of waste in different ratio (from 30-50 % of NLR) with raw materials (andesite, dolomite, glass sand) was melted in microwave furnace with frequency of 2.45 GHz and output 1000 W during 45 minutes. After melting, the vitrified samples were similar to glassceramics. The TCLP test was carried out for testing chemical durability and Vicker`s indentation method for microhardness evaluation. The TCLP results showed good chemical durability of glassceramics. The measured values were under limit. The microhardness was measured in two different zones (matrix and white zones), which were identified in the pictures from light microscopy. The results of experiments proved that it is possible to stabilize the waste with content up to 50 % NLR in short time by microwave energy.

Key words: Microwave energy; biomass; waste; pyrolysis; flotation; vitrification.

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Iron minerals removal from different quartz sands

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ABSTRACT

Quartz sand occurs in varying degrees of purity in dependence on relation to iron mineral composition, but only a small percentage is suitable for glass industry after washing and magnetic separation treatment. Bioleaching in combination with washing can increase the quality of quartz sands. The addition of glucose in the leaching medium was important for the continuing leaching activity of iron by heterotrophic bacteria. The amount of bacterial iron removal was not directly proportional to the initial iron content of untreated samples. It was dependent on the mineralogical composition of the quartz sands with kaolinite, illite encapsulated and sealed by goethite (Q1), quartz sands with phengite, kaolinite encapsulated and sealed by siderite (Q2), quartz sands with glauconite encapsulated and sealed by clinoptilolite and Fe smectite (Q3). Heterotrophic bacteria decomposed these sealed polymineral grains with the iron dissolution and caused the formation of a fine – grained fraction of mineral particles predominantly below 49 μm in size. The bioleaching and washing processes resulted in a 65% decrease in Fe content of Q1, in a 75% decrease in Fe content of Q2 and in a 46% decrease in Fe content of Q3 after 3 months bacterial treatment. This bioleaching pretreatment may be used to the decomposition of iron minerals sealed by silicate minerals and to the removal iron surface coatings from different quartz sands. The washing process can removed the iron fine – grained particles bioformed after bioleaching. The reductive dissolution of iron polyminerals and washing process may have biotechnological application in the quality improvement of quartz sands.

Key words: Quartz sands; bioleaching; iron removal; heterotrophic bacteria.

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Evaluation of heterogeneous sulfide – rich mine tailings as secondary raw materials: a case study in the Mirdita District (Northern Albania)

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ABSTRACT

Sulphide-rich tailings constitute a major environmental concern due to the acid drainage (AD) production and release of potentially toxic elements (PTE). Therefore, the management of active mine dumps and the reclamation of inactive ones require to reduce the exposure of the possible environmental receptors to contamination. A common, critical feature of mine dumps is the heterogeneity of the tailing materials that may complicate the quantitative prediction of potential contamination. On the other hand, heterogeneity can be a key for a more rational and cost-effective remediation, given a good characterization of the dump materials. Moreover, mine wastes often contain valuable components and therefore a suitable solution is to make positive use of them. In fact, as mining and processing (comminution and concentration) constitute a major cost of the ore mineral cycle, the availability of partly-processed, although low-grade resources may represent an interesting opportunity of exploitation. The present work is a case-study for a quantitative flow-sheet-related approach to the aim of heterogeneous sulphide-rich tailing dumps management. We selected the former processing site of Reps, in the Mirdita District (northern Albania), where we characterized two tailing dumps and assessed the contamination. Moreover, we evaluated the concentration potential of commodities, namely pyrite and gold, from the tailing materials. We analysed the Reps tailing samples in order to evaluate mineralogy, grain size and bulk chemical composition, concentration of PTE, the presence and persistence of AD. The data set splits in two classes, based on the sulphide content. The reconstruction of the former processing flow-sheet allowed us to recognize this pattern as resulting from two distinct processing stages and to quantitatively improve the AD prediction results. We selected a shaking table concentration method for testing separation of pyrite and gold, by taking into consideration the need of reducing both costs and volumes. The effectiveness of the method was verified by monitoring both the feed and the output materials for grain size, geochemical and mineralogical parameters. The optimal grain size of the input samples was obtained through a closed-circuit regrinding and milling method. The concentrate output shows an enrichment in pyrite in all the samples. The concentrates constitute 16-37.4 wt% of the shaking table output, depending on the initial sulphide content of the sample. Au concentration data were gained by Activation Analysis on selected grain size classes, in order to verify the correlation of Au concentration and the particle size distribution. Preliminary data show that in our samples a valuable recovery can be achieved by sieving in order to separate the Au- rich (up to 580 ppb) fine fraction (<38μm), followed by tabling of the coarser fraction. Thus the Metal Recovery reaches 49.6%. Our results show that information about former processing can provide a useful insight for remediation planning. Moreover, this quantitative approach can lead to a rationale recycling of tailings and thus to a reduction of their volumes and environmental impact.

Key words: Shaking table; sulfide-rich tailings; secondary raw materials; heterogeneous mine wastes; Mirdita District.

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Study of using rock mass-coupled natural heat exchangers as large scale thermal energy storage systems for underground mine ventilation

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ABSTRACT

Mining industry is among the most energy-intensive industries of Canada and is usually associated with long-term environmental liabilities. Due to extreme seasonal variation of temperature in Canada (-40 °C in winter and +30 °C in summer), underground mining operations have to burn fossil fuels (usually propane) to pre-heat their ventilation air during the winter. In some cases pre-cooling is required during the summer as well. This pre-heating/pre-cooling process can incur up to 2 Million Dollars of annual energy costs and imposes a large Carbon footprint to a typical Canadian mine. An innovative solution is to use the extensively large mass of waste rocks (Millions of tones in scale) as a thermal storage mass. This technique allows for storing heat during summers and extracting it in winters. The present study examines the possibility of using large scale thermal energy storage systems for the purpose of pre-heating/pre-cooling of ventilation air in Canadian mines. It presents a novel method developed by researchers at McGill University to evaluate the techno-economic feasibility of application of large-scale seasonal thermal energy storage systems for mine air ventilation. To investigate the feasibility of this novel technique, a numerical study is conducted. To assess the performance of the proposed system, results of numerical model is presented and compared with those from existing models. The model is capable of simulating heat transfer in the fractured rock mass and its interaction with the ventilation air. By introducing information gathered from a Canadian mine into the developed heat transfer model, effects of key parameters are examined. This study shows that by adopting the proposed method Canadian mines can considerably lower their heating/cooling costs and emissions.

Key words: Seasonal thermal energy storage (Se-TES); energy efficiency; porous medium; ventilation energy.

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Diagenesis of sedimentary phosphorite deposits in Djebel Onk basin, Algeria

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ABSTRACT

Phosphate rocks are important economic natural resources. The sedimentary succession of Djebel Onk, which is characterised by the deposition of phosphatic formations of Late Palaeocene - Early Eocene age (Upper Thanetian-Lower Ypresian), range in age from Upper Cretaceous (Maastrichtian) to the Eocene (Lutetian); this marine sequence of approximately 500m thick is overlain in discordance by a thick continental sequence of sand and clays of Miocene age, then by the Quaternary deposits. The Thanetian sequence starts with dark grey marls and pass up section to thick economic phosphorite layer of about 30m at Djebel Onk and which thins until it disappears northwards, the West and the South of this economic phosphorite layer generally ends by a lumachellic level. The economic phosphorite layer crops out as a NE-SW lenticular body of friable gray-brown phosphorites and consists of two phosphate horizons, bright (friable brown), at the upper part, and dark (gray-black), at the lower part. These two horizons evolve laterally, either in a single layer of brown phosphorite or in a layer of black phosphorite. Petrographic analysis of thin sections and scanning electron microscope observations of the studied phosphate samples indicate that the phosphate ore mainly consists of structureless peloids, the most common phosphate grains, and other minor phosphatic grains like bone fragments, fish teeth and coprolites, that were cemented authigenically by dolomite and microcrystalline Si-rich phase, which have been formed by diagenetic processes. Based upon on the environment of deposition for the phosphate grains, the detailed Petrographic analysis using back scattered electron (BSE) imaging, and taking into account the paleogeography of Djebel Onk basin. The following main diagenetic processes affecting the Upper Paleocene phosphorites of the Djebel Onk include: (1) accumulation of phosphate grains, (2) compaction, (3) dolomite cementation, (3) minor amount of other diagenetic mineral cements: opal-CT, K-feldspar overgrowth, clinoptinolite and pyrite, (4) dissolution of dolomite crystals and calcite cementation.

Key words: Phosphorite; diagenesis; carbonate-fluorapatite; dolomite cement.

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Late Neoproterozoic Pan-African ophiolitic serpentinites of Eastern Desert of Egypt as natural CO_2 sequestration feedstock and a source of magnesia

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ABSTRACT

Late Neoproterozoic ophiolitic serpentinites occur as elongated mountainous ranges in the Central and Southern Eastern Desert of Egypt, following mainly the regional ductile shear zones. They were derived from peridotite/harzburgite protolith and represent obducted oceanic crustal slices onto island-arc successions. These ultramafic, Mg-rich rocks had been acted as a natural CO_2 sequestration feedstock, where enormous quantities of talc–carbonate rocks are distributed in intimate spatial and genetic association with them. The talc–magnesite rocks represent in situ fissure-fed metasomatic products of serpentinite precursors via extensive rock–fluid interactions. The main fluids involved in the transformation processes of serpentines to talc–magnesite were SiO_2 aqueous solutions and CO_2. The deposits located along the fault systems cutting the serpentinite-host are magnesite-rich, whereas those located at the contacts between serpentinites and the more siliceous country rocks are typically talc-rich. They could serve as possible natural magnesia source for a wide spectrum of industrial applications such as metallic, chemicals and refractories.

Key words: Late Neoproterozoic; Pan-African ophiolitic serpentinites; Eastern Desert of Egypt.

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Origin, occurrence and economic importance of marine phosphorites of Gujarat, India

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ABSTRACT

Preliminary investigation by Geological Survey of India in Exclusive Economic Zone off Gujarat has revealed that a detached underwater plateau of about 200 sq.km area in the continental margin of Arabian sea contains abundant phosphorites in the form of massive rocks, nodules, pellets, casts, etc. The plateau is situated at about 120 km of Okha, Gujarat. The water depth varies from 360 to 800 m. Phosphorite nodules,casts and pellets are mainly found in calcareous sand and massive phosphorites in carbonaceous silty clay. Nodules vary in size from 2 mm to 10 mm. Size, shape and colour of the phosphorite materials vary. Size varies from 2 mm to 20 cm and colour in shades of grey, black, brown & reddish brown.They are rounded to angular and sub rounded in shape. Intermixing of carbonates with phosphorites and carbonate veins seen in phosphorites indicate that phosphorites are deposited in a carbonate platform and its origin may be by metasomatic replacement of carbonates by P_2O_5 in an aqueous condition. Presence of casts of tests of foraminifers, gastropods and phosphatised bones etc. supports this theory of origin. SEM study of the phosphorite samples shows that bacterial activity (coccoliths) also played an important role in the phosphorite formation. Nodules seen in the calcareous sand might be of re-worked phosphorites, which were eroded, transported and deposited from a nearby source. XRF analysis of the phosphorite samples show that P_2O_5 content varies from 12.99 to 28.16% and in bulk sediments it varies from 0.73 to 7.21%. XRD study shows that Carbonate Fluorapatite (CFA) is the major mineral in all the phosphorite samples with minor amounts of dolomite, pyrite, ankerite and quartz. If the thickness of phosphorite body in the area is taken as a minimum of 50 cm below seabed and in the area of 200 km^2, the total weight of materials will be about 100 million tonnes. If 10% of the materials are phosphorites, the reserve will be 10 million tonnes and current market price of the reserve will be 7130 crore rupees.

Key words: Phosphorites; nodules; P_2O_5; carbonates; reserve.

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Community initiative in conserving natural resources through sacred groves in Westren Ghats of Karnataka, Peninsular India

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ABSTRACT

India is bestowed with rich diversity inter alia in natural resources, forests, water bodies, climate, people, language and crops grown. In order to sustainably manage, conserve and judicious use of natural resources, collective action by the community initiative is desirable since private property rights lead to inequitable and unsustainable use. In this paper efforts towards conservation of natural forests, through the collective action of providing social fencing reflected in the institution of sacred groves are discussed. This pertains to the village community in the Western Ghats region of Karnataka, India, committed towards stringent conservation efforts. The rituals of annual festivity called Devatehabba, (The worshiping festival of Goddess Mother Nature) as they trust are a part of the conservation efforts binding the members of the village community together for the cause of nature conservation. On the day of festivity, the village community invites relatives, friends and admirers to Devarabana (Virgin forest grove maintained in the name of Mother Nature for centuries without any disturbance) for participation in worship of the Mother Nature which is called as Sacred Grove. In some villages, an icon, Idol or earthen pot structure is worshipped in the sanctum of Devarabana. The entry to the sanctum is restricted to the day of annual worship in the year. Thus, after the festival, if any person forgets his/her belongings, the same can be found on the very festival day, next year only in the sacred grove. Members of the village community are not supposed to graze their livestock in the sacred grove. Violaters will pay a ritualistic fine of rolling a coconut per animal from the boundary of Devarabana. In some sacred grove natural springs have originated and flows as a stream serving the potable water needs of the community which they consider the result of the nature worship and sacred grove conservation. People have immense value for this cool and sweet water which is collected in a pond and/or supplied through piped water supply to individual households through gravity, throughout the year for domestic purposes. In this study, nature conservation efforts of village communities in Uttara Kannada district of Karnataka Southern India will be documented and analysed for policy implication highlighting the rich repertoire nature conservation for the benefit of posterity. Thus, conserving the forests and water bodies through the institution of sacred groves is praise worthy and replicable elsewhere, as a tradition for our next generation to emulate.

Key words: Sacred groves; western Ghates; Devate Habba; Devarabana.

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Geochemistry and potential industrial use of Numidian sandstones from Southern Apennines (Italy)

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ABSTRACT

Forty-nine samples of quartz-rich sandstones collected in the Numidian Flysch of Southern Apennines (Italy) have been studied to highlight their geochemical characteristics and to check their potential industrial use. Sampling was performed from five different depositional sequences along a NW-SE traverse: Monteverde (MV, n=8), Aquilonia (AQ, n=8), Pietragalla (PQZ, n=16), Rotondella (RO, n=6) and Valsinni (VAL, n=8). The sandstones derived from NW successions (MV, AQ and PQZ) show a major compositional maturity with higher contents in SiO2 (93% wt in average), K2O (around 1% wt) and Rb (25 ppm), connected with the presence of K-feldspar and micas; they show lower contents of CaO (0,1% wt), Sr, MgO (0,10% wt) and Fe2O3 (0,9% wt) owing to the absence of carbonatic and clay-ferruginous cements. The sandstones from SE sequences (RO and VAL) show lower contents of SiO2 (88% wt in average), K2O (0.3% wt in average) and Rb (9 ppm) and higher contents of CaO, MgO and Fe2O3. According to Herron (1988) classification, the sandstones from NW are subarkoses and sublitharenites, whereas those from SE fall mainly in the Fe-sand field. The sandstones from NW area show a potential vocation to use in the glass industry; to test this capability, four samples from these sequences were analysed considering different granulometric fractions. Chemical analyses were performed on four granulometric fractions (A< 63μm, 63μm< B < 125 μm, 125μm < C < 250 μm and D >250μm). The C and D fractions represent the most suitable for a vitrifiable mix because they are the most rich-SiO2 (around 96% wt) and the poorest in contaminant elements (Fe2O3=1,25-0,30%, Al2O3=3,63-1,97%, MgO=0,14-0%, CaO=0,1-0,02%). However, C and D fractions fall outside the granulometric range required by the glass industry, this problem can be easily solved subjecting them to further grinding. A and B fractions result less suitable for glass industry owing to their chemical characteristics (SiO2=93,7–77,2%, Fe2O3=3,35-0,44%, Al2O3=10,7-3,5%, MgO=0,41-0,03%, CaO=0,4-0,03%), on the other hand, these fractions are the most abundant (A+B≈ 80% in weight against C+D ≈20% in weight). We suggest that after additional treatments (ultrasound washing, magnetic and electrostatic separation, and chemical dissolution) even these fractions could be used in glass industry. Overall the Numidian sandstones from Southern Italy seem suitable for glass industrial uses.

Key words: Numidian sandstones; glass production; Southern Italy.

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Evaporation process and pore size distribution in tight sandstones: a study using NMR and MICP

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ABSTRACT

The phenomenon of evaporation is widely observed in a variety of processes and drew attention from researchers. In the petrophysical study of sandstone, the knowledge of evaporation is needed to understand the fluids distribution in the rock. Evaporation method was used in the determination of irreducible saturation in lab and removing water blocking in the gas well. However, the distribution of fluids in the reservoir has yet been studied properly. Nuclear Magnetic Resonance (NMR) is a technique useful in determination of porosity, water saturation and pore size distribution. Transverse relaxation time (T2) is popular in obtaining pore size distribution. In this study, T2 distribution was used to determine the water distribution and migration during evaporation. Mercury Injection Capillary Pressure (MICP) was used to calibrate the T2 distribution produced by NMR. The factor, effective relaxivity (27.2 um/s in the study area), transforms the T2 distribution to pore size distribution. Based on the NMR data and MICP data, the absolute pore radius distribution was obtained and the whole evaporation process of tight sandstones can be divided into three stages: the first stage was from 5 to 30 minutes when the water in the large pore (pore radius between 0.816 and 16.32 um) was evaporated; the second stage was from 35 to 75 minutes when the evaporation occurs mainly in middle pore size (pore radius from 0.01632 to 0.3808 um); the third stage was from 90 to 300 minutes when the water in the middle size and small size (pore radius from 0.00544 to 0.3808 um) evaporated. In the tight sandstone, the threshold pore radius for the initial evaporation is larger than 0.8 um. The permeability did not affect the first stage evaporation, but it affected the following stages. The NMR data for the tight sandstone core were plotted together to get the cut-off time for Bound Volume Irreducible (BVI) and Free Fluid Index (FFI). T2 cut-off was found shorter than the value of conventional sandstone (33ms). Furthermore, the evaporation method was more efficient, the equivalent water saturation can be reached in 30 minutes. And 30 minutes is the end of the first stage, which means the centrifuge only can produce the water in those relative large pores.

Key words: Tight sandstone; evaporation; gas well; NMR; pore size distribution; formation damage.

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Artificial Neural Network modelling for optimum design of CO_2 WAG

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ABSTRACT

CO_2 WAG is an effective EOR method for increasing sweep efficiency. In CO_2 WAG optimization for considering interactive effect between cycles, optimum design should be performed for whole cycles at once. Therefore, in this study, we developed an artificial neural network model to optimize the entire cycles at once, more effectively, and also reducing the time consuming computational work for forward modelling. A commercial reservoir simulator was used to generate process performance for training and validating the neuro-simulation proxies: A forward proxy model to predict production performance for reservoir properties and design parameters; and an inverse proxy model to provide necessary design parameters at each stage for a set of desired reservoir system. The particle swarm algorithm was implemented to search the best design scenario as an optimization method in proxy models. The results of this study showed that CO_2 WAG injection process could be optimized much more effectively by utilizing artificial neural network developed in this study. The proxy models were found to be effectively able to recognize the relationship between the reservoir characteristics and oil production performances of the WAG process in order to predict proper operating conditions. From the results, it was observed that the best sweep efficiency was obtained by varying the operating parameters such that WAG ratio, slug size and injection period at each cycle. This optimizing work was achieved only at one time for the number of cycles with the aid of an artificial neural network model. The forward and inverse proxy models using artificial neural network were proved to be very efficient for a wide range of reservoir conditions when optimizing WAG injection process for whole cycles at once, unlike conventional WAG optimization. We concluded that this model employed by particle swarm optimization was practical and efficient, especially in WAG Process that requiring so many numbers of computational works at every cycle to develop optimized injection scheme.

Key words: CO_2 WAG; WAG Design; sweep efficiency; Artificial Neural Network; Particle Swarm Optimization.

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Development of hydraulic fracture propagating model in naturally fractured reservoirs

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ABSTRACT

This paper presents a hydraulic fracture propagating model considering geomechanical factors, in which the model represents the twisted multiple planar fractures based on microseismic data, rather than single planar as previously described. When hydraulic fracture propagates and meets natural fracture, there are two criteria used; maximum tangential stress determining the fracture initiation angle, and judgement whether hydraulic fracture crosses natural fracture. The model proposed in this study was validated for the parameters relevant to fracture propagation, such as initiation angle, crossing ability through natural fracture, and use of multiple planar fractures. In the results of initiation angle, it was found that the initiation angle was dependent upon intersection angle, and the next fracture was propagated with a maximally twisted state when the angle is 40 to 45 degrees. Therefore, we can realize that this model can implement more realistically the corresponding microseismic data. From the results for checking whether a hydraulic fracture crosses a natural fracture, the model results on crossing state excellently matched with the experimental data. In conventional models applying single planar fracture, the hydraulic fractures were initiated perpendicularly from the well point regardless of the angle at which hydraulic fracture meets natural fracture. Meanwhile, in this model, it was ascertained that hydraulic fracture crossed the natural fracture at various angles. Finally, we observed that there is a large discrepancy on stimulated reservoir volume for different fracture network systems generated by this model and conventional fracturing model. This investigation is expected to improve the optimization of hydraulic fracturing design and to control hydraulic fracture propagation with a combination of in-situ stress, reservoir pore pressure and properties of rock and natural fracture.

Key words: Twisted multiple planar; hydraulic fracture propagation; natural fracture; geomechanical factor; shale reservoir.

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Utilization of traditional water supply systems as a solution for water shortages on Croatian islands

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ABSTRACT

The Croatian archipelago consists of 1246 islands, islets and rocks, with only 47 islands permanently inhabited. Total population of the inhabited islands is 125.000 which is a mere 3% of the total Croatian population. The islands' traditional agriculture-based economy was transformed during the second half of the 20th century due to a growth of mass tourism which created a substantial pressure on the islands' water resources. The islands receive between 700 and 1.500 mm of annual rainfall, but due to the prevailing highly permeable carbonate rocks (i.e. limestone) in the, most of the water rapidly infiltrates underground. Water shortages can occur periodically since the peak of the water consumption coincides with summer, the driest period of the year. Only a few larger islands have substantial local water sources while other rely on the water transported from the mainland either through water mains or by special water carrier ships. Historically, settlements on the islands depend on often scarce local water sources as well as on collecting rainwater during the wet season. Traditional means of collecting water were mostly abandoned when modern water supply systems were introduced. However, the expanding tourism creates a constant increase in the demand for water. Therefore, there is a need for alternative water sources, especially on smaller islands. Apart from high-tech and often expensive solutions (i.e. desalination, waste water recycling), utilization of the once abandoned traditional means should be considered as cheap and ready-to-use method of obtaining additional water. Such methods should be used as a back-up for modern supply systems during the consumption peaks. Due to the fact that the water thusly obtained is often of lower quality, it could be used primarily in agriculture, which would leave more water from the water mains for the purpose of human consumption. Furthermore, global climate change and the associated sea-level rise could affect already vulnerable islands' aquifers through the infiltration of saltwater which additionally emphasizes the importance of the implementation of the traditional water supply systems in the future.

Key words: Croatia; islands; water supply; traditional methods; water shortages; tourism.

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Gypsum application in the correction of soils with sodium excess

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ABSTRACT

An excess of sodium in the soil produces loss of structure. The gypsum ($CaSO_4.2H_2O$) corrects that excess, because the calcium displaces it in the exchange complex, and promotes aggregation. In Uruguay there are natural areas where the soil has too much sodium (call blanqueales). The purpose of this research is to study the effectiveness of the addition of gypsum to correct the blanqueales, using a soil with 4 cmolc.kg-1 Na, of the M. A. Casinoni Experimental Estation (EEMAC, for its Spanish sigils) on Paysandú. In 2013, were applied manually two types of gypsum, in doses: 0, 1000, 2000 and 3000 kg.ha-1, on the Festuca pastures and spontaneous species surfaces. On the other hand, soil was taken off from the first 20cm blanqueal's surface, and it was brought to the laboratory (humidity and temperature were kept constant). This sample was mixed with gypsum in doses: 0, 3000 and 6000 kg.ha-1, using the same sources as in the field. Water leaching and its effect on the soil by destructive sampling, was evaluated using microlysimeters. At the start of the experiment the percolated water showed a high level of Na, but after the third month it stabilized between 8 and 10 cmolc.L-1. After six months, in the soil samples with the highest dose of pelleted gypsum (more soluble), the Na concentration decreased from 7,6 to 1,44 cmolc.kg-1. However, in a field experiment in a similar period of time (three months later), no significant differences were observed in the soil's Na level. Nonetheless, the addition of gypsum has produced a higher yield in dry matter of pastures, with a lower concentration of Na and higher concentration of S on it. Based on this, in order to get deeper about correcting Na problems in soils, it is required more studies and time for it.

Key words: Sodium (Na); gypsum; blanqueales; sulphur (S); microlysimeters.

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Relationship between Na_2SO_4 concentration and thermal response of reconstituted stone in the laboratory and on site

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ABSTRACT

Reconstituted stone produced by mixing debris of natural stones with cement has been commonly used in several restoration works in southern Belgium where natural stone supply was not enough (i.e. the Orval Abbey). Because of their artisanal making, their composition and structure can differ from one to another and they are often highly salt-prone. The major salt found in these artificial rocks and at the surface of walls built with these materials is thenardite (Na_2SO_4). Sulphates can originate from the reconstituted stone itself, likely due to the stome-making process. Active infrared thermography (IRT) was recorded on a salt-weathered wall of which the salt concentrations were known via pXRF surface measurements and drilling. Flash light illumination was used to excite the wall, leading to an increase of its temperature. Images showed that the thermal response (parameter Tmax: maximum temperature reached after the flash) of salt-weathered parts was different from that of unweathered ones. Unweathered but highly salt concentrated zones could be detected. However, surface properties such as colour, rugosity and humidity made the relationship between the thermal response and salt concentrations more complicated. This technique was applied in the laboratory on samples of reconstituted stones submitted to 1 to 20 immersion-drying cycles in Na_2SO_4 solutions of 7, 14 and 26 % wt. The aim was to see if the relation between the extent of salt contamination and thermal response could be assessed. Sanding on the edges and surface of the samples occurred all over the experiment and some samples disaggregated completely from cycle 13. However, sample weight increased with number of cycles. Final values ranged between 2% for the 7% salt solution and 7% for the 26% salt solution. Those high values are likely due to the high micro-porosity (around 0.1 µm) of the reconstituted stone. Stone surface colour changed from the first cycle ($\Delta E > 3$) and increased until cycle 5 where it nearly stabilized with a ΔE around 15 for 7% solution tests and around 20 for 14 and 26% solution tests. The Tmax increased with the number of cycles and salt-solution concentration as long as significant degradation (apart from the aforementioned sanding) of the samples was not observed. When degradation occurred, Tmax started to decrease and stabilized. On the other hand, effusivity of the reconstituted stone didn't change whatever the concentration and the number of cycles, until the onset of degradation. After that, it increased with ongoing cycles. These results showed a link between salt uptake, degradation and the change in thermal properties of building stones. Although the relationship needs to be refined, this confirms that active IRT may be a valuable tool to detect high salt concentrations and early stages of stone weathering.

Key words: Na_2SO_4; reconstituted stone; infrared thermography.

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Controlling factors and thermic sensitivity of enzymatic activity of organic matter decomposition processes in Chilean volcanic soils

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ABSTRACT

In the frame of climate change the effect of the temperature on the decomposition rate of the organic matter (OM), and its long scale consequences on soil carbon stocks, is relevant. Since enzymatic activity is considered one of the major factors to affect OM decomposition rate, then it is important to know the controlling factor which would affect the enzymatic activity in volcanic versus to non-volcanic soils, and how an increase in soil temperature would affect the performance of the enzymes. In this study, we aim to know the sensitivity of this phenomenon to an increase of soil temperature due to -global warming, and consequently, how it would behave with different temperature and moisture regimes in a latitudinal gradient, which are as well, important seasonal factors affecting vegetation growth, microbial activity and intrinsically enzymatic activity. Chile provides a remarkable latitudinal geomorphoclimatic gradient, including a relevant area of volcanic soils. To assess the temperature sensitivity of the enzymatic activity in the decomposition of SOM processes, three enzymes related to the C-cycle were measured (3 hydrolases: Cellulose, β-galactosidase and Dehydrogenase); at five temperatures in 14 soil series where 6 of them correspond to Andisol order in a 2,000 km latitudinal gradient north-South. We used the Q10 coefficient in order to determine an increase in the decomposition rate, and a multivariate analysis was performed to know the majordecomposition controlling factors. Preliminary results show that soil moisture ends to be the major factor controlling enzymatic activity in non-volcanic soil, while soil pH and clay content appear to be more relevant in volcanic soils. Related to enzymatic activities, an increase when shifting the temperature of the reaction from 10 up to 60°C were found. Nevertheless, only some enzymes show an increase in the rate of substrate decomposition. We conclude that the factors which would affect the most to volcanic soil would be soil pH and clay content and to some enzymes the rate of enzymatic reaction would increase with increasing soil temperature.

We acknowledge to FONDECYT 1121138 for funding.

Key words: Q10; activation energy; C degradation.

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Do andisols have differences in their sensitivity for soil organic matter decomposition?

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ABSTRACT

Temperature sensitivity of soil organic matter (SOM) decomposition and potential feedbacks to climate change is a topic of considerable interest and controversy for the international scientific community. Reported evidences support different and/or opposing views in this issue. Therefore, no consensus exists regarding soil organic carbon (SOC) lability and the temperature sensitivity of its decomposition, limiting the accuracy in predicting the long-term impacts of climate change on soil C storage. Through their understanding in Chilean soils we expect to contribute in finding an answer whether soil CO_2 efflux patterns truly change or they do not in the frame of global warming. The aim of this study was to assess the temperature sensitivity of SOM decomposition of different Chilean soils using a climatic gradient and different physiographic zones. For that, ten Andisols (under natural prairie) of a total of 36 sites, were included and sampled from Mediterranean Humid and Humid zones of Chile (36 to 46°S and 71 to 72°W); according to criteria as different soil moisture regimes (xeric, udic and perudic), and soil temperature regimes (thermic, mesic and isomesic). Common approaches to determine temperature sensitivity of decomposition include exponential and the Arrhenius equation; and the determination of Q10 values. To investigate temperature sensitivity of SOM decomposition, through differences in the activation energy (Ea), soil samples were long-term incubated (365 days) at 20ºC as basal temperature. Preliminary results shown that Ea evaluated during the incubation period was variable between Andisols, presenting different tendency (increase, decrease and no changes during the incubation time), showing variable values as well of Q10 for labile and recalcitrant C forms. The differences in the thermodynamic parameters that represent the sensitivity to C decomposition could be attributed to different geochemical composition, climate condition, geographic localization or differences in the capacity to retain or sequester the organic C. We are working to elucidate which are the most relevant factors explaining these results and if they extend to all soils sampled.

We acknowledge to FONDECYT 1121138 for funding.

Key words: Energy of activation; Q10; Arrhenius equation.

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Fulvic and humic acid substances and potential raw material of some Tertiary Turkish coals from Anatolia, Turkey

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ABSTRACT

This study aims to determine some Turkish low rank coal samples for applications in the agricultural sector and assesses the suitability of a certain coal either as soil conditioner or as raw material for manufacturing organic fertilizers. Twenty-six samples of subbituminous coal obtained from several Turkish coal deposits such as Arguvan (Malatya), Çayırlı (Erzincan), Artova and Zile (Tokat), Kangal-Gemerek-Divriği (Sivas), were studied. When optimum parameters were used, 12.1% fulvic acid and 39.7% humic acid from Arguvan samples, 3.20% fulvic acid and 4.12% humic acid from Çayırlı samples, 15.12% fulvic acid and 45.28% humic acid from Zile samples, 23.55% fulvic acid and 21.45% humic acid from Arguvan samples, 33.33% fulvic acid and 5.30% humic acid from Gemerek and 11.33% fulvic acid and 8.60% humic acid from Divriği samples, on dry basis were obtained.

Key words: Subbituminous coal; fulvic acid; humic acid; organic fertilizer; Turkey.

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Study of the mechanism and control technology of cyanobacterial blooms in the lake

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ABSTRACT

China is faced with the challenge of widespread and serious water pollution. One serious water pollution issue is the eutrophication of water bodies and the resulting harmful algal blooms, which have threatened not only drinking water safety but also the ecological integrity of aquatic environment and the sustainability of socioeconomic development. Despite China's enormous investment in reducing pollution loads from various pollution sources, little progress has been made in alleviating the eutrophication trend of water bodies. There are two factors contributing to the unsatisfactory results. First, excessive nutrient discharge contributing to eutrophication largely comes from non-point pollution sources, while the previously implemented pollution control programs have only been able to control point pollution sources more effectively. Secondly, besides external pollution sources, internal pollution loads make large contribution to the lake eutrophication. There has been a lack of both theoretical research of the definition, formation, and quantification of internal pollution loads and the development and implementation of technologies specifically targeted towards the reduction of internal pollution loads. Dianchi Lake is the largest lake in Yunnan Province and the sixth largest freshwater lake in China. Since the 1980s, the water quality of Dianchi Lake has deteriorated rapidly and cyanobacterial blooms have broken out frequently in the past 30 years. Explore the conditions of cyanobacterial blooms have been a focus of academic research in the world. It is generally believed that excess nutrients from external and internal pollution loads have a large relevance with algae blooms. However, the mechanism of algae outbreak is still unclear, and control technologies have lots of defects in the process of practice. To solve this serious problem, we should study the mechanism of cyanobacterial blooms breaking, develop a targeted control cyanobacterial blooms technology system, and establish a mass demonstration area based on previous study, which can provide technology demonstration parameters for the eutrophication prevention and cyanobacterial blooms controlling.

Key words: Cyanobacterial blooms; lake; nutrients.

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Comparative study of heavy metal contamination in the surface sediments of Vembanad lagoon and Ashtamudi estuary, south west coast of India

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ABSTRACT

Coastal environments are under increasing pressure as a result of increasing human population. In fact coastal areas including estuaries, bays, shorelines, lagoons and continental shelves are used intensively and receive the by-products of inland human activities, mainly via rivers. Lagoons and estuaries are especially at a risk of contamination by different contaminants from anthropogenic sources including heavy metals since change of the sediment regime often occurs. An attempt has been made to compare the contamination of heavy metals in Vembanad lagoon and Ashtamudi estuary located in the south western Indian coast. Heavy metals in the surface sediments of Vembanad lagoon follow the order Fe>Ti>Mn>Cr>Zn>Sr>Ni>Cu>Pb>Co and that of Ashtamudi estuary is Fe>Ti>Mn>Sr>Cr>Zn>Ni>Cu>Co>Pb. Based on the heavy metal concentration in the sediments, contamination factor (CF), degree of contamination and Pollution Load Index (PLI) were computed. Contamination factor for the heavy metals in Vembanad lagoon and Ashtamudi estuary explains that the surface sediments show low degree of contamination. Pollution Load Index (PLI) of the surface sediments of Vembanad lagoon is 1.044 and that of Ashtamudi estuary is 1.11 representing slight pollution. The ecotoxicological sense of heavy metal contamination in the surface sediments of central Vembanad lagoon appears to be moderately toxic while Ashtamudi estuary is less toxic. Based on Nemerow Pollution index, Vembanad lagoon is in dangerous zone while Ashtamudi estuary is in precaution zone. Based on the exceedances level of ERM and ERL values, it is assessed that Vembanad lagoon is a poor environment for sediment dwelling fauna. About 92% of the sampling sites are classified as poor zone. Ashtamudi estuary is classified into good zone based on ERM and ERL values pointing towards a moderate healthy ecosystem for organisms to living in its natural environment. But When compared with the heavy metal concentrations of central Vembanad lagoon and Ashtamudi estuary with other lagoons and estuaries worldwide, the registered concentration in the surface sediments is relatively much higher, indicating a great threat to the lagoon and estuary in near future.

Key words: Heavy metal; enrichment factor; pollution load index; contamination factor; ecotoxicology.

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Relationships between radon concentration and temperature and barometric pressure variation in the Sopronbánfalva Geodynamic Observatory, Hungary

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ABSTRACT

The Sopronbánfalva Geodynamic Observatory is located on the Hungarian-Austrian border in the Sopron Mountains belonging to the extensions of the Eastern Alps. The Sopron Mountains consist of metamorphic rocks of Palaeozoic age such as gneiss and different mica schists. The observatory is an artificial gallery at a depth of about 60 m driven horizontally in an outcrop of the bedrock formed by gneiss. The observatory is thermally insulated by three doors but not perfectly hermetically sealed. It means that there is a slow air circulation which does not change the temperature in the gallery but it ensures that the indoor and outdoor barometric pressures are the same. So, we can safely assume that the transport of radon to the outside is very slow. The yearly mean temperature in the gallery is 10.4 ºC and the yearly and daily temperature variations are less than 0.5 ºC and 0.05 ºC, respectively. The relative humidity is 90% and it is nearly constant. Radon concentration variations have been monitored in the observatory since 2009. The radon concentration is extremely high, 100 – 600 kBq m^{-3} in summer and some kBq m^{-3} in winter. The relationships between radon concentration and the temperature and barometric pressure were separately investigated in the summer and winter months by Fast Fourier Transformation, Principal Component and Multivariant Regression Analyses in different frequency bands. The long-period radon concentration variations are mainly governed by the temperature (20 kBq m^{-1} $°C^{-1}$) both in summer and in winter. The regression coefficients between long-period radon concentration and barometric pressure are –1.5 kBq m^{-3} hPa^{-1} in summer and 5 kBq m^{-3} hPa^{-1} in the winter months. In the 0.072-0.48 cpd frequency range, the effect of the temperature is about –1 kBq m–3 $°C^{-1}$ and the effect of barometric pressure is –5 kBq m^{-3} hPa^{-1} in summer and –0.5 kBq m^{-3} hPa^{-1} in winter. In frequency range above 0.48 cpd all regression coefficients are one order of magnitude smaller than in the range of 0.072-0.48 cpd. The investigations contribute to a better understanding of the nature of radon emanation and the effect of meteorological processes on it.

Key words: Radon concentration; air pressure; temperature; underground gallery; data analysis.

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Development of GIS based method for risk assessment of Olive Mill Waste Water in Crete, Greece

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ABSTRACT

Water resources are subjected to different pollution sources. Point source water pollution of surface water is an important issue when considering the limited surface water availability as well as the potential knock on effects of this pollution on human health as well as habitat and land degradation. One of the main point sources of water pollution, Olive Mill Waste Water (OMWW) is the liquid by-product generated during olive oil production. However, there is no standardized method to assess the risk of water pollution by OMWW for any given river basin. This research addressed the above issue by designing a detailed quantitative risk assessment methodology, which utilizes Geographic Information System (GIS) modelling to classify within a watershed individual sub-catchment risk of water pollution occurring from olive mill waste discharges. The research presents the proposed criteria and calculations required to estimate sub-catchment risk significance and comments on the methods potential for wider application. This research combines elements from risk assessment frameworks, Multi Criteria Analysis (MCA), and GIS.MCA helped in aggregating different aspects and elements associated with this environmental problem, while GIS modeling tools helped in obtaining many criterion values and providing insight into how different objects interact in the nature and how these interactions influence risk at the watershed level. The proposed method was tested in the Keritis watershed in Crete, Greece, where OMWW is one of the main stressors influencing water quality, and the results indicated that this method has the potential to be a useful guide to prioritize risk management actions and mitigation measures to be incorporated in River Basin Management Plans.

Key words: GIS; multi criteria analysis; Olive Mill Waste Water; point source; risk assessment; water pollution.

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Mineral magnetic characteristics of surface sediments from Visakhapatnam coast: A seasonal perspective and pollution monitoring

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ABSTRACT

The spatial and seasonal distribution of Sediment texture, magnetic concentration, mineralogy and grain size dependence parameters were carried out on surface sediments collected from Visakhapatnam coast during three different seasons. The associations of sediment grain size with mineral magnetic characteristics were established by Pearson correlation analysis. The texture of surface sediments in the study area was dominated by silty sand during post-monsoon; it was dominated by sandy silt during pre-monsoon; and it was dominated by sand during monsoon. The values of magnetic concentration dependent parameters such as χ, χ_{ARM}, SIRM obtained their lower and highest values and this large variation suggests an alteration of the magnetic signal, induced, not only by the magnetic concentration, but also by variance in the magnetic mineralogy and magnetic grain sizes. In post-monsoon season the concentration of magnetic minerals decrease seaward, while it increase seaward during pre-monsoon and monsoon seasons. The values of magnetic mineralogy and grain size dependence parameters revealed that the surface sediments of Visakhapatnam coast dominated by MD/PSD ferromagnetic minerals. Pearson correlation analysis revealed that the strong association of ferrimagnetic minerals with fine grained sediments in all the three seasons.

Key words: Surface sediments; aeasonal variation; magnetic mineralogy; Pearson correlation analysis; Visakhapatnam coast.

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Occurrence of antibiotics in groundwater, river water and wastewater at Jianghan Plain, central China

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ABSTRACT

The occurrence of 25 antibiotics from four categories, including macrolides (MLs), tetracyclines (TCs), fluoroquinolones (FQs) and sulfonamides (SAs) were detected in groundwater, river water and swine wastewater at Jianghan Plain, central China. The method of solid phase extraction-high performance liquid chromatography-tandem mass spectrometry (SPE-HPLC-MS/MS) was used for the purification, enrichment and detection of antibiotics in water samples. Standards addition method was used to assess the accuracy of pretreatment and instrumental analysis. The recoveries of 25 antibiotics were ranged from 53% to 120%, 52% to 125%, and 61% to 110% for groundwater, river water and wastewater respectively. The limits of detection (LOD) of 25 target compounds were varied from 0.01 to 2.16 ng/L, 0.02 to 4.91 ng/L and 0.13 to 21.73 ng/L for the foregoing three kinds of water samples respectively. The high recoveries and low LOD for groundwater and river water indicate that matrix effects were minor, however, for the analysis of wastewater samples the matrix effects should be fully considered. Two sampling campaigns were carried out in December 2013 (winter) and April 2014 (spring). The order of total concentration levels of selected compounds in the aquatic environment was: wastewater > river water > groundwater, and the higher antibiotic residues occurred in spring than winter for river water and groundwater samples. Sulfamethazine, erythromycin and norfloxacin were predominant antibiotics with average concentrations of 7677.27 ng/L, 217.23 ng/L and 46.26 ng/L in winter in wastewater, river water and groundwater respectively, and that of 463.63 ng/L, 1598.26 ng/L and 73.13 ng/L in spring separately. The seasonal variation of antibiotic residues in the aquatic environment reflects the effects of complicated processes of sewage discharge, infiltration of wastewater and contaminated river water, and geochemical processes in the soil and aquifer systems.

Key words: Antibiotics; groundwater; river; wastewater; Jianghan Plain.

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Acute toxicity assessment of antibiotics in water by Luminiscence Bacteria and Lepidium Sativum

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ABSTRACT

Antibiotics are drugs which are used extensively by people and animals. The large part of the antibiotics, which are consumed by people and animals, is sent to domestic waste sewage without changing through stools or urine and discharged to aquatic habitats directly or with outrun waters of waste water treatment plant. It is stated through researches that these are antibiotics in aquatic habitats around the world. Vibrio fischeri toxicity tests will be used in this study as a method for evaluation of toxicity of synthetic antibiotic waste water which is prepared to determine possible harms of antibiotics, whose consumption increases with each passing day, for microbial ecology of receiver environment. Toxicity of waste water, which contains antibiotic, for plants and aquatic life will be determined and different types of tests will be compared in terms of sensitivity. This research is pretty important in terms of evaluation of applicability of toxicity test methods, which will be used in this study, and shedding light for researches that will be carried out from now on.

Key words: Antibiotic; Vibrio fischeri; Lepidium sativum; toxicity.

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Acute toxicity of Konya (Turkey) landfill leachate

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ABSTRACT

In this study, toxicity of Konya landfill leachate was investigated. The method of phytotoxic evaluation is Lepidium sativum toxicity test was used. The determination of the leachate to aquatic media was used toxicity test of daphnia magna. The different biological test methods which were used in this study were compared with sensibility. The test results and control battery were compared at the same time and calculated % inhibition and EC50 value. For landfill leachate, all of the test species which is used in our study was determined toxic for plant and aquatic media.

Key words: Toxicity; leachate; Lepidium sativum; Daphnia magna.

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Physico-chemical variability of alluvial sediments in a floodplain area of the downstream Vltava (Moldau) River in the Czech Republic after the last catastrophic flood in 2013

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ABSTRACT

Since 1118, floodplain area along the downstream Vltava River has been affected by more than forty catastrophic flood events as was recorded in historical texts. The former sediments have been eroded and a new matter coming from a 28,000–km2 river basin including geochemically variable regions and highly industrial and urbanised areas has been deposited in the floodplain. The investigated inundation zone of the Vltava River near the town of Veltrusy was affected by strong erosion and sedimentation during the last catastrophic flood in 2002 and prevailing deposition of organo-clay and sandy-gravel sediments during the last inundation in spring 2013. In June 2013 samples of alluvial cover were collected across the former Veltrusy castle manor with the area of 290 ha (50.283ºN; 14.333ºE) founded at a former river island (1720–1784). Since the 18th century this area has been continuously utilised for both a landscape park and crop production. Samples of alluvial material with approximately same size (25×25×10 cm) were collected from the depth of 0–10 cm and 30–40 cm at 102 sites situated mainly in woody (32), grass (13) and field (22) plots and in a game enclosure (3 sites). After total digestion (HNO3+H2O2+HF+H3BO3) of the samples, content of Ag, Al, As, Ba, Be, BI, Ca, Cd, Ce, Co, Cr, Cs, Cu, Fe, Ga, Ge, K, La, Li, Mg, Mn, Mo, Na, Nd, Ni, P, Pb, Pr, Rb, S, Sb, Se, Sn, Sr, Th, Tl, U, V, W, Y and Zn was determined using ICP-MS methods. In parallel, content of available Al, Ca, Cu, Fe, K, Mg, Mn, Na, P and Zn was detected in extracts of the samples with Mehlich 3 solution. Other characteristics of the sediments (soil textural classes, pH-H2O, pH-CaCl2, electric conductivity and total C, N and Hg contents) were determined as well. Despite repeated floods, long-term land use of the plots has considerably controlled the investigated sediment characteristics. For example, the highest number of significant differences in the investigated characteristics of surface and deeper sediment layers were found in the woody plots while only a few differences were recorded in ploughed sediments of the fields. Respective significant differences in the contents of about 5 and 25 chemical elements were detected between woody and grass plots and woody and field plots for both 0-10 and 30-40 cm depths. Results of multivariate statistics, classified post maps and correlation analyses showed more details about distribution of the sediment characteristics and their relationships. Since 2002 the original ornamental and production plots of the area have been reconstructed. The main identified problems have been high content of toxic elements (As, Cd, Cr, Ni, Pb and Zn) in the flood deposits exceeding maximally allowed total concentrations in the agricultural soils, and negative effects of eutrophication on the recovery of meadow biodiversity. On the contrary, determined total Hg content in the sediments has been substantially lower than generally assumed.

Key words: Floodplain sediments; total element concentrations; element available concentrations; land-use restoration.

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Effect of silica on the tensile strength properties of epoxy based composites

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ABSTRACT

Cotton fabrics and fibres is an important renewable, natural reinforcement material for composites. In this study, silica and resin were combined and pressed to form natural fabric composites. The tensile properties of the composites were measured to observe the effect of silica and alkalization. The tensile strength of the treated composites were compared to untreated. The treated and untreated composites has tensile strength of 90 MPa, and 72.MPa respectively. This values showed that the addition of silica nanoparticles improves tensile strength of the composites. The tensile properties of the fabric improved by 41%.

Key words: Silica; tensile strength; epoxy- matrix composites; fabrics; natural fibers.

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Resistance to vancomycin in surface water isolates monitored by vanA-specific oligonucleotide probe

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ABSTRACT

The emergence and spread of glycope ptide resistance in enterococci has become a significant clinical concern and vancomycin resistant enterococci (VRE) are now an increasingly important universal problem worldwide. Two VRE species cause most enterococcal infections, Enterococcus faecalis and E. faecium. The rapid increase of vancomycin resistance compromises physicians' ability to treat infections caused by many of these strains because of lack of alternative drugs. Acquired resistance to vancomycin is mediated by various mechanisms, however, the vanA and vanB resistance genotypes are by far the most prevalent. Resistance encoded by vanA presents the greatest therapeutic threat because it is genetically transferable and results in high-level glycopeptide resistance including both vancomycin and teicoplanin. Although van genes are mostly found on enterococci, their homologues with high similarity are also ubiquitous in the vancomycin-resistant surface water isolates other than enterococci. The transferable nature of the vancomycin resistance determinant raised the possibility of a more complex epidemiological picture, especially in surface waters due to the transfer of van genes from enterococcal to non-enterococcal isolates. As there is increase in emergence and rapid dissemination of resistance to vancomycin that has become challenge to treat human diseases, there is an urgent need to screen presence of vancomycin resistance genes in surface waters. Therefore, this study aimed at monitoring of van harboring surface water isolates by using vanA-specific oligonucleotide probe. For this purpose, water samples collected from a river over a year was monitored with vanA-specific DNA probe through in situ fluorescent hybridization technique. The oligonucleotide probe targeting vanA gene labelled with fluorescein isothiocyanate at the 5' end was used to calibrate the optimal hybridization stringency for vanA harboring isolates. Strong linear relationships between the signal intensity and the target vanA gene was observed. The results indicate that the vanA-specific DNA probe might be a potential analytical tool for in situ monitoring of vancomycin-resistant isolates in surface waters.

Key words: VRE; vancomycin resistance; van genes; van probe; glycopeptide antibiotics; surface waters.

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The factor analysis of Mesooligotrophic Bog Medla-Pev-Njur data

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ABSTRACT

Measurements are taken by the staff of Institute of biology since May, 2012 on the mesooligotrophic bog located in a taiga in the European Northeast of Russia in 40km from Syktyvkar. Measurements of all parameters were carried out by method of microvortex pulsations with use of a gas analyser of Li-7500A and the ultrasonic CSAT 3D anemometer at height 3,93m. Frequency of measurements is-10 Hz. Measurements included also meteorological characteristics. In this work mutual influence of the measured characteristics is studied. The analysis included 54 parameters, such as concentration of methane, carbon dioxide, water vapour, the air temperature, wind speed components, atmospheric pressure, average values of fluctuations of squares a component of speed of a wind, work of fluctuations horizontal a speed component with vertical, vertical streams of heat, methane, carbon dioxide and water vapour, kinetic energy of turbulence, dynamic speed, estimates of local derivatives on time of average values of temperature, a component of speed, atmospheric pressure, methane, carbon oxide and water vapour, and also average on 30 minutes intervals of time of values of atmospheric pressure, density of air, relative humidity, streams of carbon dioxide and methane without adjustments, albedo, all types of radiation, soil temperature at two depths and photosynthetic radiation. The average constantly these were used. For characteristics concerning which there was only average on 30minutnym to intervals information, interpolation was carried out by square polynoms. For the analysis of data the factor analysis with use of procedure of rotation of VERIMAX is used. Data of August, 2012 when activity of biological processes is high are analysed. 13 factors are allocated, the first two of which define about 50 percent of information, and in total allocated factors explain 90 percent of total dispersion of characteristics. Dynamics of the allocated factors has the expressed daily character. Results Major factors are the air temperature, total radiation, short-wave and long-wave radiation, relative humidity, temperature and humidity of the soil at different depths, PAR, kinetic energy of turbulence, atmospheric pressure, friction speed. These indicators are included in most cases into structure of the first two factors defining 50 percent of the general dispersion.

Key words: Methane; carbon dioxide; bog; factor analysis.

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Restrictions on the survival of the local environmental sustainability

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ABSTRACT

The aim was to generate a situational portrait of the themes that make up the ecological subsystem of a local system (Ribeirão Preto, Brazil), with the Sustainability Barometer tool. The basis of the topics chosen assists in the interpretation of the subsystem and provides attributes to configure and make considerations for each theme portrayed in the research. The Soil and Biodiversity issues were characterized as unsustainable from the variables used.

Key words: Sustainability indicators; barometer of sustainability; local development.

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Changes in the structure of land use as an indicator of the transformation of the landscape in the post-mining areas

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ABSTRACT

The functioning of the Polish Lowlands mining landscapes in various stages of development (phases of facilitation, mining and reclamation) associated with conduct in this area for over 50 years opencast lignite mining, opens up wide possibilities for studying the evolution of the landscape under strong anthropogenic pressures. The main objective of the study was the quantitative recognition of changes in the structure of land use as an indicator of the transformation of the landscape in the pre- and post-mining areas. The preliminary step was to identify the types of land use in the five study areas with a total area of 916.98 km2 located in Konin – Turek Lignite Basin over two time horizons (before and after mining) and to determine changes with respect to the number and surface of the patches of the particular type of land use. Analysis of the changes in directions of transformation of the different types of land use into other types (eg. cropland into forests, meadows into arable land) was an essential aspect of the study. The dynamics of these transitions was visualized with the use of pie charts (circular plots) developed on the basis of the transformation matrix. As a result, the share of the surface which underwent degradation (negative changes), that which was revitalized (positive changes) and those which were not transformed, was determined. Spatial diversity of land use patches as an important functional indicator was analysed based on the distribution of the surface of the patches. The regularity of the changes of the composition and configuration of the structure of usage was also characterized with the use of landscape metrics and, on which basis, the spatial processes of landscape changes in the post-mining areas were determined. In order to develop a land use map, Remote Sensing and Geographic Information System were used. As a data source for the pre-mining areas, I have used cartographic materials - Karte Topographische Urmesstischblatt 1:25 000, which shows the structure of land use in 1940; while for the post-mining areas - orthophotomap of Konin - Turek area, which presents the types of land use in 2011. The metrics which characterize the landscape were calculated with the use of using Fragstats 4.1. The results, supported by statistical analysis, show that changes in land use in the post-mining areas of Konin - Turkish Lignite Basin are highly statistically significant (p-value <0.001), and a decline in the share of arable land, meadows and pastures as well as the increase in the share of forested areas and surface water was consistent. This is representative of the course of change, which is also significant, is an increase in the share of built-up areas as well as new types of land use unique to the post-mining areas related to the mining of lignite. Analysis of the course of transformations of the various types of land use into other types, showed that the changes in most cases considered the conversion of meadows and pastures into agricultural land (mainly arable land) as well as afforestation and development of the agricultural land. Analysis of the distribution of surface patches showed highly statistically significant changes – after the exploitation, the share of larger patches increased at the expense of small ones (p <0.0001). This was also confirmed by statistical analysis of surface – peripheral indicators. Another characteristic feature of the post-mining structure was a smaller number and density of the patches, less dispersion of the patches, more uniform distribution of the patches in the mosaic as well as reduction in the length and density of the patch edges. The distance between the nearest patches of the same type decreased, the patches are located much closer together. According to the statistical assessment, these changes are highly significant (p <0.001). The conclusions derived from

recognizing course of structural transformation of land use in the post-mining areas and their functional dimension, should form the basis for corrections of reclamation as well as planning future reclamation activities in order to create post-mining landscapes in accordance with the principles of landscape ecology.

Key words: Mining areas; land use changes; landscape metrics.

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Biosorption of diethylketone and Cd using a Streptococcus equisimilis biofilm supported on vermiculite: kinetics and equilibrium studies

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ABSTRACT

This works aims to infer about the possible application of a supported biofilm on the simultaneous removal of a metal and a ketone from aqueous solutions and accordingly it describes two sets of experiments: cadmium and diethylketone, DEK, adsorption assays on vermiculite, the support, and cadmium and diethylketone biosorption assays on vermiculite covered by a S. equisimilis biofilm. Removal percentages between 60 % and 98 % were obtained by the vermiculite for initials concentrations of 3g/L of DEK. For Cd, the removal percentage ranged between 72 % and 78% for initials concentrations of 0.1 g/L of metal. Regarding the assays conducted with the S. equisimilis biofilm supported on vermiculite, the percentage of removed cadmium increases with the increase of the amount of vermiculite whereas DEK removal decreases (maximum removals of 86.16 % and 95.70 % for Cd and DEK, respectively). Adsorption kinetics for both pollutants follows the pseudo-second order model and equilibria are well described by the Freundlich and by the Dubinin-Radushkevich models for Cd and DEK respectively.

Key words: Streptococcus equisimilis; vermiculite; cadmium; diethylketone; biosorption.

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Environmental assessment on acidic river water neutralization system in Kusatsu hot springs, Gunma, Japan

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ABSTRACT

The Kusatsu hot spring area, located on the eastern mountainside of the Kusatsu-Shirane volcano and originating from the volcanic activities of the volcano, is one of the most famous spa resorts in Japan. Since the springs are all strongly acidic, rivers in this area are all acidic. Hence, the Gunma prefectural government started a river water neutralization system to improve water quality in the downstream in 1964. The system is now operated by the Ministry of Land, Infrastructure and Transport (MILT). In the neutralization system, the neutralizer prepared by mixing powdered limestone with river water is poured directly into the river. The system thus results in several thousand tons of neutralization products with the surplus neutralizer being accumulated annually in the Shinaki Dam reservoir located on the downstream. Therefore, the sediment in the Shinaki Dam is continuously dredged by a slurry pump. The dredged slurry is first dehydrated with a filter press, and then dumped at dedicated disposal site located around the dam. The previous study revealed that around 25 tons of arsenic originating from hot springs accumulated annually in the Shinaki Dam by coprecipitating with the neutralization products (Kikawada, 2008). In this study, we performed environmental assessments on the river neutralization system and the disposal process of the neutralization products, focusing on arsenic. The neutralization products in the Yu River, the river with the highest concentration of dissolved substances in the area, contain around 1% (w/w) of arsenic in dry basis. As(V) species in the river water is selectively precipitated with ferric oxyhydroxides. The sediments in the Shinaki Dam partly contain about 2000 mg/kg of arsenic in wet basis, which is in good accordance with the content in the neutralization products, 1% (w/w) in dry basis, assuming the water content of the sediments is around 80% as reported by MILT. The results of the sequential extraction experiments on the sediment core samples from the Shinaki Dam with three types of extractants suggest that arsenic in the bottom layer coexist with ferrous minerals like iron sulfides as As(III) under anoxic conditions, while that in the surface layer coexist with ferric oxyhydroxides as As(V). The anoxic condition in the sediments could reduce As(V) to As(III), and the reduction processes may influence the mobility of arsenic. The sediment core samples in the disposal sites contain 400 to 500 mg/kg of arsenic. Arsenic in the sediments treated with a cement type solidifier in the disposal process shows higher mobility than that in the sediments without solidifier treatment. The mobility of arsenic in the disposal sites is thus strongly affected by variations in the disposal process.

Key words: Acidic river; neutralization; arsenic; hot spring.

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The effect of belowground herbivory by wireworms on plant performance in post-mining sites

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ABSTRACT

The effect of belowground herbivory by the wireworm Agriotes lineatus L. (Coleoptera: Elateridae) on the grass Calamagrostis epigejos was studied in greenhouse and field experiments. In the greenhouse, C. epigejos and Festuca rubra were grown together in pots with or without wireworms; wireworms decreased the above- and belowground biomass of C. epigejos but increased the above- and belowground biomass of F. rubra. In a field experiment at a post-mining site, repeated insecticide application reduced a wireworm population dominated by A. lineatus by 70% and significantly ($p = 0.0317$) increased the belowground biomass of C. epigejos; redundancy analysis (RDA) indicated a significant difference in plant community composition. Both the field and greenhouse experiment indicated that wireworms negatively affect C. epigejos and therefore can speed up succession and help establishment of a more diverse plant community on spoil heaps.

Key words: Wireworm; belowground herbivory; Calamagrostis epigeios; post-mining.

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Effect of metals on phosphorus and nitrogen release from sewage sludge by chemical hydrolysis

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ABSTRACT

Phosphorus is one of the most essential nutrients for all living organisms and is a key ingredient in fertilizers for plant growth. However, phosphate rock, as the main source of phosphorus in the world, is becoming increasingly scarce. Therefore, more and more attention has been paid to develop sustainable methods to promote phosphorus release and recycle from any phosphorus-rich residue. Sewage sludge represents an important secondary phosphorus source because the major percentage of the phosphate source from wastewater is transferred into the sludge. To find an efficient way to release phosphorus and nitrogen from sewage sludge is the first step for phosphorus and nitrogen recovery. Chemical hydrolysis is a promising method for releasing elements from sewage sludge by using chemicals. In addition to the increase of phosphorus and nitrogen concentration, chemical hydrolysis resulted in the release of the metals which were normally integrated in organic complex molecules into the liquid phase. Most of the investigations were focused on the release of phosphorus by chemical hydrolysis, however, there is only a few studies investigated the effect of metals on phosphorus and nitrogen release. In this study, it was investigated to effect of metals on phosphorus and nitrogen release from sewage sludge by chemical hydrolysis. The anaerobic digested sewage sludge used in this study was obtained from a wastewater treatment plant with an anaerobic/anoxic/aerobic (A/A/O) process located in Antalya, Turkey. The anaerobically digested sludge contained 3% total solid content. The total phosphorus and total nitrogen contents were about 2 and 4.2% in the anaerobically digested sludge. The digested sludge contains a high concentration of Ca, Mg, K, Na, Al, Fe, Zn and Cu. However, the digested sludge had low concentrations of Cr, Pb and Ni. The composition of the sludge residue affects the hydrolysis results and thus, the recovery. The optimal situation for nutrient recovery is to obtain a high release of phosphate and nitrogen, and a low release of metals and heavy metals that later on can give rise to separation problems. For this purpose, the effect of organic acids (citric, acetic, oxalic), inorganic acids (sulphuric, hydrochloric, nitric) and base (sodium hydroxide) at different molar concentrations on the chemical hydrolysis (without heat or pressure) of nutrient and metals was investigated in this study. And, the most appropriate chemical was determined for release of high nutrient and low metals concentrations. In all experimental conditions, Ca, Mg, Na, K, Al, Fe, Zn, Cr, Ni were released together with phosphorus by chemical hydrolysis. When 0.5 M H_2SO_4 as inorganic acid and 0.5 M oxalic acid as organic acid were applied, a low release of metals and heavy metals were achieved.

Key words: Hydrolysis; metals release; nutrients release; recovery; sewage sludge.

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The decay state of the Spanish tower façade (Bizerte, Tunisia): assessment with non-destructive techniques

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ABSTRACT

The Spanish Tower of Bizerte (Tunisia) shows differential erosion paths on the different rock ashlars used in the construction of its main facade (sixteenth century) exposed to marine aerosol action and several earlier restoration works. In order to determine the degree of damage, non-destructive techniques (NDT) have been used in-situ: ultrasonic velocity determination, surface hardness, moisture measurements and water absorption by Karsten tube test. For a better understanding of the obtained results, samples of each lithology were taken in order to perform laboratory analyses: mercury intrusion porosimetry, polarized light and fluorescence microscopy and ion chromatography for the determination of soluble salts. Results show that weathering degree depends on the intrinsic characteristics of the rock, such as mineralogical composition, degree of cementation and original porous network. It is evident that the NDT, such as simple karsten pipe to measure hydric behaviour, are very useful tools which help to provide on-site results on compaction or hydric properties that inform about the degree of alteration and stability of rock building materials avoiding the sample collection of large quantities of historical materials.

Key words: Non-destructive techniques; stone decay.

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Radioactive cesium as a tracer for lake water circulation of Kusatsu-Shirane volcano, Japan

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ABSTRACT

The Kusatsu-Shirane volcano is one of the active volcanoes in Japan. It has four crater lakes, Yugama, Mizugama, Karagama and Yumi-ike on its summit. Yugama, the largest (around 300 m in diameter) and deepest (maximum depth of around 20 m) one among them, is filled with acidic water of pH 1 and contains dissolved substances with extremely high concentrations. This is because volcanic fluids are continuously supplied into the lake from the subaqueous fumaroles. There are no rivers flowing into or out of Yugama. Nevertheless, significant part of the lake water constantly flows out through the lake bed, and the drained water probably flows back into the lake after partially mixed with the discharged volcanic fluid. Therefore, it is important to clarify the details of water circulation system of Yugama, in order to understand the hydrothermal system beneath the volcano summit area connected to volcanic activities of the Kusatsu-Shirane volcano. Meanwhile, the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident on 11 March 2011 emitted radioactive materials into the atmosphere. Radioactive isotopes of cesium (Cs-134, Cs-137) from the FDNPP accident were deposited even on the summit area of the Kusatsu-Shirane volcano located about 240 km west-southwest from the FDNPP. In this study, we use the radioactive cesium as a hydrological tracer for the investigation of the lake water circulation system and measured its activity concentrations in the crater lakes. We then discussed three year time series of the measured activity concentrations of radioactive cesium in the crater lakes of the Kusatsu-Shirane volcano since the FDNPP accident. Activity concentrations of radioactive cesium dissolved in the crater lakes were measured by gamma spectrometry after separation and pre-concentration of cesium with 3M Empore RAD disk Cs. Activity concentrations of Cs-134 and Cs-137 in Yugama in November 2011 were about 100 and 120 mBq/ L, respectively. They have decreased faster than expected from their physical half-lives. Their apparent half-life can be divided into two phases, before and after May 2012. Radioactive cesium dissolved in Yugama might not have attained equilibrium between lake water and bottom materials before May 2012. The activity concentrations of Cs-134 and Cs-137 in Yugama decay-corrected on April 1, 2011 seem to have decreased at nearly the same rates since after May 2012. The apparent half-lives and the mean residence times of Cs-134 and Cs-137 in Yugama after May 2012 can be estimated to be around 700 and 1000 days, respectively. These estimates suggest that approximately 0.1 % of the total dissolved cesium has leaked out through the lake bed with the lake water per day, assuming that dissolved radioactive cesium could remove from the lake only due to outflow via the lake bed and that the inflow water to the lake contains no radioactive cesium. Thus, it is suggested that 0.1 % of the total volume of the lake water leaks, which corresponds to roughly 500 m^3 per day.

Key words: Kusatsu-Shirane volcano; crater lakes; radioactive cesium; hydrological tracer; Fukushima disaster.

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Water quality and quantity management practices in urban water supply systems: case study of Antalya City, Turkey

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ABSTRACT

In Turkey, 52.5% of drinking water is supplied from surface water resources including dams, rivers, lakes and sea while 47.5% is abstracted from wells and springs for municipal water supply. Groundwater wells and one spring are the drinking water resources in Antalya City. The groundwater has good water quality in general except being hard. Consequently, the water receives no treatment but chlorine is added in the form of sodium hypochlorite solution to protect the water quality against any possible contamination during distribution. Antalya Water and Wastewater Administration (ASAT) of Antalya Metropolitan Municipality has established an efficient Supervisory Control and Data Acquisition (SCADA) system on the drinking water supply system of Antalya City which has around one million inhabitants. SCADA system facilitates monitoring and management of pumps, service reservoirs, and water mains where water quantity and quality parameters such as water levels in distribution reservoirs, flow rates, water pressures, energy consumption, free residual chlorine (FRC), conductivity and turbidity levels are continuously on-line measured. The online monitoring is very useful and effective in monitoring and controlling both water quality and water quantity in water supply systems. FRC levels can be kept within certain levels along the water supply system. Supply from water springs is stopped automatically after turbidity increase following heavy rainfalls. Moreover, the water in the reservoirs is kept fresh and overflows from the reservoirs are prevented. Additionally, pipe bursts can be detected quickly due to the abnormal changes in flow rates which are easily detected online.

Key words: Drinking water; SCADA; water supply systems; water quality and quantity.

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Stabilization of As in contaminated soils using Fe- and Mn-(nano)oxides

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ABSTRACT

Nanomaghemite, nanomagnetite and novel amorphous Mn oxide (AMO) were used in our study to evaluate their influence on mobility of As in three contaminated soils differing in origin of As contamination. Basic adsorption experiments together with incubation batch experiments and pH-static leaching tests were performed. Amorphous Mn oxide proved to have the highest adsorption capacity for As from tested oxides, ranging between 28 mg g 1 at pH 4 and 134 mg g 1 at pH 8. Interestingly, the adsorption capacity in this case decreased with decreasing pH, probably as a result of strong dissolution of amorphous Mn oxide at lower pH. Both Fe-oxides proved the highest adsorption capacity at pH 4 reaching 11 mg g 1 of adsorbed As. Amorphous manganese oxide was also the most efficient amendment in decreasing As concentration in soil solution. After 1 week, it was able to decrease amount of As in soil solution from 106 mg g 1 (control level) to 7 mg g 1. After 8 weeks, the amount of As released from AMO-amended soil was 8 mg g 1 compared to 61 mg g 1 in control variant. The pH-static leaching test were conducted at pH 4, 5, 6, 7 and natural (not adjusted). Here again, in the case of all three soils and almost all pH levels, AMO proved the highest ability to decrease As content in extract. On the other hand, strong dissolution of this amendment at lower pH values (especially pH 4 and 5) was recorded. For that reason, AMO appears as promising stabilizing agent for As, especially in neutral, alkaline or slightly acidic soils.

Key words: Remediation; arsenic; maghemite; magnetite; immobilization.

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Nitrogen Forms and C: N: P Ratio Constrains to typical Microcystis aeruginosa Growth

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ABSTRACT

M. aeruginosa is a type of cyanobacterium which frequently leads to cyanobacterial blooms in surface water. Serious eutrophication occurs in most of the lakes and has become a vital environmental problem in China, such as odours, water deoxygenation, and clogging of water supply systems and so on. Moreover, the microcystin toxins produced by M. aeruginosa would cause several poisonings of domestic livestock and wildlife around the world, and they also pose a health hazard for humans through the use of water for drinking and recreation. Determining the mechanism leading to dominance of M. aeruginosa is very significant as a consequence. This study investigated the effects of different nitrogen compounds and different C: N: P ratios crossed with two nutrient levels (low and high) on the growth of Microcystis aeruginosa, and the uptake and variation of nutrients were also discussed. Results showed that four kinds of nitrogen forms could be absorbed to sustain the growth of M. aeruginosa, but the uptake of nitrate and nitrite was more thoroughly than ammonium and urea. Nitrate, ammonium and urea promoted the growth of M. aeruginosa more effectively than that of nitrite. Low and medium C: N: P ratios (30: 6: 1 and 60: 10: 1) and lower concentrations of nutrients at the same C: N: P ratio were more conducive to the growth of M. aeruginosa. In addition, nutrient condition with C: N: P=60: 10: 1, concentrations of carbon, nitrogen, and phosphorus are 30, 5, 0.5 mg L-1, respectively was the optimum culture condition in this study.

Key words: Microcystis aeruginosa; growth; nutrient; C: N: P ratio; nitrogen forms.

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Searching for solutions to mitigate greenhouse gas emissions by agricultural policy decisions – application of system dynamics modelling for the case of Latvia

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ABSTRACT

European Union (EU) Member States have agreed to limit their greenhouse gas (GHG) emissions from sectors not covered by the EU Emissions Trading Scheme (non-ETS). That includes also emissions from agricultural sector. Although the Intergovernmental Panel on Climate Change (IPCC) has established a methodology for assessment of GHG emissions from agriculture, the forecasting options are limited, especially when policies and their interaction with the agricultural system are tested. Therefore, an advanced tool, a system dynamics model, was developed that enables assessment of effects various decisions and measures have on agricultural GHG emissions. The model is based on the IPCC guidelines and includes the main elements of an agricultural system, i.e. land management, livestock farming, soil fertilization and crop production, as well as feedback mechanisms between the elements. The case of Latvia is selected for simulations, as agriculture generates 22% of the total anthropogenic GHG emissions in the country. The results demonstrate that there are very limited options for GHG mitigation in the agricultural sector. Thereby, reaching the non-ETS GHG emission targets will be very challenging for Latvia, as the level of agricultural GHG emissions will be exceeded considerably above the target levels. Thus, other non-ETS sectors will have to reduce their emissions drastically to “neutralize” the agricultural sector’s emissions for reaching the EU’s common ambition to move towards low-carbon economy. The developed model may serve as a decision support tool for impact assessment of various measures and decisions on the agricultural system’s GHG emissions. Although the model is applied to the case of Latvia, the elements and structure of the model developed are similar to agricultural systems in many countries. By changing numeric values of certain parameters, the model can be applied to analyse decisions and measures in other countries.

Key words: Agricultural systems; emission mitigation; greenhouse gas emissions; manure management; modelling complex systems; nitrogen tax; policy; system dynamics.

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Sources and properties of non-exhaust heavy metals in road dust

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ABSTRACT

Road dust sediment is composed by elements of geological origin and anthropogenic. Considering anthropogenic sources, several recent studies suggest that road traffic is considered to be one of the major sources of environmental pollution in urban areas and seems to be very important in case of low emission problem in many Polish cities. In order to avoid the problem of low emission from household furnaces, samples were collected far away from residential areas. Samples were collected on the sections of A-4 Katowice-Chorzów Batory motorway and on urban roads in Katowice. The main objective of this article is to analyse road dust sediment as an indicator in the process of assessing and identifying vehicle-derived metal pollution. The main sources of exploitation dust formed in the process of vehicle operation are vehicle specific places: braking systems, tires, clutch plates and the erosion of the active layer of the catalytic converters. Detailed morphology and chemical composition of solid phase based on mineralogical and geochemical research is necessary to evaluate their harmfulness and mobility. The purpose of the study was to investigate and characterize the content of 14 traffic-related elements in size classified exploitation dust and road-deposited sediment. Information of the total concentration of metals is not sufficient to assess their potential bioavailability and mobility, as these parameters largely depend on their chemical forms and transport phases. To gain information on the heavy metals fractionation, BCR sequential extraction scheme was implemented. Metals and their chemical forms were analysed both with an ICP-MS, ICP-OAS and AAS. The results show significantly higher concentrations of metals in samples collected on urban roads and on the motorway when compared to the samples taken from a relatively unpolluted mountain area. Based on results, it was found that traffic seems to be the significant pollution sources of metals in water-soil environment and that the following elements observed in the road dust present hazard to the environment: Cr, Zn, Pb and Cu. A very significant contamination with Zn and Cu can be observed in motorway and urban road dust of all fractions. When it comes to Zn, its source can be attributed to the wear and tear of tires, and in the case of Cu to friction materials used in a brake system. Considering fractionation result, a significant quantity of Zn and Pb are on of ion exchangeable positions and/or bounded with carbonates and can be easily released to the environment and pose a risk to environmental and human health. Obtained results make considerable impact on research in environmental monitoring as well as an attempt to analyses of ecological risk assessment.

Key words: Heavy metals; road dust sediment; exploitation dust.

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Assessment of climate change impacts and adaptation options in soil and water resources management

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ABSTRACT

Climate change is one of the most challenging issues which have affected all living matters on the Earth. It has altered the hydrological cycle which has significant impacts on soil and water resources through change sin stream flow, sediment yield and soil erosion. Implementation of appropriate measures to reduce vulnerability requires assessment of climate change impacts and performance of adaptation options. However, there has been less attention paid to the quantities assessment of climate change impacts on sediment and role of soil and water conservation measures for adaptation to climate change. This research aimed to assess the impacts of climate change on soil and water resources of Gorganroud river basin, in north of Iran, and its application in watershed management options. For this purpose, the hydrologic model Soil and Water Assessment Tool (SWAT) in combination with Sequential Uncertainty Fitting program (SUFI2) in SWAT-CUP package were used for calibration, validation and uncertainty analysis. Future climate scenarios for period of 2010–2100 were generated from three GCMs (CGCM1, HadCM3 and SCIRO) for scenarios A1F1, A2, and B1, which were downscaled. The hydrologic model was then applied to simulate the effects of climate change. Soil and water conservation options including range management, soil conservation in agriculture lands and sediment control in streams were proposed to evaluate the effectiveness of watershed management measures for adapting to climate change. Study results indicated a high sensitivity of sediment yield to climate change so that the increase in annual stream discharges were 5.8%, 2.8 % and 9.5% and in sediment yield were 47.7%, 44.5% and 35.9% for different emission scenarios for 2040-2069 period. Implementation of proposed adaptation measures in hydrological model of the watershed showed decrease of 1.1%, 6.9% 7.9% in sediment yield at watershed scale, for A2 scenario whereas in sub basin scale were 7.1%, 20.4% and 23.4 %. These results highlighted the likely impacts of climate change on hydrologic cycle and watershed management options. This emphasized that a systematic assessment of climate change impacts is the basis for selection of proper adaptation measures.

Key words: Global warming; watershed simulation; SWAT; BMPs; Iran.

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Investigating the effect of optimum land use on water turbidity (case study: Manshad Watershed in Yazd Province, Iran)

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ABSTRACT

One of the major factors on water quality reduction in rivers is land use changes. This study was conducted to choose the best way for land use management in order to increase water quality in terms of the least water turbidity, natural landscape improvement and attracting ecotourism. So, the effects of land use changes on water turbidity was investigated for return periods of 2 to 100 years using incorporation of GIS and HEC-HMS model in Manshad watershed. Variable parameters were the amount of CN and land use planning in each simulation stages. After CN map preparation, HEC-HMS model was calibrated for observed runoff-rainfall events using CN method; SCS model and lag time searching process. Finally, the best model was chosen among linear and non-linear sediment rating curves using *Excel* and *SPSS17* software. The results showed that there are a lot of conformity between present land use and land use planning model and terracing remove in land use planning model has caused to increase flood discharge (6.11%), peak discharge (6.23%) and turbidity in the peak discharge (11.02%) compared to present land use. Therefore, according to the results, gardens terracing in allowable slopes help to manage water and soil so that there was almost no difference between the two scenarios in terms of water turbidity in Watershed.

Key words: Land use change; HEC-HMS model; water turbidity; Manshad Watershed.

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Investigation of environmental awareness level of rural students and correlation with their parents' awareness: case study of students in secondary school of Villages in district Jey Esfahan, Iran

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ABSTRACT

O Since in many cases, knowledge and attitude of people affect their behaviour, it's necessary to investigate the attitude and the knowledge of people in the society towards environmental issues. In a word, when the level of awareness and the attitude of people to the environment are known, it's possible to affect their behaviour and functionality. To achieve this knowledge and to determine the level of sensitivity to environmental issues and to investigate the possibility of increasing the role of people in contributing to environmental planning, the present research which is descriptive- analytic and correlation in design, was conducted. The population of the present study consisted of students of secondary school in Villages of district Jey of the Esfahan. The data was gathered by a questionnaire with a sample size of 400 through Cochran formula using two stage Cluster sampling method. In this population, along with the investigation of the level awareness of the students, the effects of other factors such as age and sex of the students, age and the level of education of their parents and also the relationship between the awareness of the students with the awareness of parents were investigated. The results show the level of the awareness of groups to environment (the means of students' answers, and teachers/parents answers to 34 items) is appropriate, and this level is the highest for teachers ($p<0.05$). To investigate the difference between the awareness of girl students and boy students to environmental issues Mann-Whitney test was used. The results show there is a significant difference between the awareness levels of these two groups in five percent level ($P< 0.05$). Also it was found out that boys are more aware of girls in this regard. To investigate the effects of parents' educational level on students' awareness Kruskal- Wallis test was used. To this end, four educational groups of 1- under diploma 2- diploma and associated degree 3- bachelor degree and 4- the post graduate degree were formed. The results of the test indicate that students are affected by the educational level of their parents considering environmental awareness ($P<0.05$).

Key words: Environment; education; students; village; Jey district Esfahan.

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Observation of 17β-estradiol and estrone concentrations in water reservoirs and municipality treatment plants in Istanbul (Turkey)

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ABSTRACT

Nowadays, the number of treatment plants are increasing due to the advancement of technology and industrialization throughout Turkey and the world. This situation brings with it the requirement to analyse the features of the wastewater of treatment plants in a more detailed way. In recent years, it has been remarkable to see studies conducted on endocrine disrupting substances in wastewaters and the effects of these substances on the environment and public health. Being estrogenic hormones which are endocrine disrupting substances and which are found naturally in organisms, 17β-estradiol and estrone are highly important for ecological balance. This study investigates the ELISA based monitoring of two hormones found in effluent water of treatment plants in large amounts, following the determination of the current situation of 17β-estradiol and estrone. In the assessment of drinking water resources and inlet/effluent of treatment plants, it has been found that the values of 17β-estradiol and estrone are 37 – 382 ng/L and <1 and 187 ng/L respectively in water samples; and 38 – 156 ng/L and 2 – 54 ng/L in treatment sludge samples, respectively.

Key words: Endocrine disruptors; 17β-estradiol; estrone; water management; reservoir; ELISA.

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Study of Cu(II) adsorption by siderite and kaolin

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ABSTRACT

The work deals with the study of adsorption properties of natural raw materials – siderite (S) and kaolin (K) as potential adsorbents of heavy metals cations. To enhance their adsorption capacity, as well as simplify their utilization in the dynamic conditions of the adsorption processes, the coating of their surfaces by MnO2 was used. First, the natural samples were activated in the CaCl2 solution during 24 hours. Afterwards, the process of precipitation of MnO2 particles was provided to modify the surfaces of the natural materials. The samples were denoted as siderite modified (SM) and kaolin modified (KM). The changes of the surface parameters after the modification were studied by the low temperature nitrogen adsorption measurement. The increase of the value of specific surface area was observed for both samples after the modification. More expressive was for the SM sample, from 6 to 36 m2 g-1. The porosity did not change markedly the broad pore size distribution in the range of mesopores was obtained for all investigated samples. The mineralogical composition was determined from the phase analyses of the X-ray diffraction measurement. The morphology was studied by the scanning electron microscope. The nonhomogeneous distribution of MnO2 particles on the siderite surface was observed. The MnO2 particles were of needle shape creating agglomerates. The EDX analyses confirmed the presence of basic elements in the natural and modified sample. For the adsorption experiments the removal of Cu(II) was chosen. The batch experiments were conducted in the plastic tubes placed in the rotary shaker. The pH of the model solution influenced the sorption ability of natural materials. At higher pH the precipitation of CuOH was observed. The dependence of the adsorption capacity on the initial metal ion concentration in the solution was studied in the range 10 – 80 mg Cu(II) L-1 at pH 5 and the results were processed by the Langmuir adsorption isotherm. The calculated value of maximum adsorption capacity increased after the modification from 12.9 to 19.8 mg g-1 and from 10.8 to 39.8 mg g-1 for siderite and kaolin, respectively. Also, the introductory column experiments were performed. The columns were filled with mixture of S and K in the weight ratio 32:1. To compare the affectivity of the modified sample, also the mixture of S and KM was used as adsorbent. The model solution of pH 5 and initial concentration 50 mg Cu(II) L-1 was percolated through the columns. Due to the presence of higher dose of natural siderite the solution pH increased during the percolation and precipitated copper was retained in the columns. During the first three hours, the effectivity of both mixtures reached 100 % then slightly decreased to 85 % in average.

Key words: Siderite; kaolin; Cu(II) adsorption.

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Inhibition effect of heterotrophic microorganisms on Cu mobilization from contaminated soil and sediment

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ABSTRACT

Chelating agents, surfactants and many chemicals have been widely used for the extracting heavy metals from contaminated soil and sediment. The EDDS (S,S-ethylene-diamine-disuccinic acid), SDS (sodium dodecylsulfate) or $Na_4P_2O_7$ (tetrasodium pyrophosphate) were studied as biodegradable chemicals enhancing the metal extraction. However, by using of EDDS, metal exchange of extracted metal–EDDS and chemicals complexes with microorganisms and mineral cations may result in metal re-adsorption on the bacterial cells or soil and sediment particles. Therefore, this study deals with the investigation of presence of resistant bacteria in the soil and sediment with different Cu and Zn cations concentration, characterization of soil and sediment contamination, and with the biochemical releasing of Cu and Zn cations in the static flask experiments. As a result of bacterial resistance, the bacterial growth on agar plate and medium with addition of 3mM and 8mM was retarded and the bacterial extraction of Cu and Zn cations from soil and sediment was lower than for the abiotic control especially with chemicals. Moreover, EDDS increased the Zn cations extraction from the soil and sediment and SDS increased the Cu cations extraction from the soil. The significance of Cu and Zn cations releasing was the decrease in the presence of heterotrophic resistant bacteria and not only in the presence of dissolved organic source. The higher adsorption of Cu cations than Zn onto cell surfaces during the biochemical leaching of soil and sediment samples is considerable. These results indicate that live heterotrophic microorganisms influence on the Cu and Zn cations extraction from soil and sediment in natural environment as well as during the remediation processes. The enhancement of chemical remediation processes in organic rich soil and sediment should be achieved by addition of disinfectants. In view of the bacterial adsorption of Cu and Zn cations, the bioleaching provides the selective bacterial extraction of As ions from the contaminated soil and sediment.

Key words: Bioremediation; soil; sediment; resistance; heterotrophic bacteria.

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The water reservoir Ružín - accumulation of priority pollutants in sediments in the years 2010 – 2014

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ABSTRACT

The aim of this contribution is to present the results of exploration oriented to the qualitative analysis of physicochemical composition of heavy metals in samples of the sediments load from water reservoir Ružín I (main reservoir) and Ružín II (compensatory reservoir) in the years 2010 - 2014. The water reservoir Ružín, branches of the Hornád and Hnilec Rivers drained a former mining area, have been polluted in the long-term by heavy metals (Hg, Cu, Zn, Cd, Cr, Pb, Ni, Sb and As). The mineralogical compositions of the sediments were investigated by X-ray powder diffraction (XRPD). Results X-ray powder diffractometry (XRPD) revealed that the study sediment contained quartz as the major mineral and that other minerals, such as sericite and the plagioclase mineral series, were present in smaller amounts. The concentrations of heavy metals were analyzed using X-ray fluorescence (XRF) spectrometry during the years 2010-2014. In terms of the environmental risk, Cu, Ni, As, Sb and Hg exceeded the permitted concentrations in all samples from the water reservoir Ružín I. The results of the analysis of sediments from the water reservoir Ružín II load affirmed the highest contamination mainly by As, Ni, Cd and Sb from the every sampling. The obtained results provide insights for the planning of further sediment utilization.

Key words: Water reservoir; sediment; heavy metals; environmental risk.

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Cu(II) adsorption on TDI-LFG polymer from aquous solutions

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ABSTRACT

This paper presents results of an experimental study of Cu(II) adsorption process from synthetic solutions. The polymer generated from toluene di isocyanate and polyamine (TDI-LFG) was used to adsorb Cu(II) ions. Experimental studies were carried out to determine effects of changing conditions on Cu(II) ions adsorption by TDI- LFG polymer at varying initial Cu(II) concentration, polymer dose, pH and contact time. The equilibrium time of adsorption process were found to be 120 minutes and optimum pH value was determined as 6.

Key words: Adsorption; Cu(II),polymer.

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A comparison study of Cu(II) adsorption between TDI- LFG and 4TDI-LFG polymers

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ABSTRACT

In this study, 4TDI-LFG polymer was used to remove Cu(II) ions from aqueous solutions. TDI amount of previously synthesized polymer (TDI-LFG) was changed and 4TDI-LFG polymer was prepared. The effect of pH, effect of stirring time, the effect of polymer dose and the effect of initial metal concentration on Cu(II) adsorption by 4TDI- LFG have been investigated with batch adsorption experiments. The influence of different TDI amount in the polymer content was evaluated.

Key words: Cu(II) adsorption; polymer; TDI.

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Recycling of glass waste: an application for Esentepe campus of Sakarya University

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ABSTRACT

The environmental pollution increasing by the developing urbanization after the industrialization revolution affects all living things adversely, especially people. Waste recycling projects should be implemented by considering economic benefits besides the reduction of harmful effects on the environment and health. The glass recycling process constitutes the significant part of the prepared projects with this purpose. In this study, glass waste discarded by all students and staff at Esentepe campus of Sakarya University has been used to calculate costs of collecting, aggregation and transport to a recycling plant assumed to be 7.5 kilometres away.

Key words: Recycling; glass waste.

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Comparison of ion exchange and reverse osmosis in process water supplying

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ABSTRACT

In our study the efficiency of obtaining process water from well water using reverse osmosis -which is one of the most prevalent advanced water purification approaches- is explored. The investigation was made on the system of a detergent factory which uses ion exchange treatment to obtain process water and demineralized water and also the characterization of raw water. In the light of these studies, comparisons are made regarding the characterization of water and the operating cost when reverse osmosis is used as the system. The conclusion reached using the results of these studies is: microbial contamination, hardness, metals, organic materials and pesticides are filtered by 99% using reverse osmosis but ion exchange was preferred to reverse osmosis because of its expensiveness and waste production. These disadvantages of reverse osmosis needs solutions.

Key words: Ion exchange; reverse osmosis; proces water.

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National radioactive waste disposal facility in Bulgaria – Preoperational hydrogeological and geochemical site characterization

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ABSTRACT

The State Enterprise Radioactive Waste (SE RAW), Bulgaria has selected the Radiana site, adjacent to the nuclear power plant at Kozloduy in northern Bulgaria as the preferred location to develop the national low and short lived intermediate level waste disposal site. SE RAW has contracted a consortium of the National Nuclear Laboratory (UK) DEKONTA (Czech Republic) and the British Geological Survey (UK) to undertake the three year pre-disposal monitoring programme of work at the site. The aim of the work is to establish the baseline environmental conditions of the site and reflect these in a robust conceptual model. The conceptual model can then be used in the assessment of radionuclide behaviour in the local and regional environment, demonstrating that the chosen site provides and appropriate level of retention, isolation and protection required under international best practice for the disposal of low and intermediate level radioactive waste. The work undertaken has focused on developing the detailed understanding of the geochemical and hydrogeological properties of the vadose and saturated zones underlying the disposal area and how water (and following disposal, radionuclides) move through and interacts within these zones. Using detailed experimental analysis and long term site specific time series data, a comprehensive model has been developed to aid in the understanding of the impacts of the disposals and the levels of risk to key receptors in the region. The article describes site investigation approach (drilling works, ground water monitoring program, vadose zone investigation, etc.) to achieve goals required for safe operational of permanent low and intermediate radioactive waste disposal facility.

Key words: Geochemistry; ground water; hydrogeology; monitoring programme; radioactive waste disposal site investigation; saturated zone; vadose zone.

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Evaluation of soil quality on reclaimed lignite mine land in West Macedonia, Greece

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ABSTRACT

The West Macedonia Lignite Centre (WMLC) is a complex of surface mines that produces annually 45 Mt of lignite and excavates more than 280 Mm^3 of earthy materials. After 60 years of operation, WMLC occupies 16,000 ha. Up to now 4,000 ha of waste heaps have been reclaimed; sloped surfaces have been reforested and horizontal surfaces are rented to local farmers as farmland. Based on the environmental permits that are in force, WMLC conducts systematic soil sampling and lab analyses for determining the quality characteristics of reclaimed soils. These analyses concern both soil fertility and pollution control. According to the results of lab analyses carried out so far, reclaimed soils are characterized by an alkaline pH and normal electrical conductivity values. Their gradation varies from moderately coarse to fine. In many samples have been determined particularly low clay percentages, a typical feature of recently formed soils. Organic matter content varies from minimal to high. The latter applies to samples collected in waste heaps where large lignite quantities have been dumped due to reasons related to the applied mining method. Reduction of organic matter content with depth, which is typical in normal agricultural soils, is not observed. A large number of samples exhibit high $CaCO_3$ content. This is because most waste heaps are formed by marls that have been recently dumped and there was insufficient time to wash $CaCO_3$. Cation exchange capacity is high, mainly due to high concentrations of iron in assimilable form. Regarding the concentrations of nutrients, these exhibit a wide variation depending on the element and sampling depth. Sufficient concentrations of the exchangeable cations Potassium, Calcium and Magnesium have been determined in the majority of the soil samples. Potassium concentrations are relatively low. Phosphorus concentrations are below the generally accepted availability level of 20 mg/kg. Regarding the availability of micronutrients, only Zinc exhibits deficiency, while Iron and Manganese concentrations are too high. Heavy metals concentrations are below the intervention values determined by the Dutch law for soil quality with the exception of Nickel, which sometimes exhibits concentrations higher than the limit value of 210 mg/kg. Chromium concentrations are also high but does not exceed the limit value of 380mg/kg. Nevertheless, it must be noted that high concentrations of Nickel and Chromium are common in Greece and are related to the geological characteristics of certain areas. From the results, it is concluded that, in order to avoid adverse impacts on natural resources, special attention must be paid to the rate, time and methodology of nitrogen fertilisers and, to a lesser extent, phosphate fertilisers application in reclaimed mine land. As far as pollution control is of concern, Iron is the only heavy metal that exhibits systematically higher concentrations in soil samples collected from the reclaimed waste heaps than in soil samples collected from areas of West Macedonia region that have been not affected by mining operations.

Key words: Lignite; West Macedonia; soil quality; pollution.

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Effect of prolonged weakening of the geomagnetic field (GMF) on the concentration of some elements in the hair of laboratory rats

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ABSTRACT

The Earth's magnetic field plays an important role in the activity of living organisms by affecting the course of physic-chemical reactions taking place in the body, among others. GMF disturbances, like exposure of the body to an additional magnetic field, affect the evolutionarily formed permeability of cell membranes, the magnetic orientation of macromolecules, and subcellular liquid crystal structures. From the viewpoint of biomagnetic theory, the presence in living organisms of magnetic ions from the iron group (Ti, V, Cr, Mn, Co, Fe, Ni and Cu) or others (such as molybdenum) is very important. These elements differ in physical and chemical properties but share some traits. The aim of the study was to determine the effect of long-term geomagnetic field (GMF) deprivation on the concentration of selected elements in the hair of laboratory rats. A total of 32 Wistar laboratory rats were divided into four equal groups (males and females) kept under hypogeomagnetic conditions (GMF vertical component below 20 nT) and two control groups (males and females) kept free of field disturbances (GMF vertical component approx. 38 000 nT). At the beginning and at 7 months of the experiment, hair was taken from the dorsal part of all rats. The concentration of Fe, Mn, Ni, Co, Cr and Cu in hair were determined using the ICP method and a JY238 inductively-coupled plasma-atomic emission spectrometer (ICP-AES) (Jobin Yvon, France). In order to evaluate the effect of GMF deprivation on the concentration of the analysed elements in hair, analysis of variance according to SASGLM procedure (SAS/STAT User's Guide, 2001) was performed. Significance of differences between the mean changes (Stage II−Stage I) in the content of the elements in hair of various groups was verified using the Scheffe test. The study showed that long-term GMF deprivation caused a reduction in the iron, copper, chromium and manganese content of hair in rats from the experimental groups, and increased or remained unchanged in the control rats. Although the mechanism behind mineral imbalances due to GMF shielding has received insufficient study, the results obtained show that the effect of this environmental factor on animal organisms should be taken into consideration.

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Key words: Geomagnetic field; rats; hair; elements.

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Land cover assessment of Suez Canal region using remote sensing data

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ABSTRACT

Development of Suez Canal region is the core of the national developing strategy. All development proposals aforesaid and which is rightly considered a pillar real comprehensive development in the Suez Canal region need preliminary studies for defining and precisely allocating the most suitable sites that can be held by these projects. The case necessarily and firstly requires monitoring the situation on the ground. The role of remote sensing and GIS is realized in this study in the creation of geo-information databases to the current land cover types and its uses, as well as determining the optimal future uses of land, which can crystallize makers decisions of comprehensive plans for development in these areas and determine the most suitable candidate sites for each project and alternative development projects. This paper mainly emphasizes the characteristics of Suez Canal region and the application of FAO LCCS to classify that into land cover classes. The land cover database will fit and reflect the need for reliable information that are essential for sustainable management of agricultural land, natural vegetation as biodiversity, water resources, as well as for environmental protection and land use planning and land degradation. The total study area is covering of 9944.77 km² (994477 hectare). The landscape classification was based on Rapid eye data acquired in January 2014 having five multispectral band combinations of 5 meter spatial resolution. Geographic Information System (GIS) was used to manipulate the attributed layers of classification in order to reach the maximum possible accuracy. GIS was also used to include all necessary information. The identified land cover classes of the study area are 24 classes till the 4th level of LCCS, through a careful observation of spectral characteristics of Rapid eye images and ground survey information. Land cover maps at scale 1: 50,000 were produced for 21 districts in Suez Canal region. In smaller scale the whole land cover map were produces as a collective map. The identified vegetative land cover classes of the study area are irrigated herbaceous crops, irrigated tree crops, closed sparse shrubs with sparse herbaceous and very open shrubs/herbaceous. The non-vegetated land cover classes include bare rock and/or coarse fragments, bare soils (stony, very stony and salt marshes, seasonally submerged area, sabkha), loose and shifting sands and sand dunes. The water bodies were classified as artificial perennial water bodies (Suez Canal, irrigation and drainage canals and fish farms) and natural perennial water standing bodies as lakes. The artificial surfaces of the non-vegetated areas include linear and non-linear features. Within the study area, the land cover classes of bare rock, stony bare soil and shifting sand are covering almost more than 50% of the total area. The vegetated areas, both of the irrigated trees and irrigated herbaceous areas were close to each other with an area of 63679, 64702 hector respectively. Fish farm and fish ponds are extending over 43047, 9517 hector respectively. An error matrix and Kappa Statistics were used on classified map to determine the percentage of land cover accuracy. The overall accuracy of total classes for the entire Study area was 97.2%. The selected sub region in this study may have a different accuracy, if a separate sample is administrated for the sub region only.

Key words: Land cover mapping; LCCS system; Suez Canal region; Rapideye.

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Characterization of polluted desertic soils in Taltal, a mining county in northern Chile

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ABSTRACT

A As a consequence of a lack of mining closure regulation, a large number of abandoned contaminated mine sites have been identified in Taltal, a coastal city of approximately 14,000 inhabitants, located in the desertic Antofagasta Region at north of Chile. The aim of this work was to carry out a sites characterization in order to determine the concentrations of heavy metals in polluted soils as a first step to propose and implement remediation technologies. Samples of soils were taken from 6 sites, located mainly at coastal border. The soils samples were taken at 0–20 cm depths (baseline soil samples were taken at 150 meters distance at each site 50 cm depth), sieved at 2 mm and dried at 105°C for 24 h before physico-chemical characterization. Samples of seawater were also taken. The total heavy metal concentrations were determined by inductively coupled plasma – mass spectrometry. The soils had neutral alkaline pH values, conductivity ranged between 5 and 30 mScm-1, with low organic matter contain (< 0.10 % as total organic carbon). The concentration of heavy metals determined in soils were: Mo (1.23 - 20.3 mgKg-1), Co (2.35 - 58.6 mgKg-1), Ni (2.94 - 44.2 mgKg-1), Se (1.94 - 3.37 mgKg-1), Ag (0.86 - 18.7 mgKg-1), Hg (0.88 - 46.5 mgKg-1), Sb (3.66 - 135 mgKg-1), Va (13.6 - 194 mgKg-1), Pb (10.5 - 92.2 mgKg-1), As (9.91 - 2,793 mgKg-1), Cu (142 - 12,716 mgKg-1), Zn (33.5 - 111 mgKg-1) and Ba (16.3 - 10,447 mgKg-1). These values exceed the established limits of the international standards. X-ray diffraction analysis did not shows the presence of crystalline compounds of these heavy metals, and were mainly found silice, magnesium, calcium, iron, and aluminum compounds. Meanwhile, baseline soils had pH and conductivity in a range of 7.23 - 9.74 and 0.287 - 12.26 mScm-1, respectively. Additionally, average bulk density and porosity of baseline soils were 1.37 g mL-1 and 37.40%. Complementary, seawater samples contained Cu (3.4890 mgL-1), Ni (0.0074 mgL-1), Zn (0.8059 mgL-1), As (0.0279 mgL-1), and Pb (1.0356 mgL-1) concentrations were above the recommended marine water quality criteria for the protection of aquatic life and human health, probably indicating marine pollution by dust entrainment. It was demonstrated that the abandoned polluted sites were a source of heavy metal contamination of coastal areas and eventually could cause exposure to the population at such contaminants. The implementation of remediation technologies, which are of interest for regulators, the industry, and the population is necessary.

Key words: Polluted soils; heavy metals; remediation technologies; abandoned sites.

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Groundwater vulnerability assessment in Middle Nile Delta- Egypt using hydrogeochemistry and environmental isotopes

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ABSTRACT

Groundwater is the main drinking water for most inhabitants in the Nile Delta, Egypt whether via domestic or private hand dug wells. Many of households, particularly in the Middle Nile Delta villages, are using the short handpumps (17- 20m deep) to supply drinking water. Such water is seriously affecting the public health since the alluvial soil is believed to have been affected by pollutants of heavy metals from different anthropogenic sources. The present study evaluates such groundwater suitability for drinking and its vulnerability. A total of twenty five handpumping shallow (23- 35 m depth) and three deep (60- 120) groundwater in addition to four surface water were sampled and analysed for heavy metals and stable isotopes. Moreover, 24 drill cutting samples were collected from three wells (25- 35 m depth) in order to investigate the sedimentological, mineralogical and geochemical characteristics of the aquifer and its overlaying layers. The obtained isotopic data define the water samples into two main groups representing the present surface Nile water (young water) and Nile water prior to High Dam construction, 1963 (paleowater) endmembers. The deep groundwater samples display the isotopic signature of paleowater. The handpumping groundwater samples were categorized in to three categories; paleowater, young water and mixing between the former both categories. The spatial distribution patterns of δ D, and δ ^{18}O through the shallow groundwater indicate that, there is no relation between water type and groundwater flaw path and water depth. Presence or absence clay lenses within the aquifer (Mit Ghamr Formation) are the main factor which controls the water type. The groundwater TDS values (275-1274 mg/L) indicating 64% of shallow groundwater samples under a critical condition. The concentration of B, Ba, Cr, Cu, Pb, Sr and Zn are under acceptable limits for most studied samples. Mn (220-1700 ppb) representing critical concentration where its concentration is exceeded permissible limits to 95% of studied groundwater samples. There is now fixed spatial pattern of the heavy metal distribution in groundwater, but their concentrations decrease with depth increasing and in general, the deep groundwater samples are less affected by the overlaying semipervious layer. The results strongly suggest that the upper semipervious aquitard clay layer is responsible for the high Mn contents of underline shallow groundwater. This layer encloses discontinuous sand silty lenses with considerable amounts of rhodochrosite ($MnCO_3$) concretions of different shape and sizes which represent a potential source of Mn. Consequently, Mn is introduced to the water bearing formation in soluble form due to the dissolution of the concretion.

Key words: Groundwater pollution; heavy metal; hydrogeochemical processes; Nile Delta.

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Effects of pH and concentration upon TiO_2 nanoparticle-ligand-NOM stability

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ABSTRACT

pH can play a major role upon manufactured TiO_2 nanoparticles stability with ligand (alginate) and NOM (Suwannee River humic acids) concentrations. The Dynamic Light Scattering (DLS) and electrophoretic experiments have been used to explore the TiO_2 nanoparticles aggregation, disaggregation and stabilization states, considering three pH-dependent electrostatic scenarios. When pH is below the TiO_2 nanoparticle point of zero charge, nanoparticles have positively charged surface whereas alginate and Suwannee River humic acids show negative state. TiO_2 nanoparticles adsorption becomes rapid by acting surface charge neutralization and aggregation. If alginate and humic acids concentrations concentration are increased a reverse phenomenon occurred with TiO_2 nanoparticles stabilization concomitantly with charge inversion. In the second electrostatic scenario, at the surface charge neutralization pH, TiO_2 nanoparticles are rapidly forming aggregates. Adsorption of alginate and Suwannee River humic acids on aggregates leads to their partial fragmentation. In the third electrostatic scenario, when nanoparticles, alginate and Suwannee River humic acids are negatively charged, only a small amount of Suwannee River humic acids is adsorbed on TiO_2 nanoparticles surface. It is found that the fate and behavior of individual and aggregated TiO_2 nanoparticles in presence of environmental compounds are mainly driven by the complex interplay between electrostatic attractive and repulsive interactions, steric and van der Waals interactions, as well as concentration ratio. Results also suggest that environmental aquatic concentration ranges of humic acids and biopolymers largely modify the stability of aggregated or dispersed TiO_2 nanoparticles.

Key words: Colloid; NOM; TiO_2; nanoparticle; pH; concentration.

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Endocrine disrupting compounds in urban rivers: monitoring and application as wastewater tracers

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ABSTRACT

Endocrine disruptors are chemicals having a potential effect on the reproductive system of aquatic organisms and humans, resulting in hormonal system disturbance and formation of abnormalities. Phenolic compounds, as alkylphenol polyethoxylates (AKP) and bisphenol A (BPA), are one of the growing concern endocrine disruptors, because of a high persistence, potential toxicological effects and domination in wastewaters. Around 55% of world used AKP are consumed for industrial need and about 15% of AKP are expanded in household applications as nonionic surfactants in cleaning agents, disinfectants and pesticides formulations. AKP are unstable in the aquatic environment, oxidizing to short-chain nonylphenol ethoxy-acetic acid (NP1EC), nonylphenoxy-acetic acid (NP2EC) and nonylphenols (NP) in aerobic conditions and hydrolyzing into various short chain metabolites as nonylphenol monoethoxylate (NP1EO) and nonylphenol diethoxylate (NP2EO) in anaerobic one. Metabolites of NP and OP are known to exhibit high toxicity and able to mimic estrogens in the hormonal regulations. Bisphenol A (BPA) is a monomer used in the production of polycarbonates and epoxy resins from which a variety of products are generated and it is known by estrogenic properties, histopathological changes and multigenerational toxicity in aquatic organisms. European Union considers AKP as hazardous compounds that should be monitored and controlled in waters. But in some EU - neighbouring countries, sharing transboundary water resources, i.e. Ukraine, Russia and Belarus, the information on phenolic endocrine disruptors in the environmental is very limited. Taking into account the lack of regional studies on the distribution of phenolic compounds, but also the previous positive experience of the passive sampling application, we focused our research on: (i) the investigation of phenolic endocrine disruptors in urban rivers of Eastern Ukraine using the time integrative passive sampling approach and (ii) the function of phenolic metabolites ratio as a tracer of wastewaters.

Key words: Emergent pollutant; surface water; urban; wastewater.

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State of the art for a smart screening of surface continental waters contaminated by emergent pollutants

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ABSTRACT

The process of urbanization contributes to the diffuse of different chemical substances both dissolved and particulate to water catchments. The general approach considers generally dissolved and particulates. From 80's years and recently colloidal transport is taken into account and the concept of physical speciation introduced but also the conceptual phase called "thrue dissolved" or labile fraction. The aim of this study is just to present: a. the limit of general approach, b. the meaning of Labile Trace Elements (LTE) fraction, c. the importance of the colloidal pumping mechanism and speciation, d. an analytical platform requested for colloids, nanoparticules and LTE analysis, e. the interest and limit of in situ passive probes to measure and identify LTE fraction, f. the new generation of in situ passive probes, and g. the interest of stable isotope measurements for chemical speciation fingerprint. From several research data, field experiments, hyphenated platform, we propose a new approach allowing detailed, précised and objectives data collection but also how to perform, modestly but intelligently, the signals of contaminated surface continental waters by emergent pollutants..

Key words: Surface waters; inorganic contaminant; trace elements; DCE; holistic.

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Environmental aspects of Inka expansion: case study from Lomas de Lachay, Central Coast of Peru

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ABSTRACT

Inka empire expansion, from ca. 1450 to 1532 AD, was contemporaneous with relatively fast climate changes associated with transition between the Medieval Warm Period and the Little Ice Age. To study environmental influences and context of Inka socio-cultural development interdisciplinary, geoarchaeological studies were conducted in Lomas de Lachay, which is located about 100 km north of Lima, on the Central Coast of Peru. Due to seasonal, advective fogs (garua) in Lomas de Lachay peculiar ecosystems of lomas were formed. Although their abundant natural resources attracted people since early Holocene, settlement phases were separated by long hiatuses. During the Late Horizon (1470-1532 AD) in Lomas de Lachay four large settlements, located in close proximity of each other and near slope springs, were established. Architectural remains, ceramic fragments and location in watershed parts and upper parts of slopes suggest that their inhabitants were related to highland groups, rather than to coastal Chancay culture. Three cemeteries were discovered: two of them with Chancay artefacts and one with syncretic, highland-Chancay pottery. Both in settlements and in cemeteries ceramic associated with Inka influences (styles Inka Local, Chimú-Inka) was found. In the Late Horizon environment of study area was strongly influenced by an increased frequency of El Niño episodes. Rainstorms connected with this climatic phenomenon alimented slope springs and perhaps allowed the emergence of small creeks in the uppermost parts of gullies (quebradas). Due to water accessibility during dry season permanent settlements could existed. In LL-14 profile two Holocene buried soils lying on aeolian sands, which were TL dated to 21.2±3.2 ka BP, were found. Unfortunately it was impossible to date buried soils themselves, but given the very slow rate of pedogenetic processes in deserts soil formation phases were separated by centuries-long hiatus. Presumably at least the upper buried soil was covered with mass movements triggered by intensive llama grazing. Transhumance and camelid herding is confirmed by written sources in the early Colonial period (1532-1600 AD). Due to favourable environmental conditions, connected with high El Niño frequency, during the Late Horizon permanent settlements developed in Lomas de Lachay. Cultural analogies to highland areas and Inka influences suggest that study region was inhabited by colonists resettled by Inkas (mitmakuna). Presence of such groups was also confirmed in other lomas of Central Coast like Lomas de Caringa.

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Key words: Geoarchaeology; El Nino; lomas; Late Horizon; environmental archaeology.

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Effect of aluminium on dissolved organic carbon in Andic and Metamorphic temperate rain forest soil

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ABSTRACT

Soluble or colloidal organic matter that would otherwise be available for microbial assimilation and its interactions with soil minerals has not been fully established. The role of aluminium (Al) on carbon (C) sequestration and Al effects on available C and biodegradation was evaluated in the top (5–15 cm) of Andic and Metamorphic mineral soils under old growth temperate rain forests in South of Chile. Water extractable organic matter (WEOM) and samples of mineral soils were incubated with increasing dosage of $AlCl_3$ at environmentally relevant concentrations: 0, 0.2, 0.4, 2, 4 and 8 mg L-1. The mineralization of WEOM to CO2 after 3 days of incubation experiment showed no differences compared with the control without Al^{3+} addition. Toxic Al^{3+} concentrations were observed over a molar Al:C ratio > 0.12 only after 15 days of incubation on the rate of microbial respiration. In contrast, Al^{3+} addition to mineral soils horizons presented a continuous decrease of mineralization rate from Al:C ratio > 0.17. Al-humus formation as indicated by ATR-FTIR spectra in mineral soils. Our results supported the hypothesis that organic C mineralization is not affected by potentially toxic Al^{3+}, even at low pH (3.8-4.3) but by microbial availability of C. We conclude that the Al:C ratio is a crucial pedogenic indicator of C transformation affecting particularly the availability of organic C in acidic soils.

Key words: Soil carbon availability; WEOM; aluminium.

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Assessment of mechanisms and dynamics of pollution accumulation by magnetic and geochemical records of the Saint Jean church façade's weathering (Dijon, France)

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ABSTRACT

On the south-east Façade of the church Saint Jean in Dijon (France), a black crust weathering is present and the atmospheric pollution is settling on. The façade is shelter from the driving rain and it is near the traffic. The studied area can be divided in two parts with different atmospheric pollution exposition length: on the one hand one is exposed from 1811 and on the other hand one is cleaned up on 1921. Then, non-destructive techniques as magnetic susceptibility and surface rock soiling measures by colorimetry are made on the façade. And samples were collected by scratching on the façade in order to make remanent magnetic analyses (anhysteretic remanent magnetization ARM; isothermal remanent magnetization IRM) and geochemical analyses. Results display that anthropogenic particles and natural dusts tend to be similarly affected by deposition/soiling and rain washing mechanism. Magnetic parameters (partial ARM and IRM) and also maps showing the titanium and the arsenic dispersion on the studied area, illustrate this mechanism. Furthermore, the parameters measured on the part which is the most exposed since 1811 are superior to the parameters of the other part.

Key words: Magnetic susceptibility; accumulation/soiling; pollution; building heritage.

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OGC SWE based system for environmental monitoring

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ABSTRACT

In this paper a sensor network for automated deformation monitoring is presented. Such network has heterogeneous structure in terms of both hardware and data, and also has a wide area of applications: monitoring of bridges, dams, tunnels landslides etc. Most common sensors in such systems are geodetic, geotechnical and meteorological sensors, and therefore they are suitable example to be described and modelled using OGC SWE standards. A number of test measurements were made to present the behaviour of this system. Based on the results possible applications are discussed. Properties observed by sensor networks range from weather data, air quality data, hydrological information like water level measurements, to positioning information of objects or persons. In order to make use of such a big range of very heterogeneously structured information the integration into application systems becomes very important. The current situation of sensor networks is that they are developed around different communities of sensor types and user types, with each community relying on its own stovepipe system for discovery, accessing observations, receiving alerts, and tasking sensor systems. The integration of a new sensor into those systems is a highly expensive task, due to the incompatible encodings and services. Sensor Web is a coordinated observation infrastructure composed of a distributed collection of resources that can collectively behave as a single, autonomous, dynamically adaptive and reconfigurable observing system that provides raw and processed data, along with associated meta-data, via a set of standards-based service-oriented interfaces. In contrast to sensor networks, the developments of the sensor web focus on an interoperable service oriented architecture. Traditional Open Geospatial Consortium (OGC) services allow you to request sensor data, but only in a limited manner. Therefore the OGC founded the Sensor Web Enablement (SWE) initiative which develops standards for access and control of sensors and sensor networks via the Internet. The goal of SWE is to enable all types of internet-accessible sensors to be accessible and, where applicable, controllable via the World Wide Web. SWE can be seen as an abstraction layer that hides the complexity of underlying sensor network protocols and interfaces. This facilitates, in case the sensors are encapsulated by SWE services, the development of clients and the integration of sensor data into any kind of application (e.g. simulation models). From the opposite perspective SWE also reduces the amount of work sensor providers have to perform for offering integration means to couple their sensors with higher level applications. Furthermore, the nature of the different SWE standards allows the seamless integration of sensors into spatial data infrastructures. This makes it possible to enhance such infrastructures with means for handling real-time measurement data. As a consequence the creation of more powerful alerting systems, simulation tools and information systems becomes possible by bringing together conventional data sources (e.g. maps, geographic features or coverage) and real time measurements.

Key words: Sensor web; deformation monitoring; sensors.

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Variation of the physico-chemical condition and labile trace metals in a differing tropical wet events: The case of the Pasig River, Philippines

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ABSTRACT

In this study, the water quality of an estuary under different type of wet conditions was examined. Period 1is characterized by a local weather of dry to wet. Period 2, on the other hand, experienced continues wet event. During the sampling regime of Period 1 and Period 2, the accumulated rainfall rate is 79mm and 79.8mm, respectively. Looking at the background, within 20 days before the measurements, the accumulated precipitation for Period 1 was 14.4mm, while, 125.2mm for Period 2. Physico-chemical parameters were measured in situ using YSI 6600 V2 data probe. Diffusive Gradient in Thin-Film (DGT) probes were used to detect the trace metals: Cd, Co, Cr, Cu, Ni, Pb, and Zn. Five sites along the stretch of the Pasig River were monitored. These sites represent the intrusion of the saline water (from the Manila Bay), the river per se, midstream, and the interference of the freshwater (the Laguna Lake). The state of the water quality is distinguished by the physico-chemical conditions. Period 1 can be described having oxic water; pH is in alkaline level; presence of turbidity and chlorophyll a was high; but weak in terms of salinity, total dissolved solids and conductivity. The water of the Pasig River in Period 2 is hypoxic; pH is in between acid and neutral level; turbidity and chlorophyll a were lesser; and salinity, total dissolved solids and conductivity were higher. The wet periods can also be discriminated if the labile trace metals will be factored in. In general, trace metal concentrations are higher in Period 1.If the Environmental Quality Standards for the Provisional Environmental Quality limit for aquatic system and abundance in freshwater will be followed, Cd, Co (Periods 1 and 2), Cr, Cu, and Zn surpassed the limit. Dilution effect is widely felt during Period 2 resulting to a wash out event. The concentrations in Period 2 decreased to about 99% for Cd, 54% for Co, 99% for Cr, 73% for Cu, 90% for Ni, 97% for Pb, and 7% for Zn.

Key words: Wet event; labile trace metals; Pasig River; Philippines.

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The use of multivariate statistical analysis to assess the contamination of urban soils by heavy metals of industrial locations in the Greater Toronto Area, Canada

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ABSTRACT

A good understanding of urban soil contamination with metals and the location of pollution sources due to industrialization and urbanization is important for addressing many environmental problems. The results are reported here of an analysis of the metals content in urban soils samples next to industrial locations in the Greater Toronto Area (GTA) in Ontario, Canada. The analyzed metals are Cr, Mn, Fe, Ni, Cu, Zn, and Pb. Multivariate geostatistical analysis (correlation matrix, cluster analysis, principal component analysis) is used to estimate soil chemical content variability. The correlation matrix exhibits a positive correlation with Mn, Fe, Cu, Zn, Cd, and Pb. The principal component analysis (PCA) displays two components. The first component explains the major part of the total variance and is loaded heavily with Cr, Mn, Fe, Zn, and Pb, and the sources are industrial activities and traffic flows. The second component is loaded with Ni, and Cd, and the sources could be lithology and traffic flow. The results of the cluster analysis demonstrate three major clusters: 1) Mn-Zn, 2) Pb-Cd-Cu andCr, 3) Fe-Ni. The geo-accumulation index and the pollution load index are determined and show the main I_{geo} values to be in the range of 0-1.67; the values indicate that the soil samples studied for industrial locations in the GTA are slightly to moderately contaminated with Cr, Fe, Cu, Zn, and Cd, and moderately contaminated with Pb, while Ni, and Mn fall in class "0". Regarding the pollution loading index (PLI), the lowest values are observed at stations 6, 7, 9, 10, 11, 12, 25, 27 and 28, while the highest values are recorded for stations 1, 5, 6, 13, 14, 16, 17, 18, 20, 22 and 24, and very high PLI readings are seen for stations 5, 13, 16, 17, 18, 22 and 24. These data confirm that the type of industries, especially metallurgical and chemical related ones, in the study area, in addition to high traffic flows, are the main sources for soil pollution in the GTA.

Key words: Heavy metals; spatial distribution; multivariate analysis; pollution loading index; Greater Toronto Area.

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Spatial heterogeneity in Aerosols over different regions of India

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ABSTRACT

Based on Aerosol Radiative Forcing Network (ARFINET) data synthesis over India, it was noticed that there have been statistically significant increasing aerosol loading (AOD at the rate of 2.4% per year during the last decade) and with a significant seasonal variability. Heterogeneity in aerosols over India is the hall mark due to distinct geographical environment, diverse human activities, region specific source distribution, sink characteristics and microphysics. Fine particle air pollution is characterized in three Indian major cities and the study revealed that in New Delhi air 230±1.6 g/m^3 of fine particle mass concentrations were found during the winter and WHO observations also supports these results (an annual average of 153 micrograms of small particulates, known as PM2.5, per cubic metre). The situ measurements of BC mass concentrations using high altitude balloons have revealed strikingly large BC concentrations at free troposphere heights. Threefold increase in aerosol extinction coefficient was observed at higher atmospheric layers compared to that near the surface and a substantial fraction (approx. 50 to 70%) of aerosol optical depths was found contributed by aerosols above clouds. Results from ICARB have revealed that while most of aerosols are located below clouds over southern India, more than 70% of aerosols are located above clouds over central India. Anantapuram has a semi- arid climate (southern India), with hot and dry conditions and it is known for being the district with the second lowest rainfall (annual average rainfall is 552 mm) in India after Jaisalmer District of Rajasthan State. Anantapuram is the second most drought-affected district of India with variety of soil structures, Denudation of the hills, poor water availability, crop production losses and decreased precipitation with increase temperatures. The source and types of aerosols observed in this region has been analysed and the studies revealed that the fine mode particles are dominant over the site. The surface ozone concentrations in this region exhibit higher daily mean concentrations of ozone than urban sites. The ozone concentration and associated Leaf injuries and crop yields are also highlighted in this presentation.

Key words: Aerosols; heterogeneity; Aerosol Radiative Forcing Network; India.

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Performance of LED lighting strategies on simultaneous biogas upgrading and biogas slurry nutrient reduction by microalgae Chlorella sp.

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ABSTRACT

Biogas is a promising renewable energy, but has to be upgraded to meet the efficient combustion standard. This study focused on the responses of the microalgae dry weight, biogas CO_2 removal, and biogas slurry nutrient reduction to various light-emitting diode lighting strategies. The optimal parameters were determined and analysed to explain the performance of the microalgae biogas upgrading system. The results showed that the microalgae biogas upgrading system used in this study could effectively upgrade biogas and simultaneously reduce biogas slurry nutrient. Red light was the optimum light wavelength for microalgae growth, biogas upgrading, and biogas slurry nutrient reduction. Only moderate light intensities (i.e., 800, 1200, 1600, and 2000 μmol m^{-2} s^{-1}) were suitable for microalgae growth. The optimal lighting strategy should be incremental light intensity strategy since it could avoid photo inhibition at the initial culture phase and insufficient light intensity at the latter culture phase. The optimal lighting strategy should be an incremental light intensity strategy: Phase 1 (from 0 h to 48 h) with 800 μmol m^{-2} s^{-1}; Phase 2 (from 48 h to 96 h) with 1200 μmol m^{-2} s^{-1}; Phase 3 (from 96 h to 144 h) with 1600 μmol m^{-2} s^{-1}; Phase 4 (from 144 h to 192 h) with 2000 μmol m^{-2} s^{-1}. Under this lighting strategy, the microalgae dry weight was 446.98 ± 25.32 mg L^{-1}; the methane concentration in the upgraded biogas was 92.87 ± 4.10% (v/v); the chemical oxygen demand, total nitrogen, and total phosphorus removal efficiency was 92.67 ± 5.14%, 80.87 ± 6.25%, and 79.33 ± 6.18%, respectively.

Key words: Light wavelength; light intensity; CO_2 removal; dry weight.

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Assessment of lignite sold quantity in Turkey

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ABSTRACT

Lignite is one of the important energy resources in the world and Turkey has large lignite reserves. In this paper, the lignite sold quantity (ton) was assessed by using the linear regression analysis and regression model was developed. The lignite sold quantity are covered from 2000 to 2014. The model is given by; Years = 2028.24 - 0.000012 sold quantity (ton). R^2 and adjusted R^2 for linear regression model are calculated that 78.40% and 76.74%, respectively. It was concluded that lignite sold quantity (ton) can reliably be assessed by using the linear regression model. Finally, this study showed that the beneficial of linear regression model for estimation of years and helps to improve energy issues.

Key words: Energy; lignite; import prices; linear regression analysis; Turkey.

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Key role of paleo-highs in richness of organic carbon in source rocks, case study Gachsaran Oilfield, Dezful Embayment, SW Iran

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ABSTRACT

The Gachsaran Oilfield is located 200 km southeast of Ahwaz city and 5 km of the Gachsaran city. The aim of this study was to calculate the Total Organic Carbon (TOC) content of the Pabdeh Formation as well as to define its vertical and lateral variations. For this purpose, TOC calculations carried out in 6 selected wells. As the well-established delta LogR method is not adequately applicable in the carbonate strata, the artificial neural network method was used for TOC calculation. Subsequently, totally 9 selected samples were measured for TOC (wt%) to check validity and calibration of the results. Results from neural network analysis showed a reasonable correlation with the observed TOC data in both carbonate and shale layers. According to our results, the average TOC values of the Pabdeh Formation range from 1.34 to 2.77.Results provide an organic geochemical zoning for the Pabdeh Formation where the higher organic content occur in the middle part of the Pabdeh Formation. In addition, mapping of the average TOC values of the Pabdeh Formation in this oilfield shows that the studied formation has the highest average TOC values in a number of wells with the maximum average TOC in well 36. The organic rich domain is located in a paleo-depression developed adjacent to the paleo-high which lies in the south eastern sector of this oilfield. The study exemplifies the role of paleo-highs in developing appropriate conditions for deposition of organic rich strata: restricted circulation in inter-paleo-high domain resulted in anoxic conditions and development of locally speared organic carbon rich zone.

Key words: Paleo-high; organic carbon; Gachsaran Oilfield, Dezful Embayment.

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Biosurfactant producing and diesel oil degrading bacteria isolated from petroleum hydrocarbon contaminated river waters

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ABSTRACT

Accidental leakages during hydrocarbon fuels transportation and other activities are inevitable, making these hydrocarbons the most common global environmental pollutants. During cleaning up, microbial degradation processes aid the elimination of spilled oil from the environment after critical removal of large amounts of the oil by various physical and chemical methods. One of the most important characteristics of hydrocarbon-degrading bacteria is the ability of emulsifying hydrocarbons in solution by producing surface-active agents such as biosurfactants. Isolation and identification of new biosurfactant producing strains are vital for effective bioremediation of surface waters contaminated with hydrocarbons. Hence, the aim of this study is to isolate and identify efficient biosurfactant producers to remove spilled diesel oil from contaminated surface waters. For this reason, bacteria isolated from the river water in close vicinity to petrol refinery were screened for their potential to produce biosurfactant and degrade hydrocarbons. Primary selection was carried out by using conventional enrichment culture technique and emulsification index. The level of diesel degradation was determined using the gravimetric analysis. Out of 15 biosurfactant producers, only two isolates were found out to be degrade diesel oil with an efficiency of 88-98%. The detected isolates were identified as the species of Acinetobacter by using fatty acid methyl ester and 16S rRNA sequence analyses.

Key words: Acinetobacter; diesel oil bioremediation; biosurfactant; river waters.

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Hydropower in Central Italy: current status and future prospects

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ABSTRACT

The largest source of renewable energy comes from a proven technology, hydropower. Hydropower is renewable because it draws its essential energy from the sun which drives the hydrological cycle which, in turn, provides a continuous renewable supply of water. The main goal of this paper is to optimize the use of hydropower resources in Umbria, a region of Central Italy. To this scope, we initially analyse the currently operating hydroelectric plants, taking into account both those of great size and the very small installations. Successively, we discuss the perspectives of this area in terms of exploitable hydraulic potential. It has been found that in Umbria are currently working 38 hydropower installations: 84% of them are run-of-river power plants, 10% are hydropower stations with a reservoir, while 6% works in both ways. Currently, 70 turbines are working: 41 are Francis, while the remaining, excluding a small Pelton and a Banki-Michell, are characterized by high degrees of reaction (Kaplan or helixes). The total installed hydroelectric capacity is over 650 MW, corresponding to an average annual production of approximately 1415 GWh. Most of these hydropower plants, 35 corresponding to 92% of the total, is privately owned: 13 from a big multinational company, 16 from small and medium size companies, 6 from private people. Only 3 installations are owned by municipalities. The described situation characterizes the Umbria region as a geographic area where the ratio between the exploited potential and the economically feasible potential has already reached a value not far from its physiological limit. In this context it is clear that in Umbria no large installations (> 10 MW) can be planned; instead, considering also the low number of existing hydropower stations with respect to the extension of the area (currently equal to 1 plant for each 222 Km^2), a significant potential for the realization of small run-of-river power plants exists. At the moment 5 new hydropower plants are under construction, while about 100 small installations (<2 MW) are waiting to finalize their authorization process, during which the following issues are typically addressed and resolved by the local scientific community: 1) the increase of hydraulic risk produced during extreme precipitation events; 2) the management of hydrometric stations located near the new installations; 3) the environmental impact; 4) the definition of selection criteria when in the same location there are two or more requests of hydropower installations.

Key words: Renewable energy; hydropower.

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Effects of sulphide loadings on anaerobic digester's microbial population efficient in biogas production

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ABSTRACT

Anaerobic sludge digestion offers an effective way to handle the sludge treatment problem in wastewater treatment plants due to not only its high loading rate capacity but also biogas production as an end-product. However, the sensitivity of an anaerobic digester's microbial population, mostly because of methanogens, to inhibitors makes the system less favourable process. Sulphide produced in anaerobic digestion from sulphate via sulphate-reducing bacteria (SRBs) is one of the most encountered inhibitor for methanogens. SRBs also compete with methanogens over carbon sources available in anaerobic digesters. Because of these reasons anaerobic digestion process becomes less efficient for biogas production. For the efficient biogas production, therefore, a better understanding of changes in microbial population within the digester exposed to varying concentrations of sulphide is required to enhance the performance and stability of anaerobic sludge digester. For this reason, this study aimed at monitoring changes in microbial population, total gas production, methane percentage in the off-gas, volatile fatty acids, chemical oxygen demand, total solids, and volatile solids of the sludge during digestion process within lab-scale bioreactors exposed to varying concentrations of sulphide. Microbial community structures were investigated by using fluorescent in situ hybridization (FISH) technique. In FISH, oligonucleotide probes specific for each microbial species efficient in biogas production were used to reveal microbial dynamics of anaerobic digester exposed to varying sulphide loadings. The relative abundance of each member of the dominant bacteria in the digester was determined.

Key words: Biogas; anaerobic digestion; sulphide; population Dynamics; FISH.

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The preliminary assessment of contamination of soils due to toxic metals (As, Cr, Cu, Ni and Zn) around Tunçbilek coal fired thermal power plant, Kütahya, Turkey

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ABSTRACT

The Tunçbilek lignite basin, which is one of the most important coal basins of Turkey, is located in the eastern Aegean. Annual coal production is about 4.2 Mt and 2.4 Mt of this production is being used to feed Tunçbilek Thermal Power Plant (TTPP). TTPP has capacity to generate 365 MW (per year) electricity. Combustion of coals in the thermal power plants is one of the major sources of environmental pollution. Fifty topsoil samples were collected from a depth was about 0–20 cm in the region. The samples were taken from random points and at different distances from the TTPP. Inductively coupled plasma–mass spectrometry (ICP-MS) was employed to analyse selected elements including As, Cr, Cu, Ni and Zn concentrations in the soils. Heavy metal concentrations in surface soils around TTPP varied from 4.4 to 317.4 mg kg-1 for As, 20.3 to 1027.6 mg kg-1 for Cr, 4.8 to 76.8 mg kg-1 for Cu, 16.6 to 2384.7 mg kg-1 for Ni and 14.5 to 249.4 mg kg-1 for Zn. Enrichment factors (EFs) and geoaccumulation index (Igeo) have been calculated in order to evaluate heavy metal pollution in the surface soils. The enrichment factors of As, Cr and Ni in most of the sampling locations indicate significant to extremely high enrichment. The enrichment factors for Cu and Zn are less than 20. According to the Igeo calculations, the surface soils around TTPP are polluted by As from uncontaminated to extremely contaminated. Igeo values for Cr and Ni shows practically uncontaminated to heavily contaminated in most of the locations. Especially, As, Cr and Ni elements may cause problems for the local ecosystem.

Key words: Soil contamination; Tunçbilek thermal power plant; Kütahya.

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Geothermal resource assessment of Simav geothermal field, Kütahya, Turkey

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ABSTRACT

One of the most conventional methods in geothermal resource assessment is the volumetric approach known as “heat in place” based on the calculation of heat stored in a certain volume of porous medium. Application of the method for the calculation of accessible resource base requires determination of many reservoir parameters such as, porosity, temperature, thickness, etc. Since the most of geothermal reservoirs are highly heterogeneous, all physical parameters vary spatially and include some uncertainties. Monte Carlo Simulation has been widely used to estimate such parameters using random variables in the context of a certain probability distributions. The Simav Geothermal field developed on the northern margin of the WNW-ESE trending Simav Graben, one of the most prominent extensional features of the western Anatolia (Turkey). The highest bottom-hole temperature at the field was recorded as 162.4 oC in deep well (725 m) penetrating metamorphic rocks of Menderes Massif. Silica and cation geothermometers applied to Simav thermal waters resulted in temperature up to 200 oC indicating that the area is suitable for power generation. In this study we used Monte Carlo Simulation to estimate the accessible resource base and the probable electrical generation capacity of the Simav Geothermal Field. For this purpose, an Excel VBA spreadsheet model that generates random values corresponding to the probability distribution for each parameter was created. Using a lognormal distribution for porosity and triangular distributions for reservoir thickness, area and temperature, the mean and the most likely accessible resource base of the Simav Geothermal Field was calculated as 1x1015 kJ and 8.5x1014 kJ, respectively. The most likely accessible resource base has a probability of 65%. While assuming a project life of 25 years with a plant capacity factor of 90-97%, the most likely electrical generation capacity of the field was estimated as 9.7 MW, which has a probability of 70%. Mass flow rate that should be supplied to the power plant of 9.7 MW was calculated as 917 tonnes/hour (255 L/s).

This research was supported by TUBİTAK with project number 112Y140.

Key words: Simav; geothermal; resource assessment.

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Physico-mechanical properties of wood-plastics composites from the valorization cellulosic waste

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ABSTRACT

Natural fibers have been widely used to produce composite or thermosetting polymer matrices in the fields of textile, automotive, packaging, and applications of the civil construction industry ... etc. This growing interest is due to the low cost and biodegradability of these raw materials as well as good mechanical properties they impart to the composite. Millions of tons of wood waste are produced daily in the treatment of solid wood or reconstituted wood panel. Currently, these residues are used in energy or coal production. The production of this waste, is real consequence of the wood processing and deserve special attention as a low density materials require greater storage room and cause major pollution problems that are not properly disposed of. Given the growing interest in the use of natural cellulosic fibers in the production of composites with different polymer matrices, wood waste is another source of fiber, reducing the environmental impact of large amounts of waste products by the furniture industry. The combination of properties of industrial waste based beverage polymers, such as polyethylene terephthalate (PET), can be used to produce composites with specific properties. This study aims to characterize composite wood / polyethylene terephthalate from waste materials (wood and PET from recycled plastic bottles). The composites will be characterized by chemical analysis, physical and mechanical (Tests), morphological (FTIR, SEM), etc.

Key words: Composite, polyethylene terephthalate; cellulose waste properties; physical; chemical; mechanical.

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Geothermal mine cooling: applications in underground operating and ecommissioned mines

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ABSTRACT

An underground mine is a potential source of geothermal energy which can be used in a variety of applications including district heating (or cooling) and mine heating (or cooling). Considering the extensive volume of void created in mine workings, virtually all underground mines have concerns associated with groundwater and heat flux. A well designed geothermal energy system (GES) addressing these concerns can change the liabilities associated with mine heat to an asset.

Key words: Mine ventilation; mine cooling; geothermal energy; geothermal heat pump; mine energy; GES.

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Dynamic modelling of the environmental and economic aspects of bio-resources from agricultural and forestry wastes

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ABSTRACT

The aim of the paper is to present a dynamic mathematical model developed for assessing the potential greenhouse gas (GHG) emissions and economic impact associated with bio-resources from agricultural and forestry wastes. Agriculture is directly associated with climate change issues on environmental, economic and social dimensions. Agricultural activities emit greenhouse gases that, on their turn, influence the agricultural productivity. Part of the agricultural GHG emissions arise from crop production, and crop residue decomposition and burning. Conversely, forests work as removers of the GHG emissions from the atmosphere. However, the increasing wood felling generates forestry waste that gradually decomposes, thus also generating emissions. To avoid these emissions and to gain an added value the agricultural and forestry wastes can be turned into valuable resource. In the study, a mathematical model is developed that simulates the interaction between agricultural and forestry activities, generated waste and their efficient use, and the GHG emissions. Several scenarios are developed where application of the waste as resource for fuel and added-value products is assessed with respect to environmental and economic aspects. We apply a model where system dynamics modelling approach is integrated with life cycle cost analysis. The results show how GHG emissions change depending on the selected removed waste material and its potential application. The results also show the largest life cycle cost categories for each waste application scenario and indicate the most economically efficient alternative among the scenarios developed.

Key words: Added value products; agriculture; bio-resources; forestry; greenhouse gas emissions; life cycle cost analysis; system Dynamics; waste.

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Conceptus as a model in studies on the influence of electromagnetic fields emitted by mobile communications on the conceptus-genesis process

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ABSTRACT

During the course of evolution, living organisms have developed in the constant presence of natural electromagnetic fields (EMF). Today, artificial electromagnetic fields which are a consequence of human progress begin to play a considerable role in shaping the Earth's electromagnetic environment. Electromagnetic smog can influence on health and welfare of animal. Due to the rate and specific characteristics of development and the well understood process of embryogenesis, chick embryo is frequently used as a model in different kinds of biological research, including studies investigating the effect of EMF on living organisms. Therefore, this study attempted to determine the effects of the 1800 MHz field on chicken embryogenesis. The hatching eggs (n = 100) were randomly divided into two equal groups. Group I (control group) was incubated in control conditions, i.e. in the incubator without an EM field generator. Group II (1800 MHz group)- chicken embryos were exposed to 1800 MHz electromagnetic fields with power density of 0.1 W/m2,13 times per day for 2 min throughout whole period of incubation. The body weight, heart weight, thickness of left and right heart ventricles, thyroid hormone levels (thyroxine - T4 and triiodothyronine -T3) and corticosterone (CORT) concentrations in the blood plasma were investigated in embryos in 12 and 18 day of incubation, newly hatched chicks and birds that are ready for slaughter. Moreover, the hatchability was also determined after the incubation process. The experiment showed that T4 and T3 concentrations decreased markedly and CORT levels increased in the embryos and in the newly hatched chicks exposed to EMF during embryogenesis. However, no changes were found in the level of the analysed hormones in the birds ready for slaughter. The additional EMF had no significant effect on the body weight of embryos and chicks. In 18 days-old-chicken embryos and new hatched chicks exposed to EMF we found decrease in thickness left ventricle and decrease relative heart weight. The results showed that the EMF significantly accelerated the time of hatching. In II group (1800 MHz) it was 28 hours earlier in comparison to the control group. However, percent of hatched chicks in experimental groups with the additional EMF (86.9% for Group II) was close to the control group (93.5%).

Acknowledgement: This study was performed under the project NN311536340 Chicken embryo as a model in the studies on the influence of radio frequency electromagnetic fields on the embryogenesis process and DS 3210/ZWRiDZ. Manager of project: Krzysztof Pawlak.

Key words: Electromagnetic fields; mobile phones; embryogenesis; chicken embryo.

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Biogas production from anaerobic co-digestion of kitchen waste and slaughterhouse waste

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ABSTRACT

Biogas is a renewable energy produced from different resources of waste organic materials coming from the food industry and urban wastewater. These wastes can contribute in a decrease of fossil fuels uses, which has a direct positive impact on the environment due to reduction of greenhouse gases emissions. The anaerobic digestion offers the possibility to combine the treatment of such as wastes and the production of a valuable biogas rich in methane CH_4. It has a high-energy content and can be used in many applications such as heat and power generation, biofuels, or can be injected in gas networks after high purification. The aim of this study was to analyse the biogas production from anaerobic co-digestion of kitchen wastes and slaughterhouse wastes with total solid rate of 5% in mesophilic temperature during 60 days. The experimental procedure was conducted in a lab scale reactor with work volume of 4000 ml. Some parameters were measured as pH, temperature and concentration of volatile fatty acids VFA. The produced biogas was also measured at different periods to finally reach an overall volume of 2000 ml. Methane (CH_4) and carbon dioxide (CO_2) are the main biogas constituents, but it also contains significant quantities of undesirable contaminants, such as hydrogen sulfide (H_2S), ammonia (NH_3) and siloxanes, etc. To eliminate the CO_2, preliminary tests of biogas purification was made by a chemical treatment with a pure solution of sodium hydroxide NaOH employed as absorbent. It was found that CO_2 removal rate varied between 0.5 and 2.3 % in the various stages of anaerobic digestion.

Key words: Anaerobic digestion; biogas; VFA; CO_2/CH_4 purification.

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Removal of methyl orange from aqueous solutions using a chitosan biomass

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ABSTRACT

Many industries such as textile, pulp and paper, dyestuffs and plastics industries use dyes to colour their products and discharge a considerable amount of coloured wastewater into the environment. Dyes are recalcitrant molecules (particularly azo dyes), toxic and even carcinogenic and make a serious hazard to aquatic living organisms. Therefore, it is necessary to eliminate them before discharging. This study investigates the adsorption behaviour of Methyl orange MO from aqueous solution on chitosan biomass. In preliminary study, the sorption of MO has been carried as a function of shaking time, pH, dyes concentration and temperature. The sorption of MO was characterized using SEM-EDAX and FT-IR spectroscopy. The equilibrium data on the Methyl orange fitted to both Langmuir and Freundlich isotherms, but the experimental data of the MO was found to be better fitted by the Freundlich model. Maximum sorption capacity reached up to 29 mg/g at pH 3 was achieved within 60 min. The sorption data were the best fit with the pseudo-second-order kinetic model. These results indicate that chitosan is an interesting alternative for dye removal from the wastewater.

Key words: Chitosan; methyl orange; azo dye; sorption; modelling, decolonization.

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Project on solid waste recycling plant in Sakarya University campus, Turkey

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ABSTRACT

The inevitable result of life, wastes and waste management, became one of the most neglected issue for years by society; and the humanity didn't consider that this acts might influence natural environment badly for a long time. The wastes which appeared with the increase of the population, technological development, industrialization, urbanization, rapidly increasing and changing consumption became an important issue nowadays for the environment and human health. Waste management is a topic which should be dealt with the system approach. The system approach is; waste management should involve waste creation, collecting, processing and disposal as well as energy, protection of environment, protection of sources, increase of productivity, and employment as a whole. System approach of the waste management won't just deal with the removal of the waste from the human environment; it will also protect and improve the human health and nature and it will have positive effects on economic development. In this project we aim to dispose the Sakarya University's waste by recycling and make them usable again with the recycling plant.

Key words: Solid waste; recycling.

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Biogas production from animal manure

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ABSTRACT

The continuous increase of the world's energy needs, extinction of fossil-based energy sources, and changes caused by the destroyed natural balance requires the more effective use of fossil-based and renewable energy sources. Otherwise, an energy crunch will be inevitable in the near future of the world. Biogas is one of the many renewable energy sources. In this study, obtainable amount of biogas was determined by using data from hundred cattles in a farm. The amount of electricity that can be generated from biogas and economic benefits calculations were performed.

Key words: Renewable energy; biogas.

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Thermal and spectral characterization of bottom sediment from the Water reservoir the Ružín No.1, Eastern Slovakia

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ABSTRACT

There is growing interest in how to work out the bottom sediments from the Water reservoir the Ružín No.1, which is located in Eastern Slovakia and find their utilization in practice. From this point of view, our research was focused on combination of thermal (TG/DTG, DTA) and spectral (XRPD, XRF, FT-IR) techniques for characterization of the bottom sediment from the water Water reservoir the Ružín No.1. The obtained results from these techniques might be useful in the planning of further sediment utilization. The study bottom sediment was collected from a monitoring station on the Water reservoir the Ružín No.1 concretely on the river Hornád in year 2014. The mineralogical composition of the individual fractions of study sediment was investigated through X-ray powder diffraction (XRPD) integrated with differential (DTA) and thermo gravimetric analysis (DTG). The X-ray fluorescence spectrometry was used to determine concentrations of elements (As, Cr, Cu, Cd, Hg, Ni, Pb, Zn,) in individual sediment fractions (100, 63, 40 and under 40 μm). Within the frame of the evaluation it was found that the certain concentrations exceeded the maximum permissible concentrations or intervention value. It was found that the highest concentration of metals (Cu, Zn, As, Pb, Cr, Ni, Cd) was occurred in the fraction < 40mm.

Key words: Bottom sediment; particle size; thermal analysis (TG/DTG, DTA); X-ray fluorescence Spectrometry (XRF).

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Enhancing the metal uptake of plants growing in waste incinerator residues using EDTA and intercropping

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ABSTRACT

Within an Austrian project about recovering metals from waste incinerator bottom ash with biological means one aspect is to determine suitable plant species with favourable biomass for phytomining. This specific study deals with two strategies to induce phytoextraction, namely application of EDTA and utilization of intercropping species. EDTA as a complexing agent can form soluble metal complexes, thus enhancing metal availability and consequently also potentially increasing the accumulation in plant tissues. The specific intercrop species fix atmospheric nitrogen in the soil and improve the N content of the substrate on the one hand, and on the other also release organic acids as exudates to the rhizosphere, where they can interact with the surrounding metals. These strategies can contribute to enhanced metal recovery from the specific substrate consisting mostly of waste incinerator bottom ash, supplied by waste incineration plants of Vienna. Previous experiments included an optimization of the substrate with different amendments, such as biochar and compost, in order to create a mixture which can support seed germination and plant growth. These materials were collected from municipal and hazardous waste incineration, as well as organic material from municipal compost. Analysis of these selected slag materials has shown very high pH, high salinity, and outstanding concentrations of some heavy metals including cobalt, chromium, zinc, copper, and nickel alongside some trace metals and rare earth elements. On the other hand, some major nutrients, such as N, were only marginally available. During a greenhouse experiment, several plant species with metal accumulating characteristics are going to be planted on the chosen substrate. The plants have been chosen according to previous studies and literature review. At a later stage of development EDTA will be added to enhance the metal availability in comparison with non-treated pots. Three of these plant species are going to be intercropped with N fixating Lupinus albus and compared with single species controls. The experimental plants will include species of the genera Artemisia, Amaranthus, Chenopodium, Bassia, Phytolacca, and others.

Key words: Heavy metals; phytomining; phytoextraction; biochar; slag; EDTA.

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The studies of exploitation dust from frictional elements of cars as a sources of metals in environment

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ABSTRACT

In order to understand the impact of non-exhausted traffic emission on the environment, it is important to analyse and evaluate pollution originating through the wear of frictional elements in vehicles. During rapid braking, the brakes are exposed to a large amount of heat due to friction, which is transmitted to brake friction discs and results in the emission of particles into the environment. The level of wear depends primarily on the physical properties and chemical composition of the material. The research presented here is an attempt to identify and investigate exploitation dust from frictional elements of cars as a sources of metals in environment and parking lot road dust sediment as one of the first receivers of such pollutants. Today, friction materials in vehicle brake lining consist of a wide range of compounds, with fibers of steel, glass and plastic serving as reinforcements. Standard brake pads consist of barite, vermiculite, phenolic resin, antminite, rubber, aramide and sulphur. There is still a number of uncertainties relating to the emission rates, physical properties, chemical characteristics of the particles derived from vehicles (break, clutch, tyre were) and road infrastructure. The chemical composition of exploitation dust is made more difficult by the variety of materials used in different types of vehicles. The study of the parking lot road dust sediment samples and exploitation dust was conducted with the use of scanning microscope SEM: S4200 (HITACHI) magnification from 50x to 8000x was used. To the analysis of chemical composition of the dust X-ray spectrometer with energy dispersion cooperating with microscope was used (EDS): VOYAGER (NORAN, detector Si – Li, thin polymer window). Furthermore, the purpose of the study was to investigate and characterize the content of traffic-related metals in size classified exploitation and parking lot dusts by ICP-MS (ELAN 6100 Perkin Elmer). In order to obtain unambiguous and unbiased ICP-MS results, the above-mentioned metals were additionally measured by ICP-OES (OPTIMA 7300DV Perkin Elmer), while Zn, Pb, Fe, Cu and Cd were measured by AAS (GFAAS Thermo Scientific IC 3500). Analysis of the composition of brake dust and clutch plates dust revealed that over 95% of the dust consists of dust particles with a diameter of up to 56 μm. Micro-photo of exploitation dust coming from a brake pads obviously confirms such metals as Cr, Fe, Cu, Zn, Mg, Al., Si, Zr, Sn and Cr and clutch dust, in turn, contains significant amounts of Cd, Cr, Cu, Pb, Ba, Sb and Zn. For example EDS analysis confirms the presence of e.g. ZrSiO4. Zirconium silicate is a friction modifier, a filler and it increases the resistance to friction. In parking lot dust detected high Cu concentration in bulk sample up to 121mg/kg, and in fraction size < 0,063 μm even 194 mg/kg-probably pollution originating from breaking system as well as significant amounts of Zn coming from tyre.

Key words: Exploitation dust; parking lot dust; metals.

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Hydrodynamic simulations of aeration tanks of activated sludge wastewater treatment plants in Algeria (three case studies)

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ABSTRACT

Most wastewater treatment plants currently in operation in Algeria use the activated sludge process, which is designed to foster the development of microorganisms in the form of flocs that are then kept in suspension in an aeration basin or bioreactor supplied with wastewater to be treated. The process efficiency depends heavily on the flow field in an aeration basin (tank), a good understanding of hydrodynamics of the basin is needed for a successful design. The present study was conducted to investigate the hydrodynamic behaviour of aeration tanks currently in operation in three localities in Algeria (Chelghoum Laid, Souk Ahras, and Annaba city) with different aeration systems (surface aeration and air insufflation) to meet new legislation on water quality (executive order 05-12 of 4 September 2005 “Protection and conservation of the water resources”) and environmental protection (littoral) taking account the engagements of Algeria in the process of Barcelona.

Key words: Wastewater; treatment plant; aeration tank; geometry; hydrodynamics; simulation; fluent; design.

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Geochemical control of acid mine drainage in abandoned mines: the case of Ermioni mine, Greece

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ABSTRACT

Acid mine drainage is an extensively documented environmental issue, commonly originated by the weathering of sulphide ores both in active and abandoned mining sites. Even though national and international regulations obliged mining companies to handle this problem in active mines, in the abandoned ones it is usually regarded as a major environmental thread. Natural attenuation is a term that is used to describe a combination of in situ physical, chemical and biological processes that under some specific conditions, act without human interventions in order to reduce the mass, toxicity, mobility and concentration of metals in soil or groundwater" (USEPA, 1999). For those processes, the local lithology may plays a key role, when contributing to an alkaline environment, consequent the precipitation of metals in the form of hydroxides. Despite of the fact that in Ermioni, Greece, a mixed sulphide ore mine, had been operational since 1928, it has been abandoned after 1978 and no restoration actions have been implemented. Dispersed ore tailings have been deposited near the galleries, being exposed to atmospheric conditions. Soil and minewater samples were collected from the region of that abandoned mine. The soil was collected from tailings at superficial points near the mining galleries, while the water samples were collected from canals that drain from the mining galleries to the nearby Roros River. The mineralogical composition the soil samples was studied by X-ray Diffraction Spectroscopy and Scanning Electron Microscopy, while Flame Atomic Adsorption Spectroscopy was applied for the determination of the Fe, Zn, Cd, Cu, Pb, Mn, Ni, Co, Cr and Hg concentrations in the water samples. The results from our field and laboratory study indicated that, the acid mine drainage, produced by the oxidation of the sulphide minerals (primarily pyrite), has been geochemically controlled by the lithological formations. A series of geochemical reactions between the sulphuric acid derived from the oxidation of pyrite in the presence of O_2 and H_2O, diluted in groundwater, and the calcareous carbonate minerals of the wall rock and the neighbouring lithological formations (limestones and flysch) have led to the neutralization of the acidity and the formation of secondary sulphate minerals such as gypsum and jarosite. The initial acidity and the contamination of water by toxic elements, like Fe, Al, Mn, Cr, As, Pb, Zn etc. originated by the chemical weathering of the ores by the sulfuric acid, seems to be remediated by the elevation of the pH that leads to the precipitation of those elements. Moreover, gypsum has been identified as the main mineralogical component of the soil in that area (up to 95 vol. %) accompanied by small amounts of quartz, jarosite and residual, partially oxidized, pyrite grains.

Key words: Natural attenuation; acid mine drainage, sulphate ore mines; Ermioni.

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Recycling the cork powder in a PVC-based composite material: combined effect on physico-mechanical and thermal properties

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ABSTRACT

The Algerian industry of cork produces (CP) a large amount of powder as wastes. The latter's are the crushing result of natural cork flooring thrown in public dumps, this poses an environmental problem that deserves to be resolved hence the need to recycle this wastes. For this purpose, this work aims to combine the recovered cork powder with a thermoplastic material for obtained a composite material based on cork (CPL) having physico-mechanical and thermal characteristics very interesting. An experimental study was conducted out to evaluate physico-mechanical and thermal properties of the several formulations of composite materials based on PVC (as a matrix), cork powder (as a charge) and a coupling agent PVC-g-MA. To study the combined effect of the cork powder and PVC-g-MA on composite properties, samples have been manufactured by varying the content of CP (20, 30, 40 and 50%) with two concentrations of PVC-g-MA .The obtained results show that an improvement of stability of PVC which is highlighted by the coupling agent presence. Also, it was noted that the incorporation of coupling agent has allowed the removal of the negative effect of the cork powder, by improving the tensile strength. The obtained composite material in this study has given some promising properties, although reinforcement strategies to reach higher stiffness and strength could be needed for specific applications.

Key words: Cork powder; PVC-MA; composite; tensile strength; elastic modulus; thermal properties.

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Comparative adsorption of metal ion and anionic dye with activated sludge

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ABSTRACT

In this study, adsorption of Cu (II) ions and AO74 dyes existing in undesirable concentrations in industrial wastewaters has been investigated in media containing aerobe and anaerobe activated sludge. In the first stage of the study, the single adsorption experiments were conducted. The maximum adsorption pH of Cu (II) ions and AO74 dyes determined as 4.0 and the experiments were carried out at this pH value. It was investigated that the adsorption rate and adsorbed amount of metal ions increasing with increasing of initial metal ion concentration up to 750 mg/L in and 0.5 g adsorbent containing mediums. The results of the metal ion and AO74 dyes of both aerobe and anaerobe activated sludge, as comparing with the adsorption rate and the absorbed amount of metal ions and AO74 dyes, adsorption values of Cu (II) ions and AO74 dyes are close to each other with both aerobe and anaerobe activated sludge. In terms of the values of Gibbs free energy (ΔG), all metal ion and dye concentrations, it was concluded that the adsorption process occurs spontaneously. Calculated enthalpy values of Cu (II) ions in low concentrations the reaction is endothermic and exothermic reactions occur with the increase of concentration showed. AO74 dyes of the system in a low concentrations is exothermic and endothermic reactions take place with the increase of concentration showed.

Key words: Activated sludge; anionic dye; heavy metal.

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Removal of physical information chemistry of spa that it is utilizing geothermal waters in Ecuador and interpretation of its composition from the point of view of health of swimmers

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ABSTRACT

Volcanic activity in Ecuador is the result of subduction of the Nazca Plate and South American Plate. The country has around six volcanoes, many of them active or potentially active. Because of this volcanic activity Ecuador has a vast and varied wealth of geothermal sources. The purpose of this research is to build physical information - chemistry to classify these waters from the point of view of health according to their composition. The temperature values obtained vary between 18 °C and 62 °C, the pH between 4.96 and 8.3, the values of electrical conductivity between µS 166.9 cm-1 and 20220 cm-1 µS and dry residue values between 208 and Evaporated 11208 mg L-1. Waters such as Guapán, Jamanco, El Salado (spring), El Salado (pool), La Virgen, Oyacachi Cununyacu, Chachimbiro 1, Chachimbiro 2 baths Cuenca called for the development of new studies by high values in temperature, electrical conductivity and Total Soluble Solids. This research manifest the importance of geothermal water resources in Ecuador and their classification according to their composition helps to know the different effects of these waters on the health of users.

Key words: Springs; Piper diagram; sampling; high concentrations.

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Variations of species of concentration inorganic water dam purpose multiple chone, Ecuador according precipitation, evaporation and evapotranspiration

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ABSTRACT

In the system hydrographic of the Rio Grande belonging to the basin of the Chone River located in the province of Manabi Dam Purpose Multiple Chone (PPMCH) is built with an investment of Ecuador approximately 66 million US dollars. The dam will be finished in late 2015 and this has as purposes irrigate over 2000 ha of crops. The variations of species of inorganic concentrations of system hydrographic of the Río Grande will be parameters to consider in chemical processes in function of precipitation, evaporation and evapotranspiration, therefore, this work contributed with a current characterization of the basin and a prediction of the environmental effects that cause the construction of the dam. The aim of this study was to calculate the precipitation, evaporation and evapotranspiration from three meteorological stations located in the system hydrographic of the Rio Grande, measuring ions Rio Grande waters in the dry season and rainy to determine the relationship between precipitation and evaporation depending on the concentration inorganic. The sampling was done across the Rio Grande basin in 2013 and 2014 for 111 stations. The parameters measured in each water sample were anions and cations. The results showed that the waters of the reservoir having a composition ranging from calcium to sodium bicarbonate throughout the year chloride, these variations are directly related to the marked differences in rainfall characteristics of the area. There are eight months of water deficit. The predominant trend in relation to evaporation precipitation was reflected in the diagram Gibbs increasing chloride-sodium concentration with the effect on the biota of the area type. Probably with the operation of the dam, change the type of saline waters low concentration to high concentration.

Key words: Total dissolved solids; chemical process of water; salinity.

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Individual trees, surprising factor of soil complexity in temperate old-growth forests

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ABSTRACT

Biota–soil interactions in natural ecosystems are the subject of considerable research. Our hypothesis is that individual trees play a significant role through biomechanical and biochemical disturbances affecting soil formation in temperate forests, resulting in a complex spatial pattern of disturbance regimes and a close relationship between disturbance histories and soil units. From this point of view, individual trees could be recognized as crucial factor of soil complexity in forest ecosystems.

Key words: Pedogenesis; pedodiversity; disturbance regime; forest dynamics; biogeomorphology; dendrochronology.

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Bacterially-induced calcium carbonate precipitation for in vitro bioconsolidation of a sand matrix

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ABSTRACT

Numerous examples of microbiologically-mediated mineral precipitation in natural environments have been documented. These reactions result in relatively insoluble compounds that can contribute to soil cementation. One of these natural processes is the microbially-induced calcium carbonate precipitation (MICP). In addition to play a role in natural environments, MICP has also been investigated for biomediation of soil geotechnical properties, repair of concrete or calcareous stone, or immobilization of environmental contaminants. The aim of this preliminary study was to choose the most suitable bacterial calcifying inoculum for sand improvement. Eleven calcifying heterotrophic bacterial strains (named from P1 to P11) were isolated from a garden soil and purified by streaking on B-4 agar medium. All the calcifying isolates formed rod shaped cells, 82% of them were Gram-positive. Among the calcifying isolates we identified by the Biolog System Corynebacterium sp. (strain P4). Calcium carbonate formation took place rapidly, and crystal precipitation began four days after inoculation at 28°C. All the calcifying bacteria began to precipitate after two weeks at 28°C and after four weeks at 20°C. At 4°C only the strain P8 precipitated after three weeks. The corrosion behaviour of the calcifying isolates was also studied showing that 36% of the studied calcifying bacteria solubilized calcium carbonate when grown on agar plates containing 0.14% $CaCO_3$ after four weeks at 28°C. None of the calcifying bacterial isolates solubilized calcium carbonate when grown on 2.5% $CaCO_3$, after four weeks of incubation at 28°C. Three pure calcifying bacterial strains (P2, P9 and P11) and one mixed culture, M5, were selected for the experiments of sand biocalcification, based on: cell morphology, Gram-staining, capability to precipitate calcium carbonate at different temperatures, days required for crystallization, amount of $CaCO_3$ bioprecipitated, production of extracellular polymeric substances, size and shape of the bioliths, presence of coalesced crystals, $CaCO_3$ solubilization activity. Seven grams of sterilized sand were homogenously distributed on a 90 mm Petri dish and inoculated with 25 mL of a cell suspension (107 CFU/mL) of the selected cultures grown on B-4 liquid medium. The biopretreated sand samples were incubated at 28°C statically to allow the bacteria to attach the sand. After twenty days of incubation, SEM (Scanning Electron Microscopy) and EDX (Energy Dispersive X-ray microanalysis) analyses were used to examine the nature of the cemented sand obtained in all four experiments performed by the selected pure and mixed cultures. It has been found that $CaCO_3$ crystals coat and bridge the sand particles, cement the sand matrix and increase the mechanical strenght of the material. We achieved the best results with the mixed culture M5, consisting of three unknown species. The cohesion of sand particles by biocalcification, unlike artificial cements, is a technology environmentally friendly very useful in geotechnical engineering to prevent or stabilize erosion and produce increased slope stability. Nevertheless, few attempts have been made to cement soils by biocalcification. Our preliminary data confirm the importance of MICP in bioconsolidation of sand and underline the potentiality of mixed cultures that would give a more efficient process, producing more $CaCO_3$ in shorter time.

Key words: Biocalcification; calcifying bacteria; geotechnical engineering; sand matrix.
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Session Title:

Geological Heritage & Geoparks

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The scientific and educational value of non-karst caves in a new Geopark project "Wisłok Valley – The Polish Texas" (the Polish Outer Carpathians)

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ABSTRACT

Most of the caves in the Polish Carpathians are associated with slope processes. The first studies on the origin of these objects were made still in the 1970s and 1980s. They indicated a relationship with gravity mass movements. Currently, the research and observations of caves performed in the Polish Outer Carpathians allow to recognize the type of mass movement and help characterize the stages of deep rock landslides development. Caves, which are an initial stage of landslide scarp development, allowed to distinguish two planes of the rock landslides development, i.e. cutting surfaces and the shearing zone (Margielewski, Urban 2000; Margielewski 2001). Owing to the diversity of caves (both geomechanical and morphogenetic), a new division of these objects was adopted (Urban, Margielewski 2013). According to the morphogenetic criterion, initial caves, subsequent caves, „intermediate" caves and multiphase caves, formed during several stages of development, were distinguished, whereas according to the geomechanical one, dilational caves, dilatancy caves and boulder caves (among colluvium and movement rock boulders) were singled out. Additionally, complex caves, corresponding to multi-phase caves, can be distinguished. Besides the caves whose origin is associated with mass movements, those conditioned by erosion processes and weathering can be also distinguished. The insufficient use of geodiversity in the Polish conservation system induces the search for new areas of high scientific and educational value. Therefore, there is a need to create geoparks, whose role is not only to protect valuable scientific geosites, but above all to educate. Taking into account the current range of knowledge, the caves located in the middle part of the Beskid Niski Mountains, in the area of a new Geopark project "Wisłok Valley – The Polish Texas", are especially predisposed to this type of protection. It is one of the largest concentrations of caves in the Polish Carpathians, and the morphogenetic variety of cave objects in this area encourages to describe their scientific and educational roles.

Key words: Geoconservation; geopark; geodiversity; caves.

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The potential of indigenous knowledge for Rio Coco Geopark geotourism

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ABSTRACT

The contribution deals with the potential of indigenous knowledge for the geotourism sustainability of the aspiring Rio Coco Geopark (Nicaragua). This indigenous knowledge includes traditional, orally transmitted wisdom, skills and lifestyle of indigenous peoples built on their intensive linkage to nature and verified by time. The article focuses on the analysis of potential of integration of this traditional know-how passed from generation to generation and as well as other elements of collective memory into the philosophy, management and products of the emerging geotourism destination of Rio Coco Geopark. Author presumes that the integration of local indigenous knowledge into the geotourism developed by Rio Coco Geopark has potential to increase the sustainability level of this geotourism. To verify this hypothesis, the local indigenous people – Chorotegas were inquired. The research of these native people was conducted in all four municipalities of Rio Coco Geopark recognized as indigenous and it employed methods of participant observation, photo-documentation, focal group discussions, life history narratives and local informants (indigenous leaders, healers, midwifes etc.) interviewing. The main potential was found in the system of values related to nature (e.g. respect for Mother Earth as a life giving entity) and related natural resources management, the systematic involvement of seniors into the top management, using cosmology and natural cycles into the local agriculture and medicine, using the traditional knowledge in processing of local crops and natural raw materials as well as keeping and transmission of many interesting indigenous legends and rites connected to the local geoheritage and other elements of local nature. Findings of the research indicate that the sensible and gradual fusion of the modern science knowledge with the traditional indigenous knowledge can essentially assist with optimization of the environmental, socio-cultural and economic tourism impacts. It could be assumed that it pays not only for the aspiring Rio Coco Geopark but also for other destinations with important geoheritage and related fragile natural and cultural heritage.

Key words: Indigenous knowledge; geotourism; Rio Coco Geopark; tourism sustainability.

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Assesment of Natural Stones and their Deterioration Types used in Süleymaniye Mosque (Istanbul,Turkey)

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ABSTRACT

Süleymaniye Mosque located in the historic peninsula of Istanbul, is one of the most important monuments of classical Ottoman architecture. Different types of natural stones having different lithological characteristics were used in its construction. However, functionalities of these natural stones have been deteriorated over time based on their characteristics such as chemical properties, mineralogic, petrographic and human impacts. The aim of this study is to investigate different natural stones and their deterioration types used in Süleymaniye Mosque. According to the results obtained, generally different types of granites, marbles, limestones, pudding stones, porphyry, serpantines were used in Süleymaniye Mosque construction. Beside this, detachment, material losses, biological colonization, discoloration and deposits, have been determined as a deterioration types on these stones.

Key words: Natural stones; deterioration; Süleymaniye Mosque.

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The dissemination of geoscience education through geoparks and geosites: the SOLE (Social Open Learning Environment) Erasmus+ project

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ABSTRACT

The global community is facing a variety of pivotal challenges such as sustainable development, global climate change and natural hazards: these require the development of policies and actions to prevent a rapid deterioration of our planet's conditions in the near future. An increase in awareness of the role of Geosciences, at all levels of society, is essential to face such challenges and to formulate common global policies leading to sustainable behaviours. The SOLE project's goal is to create a friendly environment to share scientific knowledge with the general adult population as well as secondary schools and university students. The Associazione Il Geco, within the SOLE framework, is developing multimedia content for the dissemination of geoscience knowledge and environmental awareness. Il Geco aims to involve people culturally but also emotionally with some of the following approaches: a. Emphasis on a close connection between a population with its territory, b. The presence in the territory of the community of Geoparks, Natural Parks and geosites, c. Concepts of geotourism, d. Formal educational activities within schools. The Il Geco program identified three test areas in Italy and Greece that are favourable for the development of the project. The first area is the UNESCO Val Sesia Val Grande Geopark, in Piedmont. Val Grande is the largest wilderness area in the Italian Alps and exposes on easily accessible paths a variety of geological themes, such as a cross section from the moho to the intermediate continental crust and the contact between the Alps s.s. and the South-alpine domain. Val Sesia hosts a number of geosites and important geological formations (deep crustal rocks and "moho" outcrops). Several geosites are related to the Ivrea Verbano mafic-ultramafic complex. This Geopark has a well-developed network of products and activities for geotourism, but needs more integrated activities to involve school and university students. The second area is the preAlpine environment within Varese district that hosts the Campo dei Fiori Regional Natural Park. There is no Geopark, and geotouristic activities, although present, are not highly developed. Geologic features include glacial geomorphology, Permian lava quarries, active travertine sites, karstic landscapes, and a great number of abandoned mines. The third area is the Grevena-Tethys Geopark in the Pindos (Northern Greece), at present an applicant for UNESCO European Geopark Network membership. This Geopark neighbours the UNESCO world heritage site of Meteora. The Grevena-Tethys area hosts valuable geotouristic attractions, as well comprising some of the "founding sites" of plate tectonic theory (the Vourinos Ophiolite Complex). Meteora is the second most visited touristic attraction of Greece, with a unique landscape of conglomerate pinnacles. These geological sites will be studied by students in Earth Sciences with supervision by regional expert scientists: they will produce geotouristic itineraries that will be presented in English, Italian, German, Spanish and French, and each will be accompanied by a presentation video. These itineraries will be integrated into educational activities for school and university use. The final products will be shared for free in specially developed SOLE social networks and websites.

Key words: Geoparks; geoturism; geosciences; education.

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Educational path “Szlak Naftowy” and mobile geoeducational system presenting its history and attractions

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ABSTRACT

Oil Trail [Szlak Naftowy] is a cross-border route important for the history of the oil industry. The main part of the route goes from Jaslo through Krosno, Sanok and Lesko to Ustrzyki Dolne. It continues further through Ukraine, but it is not a matter of this study. The main goal of the project was to develop digital maps of selected regions of Oil Trail based on Web-based Geographic Information System. Maps present topographical, geological and environmental information of the selected areas (from the Krosno area to the Polish - Ukrainian border), influenced by oil and gas. LIDAR method have been used to create a digital model of the terrain surface. As a result, geoportal is now available in desktop, web and – most importantly – mobile versions. Therefore this geo-educational system becomes another type of traditional educational path, an interactive one. It not only educates, but also promotes tourism in this region. We would like Szlak Naftowy (or its part) to be marked properly (in cooperation with COTG PTTK) and enriched with information boards including QR signs (with the help from local government). Project’s result is compatible with the newest mobile solutions. The most important places on the trail (as well as professional information about them) are displayed on mobile devices’ screens after identifying the users’ position (GPS coordinates) or scanning the QR code. Whole idea has bug influence on protection of historical oil objects which are now much more available to the audience. Project is a part of University of Science and Technology rector’s grant competition. Scientific Society “KIWON” representing oil industry and Scientific Society KNGK Geoinformatyka representing surveying and geoinformatics environment are working together on what has already resulted in popular science industrial portal with professional digital maps and historical background of the trail.

Key words: Oil; trail; geoinformatics; geoportal.

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Cappadocia volcanic paradise in Central Anatolia, Turkey

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ABSTRACT

Cappadocia region (Aksaray-Nevşehir) is one of the largest volcanic centre in Turkey. Early Miocene to Quaternary volcanics in the Cappadocia region represent a most typical example of the collision related volcanism in Anatolia. Mt. Hasan (3257 m) and Mt. Erciyes (3916 m) both of them evolved as a result of main volcanic activity. The area extending from Hasandağ to Erciyesdağ is an interesting volcanic terrain dominated by a large number of volcanic craters, cones, lava flows, volcanic ashes and ignimbrites deposits. Numerous cave dwellings and churches were carved into these rocks, especially ignimbrites, by early Christians. Also, it is possible to observe plenty of fairy chimneys in area. The recent geomorphological cycle of erosion had begun immediately after the end of the volcanic activity in the area. Wind, rain and other natural events all together erode the partially soft layers in the area, producing the glorious earth pillar of natural wonders. Now, because of their spectacular forms the earth pillars are of touristic value, and in practice they are used as houses, or to store fruits and vegetables since keep them fresh for a long-time. The natural and artificial caves of this area had also been used by ancient Christians as churches and places to live in seclusion. Cappadocia region has gained importance from its activities in the sphere tourism.

Key words: Cappadocia; Mt. Erciyes; Mt. Hasan; ignimbrites; sphere tourism.

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Geoheritage in karst areas: examples in Portugal

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ABSTRACT

The knowledge of geoheritage it's an important tool to manage, preserve and promote the abiotic values of a country or region. The effort to do the synthesis of the Portuguese geoheritage it's fundamental to understand the gaps of research in this field of work and to integrate the national heritage in larger areas like European ones. Unfortunately there is a lot of work still missing to establish the main geoheritage values present in the Portuguese mainland, namely those related with the geomorphological features and the landscapes (geomorphosites). If the geosites knowledge needs to be improved, the karst ones are poorly publicized in what concerns the karst features besides caves. All over the world, such as in Portugal, there are a natural curiosity related to the underground caves located in karst areas mainly due to the unusual and beautiful depositional formations existent in the chambers and galleries, that can't be seen at the surface. In this paper we pretend to make a synthesis of the karst geoheritage present in the four Portuguese limestone massifs and discuss its importance within the global geoheritage known in Portugal. These limestone massifs are located in Central Portugal were the limestone rocks included in the sedimentary occidental basin were uplifted by regional tectonic movements. The main groups of considered karst geosites were divided into three groups: major karst forms (big depressions such as poljes), medium scale karst forms (mainly formed by dolines and other surficial depressions as well as subterraneous systems) and small scale features (such as the karren different types).

Key words: Geoheritage; geosites; geomorphosites; karst; Portugal.

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The Portuguese cave project: karstic caves of central Portugal as palaeoenvironmental archives

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ABSTRACT

Karst systems record (as other records like marine sediments and ice sheets) changes in several parameters and preserve this valuable information over time. The isolation of these systems from the exterior environment transform the caves in a “living” archive of extreme importance to understand the environmental changes to which cave environments have been exposed. This fact allows the use these records to climate change scenarios. In Portugal, the work of local speleological teams consists mostly on the inventory and topographic analysis of caves. The resulting observations are rarely scientifically published. Most of the Portuguese karst systems are within protected areas due to their particular origin and evolution, as well as its national value and environmental fragility. Nevertheless, particular land use and management problems persist, threatening the integrity of karst resources for future generations. So, the scientific data resulting from the CAVE project will be directly applicable to the management and conservation of karstic environments at a regional scale. The CAVE project proposes an integrated approach based on an analysis of the various palaeoclimatic archives from caves and karst deposits. The most important tool is the stable isotope analyses and absolute dating in speleothems and the fluviatile, lacustrine and other cave sediments analysis. These cave formations contain information relevant to the palaeoclimate reconstration at a regional scale and sometimes show evidence of archaeological materials correlated with human occupation. The combination of data from various proxis within the same karstic environment (speleothems, clastic cave sediments, cave animals remains and archaeological evidence) allow for the ability to overcome the limitations of some absolute dating methods, to combine different climate records into a composite record, to carry on time-series analyses taking into account regional or global climate records and to identify the regional constraints of climate oscillations. The proposed research will focus on the some main karstic massifs of Central Portugal (Outil/Cantanhede Massif, Sicó Massif and Estremadura Massif) and has the following aims: i) the creation of an evolutionary model of caves based on structural, morphologic, sedimentologic and geoarchaeologic analyses, that will be further integrated with known geologic and geomorphologic regional evolutionary models; ii) the understanding of contemporary cave activity and groundwater dynamics and their vulnerability to human activities; iii) to transfer the project results and conclusions to public and private institutions with territorial planning and conservation responsibilities in karstic areas. Here we will present the preliminary results obtained for some caves in the Central Portugal area.

Key words: Cave sediments; geoarchaeology; isotopic analysis; climate global change.

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Anthropogenic changes in fluvial and slope systems in the Prehistoric and Mediaeval period on the example of Węgierka river catchment (N Masovia)

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ABSTRACT

Pressure of human groups in landscape is varied depending on period in Prehistory. Human since Early Historical times caused transformations in functioning of the slope and river systems. Changes in the pace of erosion, which was the result of the human impact on environment, are recognized as a proxy for deforestations and reforestation. Due to that, analysis of sediments deposited in river valleys and on the slopes is used in archaeology to reconstruct the settlement phases. The aim of the study was recognition of lithological and geochemical features of the slope sediments and infilling of old oxbows and analyse their changes in relation to the settlement history. The analysed area is a small lowland river catchment in central Poland (N Masovia region). Methods which were used are: LOI, sediments fraction composition and geochemical analysis of sediments. Probes were taken from drills using the Eijkelkamp gouge auger. The settlements phases were obtained based on the data from the Polish National Record of Archaeological Sites. The results of LOI and sediment fraction composition show the existence of two levels of the higher erosion. They are characterized by a higher content of an organic matter – up to 12 % and an increase in a content of a silt. They are separated by the level with a lower content of an organic matter – up to 6 % and a lower content of a silt. The geochemical markers of a human impact on the environment correlates with the above distinguished stages of an erosion. The each stage is recorded by the influx of the silt material with organic matter and higher contents of trace elements: Cr, Cu, Pb, Zn. The first stage of erosion is preceded by the increase of Pb and Cr content. The proxy for landscape openness is also less content of organic matter in colluvium and inversely, the higher content of organic matter distinguish process of recovery of forests. Above described phases show that the settlement did not develop linearly. This can be partly explained by the densities of the artefacts collected during the Polish National Record of Archaeological Sites, which shows smaller activity of the settlers during the Migration and Early Mediaeval Period.

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Key words: Erosion; geoarchaeology; colluvium; human impact on environment.

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City region building and socio-spatial polarization in Romania

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ABSTRACT

In the last two decades there has been an increasing interest in regional policy research and practice towards the concept of city region building. The idea of forming and promoting metropolitan regions is only partly based on empirical observations. This process of concentration along with the idea of supporting the formation of internationally renowned competitive regions can also be regarded as a form of regulation, part of national and European policy agendas and thus also reflects changing paradigms of spatial policy. Although the conceptual debate about such regions started relatively late, it has gained an important role in spatial planning and research. The main processes which have brought about these new priorities in spatial planning are seen in structural economic changes, the change towards a flexible network economy, processes of globalization and internationalisation. In Romania, the concept of metropolitan regions has been adopted relatively late, the primary purpose being to facilitate the levelling of disparities at regional level so that the social and economic imbalances between the city and the adjacent localities could be reduced. In 2001 a new law for newly established metropolitan areas has seen the light of day, emphasizing the importance of local initiatives and multi-level cooperation networks, although the first of such initiatives has appeared only in the first part of the year 2004. Since then, the ‘metropolization’ process has advanced, with 10 metropolitan areas being created, while many others have been proposed and are still in a pilot phase. The present paper aims to deal with the effects of metropolitan regions on the process of centralisation and peripheralization in Romania - and to find best practices in Western Europe which could be adapted and transferred eastwards. The paper aims also to examine the transfer and implementation of the metropolitan region concept into the Romanian territorial development practice establishing whether it has been able to contribute to a more balanced territorial development.

Key words: Metropolization; core-periphery relation; Romania.

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Preparation of GIS-based medium-scale settlement suitability plans of Sivas city province by using Analytical Hierarchy Process (AHP)

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ABSTRACT

In the content of disaster management, urban planning models to be created taking into account the relevant parameters, during and after disasters, is very important in terms of minimizing the potential losses. Especially in the last 10-15 years, development in the Geographic Information Systems, remote sensing, computer and software technologies simplifies and accelerates the production of the models. Accuracy of these models, however, obtaining of models by use of technology only is almost impossible without and expert opinion. In scope of this thesis; construction of GIS-based medium-scale map models of settlement suitability plans which will create the necessary base map of Sivas city for the future was aimed. As main component of Disaster Information System, the models was obtained at the end of this thesis which will be an important guide to urban and regional planners for disaster within the scope of the planning ahead and selection of the residential areas. Furthermore, questioning and analysis capabilities of these models in the aftermath of a disaster will help to creation of Emergency Action Plans and implementation of these plans quickly and effectively when necessary. Sivas province has a potential by means of landslides, failures in poor foundation conditions, potential collapses depending on gypsum karst, floods, rock fall events, and in terms of its proximity to an active fault zones has the potential to be affected by natural disasters such as earthquakes. In the content of the thesis studies, as a basement of the construction of the Disaster Information System process and urban plans, suitability for settlement were analysed and synthesised, and city development directions were determined. In the creation of these models, the Analytic Hierarchy Process (AHP) which is a type of decision support systems and based on expert opinion was used.

Key words: Urban plan; settlement suitability plans; Analytical Hierarchy Process (AHP); GIS.

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Spatial transformation in large and midsize cities in Vietnam: A case study of the Hanoi capital and the Danang city

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ABSTRACT

Although the rapid urbanization in Vietnam has started since 1990, however, the country is still on an early stage of urbanization. During the period of 2000 and 2010, the urbanization rate estimated as +2.8% and the total urban population recorded in the year of 2010 was accounted for only 29% of the total population in the country. Together with the increase of the urban population, income has risen not only in large cities but also in emerging midsize harbour cities that forming networks of distally connected people, commodities, information, and capital. Previous studies focused on the urban expansion and the spatial configuration of individual cities or mainly the linking between large cities at national or international scales. The main objective of this study is to assess and compare the development of urban for (i) the Greater Hanoi, which is the capital cultural city of Vietnam and (ii) the Danang city, which considers the fast-economic-growth city in the centre area. They are belong to the two most urbanized cities in Vietnam. We focused on the analysis of three characteristics of each city such as spatial form, population density, and accessibility to the central business district (CBD) at the finest level (commune) between 2000 and 2010. We analyse similarities and differences of the spatial forms, the population density, and the accessibility. The spatial forms are measured by spatial metrics, and cluster analysis of the change of built-up patterns such as residential, industrial, and governmental office buildings. Three patterns are analysed along ring roads and urban-rural gradients that buffered from the core urban area in 1990. The result shows that the change of the patterns and the growth rates of the urbanized land, the population density, and the accessibility between 2000 and 2010 of the two cities show a closer view of the rapid urbanization at the early stage of developing countries. Looking behind the economic growth, the discussion focus on challenges and opportunities of these dynamics of population and accessibility in the both cities. Although the midsize city is characterized less by their size and the urban population, how harmonized transport accessibility and local policies of midsize city makes them more competitive than others large cities. This is an exception of the midsized city, which is normally considered as less competitiveness and may lose employment and increase social issues. The comparative study of a large and midsize cities gives supporting figures to urban policies in managing and cooperating between the central agencies and local authorities in the rapid-growing midsize city. Further study will dig deeper on how local policies can adapt and foster a dynamic economic environment in midsized city.

Key words: Spatial form; dasymetric mapping; accessibility; Vietnam; midsize city.

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Determination of land use/cover changes and land use potentials of Sivas city and its surroundings using Geographical Information Systems (GIS) and Remote Sensing

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ABSTRACT

Land cover/use change information is a very important and useful information source for planners in land use studies. Moreover, determination of land usages (land use potential) by considering capability of the land and other characteristics of the land provides an important data source for regional planning studies. Remote Sensing and Geographical Information Systems (GIS) are widely used in obtaining such information. This study aims to determine land use/cover changes in the Sivas city and its surroundings using Remote Sensing and Geographical Information Systems, and to create the land use potential map that shows the optimal land usage of the study area. Aerial photos from 1973 and 2005 and Landsat satellite images from 1987 and 2002 will be used to determine the changes in the land use/cover of Sivas city and its surroundings. By revealing the existing environmental characteristics of the study area (topography, geology, soil, climate, hydrology), optimal land usages (settlement, agriculture, forest and meadow-range) will be determined in the light of the data obtained for each land use with respect to the purpose. Land use potential map of the study area will be created using suitability maps for the optimal land usages (settlement, agriculture, forest and meadow-range). By assessing the land use/cover change information and optimal land usages together, suggestions will be made for the planning studies of the Sivas city and surroundings.

Key words: Sivas; Geographical Information Systems (GIS); Remote Sensing; land use/cover information; land use potential.

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Gradients of land cover and potential ecosystem services. A comparison of suburban and rural fringes of the towns Dresden (Germany) and Poznan (Poland)

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ABSTRACT

The change of land use and landscape structure by urbanization, fragmentation and intensification are one of the most dramatic form of land transformation that profoundly influences biological diversity and human life in Europe. Particularly strongly is the influence of these processes on protected areas located in the vicinity of the cities. The threat is primarily influenced by the process of cutting the protected areas by roads and build up areas due to moving of the citizens to the suburban zones. Another threat is the intensification of agricultural areas by homogenization of land use and the forming of large cultivation units in combination with loss of natural landscape elements. Quantifying landscape pattern and its change is essential for the monitoring of changes in ecosystem services caused by urbanization and other processes. Landscape indicators can be very useful for such assessments. The authors used landscape metrics for a gradient analysis of land cover between cities and protected areas. The two cities Dresden (Germany) and Poznan (Poland) were chosen, because they are comparable due to inhabitants, area and location in former socialistic regimes. The biggest difference affects legal and socio-economic conditions. Overall, the study shows decrease of ecosystem services and diversity indices with increasing distance from the protected area, but the lines of trend near Dresden and Poznan have a different course. In comparison to Poznan, around Dresden are more protected areas and much more settlement areas are located near or even inside them. Protected areas around Poznan are more aggregated and more distant from the town centre, have more natural character and are more diversified in terms of land cover configuration. It let us suppose that the protection of these areas is more efficient and protected areas provide more ecosystem services. On the other hand in Dresden, thanks the more compact character of built-up areas and accompanied green urban areas, the landscape of suburban zone is more diversified and the benefits of ecosystem services are closer to the people. The reason are more restrictive legal aspects of spatial planning in Germany.

Key words: Urbanization; ecosystem services; protected areas; landscape metrics; gradient analysis.

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Thermal comfort assessment during a summer hot episode in the tropical city of S. Paulo (Brazil)

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ABSTRACT

Several studies emphasize that the Urban Heat Island (UHI) effect tend to occur with higher duration and intensity in the next decades due to climatic changes, demographic and urban growing. The absence of green areas (reduced evapotranspiration), poor ventilation, pollution and an excess of anthropogenic heat are also common causes pointed out by authors. Therefore, studies about local and microclimate are a necessity to understand and quantify the thermal comfort of humans. The main goal of this research is to assess the thermal comfort in Avenida Paulista, the cultural and economic centre of São Paulo – SP, Brazil, during the hottest summer day of 2015 (the 20th of January). During this extreme event the temperature in São Paulo (Santana meteorological station) attained the maximum air temperature of 36.7°, the specific humidity was about 52% and the wind speed was very weak (1.87 m/s). To understand and quantify the UHI effects on the thermal comfort in several urban spaces of Av. Paulista, the air temperature, the Mean Radiant Temperature (MRT), the humidity and the wind speed and direction were modelled with ENVI-met software. Beside these meteorological variables, PET (Physiological Equivalent Temperature) was also computed. The results presented here (6:00, 10:00, 14:00 and 18:00h), were taken from 12 hours of simulation. The study area represent diversified urban morphologies: 1) open spaces with high buildings and the main routes of circulation; 2) compact spaces with high buildings and some vegetated areas; 3) spaces with high buildings densely vegetated. The PET results indicate that the thermal amplitude ranged between 18.4° (at 6:00h) and 60.4° (at 10:00h), with an average of about 40°. This high variability can be explained by the intense verticalization and high urban compactness in the Av. Paulista that produces an effective shadowing effect, changing considerably the thermal component and the air circulation, contributing to the cooling of the shadowed places and overheating the open spaces. The MRT ranged between 23° and 33°, which indicates that the areas with the higher MRT agree with higher PET. The strongest thermal stress occurred in the areas with poor air circulation (we must keep in mind that the wind speed was very low <1 m/s), resulting on extremes index PET (>60°) in open spaces with high buildings and few vegetation. The vegetated areas presented a potential cooling effect, with an average reduction of about 2°C when compared with non-vegetated spaces (the same was verified with the reduction of PET).

Key words: Thermal comfort; Sao Paulo; PET; vegetation; Avenida Paulista.

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U-235/U-238 isotope ratios in monthly atmospheric deposits collected at Akita, Japan in 1977 and 1978

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ABSTRACT

The U-235/U-238 ratio fractionates insignificantly under natural environment. Uranium with a different U-235/U-238 ratio from the natural one is thus attributable to anthropogenic nuclear activities. Warneke et al. (2002) has reported that the enriched uranium was found in the deposits on the archived herbage samples in UK in the 1950s and 1960s. Moreover, the results of their study have suggested the possibility of the depositions of depleted uranium (DU) in 1977, 1978 and 1983. In this context, we have been trying to find the “anomalous uranium” emitted in the past few decades to the environments due to the nuclear activities. Recently, we have found one, the uranium enriched in U-235, in some atmospheric deposits having been collected monthly by Japan Meteorological Agency and archived at Meteorological Research Institute. In this study, we conducted the verification of the fallout of DU in the late 1970s by determination of uranium isotope ratio in the Japanese atmospheric deposits at that time. The monthly atmospheric deposits, which were collected in 1977 and 1978 at Akita City, the prefectural capital of Akita, and have been archived at Meteorological Research Institute, Japan (MRI), were subjected to this study. Akita is located at the west side of northern part of “Honshu”, the main island of Japan. In Japan, the deposition of anthropogenic radionuclides originated from nuclear test explosions worldwide predominates on the west side of the northern Japanese Islands, especially in Akita, due to geographical and meteorological reasons. The deposition samples were first subjected to the HNO_3 leaching treatment. After the treatment, the uranium isotope ratios in the leachates (acid-soluble part) and residues (acid-insoluble part) have been determined separately by HR-ICP-MS (Attom, Nu Instruments). The obtained uranium isotope ratios were normalized to that in seawater measured at the same time, whose isotope ratio is regarded as the natural ratio. The uranium isotope ratio of a sample (leachate and residue) is expressed as N(U-235/U-238), which is the average value of the seawater-normalized values in multiple measurements. The uranium contents and the N(U-235/U-238) values in the monthly deposition samples had varied seasonally and temporally from 1977 through 1978. However, the uranium contents seem not to correlate with the N(U-235/U-238) values. The anomalous uranium slightly depleted in U-235 has been found in the some Akita atmospheric deposits collected in mid-1977. On the other hand, a certain amount of plutonium has been deposited in Japan at that time (MRI, 1996). The uranium depleted in U-235 found in the Akita deposits collected in 1977 had probably been injected into the atmosphere together with plutonium by the largest Chinese nuclear tests conducted on 17th November, 1976 and directly transported to Japan through the air. Those two radionuclides had probably been transported by the mechanism different from that of radioactive strontium and cesium, although all of these radionuclides had come from the nuclear test explosions.

Key words: Uranium; anthropogenic radionuclides; nuclear test; aerosol; fallout.

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Investigation of air pollution in Bilecik, Turkey

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ABSTRACT

In this study, the air pollution dataset of Bilecik in Turkey was evaluated by using the statistical process control technique including mean control chart. The technique was applied to the air pollution data such as particle material (PM10) and sulphur dioxide (SO_2). Mean control chart show that process isn't under control because pollution is increased by November 2013- February 2014. Finally, this study showed that the usefulness of statistical process control technique for interpretation of air pollution parameters.

Key words: Air pollution; mean control chart; particle material (PM10); sulphur dioxide, Bilecik; Turkey.

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Comparison of surface observation data and simulations of atmospheric flow using CFD model: a case study of Seolleung area in Seoul, South Korea

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ABSTRACT

Dispersion of hazardous substances by events such as big fire or terror in a built-up area causes huge losses of both life and property. For emergency response, decision makers want to know what areas are impacted and how long the impact will last. In order to do this, atmospheric flow information is essential. However, the atmosphere of urban area has a very irregular flow pattern due to surface structures and local thermal imbalance. To deal with this matter, atmospheric flow patterns of large cities are investigated using a Computational Fluid Dynamics (CFD) model. As input data for CFD simulation, fixed log profile assuming neutral condition is created using radiosonde observation data and output from WRF. And CFD model results are compared with surface observation data of 16 points station which installed at Seolleung in Seoul, Korea. Wind analysis using the radiosonde data and WRF model results show similar pattern to the wind observation done at the surface of the urban area.

Key words: CFD; WRF; radiosonde.

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Large-eddy simulation of urban flow and dispersion over Seolleung area in Seoul, South Korea

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ABSTRACT

Air quality is a growing concern in urban environment and accurate prediction of transport and dispersion of contaminants is needed. Urban flow and dispersion characteristics over Seolleung area in Seoul, South Korea are investigated using the parallelized large-eddy simulation model (PALM). 10m high resolution terrain data is applied. Computational domain is rotated into direction of inflow. Additional terrain is added to avoid confliction of outflow boundary condition. We validate our result against vertical observation data of radiosonde. Turbulent recycling method is used to input initial turbulence. Quasi-steady turbulent state in time is checked to show reasonable large-eddy simulation. A passive substance is released on the centre of Seolleung under virtual scenario and its path of dispersion is tracked.

Key words: LES; urban flow; dispersion.

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Numerical analysis of a capping inversion effect of a convective boundary layer flow on contaminant gas dispersion

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ABSTRACT

Contaminant gas dispersion resulting from accidental release from industrial areas or intentional release of CBRN (chemical, biological, radiological, or nuclear) agent is of great concern to public health and social security. For the assessment of human health hazards from such harmful substances, the existence of high concentration peaks in a plume should be considered because it is the instantaneous, not average, concentration which is fatal to humans. In such a situation, it is necessary to accurately predict the unsteady behaviour of a plume, considering atmospheric thermal stability. In the atmosphere, heating and cooling within a boundary layer due to solar cycle during a day result in temperature differences, which introduce buoyancy forcing. Especially, a convective boundary layer (CBL) capped by a temperature inversion is one of common cases of atmospheric boundary layers during daytime conditions. For simulating plume dispersion under various thermal conditions, there are typically two approaches: one is a wind tunnel experimental technique, and the other is a numerical simulation approach based on computational fluid dynamics (CFD). It is well known that wind tunnel experiments are a reliable tool. Recently, wind tunnel experiments have been conducted to investigate the influence of a convective boundary layer capped by a temperature inversion on plume dispersion behaviours of a contaminant gas and relative source elevation to the capping inversion height on the longitudinal distribution patterns of concentration. However, these studies have focused on the characteristics of plume dispersion under a certain thermal condition of a CBL flow. CBL flows have shear- and/or buoyancy-driven flows and can be categorized depending on the ratio of friction velocity to convective velocity scale. The influence of CBLs on plume dispersion behaviours depending on the flow types has not been fully discussed. In this study, we performed numerical simulations of various CBL flows capped by a temperature inversion by changing the bulk Richardson numbers (Rib) as one of parameters for representing atmospheric conditions and investigated distribution patterns of plume concentrations. First, compared to the existing wind tunnel experimental data, it is found that turbulence structures are reproduced well for each case. Then, we categorized the patterns of vertical profiles of mean concentrations depending on the atmospheric conditions. It is found that a plume quickly begins to touch the ground for strongly unstable boundary layers with Rib < -0.45.

Key words: Numerical analysis; atmospheric sciences; air pollution; atmospheric boundary layer.

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Influence of atmospheric deposition on selected areas of Eastern Slovakia – Košice and Krompachy

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ABSTRACT

The contribution deals with the selected components of atmospheric bulk deposition in the eastern part of the Slovak Republic, in the Krompachy area. The atmospheric deposition (AD) is a significant source of many toxic pollutants and their major input into the surface and other components of environment. The monitoring was focused on the deposition fluxes of solid particles, trace metal elements (Fe, Mn, Pb, Cu, Cd and As), on their seasonal variations, origin and presence in water soluble and insoluble phases in the rural area close to the coppersmeltery in Krompachy. The values of deposition solid particles in summer seasonexceed the values obtained during the winter. Significantly higher abundance of allelements besides the Fe was found in the soluble phase in the area of Krompachy.Very high enrichment factor values were measured for Mn, Pb and Cu at sites nearbythe copper smeltery in Krompachy. The Košice city lies in the eastern part of Slovakia. Except emissions arising from small industrial and municipal sources, road traffic and civil engineering, two large industrial sources of pollutants are located in its vicinity and directly in the town. In the area Krompachy, several times higher values of deposition fluxes were measured in the case Cu, Cd, Pb, Zn and As, which come predominantly from copper smeltery. The elements Al, As, Mn, Fe and Cr show a significantly higher presence in the summer period in this area. The higher deposition fluxes of Fe, Mn, Al and Cr were determined at sampling stations in Košice. In the case of Košice, only elements Al, As and partially Cu were achieved higher values in summer season. The deposition fluxes of Cd, Pb, Zn, Mn, Fe and Cr were significant up to slightly higher in winter season. The values of deposition insoluble phase (solid particles) in summer season were relatively balanced and exceeds the values in winter one from both areas.

Key words: The Krompachy and the Košice area; bulk deposition; heavy metals; metallurgical activities; urban area.

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Exploring the relation between ground level PM2.5/PM10 and AERONET/ MODIS aerosol optical depth over an urban site in Valencia, Spain

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ABSTRACT

Air pollution constitutes one of the main environmental problems in developed countries as it affects human health, visibility and global climate. Its effects on human health are dominated by particulate matter, both PM2.5 and PM10. Inhaling these particles is usually related to different respiratory illnesses (asthma, lung cancer or bronchitis) or cardiovascular diseases, as ultrafine particles can penetrate the lung lining and enter the blood. Since aerosol optical depth (AOD) is related to the aerosol loading in the atmosphere, several attempts have been made to establish a relationship between AOD and PM concentrations in order to be able to estimate PM concentrations over different regions using satellite data. In this study we explore the relation between AOD and PM2.5-PM10 in Valencia using data from 2007 to 2015. First, as PM2.5 is a fraction of total PM10 measured in our site, daily PM2.5 and PM10 relation was analysed obtaining a correlation of 0.66. Percentiles P25 and P75 for PM2.5 and PM10 concentrations in our site range from 12 to 22 $\mu g/m^3$ and from 17 to 30 $\mu g/m^3$, respectively. AERONET level 2 AOD was then compared to PM2.5 and PM10, obtaining a low correlation when using the whole dataset but with significant dependence on the season and the mixing layer height. In this way we observed that the correlation between the data improves in winter, when the mixing layer height is lower. In general, results show that PM10 is better correlated to AERONET AOD than PM2.5. The AERONET network, although it is greatly expanded throughout the world, has a lower spatial coverage than products from sensors on board satellites. In this way, MODIS AOD has been related as well with ground level PM concentrations. MODIS sensor gives two different AOD products, providing this parameter with a pixel resolution of 10 x 10 km and 3 x 3 km. Both of them have been compared to PM values, in order to see how pixel's size can affect the relation observed between AOD and PM. Results obtained are similar to those already observed using AERONET AOD and show that using MODIS AOD 3 x 3 km products slightly improves the correlation in comparison with MODIS AOD 10 x 10 km products.

This work was financed jointly by the Spanish Ministry of Economy and Competitiveness and the European Regional Development Fund through projects CGL2011-24290 and CGL2012-33294, and by the Valencia Autonomous Government through projects PROMETEUII/2014/058 and GV/2014/046.

Key words: MODIS; AERONET; aerosol optical depth; particulate matter; PM2.5; PM10.

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Relationship between climatic changes and land use: a proposal of analysis from the metropolitan region of Baixada Santista, São Paulo State (Brazil)

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ABSTRACT

The proposal of this study is to evaluate the efficiency of the multidecadal indicators to recognize recent trends of these parameters, how they relate among themselves, and which socio-environmental responses can be expected from changes in their dynamics. The study area encompasses Santos and neighbour cities, which besides being one of the first regions to be occupied in Brazil, in the 16th century, presents an increasing strategic importance that contrasts with its low natural stability thresholds, which are continually modified by constant natural and anthropic pressures. Therefore, natural processes such as landsliding, flooding and erosion have been more and more frequent and severe, which might permanently compromise the activities of this vital region for the regional and Brazilian economy. In order to select multidecadal indicators, a survey of experiences in the light of climatic changes has been carried out at national (Instituto Brasileiro de Geografia e Estatística – IBGE) and international (United Nations Environment Program – UNEP; Organization for Economic Co-operation and Development – OECD; World Resources Institute – WRI) scales. As reference, the DPSIR model (Driving Force – Pressure – State – Impact – Response) was adopted, which derives from the model used by OECD in 1994. Following a logic cause-effect-response sequence between its components, the state of the environment is assessed, considering the factors associated with human activities that establish Pressure on it and that can derive from direct and indirect “causes” in relation to the present state. Thus, State corresponds to conditions and quality of the environment that result from anthropic pressures; Impact refers to the adverse effects to the quality of life, to ecosystems and to socio-economy; and Response encompasses the actions of the society (the government, companies and the population), in order to improve environmental conditions. The following indicators are proposed: Driving Force (urbanization, economic activities); Pressure (Demographic dynamics: population growth and demographic density; Economic Activities: industries and services; Territorial occupation: land use: expansion of the urban area, reduction of the vegetal cover, and precarious settlements – favelas); State (Climatic variables: rainfall intensity and distribution, temperature changes; and other environmental variables: landsliding, flooding, erosion, siltation and undertow); Impact (Vulnerability: area and population affected by landsliding, flooding, erosion, siltation and undertow – natural disasters; extreme events: extreme rainfall); Response (Legal instruments: climatic changes and environmental legislations; technical instruments: master plans, geotechnical charts, plans for the recovery of vegetal covers, programs for the recovery of precarious settlements). Lastly, the objective of the understanding of the local dynamics, by means of the assessment of the correlations between multidecadal indicators, is to contribute to the adoption of adaptive strategies, so that the proposal can be adapted to other areas, with the choice of parameters that are more important to the local dynamics.

Key words: Indicators; climate change; land use.

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Evolution of research on adaptation to global climate change between 1999 and 2013: case study of the magazine "Mitigation and Adaptation Strategies for Global Change"

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ABSTRACT

A Adaptation and mitigation are complementary strategies for reducing and managing the risks of climate change. However, the amount of studies and actions on mitigation has been much higher than the ones on adaptation since the beginning of the discussions on climate change, but this tendency has been changing in recent years. This article aims to analyse the evolution of research on adaptation, taking as a case study publications in a specialized magazine, keeping in mind that the 5th Report of IPCC (2014) has mentioned that researches on adaptation had roughly doubled on the period from 2008 to 2010. The magazine chosen to observe the growth of interest in research on adaptation was “Mitigation and Adaptation Strategies for Global Change”, due to its relevance in the field and for being a transdisciplinary journal, addressing both mitigation, adaptation, as well as other issues, always following global trends of research on the subject. To verify this trend, the papers published in two periods were compared: 1999-2003 and 2009-2013. It was observed that the number of articles on adaptation in this magazine increased from 23 in the first period to 118 in the second period, almost equalling the other themes (mitigation, health issues, biology, etc) which increased from 80 to 130 articles published in the two periods, denoting significant increase in research published in this journal addressing adaptation policies, almost equalling the other issues in the second period, which did not occur in the first period. This increase began mainly after the Marrakesh Agreement (COP 2001), which created a fund for financing adaptation, and also reinforce the need to discuss further actions to cope with global climate change in a scenario in which the USA, the world's biggest polluter, remained outside the agreements for reducing the emission of greenhouse gases. This research is part of a comprehensive project Metropole (Belmont Forum, call coastal vulnerability), which aims to contribute to the linkage between the scenarios projected by scientific research on climate change and policy decisions on adaptation of municipalities of the three members of the project: United States of America, United Kingdom and Brazil.

Key words: Climate change; adaptation; mitigation; COP.

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Recent changes of the phenological development north and south of the Ore Mountains

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ABSTRACT

As an extension of the evaluations of the INTERKLIM study (see www.interklim.de) was studied the development of selected phenological phases for the region. The observation period begins in 1961 and ends in 2014. It can be shown that the changes in the climatic conditions also have a significant impact on the development of plants. Both north and south of the Ore Mountains the plants react in a similar manner. In general it can be seen earlier admission data. The earlier dates occur in this case, especially in spring. Thus, the growing season is extended, because in the data of phases in the fall only weak and hardly any significant change signals are recognizable. The signals are similar while the north and south of the Ore Mountains, but in some years also show differences especially in early spring, due to local differences in the persistence and thickness of the snow cover. Continue to show up in some regions in direct north-south comparison relief conditional greater change signals south of the Ore Mountains. By regression analysis it becomes clear that the climatological causes of prematurity in the higher temperature and slightly elevated sunshine can be seen. The precipitation and the resulting soil moisture have no effect in the spring and early summer. Their effect is only noticeable when the soil moisture is very low in the summer. This drought also causes then an acceleration of phenological development in the sense of an earlier maturity and previous leaf colouring. The considered 54 years can be divided into two periods. In between 1961 and 1990, there has been little change. In the following 24 years, the displacements were all the stronger.

Key words: Phenology; climate change.

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Micrometorological observations for the evaluation of the Selective Inverted Sink against radiation frost and the potential of a new hybrid system

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ABSTRACT

For the radiation frost in agricultural fields, it is difficult to determine a satisfactory solution. To solve this problem, Selective Inverted Sink (SIS) is proposed as a new active frost protection method, which has been increasingly adopted worldwide due to its low investment costs. However, the interactions of the SIS (also known as tower less wind machine) with some topo climatic effects such as cold air drainage and inversion strength are not well known. Consequently, this study was dedicated to two main objectives: First, different microtopographic conditions are compared to validate the capability of SIS against the radiation frost. Second, a new hybrid system was proposed to improve the SIS effects. For these two purposes, three meteorological field campaigns (Fall 2013, Fall 2014 and Spring 2015) were conducted on the fields of a vineyard and an orchard in Quebec, Canada. The air temperature was recorded with a fine spatiotemporal resolution in a synchronous mode of operation. In addition, the air temperature and humidity were recorded with mobile measurements and launching balloons to infer the general variations of temperature and specific humidity. Based on the topographic maps and field measurement, the several locations for SIS (Propeller diameter: 2.39m, velocity of 540 rpm at PTO) installation were determined. The high resolution isotherms maps were used to evaluate the influence of SIS on nocturnal air cooling. These results did not provide conclusive observational evidence that the SIS has impartial efficiency on nocturnal cooling. Indeed, a minor part of the SIS's exhausted flux was from horizontal direction, essentially due to land surface roughness. In contrast, a major part of the flux was from the upper layer around the SIS, which behaves like a funnel. The wind speed in the funnel's direction was 3 times greater than the wind speed in the horizontal direction. Therefore the SIS was not able to remove a sufficient amount of cold air pool or stagnant air. To elucidate the second objective, a simple and affordable innovation with reliable testing was performed. A hot water SIS hybrid system (HWSH) was proposed to use the "forced convection" produced by the SIS to disperse a maximum of water vapours into the air in order to decrease the air dryness. In this system, hot water with a temperature of 60°C was deployed under the SIS. The observation during a radiation frost night demonstrated that, although the reference area (35m away from the HWSH) was affected by frost, hybrid system's location area (high risk area) was not affected. However, there was no significant temperature gradient between two points but the moist enthalpy calculated at 18m altitude was higher above the HWSH in comparison to reference point. In conclusion, the main physical notion throughout this study is moist enthalpy which depicts heat content. Nocturnal air cooling decreased by increasing the air moist enthalpy with the HWSH system. This environmentally clean hybrid system has potential to be considered as an alternative to some frost protection methods such as heaters and fires burning. In addition, the importance of fine-scale measurement in agricultural field is highlighted in this study.

Key words: Radiation frost; cold air drainage; topoclimate; moist enthalpy.

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Analysis of observational experiments on spatial temporal nocturnal temperature during radiation frost in elevated complex terrain of Coaticook River Valley (Quebec –Canada)

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ABSTRACT

In order to efficiently implement the frost protection, there is a need to know where and when the frost is more likely to occur. Therefore, the aim of this study is to investigate the spatial and temporal variability of meteorological parameters during radiation frost in elevated complex terrain. The study area was Coaticook River Valley, Quebec, Canada. Toward this end, seven experimental stations on various topographic conditions (open valley, valley close to the river, shelter wood forest, etc.) were installed. In addition, data of two classical meteorological stations were used. Based on the datasets, two modules were developed: 1-Statistical module: The outline of the statistical approach (3-D maps) illustrated the lower daily maximum dew point, leading to the lower minimum nocturnal temperature. In addition, the difference of nocturnal temperature between the experimental stations and the two classical stations showed that a simple linear correlation was present between the different temperatures for the non-frost night. On the other hand, a nonlinear and complex correlation was observed for the frost night. This may be attributed to a number of microclimate phenomena (e.g., cold air drainage) that were revived or amplified during the frost night and that could change the mechanism of nocturnal cooling. 2-Physiographical module: The relationship between nocturnal temperature and the radiative cooling rate, the Vapour Pressure Deficit (VPD), Saturation Equivalent Potential Temperature (SEPT), and the air-surface temperature gradient was investigated during the frost nights of fall 2012. Heterogeneous nocturnal cooling due to the diversity of the topography was presented in this module. The largest variation in nocturnal temperature could be found in sheltered locations or in valleys (i.e., 7- 9 °C). On the other hand, less variation was observed in the valley close to the river, or a different temperature (i.e., 3°C one hour after sunset) for two points with the same altitude with 10 km distance. In addition, the results indicated that the cooling rate increases with the air surface temperature gradient. The time series of VPD showed that the correlation between nocturnal temperature time scales with VPD was stronger than that with soil humidity or soil temperature. In addition, VPD's values were higher before and after the frost night. The rapid decreasing of SEPT for all the stations during the evening transition period implied rapid decreasing of specified humidity of the lower atmosphere. The physiography of SEPT against the radiative cooling rate indicated different patterns for different experimental stations. This could be explained by the effect of microclimate on the amount of air humidity evaporation. In conclusion, the fall of temperature on frost was mainly determined by two factors. The air humidity and local terrain's effect, so using just the statistical method to extrapolate nocturnal temperature may lead to incorrect determination. In addition, this study did not find any correlation between altitude and nocturnal temperature. Therefore, an understanding of terrain-related processes such as cold air drainage or sheltering is required. Finally, in this study the absolute humidity of the lower atmosphere was measured, expressed by vapour density (using SEPT) and vapour pressure (using VPD). They are presented as two sensitive indicators to air humidity and drying power of air which could be used for monitoring and the assessment of frost condition.

Key words: Radiation frost; nocturnal temperature; vapour pressure deficite; saturated equivalent potential temperature; air specific humidity: soil humidity.

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Study of the exposure to frost in a vineyard in Domaine Bergeville in the Eastern town ships Quebec, Canada

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ABSTRACT

Frost Damage Risk is a function of Frost Occurrence, Vulnerability and Exposure. In order to efficiently implement the frost protection, there is a need to know where and when the frost is more likely to develop. Accordingly, the goal of this research was to study which part of a vineyard was more exposed to frost and how much a vineyard was in the exposed to it. The study domain was a commercial vineyard in Domaine Bergeville in the southeast of Quebec province, Canada. An observational study was conducted during late frost period (may 10th to June 10th, 2015). Air temperature and humidity 1.7 m above the surface and 30 cm under the ground, wind speed and pressure data from the two Hobo stations were used in the analysis. One of the stations installed in clear cut area (upper station at 262m altitude) and the second at 110 m distance from the clear cut center situated in the shelter wood region (lower station 250m altitude). This station was blocked by a forest arc form. The result showed microclimate differences between the upper and lower stations including lower temperatures that were often observed at the bottom. On one hand, observation indicated more soil humidity (surface and 30cm deep) for the lower station in comparison to the upper station; on the other hand, time series of specific humidity exhibited very close trends for the two stations. Therefore, there was no mechanism to remove (or add) water vapor from the lower station, and the temperature gradient between the two stations was due to topographic structures and shelter wood forest, instead of atmospheric parameters. In addition, using Trapezoidal Numerical Integration Method (TNIM), the exposure of frost was calculated for stations. The result demonstrated that the lower station was exposed to lower temperature 60403 minutes more than the upper station during the experimental period. Reduction in temperature started in the lower station sooner than in the upper station by range of 85-110 minutes. So the time of implementation must be one or two hours sooner in exposure of frost risk. As conclusion, this study shows the importance of understanding of terrain-related processes such as sheltering and clear cut to improving the frost protection system in the agricultural field. The results indicated that the topography and forest exert a major influence on local climate and temporal temperature variation. This is more important for agricultural purposes where knowledge of the local differences in climate within a relatively small area is important. And finally, active control strategies and methods must be implemented based on exposed frost zone in the vineyard.

Key words: Frost damage risk; Shelterwood, clear cut area; trapezoidal numerical integration method, specific humidity; topography.

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Oil reservoir simulation using Super Element Method

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ABSTRACT

Simulation of oil field development is traditionally performed using full-scale filtration models (Roxar Tempest More, Schlumberger Eclipse, etc.) on computational grids with a cell size of approximately several tens of meters horizontally and tens of centimetres vertically. Such models require specification of an excessive number of parameters, and in case of large fields (length of the order of tens of kilometres, thousands of wells) they contain millions of cells. This complicates their adaptation and makes it virtually impossible to use them for multivariant prediction calculations. To overcome these problems when optimizing the system of oil field development, it is proposed to use a super element modelling method. Compared to the traditional models, the super element model makes it possible to speed up calculation of two-phase filtration in an oil reservoir by hundreds of times owing to the use of large computational cells – super elements, the number of which corresponds to the number of wells in the field. Satisfactory accuracy of the solution on a coarse grid is maintained due to the problem formulation relative to the smooth mean fields of pressure and saturation as well as due to the preliminary upscaling of the reservoir's hydraulic and capacity properties and the use of independent detailed nested computational grids in cases of local refinement of the solution. For constructing a grid of super elements in a horizontal plane, we use the algorithms of centred PEBI-segmentation, which make it possible to build a predominantly hexagonal grid covering of the computational domain, in which case the centres of the computational blocks coincide with the initial control network. The role of triangulation centres is performed by active vertical wells as well as additional centres that ensure a uniform coverage of the field area. Unstructured computational grids simplify the description of reservoir geometry and the determination of boundary conditions. They also reduce the impact of grid orientation on the numerical solution. The division of the reservoir into super elements in the vertical direction is performed along the boundaries of the geological packs containing several permeable layers. The super element model is based on the known two-phase flow in porous media equations written without regard to capillary and gravity forces. A low-dissipative approximation of the hyperbolic equation of saturation transport is constructed using a TVD method in its algebraic form in combination with the original approach to the correction of saturation movement, based on the analytic theory. Problems of absolute and relative permeability upscaling are solved on detail computational grid using multigrid method and parallel algorithm for NVIDIA CUDA platform. For problems of hydraulic fractures and tectonic faults method of direct QR-factorization is used. It appears sufficient to use a coarse super element grid for cumulative adaptation of the model. The high accuracy of the numerical solution near the computational domain's geological and technological features (tectonic faults, high permeable lens inclusions, paleochannels, vertical and horizontal wells, and hydraulic fractures) is achieved by solving the auxiliary problems on fine nested grids. Testing of the model on the real oil fields and comparison between the results from numerical simulation and the corresponding results obtained using the traditional models on small grids confirm wide opportunities and prospects of the super element model for rapid calculations. It is possible to speed up simulation of oil reservoir development by hundreds of times using the super element method without significant loss of accuracy. The super element model is able to describe arbitrarily oriented wellbores, hydraulic fractures, tectonic faults and geological bodies. In each individual case, this requires using auxiliary fine grids and solving the corresponding mathematical problems. The model is implemented by an ongoing software system for maintenance and monitoring of oil field development, which helped build the super element models for the development of a number of fields in Kazakhstan and Russia.

Key words: Super element; oil reservoir simulation; two-phase flow in porous media; upscaling.

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Modelling of fluid flow through porous cylinder in periodic array using a boundary element method

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ABSTRACT

The problem of air flow through porous bodies has practical applications for the solution of different environmental problems, for example in air cleaning devices - aerosol filters, wire screens, protective aerosol respirators. The use of porous cylinders as elements of aerosol filters significantly increases the efficiency of deposition of aerosol particles. During the filtration process the suspended particles, deposited on fibres, form a porous layer. The fluid flow through the filter elements covered by porous layers considerably affects the inertial and diffusional capture of aerosol particles. The efficient models of fluid flow past porous bodies should be developed to calculate the two-phase flows of dusty air. In present work the fluid flow in periodic array of porous cylinders (model of flow in aerosol filter) is considered in the assumption of viscous incompressible flow. The Stokes flow model is accepted outside the cylinders. Inside the porous cylinder Darcy law of drag is applied to find the filtration velocity field. The boundary problems for biharmonic and Laplace equations for stream function and pressure are formulated. The equality of pressure and normal velocity and the condition for the tangential velocity proposed by Beavers and Joseph (1967) are taken as the boundary condition on the porous surface. The boundary elements method is developed to solve the considered boundary problems. The Green formulas are written for biharmonic and Laplace equations. The boundary conditions are expressed through the stream function. The system of algebraic equations is obtained for unknown functions outside and inside the porous cylinder. The numerical solution is compared with analytical solution obtained within the approximate periodic cell model with Kuwabara boundary conditions. The good agreement of numerical and analytical model is observed. The developed approach will be applied to calculate the dusty air flow in the array of filter fibres taking into account the change of the fibre shape and size due to the dust particle deposition.

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Key words: Porous cylinder; Stokes flow; Darcy model; boundary element method.

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Visibility graph analysis of real seismicity sequences and synthetic seismicity generated by a stick-slip experimental model: a comparative study

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ABSTRACT

The visibility graph (VG) approach is applied to two different types of data sets, one is the seismicity generated by the subduction processes occurred at south Pacific coast of Mexico between 2005 and 2012, and the other corresponds to the synthetic seismic data generated by a stick-slip experimental model. This comparison has the purpose to show the similarities between the dynamical behaviours of both types of data sets, in the context of complex systems. In particular five seismic areas of the Mexican subduction zone, Guerrero, Chiapas, Oaxaca, Jalisco and Michoacan, were investigated. For both the real and synthetic seismic sequences the typical seismological b-value of the Gutenberg–Richter law was calculated and put in relationship with the topological VG parameter, the so-called k-M slope. The found relationship, hold by both the types of datasets, indicates that the experimental model of stick-slip fault globally reproduces the behaviour observed in the statistics used to describe the seismicity of the subduction zone. The present study is supported by the Bilateral Project Italy-Mexico "Experimental Stick-slip models of tectonic faults: innovative statistical approaches applied to synthetic seismic sequences", jointly funded by MAECI (Italy) and AMEXCID (Mexico) in the framework of the Bilateral Agreement for Scientific and Technological Cooperation PE 2014-2016.

Key words: Earthquakes; stick-slip model.

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Predictive radon potential mapping using Frequency Ratio and GIS

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ABSTRACT

The aim of this study was to analyze relationships between radon and spatial factors, and to integrate these relationships through a probabilistic method using Geographic Information Systems (GIS). We identified potential areas that have not been subjected to exploration, and compiled a variety of spatial data—including geology, topography, soil and geochemical data—for these areas. We then evaluated and integrated radon concentrations with these spatial factors to produce a map of potential radon deposits in the Yongin area of Korea. The method consists of three main steps: 1) identifying spatial relationships, 2) quantifying these relationships and 3) integrate between these relationships. A spatial database containing radon, topographic, geologic, soil and geochemical data was constructed for the study area using GIS. We related these factors to 147 radon occurrences, as well as geological data such as lithology and fault structure, topographic data such as elevation and slope, soil data such soil texture and geochemical data such as abundance of T, EC, Eh, DO, DTW, Gross_Alpha, Ra_226, K, Na, Ca, Mg, SiO_2, Sr, F, Cl, NO_3^-, SO_4^{2-}, HCO_3, Rn_222, U. By using the constructed spatial database, the relationships between radon occurrences and these 22 factors were identified and quantified using probabilistic modelling (specifically the frequency-ratio method). All factors were combined to produce a radon potential map using the overlay method in GIS. This radon potential map was validated by comparison with known occurrences of radon gas. Of the total number of radon occurrences, 50% were used for mapping, and the remaining 50% for model validation. Our radon potential map was accurate 93.33% of the time, according to frequency-ratio models. This radon potential map could be an important source of information regarding potential radon exposure.

Key words: Radon potential; Frequency Ratio; GIS; prediction.

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Outdoor multi purposes geophysical test site for educational and research activities, King Saud University, Saudi Arabia

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ABSTRACT

Constructing controlled test site is one of the most important tasks for educational and research purposes. In the test site, simulation of the real filed objects are essential to enhance the geophysical educational tasks and enrich the results of the geophysical modelling for the shallow geophysical applications in engineering, environmental and archaeological studies. The site has chosen to simulate most of the subsurface utilities, cavities, different environmental and archaeological materials. The selected buried materials that were hosted by different types of sediments have been defined accurately with controlled coordinates (x, y, z). Different geophysical surveys have been carried out along the planed level site before starting the buried process. Then different techniques are used to locate the different buried targets and compare the resultant signals with the actual body parameters. Such procedures can greatly help in calibrating different geophysical systems, train the students in controlled site, choose the optimum geophysical system for each subsurface target and conditions, test the performance the different geophysical surveying practice, as well as ease the implementation of the forward calculations over different buried objects.

Key words: Geophysical test site; utilities; archaeological materials; cavity.

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Estimation of daily soil temperature by using M5 Tree Model

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ABSTRACT

This paper investigates the potential of M5 tree model estimation of daily soil temperature at 5-100 cm depths. Tree structure of this model is able to divide total variables space to some sub-spaces and make linear models for each sub-space to predict target variable. Climatic and soil temperature data of Isfahan province located in central Iran was used for modelling process as inputs. Result showed that M5 tree model with determination coefficient of 0.98 and root mean square error 1.64 could be estimate daily soil temperature with high accuracy in 10 cm depth. On the other hand M5 tree model provides a simple linear relation to predict the soil temperature for the data ranges used in this study. Error analyses of the predicted values at various soil depths suggest that estimation error tends to increase with the depth.

Key words: Soil temperature; data mining; M5 tree model; Iran.

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The trend analysis of lakes region precipitation

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ABSTRACT

In recent years, population growth, urbanization, tainted water use policies, water pollution due to industrialization and climate change has led to the re-evaluation of water resources. Protection plans developed in the past have lost their validity otherwise today made the new prevention plan has caused the critical analysis. In this research, the monthly precipitation data were analysed for Lakes Region in Turkey. For this purpose, the data subjected to test for homogeneity was maintained and Mann Kendall and Sen Analysis were applied. The Mann-Kendall analysis were applied to 9 meteorological stations which identified in the study area for monthly precipitation data. The existence of a trend is indicative of a change in terms of precipitation in the region. The results of the tests, a decreasing trend has been observed in most of the 9 stations.

Key words: Trend analysis; precipitation; meteorological stations; Lakes Region.

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An investigation of water potential of Lake Eğirdir, Turkey

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ABSTRACT

Recent increase in urban population, water pollution due to industrialization, and climate changes revealed the need to revisit water utilization policies, to use water resources adequately, redo critical analysis for existing prevention plans and prepare new prevention plans. In the present study, current state of the water potentials of Eğirdir, region, located at lakes region, are investigated in terms of precipitation, temperature, evaporation, and water level change by using the monthly and annual data available. Therefore, the data is processed by using Run homogeneity test, Mann Kendall and Sen Analysis. In addition, water budget analysis is carried out for Lake Eğirdir. It is found that analysis results and water budget results overlap for Lake Eğirdir. Provided that, preventive measures are not taken immediately, at the end of a 100-year period. Level of Lake Eğirdir is estimated to decrease 24-%, annually. To prevent the water level decrease in Lake Eğirdir, there are some necessary precautions should be taken-: (a) Inactive underground resources should be activated,-. (b) Irrigation lands which use water from Lake Eğirdir should not be allowed,-. (c) Future water storage within the rainfall watershed should be prevented,-. (d) The lands that have shown no signs of development and expected not to improve in the future should be detected and these lands should be removed from future irrigation plans,-. (e) Efficient methods of economical use of water resources for the currently cultivated irrigated lands should be explored and developed,-. (f) Throughout the use of intelligent farming methods economic utilization of water should be performed.

Key words: Precipitation; temperature; evaporation; water level; Eğirdir Lake.

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Groutability estimation of granular soils with cement-based grouts using a hybridization of soft computing approaches

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ABSTRACT

Permeation grouting is a common technique for soil improvement. Predicting the groutibility is particularly important in the planning phase of a grouting project. This study presents a novel method for groutability estimation with cement-based grouts in granular soils using soft computing methods. The new method, named as ABC-SVC, incorporates the Support Vector Classifier (SVC) and the Artificial Bee Colony (ABC) algorithms which operate in a synergistic manner to estimate groutability. The SVC is used to recognize the groutability outputs ('success' or 'failure') based on a set of input information: water/cement ratio of the grout, grouting pressure, relative density of the host soil, and the diameters of the soils and grouts. In addition, the ABC is utilize to assist the SVC's model selection process. A dataset consisting of laboratory tests, collected from a previous research work, is employed to train and verify the proposed method. The experimental results demonstrated that the ABC can help the SVC's model selection process to converge quickly into a satisfactory prediction model. The average results (Avg.) and standard deviation (Std.) obtained from the repeated random sub-sampling procedure (including 10 runs), is provided in the experimental results. The ABC-SVC is compared with the Backpropagation Neural Network (BPNN). The result shows that the proposed method is better than the BPNN in terms of both classification rate (CAR) and Area Under the Curve (AUC). Moreover, the standard deviation of prediction results obtained from the ABC-SVC is significantly lower than that obtained from the BPNN. These facts demonstrate that the new method is an effective and reliable tool to predict groutability of granular soils with cement grouts.

Key words: Groutability estimation; soft computing; granular soils; cement-based grouts.

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The interaction of reservoir properties and microwave heating- an experimental and numerical modelling study of Enhanced Gas Recovery (EGR)

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ABSTRACT

The application of microwave heating in improving the production of natural resources has been studied by many researchers. It is more widely studied that the microwave heating is used in heavy oil recovery by decreasing the viscosity of oil and in drilling to decrease the rock strength. However, the application of microwave heating in improving gas production is neglected. The present study focused on the interaction of the properties of rock and interstitial fluid and electromagnetic wave, the presence of micro fracture and how these factors lead to an enhanced permeability and an improved gas production. The properties of rock discussed include the mineralogy, particle size and porosity, and properties of fluids are salinity and water saturation. All of these properties are measured in the lab. Thin sections were made for each sample and observed under microscopy. The images taken from microscopy were analysed in image processing software. The increased temperature affects these properties by evaporating the free water and bound water, shrinking clay mineral and increasing salinity. The temperature dependent properties are input in numerical model which is constructed in commercial Finite Element Modelling software and industry standard reservoir modelling software. The relative permeability and production are plotted against time to illustrate the feasibility of EGR assisted by microwave heating. Besides the modelling in a reservoir, the numerical modelling on a 1.5 inch core indicate the water inside the sample was heated firstly and then the outer part. The water distribution during microwave heating is directly related to the electric filed distribution. The NMR technique was used before and after microwave heating to study the microwave heating on pore size distribution. Samples with different pore size distributions were compared to identify how different pore size and water distribution lead to a different heating result. Porosity and permeability were measured, as a supplementary to illustrate the change of reservoir properties caused by microwave heating.

Key words: Tight gas reservoir; numerical modelling; reservoir properties; microwave heating; reservoir modelling.

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Modelling evaporation from salty water lakes (case study: Lake Urmia, northwest of Iran)

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ABSTRACT

Salty water lakes are unique ecological treasures of world and evaporation from water surface is one of the most important factors in drying and reduction of water reserves in these lakes. Pan evaporation in the most of meteorological station around the lakes are commonly used devices to measure and monitoring evaporation; but evaporation from salty water because of its high salt concentration, different albedo coefficient and light colour of bed material is different from pan evaporation. Hence, applying pan data in the lake management will not produce reliable results. In the This study, using intelligent methods including artificial neural networks and M5 model trees and applying actual evaporation data from salty water of Lake Urmia as one of famous salty water lakes located in the northwest of Iran, monthly evaporation has been modelled based on average temperature of two previous months. Results showed that both of studied methods had high precision in evaporation modelling. Comparison of two mentioned models revealed that artificial neural networks with RMSE of 26.27 mm and MAE of 18.76 has relatively better performance than M5 model trees with RMSE of 29.03 mm and MAE of 22.33.

Key words: Evaporation; intelligent methods; modelling; salty water lakes.

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Application of data driven approaches for river regime

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ABSTRACT

An alluvial stream does not accept any channel forms provided by humans or nature. A stream creates a channel of “its own”, the so-called regime channel, which mostly does not vary with time under ideal conditions. This regime channel can be characterized by three geometric characteristics: the channel width, depth, and slope. The importance of the prediction of such channel characteristics is explained by its minimum protection, and therefore, minimum expenses for its maintenance (Yalin and da Silva, 2001). Since one goal of river engineering is to create streams as stable as possible, these geometric parameters are very important for planning, design, management, and training works (Singh, 2003). Presently, many empirical methods to predicting the regime channel geometric characteristics are available, however all of them have their limitations and restricted ranges of application. Currently, the methods of artificial neural networks (ANN) and adaptive neuro-fuzzy inference system (ANFIS) approaches have become increasingly popular in a number of fields e.g. in hydraulics and many other engineering tasks. In contrast to most traditional empirical methods, which need prior knowledge about the nature of the relationships among the data, these data driven systems learn from data examples presented to them in order to capture the subtle functional relationships among the data even if the underlying relationships are unknown or the physical meaning is difficult to explain. Furthermore, these methods do not need to be introduced with an explicit form of the regarded task and additionally have proven a high tolerance against data sample errors. These attributes make the utilization of ANN and ANFIS for the calculation of river regime very promising. Based on 509 observations, we have designed Artificial Neural Networks and Adaptive Neuro-Fuzzy Inference Systems for studying river regime. In the systems, the input variables are the discharge and median grain size, the output variables are the channel width, depth and slope. The network architectures have been optimized by analyzing the capability and accuracy of numerous model architectures trained with different learning rules. To evaluate the prediction qualities of the designed networks, a comparative study was carried out for these models by evaluating several statistical parameters that describe the errors associated with the model in terms of statistical measures of goodness-of-fit between the observed and estimated geometric parameters. The computed regime channels were also compared with the Thermodynamic Entropy Theory of Yalin and da Silva (2001) and the Stability Theory of Julien and Wargadalam (1995). An improvement for the results of Artificial Neural Networks has achieved by distinguishing the input variables into sand and gravel bed materials as well as different discharge groups.

Key words: River regime; alluvial river; Artificial Neural Network; Adaptive Neuro-Fuzzy Inference System.

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3D-Modeling of Tétouan landscape city in the 15th century (Northern Morocco): Contribution of new technologies to the appraisal of a universal heritage

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ABSTRACT

The Medina of Tétouan was for many centuries a meeting place of spiritual, cultural and artistic traditions that shaped its social identity. These meetings were the product of a lively story with its originality and its socio-cultural specificity. This city, which is "the white dove" of Arab poets, was also designated by various terms like, "Granada Girl" or "Little Jerusalem". The later meeting place of peoples, religions and cultures such as Andalusian, Ottoman, Moroccan and European cultures, whose symbiosis has instigated a particular conservative culture of its residents similar to the Grenadian peoples. The city incorporated Andalusian architecture in its walls, Kasbah, houses, palaces (with patios, fountains and gardens), minarets, mausoleums and fondouks. It likened more popular language, music, sewing, handicrafts, state of Andalusian open-mind and soul. However, this city has suffered other influences as the European cultural impact which was felt as result of its interactive relationship through the Mediterranean space. Assessment of cultural heritage is an actual necessity and each region is a special case, with a unique architectural philosophy. Thus, cultural heritage evaluating need to: i) Protect the historical sites and monuments against various natural and human damages; ii) Restore historical monuments to their former values, according to scientific standards defined by UNESCO; iii) Make use of historical sites and buildings according to current needs of society without depreciating former cultural values. Nowadays, 3D-Modeling heritage has become increasingly solicited. Namely, both IT and new info-graphics technology can help on cultural heritage evaluation, management and conservation as a cultural collective memory which records our identity, and which we have to keep safe for future generations. For all the aforementioned reasons, and as a part of our research project, we present here a preliminary 3D model, landscaping the Medina of Tétouan in 15th century, the minarets, mausoleums and Fondouks that can be later animated with 3D modelling software(s) running with 3D scenes rendering module(s). Thereafter, the 3D modelling will allow us to explore all Tétouan city building and architectural elements during 15th century, all reconstructed as "realistic" imagery or animations from 3D modelled scenes. We used Google SketchUp 3D modelling software to digitize 2D urban map, to develop the 3D final model and later to extrude from 2D map, all urbane outlines (houses, walls, etc...). The reconstructed architectural elements and building were textured, 3D rendered, and finally, by a suitable software, we applied light and shadow effects in order to get a more realistic virtual view of 3D Medina landscape city, approximately as it was during the 15th century.

Key words: 3D-Modelling.

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Experimental and mathematical modelling of two-step biodegradation in the case of crude oil contamination of soil

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ABSTRACT

The oil hydrocarbons in the soil are almost always subjected to biodegradation by indigenous microflora with intensity, depending mostly on soil moisture and the nature of hydrocarbon. Biodegradation of hydrocarbons realizes mainly by microorganisms, which require organic carbon, often micromicetes. At that the presence of other sources of organic carbon are important, as any oil hydrocarbons are difficult for oxidation, less attractive of them are aromatic ones (Nai et al., 2013). Experimental study of hydrocarbons' biodegradation and simulation of the two-step process were performed. Air dried arable layer of leached chernozem was sampled. Before the experiment the soil was split into three parts: 1) uncontaminated control, 2) processed with hot steam, 3) contaminated with 1,5% (to weight) crude oil (the Tartar oil field) at laboratory conditions during 1 month. Processing with hot steam was conducted three times with interval of one day, trying to obtain sterilization ("tindalization"). The pollution of the soil was conducted a month before experiment in the sealed conditions to allow pollutant to be distributed uniformly in pores. For the same purpose the vegetable oil was added to oil, reducing its toughness. Then, the samples were wetting during 200 days. During this interval content of organic carbon (hardly and easily oxidizable parts), soil respiration, contents of components, absorbing and luminescent in UV-rays, had been assessing. A mathematical model of two-step biodegradation for experimental process was developed. It was based on the modified Monod kinetics and included a set of ordinary differential equations expressing the material balance for each component of the system – biomass of each level (step), substrate and metabolic products. There, following two consecutive reactions carried out by two conventional groups of microorganisms was assumed. The model parameters were found by solving the problem of minimizing the functional of deviation between the modelled values and the experimental ones. A comparison of one-step and two-step models showed no opportunity to describe the observed process using a one-step model, while the two-step model quite accurately describes the experimental data.

Key words: Soil; oil hydrocarbons; contamination; biodegradation; experimental modelling; simulation; two-step model; ordinary differential equations.

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Multi-stage hydraulically fractured horizontal well 3D simulation

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ABSTRACT

Three dimensional mathematical model of steady state single phase fluid flow to simulate multistage fractured horizontal well in horizontal petroleum reservoir is proposed. Model describes fluid flow both in heterogeneous reservoir and in homogeneous fractures. Linear horizontal wellbore passes through the middle between top and bottom boundaries of reservoir. Multistage fractures have a finite permeability. Fractures are orthogonal (transversal) to the wellbore. Distance between each two adjacent fractures are equal. Whole volume of heterogeneous by permeability reservoir around the wellbore is splited by separate sectors near each fracture. In that sectors which are presented as parallelepipeds fluid flow to fractures and to wellbore is considered. On external bounds and on the well pressure values are given. Numeric simulation as well as analytical approximate evaluation of multistage hydraulically fractured horizontal well productivity is offered. To solve reservoir's and fracture's equations together (instead of iterational accordance of solutions in two domains) in numerical solution a coupled method was used. The linear system which is result of approximation of all equations by finite volumes method was solved by QR factorization. Comparison of the results with other known analytical solutions is adduced. Presented results contain i) classical nomograms of fracture parameters effect on the horizontal well productivity and ii) original approximate formulas for evaluation of that magnitude. This formulas contain adaptive coefficients which are defined by comparing with a most accurate numerical solution.

This work was supported by the Russian Foundation for Basic Research and the Government of the Republic of Tatarstan (nos. 15-41-02698, 15-41-02699) also by BP Exploration Company (no. C175 13).

Key words: Multi-stage hydraulically fractures; horizontal well; petroleum reservoir; simulation; analytical solution.

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Relative permeability functions modification for petroleum reservoir simulation by super element method

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ABSTRACT

Upscaling method for relative phase permeability functions is formulated. Result of such procedure minimizes the error of phase flow rates approximation at super element simulation of oil reservoir. A feature of this simulation is to perform calculations on large unstructured meshes with the areal size of the blocks (super element), comparable to the distance between adjacent wells (hundreds of meters). The vertical size of super element corresponds to the thickness of the reservoir consisting of several layers (tens of meters). Relative permeability upscaling is performed based on solving a series of two-dimensional problems on a detailed grid. To construct the modified relative permeability functions proposed a special functional form of dependencies. These coefficients are found by minimizing the functional of differences between averaged and approximated phase velocities at the sites corresponding to the faces of super element. In general, that procedure must be performed for each super element and takes a lot of CPU's time. To overcome this difficulties in the case of ideally layered oil reservoir all set of super elements divided on different types – elements with production well, elements with injection well, and elements without acting well. Then modified functions is defined only for each type of super elements by solving of the problem of two phase flow in stratified reservoir with special boundary conditions. The successful application of the modified functions is demonstrated in the example of super element modeling of the three-dimensional two-phase filtration problem in the reservoir sector developed by the system of injection and production wells. Also the comparison with the upscaling procedure neglecting vertical cross flow between the layers is performed.

This work was supported by the Russian Foundation for Basic Research and the Government of the Republic of Tatarstan (nos. 15-41-02698, 15-41-02699), BP Exploration (no. C175 13 - 063100027).

Key words: Two-phase flow in porous media; relative phase permeability; upscaling; pseudofunctions; super element method; stratified oil reservoir.

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Human exposure to heavy metals released from tin-columbite minig operations on the Jos Plateau, North Central Nigeria: human health impact

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ABSTRACT

The Younger Granite Province of Jos Plateau is associated with the biotite granite plutons in the Jos-Bukuru which is the richest sources of cassiterite and columbite. Mining on the Jos Plateau is closely related to the origin, early growth and development of the city of which started early in the 20th Century. For this research work, fifteen (15) soil samples and fourteen (14) water samples from mining ponds and well were collected and analyzed to determine the concentration of heavy metals release from tin-columbite mining operation on the Jos-Plateau. Using the results obtained from the soil samples analyzed, Index of geo-accumulation (Igeo) and Anthropogenic Factors (AF) were calculated to know if the sources of heavy metals released are geogenic or anthropogenic in nature. From the values of AF obtained from these calculations, As (2.49 – 106 ppm), Co (1.33 – 3.70 ppm), Cu (1.68 – 5.32 ppm), Fe (1.28 – 3.09 ppm), Pb (1.16 – 8.88 ppm), and Zn (1.24 – 70.54 ppm) indicate that the sources of contamination is anthropogenic which is as a result of mining activities while almost all the Igeo values are below one (1) with the exception of Zn (1.40 – 14.16 ppm). The concentration levels of Fe in the mining ponds (0.41 – 1.15 mg/l) are greater than the World Health Organization (WHO) Standard (0.3 mg/l). The values of Fe in the mining ponds are higher than its values in the well water samples (0.01 – 0.22 mg/l). In all the fourteen (14) water samples from mining ponds and wells, the concentration of As and Sb (0.04 – 0.14 mg/l and 0.026 – 0.039 mg/l respectively) are above the WHO admissible values (0.01 and 0.005 mg/l respectively) with the water samples from the mining ponds having the highest values (0.14 and 0.04 mg/l respectively). Humans feeding on crops grown on these soils and use these sources of water for drinking are expose to health risks associated with high levels of these elements in their bodies.

Key words: Human; exposure; heavy metals; tin – columbite mining.

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Thermal water and weloid of Sandıklı-Hüdai Spa and their use in pelotherapy

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ABSTRACT

Hüdai spa is located in southwest of Sandıklı geothermal field in Afyonkarahisar. The spa offers both touristic and healing features. Thermal waters and peloids that are used in healing applications in the spa were investigated in many aspects. The Hüdai spa is famous and many local people visits for its balneotherapy and pelotherapy services. The temperature of the thermal waters in spas pool and spas spring were 41 and 68 °C, respectively. These waters are sulfated and bicarbonated and rich in Ca and Na. The peloid used for healing purposes is created by a mixture. This mixture was prepared with the thermal waters and the soils from the alluvial deposits in the area. This soil consist of smectit, illite, kaolinite, quartz, calcite, and partially chlorite and feldspar. As a result of the chemical analyses of the peloid, it was compared to commercial peloids. CaO, K_2O, As, Pb, Ba, Rb, and Sr content of the peloid were higher than the commercial peloids and Al_2O_3 and SiO_2 content were lower. Geoaccumulation index and contamination factors were also determined for peloid. Some of the elements were exceeded the standard limits and it can be dangerous to human health. As a result of the tests, physical and chemical characteristics of the peloid such as viscosity, abrasivity indices, consistency limits, oil and water absorption capacity, cooling index, heat retention capacity, BET surface area, cation exchange capacity, and grain size were determined. Some of the parameters were inadequate to use peloid for healing purposes. These negative parameters needed to be eliminated to use peloid more suitable for therapies.

Key words: Sandıklı; peloid; pelotherapy; thermal water; clay.

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Groundwater quality in the ancient parts of Bauchi Metropolis, Nigeria

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ABSTRACT

Waters were sampled from nine hand dug wells and a pond in the ancient parts of Bauchi Metropolis, Nigeria in May, 2012. Analysis was done using standard methods. The results showed the ranges of parameters to be: Temperature: 28.8-30.3oC, Turbidity: 0.4 - 12 NTU, Electrical Conductivity: 620 - 2420 µs/cm, Total Dissolved Solids: 310-1216 mg/L, pH: 7.0-7.6, Total Hardness: 180-990 mg/L, Fe^{2+}: 0.00-3.34 mg/L, Cu^{2+}: 0.00-0.47mg/L, F^{-}: 0.00-0.032 mg/L, Zn^{2+}: 0.00-0.84 mg/L, NO_3^{-}: 1.907-350.0 mg/L, Pb^{2+}: 0.00-0.001 mg/L, SO_4^{2-}: 35.0-450 mg/L, Cl^{-}: 125-422 mg/L, Cr^{6+}: 0.00-0.001 mg/L, Total Coliform: 50-622 cfu/100ml and Faecal Coliform: 14-601 cfu/100ml. pH was within, Cu^{2+}, F^{-}, Zn^{2+}, Pb^{2+}, Cr6+ were below, while Total Hardness, HCO_3^{-}, Ca^{2+}, Mg^{2+} and Total Faecal Coliform were above the Maximum Permissible Limit (MPL) of the National Standard for Drinking Water Quality (NSDWQ) of Nigeria Industrial Standards (NIS), 2007, in all the samples. Turbidity was above in Kofar Idi and below MPL of the NIS in the remaining nine samples. Electrical Conductivity and Total Dissolved Solids were below in Railway, Unguwan Gulmammu, and above the MPL of NIS in the remaining eight sample stations respectively. Fe^{2+} was below the MPL of NIS at Rariya, Bakin Kura, Shakel Yammawa, Kofar Dumi, Railway and Gwallaga and above at Kofar Idi, Unguwar Gulmammu, Dutsin Tanshi, Unguwan Kuka, Nufawa Behind Bata. NO_3^{-} and NO^{2-} were below the MPL of NIS at Kofar Dumi and above in the remaining nine sample stations. Pb^{2+} was within the MPL of NIS in all the samples. SO_4^{2-} was below the MPL of NIS at Kofar Idi and Unguwar Kuka and above at the eight remaining sample stations. Cl^{-} has the lowest concentration below the MPL of NIS at Railway and highest at Rariya, Bakin Kura. The high values might be attributed to proximity of dumpsites, soak ways and pit latrines to the wells.

Key words: Water quality; Nigerian Industrial Standard (NIS).

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X-ray diffraction and optical microscopy analysis of some kidney and gallbladder stones

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ABSTRACT

3 samples of kidney stones and 19 of gallstones were examined using X-ray diffraction and polarized transmitted optical microscopy. The lithiasis calculus (stones) came from several hospitals from Bucharest, Romania and are taken from patients between 30-50 years old, mans or women. The stones have different shapes (from oval to cone, with or without surface nodules) and different grain size and vary colours (grey, brown, black or yellow). The polarized light microscopy showed radial aggregates in some gallstones, with a central area (nucleus) where the stones start increasing, as well as homogeneous structures. Cholesterol crystals (the main crystalline phase) are acicular or lamellar, pale-yellow and show high birefringence in polarized light. The kidney stones are rather massive, granular, with small crystals without specific growing structure. The X-ray diffraction revealed the presence in this stones of some crystalline compounds, other than well-known weddellite and whewellite described in kidney stones. In gallstones the most abundant crystalline phases are cholesterol and other products of the biochemical synthesis of bile acids from cholesterol, associated with human hormones (testosterone, progesterone and androsterone), vitamines (B12, B6, provitamin A) and traces of some pain control pills constituents: ketoprofen, diclofenac and acetylsalicylic acid. Other crystalline phases identified are adenosine, cyclothiazide and cortisone. The main constituents of kidney stones are weddellite and whewellite. This study highlights the crystalline compounds existing in human organs as metabolic products, hormone secretion and residual growing crystals of some pill constituents. Cholesterol, testosterone or ketoprofen are most common substances in the human body and the processes involved in their growing and stability can be analysed using X-ray diffraction.

Key words: X-ray diffraction; kidney stones; gallbladder stones.

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Healing properties of Triassic variegated claystone from south-western Poland and its potential for use in SPA therapy and balneotherapy

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ABSTRACT

In Krasiejów in south-western Poland, there are seams of variegated claystone which actually form the present of late Triassic river and lake, and had extracted in several, inactive now open-pit mines for the needs of the local brick factory in 1910, and for the cement works. In the seams of one of those mines numerous fossils are found, including bones of Triassic amphibians and reptiles, which have been extracted since the 1980s. In SPA therapy, clay, including variegated claystone, ranks among balneologic materials called peloids, water-insoluble abiolits. Its therapeutic effects are in thermo-physical properties. It is used externally for wrapping, compresses and baths as a skin peeling medium. So far, variegated claystone has not been used in Poland for SPA treatment and balneotherapy.

Key words: Healing properties; Triassic variegated claystone; SPA therapy; balneotherapy; Poland.

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Occupational Health & Safety

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The connection of the non-structural precautions with the local fault line before the earthquake

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ABSTRACT

There are lots of plates around the world and also in our country because of physiological structure of the world. Tectonic earthquakes occur by movement of these plates. The two most important fault lines which are very similar to each other, are the Turkey's North Anatolian Fault and the fault line of the San Francisco State of USA. Most important feature of these similar faults is lateral exploit. One of the main characteristics of Lateral exploit fault lines is that the total mass exploits laterally 1,2,3,4 and from time to time 5 meters at its own place. Emergencies, explosions, emissions arising from hazardous chemicals, fires that may occur in all over or part of the working area, are events that require first aid or evacuation like in emergency response to natural disasters. Safety culture is as important as occupational health and safety qualifications for natural disasters and emergencies. Besides being have to keep ready for natural disasters and emergency situations, the emergency plans and arrangements which are pre-non-structural disaster have to be determined during the necessary risk analysis. This culture should be created in schools, mosques and hospitals. This culture must begin with educations of children in primary schools. The culture is adopted by children in primary education in Japan. At the same time, this training is provided by geology engineers. The Employer, takes necessary precautions in order to prevent damages from any possible emergency situation and to classify them. When it comes to necessary precautions, we should not only think about stabilizing furniture. Putting the furniture against the correct wall and the buildings location must be taken into account while calculating the precautions for a possible emergency situation and deciding where to hide. The building being parallel or perpendicular to the fault line must absolutely be considered. After 17th Augst Gölcük earthquake, in the two conducted inspections in two different streets, there were a difference of 65% in the terms of damage. This difference is resulted from buildings being parallel or perpendicular to fault line. Shape of building is highly important. It should be determined that whether the building is L shaped, square or if it's an adjoined structure. Because you cannot show the people where to hide unless you do these. In industrial structures, big shelves just being stabilised and connected to each other is not enough. They should also be connected to main carcass and made to move with building. In this paper, the foresight when calculating the necessary precautions against emergencies and natural disasters and the risk analysis perception of work safety experts and the improvement of safety culture of them is the aim.

Key words: Fault; earthquake; safety.

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Preliminary results of project focused on implementation of ergonomic programs to integrated management system in Slovakia

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ABSTRACT

To achieve competitiveness in the global market, enterprises must pay more attention to adaptation to supply and demand conditions. One from the most important parameter of products in terms of competitiveness is their quality which is mostly affected by employees. Practical experience shows that the quality of work performance can be expected only from the employees that are healthy, rested and satisfied. That is why it is important to pay attention to employees' health and prevention of diseases related to work. In developed countries, this is ensured systematically by the programs aimed to health and safety of employees at work. Until 1989, Czechoslovakia strictly implement the integration of occupational safety and occupational medicine in the enterprises for the purpose of creating flexible and ergonomically acceptable working conditions. After changing political and economic situation and after dividing of Czechoslovakia into Czech and Slovak Republic the plant physicians ambulances were excluded from companies on the basis of free decision of employees. The current state in Slovakia is that in the enterprises operate independently occupational safety and mandatory health service. On the company level, the concrete proposals for solutions in the field of working conditions optimizing is often undertaken by safety technicians who are responsible for the quality conditions of the work environment, safety and protection of health at work. Safety technicians often receive tasks for the field of ergonomics and staying responsible for ergonomics program in enterprises. This situation is not sustainable, therefore there is effort to implement an ergonomics program in to the company structures by using the principles of IMS. Due to mentioned facts, this paper is focused to the issue of the application of ergonomics program established with the aim of increasing the quality and efficiency of human work in industrial enterprises. The aim of this paper is to describe the various steps and procedures that have been made in recent decades on the example of the chosen enterprise. The paper presents experience from the implementation of preventive – oriented ergonomics program in the enterprise Johnson Controls International, LTD – branch plant Lozorno that achieve positive results. Enterprise which is incorporated herein realized the proposed measures during the ten years period. The results of long – term cooperation demonstrates that the occurrence of musculoskeletal disorders as an indicator of shortcomings in the time period 2005 - 2014 declined from the third group (occurrence of musculoskeletal disorders at level 90-100%) to the first group (occurrence of musculoskeletal disorders at level 70 to 79%) was considered a success. Results are confirmed by confidence limits from the years 2005 and 2014 that do not overlap (confidence limit) from year 2003 is 87.9%, which is below the upper limit from year 2013 with a value of 87.4%). Experiences from the application of ergonomics programs based on participatory principle in enterprises in Slovak republic shows that it is possible to implement effective prevention of cumulative trauma disorders without adverse economic impacts to enterprise.

Key words: Ergonomics; integrated management system; human.

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Determination of radiation shielding properties of dyed woven fabric coated with different barite rate

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ABSTRACT

After discovery of the radioactivity by Becquerel, radiation started to be used in large fields and it became part of our life nowadays. Using radiation from industry to medicine brings its hazardous effect and radiation protection developed in physics in parallel with the utilization of radiation. On account of these, people have started to be exposed extra radiation. In the world more than three-hundred nuclear facilities have been used to fulfil the needs in the fields of scientific research, energy, agriculture and industry, in addition to this in medical centres radiation beams have been used for treatment and diagnosis. It is extremely important to protect the human body from radioactive rays. Barite is a mineral which can be used for shielding because of high atomic numbered element constituent namely barium. The shielding property of barite is utilised in fabrics. Barite coated fabrics having characteristics of retaining radiation was obtained by penetrating barite on fabrics via coating method. The linear attenuation coefficients (μ) of the coated barite fabrics were measured at the photon energies of 662, 1173 and 1332 keV obtained from 137Cs and 60Co γ-ray sources, respectively. As detailed elsewhere, the measurement has been performed using the gamma spectrometer that contains NaI(Tl) connected to 16k channels Multi-Channel-Analyser. In this study, dyed woven fabric was used. To apply barite mineral to fabric via coating method, it was grinded to a size of 2-10 microns by using jaw crushers. FK 800/N type transparent as adhesive was used. Fabrics was be produced by penetrating with the methods of barite covering. The coated fabrics prepared with different volume of barite. For this purposes four different types of fabrics where barite used in the rate of 0%, 40%, 50% and 60% have been produced. The results of experiments show that barite coated fabrics have blocked radiation. When barite ratio increases, the amount of radiation absorption has increased.

Key words: Fabric; safety; dyed woven; barite; coated; shielding.

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Occupational illness of mine workers with the exposure to the radon gas

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ABSTRACT

In every second of the life on Earth, our world is constantly expsed to the radiation becuse of cosmic rays such as alpha, beta, gamma which comes out of solar system and of the radioisotope on the Earth's surface, natural sources as water, soil and nutrition, in addition to these because of the artificial sources. On account of the natual resources, radon' s ration comes first in the radiation doses to which live organisms are exposed. Both natural and artifical resources of radiation can create health risks in different degrees according to the dosage of the exposure. Different igneous rocks includes different quantities of radioactive elements that always changes or degradates. On one part of the degradation chain, the elements turn into Radon which is a natuarl radioactive gas. Radon come together in unventilated places such as mine pits, caves, subway stations and basements of the buildings. Radon and especially its products are moved with the dust of inhaled air or other bits and can enter the human body through respiration or digestion. These inhaled radioactive bits can place the lung and upper respiratory tract organs and continue to degradate in a determined way by spreading ionizing radiation. This situation may cause lung canser. Radon gas ; announced as A class carcinogenic matter by World Health Organization (WHO) and Environmetal Protection Agency (EPA) , is responsible for the 10 percent of lung cancer in the world. One of the elements causing occupational risks for the worker's health of underground mine pits are the radiation doses that the workers get because of the radionuclides from the mine air. Mine workers are exposed to radon in the air or its half-short lived degradation products and gamma radiation spread by the natural radioactive elemets in geological structure. Epidemiological studies show that being exposed to the radiation with long periods increase the risk of lung cancer. The said doses of the radiations are closely related to parameters such as type of th mine tip, working hours in the mine, applied production technique and ventilation. Depending on these parameters, radionuclides concentrations and the change of the doses taken should be increased in the mines and optimum working conditions should be defined. The most effective contolled precaution against the radon gas and its products is to thin and remove the gas by ventilation. Using personal gas masks doesn't do any good against radon products. In this case, decreasing gas levels to the minimum possibly is the best application to protect mine workers from the harmful effects of radon gas. That means; technical contol precautions like ventilation should be used, revised and updated regulary.

Key words: Aoccupational illness; radon gas; precaution.

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The processing of occupational safety from the perspective of the state, employer and employee

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ABSTRACT

The processing of occupational safety from the perspective of the state, employer and employee.So that in Turkey the execution and adaptation of occupational safety and health in the most efficient manner is executed, it is necessary that the state, employers and employees to work in an accurate and effective communication. It is an important role from the perspective of the state: it is the legislative, regulatory and assertiveness uses; from the perspective of the employer: the full implementation of the law, the necessary precautions against dangers and risks and the participation in the work; from the perspective of workers: find compliance with the precautions comply with occupational safety, new ideas and provide feedback. it must be ensured that this structure works with 3 coordination, constantly renewed, not reactive but proactive responds to events, the transfer of knowledge through training and to work in harmony. This coordination is a systematic approach, which requires a mature and familiar structure of all members. The result of this work: which must be taken into account because of all the view Add all 3perspektiven, the fastest transmission of symmetric and asymmetric communications between the structural elements of occupational safety culture.

Key words: Employer; state; safety culture; risk.

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Urban transformation process of building demolition in the asbestos technical working with protective measures and use of personal protective

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ABSTRACT

Many building are built as a result of urban transformation. Asbestos, due to its nature, is used within buildings in various applications. Today many construction workers, their families, and people are faced with danger of inhaling asbestos without knowing. Therefore it’s imperative that an asbestos inspection should be done prior to demolition, repair or restoration projects and proper work plans should be made. Technical prevention measures focuses on reducing or elimination asbestos exposure levels. A risk assessment for every item on work plan will be made and personal prevention tools (PPT) will be determined. Within this article preventive measures on materials containing asbestos, regulations, and standards of PPT usage will be examined.

Key words: Asbestos; personal prevention tools (PPT); protective measures.

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Safety in the construction of social facilities

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ABSTRACT

First comes to mind when he said social facilities dormitory cafeteria shower and toilet. These facilities should be planned according to the type of work done and the number of employees. This planning should take into account the specific risks of performing the construction industry and related safety measures should be taken accordingly. Lack of education on safety, the most important part of the sector employees and creates the risk of taking measures. During the use of social facilities, our working sector employees, depending on the extent to lack of education of the causes of the problems caused by electric risks that may occur, dangerous situations and to understand that due to the movement and the measures to be taken in order to overcome was investigated.

Key words: Sites; job security; social facilities; work accidents; dangerous; hazardous movements.

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Chemical risks in education sector

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ABSTRACT

Nowadays with opening and development of a very dangerous business areas, risk factors have been increasing day by day. Also modern technological developments create data which are beneficial for the mankind, and the effects of technology are known on the next generation with the usage of it. The effects of chemical which is perfectly created for a certain aim on the human health may not be perfect purity. Also when the usage area of this chemical, the training of user and exposed of it are considered, the level of dangers can be much more increased. When it is mention about educational sector, we are faced to the materials which seem to be innocent but lots of dangerous elements hide in it. Especially primary school students' inadequacy of hygiene issues, because of their age, it carries these dangers of high levels. The idea called “nothing happens to me” begins with the idea called “the thing does not do anything” which is more serious. If an apparent serious danger is not a matter, everything they are in touch with has the characteristics of game material. Especially chalks and board markers, crayons, play dough, water bottles, erasers, and etc. materials seem to be innocent but cause serious health problems. Also when unhealthy foods and game materials which are sold in school canteen, threat pushes the limits. One of the other risk factor at schools is cleaning supplies. In the cleanings which is for providing the students' hygiene condition, the way of cleaning is important as well as the frequency of the clean. The importance of the children which shape our future is inevitable for us. That is why the environment where they are and materials they are in touch with are an important component and should be taken into consideration by their families. According to these results, some chemicals which treat children's health are searched and studied.

Key words: Education; student health; risk factors; chemical.

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The studies in order to minimize the possible fire and explosion risks in fuel stations

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ABSTRACT

This study examines the precautions to be taken in fuel station to reduce the hazards of petroleum fuels and other chemical substances that create the potential for fire and explosion minimize to the minimum level under certain conditions. It is one of the major requirement to make the identification of the hazardous zone to make sure the dangerous and sensitive areas in the station which consisting of combustible and explosive substances. Flashpoints, characteristics, recognition by workers, explosion-fire risk ratios of the flammable and explosive liquid and gaseous fuels that stored without departing from the standards foreseen are very important for the preparation of the fire-explosion risk analysis plan and the ventilation of the fuel tank special precautions. The existence of the required resources that cause the grips (such as fire, sparks, heat, static electricity etc.), the probability of occurrence, the classification and control will take the hot surfaces (for example; the vehicle’s exhaust and radiator surface which comes to fuel station to refuel etc.) the detection for the suitability of the station for the works could create sparks and glare and the special precautions taken to apply them are also so indispensable and important. Building the fuel station according to the standards and the placement of equipment in accordance with the project are the big issues for safety rules (isolated underground storages, the placement of the dispenser regularly in specific groups etc.) Working environment that is deliberately created, appropriate to occupational health and safety rules and sticking to risk analysis plan and well-trained personnel reduce the risk ratio as low as possible. In addition, the different types of vehicles that arrive and departure to fuel station to allocate the different kinds of flammable materials (petrol, diesel, LPG, engine oil etc.) and the individuals that may have been attached to station in any manner (such as tanker drivers, outsourced maintenance and repair service people etc.) behavior according to the environment is an integral part of the safety ring. Even so despite all these precautions taken, the presence of necessity is inevitable for an emergency action plan that can be implemented in emergency situations which may occur unexpectedly (natural disasters, adverse weather conditions and traffic accidents etc.).

Key words: Fuel station; static electricity; risk analysis; fire; explosion.

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Occupational health and safety basic rules in hospitals and safety culture

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ABSTRACT

Work, work environment and production in manufacturing all kinds of relationships, the use and exchange value of goods and services production job. The main components of labor power generation, production tools and work environment. If the place of production activities, healthy and safe working environment, regardless of the worker's health, positive, negative changes in working life has been positively affected by the negative it is unhealthy and unsafe. A business arm of the health service is also a branch of production. It contains unique health risks like in every business sector. The great number of employees in the health sector in this area is another reason which increases the importance of this risk. A very important issue here is remarkable. Subject does not concern only the medical staff. Service staff will give employees at risk patients and at least one service area are also of interest to other people. Safety culture in this context; possible threats and risks to people or institutions of a fundamentally realistic assessment, and prioritization of these threats and the basic values on risks and take preventive action to eliminate attitudes that suggest the culture. When we look at in terms of our subject country experienced a lot of accidents and the level of preparedness for natural disasters examined the basic statistics on this issue, Turkey's European basic safety culture and even emerge as one of the world's most troubled countries. The health sector is also one of the most dangerous sectors in terms of occupational accidents. In this study, the safety culture of personal protection, warning signs, the business risk assessment of hygiene in the workplace will be discussed in a process dating back to the quality of the supply period. Target risks, in a time dimension is defined not in the acceptable level.

Key words: Occupational health and safety; hospital; safety culture.

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Tired and aged drivers in traffic with regard to occupational health and safety and precautions required to be taken

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ABSTRACT

One of the fact that threats the public health is also Traffic accidents. The specialists and statistics bring to the agenda perpetually that the traffic accidents arise from lack of driver training. Beside this it is considered that they arise also due to tiredness, sleep apnea and aged drivers which are the factors of physical safety. The reasons of Physical Risk Factors which are the reasons of traffic accidents and how they can be avoided and precautions will be taken will be expressed within the scope of this paragraph. Description of fatigue is working capacity and decrease of sensibility. There are 2 kinds of tiredness according to Psychologists. 1. Muscle fatigue or physical fatigue, 2. General fatigue. There are heavily sleeping desire and minimum degree working desire at general fatigue. Sleeping disorder and problems regarding sleeping create risks at the most accidents that the truck drivers made in connection with fatigue. When long time driving and also bad working conditions are added to fatigue arises from sleeping disorder, the accident risk occurs. The professional truck drivers are exposed to more illness and mutilations which have got occupational connection than other occupation groups. The % 67 of truck accidents arise from fatigue and again it has been seen at the result of researches that between the % 10 and % 25 rate of the accidents that trucks involved, are connected with sleeping. The accidents arise from at the result of sleeplessness are three times more deadly than the accident arise normally. Death risk between the passengers in a truck and any car is 24 times more according to the truck driver. Development of driver's behavior and manner and development of new technologies and application of them are required to strive with fatigue. Undoubtedly the essential solution is training of driver and applications directed to change mentality and behavior of the driver.

Key words: Traffic; aged drivers; sleep apnea; sleeplessness; fatigue; training.

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Scaffolding setup and work safety in construction industry reviews

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ABSTRACT

Work accidents have happened three times more as compared the other sectors in the construction industry on the world. Majority of performed on the high performed on the scaffoldings and platforms in the construction industry. For this reason, take security precautions on the scaffoldings and platforms in respect of occupational health and safety is very important. By considering all the negativity that may arise during the installation of the scaffoldings should be setup .A lot of work accidents can happen on scaffoldings and platforms. If the scaffolding installation and process of working on the scaffolding what are followed by PDCA Cycle (plan, do, check and act), it is possible, the accident rates will able to reduction %98. The risk of accidents at work scaffoldings and platforms is high. Scaffolding installation plan should be preparation before the establishment of the scaffolding, Skilful individuals by the establishment to be checked by the technical personnel during the study and for the application of all health and safety rules is important In this article, the installation of scaffolding and scaffolding during the work on occupational health and safety measures that need to be taken are discussed in the construction industry.

Key words: Work accidents; scaffolding; platforms; construction industry.

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The perception of OHS in workers and their families

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ABSTRACT

For many years, with the development of technology and industry, increasing amount of importance of human power at some aspect and at the same time increase of instruments, raw materials and diversity of chemicals which are used have led people to deeper thoughts on OSH and increased the importance of this issue. When we take a look at Turkey, it is understood that Turkey is not enough about OHS issue at much and the perception of OHS has not been fitted well from that Turkey ranks first in fatal occupational accidents at work in Europe and forth all around the world. The most important factor in the high occupational accident is the employees'' and employers' perception of OHS. Some of the factors are workers' sex, age, education background, and level of income, number of children, father's educational status and even number of brothers or sisters and mother's educational status. The most important factor which influence the perception of OHS is education and even the effect of education which comes from childhood in family as shown. OHS experts have an important and high role in preventing occupational accidents but these experts cannot control the workers in every minutes in large companies. Besides, 98 percent of fatal occupational accidents arise from the facilities which have not OHS expert, are flexible about OHS rules and applications according to data gained. To prevent occupational accidents and raise awareness of the perception of OHS, make a culture of this perception on these facilities' workers and employees the studies should be done immediately. The trainings should be durable in order to make the studies consistent and ensure continuity the studies. In order to create the perception of OHS and place the perception of OHS., frequent meetings should be made in this regard and it should be repeated that human life is superior to everything and how severe consequences can be arise for the rest of the workers' families as a result of the bereavements. As a conclusion, with the implementation of OHS rules which have emerged recently in our country and the increase of the value given to human life, all of the people involved in this chain including employee, employer and their families should be engrained in the perception of OHS and everyone should be informed and it should be raised awareness. In this study, it is focused on the perception of OHS of workers and their families, the factors which influence this perception and the trainings and enlightenments which are for raising this perception. Convinced that educated society is conscious, with the help of education, the importance of the perception of OHS in workers and their families, the factors which cause lack of these perception, also the differences of this perception will be explored and put forward practical solutions.

Key words: Perception of occupational safety; occupational accident; occupational health and safety.

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Analysis of the work accidents that occurred in Turkey electricity production plants in 2013

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ABSTRACT

Electrical energy, being a part of our daily lives as societies develop, varies according to different production, transmission, distribution and usage methods. With the production and transmission of electrical energy, advanced technological equipments and systems started to be used. Producing and using cheap energy is one of the most important economical benefits today. In this study, occupational accidents at EÜAŞ that have taken place in 2013 have been analysed in consideration of statistical data. Private sector business data have not been included in this study. EUAS number of employees in 2013 and accidents at work occurred was evaluated by the accident of the nature of the business, accident causes, employee education level, employees' length of service, employees' ages, body injuries of employees, body damages of employees, loss of working days; the month, the day, the time of the accident, having safety training, having first-aid training, using protective material. Thus it is aimed to provide concrete contributions in terms of statistical distribution in the Occupational Health and Safety studies area. Developed and developing countries try to meet their increasing demands of energy by signing bilateral agreements with countries that are rich in energy resources. 1.008 work accidents have occured in thermal and hydrolic power plants that belong to EÜAŞ (Turkey Electricity Generation Company) during the period from 2003 to 2013, a significant amount of them being major accidents and 15 resulting in death. Statistics show that the number of fatal accidents in electricity sector is higher than the country average in Turkey. Measurements to be taken regarding occupational health and safety are today still very important. It is necessary that electrical energy is used in a more extensive manner, power plants and energy transmission systems utilize the latest technology, workers are trained regarding occupational health and safety and are obligated to use personal protection tools appropriate to the working environment. In 2013, study about work accidents statistics had not seen in EÜAŞ. It is possible to say that young workers and workers over 40 are exposed more accidents.

Key words: Occupational accidents; Occupational health and safety; energy generation systems; EÜAŞ.

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Haydarpasa train station (Istanbul, Turkey) fire-anatomy, criminal method sareused in determining the reasons for the fire cause

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ABSTRACT

Among the mega-cities in Turkey Istanbul, Ankara and Izmir can be counted. Population levels are quite high in this city. In terms of healthy building and residential building there are deficiencies in terms of structural fire safety. However along with this, fires that occur in facilities poses a separate problem. For instance on the date 28.10 .2010 great damage to the historic Haydarpasa Train Station fire occurred. Fire in the facilities are generally caused by electrical contacts, extension wiring, LPG, LNG gas leaks during the repair and maintenance procedures, tools and equipment are listed in the form of misuse and sabotage. The Haydarpasa fire investigation was assigned to the competent public prosecutor, as required by law they are required to determine the cause of the fire exit. Four-person committee is tasked to determine the cause of the fire exit. This delegation after fire scene, especially looked in to the facilities burned , half-burned, scrutinized severe burned sections, also setting the burning substance residues in different intensities fabric, carpet piece of paper, plastic track, accumulating in heatmosphere during the intervention and syringes received chemical properties carrying liquids, wiring the ignition-induced clumping (pilling) material placed in special containers such as signs, to examine the Police Criminal, sent to the Forensic Science Laboratory and the University has been requested to examine the methods listed below. GC / MS Gas Chromatography / Mass Spectrometry method with (oil derivatives in the samples taken from the crime scene is required. Gasoline, deselect.). TLC / HPTLC high performance thin layer and gas chromatography tests (molecular scale fires in different petroleum exploration and explosive residue) FTIR (Fourier Transform Infrared Spectroscopy) (determines the received material sand mixtures scene. Especially C_3explosivessuch as $C_4$and NH4 NO_3.) SEM (Scanner Electron Microscope) (examine the morphology of material taken from the scene. (Conductor in electrical contact arcand flocculation) camera records with supporting technical findings results meteorological data, and employee statement are evaluated together the results show that the fire began while they wear making repairs on the roof toad here the membrane with the smouldering heat dupthus it created the fire. The reason the fire started starts according to Work Safety, it has been shown to be of fire safety measures and systems. Here is Suggestions in order to preventives, Occupational Safety receipt of all fire safety measures in the direction of making the maintenance of the building and the employee regular receive fire training would be appropriate.

Key words: Criminology; electrical contact; fire anatomy and safety.

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High speed rail work and workers health and safety

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ABSTRACT

With the invention of the steam engine the industrial revolution took place. Transport of rising raw material and labour has brought new research to the agenda. And with more raw materials it has led to the emergence of steam trains for the transportation of the workforce at lower costs, in the 157-Year History of the railways first the steam train then motor trains in a concise manner we find greener transport with electric powered trains and high-speed trains with the establishment of high speed trains conventional lines were established. In our country there is high speed train line between Istanbul-Ankara which length is 523 kilometres with the speed of 250km/h speed train sets that have been a part of this technological innovation. Here the motto is faster, safer, and the understanding of more secure transport .Of course, in this case in advance the great workers' health and safety risks associated with the work taken place and the measures taken have created safety precautions This is why when the general manager of railways is reinstructing his/hers own railways, the structure of security is based on the health of employees and passengers. At the same time occupation diseases with epidemiological studies work-related accidents has been provided precaution education with increased access to productive work and recover for the knowledge and skills of employees with frequent informal education, a rapid acceleration with a serious reduction in accidents and occupational diseases that occurred in previous years raises the bar on chart proving successful. Only goal: to provide fast, more comfortable transportation.

Key words: Railway; transport; high speed train; workers safety risk.

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The Turkish Department of Forestry- risk analysing for possible forest fire in Burgaz (Turkey) and organization

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ABSTRACT

The well known fact is crucial resting areas for people have been located in Burgaz and Islands where is in the south face of Istanbul. However; the forest fire had been caused in this area around 02:00p.m and had destroyed approx. 40 hectare forest land on Oct. 6th of 2013 unreasonably. Moreover; the disaster had separated quite fastly due to severe wind and heavy conditions of island and threated on local residents. Through of the disaster, 13 apartments had been damaged severely and many civilians had been poisoned due to heavy smoke and one of brave fire fighter had lost his life and many of them had suffered in this case. It is important to emphasize that “Pinus Brutia” is an dominant tree type which is quite common in this region. After a while later; the region was planted in 40 days. What we know about the tale in this case is 204 forest fire had destroyed a huge area defined as 203.76Ha. according to reports on 2003. The forest fire disaster that we have just testified above is taking 25% of total amount of forest fire according to reports in 2003. On the other hand according to The Turkish department of forestry Istanbul, forest fire disaster which had come out between 2003-2009 is taking place in the reports defined as an average of 0.95ha. It should be noted that the article in this case that we studied on is about the reasons of forest fire and risk analyzing beside of organization to control fire.

Key words: Forest fire; safety culture; risk analyzing.

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Occupational health and safety in the transport of passengers by road

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ABSTRACT

Businesses engaged in passenger transport by road, students and passenger transport, taking into account business ethics, with a total quality approach of national laws and regulations, the future regarding employees, customers, suppliers, associates, all business partners declares its security policy in order to meet the same fine. He realized that in all transport operations, improve processes, and detect performance standards applied by security targets. All employees, people in the activities carried out, the machine can identify vulnerabilities and risks that can arise as a result of interaction of environmental factors and tasks and to provide all kinds of support costs. It ensures the provision of necessary resources for the successful implementation of the security policy. Determine their responsibilities in matters relating to safety of its employees and senior management is committed to evaluate safety as a key priority across all operations. Encourages management and employees with all the activities of the safety and security notification with the voluntary participation of employees at all levels in the foreground holding and reports, undertakes to use it for punishment from the notifications. Transporters, tools that use drivers, vehicles and business offices in the nature of the work area should be subjected to risk assessment in accordance with relevant legislation including.

Key words: Occupational health and safety; passenger transtport; road.

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Perfection of work safety guidelines in school service buses

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ABSTRACT

In the World, millions of people are losing their lives because of occupational accidents. Occupational accidents have been one of the most significant issues so far, and still continue to be one of them, due to the accidents that caused the lives of many employees. Many legal and institutional arrangements are made in order to avoid occupational accidents. People should keep in mind that, work safety as a topic should rather be taken into consideration as a “humanity” factor than just a technical issue. Many employees are losing their lives due to occupational accidents in Turkey, as well. Adopting the culture of work safety will reduce the number of occupational accidents in every field of business life. HSE (Health & Safety Executive) defines the safety culture as the health and safety abilities and pattern of behaviours of an individual and a group. Since the employees’ traveling time from/to home and work are considered within their working hours; employees, teachers and personnel using the service busses are confronted with several risks. This article focuses on precautions which should be taken in order to reduce the particular risks.

Key words: Travelling; services buses; occupational accident; health and safety culture.

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Galvanization sector role in the proper use of personal protective equipment of the reduce accidents at work and occupational diseases

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ABSTRACT

Loss is defined as the potential risk of damage or injury. The risk of an event or a phenomenon, which should have its nature, and in that case it is definitely the place to be protected from harm. Accidents and occupational disease must be destroyed first source of danger. Employees moving objects in the workplace, high and low temperatures, light radiation (e.g. welding, grinding, heat treatment), falling objects, sharp, sharp-edged objects, Ground Conditions Chemicals, dust, smoke, vapour, etc. Available and are faced with potential dangers. In cases where the risks are controlled at the source of this danger by using personal protective equipment it is trying to minimize. Personal protective equipment to be worn by people to protect against one or more health and safety hazards, any device designed to be installed or moved, refers to the tool or material. When sectorial discussed Metal Surface Coating (galvanizing) sector and occupational health and safety by taking environmental measures according to international quality systems as a priority, coating types and standards, made primarily of surface preparation of the metal and its alloys required or standard value in the coating material sector be made of the production. Those working in the sector that may occur at the points where helpless general protection method dangers and personal protective equipment to provide protection from risks (helmets, protective toe shoes, long sleeved gloves, earplugs, safety glasses, protective clothing, masks) are used. Risks in the galvanizing industry study aimed to investigate the contribution of the training on the subject of the employee in the process of the use of personal protective equipment evaluated studies that can be done in order to be examined and greater efficiency of personal protective equipment and mitigation of the risks of the equipment used by the employees in mind.

Key words: Galvanizing; occupational health and safety; hazard; risk; personal protective equipment.

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Study of disadvantage of nanotechnology in health and safety

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ABSTRACT

The new delivery system (Nano technology) is a drug delivery at a specified time and with controlled dosage ends Specific drug, it significantly safer and more effective than medicine in the body. One of the problems is that very small targets in the body and spread to Bashed. In Nanvdarv Construction materials and drugs are relevant. Based on this test, the doctor can give medication to the point that the body It needs not the other way as part of the stomach to reach the injured. This feature is used for the treatment of cancer. , Disappears. Now this method is used to treat a variety of tumours. This study presented the result of research on disadvantage of nanotechnology. The result shows on one hand the use of Nanotechnology in medicine and more specifically drug delivery is set to spread rapidly. But As impressive as nanotechnology might be, there are also potential disadvantages of nanotechnology. Some of the problems with nanoscience are practical while others fall under the ethical realm. As result one of the potential disadvantages of nanotechnology includes the potential for mass poisoning over a period of time. While nanoscience can produce all kinds of new and improved products, the particles that are created are so incredibly small that they may very well cause eventual health problems in the consumers that use them. However a close collaboration between those working in Nono and no Nano is necessary for the exchange of concepts, methods and know-how to move this issue ahead.

Key words: Nanotechnology; drug; health problems; consumers.

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