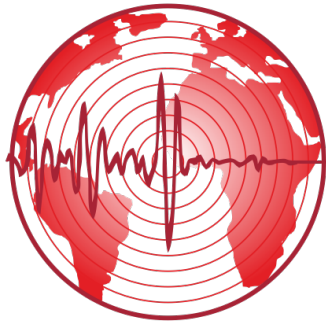




World ^{8th}

28 August-01 September, 2023– Prague (Czech Republic)

Multidisciplinary Earth Sciences Symposium



WMESS 2023

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8th World Multidisciplinary Earth Sciences Symposium

Eco-friendly Symposium - WMESS



ABSTRACT COLLECTION BOOK



*the more you save the Earth
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28 August - 01 September 2023

Prague - Czech Republic

WMESS 2023



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Multidisciplinary Earth Sciences Symposium

Preface

This Abstract Collection consists of the abstracts of papers presented in the “8th World Multidisciplinary Earth Sciences Symposium – WMESS 2023” in the city of romance Prague (Czech Republic) during 28 August-1 September 2023. 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.

WMESS 2023 was the 8th of the Annual series and 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 – **SIGI**, 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**, National Univ. of Science & Technology - Moscow Mining Institute – **NUST MISIS**, Geological Society of Africa – **GSAf**, University of Architecture Civil Engineering & Geodesy – **UACG**, Geological Society of Romania – **GSR**, University of Petrosani) of WMESS.

We would like to express our sincere gratitude to all participants of WMESS 2023 from different countries all over the world for their interests and contributions in WMESS 2023. We wish you enjoy the World Multidisciplinary Earth Sciences Symposium – WMESS 2023 and have a pleasant stay in the city of romance Prague. We hope to see you again during next event WMESS 2024 which will be held in Prague (Czech Republic) approximately in the similar period.

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P.S.: All affiliations and editorial assignments related with the members had been listed in 2015. If there will be any changes, please inform the committee via e-mail to info@mess-earth.org



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ABSTRACT

COLLECTION

ESTIMATE OF UNIAXIAL COMPRESSIVE STRENGTH OF ROCKS BASED ON POINT LOAD STRENGTH INDEX TESTS

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ABSTRACT

One of the most commonly measured mechanical properties of rocks is uniaxial compressive strength (UCS). Its precise determination is usually performed in laboratory conditions, due to the preparation of test specimens of regular shape and testing using a laboratory testing machine. For this reason, alternative methods are used in practice to determine the uniaxial compressive strength. One of them is the measurement of the point load index using a field press. The determination of uniaxial compressive strength is then calculated from the point load strength index using different correlation coefficients, which differ according to different research. The differences of individual correlation coefficients can be caused on the one hand by different types of rocks on which individual measurements and research were performed and on the other hand by the methodology of determining uniaxial compressive strength (EN, ISRM etc.). Currently, in the Czech Republic, the field press is not commonly used to determine uniaxial compressive strength, so these correlations are not determined, or are determined only for specific types of rocks in certain localities. For this reason, the subject of research was to observe the interdependence between compressive strength and point load strength index on various types of rocks taken throughout the Czech Republic and compared with compressive strength determined according to EN 1926. Based on the results of measurements in the research a correlation relation by which it is possible to determine the compressive strength of rocks. As part of this research, we focused on the main types of rocks occurring in the Czech Republic, which include igneous, metamorphic and sedimentary rocks. Separate correlations have been established for these rock groups. The article presents the knowledge gained in the solution of this project, measurement results and derived correlation relations for the calculation of uniaxial compressive strength from the point load strength index.

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GROUP DECISION-MAKING BASED ON GIS AND MULTICRITERIA FOR ASSESSING LAND SUITABILITY FOR AGRICULTURE

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ABSTRACT

The main objective of this work is to propose a methodology making it possible to take into account the multi-criteria and multi-actor aspects and to show their importance in spatial decision-making. It is about offering a group decision-making approach. Indeed, the members of a multidisciplinary team do not need to all agree on the relative importance of criteria involved or on the alternatives ranking. Each member gives his own judgment and contributes in a distinct and identifiable manner in seeking a compromise solution. Twelve criteria (Water reserve easily utilizable, Drainage, Permeability, Potential of hydrogen (pH), Electrical Conductivity, Active limestone, Cation Exchange Capacity, Soil texture, Soil useful depth, Slope, Availability of labour, Proximity (roads)) grouped in five factors (agronomic, planning, land enhancement and improvement, soil conservation and environment protection, and socio-economic conditions) will be used in this study. Criteria will be evaluated by experts in the subject area using the Analytic Hierarchy Process (AHP). The obtained weights will be introduced into a Consensus Convergence Model (CCM) to get consensual criteria weights which will be used to assess the land suitability for agriculture. All the required processing methods have been implemented into a GIS environment. The methodological developments are motivated by an application on land suitability for agriculture in a study area of Mleta, regrouping 74 land units, in the western part of Algeria.

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**INDICATIVE ROLE OF TRACE AND RARE-EARTH ELEMENTS OF THE NORTH-WESTERN
MANGANESE ORE DEPOSIT (SOUTH AFRICA) IN CONSTRAINING THE GENETIC MODEL OF
SUPERGENE MANGANESE DEPOSITS**

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ABSTRACT

This study presents the application of REEY and TE in constraining the genesis of the supergene manganese deposit in the North West Province, South Africa. The region hosts small scale supergene Mn deposit in a weathering crust of the Neoproterozoic manganese-bearing dolostones of the Malmani Subgroup, Transvaal Supergroup. The mineralization predominantly occurs as Mn nodules, wad and crusts and is confined to regional karstic depressions which resulted from the weathering and dissolution of the underlying Malmani dolostones. The early prospects of manganese mineralization in this region were carried out in the early 1960 by the then Geological Survey of the Union of South Africa. These investigations documented the small scale occurrence of manganese wad on the dolostone sections west of Johannesburg into larger portion of the former Transvaal (North West). About 30 years later few researchers (Beukes et al., 1999; Van Niekerk et al., 1999; Pack et al., 2000) documented the occurrence of Mn wad across the area and attributed its origin from manganese dolomites and/ Ecce strata of the Karoo. One of our recent papers (Pharoe and Liu, 2018; Pharoe et al., 2020) was devoted to understanding the ore body occurrence and distribution which led to the documentation of the local stratigraphy of the ore deposit. The deposit is characterized by high valence state (Mn⁴⁺) Mn oxide minerals which are well known to scavenge relatively high concentrations of trace (TE) and rare-earth elements (REE) during precipitation in geologic environments. The coherent behaviour of these elements in natural environments has led them to be inherently robust in discriminating sources of various Mn ore precipitates. The present work is therefore intended to apply the TE and REEY geochemistry to constrain the genesis of the Supergene North West Manganese Deposit. Post Archean Australian Shale and Chondrite-normalized trace element patterns of the ore samples indicate enrichment in the assemblage of Ba, Y, Cu, Sc, Ni, Cu, Co and other TE such as Ce, La and Zr and depletion in elements Zn, Nb and U. The PAAS and chondrite REEY anomalies of the ore samples further indicate enrichment of light rare-earth elements and a notably pronounced positive Ce and negative Y anomalies indicative of hydrogenetic precipitation of the ore deposit. This was supported by the observation on the high field strength (HFS) element discriminating plots; Ce anomalies and YSN/HoSN, Ce anomalies and Nd concentrations and the $Fe+Mn+(Co+Ni+Cu)*10$ which effectively discriminates between hydrogenetic, hydrothermal, diagenetic and mixed source ore precipitates. The overlap of the REEY patterns for Mn nodules and Malmani dolostones suggest the existence of close genetic relation. In contrary REEY patterns for Mn wad reflect negative Ce and positive Y anomalies indicative of hydrothermal source.

GEOLOGICAL MAPPING, STRATIGRAPHY, PALAEOONTOLOGY AND MINERALIZATIONS OF THE PALAEOZOIC AROUND THE VALÉRIO'S QUARRY AND THE MUSEUM OF TRILOBITES (AROUCA GEOPARK), CANELAS, NORTHERN PORTUGAL

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† in memory of Manuel Valério who shared this project with us

ABSTRACT

The studied area, a sector in the reverse limb of the Valongo Anticline adjacent to the Museum of Trilobites and to Valério's Quarry (Canelas, Arouca), is located in the Central-Iberian Zone of the Iberian Massif. The main objective of this study was to obtain a detailed geological map, through the recognition of the lithologies, stratigraphic units, fossils, structures and mineralizations. The Palaeozoic succession from Cambrian to Carboniferous was studied, with the exception of the Devonian, which does not outcrop in the area. Regarding lithologies, a succession of volcano sedimentary layers has been found in Cambrian (Montalto Formation, Middle Cambrian) and in the Lower Ordovician (Santa Justa Formation), either underlying Floian massive quartzites (Tremadocian?) or overlying Floian massive quartzites (Floian). At the top of the Middle Ordovician (Valongo Formation, Dapingian-Darriwilian), near the contact with the Upper Ordovician (Sobrido Formation, Hirnantian), a ferruginous layer with abundant siliceous nodules occurs. In the base of the Sobrido Formation, massive quartzites underlie diamictites. Concerning the fossil record, abundant icnofossils such as *Cruziana* and *Planolites* were identified in the quartzites of the Lower Ordovician. Also different somatofossils occur in the Middle Ordovician slates, namely trilobites (between the largest trilobites in the world) and other arthropods, graptolites, cephalopods, brachiopods, gastropods, bivalves and echinoderms (cystoids and crinoids). In Silurian, besides quartzites (Rhuddanian), light grey slates bearing graptolites, namely *Monograptus* (Llandovery), are dominant. In Carboniferous (Gzhelian) breccias, sandstones and slates with plant fossils, namely with articulated plants and ferns, occur. Regarding the mineral resources of the area, beyond the slates of Middle Ordovician (Valongo Formation) exploited in the Valério's Quarry, there is a Roman mining work, the Gralheira d'Água mine (Au-As type mineralizations), associated to the Lower Ordovician (Santa Justa Formation) quartzites and volcano sedimentary layers, exploited for gold. Antimony mineralizations (Sb-Au type mineralizations) associated to the volcano-sedimentary succession of the Cambrian-Ordovician transition, were found and studied by Scanning Electron Microscopy (SEM). The final work resulted in a geological map, covering an area of 1200m by 900m, at a scale of 1: 3,400.

Corresponding Author: Helena Couto

SeisRICHerCRO: ESTIMATION OF LOCAL SITE FREQUENCIES USING MICROTREMOR MEASUREMENTS IN TRAKOŠĆAN, ŠIBENIK AND DUBROVNIK

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ABSTRACT

In many seismically active regions there is a large amount of vulnerable infrastructure and it is impossible to adequately protect all vulnerable infrastructure. So, it is important to establish priorities when planning construction retrofitting. A key tool for establishing priorities for construction retrofitting is seismic risk assessment. Seismic risk assessment is especially useful in the case of cultural heritage buildings, which are invaluable. The most seismically active regions in Croatia are the coastal region and the north-western part of Croatia, regions that have numerous cultural heritage sites. Therefore, it is important to estimate seismic risk for cultural heritage sites and to develop procedures for seismic risk assessment. These are the goals of the research project Seismic Risk Assessment of Cultural Heritage Buildings in Croatia (SeisRICHerCRO) funded by the Croatian Science Foundation (HRZZ). The targeted locations of the project are Trakošćan Castle, the Cathedral of St. Jacob in Šibenik and the old city centre of Dubrovnik. The project has many objectives: investigation of seismicity according to the compiled earthquake catalogue, determination of local site characteristics, numerical analysis of local seismic site response, determination of dynamic characteristics of selected buildings, seismic hazard assessment, seismic vulnerability and risk assessment and finally coordination and administration. Here will be presented results of the determination of local site characteristics, specifically microtremor Horizontal-to-Vertical Spectral Ratio (HVSr) results. Microtremor measurements were carried out at all three targeted locations: Trakošćan Castle (approx. 0.1 km², 36 measurements), in the proximity of the Cathedral of St. Jacob in Šibenik (approx. 0.15 km², 108 measurements) and in the old city centre of Dubrovnik (approx. 0.2 km², 115 measurements). Measurements were performed using four Tromino instruments (MoHo, Italy). To reduce the impact of traffic, industry, trees, buildings or any other source of noise that would affect the measurements, locations were carefully picked. Moreover, since Dubrovnik is a famous tourist destination all measurements there were performed at night. Analysis of HVSr microtremor was performed in line with SESAME guidelines (SESAME, 2004), according to the criterion of obtaining the most reliable measurements and clearly expressed maxima. This research presents typical examples of HVSr curves and fundamental soil frequencies at targeted locations. Also, differences and difficulties encountered at targeted locations are discussed.

Corresponding Author: Jakov Stanislav Uglešić

LANDSLIDE AND DEBRIS FLOW HAZARD -AND-SUSCEPTIBILITY ASSESSMENT USING MACHINE LEARNING MODELS: A GENERAL WORKFLOW FROM STATE-OF-THE-KNOWLEDGE

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ABSTRACT

Landslides and debris flow are two of the major hazards worldwide, especially in areas with intense rainfall, high rates of tectonic processes, and high relief as Andean region. For this reason, it is important determining areas prone to landslides and its derived flows with the aim to preserve human lives and avoid adverse effects on economy and infrastructures of the countries, mainly in developing countries in tropical and mountainous regions as Colombia. Landslide and debris flow hazard -and- susceptibility assessment is a primary task used to understand the basic characteristics of the prone to failure slopes, particularly during extreme rainfall. Since it is very urgent to understand landslides and debris flows in order to predict their occurrence, behavior and impact, with the aim to apply prevention guidelines and appropriate assessment methods, several researchers have developed some methods and techniques to assess these phenomena hazard or susceptibility through heuristic, statistical and deterministic approaches. In the last decades, many hazard and susceptibility models emerging from various statistical approaches due its applicability at regional scale. Precisely, Machine Learning Models (MLM) are growing in popularity in environmental science research because they can be integrated with a Geographic Information System (GIS) to solve non-linear and nonparametric problems landslide-related, emerging as analytics tool that has been widely used in landslides prevention to obtain accurate risk zonation maps. Nowadays, the margin between statistical models and machine learning is a subject of debate. The main objective of this paper is to present an overview of current machine learning models workflow for landslide hazard -and- susceptibility studies from state-of-the-knowledge of this topic, including an information context, implementation, and typical performance. It summarizes and discusses some characteristics of the MLM. The results of a literature review of MLM applicability for landslide and debris flow assessment suggest that MLM provide an effective basis for decision-making and sustainable urban planning for disaster prevention and mitigation in high landslide-prone areas and develop environmental control.

Corresponding Author: Johnny Vega

**LANDSLIDE SUSCEPTIBILITY MAPPING VARIABILITY BY USING OF FUZZY LOGIC OPERATORS -
STUDY CASE: LA LIBORIANA BASIN (SALGAR, COLOMBIA)**

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ABSTRACT

Landslides and the associated flows are two of the leading causes of loss of life and damage to infrastructure in mountain areas. Landslide susceptibility assessment (LSA) is defined as the spatial probability that a landslide will occur in a specific area, derived from the spatial correlation of conditioning factors and the distribution of registered landslides within the study zone considered. Several qualitative approaches have been used for LSA at large-scale like expert knowledge-based methods and statistical approaches by bivariate or multivariate analysis. Among the qualitative approaches, the Fuzzy Logic (FL) technique is based on subjective judgements about the relative importance of the predictive variables and their several states. Due to landslides are a complex process that involve many uncertainties, FL is used to deal with the uncertainties associated to spatial analysis and modeling, and some degree of knowledge of the relationship between the conditioning factors and slope instability process. The main objective of this study is to evaluate the effect of the application of a combined method of a data-derived model (frequency ratio) and a knowledge-derived model (fuzzy logic operators) on landslide susceptibility mapping in the “La Liboriana” Basin (Salgar-Colombia) located in the north-western zone of the Colombian Andean region as study case. A fuzzy logic membership function was assigned to each of 15 conditioning factors considered (Elevation, Slope, Aspect, Curvature, Landforms, Terrain Ruggedness Index, Drainage Density, Soil Depth, Lithology, Landcover, Normalized Difference Vegetation Index, Stream Power Index, Sediment Transport Index, Topographic Wetness Index, Antecedent Rainfall Index) according to landslide density and frequency ratio values using a landslide inventory of the study zone. The fuzzy landslide susceptibility (FLS) maps were generated using the fuzzy conditioning factors by integration into a geographic information system (GIS) environment, applying the fuzzy operators Sum, OR, AND, Product and Gamma. Finally, the FLS maps were verified by comparing with existing landslide inventory for prediction accuracy validation using ROC (AUC) analysis. Among the fuzzy logic operators, in the case in which the Gamma operator ($\gamma=0.90$) showed the best accuracy (81.2%) while the AND operator showed the worst accuracy (50.4%). The final FLS map can be very useful to support decision-making process at regional-scale land use planning and landslide hazard mitigation, even in a data scarce area of tropical mountainous regions.

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HISTORICAL GEOLOGY AND MINING HERITAGE OF CENTRAL EUROPE

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ABSTRACT

Geology is often described as the history of the Earth and the two disciplines are commonly compared and contrasted. However the interface of geology and history can be a fascinating story. History and geology? What a surprising good combination. Yet geological discoveries especially minerals have marked History and determined the distribution of political entities. Between economy, geostrategic issues, population migrations ... geologist is an unknown actor in many historical events. Many Surveys are imagining the maps of the future, fully digital, free and in 3D. In parallel to these issues, geoheritage is being increasingly addressed within public policies. Beyond the protection of outstanding natural sites, it is important to show how geology also forms the heart of our history. Mining and geological activity in the search for mineral raw materials in the past century has been decisive for development in Central Europe. The development of professional education in the field of geology and mining is also very closely related, especially after the founding of the Mining Academy in Banská Štiavnica, the Reich Geological Institute in Vienna and the Hungarian Royal Geological Institute in Budapest. The modern era of Central East Europe starts from 18th century. From that era until now, the huge geological and mining heritage exist, like books, documents, and maps in many forms. After several transformation of controlled territory, the final disintegration happened after First World War in 1918, with the end of Austro-Hungarian monarchy. Despite the fact that we are talking about historical documents, they have not only enormous historical value but also, they are sources of important information, which still have a big potential for scientific research all over the world. Up to now, each country has its own archive or archives, where mentioned materials are stored, some of them were able to digitalize part of resources but many stays in original form. The access original documents in local archives is limited and there is no way to combine it, as part of the maps are in Slovakia, part in Austria, Hungary and others in others countries. Also, there is no possible way, how to sophisticatedly search through any kind of registers, as they don't exist. What's less interesting is the fact that some of these unique monuments are included in the world-wide UNESCO World Heritage Register for the Registration, Protection, Processing and Accessibility of the World Documentary Heritage. The main goal of proposed project is developing distributed archive system with central multilingual portal, which will allow to store and find any document stored in central or local warehouses. The primary focus of archive will be historical geological maps which are now stored in successor states, but in future, it will be possible to add any thematic historical maps directly, or harvest it from different public portals.

NUMERICAL MODELLING AS A TOOL FOR INVESTIGATING HYDROGEN EXPLOSIONS

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ABSTRACT

Currently, the burning of fossil fuels in industry or for transportation has a major negative impact on the environment. Most countries are concerned with environmental security and pollution regulation, motivating researchers around the world to find alternative solutions. An alternative solution may be the large-scale use of hydrogen. Applications of hydrogen in industry or for transportation face challenging conditions. Among other things, we are talking about pressures of up to 1000 bar, extreme temperatures starting from $-253\text{ }^{\circ}\text{C}$ (for liquefied hydrogen) and up to $650\text{ }^{\circ}\text{C}$ - $950\text{ }^{\circ}\text{C}$ (in the case of solid oxide electrolytic cells), as well as the imminent risk of explosion. This is because H_2 has an extremely low ignition energy, with much wider flammability limits compared to other fuels such as methane or propane. Hydrogen is a highly reactive and explosive gas. Therefore, explosion protection is essential for all processes involving the use of hydrogen in one form or another. The same principles that are applied to natural gas can be applied. Hydrogen behaves similarly to methane in terms of explosion risk, meaning in principle that explosion protection works similarly for both gases. However, there are still many unknowns regarding the phenomenon of initiation and propagation of explosions caused by air-hydrogen mixtures. Taking into account the multiple aspects related to security techniques that must be taken into account for the use of hydrogen in industry or for transport, the current paper focuses on aspects with regard to the use of modern numerical modelling tools for increasing the occupational health and safety level in technological processes endangered by the occurrence of explosive atmospheres generated by air-hydrogen mixtures.

Corresponding Author: Vlad Mihai Pasculescu

THRUST-TOP BASINS WITHIN RIONI FORELAND FOLD-AND-THRUST BELT, GEORGIA

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ABSTRACT

The Rioni foreland fold-and-thrust belt (RFFTB) as a part of the Greater Caucasus (GC) pro-wedge is one of the most important examples of the collision-driven far-field deformation of the Arabia-Eurasia convergence zone. The tectonic evolution of the GC double wedge orogen is the result of the Arabia-Eurasia collision during Alpine times, which led to the inversion of the GC back-arc basin. The RFFTB sedimentary infill (more than 7 km) consists of pre-and syn-orogenic sequences. The pre-orogenic sequences consist of Jurassic-Late Eocene shallow and deep marine deposits. The syn-orogenic sequences are composed of the foreland basin (Oligocene-Early Miocene) and syn-tectonic strata. The regional balanced cross-section shows the general styles of deformations along the RFFTB. The RFFTB underwent from the Middle Miocene – Pleistocene N- to S-directed shortening. The main style of deformation within the RFFTB is represented by a set of growth fault-propagation folds, duplexes, and triangle zone. The synclines within the Rioni foreland fold-and-thrust belt are filled by the Middle Miocene-Pleistocene shallow marine and continental syn-tectonic sediments, forming a series of typical thrust-top basins. Fault-propagation folds and duplex structures formed the main structure of the thrust-top basin. The evolution of the thrust-top basins was mainly controlled by the kinematics of thrust sequences. Using end-member modes of thrust sequences, the thrust-top basins are divided into: (i) Type I-piggyback basin, (ii) Type II-break-back basin, and (iii) Type III – formation of thrust-top basin characterized by bi-vergent geometry and related to combined, piggyback and piggyback back thrust sequences.

“This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSF) [Structural model of the Rioni foreland fold-and-thrust belt and the Southern Slope of the Greater Caucasus (The Tekhuri river gorge area) Grant #: PHDF-21-087]”

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**RESERVOIR CHARACTERIZATION OF THE PRE-CENOMANIAN SANDSTONE: CENTRAL SINAI,
EGYPT**

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ABSTRACT

Fifty-one sandstone core samples obtained from wadi Soaal area. They are belonging to the Pre-Cenomanian age. These samples were subjected to various laboratory measurements such as: density, porosity, permeability, electrical resistivity, grain size analysis and ultrasonic wave velocity. The parameters describing reservoir properties are outlined. Packing index, reservoir quality index, flow zone indicator and pore throat radius (R35 and R36) were calculated. The obtained interrelationships among these parameters allowing to improve petrophysical knowledge about the Pre-Cenomanian reservoir information. The obtained rock physics models could be employed with some precautions to the subsurface existences of the Pre-Cenomanian sandstone reservoirs especially in the surrounding areas.

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THERMAL DIFFUSIVITY PREDICTION FROM P-WAVE VELOCITY AND POROSITY ASSESSMENT FOR SANDSTONE RESERVOIRS

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ABSTRACT

petrophysical heterogeneities of sandstone reservoirs which are generated by rock internal variability resounded to the magnitude of the rock thermal diffusivity. This is expected mostly to variation of rock density, porosity, reservoir temperature and its thermal conductivity. New methodology for calculating thermal diffusivity in a sandstone rock formation is intended and effectively employed some laboratory thermophysical measurements for sandstone reservoirs. The proposed petrophysical model establishes thermal diffusivity if both the effective porosity and acoustic (compressional) wave velocity of the rock are known. Some reliable petrophysical models (El Sayed, 2011; 2019) concerned to both the Baharia (Egypt) and Szolnok (Hungary) sandstone formations are used with some modifications to build an innovative nomography. It permitted precise quantification and determination of the thermal diffusivity for both dry and saturated sandstone samples normalized to reservoir temperature (300K-1060 K). Verification of the proposed model is achieved with applying study cases of laboratory measured thermophysical properties (i.e., porosity, thermal diffusivity/or conductivity and longitudinal wave velocity) for different sandstone types, geological ages and geographic locations. A regression analysis of thermal diffusivity between laboratory measured and predicted data for dry (K-dry) rock samples yield a plausible coefficient of correlations as ($R = 0.73$; 0.86 and 0.98) for three different sandstones obtained from Permo-Carboniferous in Germany (Aretz et al., 2016) and of dissimilar geologic age in Switzerland (Pimienta et al., 2018) respectively while, the average standard error equals 0.011 . Then again, the laboratory measured and predicted thermal diffusivity (K-sat) of saturated samples display an appropriate coefficient of correlation ($R = 0.76$) and average standard error (0.0089).

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BIMODALITY AND LONG-TERM TRENDS OF THE EXTREME VALUES OF AIR TEMPERATURE

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ABSTRACT

Many regions of the world show histograms of air temperature with a bimodal shape. In the presented study we address the causes of bimodality of histograms of the daily temperature series (minimum, average, and maximum) for selected climatological stations in Slovakia. In the first part of this paper we explained that in the region of Central Europe latent heat of freezing is responsible for the bimodal shape of the histograms of measured daily and extreme air temperature as the surface of snow and ice and the air are thermally coupled. The reason for the asymmetry in the air temperature histograms is, that the mass heat capacity of ice is half that of water and a quarter that of air. The reason for the bimodality of the air temperature histogram is the energy-intensive latent heat of conversion of ice to water (and vice versa) associated with the consumption or release of heat (latent heat of melting and freezing) and, as a consequence, the more frequent occurrence of ground-layer air temperatures around the freezing point and, hence, the formation of the observed local maximum. This fact has far-reaching implications, for example, for the calculation of the annual mean air temperature at climatological stations. When calculating the average air temperature, the negative temperatures have lower weight than positive. Temperatures around 0-6 °C should be taken with higher weight. It is also a possible explanation for why the Arctic regions of the Earth are warming more significantly than the equatorial regions. In the second part of the paper we assess the changes in long term trends of the selected average, minimum and maximum air temperature indices for the climatological station at Hurbanovo (Slovakia) during the period 1871–2020. The results showed statistically significant changes in all temperature indices. The indices related to cold temperatures in Slovakia increased more significantly – at least, about 3°C per last 60 years. On the contrary, the indices associated with high temperatures increased by 1 °C per 60 years. Although the period 1950–1980 witnessed a few downward trends, after the year 1985 significantly increasing trends of all thermal indices were detected.

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IMPACT OF ANTHROPOGENIC ACTIVITY IN THE UPPER DANUBE BASIN ON THE DANUBE WATER TEMPERATURE REGIME AT BRATISLAVA

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ABSTRACT

The man activity in the basin affects the water temperature in the increasingly higher levels (construction of water reservoirs, construction of thermal and nuclear power plants or drainage of waste water to streams). In this paper, we focused our attention on the evaluation of the impact of anthropogenic activity to increase the thermal load of the Danube River for the period 1926–2020 at the Bratislava (Slovakia) station. In the first part, the long-term trends of a series of annual water temperatures in the Danube (period 1926–2020) are identified. In the second part, the dependence of the range of monthly water temperature values is analysed at the temperature of the atmosphere in Vienna. The last part of the study is oriented on the impact of human activity in the Danube basin on raising the water temperature in the Bratislava station. The impact of an increase in the temperature of the Danube water due to human activity was tried to identify only for low flows periods (below Danube discharge $1400 \text{ m}^3\text{s}^{-1}$) by comparing two periods: 1925–1960, and 1985–2020. At low flow (dry) periods and at high air temperatures, the effect of water heating in the river stream is most noticeable and therefore easier to identify. At the temperature of the atmosphere in Vienna $10 \text{ }^\circ\text{C}$, the temperature of the Danube water in Bratislava is approximately $0.8 \text{ }^\circ\text{C}$ in the second period. This growth could be attributed to human activities in the Danube basin above Bratislava (warming of water in the built tanks, the wastewater flow to the Danube flow, etc.).

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ESTIMATION A CONVERSION FACTOR BETWEEN ELECTRICAL CONDUCTIVITY AND TOTAL DISSOLVED SOLIDS IN ŽITNÝ OSTROV SURFACE WATERS

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ABSTRACT

The study was focused on pollution the surface water quality on Žitný ostrov channel network. Monitoring and assessment of following indicators were performed – temperature (t), dissolved oxygen (O₂), chemical oxygen consumption (CHSK_{Cr}), pH, electrical conductivity (EC), specific conductivity (SPC), total dissolved solids (TDS), mainly total nitrogen (N_{TOT}), nitrate nitrogen (N-NO₃⁻), nitrite nitrogen (N-NO₂⁻), ammonia nitrogen (N-NH₄⁺), total phosphorus (P_{TOT}), phosphate phosphorus (P-PO₄³⁻). Estimations of total dissolved solids (TDS) content are commonly based on electrical conductivity (EC) measurements, using a conversion factor (k) retrieved from regulations or guidelines. The aim of this paper is to establish a conversion factor parameter as a case study to identify if reported conversion factors are valid for surface waters in Žitný ostrov region (Danube Lowland, Slovakia). Total dissolved solids (TDS, in mg.l⁻¹) can be estimated from measurements of electrical conductivity at 25°C (EC, in μS.cm⁻¹) by applying a conversion factor k. This factor is commonly reported to range from 0.50 to 1.1. For each three locations (Z1, Z2, Z3) water samples conversion factors, with a median of 0.8 were determined. The samples cover an EC-range of 50-2 500 μS.cm⁻¹ and TDS of 70–7 000 mg.l⁻¹. Linear regression for the entire dataset yields a conversion factor k was estimated 0.8. However, both of these factors allow only estimates of TDS and for accurate TDS values it is necessary to determine the conversion factor specifically for each site. Besides spatial variations, temporal variations of conversion factors were also observed.

KEY SECTION OF A CREVASSE-SPLAY COMPLEX IN LIGHT OF SEDIMENTOLOGICAL AND STATISTICAL ANALYSES (TOMISŁAWICE OPENCAST, KONIN LIGNITE MINE, CENTRAL POLAND)

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ABSTRACT

Crevasse splays are known to occur in various sedimentary environments, e.g., fluvial, deltaic, and are always located in close proximity to river channels. They are formed in overbank areas by breaching natural levees during the initial stage of a flood, although crevasse splays differ in size, shape, and thickness. They are known from modern and ancient successions, including coal/lignite-bearing strata. Most commonly, crevasse splays represent single forms or complexes consisting of two or more superimposed splays. The last case occurs in the Tomisławice lignite opencast, where the interseam siliciclastics consist of four, and locally five layers of sand. Simply put, they form a crevasse-splay complex, the profile of which has been recognized as key section and subjected to preliminary sedimentological and statistical studies. The investigated crevasse-splay sandbody splits the 1st Mid-Polish lignite seam (MPLS-1) mined from the Tomisławice opencast. In general, this sandy complex is finger-shaped, 0.4–0.6 km in size and up to 5 m thick, whilst the key section studied in detail is 3.8 m high. Sandy-coaly (SCm, SCh, SCh(d), SCp, SCp(d), SCr(d)) and sandy (Sm, Sh, Sp, Sp(d)) facies dominate, but they are separated by 4 layers of lignite, which are 0.1–0.6 m thick and together reach 1.2 m in thickness. In the case of these fine sands, the grain sizes range from 0.12 to 0.20 mm. The crevasse-splay sediments are predominantly massive, weakly coarsening upwards, well sorted, symmetrically skewed, and they graphic kurtosis is peaked (leptokurtic). In summary, it can be said that the crevasse-splay complex from the Tomisławice lignite opencast is the best developed in the entire lignite-bearing Miocene of Poland. It is also possible that it is one of the most developed of all known global deposits of both coal and lignite.

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COMPARISON OF THE GEOLOGY PRESENTED IN A CROSS-SECTION AND THAT OBSERVED IN THE FIELD – A LESSON FROM THE TOMISŁAWICE LIGNITE OPENCAST MINE, KONIN BASIN IN CENTRAL POLAND

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ABSTRACT

In general, data from boreholes are the basic source for maps documenting the resources and reserves of deposits, including the 'Tomisławice' lignite deposit in central Poland. Based on this information, cross-sections in geological documentation and scientific contributions are also constructed. Nevertheless, the results obtained in this way are sometimes different from direct field observations. Such a situation occurred in the summer of 2022 in the Tomisławice opencast, which requires clarification. The aim of this research was achieved by analysing two examples. Firstly, data from the borehole BT-1 were compared with observations of the opencast wall in its vicinity. And secondly, the information from the geological section, based on data from 5 wells, was compared with the observations of the mining front. It turned out that in both cases the differences are significant. The first case confirms that the borehole information is very generalised. It means that the coaly sands described in the borehole chart, in fact, consist of interbedded layers of sand, coaly sand, and lignite. Obviously, field observations allow the identification of structural features of the sediments such as stratification and deformation. In the second case, the differences are both large and surprising. This refers to a sudden lowering of the lignite roof, which at first glance was associated with Pleistocene erosion or with post-depositional tectonics. In fact, the phenomenon in question is a consequence of the compaction of peat, which was then transformed into the lignite seam mined in the Tomisławice opencast. In conclusion, the obtained results clearly show that the borehole data should be treated as preliminary. However, borehole data is often necessary in addition to field observations to properly verify initial hypotheses about the geology of the study area.

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MAIN COLOURING MINERALS IN THE 'POZNAŃ CLAYS': CASE STUDIES FROM THE UPPER NEOGENE IN THE POLISH LOWLANDS

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ABSTRACT

Clayey sediments and rocks have been used for centuries to produce varicoloured materials and pigments for colouring artistic works, paints, ceramics, etc. Moreover, due to their colourful beauty, they have been and are (as geotourism objects) attractive to humans, and can also be used in palaeoenvironmental research. Hence, this study focuses exclusively on three iron minerals that have a decisive influence on the colour of the 'Poznań Clays', which cover a quarter of Polish territory, i.e., ca. 75.000 km². The sediments examined are exposed in many small (e.g., Dymaczewo Stare site) and large outcrops (e.g., Józwin IIB lignite opencast mine) in central Poland. To identify the main iron-containing mineral pigments (jarosite, goethite, hematite) were used the powder X-ray diffraction (PXRD) and ⁵⁷Fe Mössbauer spectroscopy (⁵⁷Fe-MS) methods. The results obtained by PXRD and ⁵⁷Fe-MS are consistent with each other or similar in most of the analysed samples of the 'Poznań Clays'. The aforementioned iron minerals are rarely found together, but they always give the sediment layers a 'warm' colour, i.e., from yellow through orange to red. Jarosite, KFe₃(SO₄)₂(OH)₆, is typically yellow in colour with shades ranging from light to brownish. Goethite, α-FeOOH, is yellow, whilst nano-goethite is beige-brown in colour. Hematite, α-Fe₂O₃, is characteristically red, both in the powdered form and in the sediment. Jarosite can be created by pyrite oxidation and then transformed into goethite. On the other hand, hematite is generally recognized as the final product of the transformation of other iron oxides and hydroxides, such as jarosite and goethite, respectively. Summing up, it should be said the beauty of the multicoloured 'Poznań Clays' is mainly due to the presence or absence of these pigments in the sediments. In the presence of the main colouring minerals (jarosite, goethite, hematite) the sediments have a 'warm' colour. On the contrary, in the absence of the listed pigments and/or the presence of organic matter, the studied 'Poznań Clays' have a 'cold' colour.

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EFFECT OF THE REINFORCEMENT OF THE ROCKY MASSIF ON THE STABILITY AND BEHAVIOR OF UNDERGROUND STRUCTURES - CASE: RAS ELMA-AZZABA RAILWAY TUNNEL

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ABSTRACT

The construction of a communication tunnel requires the guarantee of flawless security during its operation. The study focused on a comparison of the results obtained when carrying out a reinforcement of the rock mass by in situ radial bolting and numerical modelling. The use of bolts as a means of reinforcement of the foundation shows their effectiveness in reducing the convergences of the walls of the tunnel under the conditions of the Ras Elma railway tunnel. The analysis of the results obtained in situ and those by digital modeling, indicates the importance of maintaining the rock mass by additional radial bolts, which will undoubtedly ensure the stability of the tunnel during and during its operation. In this way we demonstrate the importance of a few extra bolts for the stability of the structure. Some analytical or numerical calculations of cavity expansion show the high influence of expansion bolts on the stress field of the bolted area.

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REACTIVE MAGNETRON SPUTTERING TECHNOLOGY FOR RECEIVING III NITRIDES

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ABSTRACT

In the present work is studied synthesis of gallium nitride (GaN) and aluminum nitride (AlN) by DC Reactive Magnetron Sputtering technology. As a sputtering target was used high purity (99.9999%) Gallium and Aluminum materials and as a reagent gas was used high purity (99.9999%) Nitrogen. Magnetron sputtering system with strong magnets (1450 mT) allows to make plasma at a low pressure 3×10^{-2} Pa and deposition process was carried out at high vacuum conditions. Deposited layers of GaN and AlN on the sapphire substrate was analysed by X-ray diffraction (XRD) and revealed the crystalline nature highly oriented with the (0002) for both nitrides. For chemical composition was measured X-ray Photoelectron Spectroscopy (XPS) and it was found out the ratios of Ga:N and Al:N to be 1.07 and 1.04 respectively. For surface analysis was made Scanning Electron Microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS) image for material content. Optic transmission spectra showed band gaps to be 3.43 eV and 6.13 eV for GaN and AlN respectively.

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HfO₂-HfO_x BASED MEMRISTOR WITH DIFFERENT SIZE ACTIVE LAYERS

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ABSTRACT

Memristore parameters are strongly depend on the size of active layers. In this paper is reported the outcomes of memristore created with different size active layers. There are considered 1 μ , 5 μ and 10 μ diameter separated devices in the form of crossbar with HfO₂ + HfO_x active layer and tungsten top contact, titanium nitride botton contact and aluminum wiring contact. As substrate was used sapphire and active layers of memristore was deposited by reactive magnetron sputtering technology. With photolithography exposure system by new pothomask has been done 1 μ , 5 μ and 10 μ diameter lithography for formation active layers and all contacts. Leakage currents dropped to 0.01mA, increased cicles of histeresis of I-V curves and dramatically increased R_{off} /R_{on} ratio to be 100000.

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CLIMATE CHANGE IMPACTS ON BUILT ENVIRONMENT

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ABSTRACT

We are currently in the period of an intensive climate change, resulting from changes in the heat balance of the earth's surface and causing an increase in the temperature of the lower troposphere levels. According to the latest IPCC report of 2021, it is human activity that has indisputably caused the increase in atmospheric concentrations of greenhouse gases, responsible for this process. The consequences of climate change under Polish conditions, apart from a rise in temperature especially in the spring and winter months, are also changes in the amount and distribution of precipitation totals. A slight increase in precipitation totals is observed, however heavy rainfall is significantly more frequent, interspersed with periods of droughts and heatwaves. Ground frost-free periods are prolonged, and a negative trend in the duration and thickness of snow cover is recorded in most parts of the country. Although extreme phenomena occurring in Poland are permanently inscribed in its climatic conditions, the threat of strong winds has been increasing in recent years, and the intense precipitation that often accompanies them is the cause of peak discharges and flooding. Forecasts for progressive climate change are not optimistic, either on a global scale or for the country in question. The article examines the impact of climate change on the design, construction and maintenance of engineering structures globally and for Poland. Changes in design standards, selected examples of disasters and solutions to adapt and build resilience to climate change have been analysed. For most building disasters, climatic factors were the direct cause of the disaster, although in the course of the analysis it has usually turned out that the disasters exposed human errors in the design, construction and, to a lesser extent, the improper maintenance of engineering structures. However, there is an increasing number of new approaches to creating a climate change resilient built environment, including the latest one, which proposes to use the grey infrastructure of cities to build resilience to climate change.

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HYDROLOGICAL MODELLING AS A SUPPORT FOR INFRASTRUCTURE DESIGN AND MAINTENANCE

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ABSTRACT

The impact of climate change on infrastructure is merely one of the many issues that need to be addressed. An example might be bridges and culverts which are more frequently exposed to conditions such as floods or significant differences in water table levels. Varying weather can also lead to the deterioration of quality in the materials used for construction, which when combined with heavier loads (water, wind, or temperature change, depending on the structure), reduces their durability and impairs their functionality. The design assumptions used in the construction of existing infrastructure assets were based on historical data, making them potentially out-of-date at present and invalid as the result of subsequent climate change. Moreover, in planning and design of new infrastructure facilities as well as the upkeep of those that presently exist, climate change should also be considered. Hydrological modeling is one of the tools that may be used to evaluate how climate change will affect bridges and other elements of river infrastructure. The authors of this paper offer a hydrological model of the flow in the Ślęza River, a 78.6 km long left-bank tributary of the Odra River, and in its tributaries, with a particular focus on the locations of bridges. The model was run using the QSWAT program, accounting for the SSP2-4.5 and SSP5-8.5 climate change scenarios (obtained using the NorESM2-LM model), and calibrated with the use of historical meteorological data. Daily flows for the years 2023–2050 have been included in the model's output, allowing the comparison of typical (statistical) flows and the observation of trends. While the maximum flows vary depending on the point of interest (the land use in the basin differs from forest areas in the upper part of the basin through agricultural land in the middle part of the basin to urban area in the lower course of the river), the mean flows in most of the analysed points decrease over time in both scenarios (which is a stronger trend for the SSP5-8.5 scenario). The flows also vary depending on the circumstances; for instance, thaws might induce a shift in the river's dynamics. The acquired results would be beneficial for engineers who schedule the upkeep of infrastructure, since this study would provide them with more information to use in making the best decisions for the environment and exploitation costs.

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28 August-01 September, 2023– Prague (Czech Republic)

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LANDSCAPE-BOTANICAL METHOD FOR RUSSIAN VEGETATION ZONING

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ABSTRACT

Geobotanical zoning is a recognized method for displaying regional features of vegetation cover. It is based on the properties of the vegetation itself. The purpose of the article is to substantiate the expediency of the landscape approach, which is implemented in the landscape-botanical method of zoning. The latter is based on the close connection of regional features of vegetation with landscapes. This method allows us to most fully consider the problem of studying the vegetation cover, both from a geographical and botanical point of view.

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STABILITY ANALYSIS OF FRACTURED ROCKS CLIFFS IN THE GORGES OF KHERRATA, BEJAIA, ALGERIA

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ABSTRACT

The rock mass is a geological entity consisting of the intact rock matrix and discontinuities. In many cases, the behavior of rocks is often guided by discontinuities (joints, faults, bedding joints). Therefore, is very important in the design of rock structures to consider these structural defects whether they are large-scale or small-scale. The present study is a deterministic analysis of the stability of very steep fractured rock slopes. The area of study was crossed by an old road N° 9 connecting the city of Bejaia to Sétif in the north of Algeria, this old road is sinuous and perched in high cliffs as well as tunnels excavated in the rocks. This area has known in the recent past of landslides and rockfalls due to the evolution of fractures, the effect of freeze-thaw and several earthquakes that have occurred in the Bejaia area between 2003 and 2022. This justifies its rehabilitation to an optimum level of safety by carrying expansions works by booms, tunnels, bridges and the reinforcement of the unstable zones. The aim objective of this stability analysis is the evaluation by numerical and limit equilibrium methods of the degree of stability of the areas identified as being at high risk of rockfall, also the recommendation of an adequate stabilization method in order to control the risks and reduce the vulnerability on the road. To conduct the study, a geological and geotechnical investigation was carried out in situ, through the recovery of core samples from depths up to 30 m, the execution of mechanical tests, and the estimation of the fracturing rate of the exposed zones. Pressuremeter tests were also executed in the depression and toppling areas to evaluate the risks of endemic movements as well as the strength and deformability parameters of the rocks in deep. The exploitation of the measures and the identification of the risks sections were the subject of a numerical analysis by finite elements in plane deformations to estimate the kinematics of the displacements and the safety coefficients before and after reinforcement by shotcrete support reinforced by passive ground anchors. In addition, a risk and vulnerability mapping along the road alignment was established to assist the project manager in planning and prioritizing slope reinforcement operations before the start of service of Road N° 9.

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RESULTS OF THE STUDY OF ALGAE AND CYANOBACTERIA IN VARIOUS ECOTYPES OF SOILS IN ADJARA, GEORGIA

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ABSTRACT

The publication deals with the studies on the diversity of species composition of Algae and cyanobacteria in various layers of soils (yell, red, soilsod-podzolic, marsh, urban) of the Adjara. The aim of the study was to identify and determine the composition of Algae and cyanobacteria; Establishment of the scale of development and spread of algoflora; Assessment of the ecological state of the Algae and cyanobacteria in adverse and favorable conditions. The diversity of algae and cyanobacteria was studied in soil cultures using the method of fouling glasses. Each treatment included 5 sterile cover glasses for micropreparations; cultures were wetted with distilled water. The presence of algoflora was detected in various soil samples based on morphological characteristics, percentage frequency, growth rate, and colony forming units. The study has found 171 species and subspecies of soil Algae and cyanobacteria, belonging to the divisions of Ochrophyta (59 species), Chlorophyta (51 species), Xanthophyta (8 species), Eustigmatophyta (1 species) and Cyanobacteria (52 species). Classes Bacillariophyceae, Chlorophyceae, and Cyanophyceae were considered polymorphic among the leaders. 11 species of algoflora involved in algoflora of the consortium have been specified as well. The most widely distributed algoflora in soil samples were of the genera Chlamydomonas (20 species), Eunotia (17 species), Phormidium (11 species), Pinnularia (11 species), Tetracystis (10 species), Leptolyngbya (9 species), Nitzschia (9 species), Chlorococcum (8 species), Nostoc (7 species) and Oscillatoria (6 species) were dominant flora in all soil samples. Frequency percentage algoflor showed that from all of the soil, the maximum quantities of algoflora and cyanobacteria in marsh soil that was 65.49%, in sod - podzolic soil 34.51%, in yell soil 19.88, in red soil 18.71%, the lowest frequency of occurrence of algoflora and cyanobacteria was shown in urban soil 9.35%. Due to seasonal changes in soil and air temperature, there are 71 species (41.52%) in spring, 65 (38.95%) in summer, 78 (45.61%) in autumn, and 53 (30.99%) in winter. A lower level of biological activity in the urban soils was found. Morphometric trait differences in test objects activated on the soil samples have been observed. The study was found specialized species of Algal-cyanobacterial communities from each ecotype of soil. The soil samples collected from polluted sites were more affected by waste water which affected the population densities of Algal-cyanobacterial communities. Found that Adjara support a large and diverse community of Algal-cyanobacterial on soil, many species of which are previously undiscovered and undescribed. On this basis, works of longer duration and more intensive sampling are needed to obtain data regarding Algal-cyanobacterial communities, with more attention to specific variables such as microclimate, soil moisture, soil type, soil pH and vegetation types.

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**STRUCTURAL ANALYSIS AND PEGMATITE DIFFERENTIATION IN THE ANCIENT CLAIM, GIRAÚL IV,
NAMIBE PEGMATITE DISTRICT, ANGOLA**

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ABSTRACT

Since the early 60's, in the past XX century, the Giraúl pegmatites have been known for their resources of beryl, mica and feldspars, which were exploited in a regular basis from Giraúl claims I to IV till 1974, during the Portuguese administration of Angolan territory. A broader exploration of this pegmatite field was performed by the ancient Lobito Mining Company (LMC) engaged in detailed geological mapping of the granitic pegmatites and the structural constraints of their location. A structural map of the region was then elaborated, combining the interpretation of aerial photographs with field work performed by the LMC geologists. Recently, a growing economic interest is attributed to these claims, in the region of Bulamuocolocai, Pitau and Muvero desert-dry rivers (locally known as "mulolas"), considering the Li, Cs, and Ta (LCT) metallic specialization of some pegmatite bodies and the occurrence of beryl and tourmaline gemstones, mainly, morganite (Cs-beryl), aquamarine and also elbaite-liddicoatite. Giant crystals of spodumene, up to 6 m in length, define individualized quartz + spodumene units inside some of the more typical LCT pegmatite bodies. Pollucite was identified in the main pegmatites of Giraúl IV claim and not in the adjacent igneous leucocratic breccias. These, in turn, correspond to a complex pegmatite assemblage, very peculiar in what concerns its selective metasomatic effect over some surrounding rocks, with the formation of rims of holmquistite amphibole in contact with gabbro and schorl-dravite tourmaline in contact with gneissic to metapelitic hosts. The breccia-like granitic rock combines clasts of spodumene and K feldspar with a matrix mainly composed of some quartz, albite and mica including tourmaline, garnet and F-apatite, as accessory minerals. In the same area, huge potassic pegmatites hold giant crystals of microcline and orthoclase and very little quartz, being unusual due to its high content of triplite – zwiesselite and triphylite – lithiophilite primary phosphates. The overall composition of these pegmatites is more likely syenitic (low quartz content) than truly granitic. A high-resolution structural analysis of the LCT ensemble (pegmatite plus related lithotypes) is now proposed enhancing the unusual relations between granite breccia plugs, sill-like more typical pegmatites, irregular shaped isodiametric bodies and products of metasomatism. This approach will lead to the understanding of the true dimension, anatomy and inner fractionation of the different LCT facies and rare-metal deposits with obvious consequences regarding mineral detection and resource – reserve estimation, through the proposal of more suitable conceptual models to rule its exploration.

CONTRASTING STYLES OF METAMORPHIC TO METASOMATIC DEPOSITS OF GEMSTONES IN CABO DELGADO, NORTHERN MOZAMBIQUE

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ABSTRACT

From a conceptual point of view, in some ruby and garnet deposits of the Lalamo Supergroup – Cabo Delgado Nappes Complex, Northern Mozambique – the structural control of the primary mineralization seems to be spatially and geochemically related to the genesis of calcsilicate rocks, also with gemstones. Two main locations, with contrasting paragenesis, were studied in detail – Miteda area and Micute to N'Djekwa sector. Structural and paragenetic analysis, departing from high-resolution cartography, fabric microanalysis, SEM microscopy and mineral identification by X-ray diffractometry, were used with a major incidence in outcrops and small-scale mine diggings. Regional Neoproterozoic formations, especially its metacarbonate members, host Mg, B - rich skarns, bearing dravite and B-Mg-calc-silicate gemstones, especially in Micute and N'Djekwa area. Following the composition of the probable lithological precursor, these minerals, consistently, reveal a geochemical Mg - B signature that could have been inherited from an evaporite type ancestor, inter-stratified with carbonate rocks in the protolithic Lalamo sequence. The focus of hydrothermal circulation in multistage shear zones is invoked as the main pathway to interpret the complex mineralization observed in Miteda. In this case, the structure of a corundum + garnet major spot is coherent with a pull-apart dilation associated with sinistral shear. There is a relation between red color saturation of ruby and the content of Cr in corundum. Cr can be leached from the meta-ultramafic host-rocks as a byproduct of desilication. Calcsilicate metasomatism could trigger Si sequester, producing metamorphic desilicated fluids. The focus of hydrothermal circulation in shear zones is invoked as the main pathway for the entrapment of metamorphic and metasomatic gem deposits. These occur in corridors of anomalous host-lithologies and vein swarms where peraluminous paragenesis are located inside highly modified meta-ultramafic or metacarbonate rocks. Skarn like lithologies result from reaction with a sedimentary carbonate protolith and gem deposition is mainly metasomatic. Veining affecting metaultramafic sequences of amphibolitic to granulitic facies show occasional, metasomatically affected, eclogite. For the contrasting styles of deposits represented in Micute – N'Djekwa and in Miteda, although the corresponding paragenesis are separated in space, their deposition can be situated in a conceptual model characterized by a geochemical interdependency and time proximity.

ACID MODIFICATION OF GEORGIAN NATURAL HEULANDITE

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ABSTRACT

Acid treatment is a powerful tool for improving the performance of natural zeolites used as molecular sieves, adsorbents, ion exchangers and catalysts, and the purpose of our work was to study chemical composition, structure and properties of acid-treated heulandite from the Tedzami-Dzegvi deposit, Eastern Georgia. Samples of heulandite-containing tuff from the Rkoni plot with zeolite phase content up to 90%, consisting of heulandite and chabazite in a ratio of 8:1, and having chemical composition described by empirical formula $[\text{Na}_{0.25}\text{K}_{0.06}\text{Ca}_{0.19}\text{Mg}_{0.15}][\text{AlSi}_{3.6}\text{O}_{9.2}] \cdot 3\text{H}_2\text{O}$ were treated with hydrochloric acid solutions with concentration up to 2.0 N. It has been established that as a result of acid treatment, significant dealumination occurs (the molar ratio of Si/Al increases from 3.6 to 9.5) and decationization (the total charge per aluminum atom decreases from 1 to 0.68), sodium is mainly leached, magnesium to the lesser extent, while calcium and potassium does not take part in the decationization process. Powder X-ray diffraction patterns show that hydrochloric acid solutions with a concentration up to 2.0 N do not lead to amorphization of the zeolite microporous crystal structure, but can gradually dissolve it. The adsorption of water vapor indicates the availability of micropores for the entry of small polar molecules, benzene adsorption shows a slight increase of hydrophobicity of the surface as a result of acid treatment. Low-temperature nitrogen adsorption-desorption isotherms show acid-mediated sharp increase of adsorption in micropores and of the surface area, as well as changes in the mesoporous system, leading to the prevalence of pores with a diameter of 3 – 10 nm. The concentration of dilute solutions of hydrochloric acid is determined, which provides availability of micropores for large ions and nonpolar molecules, but at which dealumination is insignificant and ion-exchange capacity remains at a sufficient level. Materials obtained by acid treatment of heulandite can be used as adsorbents, ion exchangers, and carriers of biologically active substances and metal ions.

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PROPERTIES AND APPLICATION OF GEORGIAN NATURAL PHILLIPSITE

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ABSTRACT

Oceanic and terrestrial sedimentary phillipsites make up very large and hitherto unestimated reserves, but the use of this natural zeolite is not so wide comparing to clinoptilolite. The purpose of our contribution is to characterize the phillipsites of the Georgian deposits of Akhaltsikhe (Southern Georgia) and Shukhuti (Western Georgia), as well as to highlight their possible application. It is shown that the sample of Akhaltsikhe deposit is not typical for the sedimentary tuffs from saline alkali lakes due to high content of calcium and magnesium, zeolite phase content in rocks differs in a range of 60-70%, major impurities are chlorite and montmorillonite; the Shukhuti phillipsite is characterized by high content of potassium, zeolite phase content differs from 60% (lower plot) to 80% (upper plot), main impurity is heulandite. Samples are characterized by powder X-ray diffraction patterns, FTIR spectra, thermogravimetric curves, water and nitrogen adsorption capacities, as well as the ion-exchange capacities and selectivity series; synthetic phillipsite sample was used as a reference. It is shown that natural phillipsite can be used as a raw material for the synthesis of widely used zeolite materials: phase-pure zeolite NaX with Si/Al~1.5 was prepared in the form of octahedral crystallites with uniform micrometric (2-7 μm) dimensions by hydrothermal crystallization of aged at room temperature gel ($2.9\text{Na}_2\text{O} : 0.26\text{Al}_2\text{O}_3 : \text{SiO}_2 : 150\text{H}_2\text{O}$) obtained from water suspension of phillipsite, treated with hydrochloric acid and mixed with sodium hydroxide; the product is characterized by high specific surface area ($589 \text{ m}^2/\text{g}$) and volume of pores ($0.578 \text{ cm}^3/\text{g}$) including uniform zeolitic micropores and cylindrical channels with an average diameter of 55 nm, which opens up the prospect of its use in catalytic processes. It has been established that natural phillipsite is a suitable carrier of bioactive metals: silver-, copper-, and zinc-containing micro-mesoporous materials have been prepared on the basis of phillipsite from Shukhuti using ion-exchange reactions between zeolite and a salt of a transition metal in the solid phase followed by washing; the products contain up to 230 mg/g of silver, 66 mg/g of copper, and 86 mg/g of zinc, and in the Kirby-Bauer disk-diffusion test show strong bacteriostatic activity against such microorganisms as gram-negative bacterium *Escherichia coli*, gram-positive bacteria *Staphylococcus aureus* and *Bacillus subtilis*, fungal pathogenic yeast *Candida albicans* and a fungus *Aspergillus niger*. The use of bactericidal materials obtained on the basis of natural phillipsite is possible both for water purification and disinfection, and as fillers in the production of polymeric materials, paper and cardboard.

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STRUCTURE STABILITY OF GEORGIAN NATURAL HEULANDITE

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ABSTRACT

Zeolites, aluminosilicates of the general formula $M_x[Al_xSi_yO_{2(x+y)}]mH_2O$ ($M^+ = Na^+, K^+, \dots, \frac{1}{2}Ca^{2+}, \frac{1}{2}Mg^{2+}, \dots$), have a unique set of molecular-sieve, sorption, ion exchange and catalytic properties due to their framework microporous structure, and structural stability is an important characteristic and often a decisive factor in the application and performance of natural zeolites. The most important factor determining the balance of the three components of the zeolite crystal structure (negatively charged framework $[AlSi_nO_{2(1+n)}]^-$, cations M^+ and water molecules) is temperature. The aim of our work was to study the processes occurring under the influence of heat, which determine the thermal stability of the zeolite-containing tuff of the Tedzami-Dzegvi deposit, Eastern Georgia, with zeolite phase content up to 90%, consisting of heulandite and chabazite in a ratio of 8:1, and having chemical composition described by empirical formula $[Na_{0.25}K_{0.06}Ca_{0.19}Mg_{0.15}][[AlSi_{3.6}O_{9.2}]] \cdot 3H_2O$. It was found that as a result of exposure to heat, a slight dealumination of the surface of the calcined (400-500 °C) samples occurs, as well as dehydration and amorphization of the crystal structure are observed. Sample dehydration occurs in several stages: (i) most of the water ($\approx 60\%$ of the total water content) is continuously lost at temperatures below ≈ 250 °C, (ii) the part of the remainder ($\approx 24\%$) is slowly dehydrated up to 650 °C, (iii) complete dehydration of the sample is achieved at ≈ 800 °C. Amorphization of the heulandite phase begins at temperatures above 200 °C, the transition to the metastable heulandite B phase at ≈ 340 °C is not fixed either on the thermogravimetric curves or by powder X-ray diffraction patterns, but at high temperatures wairakite or another mineral of the 9.GB.05 group and quartz are formed; the chabazite phase is stable up to ≈ 1000 °C, and at temperatures above 1100 °C, leucite $(K,Na)AlSi_2O_6$ is formed. The adsorption of water vapor and benzene on heat-treated samples decreases monotonically with an increase in the calcination temperature, apparently following the degree of amorphization. Low-temperature nitrogen adsorption-desorption isotherms show slight decrease of the absorbent surface area and an increase of average mesopore size with an increase in the calcination temperature. It has also been shown that heat treatment increases the acid resistance of heulandite by reducing the degree of dealumination after treatment of the sample with hydrochloric acid. The obtained data on the stability of the structure of Georgian natural heulandite should be taken into account both when determining its operating conditions and when using heat treatment as a tool to improve its properties.

“This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) [grant number AR-22-610, Project Title “Production of paper with bactericidal and improved surface properties”]”

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GEOCHEMICAL TYPIFICATION AND FORMATION CONDITIONS OF LATE VARISCAN GRANITES OF THE KHRAMI CRYSTALLINE MASSIF (GEORGIA)

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ABSTRACT

The Khrami crystalline massif is exposed on the territory of Georgia, within the Artvin-Bolnisi block. The massif is built up of Precambrian gneiss-migmatite complex, Late Variscan (321-331±6.0 Ma) granites, alaskites, quartz-porphyrines and granite-porphyrines and Late Paleozoic volcanogenic-sedimentary rocks. The granites are represented by biotite-hornblende-alanite-, biotite-microcline- and biotite-garnet-bearing varieties. Late Variscan granites and alaskites have not been studied in detail from the petrogeochemical point of view. For this purpose, a microscopic study of granites was carried out, their chemical composition and the content of RE and REE in them were determined. Based on the obtained data the geochemical typification of Late Variscan granites of the Khrami crystalline massif was accomplished and their formation conditions were determined. During the study, different diagrams were used. According to the $Al/(K+Na+2Ca)/Fe+Mg+Ti$ and Na_2O+K_2O/SiO_2 diagrams, Late Variscan granites belong to high-alumina rocks, mainly of sub-alkaline and partly of normal-alkaline series. According to S-I-A discriminative diagram, garnet-bearing granitoids belong to I (magmatic) type of granites, biotite-hornblende-alanite-bearing – to I and partly A (anorogenic) types, biotite-microcline-bearing - to I and a small amount to A and S (sedimentary) types, but alaskites completely belong to A type of granites. Using the three-level diagram of P. Maniar and F. Piccoli, the granites formed under different geodynamic conditions were distinguished. According to the first step of the diagram (K_2O-SiO_2), none of the types of granites belongs to oceanic plagiogranites that is confirmed by the discriminative diagram defining continental trondhjemites and oceanic plagiogranites. The second step separates granite types according to geodynamic conditions of their formation. According to the $Al_2O_3-SiO_2$ diagram it has been established that all granite varieties correspond to both IAG (island arc) + CAG (continental arc) + CCG (continental collision) and RRG (rift related) + CEUG (continental epirogenic uplift)/POG (postorogenic) geodynamic conditions, while the alaskites belong to rift related + continental epirogenic uplift/postorogenic conditions. According to the $FeO^*/(FeO^*+MgO)-SiO_2$ diagram, biotite-microcline variety belong to RRG+CEUG/POG granites, and only little part - to IAG+CAG+CCG granites. Garnet-bearing and biotite-hornblende-alanite varieties and alaskites correspond to RRG+CEUG/POG granites. This is also confirmed by J. Pierce's Nb-Y and Rb-(Y+Nb) diagrams. On the Rb/Sr-SiO₂ diagram, the granites, apart from the garnet-bearing varieties, are located close the border between the upper and lower parts of the crust. Comparison of the average data of the petro-geochemical characteristics of Late Variscan granites under consideration and the same data of diagram by S. Taylor and S. McLennan shows that the studied granites mainly correspond to the upper crustal formations. As a result of the petrogeochemical research of Late Variscan granites of the Khrami crystalline massif, it was determined that: at the initial phase of the granite-formation biotite-hornblende-bearing variety appeared, and the process closed with the alaskitic phase; the granites belong to high-alumina rocks of sub-alkaline series and are mainly represented by I type granites; their initial magma formed in the upper crust; according to the geodynamic conditions of formation, they correspond to island arc granites.

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UTILIZATION OF CONTACT TESTS FOR EVALUATION OF AGRICULTURAL SOILS

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ABSTRACT

A soil has been of great concern throughout the world due to increasing environmental awareness and interest in the quality and management of such soils. Košice, the city in eastern Slovakia, is exposed to typical urban contamination sources such, furthermore, being the largest steel producer in Central Europe, it is long-term environmentally loaded by the iron and steel works that represent the largest source of (metallic elements) contamination in Slovakia. Five sampling sites located in the surrounding of U.S.Steel Košice (Slovakia), were selected, where almost all the agricultural soils were polluted by the metallic elements (Fe, Al, Mn, Cu, As). Agricultural soils toxicity was assessed with the toxicity bioassay -Phytotoxkit. Tests of limit concentrations of the elements (Fe, Al, Mn, Cu and As) and Tests of soil concentration series (100-50-25-12.5%) - screening tests mustard *Sinapis alba* and *Lepidium sativum* were performed. The testing of the concentration range was performed in order to determine the values of 14d/EC₅₀ and the possibility of comparing the ecotoxicity of metallic elements in agricultural soils (ISO 11269-2 Soil quality). Four concentrations were prepared in test plates: 12.5 - 25 - 50 - 100% soil samples. Concentration of metals in the soil samples ranged from 24400 to 39000 mg/kg for iron; 54000 to 85000 mg/kg for aluminum; 381 to 1035 mg/kg for manganese; 27 to 59 mg/kg for copper; and 7 to 36 mg/kg for arsenic. Based on the median concentration, the metals in the soils were arranged in the following decreasing order: Al > Fe > Mn > Cu > As. In the agricultural soils (4USS-PW) showed high contamination values for the iron with a median 35300 mg/kg, aluminum with a median 82500 mg/kg, manganese with a median 1027 mg/kg. The median level of arsenic in the soil (4USS-PW) was 34 mg/kg, this indicate higher concentration as the limit concentration is 25 mg/kg (Law No. 220/2004-2). Agricultural soils 1-3USS and 5USS showed less than 50% inhibition of the seed germination and root growth in the *S.alba* and *L. sativum* tests compared to the control, excepting of soil from 4USS plant west ((values of the EC₅₀ to 65%). Thus, the results of phytotoxicity tests were consistent with the chemical data. The rapid increase in urbanization, industrialization, human population, and traffic flow has resulted in the environment surrounding farmland ecosystems being critically contaminated by metallic elements.

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RAPID SCREENING OF URBAN SOIL POTENTIAL TOXIC TRACE ELEMENTS AND ORGANIC MATTER, KOŠICE CITY, SLOVAKIA

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ABSTRACT

Urban soil survey is necessary in terms of assess the life quality of their inhabitants. From this point of view the detection of the ecological risk in urban soils was done. At first fifteen samples were collected from a depth 0-30cm, in Košice city, Eastern Slovakia around the lake located in the residential zone. In collected samples potential toxic trace elements were established and also the presence of soil organic matter (SOM) was studied, because at present the SOM was recognised as an indicator of sustainable development in the frame of the UN Agenda 2030. The pH of all studied samples was estimated in the range 6.83-7.42. For rapid screening were used following methods: X-ray fluorescence spectrometry (XRF) and thermogravimetry (TG) coupled with differential scanning calorimetry (DSC). In thermogravimetry, the dynamics of weight loss can be continuously recorded in the temperature range from 25 to 1000 °C. This allows the identification of temperature areas with overlapping weight losses from different and individual components and thus to create mathematical algorithms for the evaluation of thermogravimetric curves to calculate soil properties with maximum accuracy. From this point of view the thermogravimetry was used and its application confirmed a reliable estimation of organic C, total N, clay and CO₃-C. On the basis of XRF analysis it was found that the permitted limits for the elements Co, Ni, Cu, Zn, As were largely exceeded. It is concluded that thermogravimetry and XRF spectrometry allows a simultaneous, rapid and reliable screening.

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**THE INFLUENCE OF METALLURGICAL INDUSTRY EMISSIONS ON THE DEVELOPMENT OF
SELECTED COMPONENTS OF ATMOSPHERIC DEPOSITION IN THE KOŠICE AREA (SLOVAKIA)**

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ABSTRACT

The aim of this paper is to assess the impact of emissions and their decrease on the level of environmental burden through the study of selected atmospheric deposition parameters in the area with the dominant source of emissions from the iron and steel production complex. Total atmospheric deposition (AD), i.e. j. both wet and dry, was sampled from eleven sampling points at a distance of 1 to 15 kilometers from the ironworks complex. AD fluxes of selected elements (Fe, Al, Mn, Zn, Pb, Cu, Cr, Cd, As) and dust particles (PM) were evaluated in relation to the amount of emissions from the results of long-term AD monitoring (2009 – 2022). The analysis shows the significant influence of emissions from the metallurgical industry on the deposition fluxes of most of the monitored parameters and thus on the environmental burden of the area. Relatively high correlation coefficients were found between emissions and AD for manganese, chromium, iron and zinc at all sampling site. The level of dependency has a pronounced seasonal course. Higher correlation coefficients were found in the winter period and for the sampling point located closest to the ironworks site. Positive but relatively low values were recorded for Pb and Cu. The minimum degree of dependence with low values and negative values of correlation coefficients were found in the case of As and Al. The several-fold decrease in emissions had only a partial effect on the AD of the monitored parameters. The results of the analysis show that the amount of emissions is not the only factor influencing the quantity of deposition of particulates and monitored elements. In addition to seasonal factors, local meteorological and climatic, orographic, and other conditions also have a large influence.

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APPLICATION OF CARBON BLACK GENERATED BY LIQUID PHASE PLASMA METHOD AS A CONDUCTIVE MATERIAL FOR SUPERCAPACITORS

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ABSTRACT

In this study, carbon black particles were produced together with hydrogen from a benzene solution using the LPP process. For the LPP method to be superior to other hydrogen production methods, it is very important to secure economic feasibility by increasing the value of carbon black particles. Carbon black produced by the LPP method was heat-treated at various temperatures and applied as a conductive material for supercapacitors, and its performance was evaluated by comparing it with commercially available Super-P. When a plasma field is formed in a benzene solution using LPP, primary carbon black particles are generated together with hydrogen, and are agglomerated by solid-liquid separation and heat treatment to increase the particle size to a secondary structure. Carbon black was crystallized by heat treatment, and polygonal multiple nanoshells were formed by the formation of multi-graphenes. Also, as the heat treatment temperature increased, the pore volume and diameter increased, but the interlayer spacing $d_{(002)}$ decreased. The electrical conductivity of carbon black heat-treated at 1500 °C was the highest, and rather decreased when the temperature increased above that. The electrode used as the conductive material after heat treatment at 1500 °C showed the largest specific capacitance value and the smallest IR drop. Carbon black heat treated at 1,500 °C and 2,000 °C showed excellent charge and discharge characteristics of Super-P, which was thought to be due to its excellent conductivity and large specific surface area. The energy efficiency of the hydrogen production method by the LPP method performed in this study was evaluated to be superior to that of the water electrolysis method. In conclusion, since the carbon black produced by the LPP method showed better conductive properties than Super-P, it was possible to confirm the possibility as a new hydrogen production method.

**STABILITY STUDY OF THE REINFORCEMENT TUNNEL FACE BY NUMERICAL MODELLING
USING FINITE ELEMENT METHOD: A COMPARATIVE STUDY**

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ABSTRACT

The digging and construction of the tunnel requires a stabilization study, which has a very important interest, the movements that induced at the face level have led to the innovation of several reinforcement techniques that are particularly important in unfavorable geological conditions. The excavation of a tunnel produces a modification of the initial ground mass stress field. Deformations of soil (extrusion and pre-convergence) triggered in the core ahead the tunnel face, afterwards spread in the cavity and towards the surface. The purpose of this work is to compare numerically study the stability of a *section of tunnel T4 (east-west highway constantine in Algeria)*. The modelling concerns the methods that were used during the tunnel digging work such as NATM (New Austrian Tunnelling Method) and ADECO RS (Analysis of Controlled Deformation in Rocks and Soils). The modelling consists in comparing between the NATM which is based on the sequential excavation and the method ADECO RS. The results of the finite element numerical modelling using the Plaxis 3d calculation software have proved the effectiveness of the ADECO RS method compared to the NATM method.

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SPATIAL DISTRIBUTION OF EVAPORITES OF PÜLÜMÜR VALLEY (TUNCELİ, TURKEY)

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ABSTRACT

In the north of Tunceli, there is a very thick succession consisting of sedimentary and volcanic rocks in places on the metamorphic rock assemblages represented by the Devonian and pre-Devonian age. The carbonate platform, which forms wide spread and thick deposits in the form of Tethys deposits in the region, crops out as the Munzur Limestone Formation and has a steep topography. If the Munzur limestones are considered as the foundation along the Pülümür valley, there are evaporite sediments along with the metamorphic, clastic and volcanoclastic units of different ages in the sequence that becomes younger towards the north. In the evaporite outcrops observed in the field, gypsum and anhydrite facies are generally in contact with clastic rocks. The outcrops of these evaporites can be observed in the valleys of the Pülümür River, which cuts the valley in a north-south direction, and in the drainage areas of this river in a roughly east-west direction. In addition, new gypsum and anhydrite facies have appeared as a result of the roads opened in recent years to access the villages. Due to the active tectonism and fracture systems in the region, evaporitic minerals such as halite and trona, which do not occur at the surface, are dissolved by groundwater activity and in some areas are discharged in the form of mineral water springs. Some of the springs, which have ceased most of their activity in the past, formed the travertine deposits in the southern parts of the region. During the closure of the northern branch of the Neo-Tethys Ocean, the volcanic activity in the region due to the continent-continent collision on the İzmir-Ankara-Erzincan suture zone and the presence of this entire evaporitic rock complex, which was formed by the evaporation of the almost north-south water corridor, forms the small evaporitic basins. The elucidation of such such sedimentary systems plays an important role in understanding the tectono-stratigraphic evolution of the region in the last period.



World 8th

28 August-01 September, 2023– Prague (Czech Republic)

Multidisciplinary Earth Sciences Symposium

TUNCELI (TURKEY) PROVINCIAL SETTLEMENT NATURAL DISASTER RISKS AND DIVERSITY

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ABSTRACT

Tunceli province, which has almost the lowest population density in Turkey when the distribution of provincial population is compared with the area under cultivation, has a rather scattered population except for a limited area in the center. Despite its low population density and scattered settlement, this province faces a wide variety of natural disasters and risks due to its location, regional geology, and climate. When the location and regional geology are considered together, the greatest natural disaster risk is an earthquake, as the region is located near large active fault zones. Liquefaction is also a risk factor for such areas, threatening areas such as alluvium, floodplains, and permeable-filled soils created by the earthquake, where settlements are rare in the scattered settlement of Tunceli. Considering the regional geology, there is a significant landslide risk in the very rugged topography due to marl-clay facies with flysch deposits that were once the sediments of a closed ocean and are widespread in the region. Limestone facies, on the other hand, belonging to the same oceanic deposits, trigger rockfall events due to their cracked structure and weathering along steep valleys and steep topography. The Munzur and Pülümür rivers, which feed very large bodies of water in the Eastern Anatolia Region and have a fairly wide drainage area, cause flooding and flood hazards from time to time due to seasonal precipitation, and water pipes in the city center are damaged by excessive sediment transport. The climate, topography, and valley morphology in the region, which primarily affect road traffic and limited settlement, are the most important factors that determine avalanche risk in winter. In the evaluation of all these risk factors, a very young, highly porous, and permeable sedimentary group containing travertine-limestone-clay is also observed, occurring mainly in the southern parts of the city and reaching a thickness of about 50 m in the cuts along the highway, indicating the risk of sinkholes that have not yet reached the level of a disaster.

THE INFLUENCE OF DIELECTRIC PROPERTIES ON HEATING OF SULPHIDE ORES IN ELECTROMAGNETIC FIELD

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ABSTRACT

Microwave heating is a form of high-frequency electromagnetic radiation. The heating of primary and secondary mineral raw materials in the microwave field depends primarily on their dielectric and thermal properties. The condition is the absorption of microwave radiation. Dielectric heating of materials occurs immediately after placing them in an electric high-frequency field. Knowledge of the dielectric characteristics of mineral raw materials is an important assumption for the use of electromagnetic radiation at the intensification of technological treatment methods. Most mined minerals consist of several mineral components that have different dielectric properties. Most sulphides are well heated in a microwave field. Conversely, quartz and barite are transmission materials. The study of dielectric properties involves measurements of the complex relative permittivity ϵ_r , which consists of a real and an imaginary part. The imaginary part of permittivity /loss factor/ represents the measure of dielectric losses in the material. Microwave heating of sulphide ores and concentrates such as chalcopyrite, tetrahedrite, galena thus depends on their chemical composition and content of impurities. The article describes the possibilities of measuring the dielectric permittivity of selected sulphide minerals. SEM analyses of the samples before and after heating in the microwave field are presented. Selective microwave heating of useful components of refractory sulphide ores is an important factor at increasing the efficiency of obtaining strategic metals such as Cu, Zn, Sb, Fe, Ag, Au in extraction processes.

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RESEARCH OF OCHRE FROM THE MARTA ADIT (NIŽNÁ SLANÁ, SPIŠ-GEMER ORE MTS., EASTERN SLOVAKIA)

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ABSTRACT

The contribution deals with the study on composition of ochre sample from the Marta adit at Nižná Slaná. Three samples were prepared from ochre by hand picking and screening, which were subjected to GA, AAS, XRF and XRD. Salts precipitated on surface at drying contain 17.7 % S (53 % as SO₄), 16.5 % MgO, 13.6 % Fe₂O₃, 3.54 % CaO and 1 % MnO. As to mineral composition, sulphates such as gypsum, starkeyite and rozenite are dominant. The fraction of grain size under 250 micron contains 30 % Fe₂O₃, 28.6 % SiO₂, 8 % Al₂O₃, 6.6 % CaO, 2.9 % MgO and 1.95 % S. Notable is content of arsenic in this fraction, which attain as high as 1.84 %. Quartz and gypsum occur as dominant crystalline phases. As to coarser fraction, i.e. under 150 microns, 44.5 % SiO₂, 16.8 % Fe₂O₃, 11.3 % Al₂O₃, 6.9 % CaO, 2.4 % MgO a 2.3 % C were assayed. Dominant quartz is accompanied by mica, plagioclase, ankerite and dolomite. It was shown that arsenic is bonded in finer grain size fraction.

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THE INFLUENCE OF WATER RESERVOIR TO THE ECOSYSTEM

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ABSTRACT

The problem of supplying the population, agriculture and industry with water and electricity becomes more topical. Against the background of modern ecological conditions, in the conditions of global warming and the progressive process of desertification, further deterioration of the problem is expected. A partial resolution of the problem may be the construction of water reservoirs. Through them, a river runoff distribution in time and space takes place as well as an increase in water resources within the useful volume of the reservoir. Thus, in Georgia, there are significant reserves for the enhancement of water resources and, therefore, the water supply of the population and territory. Only 4% of river runoff is regulated here. Recently the rehabilitation of water reservoirs and construction of new reservoirs has become topical in connection with the rehabilitation-development of hydroelectric power and irrigation in Georgia. Scientific innovation of the research is the following: determination of the areas of influence of reservoirs; the influence of reservoirs on the present cultural monuments; etc. To assess the impact of water bodies on the microclimate, the changes caused by global circulation processes characteristic of this climatic zone are identified. For each water reservoir, the meteorological data of another basin with similar climatic conditions were selected and analyzed. For the detection of the impact of reservoirs on the values of meteorological elements the parametric and non-parametric criteria of evaluation of statistical uniformity (inhomogeneity) of accidental values were used. For the revealing of the impact of reservoirs on the ecosystem, a special questionnaire was used for the local population survey; the relevant statistical material was collected. Introduction of data and information into project, organization, processing, control and visualization carried out by ArcGIS. The outcomes of the research are: a. Influence of reservoirs on meteorological elements (air temperature and humidity, atmospheric precipitation) revealed and their quantitative assessment carried out; b. Areas of influence on individual meteorological elements ascertained and their spatial visualization done for different values of probability of statistical reliability level; c. Impact of reservoirs on the population and cultural monuments evaluated; d. The obtained results will be generalized for the region of the possible construction of reservoirs.

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ANALYSIS OF WALL PILLARS DEPENDING ON THE STIFFNESS OF THE SUBSOIL

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ABSTRACT

The article presents a numerical analysis of the stress state in the wall pillars of an apartment building. Deformations and stresses are analysed depending on the elastic support of the pillars. The foundation structure is a reinforced concrete slab placed on an elastic subsoil. The elastic subsoil is solved in the finite element method (FEM) according to well-known mathematical-physical models of the subsoil. First of all, it is the simplest subsoil model - the Winkler model. This is described by the proportionality equation. In the equation, the subsoil push is directly proportional to the subsoil stiffness. The stiffness characteristic of the subsoil is k (N.m⁻³). This model is characterized by the fact that the deformation of the subsoil occurs only under the foundation structure. Subgrade outside the foundation is not activated and included in the calculation. This shortcoming was solved by a two-parameter subsoil model based on Pasternak's theory. It is defined by two stiffness characteristics $C1$ (N.m⁻³) and $C2$ (N.m⁻¹). The relationship between vertical strain and load is described by a partial differential equation. Currently the so-called "modified Winkler model" appears in the literature which took part of the solution from Pasternak's model. It is mainly about taking into account the stiffness of the subsoil around the foundation structure. The basis of the solution are derived stiffness matrices of the base plate on individual types of subsoil. These matrices are implemented in all available static software. In this article, we present different approaches to the solution of wall pillars of a reinforced concrete structure of an apartment building. The apartment building has a rectangular floor plan of 52.5 x 16.5 m. The structure has two underground floors and six above-ground floors. Vertical load-bearing structures mainly consist of reinforced concrete walls. In the premises of the underground parking lot there are also columns - wall pillars which are the subject of the analysis. On the walls or reinforced concrete ceiling slabs are placed on the columns. In the above-ground floors, it is a system of load-bearing walls perpendicular to each other. It is a plate-wall monolithic construction of an apartment building. The article analyses the internal forces in the wall pillars of underground floors (parking area). The stiffness parameters of the subsoil were calculated from the specific geological profile. The structure was calculated using FEM-based software. The flexible subsoil was modelled by the classic Winkler subsoil model for two types of its stiffness. The third and fourth models of the structure were calculated on the "modified Winkler" foundation. Two different subsoil stiffness' were considered taking into account the stiffness of the subsoil even outside the foundation plate. The analysis compared the internal forces in the columns. The basic values of the forces in the columns were the forces with rigid support of the columns. The difference in the size of the normal forces in the columns when considering different types of flexible support reached a value in the range of 80 to 140%.

DEVELOPMENT OF A ROMANIAN BLACK SEA LEVEL MONITORING NETWORK

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ABSTRACT

Black Sea level monitoring started within the Marine Geohazards project (2013) in collaboration with the Joint Research Center of the European Commission JRC (2015) with 3 IDSL (Inexpensive Sea Level Measuring Device) stations installed in the western part of the Black Sea with the main tsunami protection purpose. As of 2022, the equipment has been replaced with new sensors such as MB7360 (IDSL radar), LT500 (pressure sensor) and weather stations. New data acquisition software has been developed that extends tsunami protection to assessing the effects of global warming through climate change that can induce storms, an increase in the level and temperature of the Black Sea. The main results indicate the importance of the sensor installation method and the limits of the use of IDSL radars. In this case, the measurements taken depend on the space between the sensor and the water surface, which in our case is variable. Two examples will analyze the measurement errors using IDSL radars type MB7360 depending on the installation location compared to a pressure sensor located in water. The possibility of an earthquake producing a tsunami in the Black Sea is lower compared to the cases in which a nuclear explosion would generate an earthquake with a magnitude above 7R in the Shabla seismic zone or an asteroid would hit the water near the Romanian coastal area. For this reason, the Black Sea monitoring facilities were expanded in the area of the Romanian coast. The new application also performs forecasting - the detection of storms, which also involves the evaluation of waves through the background noise. For this reason, no external wave attenuation devices are used. Radar-measured water level (above water) and pressure (in water) are correlated with local meteorological and seismic information. A decision matrix based on seismic, meteorological and level data provides tsunami warning and forecasting - storm assessment. Also, from the analysis of the level data of the Black and Mediterranean seas correlated with storms and zonal seismicity, a correlation and the possibility of inducing some events was found.

This work was carried out within PNRR-III-C9-2022-15 (Competence Center for Climate Change Digital Twin for Earth forecasts and societal redressment: DTEClimate), PN23360101 (Parameterization and evaluation of the effects of earthquakes or other natural or anthropogenic phenomena), PN23360201 (SOL4RISC), and Project PN-III-P4-ID-PCE-2020-1361 (AFROS).

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HIGH RESOLUTION BIOMARKER RECORDS IN LATE HOLOCENE SEDIMENTS FROM THE SOUTHERN CONTINENTAL SHELF OF KOREA: IMPLICATIONS FOR EAST ASIAN CLIMATE

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ABSTRACT

High-resolution records for carbon isotopes of organic matter and *n*-alkane compounds were investigated in two gravity cores (SJP15-2 and SJP15-4) taken from the southern continental shelf of the Korean peninsula to evaluate the variation in influxes of terrestrial organic compounds and their linkage to East Asian paleoclimate variations since the last 4 kyr. The total organic carbon contents were < 1%, and the carbon isotope($\delta^{13}C_{org}$) ratio ranged from approximately -21‰ to -22‰ and, they did not highly fluctuate throughout the two cores. There are two switching points that discriminate patterns of excursion and distribution at ca. 2.5 ka, and 0.5 ka. Several *n*-alkane combined indices such as average chain length (ACL), carbon preference index (CPI), and paleovegetation index (*Paq*), were coincident with these switching points, implying that the supply of terrestrial biomarkers was strongly associated with environmental changes at the source area. In particular, the ratios of nC_{31}/nC_{27} and nC_{31}/nC_{29} show coincident excursion pattern with lower ratio between 2.5 ka and 0.5 ka, implying that this gradational change is associated with wetter climate conditions, and thus paleovegetation and paleoclimate variation. Comparison with previous data of the detrital quartz from the East China Sea and aeolian dust in the Cheju (Jeju) Island, South Korea, and Dongge cave oxygen isotope records indicates strong synchronicity with gradational East Asian climate changes, suggesting that paleoclimate system of the East Asian region may have influenced the sediment records of study area since the last 4 kyr. Therefore, our high-resolution biomarker data are very useful for understanding past climatic records, and East Asian monsoon and regional records could be associated with the paleoclimate variations of the study area.

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ON THE LOCALLY BEST FITTED ELLIPSOIDAL MODEL IN PACIFIC AND INDIAN OCEAN

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ABSTRACT

It has been shown in the literature that the marine topography in coastal areas can be well described by a locally optimized Ellipsoidal model with average difference from the measured mean sea surface, less than 15cm. Therefore, such mathematical model can be considered as a realistic local description of the sea surface, which is very important for a number of applications, such as marine or airborne navigation. But what happens if we apply this calculation to large oceanic areas? How will the average differences be affected? In this paper we compute locally optimized anisotropic ellipsoidal models for two ocean zones, one in the Pacific Ocean and one in the Indian Ocean. These two regions are known to be dominated by completely different geoid forms, with the latter showing strong variability (also known as Indian Ocean Geoid Low - IOGL) while the former has a very smooth geoid form. In both oceanic zones we have calculated the locally best fitted ellipsoid for a total area of 1200 km divided into 4 zones, while the grid of points varied from 0.2 to 0.01 of a degree. Estimates of the geoid models EGM96 and EGM2008 were used as raw data. The results show that the deviation increases linearly with the size of the application zone, reaching a maximum of 1 m deviation. A higher densification of the point grid significantly increases the accuracy as it reduces the deviation at least to 11% and up to 26%. Contrary to what was initially assumed, the locally optimized ellipsoidal models of the two areas, despite their significant actual differences in geoid shape, do not show large differences in average deviations.

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DESIGN CRITERIA FOR A CYCLEWAY NETWORK USING GIS, TOPOGRAPHIC LEVELING AND SPATIAL ANALYSIS

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ABSTRACT

The current need for the creation of cycleways in traditional cities often presents problems. Converting existing roads into cycleways frequently creates serious traffic issues without leading to the expected increase in bicycle use. In order to overcome some of these problems, this paper presents a composite methodology using GIS, topographic leveling and spatial analysis. Upon application of this methodology in a case study in the city of Patras, Greece, problems with the city's existing, recently-constructed cycleway are identified. After applying topographical, qualitative and population criteria, an alternative network of cycleways is proposed. This proposed new network does not create traffic congestion, as the basic criterion for selecting roads is their low traffic load. At the same time, topographic leveling is employed to select routes with a very low gradient (<2%), which is a determining factor in making the network attractive to users. Using spatial analysis, the network is spread in order to serve all areas of the city, making it available to the vast majority of residents. Finally, the findings of a social research poll (through the use of a questionnaire) indicate that the creation of such a network could increase bicycle use by a factor of up to 18, which would make bicycles the main mode of transport for 22% of residents.

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A STUDY OF THE GEOID AND MARINE TOPOGRAPHY IN LAGOONS

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ABSTRACT

The study of geoid fluctuations in coastal areas is extremely important in understanding the changes in the extent of the Earth's crust and also in the form of the mean sea surface topography (MSST). In recent years, the GNSS-on-boat method has made important steps towards the detailed description of marine topography, achieving precision to the order of a few centimeters, which is much more significant than has been achieved with the alternative satellite and altimetric methods. In this study, the method is applied for the first time in a lagoon, a challenging but exceptionally interesting environment both from a geophysical and hydrodynamic viewpoint. The 'Papas' lagoon in Western Achaia (Greece) was chosen for field measurements. The result for the geoid form shows a peak (13-15cm) in the marine topography approximately in the center of the lagoon. If this is confirmed in other lagoons or lakes, it will constitute a significant contribution to hydrodynamic models, which currently take as a basic assumption that the surface of the water is level. At the same time, the form of the SST indicates a significant reduction in gravity in the center of the lagoon, which may be linked either with a local reduction in the thickness-density of the Earth's crust or with the existence of underground voids, faults or deposits.

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INVESTIGATION OF METHANE-HYDROGEN MIXTURES IN VERTICAL

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ABSTRACT

The paper presents issues regarding the separation phenomena of methane-hydrogen mixtures in vertical pipelines. In the first part of the paper, the explosion risk is underlined. Thus, the widespread use of methane in both the industrial and domestic sectors is well known. In practice, due to recent trends, the injection of hydrogen into dedicated methane installations, the differences in densities can lead to separation phenomena which have an unfavorable effect on the operating regimes of equipment using this mixture and also, on the risk of explosion. The use of hydrogen in the industry is not new, but the increasing impact in terms of the number of users may involve a higher number of accidents due to the increased field of probability of hazardous situations in terms of explosions. The second part presents the used methods. The diffusion and gravitational separation are presented as phenomena having opposite effects. The used methods are theoretical and simulation approaches. The theoretical model is based on the nondynamic model. Therefore, no time parameter was not involved in the model. A linear dependence with the height of the concentration variation was observed for the range of heights considered. The conducted simulation underlined the same conclusion regarding the magnitude of gravitational separations in the methane-hydrogen mixtures. The main conclusion of the approach is that the separation phenomenon effect due to the gas density differences is negligible. The approach also revealed, as expected that the higher level of pipe is exposed to a higher risk of increased hydrogen concentration.

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STUDY OF THE THROTTLING EFFECT IN TUNNEL FIRES

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ABSTRACT

As per the emergency ventilation strategy, air velocity of 3 m/s in case of the longitudinal ventilation is sufficient for smoke control in all fire conditions. Numerical experiments were carried out with FDS software to estimate the numerical value of the critical velocity. Numerical models were realized in 0-6% slope tunnels with a 1% step for 5, 10, 20, 30 and 50 MW fires for four types of fuel: gasoline, diesel fuel, oil and firewood. The paper notes that the dynamic pressure induced by a strong fire is much higher than the static pressure of tunnel jet fans. As a result, following the algebraic summation of positively-directed ventilation flows and the negatively-directed flows induced by fire, an intense back layering occurs, which casts doubt on the suitability of the specified emergency ventilation strategy when designing the fire ventilation. The critical ventilation speed of 3 m/s cannot cope with the traction caused by fire, expressed by the ascending movement of the high-temperature and low-density combustion products. The paper discusses the numerical modelling results with an adiabatic underground heat exchange model and presents typical tunnel fire modelling plans, which correspond to an inclined tunnel for ascending and descending ventilation flows as well as a horizontal tunnel. The article gives the regularities obtained by the numerical models of changes in the variables of average air temperature and density, average carbon monoxide, average carbon dioxide and soot concentrations. According to the emergency ventilation strategy, critical velocity is an important value and a major determinant of back layering prevention in sloping tunnels. Although many papers have been devoted to this problem, the obtained results differ much. The present paper shows that strong fires induce much greater dynamic pressures than the static pressures of the tunnel jet fans are. Consequently, the flows caused by these forces, as they move in different directions, following their algebraic summation, cause a strong back-layering in case of positive ventilation flows, i.e., when the ventilation flow is descending and the fire seat is found at a lower point compared to the air supply portal. The new results can be used to develop fire ventilation plans as well as life-saving and emergency control solutions in the operating tunnels for personnel and rescuers.

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RECONSTRUCTING THE 1977 VRANCEA EARTHQUAKE USING AMBIENT NOISE RECORDINGS

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ABSTRACT

The Vrancea seismic nest, located at the South-Eastern Carpathians Arc bend (Romania), is a well-confined cluster of seismicity at intermediate depth (60 – 180 km). Vrancea seismic zone generates high magnitude earthquakes releasing the largest strain in continental Europe. The intensity distribution is asymmetric and with larger accelerations recorded outside the epicentral area. During the last 100 years four major shocks were recorded in the lithosphere body descending almost vertically beneath the Vrancea region. The last significant earthquake occurred on 4 March 1977 (M_w 7.4, depth 94 km) with devastating effects on the Bucharest city. This earthquake was not well recorded locally. There is only one record without absolute time. Nowadays it is possible to apply the latest analysis methods due to the development of the National Seismic Network. We reconstruct realistic ground motion records for the 1977 event using the new algorithm of Virtual Earthquake Approach (VEA, Denolle et al., 2013) as if the stations operating today recorded this destructive earthquake. We use one year of three-component ambient noise records from 44 broadband stations located near Vrancea seismic zone. We use pairs of stations to build the Green's tensor from ambient noise. Then we add the signature of the real earthquake, i.e. the focal mechanism, buried source and the realistic earth model in the epicentral area. We validate the method by comparing recorded waveforms with our simulations from a modern earthquake. We then simulate the ground motion generated by this earthquake recorded by modern seismometers decades after occurrence (Petrescu et al., 2023). Preliminary results accurately simulate the anomalous ground motion patterns of Vrancea earthquakes in contrast to simplified synthetic data which do not capture the full information on wave physics and structural heterogeneities. Our new results demonstrate the viability of this innovative method and provide a unique opportunity for more accurate seismic hazard analysis.

The present study was funded by the EENSANE (East European Ambient Seismic Noise) Project PN-III-P4-ID-PCE-2020-2972 supported by UEFISCDI (Executive Agency for Higher Education, Research, Development and Innovation Funding), Romania.

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RECENT WORLDWIDE TSUNAMIS (2020-2023) - COMPARISONS BETWEEN MODELING AND MEASUREMENTS

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ABSTRACT

Few high magnitude earthquakes were generated worldwide in the last three and a half years, some of which triggered tsunami waves. We took into account all the events during the interval January 2020 - June 2023. There was a total of 15 earthquakes (5 in 2020, 5 in 2021, 2 in 2022, 2 in 2023) which lead to moderate and/or small tsunami waves (above 0.1 m), having magnitudes higher than 7, but also one earthquake with magnitude below 7 (6.8) which lead to very small tsunami waves generation. Not all the high magnitude earthquakes resulted in tsunami waves, depending on the depth, focal mechanism and / or other parameters (distance to shore, local conditions, etc.). From tsunami measurements point of view, we considered the most relevant ones and studied only the events that lead to measured waves higher than 0.5 m. The most significant ones are 5 events: 23rd of June 2020 (15:29 UTC), Near Coast of Oaxaca Mexico, M7.4 (maximum waves 0.68 m); 19th of October 2020 (20:55 UTC) South of Alaska M7.4 (maximum waves 0.76 m); 10th of February 2021 (13:20 UTC) Southeast of Loyalty Island, M7.7 (maximum waves 0.78 m); 4th of March 2021 (19:28 UTC) Kermadec Island region, M8.1 (maximum waves 0.56 m) and 19th of September 2022 (18:05 UTC), Coast of Michoacan Mexico M7.6 (maximum waves 0.79 m). We compared, in this paper, the values of sea level measurements with the results of the tsunami simulations, using the parameters of each earthquake (latitude, longitude, magnitude, depth, focal mechanism). The modeling simulations were accomplished using TRIDEC Cloud software, provided by the German Research Center for Geosciences (GFZ), Potsdam, Germany. When comparing the values between the two types of data (measured vs. computed), the results show that some simulations overestimate the measured values, others underestimate it. More studies are necessary for a better numerical assessment of sea level, in order to be more precise and closer to the real measurements. Future work might include using two or three different modeling software, for the same earthquake parameters, and comparing the results.

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THE EENSANE (EASTERN EUROPEAN AMBIENT SEISMIC NOISE) PROJECT: A NEW DATABASE OF AMBIENT NOISE CROSS-CORRELATIONS AND CRUSTAL TOMOGRAPHY MODELS

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ABSTRACT

Ambient seismic noise has proven to be a fantastic tool for subsurface imaging in the last decades, with applications ranging from near surface imaging, to crustal or upper mantle tomography. Fundamentally, it relies on the cross correlations of continuous recordings of ground motion data at pairs of seismic stations. Processing steps have become more refined and promising in extracting meaningful signal that can further be used in a range of classic seismology tools. The processing, however, is usually cumbersome, time- and memory- consuming, as it requires years of continuous noise recorded at broadband seismic stations, to obtain high signal-to-noise ratio empirical Green's functions. In order to ease the research effort, we made an open-source database of ambient noise cross correlations that can be used for further processing, through the EENSANE (Eastern European Ambient Seismic Noise) project. Our database comprises ambient noise cross-correlation data between pairs of permanent and temporary Central and Eastern European stations that operated between 1999 and 2020, and aims to progressively grow as more stations become available, such as the new AdriaArray network. Based on this database and using state-of-the-art inversion techniques, we developed a series of near-surface and crustal tomography models of the Eastern European craton, the Trans-European Suture Zone and younger accreted terrains from Central Europe. Our integrated models provide both isotropic and azimuthally anisotropic seismic velocities from surface wave dispersion and attenuation parameters from the decay envelopes of Rayleigh waves. Using horizontal-to-vertical ratios of ambient noise, we also recovered the fundamental frequency of resonance and near surface shear wave velocity models beneath stations located across the Carpathian Orogen. Based on cross-correlation functions, we were also able to retrieve the seismic wavefield and peak ground displacement amplitudes from past earthquakes decades after their occurrence, offering a chance for improving seismic hazard and risk models in seismically vulnerable and developing regions of Europe. Our multidisciplinary results prove the versatility of ambient noise uses and the importance of the EENSANE database for a wide range of seismological imaging and hazard applications.

The present study was funded by the EENSANE (East European Ambient Seismic Noise) Project PN-III-P4-ID-PCE-2020-2972 supported by UEFISCDI (Executive Agency for Higher Education, Research, Development and Innovation Funding), Romania.

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GEOHERMAL HEAT FLOW BY CONDUCTION IN MAINLAND PORTUGAL

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ABSTRACT

The first heat flow density measurements obtained in Portugal were made in boreholes used for mineral prospection. Data obtained in oil or gas prospection were also used to obtain heat flow values in the sedimentary basins of the western and southern margins of the country. Due to the scarcity of data in the central and northern regions of the country some heat flow values were obtained using numerical models based in some characteristics of the region obtained from seismological data, heat production by radioactivity, geoid height values, fault location and tectonics of the region. The total of heat flow density values used in this work is 70, with 20 values obtained using numerical models, 2 values obtained in holes drilled for water prospection, 32 obtained in mining boreholes and 16 obtained in sedimentary basins from oil/gas wells. Heat flow density values from 65 to 106 mW/m² were obtained in the western margin. The two values obtained in the Algarve Basin (southern offshore coast) are 63 mW/m² (western part) and 73 mW/m² (eastern part). Values from 61 to 136 mW/m² were obtained in the southern part of the country. The average value obtained for the southern part is 82.9 mW/m². Values from 54 to 85 mW/m² were obtained in five boreholes located in the central part of the country with lowest values measured near main faults in the region. Only one value of 86 mW/m² was measured in the northern part of the country. Using all data available we can present an average value of 80.6 mW/m² for heat flow density and 3.0 W K⁻¹ m⁻¹ for thermal conductivity values in the northern part of the country. For the central part of the country the average heat flow obtained is 82.2 mW/m² with an average thermal conductivity of 3.4 W K⁻¹ m⁻¹. The average heat flow density value obtained in sedimentary basins is 75 mW/m² with an average thermal conductivity of 2.9 W K⁻¹ m⁻¹. For the onshore Lusitanian Basin average values are 80 mW/m² and 2.7 W K⁻¹ m⁻¹ respectively. The results clearly show the need to analyze the flow values taking into account the characteristics of the place where it was measured and dispersion of data in the region. Heat production in the upper crust is a very important data in the region. Heat flow values from deeper zones are relatively higher than those used in other works. This fact may be related with geoid height values found in the region (positive anomaly).

HYDRODYNAMIC STRESS ON THE BOTTOM OF THE STILLING BASIN

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ABSTRACT

The hydraulic assessment of the safety objects on the hydraulic structures based on the evaluation of experimental measurements performed on a physical hydraulic model is the main subject of this article. Experimental research of outflowing water jet behaviours concerning the safety of the downstream earth dam toe is also related to the field of the hydraulic structure's safety. The higher the dam the higher the potential energy of water on the spillway's crest and thus the higher the kinetic energy at the toe of the dam. The dimensions of the stilling basin (especially its depth) grow with the increasing energy. The river bottom particles are washed away due to high flow velocity if the amount of the energy dissipated on the spillway or in the stilling basin is not sufficiently large. This leads to the formation of scour holes or the destruction of the channel which has negative effects on the watercourse, its surroundings and the hydraulic structure itself. Hydrodynamic stress is mainly represented by pressure pulsations which can have a degrading effect on the objects and thereby their lifespan and operability decrease. From the reasons stated it is necessary to strive for the quantification of this oscillating load and then the adaptation of the constructions on this. A very accurate evaluation of the suitability of the technical measures can be obtained by comparing the measured results of the individual technical adjustments on the physical model. These technical adjustments of the constructions like spillways, chutes, sluiceways, stilling basins and so forth, could be the results of numerical and physical modelling. Hence hydraulic parameters can be refined using physical or three-dimensional numerical models with an inaccuracy of up to 3 %.

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**PEDOLOGICAL AND MICROMORPHOLOGICAL CLUES TO POLYGENETIC SOIL FORMATION ON
LATE GLACIAL LOESS OF THE SUSAK ISLAND, CROATIA**

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ABSTRACT

Loess deposits are widespread in continental Croatia, but sporadic in its Mediterranean region. During most of the Upper Pleistocene, sea level was lower and northern part of the Adriatic was a large sedimentary basin. Alluvial sediments, deposited therein mainly by the Po River, were subjected to wind deflation/transport. Part of the entrained dust and sand was deposited over the carbonate bases of present-day North Adriatic islands. Susak, as the most distant of these, is the only Croatian island entirely covered by loess. It has a 3.8 km² area, 96 m asl elevation, Mediterranean climate, and grasses/shrubs as dominant vegetation. Its base is made of Upper Cretaceous limestone with numerous cracks/cavities often filled by lithified remains of terra rossa-like palaeosols. The carbonate base is covered by up to 90 m of loess deposits. These comprise several intercalated palaeosols, forming pedosedimentary complexes. Focus of this research (published in Durn et al., 2018) was on the modern soil found on the highest plateau of the island. The aim was to study the youngest soil (formed on Late Glacial loess) on Susak in order to reconstruct sedimentological/pedological processes that lead to its formation and shed light on paleo-environmental conditions in the region. One soil profile was described and sampled. Soil physico-chemical, micromorphological and mineralogical properties were analysed, with the results supported by luminescence dating. The following soil horizons were identified: A(0-5cm)-2C(5-65cm)-3Btb(65-100 cm)-4Ck(100-200cm). The profile was classified in line with the WRB system as Eutric Leptic Regosol (Geoabruptic, Siltic, Raptic) over Argic horizon over Loess deposit. The obtained age of the Last Glacial loess forming the 4Ck horizon was 16.1±1.3 ka (OIS2). The 4Ck horizon was part of an eroded and buried A-C paleosol, whose incipient formation corresponds to steppe-like vegetation and semi-humid/semi-arid climate. Bølling-Allerød warming (14.7-12.7 ka BP) enabled a vegetation shift (forests replacing grasslands) and pedogenesis towards Luvisol-like soils (as suggested by the 3Btb horizon). The 3Btb horizon was key to inferring on environmental changes, largely due to its micromorphological features: planar voids, illuvial clay coatings/infillings, Fe/Mn nodules, sharp horizon boundaries, etc. Towards the end of the Bølling-Allerød period, a period of forest decay and surface instability presumably occurred, with subsequent truncation of the palaeo-Luvisol topsoil (A and E horizons). The exposed argic horizon was then again covered with loess (horizon 2C), possibly during the cold period at the very end of the Last Glacial (Younger Dryas: 12.7-11.7 ka BP). On top of this loess, modern soil is formed (with some aeolian additions, erosional losses, and human influences). The analyzed profile is a polygenetic soil, formed as a result of alternating loess depositions, erosion events and periods of top-down pedogenesis, in environmental conditions that varied significantly from the end of the Late Glacial onwards. Accordingly, the studied soil is an archive of regional climate, vegetation, land surface and land use changes.

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HYDROLOGICAL CONNECTIVITY, STRUCTURAL AND ECOLOGICAL FUNCTIONALITY OF A MEANDERING ECOSYSTEM OF THE DANUBE DELTA

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ABSTRACT

The pressure control of the climate change and anthropogenic factors have consequences on the ecological systems, generating structural changes. The abiotic (i.e., water hydrology and hydraulics, sediment load, water physic-chemistry) and biotic (i.e., biodiversity, structure and functionality of food webs) characteristics of river-channels-lakes from deltas depend on several factors; however, the main driver of these characteristics is represented by the hydrologic connectivity with the main stem of the river. Floodplain lakes can be permanently, temporarily or disconnected with the main stem of the river producing interruptions in the transfer of fresh water and thus affecting benthic macroinvertebrates, by decrease in their population, diversity and even loss of sensitive taxa. Multidisciplinary investigations (hydrodynamics, sedimentological and ecological measurements and analyses) were made to investigate a river-channel-lake site type situated on the St. George branch formed by a cutoff meander (Mahmudia meander), a connective channel (Uzlina Canall) and a lake (Uzlina Lake) to observe how much the fresh water and sediment input to the delta depressions is affected by the structural changes of the meander physiography. The Mahmudia meander was rectified 40 years ago and the response of the channel consisted in a very fast silting of the former meander, currently receiving less than 5% of the upstream water and sediment discharge. The lateral connectivity with the deltaic depressions through the lateral canals is compromised.

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COMPARISON ON COMMERCIAL AND FREE SOFTWARE FOR POINT CLOUD PROCESSING

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ABSTRACT

Terrestrial laser scanning technology is becoming an increasingly common for automated spatial data acquisition and digitization in the fields of surveying, construction and architecture. The data from measurements made with terrestrial laser scanners is a huge array of points in space, called a point cloud, which describes the captured surface of the object under study. The point cloud processing is performed in specialised software products for handling measurements from laser scanners, which provide different possibilities for manipulating the point cloud and forming different results. The software available on the market differs according to its data processing capabilities and functionalities, application areas, methods used, manufacturer and cost. In order to be able to perform spatial data processing and analysis correctly and with high quality, it is important to understand the available functionalities of the different software products and their advantages and disadvantages compared to others. A comparison is made for three software packages for point cloud processing - Autodesk ReCap Pro, CloudCompare and Trimble RealWorks. The different functionalities available in the products are described and presented on small building measurements along with their performance accuracy and efficiency. The advantages and disadvantages of the different software products are identified through the comparison performed. The first section describes the basic principles of the terrestrial laser scanning method. In section two, the different point cloud processing software products on the market are presented, together with a description of the different file formats for data exchange and a theoretical section on point cloud registration, filtering and modelling. The third section contains a presentation of the main functions and processing capabilities in Autodesk ReCap Pro, CloudCompare and Trimble RealWorks software. The fourth section describes the data used for the study, the measurements performed, their processing and results in the three software, together with an assessment of accuracy by control measurements. Section five contains conclusions and implications.

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GENERATION OF POLYPHASE ASSEMBLAGE OF THE PLATINUM GROUP MINERALS IN THE INAGLI DUNITE-SHONKINITE MASSIF OF THE ALDAN SHIELD OF THE SIBERIAN PLATFORM

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ABSTRACT

The Inagli massif is a concentric-zonal ring massif consisting of a dunite core bordered by a sequential series of peridotites, pyroxenites and shonkinites. In dunites, there are densely disseminated accumulations of chromspinelides, as well as schlieren and veined particles of massive chromitites, to which polyphase growths of platinum group minerals (PGM) are confined. The Inagli intrusive, like the well-known Konder massif, belongs to an independent "Aldan" type of platinum-bearing deposits. The Aldan type of ring intrusions is a platform analogue of the "Ural-Alaskan" zonal dunite-gabbro massifs of orogenic regions. In placers, dunites and chromitites of the Inagli massif, PGM are mainly represented by isoferroplatinum (Pt₃Fe) with an admixture of iridium up to 8 wt %. In isoferroplatinum, symplektitic iridium particles and small inclusions of osmium, laurite, ehrlichmanite, as well as other sulfides and arsenides of PGE are often observed. The forms of growths of these minerals indicate their formation during the decomposition of polycomponent solid solutions of PGE-Fe composition. The total composition of such polymineral aggregates can be calculated based on the volume ratios and chemical composition of individual phases. The results obtained in this way show that the compositions of the initial polycomponent solid solutions vary from Pt-Ir-Fe to Ir-Os-Ru-Rh-Pt-Pd-Fe alloys. Polycomponent homogeneous solid solutions, which composition gradually changes from Ru-Rh-Ir-Os minerals to Fe-Pt alloys, are known in the Witwatersrand placers. A similar series of solid solutions of PGE is identified in the placers of the Gulinsky massif. Unlike the placers of the Witwatersrand and Gulinsky massif, where MPG are mainly represented by osmium, Inagli minerals have mainly a platinum composition with a low proportion of osmium. The structures of most natural polyphase PGM aggregates are similar to those of artificial alloys, therefore, the former are also products of crystallization of multicomponent metal melts and their subsequent solid-phase transformations. The limits of solubility between PGE differ significantly, therefore, depending on the initial composition of metal alloys, both polycomponent solid solutions and polymineral aggregates can be formed. Based on the analysis of combined double and triple diagrams of PGE systems, the author considers possible ways of evolution of phase transformations of alloys of different composition.

CHROMIAN SPINEL FROM DUNITES OF THE INAGLI MASSIF AND THEIR OXYGEN THERMOBAROMETRY (ALDAN SHIELD, SIBERIAN PLATFORM)

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ABSTRACT

The Inagli dunite-peridotite-shonkinite zonal-ring intrusive with platinum-chromite mineralization is located on the Aldan shield of the Siberian Platform. Considering the structure, rock composition and ore mineralization, it is similar to the platinum-bearing zonal massifs of the "Ural-Alaskan" type, but this intrusive differs from the latter in its geological position. In order to clarify the physical and chemical conditions of formation of the Inagli massif, the mineral composition of rocks, especially Cr-spinel-containing dunites, peridotites and shonkinites, as well as platinum-chromite ore segregations, has been studied in detail. Rocks of the massif - from dunites to shonkinites, including peridotites, clinopyroxenites, and melanocratic alkaline syenites, form a single continuous comagmatic series. This is confirmed by a clear dependence of the composition of olivine, pyroxene, phlogopite and chrome spinelides on the content of MgO in rocks. They were formed from the initial high-potassium picrite melt, which, during rising, underwent gradual decompression solidification and formed a cylindrical diapir-like body at the near-surface level in the Early Cretaceous. This occurred as a result of subduction processes related to the formation of the Mongol-Okhotsk orogenic belt along the southern framing of the Siberian craton. The values of oxygen volatility ($\lg f_{O_2}$) for dunites, peridotites, shonkinites, chromitites and olivine-chromite inclusions in the isoferroplatinum of the Inagli massif, calculated using the method of the olivine-chromite spinel oxy-thermobarometer of Ballhaus-Berry-Green (BBG), form a single trend (FMQ+(2-4)) in the range 620-1140°C, i.e. along the band by 2-4 units of $\lg f_{O_2}$ exceeding the fayalite-magnetite-quartz FMQ buffer. Such a rather narrow range of variation in the values of O_2 fugacity in a wide interval of T indicates good comparability and reliability of the data obtained. At the same time, there is a natural decrease in temperature intervals for the formation of olivine-chromite parageneses (in °C): with isoferroplatinum – (1140-770); in chromite segregations – (980-710); in dunites – (930-620); peridotites – (890-770) and shonkinites – (840-710). The results obtained almost completely coincide with the field of values for dunites and chromitites of the Platinum-bearing belt of the Urals, given by other researchers. In terms of redox parameters, platinum-bearing zonal ultramafic-mafic massifs of the Ural-Alaskan and Aldan types are close to more oxidized peridotites with a long history in the lithosphere. They differ significantly from the peridotites of the sublithospheric mantle (including graphite and diamond-containing ones), for example, the Beni Bousera (Бени-Бушер) massif, as well as peridotites and basalts of the mid-oceanic ridges, alkaline basalts of Hawaii Island and others, which are formed under more reducing conditions corresponding to the range between FMQ and carbon-oxygen-CO (CCO) buffers.



World 8th

28 August-01 September, 2023– Prague (Czech Republic)

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TERRESTRIAL LASER SCANNING – CHALLENGES AND OPPORTUNITIES IN 3D BUILDING MODEL CREATION

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ABSTRACT

The technology of terrestrial laser scanning and its possibilities are subject of scientific research in the area of geodesy, construction, architecture and even more over the last decades. This method provides point clouds data, which contains full and accurate representation of the geometrical parameters of the examined subject. This publication discusses in short, the principles and possibilities for creating a three-dimensional data model using the advantages of terrestrial laser scanning. The building of University of Architecture, civil engineering and geodesy, situated in Semkovo resort, Blagoevgrad district is selected for the purpose of the task. Classical land surveying measurements with a total station and terrestrial laser scanning are used for the creation of the three-dimensional models. A comparison and evaluation of the obtained models is made. The result of this evaluation indicates that the technology of terrestrial laser scanning is efficient for representation of high-quality data with a wide scope of advantages such as high range, fast data processing, high precision and accurate details.

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COLLECTING SPATIAL DATA WITH UNMANNED AERIAL VEHICLE

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ABSTRACT

The paper briefly discusses the nature and advantages of unmanned aerial vehicle (UAV) as a spatial data acquisition method. This method and its possibilities are subject of scientific research in the area of geodesy, cadaster, architecture, construction of infrastructure objects and facilities, agricultural activities, cultural and historical heritage and even more over the last decades. This publication discusses in short, the principles and possibilities for creating a three-dimensional data model using the advantages of unmanned aerial vehicle. The building of University of Architecture, civil engineering and geodesy, situated in Semkovo resort, Blagoevgrad district is selected for the purpose of the task. Classical land surveying measurements with a total station and the data collected with an unmanned aerial vehicle are used for the creation of the three-dimensional models. A comparison and evaluation of the obtained models is made. The result of this evaluation indicates that the technology of unmanned aerial vehicle is efficient for representation of high-quality data with a wide scope of advantages such as high range, fast data collecting and processing.

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BACTERIAL REDUCTION OF SULPHATES AS SUITABLE METHOD FOR THE REMOVAL SULPHATES FROM ACID MINE DRAINAGE

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ABSTRACT

Sulphates are one of the most commonly occurring anions in natural waters. Usually they are considered as a relatively harmless substance in the aquatic surroundings. But the sulphates concentration exceeds to 250 mg/L negatively affect the taste of water, concentration higher than 600 mg/L usually results in a laxative effect after usage that result to dehydration and high risk for infants. Next implications of high level of sulphate in waters present scaling in water pipes, which results in reduced diameter or blocked pipes. Besides elevated sulphate makes serious problem related of concrete pipelines biocorrosion. Contents of sulphates in waters increase especially by waste water discharge, which comes mainly from mining, metallurgical, chemical, paper and pulp industry, etc. In addition, sulphates are liberated to aquatic environment from natural sources through sulphur mineral dissolution, atmospheric deposition and sulphide oxidation from mineral. Mine waters origin during the exploitation, mainly after closing down the exploitation of mineral deposits running in the contact zones of water and geological environment. In the deposits with sulphides content occurs specific type of mine water, called acid mine water (AMD) with pH values <4.5. The major components of AMD are sulphuric acid, metals in the form of sulphates and iron precipitates. The aim of this work was to investigate of the sulphates removal from acid mine drainage (AMD) by biological method using sulphate-reducing bacteria (SRB). A sample of AMD out-flowing from the Pech shaft of the abandoned and flooded Smolník deposit in Slovak Republic was studied. Before experiments of the sulphates bacterial reduction AMD was treated by the iron chemical oxidation and precipitation as well as the metals removing by sorption using inorganic composite sorbent Slovakite. The base of the biological sulphates elimination was the bacterial reduction of sulphates under influence of SRB genera *Desulfovibrio*. These bacteria realize the sulphates reduction to hydrogen sulphide at the simultaneously oxidation of energetic substrate. Bacterially produced hydrogen sulphide can be used for the preparation of metal sulphides from mine waters or other industrial waste water by the selective sequential precipitation or the elementary sulphur preparation by chemically or bacterially oxidation. The sodium lactate as the energetic substrate for the SRB growth at standard, double and triple amount was used. Removing of sulphates by the bacterial reduction has been reached with 39 %, 70% and 86% efficiency in depend of the sodium lactate amount. The results of this work suggest that ratio of substrate quantity and sulphate concentration is one of the key parameter of sulphate reducing condition.

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IMPROVEMENT OF SORPTION CAPACITY AND APPLICABILITY OF BIOSORBENT BY IMMOBILIZATION

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ABSTRACT

The water contamination by toxic metal ions is a worldwide environmental problem. High concentrations are hazardous for all living organisms, causing many disorders and diseases and ecological damages to the surroundings. Biosorption is an innovative technology that employs inactive and dead biomass (bacteria, fungi, algae, biowaste) for the recovery of metals from aqueous solutions. Sulphate-reducing bacteria utilization is one of the options how to prepare applicable sorbent which removes metal ions from water. This material is created as a consequence of bacteria metabolism in anaerobic environment. The use of freely suspended biomass is often impractical and has some disadvantages. In contrast to this, application of immobilized biomass shows more benefits including increased mechanical strength, resistance to chemical environment, easy separation of cells and effluents, high biomass performance and repeated use in many adsorption/desorption cycles. Cell entrapment is the most widely used method for immobilization. In this technique, the cells are enclosed in a polymeric matrix which is porous enough to allow diffusion of substrate to the cells. The aim of this work was to examine and compare the sorption ability of biogenic iron sulphides created by sulphate-reducing bacteria in “free” and “entrapped” form. Precipitates were synthesized in reagent bottles with bacteria culture and growth media Postgate C, at 30 °C during 60 days, subsequently dried and analysed. Prepared samples were immobilized in sodium alginate. Sorption of cadmium from model solutions was realized in 100 ml Erlenmeyer flasks, with sorbent dose 1 g/l, during 24 hours. During experiments, the samples showed a satisfying stability and maximum adsorption capacity achieved 38 mg/g. The results refer to good sorption properties of immobilized samples and their potential for further practical use.

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**ALTERNATIVE APPROACH TO SELECTED METALS REMOVAL/RECOVERY FROM MINE WATERS
FLOWING FROM THE FLOODED SIDERITE MINE, NIŽNÁ SLANÁ**

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ABSTRACT

The objective of this work was the application of innovative method for metals recovery from metalliferous mine water released from the flooded siderite ore deposit Nižná Slaná. Although the metals contained in mine drainage are considered environmental pollutants, they may also be recognised as valuable resources. Conventional chemical precipitation processes using alkaline reagents produce huge amounts of mixed sludge with storage and management requirement, without possibility of subsequent processing of separate metals. This study comprehensively investigated the selective recovery of Fe and Mn from real mine water. After oxidation and partial precipitation of iron using hydrogen peroxide, precipitation by sodium hydroxide was applied to the residue iron removal from mine water. In the next step potassium permanganate was used to eliminate manganese by oxidative precipitation. ORP and pH of processed mine water was recorded in the course of oxidation/precipitation processes. The morphology and elemental composition of obtained products were studied by scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX). The recovery efficiencies of Fe and Mn from mine water reached 98.4 % and 96.7 %, respectively. Target metals were removed with high selectivity to levels that meet water quality criteria for safe discharge to the environment.

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HYDRODYNAMICAL PROCESSES IN A CUTOFF MEANDER OF THE DANUBE DELTA

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ABSTRACT

This paper documents the structure of flow and bed morphology of two cutoff meanders of the Danube River in relationship with a GIS approach. The Lower Dunavăț meander belt represent one of the most affected by the rectification works performed on St. George branch between 1984 and 1994. Based on the ADCP measurements the importance of the cut-off canals on the geomorphologic and sedimentary evolution of the Lower Dunavăț meander is demonstrated. After the artificial works, the water flow acceleration in the cut-off canal produced incision processes; consequently, through the meander natural course the water and sediment fluxes were reduced. The measurements performed in September 2020 showed that on Lower Dunavăț meander belt, the main water flow is captured by the artificial canal (99%, $1294 \text{ m}^3 \cdot \text{s}^{-1}$); the natural former meander transported approximately 0.8% ($11.5 \text{ m}^3 \cdot \text{s}^{-1}$) from the total upstream flow. The average speeds were situated between the values of $0.08 - 0.19 \text{ m} \cdot \text{s}^{-1}$ on the natural channel and between 0.64 and $0.66 \text{ m} \cdot \text{s}^{-1}$ on the artificial canal. The former meander is characterized by the decrease of the channel width by banks and bed sedimentation as calculated using GIS technics. The behaviour of the meander system is in relationship with a complex series of factors, such as the channel bed slope ratio, the sinuosity, the bottom sediments grain size, the water surface elevation at the bifurcation areas, the diversion angle that were discussed and analysed in this study.

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**GIS-BASED APPROACH TO ANALYSE THE RELATIONSHIP BETWEEN LAND UNITS AND LAND USE
IN THE CENTRAL REGION OF PORTUGAL**

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ABSTRACT

Land units refer to coherent spatial areas characterized by a degree of homogeneity concerning certain properties like geology, soils, and climate. The Land use mosaic corresponds to a circumstantial layer that represents the landscape's present state, depicting the present factors of resource allocation. Nevertheless, the stable potential layer is related to the stable characteristics of each site and allows the identification of use constraints or potentials. In this study, we use a methodology based on the land unit concept to define a stable potential layer at a regional level. Therefore, land units were delimited for the Central region of Portugal, resulting from the combination of geomorphology, soil parent material, and bioclimatic influence. For each land unit representative sample areas were characterized in terms of their land use mosaic characteristics. For that purpose, selected landscape metrics were used to quantify the land use mosaic geometrical attributes: Shannon's Diversity Index, Edge Density, Mean Patch Size, and Number of Patches. The existing land use types were also quantified. Finally, a cluster analysis was performed to define groups of samples representing the land units that have similar land use mosaic types. The landscape metrics that best explain the influence of the permanent structure of the territory on the circumstantial structure of use are Shannon's Diversity Index, Edge Density, and Number of Patches. The highest diversity land cover patterns are located in formations with a lithology rich to very rich in silica under Mesomediterranean dry to subhumid climate. The validation of the previously defined land units confirmed the reliability of the proposed methodology, with most of the land units strongly influencing the land use mosaic. The delimitation and characterization of homogeneous land units are useful for the definition of soil suitability and for the choice of the most appropriate uses and activities by the stakeholders.

This work is supported with Portuguese national funds by FCT - Foundation for Science and Technology, I.P., within the GEOBIOTEC - Project UIDB/04035/2020.

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**RELATIONSHIP BETWEEN LANDSCAPE PATTERN AND HUMAN DISTURBANCE FROM 1990 TO 2018
IN PORTUGAL**

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ABSTRACT

The land use and land cover pattern of landscapes are key elements of basic landscape structure; accordingly, this pattern has an important role in landscape management, nature conservation and preservation. In the other hand, the human impact on the ecological environment has attracted a significant amount of attention. The study aimed to investigate the relationship between human disturbance intensity and landscape pattern configuration and diversity. The objectives are: (1) to analyse the temporal and spatial characteristics of landscape pattern and human disturbance in the process of land use change in Portugal between 1990 and 2018, and (2) to explore the relationship between the landscape pattern metrics and the human disturbance under different disturbance intensities, in order to reveal how landscape-pattern-change tendencies can be used as indicators to estimate the anthropic changes in the landscape. The hemeroby index (HI) was calculated to express the impacts on ecosystems associated with human-induced disturbance. According to the change in hemeroby index value verified between 1990 and 2018, the naturalness degree increased in 58% of the territory, mainly in the south and east of Portugal. Landscape configuration was quantified through a set of land use metrics, such as Mean Patch Size (MPS), Mean Shape Index (MSI), Total Edge (TE), Mean Patch Fractal Dimension (MPFD) and Mean Perimeter-Area Ratio (MPAR). The Spearman's correlations were determined to reveal the statistical connections between the landscape metric parameters and the HI values. At a landscape level the metrics TE and MSI have a strong negative correlation with HI. That suggests that complex landscapes are good indicators of low levels of hemeroby. At a class level TE and MPS showed significant correlation with the hemeroby index, for artificial areas, agricultural areas, forest and seminatural areas.

This work is supported with Portuguese national funds by FCT - Foundation for Science and Technology, I.P., within the GEOBIOTEC - Project UIDB/04035/2020.

HYDROGEOCHEMICAL ASSESSMENT OF WATER QUALITY IN THE TYRRHENIAN COAST OF THE CALABRIA REGION (ITALY)

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ABSTRACT

Groundwater accounts for 99% of liquid freshwater on Earth and provides nearly half of the world's population with drinking water and contributes to about half of the global food production. In the context of growing water scarcity across many parts of the world, the vast potential of groundwater and the need to manage it carefully can no longer be overlooked. Therefore, in order to improve groundwater governance and protect this vital resource, an increasing of its understanding is necessary. In this study, 160 spring water samples were collected in the upper, middle and low Calabrian Tyrrhenian Coast and analysed for physical and chemical parameters. The Calabrian Tyrrhenian Coast presents distinctive geological, hydrogeological and orographic features and is characterized by a tight and long shape occurring between the Tyrrhenian Sea to the west and the Coastal chain to the east. The hydrogeochemical facies of the sampled waters were evaluated by means of the Langelier-Ludwig diagram and for the total mineral content, aggressive index, hardness. The results indicated that in the upper Calabrian Tyrrhenian Coast the analysed waters can be classified as "fairly hard" and "very hard" especially those located at the lowest altitudes; for the fixed residue, they can be classified as "low mineral waters" and presented a high electrical conductivity. In the middle Calabrian Tyrrhenian Coast, there was a variability in the analysed waters due to mineralogic composition: they varied from "very light" in correspondence of acidic rocks and gneiss to "hard" in correspondence of marbles. They presented a fixed residue classifiable from "minimally mineralized" to "low mineral waters". Their mean electrical conductivity was low than the waters of the upper section of Calabrian Tyrrhenian Coast. In the lower Calabrian Tyrrhenian Coast, there was a strong hardness variability in the analysed waters with a major presence of "fairly hard" waters, "very light" and "light" waters at the highest altitudes in correspondence of acidic intrusive rocks; the mineral contents followed the hardness. The mean conductivity was similar to that of the middle Calabrian Tyrrhenian Coast. The variability of water parameters was affected by both parent material and human activities. The physical and chemical parameter values can be explained by the occurrence in the study area of the igneo-metamorphic rocks. The anthropogenic contribution was due to withdrawals, which subtract great water volumes and to contamination, which reduces or limits the water use.

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BUILDING MATERIAL RECOGNITION USING IMAGE ANALYSIS AND CLUSTERING TECHNIQUES: A FIRST APPROACH

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ABSTRACT

Building material recognition is an important task in various fields such as construction, urban planning, and archaeology. It is a process of classifying different building materials based on their visual appearance. A common approach to building material recognition is the applying of Image Analysis. In this method, an image of a building, or a portion of it, is captured and processed to extract features that can be used to classify all the identified building materials. The process starts with the acquisition of RGB (Red, Green and Blue channels) images, which provide a rich representation of the visual characteristics of each building material. Once the RGB images are acquired, the next step is to extract features that can be used to distinguish among different building materials. This can be done by applying various image processing techniques such as color histograms, texture analysis, or edge detection. These techniques help to identify the unique characteristics of each building material, such as its color, texture, and shape. Once the features are extracted, they can be used to cluster the building materials into different groups. This can be done using various clustering algorithms such as k-means, hierarchical clustering, and density-based clustering. The choice of algorithm depends on the nature of the data and the specific requirements of the application. For example, k-means is often used for large datasets with well-defined clusters, while hierarchical clustering is well suited for datasets with hierarchical structures. Once the clustering is complete, the building materials can be classified into different categories based on their features. This process is known as matter classification, and it is an important step in building material recognition. There are various classifiers that can be used for material classification, including decision trees, support vector machines (SVM), and neural networks. The choice of classifier depends on the nature of the data and the specific requirements of the application. In conclusion, image analysis is a powerful tool for building material recognition. By using techniques such as feature extraction and clustering, it is possible to identify the unique characteristics of different building materials and classify them into different categories. This information can then be used for a variety of applications, including construction, urban planning, and archaeology. The use of RGB images provides a rich representation of the visual characteristics of the building materials, making it easier to extract features and classify the materials accurately.

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**TYPOMORPHIC FEATURES OF NATIVE GOLD FROM PLACERS OF THE NORTH-EASTERN PART OF
EVOTA ORE REGION (RUSSIA, ALDAN SHIELD)**

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ABSTRACT

The Evota ore region is located in the south of the Republic of Sakha (Yakutia) within the Nimnyr terrane of the Aldan Shield. Despite the long history of studying of geology of the region, the primary sources for many gold-bearing placers have not been defined. In this work, based on the study of the mineralogical and geochemical features of gold from placer deposits, possible genetic types of primary sources are predicted. Native gold in the placers of the North-Eastern part of the Evota ore region is represented by particles with different roundness and fineness varying in a wide range - from low-grade to very high-grade. The most common grains are flattened, lamellar, elongated with a good roundness. However, in some placers, gold pieces with an average and poor roundness were found. Such gold grains are characterized by irregular, isometric shapes with torn, sharp edges, burrs, notches, a shagreen surface, and the presence of micro inclusions. According to the data of microprobe analysis, admixture elements are Cu and Hg, Pd, Ni, Hg - traces. For defining possible sources of placer native gold, the literature data of predecessors are presented, as well as the results of the study by the authors of precious metal mineralization from alkaline rocks of the Mesozoic age (Medvedev syenite massif) and highly productive metabasites of the gold-ore deposit P.Pinigin. In metasomatically altered rocks of Medvedev massif, gold occurs in quartz and goethite together with epidote and galena. In altered syenites, gold particles are found in interstice of feldspars and limonite. In addition to native gold microsegregations of cerussite, lillianite, antimonite, barite, hollandite, monazite etc. were found in syenites along with galena, apatite and quartz. Gold particles in the studied rocks have sizes from 2 to 30 μm . The fineness according to microprobe analysis varies from low to medium grade (746-865‰). Suggested that the sources for native gold of medium and low fineness in placers of the Evota ore region could be mineralization associated with syenite alkaline magmatism, which are widespread within the Central Aldan ore region. For the very high-grade placer gold the genetic link with ore occurrences studied in the P.Pinigin gold-ore deposit suggested.

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INFLUENCES OF DIFFERENT MEI-YU FRONTAL ORIENTATION AND MOVING SPEED ON RAINFALL OVER NORTHERN TAIWAN: IDEALIZED SIMULATIONS

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ABSTRACT

The May–June rainy season is an important water source in Taiwan. During this period, continuous rainfall occurs due to the influence of fronts, and there are often cases of heavy rain. The amount and distribution of rainfall produced by different Meiyu fronts are affected by many complex factors, including water vapor content, southwest airflow, frontal and topographic effects, and mesoscale disturbances. It is difficult to compare and clarify the role of a single factor in different rainfall cases. Therefore, this study uses idealized simulation to simplify the complex frontal system and explore the influence of two major factors—orientations and moving speeds of the mei-yu front—over realistic Taiwan terrain. We examine eight different orientation angles and three moving speeds, with the front assuming a straight line at the initial time. The eight orientations are every 10° from –20° to +50° (measured counterclockwise from E-W), and the three speeds are fast (20 km h⁻¹), medium (15 km h⁻¹), and slow (10 km h⁻¹). The vertical structure ahead of and behind the front is each horizontally uniform and is obtained by averaging observed conditions from the gridded analyses during the super heavy-rainfall event of 11–12 June 2012. The northerly wind behind the front is assumed to be at 45° from the front, whose slope is also prescribed based on observation. Using the geostrophic wind relationship, the three-dimensional southwesterly pre-frontal flow and the northerly post-frontal flow fields are constructed and combined according to the specified mei-yu front. Then, the combined field is fed into the Cloud-Resolving Storm Simulator (CReSS) to simulate the evolution of the front and the rainfall in Taiwan for each of the 24 scenarios (8 orientations × 3 speeds = 24 runs). For each scenario, the rainfall in northern Taiwan is examined, and its accumulated rainfall, rainfall intensity, and rainfall duration are analyzed. For the same moving speed of the front, the closer the orientation is to 20°–30° (ENE–WSW), the higher the rainfall intensity; the closer to –20° (WNW–ESE), the longer the duration. For the same orientation, the faster the front moves, the higher the rainfall intensity but the shorter the duration. The simulations that produce more rainfall in northern Taiwan are associated with one of the two following scenarios: long duration (more consistent with the reference case of 11–12 June 2012) or high intensity. Also, faster-moving fronts are more capable of producing frontal uplifting and are associated with a stronger upward motion, so slow fronts do not always produce much rain in such an idealized setting. When the orientation is close to 20°–30° (ENE–WSW), the front produces stronger upward movement as well as low-level convergence, presumably due to stronger confluence between the front and Taiwan's topography.

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INFORMATION MODELLING OF HISTORICAL BUILDINGS OF SELECTED CULTURE HERITAGE OBJECTS IN MORAVIA REGION

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ABSTRACT

Due to current legislation, a local public body is obliged to preserve as-built documentation of its buildings. A form of as-built documentation has been currently transforming according to building information modelling methodology. As-built documentation of listed buildings is an important step in preserving cultural heritage and allows preserving as much information as possible about immovable cultural monuments for future generations. Currently, building information models (BIM) of the real estate cultural heritage objects are being produced due to digitizing and conserving entire buildings with all the construction details with respect to culture heritage needs. Land surveyors are responsible for data acquisition at the building site to deliver geometrically accurate and precise 3D spatial data for the following modelling process as well as georeferencing data to appropriate datum and reference coordinate system. The 3D spatial data is primarily represented by a point cloud acquired by laser scanning technology. Historic buildings typically contain unique construction elements of very different and often more complex geometric shapes, such as arches, columns, statues, attics, etc. Such elements need to be individually modelled from the point cloud with respect to the precision of the model. The modelling process of existing historic building elements becomes far more demanding than the design of the future building. Building elements for new buildings are available in the construction products BIM database for information modelling. On the other hand, a certain degree of generalisation must always be considered when modelling historical buildings. The building elements are more of an aesthetic nature. Hence, the modelling process needs to cover the geometrical shape of the element, construction assembly as well as material definition. The resulting model of the element is geometrically and visually affected by a generalization of spatial information. Nowadays, game development environment tools are increasingly used outside the video game industry, especially in architecture/construction/engineering, automotive, virtual production, etc. Thus, the information model can be delivered to a broader audience of stakeholders without vendor-locked software restrictions. Simultaneously, culture heritage value can be provided to the public in an immersive way. This paper discusses in which cases generalization in the sense of the level of information needed (LOIN) is involved and when it is already a geometric error of modelling regarding the needs of the public body and specification of public procurement. In this paper, the matters mentioned above are described using several case studies of the creation of an information model of listed buildings, namely the Maximilian Court in Kroměříž and the Rectory in Cetkovice.

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MINERO-PETROGRAPHIC FEATURES AND PHYSICO-MECHANICAL PROPERTIES OF THE MACIGNO SANDSTONE IN THE VELLANO AREA (PISTOIA, TUSCANY, ITALY)

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ABSTRACT

The sandstones belonging to the Late Oligocene-Early Miocene terrigenous deposits of the Macigno Formation are the most used building stones in the North-western Tuscany area. From ancient times until today, the Macigno sandstone has been widely employed to realize a wide variety of stone objects, from the prehistoric statue-stele to the medieval buildings, to the architectural decorations and sculptures, until to the modern paving material of historic city pavements. The typical appearance of most buildings in Tuscany town and village is due to the use of Macigno sandstone, which has a grey to grey-yellowish colours. The chromatic alteration of the original grey colour, due to oxidation phenomena, in these sandstones favours the use as face-to-face stone for its warm colours. This research documents the petrographic and mineralogical analyses, and physical and mechanical test conducted to estimate the technical properties of the Macigno sandstone from the Vellano quarry, with the purpose of comparing the quality of the stones extracted in this area with those from the other quarries in North-western Tuscany. Mineral composition, grain size and chemical composition, water absorption, porosity, flexural and uniaxial compressive strength of the rock have been determined. The obtained results show that examined samples are characterized by fine to medium sand-sized grains made up of quartz, K-feldspar, plagioclases, phyllosilicates, lithic fragments, and accessory. Clayey matrix and calcite cement are also present. The clayey fraction is characterised by the presence of mica-like minerals, chlorite, chlorite/smectite interlayers and, in some samples, corrensite and kaolinite. From the physical and mechanical point of view the analysed samples show porosity less than 3% by volume, flexural and compressive strengths more than 10 MPa and 100 MPa, respectively. Regarding the other Macigno sandstones currently quarried in Tuscany, the Vellano stone shows rather comparable mechanical resistance than those of Greve in Chianti and somewhat lower than those of Matraia.

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**MINERALOGICAL COMPOSITION OF GRANITOIDS FROM THE IGOUDRANE REGION JBEL SAGHRO,
EASTERN ANTI ATLAS, MOROCCO**

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ABSTRACT

This research aims to evaluate the mineralogical composition of Precambrian granitoids found in the Igoudrane area of the Moroccan Anti Atlas, which are Ediacaran plutonic magmatic rocks composed primarily of quartz, plagioclases, and alkali feldspars. Macroscopic description and thin-section petrographic analyses indicate the predominance of granodiorites, granites, diorites, syenites and monzonites. Petrographic analysis of these rocks reveals that the dominant granodiorite may be further considered as a granodiorite with amphibole, distinguished by its important content of amphibole, the presence of biotite and plagioclase that has been profoundly changed into sericite. There are additional traces of quartz, potassium feldspar, and chlorite. Zircon and apatite are the most important accessory minerals. Quartz, alkali feldspars, plagioclases, altered biotite are the major components of granites, while the diorites ones are primarily composed of altered pyroxene, altered amphibole, quartz, alkali feldspars, biotite, and muscovite at the depth of the research area. The syenites are characterized by similar composition to that of granites, but they have low amount of quartz, altered alkali feldspar (orthose), microcline, chloritized biotite, and altered amphiboles. The monzonites are composed of approximately equal amounts of alkali feldspars and plagioclases, pyroxene, biotite, chlorite, with minor amounts of quartz. The granitoids of the study area have undergone a lot of alteration, either superficial or hydrothermal, in particular argillization (alteration of plagioclases), which is more common in the Igoudrane area, disappearance of pre-existing minerals, silicification of fractured zones (secondary quartz) and chloritization produced by the decomposition of ferromagnesian minerals (alteration of minerals such as pyroxenes, amphiboles and biotites). Regarding to hydrothermal alteration, it is noted that the nature of the mineral associations is influenced by the following fundamental factors: the lithological nature of the host rocks, the permeability of the rocks, the pressure and temperature conditions of the system and the fluid composition.

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QUANTIFICATION OF SOIL LOSSES AND ESTIMATION OF THE SPECIFIC DEGRADATION RATE AT A MOUNTANOUS WATERSHED IN THE CONTEXT OF CLIMATE CHANGE USING RUSLE MODEL: CASE STUDY OF THE LALLA TAKERKOUST DAM ON WADI N'FIS

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ABSTRACT

Water erosion is a complex phenomenon, widely spread in North Africa, especially in the mountainous chain of High Atlas of Marrakech, where the factors influencing this scourge express well the fragility of the environment, which is gradually metamorphosing towards the worst. The region is characterized by very uneven relief, a lithological structure generally diversified, rainfall most often stormy at the time when the arable land undergoes a strong anthropic pressure. The present study deals with the phenomenon of water erosion and its impact on the hydraulic construction works at N'fis watershed. It thus aims at estimating the transport of sediments accumulated at the Lalla Takerkoust dam. Precipitations are the main agents of the erosion phenomenon, their energetic capacity to detach and transport soil particles, often named erosivity, participates in the degradation of the land and load the runoff water in the watersheds with solids. This process is of great magnitude when it takes place on friable and loose soils. The characteristics of the eroded soil play a major role in its resistance to erosion. This erodibility, in the face of the energy of rain drops and run-off water can have a reduced or amplified impact depending on the topographic conditions and the vegetation cover. The solid load transmitted to the watercourses is often deposited in the reservoirs of the dams causing the phenomenon of siltation. Moreover, this consequence affects both the dam's water supply for several uses, and worsens the drinking water treatment process. In order to determine the annual impacts of erosion, and to propose recommendations to intervene and remedy the situation, the modeling of the phenomenon, through digital tools like GIS and Remote Sensing, is essential. The use of the RUSLE model allows to estimate the tonnage of annual soil losses, and then to determine and classify areas vulnerable to erosion. Finally, two methods are used to study the evolution of the siltation rate at the dam. The results can be used to make decisions and approaches to reduce the negative impacts of erosion and protect the dams locally at the basin studied, and also generally at dams in similar watersheds.

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IMPACT OF ANTHROPOPRESSURE ON THE MINERAL AND CHEMICAL COMPOSITION OF FOREST BIOMASS ASH BURNED UNDER LOW- AND HIGH-TEMPERATURE CONDITIONS

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ABSTRACT

A global trend is being observed to switch from fossil fuels towards green energy, and biomass is one of the most promising energy sources in the world. One of the directions it is being pursued is bioenergy from wood. Depending on the combustion temperature of the raw material, ashes are produced, which have a diverse mineral and chemical composition that are often deposited in municipal landfills. However, potentially toxic elements with high mobility in the biomass ashes are present, so they can migrate into the soil-water environment and subsequently into the biotic habitat. Depending on the conditions of biomass formation and therefore environmental factors, variability of these elements is observed, hence the study makes the comparison of both fresh forest biomass and biomass ashes, formed under low and high temperature conditions, determining their chemical and mineral composition. It was determined by elemental analysis, ICP-MS and XRD for ashes originating from low combustion - 450 °C - the temperature achieved in domestic boilers and 850°C - obtained for fluidised bed boilers. The properties of the biomass fuel material, i.e. chemical composition, calorific value, moisture content, volatile matter content and ash content, have a significant influence on the assessment of ash quality. By determining the chemical and mineral composition of ash from biomass combustion, it is possible to provide an initial indication of management directions, especially with regard to low-temperature ash, particularly as bottom ash has not been as well studied as fly ash. Ashes from low- and high-temperature combustion differ in chemical and mineral composition - the low-temperature ashes are alkaline, while the high-temperature combustion ashes contain mainly silicon oxides. Potentially toxic elements, i.e. Cu, Pb, Zn, Ni, Mn, Ba, Cd pass into the volatile form at temperatures equivalent to those for combustion in individual domestic boilers; the same is true for Pb, Zn, Mn, Cd at 850°C. Higher concentrations of Cd (2.34 mg/kg) were determined in low-temperature ashes from birch wood from industrialized areas compared to high-temperature ashes and ashes from the area of the Polish National Park Bory Tucholskie, which limits their agricultural use. A relative RE enrichment factor was further determined for biomass ash derived from urbanised environments and from non-industrialised areas (Polish State Forests), in order to assess the conversion of selected potentially toxic elements to the volatile form.



World 8th

28 August-01 September, 2023– Prague (Czech Republic)

Multidisciplinary Earth Sciences Symposium

COLLECTING SPATIAL DATA WITH UNMANNED AERIAL VEHICLE

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ABSTRACT

The paper briefly discusses the nature and advantages of unmanned aerial vehicle (UAV) as a spatial data acquisition method. This method and its possibilities are subject of scientific research in the area of geodesy, cadaster, architecture, construction of infrastructure objects and facilities, agricultural activities, cultural and historical heritage and even more over the last decades. This publication discusses in short, the principles and possibilities for creating a three-dimensional data model using the advantages of unmanned aerial vehicle. The building of University of Architecture, civil engineering and geodesy, situated in Semkovo resort, Blagoevgrad district is selected for the purpose of the task. Classical land surveying measurements with a total station and the data collected with an unmanned aerial vehicle are used for the creation of the three-dimensional models. A comparison and evaluation of the obtained models is made. The result of this evaluation indicates that the technology of unmanned aerial vehicle is efficient for representation of high-quality data with a wide scope of advantages such as high range, fast data collecting and processing.

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**COVER MANAGEMENT SOIL EROSION FACTOR USING MULTISPECTRAL VEGETATION INDICES:
AN EXAPMLE OF THE RIVER SARAYARDERE WATERSHED (EASTERN RHODOPE, BULGARIA)**

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Land cover/land use is one of the main factors influencing the development of soil erosion. It has been included in the calculation and modelling of erosion and sediment transport in many studies. In the current research NDVI (normalized difference vegetation index) and NDRE (normalized difference red edge index) are used for quantifying the cover management factor (C-factor). They are calculated on the base of Sentinel 2 multispectral images. Taking into account the vegetation phenology two time points were analyzed: end of May - June – active vegetation and September (beginning of October) – late vegetation. The changes in the values of the indices were considered for 2018, 2021 and 2022. The study area is the watershed of the river Sarayardere, located in the southern part of Bulgaria. This is a hilly to low-mountain area, prone to erosion due to rare vegetation, high slope gradients and a relatively long dry period followed by intensive rainfall. The calculated values of the C-factor are indicators for higher susceptibility to erosion in September than it is in June. The spatial distribution of the C-factor shows different patterns. The results, received on the base of the image of September 2021, show increasing the areas with C-factor < 0.1 and these ones > 0.5, in comparison with the results of September 2018. C-factor values calculated on the image of October 2022 indicate the highest susceptibility to erosion. Using NDRE instead NDVI results in slightly higher values of the C-factor. The advantage of the NDRE index is that it provides information on the content of chlorophyll in the vegetation during the end of the vegetation period and allows a more accurate assessment of the state of the separate plants, regarding the determination of diseased or damaged plants. In addition to the vegetation indices, an expert evaluation of the state of vegetation was done. The results of the current study show that the watershed of the river Sarayardere is in a relatively good condition regarding the development of erosion processes. The attention should be directed to the possible increase of erosion on deforested slopes and the availability of loose materials, in case of intense rainfall.

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NONLINEAR SYSTEM IDENTIFICATION FOR DATA-DRIVEN MODELLING AND FORECASTING IN EARTH SCIENCES

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ABSTRACT

A massive amount of data is available in almost every single research field of earth sciences. Data are usually important and useful for analysing and understanding associated systems or processes. Many systems of interest are inherently dynamic, that is, their state continuously changes in one regular and consistent way or another. For such systems, dynamic models are needed for understanding, characterizing and representing their present behaviours and making predictions or forecasts of their future behaviours. Dynamic models can be obtained through first principal approaches, but when systems of interest become more complex and only scarce or little a priori knowledge about the systems are available, first principle modeling would become intractable or impossible. Hence, gradually, data based empirical approaches becomes increasingly important. Data modelling tasks in earth sciences usually involve two primary aims or purposes: 1) Explanation or interpretation, and 2) Prediction or forecasting. Specifically, the former is concerned with revealing and understanding how the system output (also known as response or dependent variable) is related to or depends on system inputs (a number of explanatory variables also known as independent variables), how the input variables affect the system behaviours individually and interactively. The latter aims at making predictions or forecasts as good as possible. While some data-driven modelling methods (e.g. machine learning and complex neural networks) can produce good prediction or forecasting results for many applications, they usually lack interpretability and explainability. It is known that explicitly knowing the dependent relationship between the system output and input variables is very important. Motivated by the aforementioned consideration, this work introduces an interpretable machine learning approach, built upon the Nonlinear Autoregressive Moving Average with eXogenous inputs (NARMAX) model. The model is applied to real datasets (e.g., seasonal weather and space weather data). In comparison with other state-of-the-art machine learning methods, the proposed NARMAX model can not only generate competitive forecasting results, but more importantly, also fully transparent and physically interpretable, clearly and explicitly indicating which input variables significantly affect the system outputs (i.e., target response variables).

PREDICTING THE ATLANTIC MERIDIONAL OVERTURNING CIRCULATION USING NONLINEAR SYSTEM IDENTIFICATION METHODS AND THE NARMAX MODEL

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ABSTRACT

The Atlantic Meridional Overturning Circulation (AMOC) plays an important role in the coupled ocean-climate system and in global climate change. The analysis of its own behaviour and the understanding its links to other climate dynamics is of paramount importance today as we encounter an increasing pressure to adapt to climate change. Due to the enormous complexity, it is almost impossible to establish accurate models, purely based on first-principle modelling approaches, that can perfectly represent the relationships between the AMOC and other dynamic climate parameters. Data-based or data-driven modelling methods, can therefore provide an attractive alternative solution. Systematic regular and continuous measurement of the AMOC time series began in April 2004. The main objective of the paper is to use the monthly data of the AMOC measured during April 2004-February 2017, together with the North Atlantic Oscillation (NAO) index, and density anomalies of the Gulf of Mexico, Labrador Sea and Norwegian Sea, measured during the same period, to investigate and understand the quantitative relationship between the AMOC and four drivers (NAO and the three density anomaly variables). In doing so, nonlinear system identification methods and the Nonlinear AutoRegressive Moving Average with Exogenous input (NARMAX) method are employed to develop a quantitative model that relates the AMOC to the four drivers. Experimental results show that the derived nonlinear model skillfully captures and represents the dynamics of the AMOC based on the other four variables. One of the findings from this study is that the use of autoregressive variables can help improve the prediction of the AMOC.

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**EARTHQUAKE WARNING IN THE SUBDUCTION ZONE BY DETECTION OF GROUNDWATER RADON
VOLATILIZATION IN A NATURAL STRAIN METER: DILATANCY-DIFFUSION MODEL REVISITED**

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ABSTRACT

The hypothesis of dilatancy-diffusion model has been debated for a long time since the 1970s. The dilatancy-diffusion model hypothesizes the presence of gas bubbles in cracked rock and predicts low anomalous velocities of compression waves precursory to an earthquake. An obvious way of testing the validity of dilatancy-diffusion model is to provide field evidence regarding the presence of gas bubbles in cracked rock precursory to an earthquake. A suitable geological site cited here is Taiwan's Antung andesite spring. Through well pumping tests and radon concentration measurements in a small fractured aquifer at Antung, field data support the reality of dilatancy-diffusion model. A small fractured aquifer under undrained conditions is an effective strain meter for earthquake warning, where groundwater radon is a natural tracer to detect strain changes in the crust associated with earthquake occurrences. Between 2003 and 2018, anomalous declines in groundwater radon concentration were recurrently recorded at Antung precursory to five main $M_w > 5$ earthquakes occurring on the Longitudinal Valley Fault. With the help of a case study at Antung, we discover the mechanism of in-situ radon volatilization and outline the geological requisites to site a radon monitoring well for earthquake warning. All main thrust-type $M_w > 5$ earthquakes occurring on the Longitudinal Valley Fault in southeastern Taiwan can be warned through precursory anomalous declines in groundwater radon consistently measured at Antung. Our findings have significant merit on a local basis and most importantly, can perhaps be applied globally in the subduction zone with similar tectonic settings and physical-chemical relationships.

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World 8th

28 August-01 September, 2023– Prague (Czech Republic)

Multidisciplinary Earth Sciences Symposium

**AGRICULTURAL TERRITORY PLANNING IN BULGARIA - CURRENT FUNCTIONALITY OF
LEGISLATION AND PERSPECTIVES**

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ABSTRACT

Agricultural territory planning is problematic in Bulgaria because of some deficiencies in the existing legislation. The latter contains certain gaps in the regulations and the technical provision of the planning activities. The planning rules for the other types of territory such as the Urban, the Forest and the Protected ones, are well developed in detail. The purpose of the article is, first of all, to justify the need of improving and detailing of the legal framework for planning of the agricultural territory and, secondly, to offer some expert approaches for improving and harmonizing the legislation in the field of registration of the agricultural properties by an Agricultural Land Development Plan, the Restated Property Map and the Cadastral Map. Presented and analysed are the current legal grounds for agricultural land use planning in Bulgaria. A lack of detailed regulation on the scope, content and operation of the above documents was found. It is also about the applicability of the newly created municipal cadastral maps when settling land relations such as the purchase and sale of land, inheritances, divisions and changing the primary purpose of the agricultural territory. The completeness of the cadastral map with information about the quality of the agricultural land is not yet regulated in the Cadastre and Property Registry Act. The document contains specific proposals for changes to the Spatial Planning Act and the Cadastre and Property Registry Act.

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World 8th

28 August-01 September, 2023– Prague (Czech Republic)

Multidisciplinary Earth Sciences Symposium

THERMOGRAPHY OF THE EXTENSIVE GREEN ROOF OF THE BRNO-KOMÍN KINDERGARTEN

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ABSTRACT

The article deals with the behavior of an extensive green roof in winter. The behavior of the green roof of the Kindergarten Brno – Komín is described in the case study. The condition of the roof was determined using thermovisual technology. An extensive green roof shows significant temperature differences in winter compared to roofs without vegetation. The vegetation layer on roofs partially acts as an insulating layer. From this structure, the ventilation shafts and sanitary equipment emerge thermally. As part of thermography, the influence of the revision segment on heat conduction was determined. The overall thermal technical condition was evaluated using a thermal camera.

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STABILIZATION OF SLOPES VULNERABLE TO LANDSLIDES THROUGH TUBULAR ANCHORS

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ABSTRACT

This paper presents an anchor of a new design, whose properties have been selected so as to retain the advantages of a tubular anchor over the other anchor types and at the same time, ensure its adaptation to specific conditions associated with slope stabilization. The proposed anchor consists of a steel tube filled with expanding cement mortar. The outer diameter of the tube is 2-3 mm less than the diameter of the borehole, a groove is cut on the outer surface of the tube. A metal rod is placed in the center of the tube at the outer end of which a support plate is installed and a tie wrench is fixed. The length of the metal rod is equal to the depth of the bore hole, while the length of the steel tube is at least half the length of the borehole. In the process of solidification and expansion of the solution, pressure is created on the walls of the bore hole (50-70 MPa). Under the influence of pressure, the pipe is opened around the groove and close contact is achieved between the pipe and the borehole surfaces. As soon as the solution hardens, the steel tube is firmly embedded in the concrete, after which the anchor reaches operational capacity. Preliminary tests of the proposed anchor showed that it has a high clamping force (for hard rock conditions - 46-75 kN/m and for soft rock conditions 32-36 kN/m). He has other advantages, namely it does not require special equipment for installation, the inside of a tube is filled with hard concrete-like mass, which hampers the process of corrosion and increases shear strength.

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**PETROGRAPHIC AND STRUCTURAL STUDY OF BANTADJÉ LOCALITY (NORTH-CAMEROON,
CENTRAL AFRICA): CONTRIBUTION OF REMOTE SENSING AND FIELD DATA**

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ABSTRACT

Until recently in developing country, conventional mapping was generally done by studying outcrops during field trip. Unfortunately, outcrops are not continued, lithology limits being obliterated by soils and vegetation; thematic maps are therefore obtained by extrapolation. The digital nature of remote sensing images covering a wide spectral range (visible and infrared) allows for better discrimination of different geological units. In an arid context, spatial remote sensing allows to highlight most of the major geological structures (lineaments, lithological contacts, faults) in order to obtain valuable structural indications. Lithological and structural potentiality of North Cameroon is limited due to the lack of appropriate large-scale maps. The realization of detailed geological map of Bantadjé and surroundings, based on remote sensing and field data, is our contribution to overcome such shortcoming. It have been successively carry out: (1) lithological mapping from colored compositions (CC), band ratios (RB), principal component analyzes (PCA) and minimum noise fractions (MNF); application of these treatments on ASTER image allows to identify nine lithological formations; (2) Linear mapping from directional filters (N-S, NE-SW, E-W and NW-SE); (3) petrographic study, based on field data, which permit to distinguish ten petrographic types (biotite granite, amphibole and biotite granite, biotite and muscovite granite, amphibolite, amphibole gneiss, amphibole and biotite, amphibole and garnet gneiss, quartzite, amphibole and biotite micaschist and chlorite schist); and (4) structural study based on outcrops observations and measurements which allow to decipher three (03) ductile deformational phases and one (01) deformational phase. The results of our study allow updating geological information in the studied area: lithological contours were made much more precise, new petrographic types were mapped (amphibole and garnet gneiss, quartzite, amphibole and biotite micaschist). Detailed lithostructural map of Bantadjé and surroundings have been made by combination of all these data.

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FABRICATION OF PROTECTIVE COMPOSITE STRUCTURES BY INFUSION TECHNOLOGY TO RESIST THE BLAST WAVE

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ABSTRACT

The paper presents the results of experiments on the use of infusion of polymer binders into a pre-constructed skeleton of reinforcing structures. Currently, three-layer structures with the middle layer of aluminum honeycombs are considered to be one of the effective structural elements that ensure the damping of the blast wave. As an alternative middle layer, can be offer elements of various shapes (cylinders, cubes, etc.) and geometry, made of modern composites that are well-proven under the impact of shock waves. As it is knows, those are metal-polymer composites, i.e. materials which contain, in addition to polymer binder and fabric filler, thin layers of metal. In order to form a solid structure that perceives an explosive load, an attempt was made to use Resin Film Infusion (RFI) technology to obtain individual elements with which connects two steel sheets. Aramid, glass fabrics and aluminum thin (0.5, 0.15, 0.05 mm) plates were used in the experiments. For the implementation of the infusion process, an epoxy resin was used, with suitable technological parameters for this process. The use of this resin leads to the minimization of non-nourished areas and pores. In this case, the uniform condition of the product obtained from the composite material is achieved. It should be added that RFI technology differs from other polymer processing technologies in the following significant advantages: the possibility of abandoning expensive equipment, reducing energy costs for equipment and its maintenance, and complete rejection of the use of prepregs. However, there are a number of difficulties that are associated with the technological process of infusion, which primarily include the rheological requirements of the binder: at room temperature, the resin should have a high viscosity, and in the practice of fillers, the viscosity should have rather low values. In the work are presented some preliminary plans for the development of this technology in order to obtain a product that provides attenuation of the blast wave.

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DISPERSION OF METHANE IN CLOSED ENCLOSURES

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ABSTRACT

The increase of the population also involves the increase of the consumption of raw materials. This requires the diversification and development of industrial processes in semi-enclosed or open spaces. The carrying out of human activities of an industrial nature involves the accidental use, handling or presence of explosive substances such as methane. The presence of this gas in closed or semi-closed spaces can generate explosion phenomena. The accumulation of methane in narrow spaces is well studied and known, but the dispersion and especially the dispersion dynamics of methane released from a source considered infinite is less known. Knowing how methane disperses into the air is very important for establishing preventive measures. The paper presents the experiment on the dynamics of methane dispersion in a closed enclosure. The presence of pollutants in industrial premises is a major risk that is given priority attention. If there is an unexpected release of methane gas in an enclosed space, then the risk of explosion is imminent (Abbasi, T., Abbasi SA, 2007; Alghamdi, SSS, 2011; Burgess, D., Zabetakis, MG, 1962). The explosion phenomenon can occur if the three elements overlap in time and space: gases, mists, dusts or combustible dusts, atmospheric oxygen and the efficient source of ignition. Methane gas, in addition to its explosive nature, is itself an asphyxiating gas that indoors can lead to a sharp decrease in oxygen concentration but in the case of the explosion phenomenon the dynamic effect is more important, an effect that also occurs in the case of production explosions in semi-closed and open spaces. The topic of gas dispersion has been studied extensively internationally (Egeberg, T., ea, 2012; Ivings, MJ, ea, 2016; Ikealumba, WC, Wu, H., 2016; Mishraa, KB, ea, 2015; Mokhatab, S., et al., 2006; Nolan, DP, 1996; Veyssilier, F., Pecoult, C., 2015; Vianello, C., Maschio, G., 2011). However, in particular, the dispersion dynamics of methane-type explosive gases in closed enclosures has been less studied but can be analyzed mathematically using fluid dynamics or by experiments (Cavaropol DV, 2008; Cormier, BR, 2008; Ghatauray, TS, ea, 2016; Quillatre, MP, 2014; Stawczyk, J., 2003; Touahar, B., 2013; Wu, Y., ea, 2007). The specificity of the methane dispersion dynamics in the closed enclosure is generated by the appearance of non-uniform concentrations with large variations both horizontally and vertically. The results of the detailed analysis can be used to determine the escape routes in the event of an unexpected release of methane into the closed industrial premises. The gradient of dispersion and progressive dilution of methane gas at the closed enclosure, G_d , showed a variable evolution being between 0.286 - 0.767 % Vol. / h. The methane gas discharged indoors showed a phenomenon of uneven accumulation at the ceiling level proved by the fact that gas concentrations were identified at the level of detection devices, between 0.4 - 1.15 % Vol. Compared to the value of the average concentration in relation to the total volume of the enclosure of 0.36 % Vol.

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THE EFFECT OF PLANT COVER AND GYPSUM PARENT MATERIAL ON THE SOIL ORGANIC MATTER STORAGE AND TRANSFORMATION

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ABSTRACT

Soils are an important source of terrestrial carbon, storing much more C than it is in the atmosphere and in the biomass. About 70% of the organic carbon is built up in the soil organic matter, whose properties under natural conditions can vary depending on environmental factors such as: parent material, soil properties, plant species and climate. By storing large amounts of terrestrial carbon (C), soils prevent it from being released into the atmosphere as carbon dioxide, the main greenhouse gas. Gypsum rock-derived soils are very rare for soil scientists as they are an unusual example of the formation of soil with small proportion of quartz-silicate components such as calcareous soil. Meanwhile, these soils occupy a small portion of worldwide soil coverage and present some characteristic such as low water and nutrient retention due to the minimal content of silicate clays. We examined soils derived from gypsum and limestone, assuming the former had a special ability to accumulate and stabilise soil organic matter (SOM) under temperate climatic conditions when compared to limestone-derived soil. We compared the benefit of gypsum or limestone as a parent material and the effect of vegetation cover on the quantity and quality of SOM. We hypothesised that differences in SOC content and properties between soils derived from gypsum and limestone would be affected by the density of plant species and the amount of gypsum content. Furthermore, the main overall aims of the present study were (i) to evaluate and compare the content of soil organic matter according the parent materials (ii) to determine through chemical composition of plants the amount of soluble and insoluble lignin (iii) to assess the composition of humic acids. We determined properties of the soil humus horizons, including texture, available potassium (K) and phosphorus (P), pH, amount of gypsum and calcite, enzyme activity, and vegetation cover (biomass, K, P, sodium, calcium (Ca), and amount of lignin in the plant upper parts, coarse roots and fine roots). The structure and composition of humic acids (HAs), as indicators of SOM quality, were also studied. We found that the SOM in the gypsum soils was more mature, and contained more aromatic HAs, than in the limestone soils. Also, the gypsum soils had higher enzyme activity and a greater mass of vegetation cover, the fine roots providing higher amounts of lignin than the limestone soils. The factors that shaped the soil properties were identified and the interaction between the parent material and the vegetation cover and its effect on SOM storage was determined, indicating the importance of fine-root composition (lignin, Ca, K) and enzyme activity on C accumulation. Gypsum as a parent material favoured SOM accumulation through its physical stabilization, by providing active Ca cations to protect the SOM together with silt and clay, and its biochemical stabilization, through high enzyme activity and the quantity and quality of the biomass. Our results show that gypsum soils are important as a response to global warming through their ability to preserve SOM over the long term.

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POTENTIALLY TOXIC ELEMENTS (As, Sb, Cd, Pb, Zn) IN SOILS POLLUTED BY HISTORICAL SMELTING AND MINING ACTIVITY IN THE UPPER SILESIAN AREA (SOUTHERN POLAND)

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ABSTRACT

This study aimed to determine the concentration and possibility of migration of heavy metals and metalloids in soils and slags in the Silesian-Cracow region. The pollution in the studied area by potentially toxic elements (PHEs) is determined by the natural influx (e.g., the chemical composition of the bedrock or artificial soil), modern and historical industry processes connected with Zn-Pb mining, hard coal exploitation and pollution by municipal and industrial sewage. The research area covers selected locations of Ruda Śląska, Świętochłowice, Bytom, and galmanic soils in the Olkusz region in southern Poland. The concentrations of metals (e.g., Ag, Ba, Cd, Cu, Fe, Mn, Pb, Zn) and metalloids (As, Sb) were determined in 33 soil samples (with a depth range of 0.0–0.3 m) and 12 slag samples. The tests included: the determination of the pH of selected soil samples, the concentrations of chemical elements by the ICP-ES and ICP-MS methods, and the analysis of the chemical composition of soils and slags using scanning electron microscopy and electron probe micro-analyses (EMPA). The analyses show the alkaline and acidic pH of the studied soils hinders the migration of heavy metals and their accumulation in plants. It can also indicate the quality of soils and suggests the possibility of their degradation, especially at low pH values. The determination of chemical elements reveals high concentrations at almost all locations. The following concentrations were found: Zn 34–168 229 ppm, Pb 9.4–100 000 ppm, As 7–10 000 ppm, Mn 164–10 461 ppm, Sb 1.2–4 000 ppm, copper 3.2–9 562.9 ppm, Cd 0.1–1 482.9 ppm, Ba 8–4 998 ppm, Fe 1.9–58.61%, Ag 0.2–191.6 ppm. These studies show an increased concentration of metals and metalloids exceeding the level of regional geochemical background. Geochemical anomalies of silver, arsenic, antimony, lead and zinc occur in the areas of historical and contemporary exploitation of metal ores near heaps and waste dumps. The research results indicate that the degree of chemical transformation of the soils in the analysed regions of Ruda Śląska, Bytom and Bukowno is advanced. Heavy metals are permanently incorporated into stable mineral structures like oxides/hydroxides, carbonates, silicates and arsenates. However, identifying submicroscopic grains of Fe, Zn and Pb sulphides in the studied soils, which may undergo further transformations under oxidizing conditions, indicates that even after 100 years, they may be geochemically active.

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INTENSITY OF CHEMICAL WEATHERING IN SELECTED MODERN RIVER SEDIMENTS (LUBLIN UPLAND AND SUDETEN MOUNTAINS – POLAND) REFLECTED BY WEATHERING INDICES

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ABSTRACT

Many factors influence the chemical composition of modern river sediments. These include lithology of river basins, climatic conditions, land morphology and vegetation cover. The bottom sediments of rivers are composed of both materials from the erosion and weathering of rocks present in catchments and material in situ. Weathering indicators help track component variability in longitudinal river profiles. To reflect the intensity of chemical weathering and to determine the subsequent degree of depletion of soils and river sediments in mobile components relative to immobile ones, the well-established indices were used in this work: Weathering Index of Parker (WIP) and Chemical Index of Alteration (CIA). The results obtained from two distant regions of Poland show differentiation, not only to each other but also within their areas. During the research, great attention was paid to the composition of the substrate as one of the main factors, apart from climate, affecting the intensity of weathering processes. Therefore, the Lublin Upland was selected, mainly covered by Quaternary loess and loess-like formations, as well as Cretaceous rocks, and the Sudeten Mountains composed mainly of igneous and metamorphic rocks. Weathering Index of Parker values range from ca. 480 to 2300 and ca. 3500 to 5000 for Lublin Upland and Sudeten Mountains, respectively. Values of Chemical Index of Alteration vary from ca. 30 to 65 for Lublin Upland samples, while those from Sudeten Mountains show variations between ca. 60 and 66. Moreover, river sediments samples were analyzed using a scanning electron microscope, which allows for the identification of minerals that are carriers of aluminium, calcium, potassium, magnesium and sodium. These elements are hosted in potassium feldspars, plagioclases, amphiboles and carbonates. Geochemical analyses made it possible to determine the degree of intensity of chemical weathering in two regions of Poland differing in climate, lithology and altitude. Further studies regarding the Rb/Sr and Sr/Cu ratios are in progress. Vogt's Residual Index (V), Chemical Index of Weathering (CIW) and Plagioclase Index of Alteration (PIA) will be also included.

This research was funded by the National Science Centre, Poland (project no. 2022/06/X/ST10/00716).

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LOCALISATION TASK IN SEWER NETWORKS

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ABSTRACT

Paper deals with the inverse / localisation task in sewer networks. An inverse problem is defined as the process of determining the causal factors from a set of observations. Applying this principle to the water management sector, it is often a matter of determining the location of the source of pollution based on monitored data on the concentration of pollution over time. From a mathematical point of view, to decrease the uncertainty of the inverse task solution, it is necessary to know the location of the source or the concentrations time course of the source (intensity function). In practice, we usually do not know any of these quantities, however, in the case of sewer networks we can accept some assumptions, which allow us to solve this inverse problem. Paper analyses specific conditions when applied in the environment of sewer networks and describes proposed method for solving the source localisation task in the sewer network environment. The solution is based on numerical modelling of the pollution spreading in sewer system, accepting some process simplifications as well as assuming some source parameters. Typically, the solution of inverse task requires large and time consuming numerical simulations. This can be disadvantageous after recording the pollution event - a long calculation time reduces the efficiency and operability for the following pollution source reconnaissance. Therefore, our proposed method performs the necessary simulations in advance and the pollution source localisation after recording the pollution event is very fast, using a simple search and comparison in the simulation results database. The proposed method was tested on real sewer system achieving promising results. In the discussion and conclusion chapters, there are necessary conditions, advantages and disadvantages of the proposed method analysed and discussed.

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TREATMENT FOR THE OLIVE POMACE EXTRACTION INDUSTRY OLIVE POMACE OIL EXTRACTION INDUSTRY BY APPLING PEROXY-ELECTROOXIDATION

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ABSTRACT

Portugal is the fourth largest producer in the European Union (EU), producing 2.29 million hectoliters of olive oil in the 2021/2022 season, generating a turnover of 483.14 million euros in 2019. Effluent from the olive pomace oil extraction industry is considered challenging for conventional wastewater treatment, requiring the implementation of advanced treatment techniques. The peroxy-electrooxidation (PEO) technique is an alternative that presents a great potential for the efficient removal of organic matter, especially phenolic compounds. The main objective of the present study was to evaluate the peroxy-electrocoagulation in the treatment of wastewater from the olive pomace oil extraction industry. In addition, the response surface methodology was used to optimize the efficiency of the PEO under different electrolysis times, current densities, hydrogen peroxide dosage (H_2O_2) and anode electrodes (aluminum and iron). In the PEO with graphite/aluminum (cathode/anode), the concentration of H_2O_2 has a direct impact on the efficiency of total phenolic compounds (TPh) removal, H_2O_2 15 g/L show a removal efficiency lower than 80%. Chemical oxygen demand (COD) removal is more dependent on the H_2O_2 and the reaction time. Test configuration with H_2O_2 30g/L, 17,5 mA/cm² and 15 min of reaction time was defined as the best operational configuration for PEO with graphite/aluminum. In the PEO with graphite/iron (cathode/anode), the results of the experiments indicated that the maximum removal of TPh occurred with a H_2O_2 30 g/L and 30 minutes reaction. Current density also had an impact on TPh removal, with the highest removals observed at current densities of 5 mA/cm² and 20 mA/cm². Regarding the removal of COD, the highest removals were achieved with high H_2O_2 concentrations, but reaction time was a positive factor, with better results obtained with 30 and 50 minutes. Test configuration with H_2O_2 30g/L, 5 mA/cm² and 30 min of reaction time was defined as the best operational configuration. The PEO technique is effective in removing or degrading phenolic compounds, especially when using graphite electrodes as cathode and aluminum as anode. The PEO is recommended as a pre-treatment for TPh removal but not for COD and other treatment processes should be evaluated.

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TREATMENT AND VALORISATION OF POMACE OLIVE OIL WASTEWATER

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ABSTRACT

The wastewater generated in the production of pomace olive oil is complex and with great variability associated with the different characteristics of cultivation and processing, has a high toxic organic load, low pH and high chemical and bio-logical demands. The pomace olive oil wastewater is complex and toxic to the environment, and although it has potential for recovery of phenolic compounds and energy recovery there are not enough publications working with this effluent, so the study of techniques for organic matter removal and phenolic compounds as pre-treatment shows the difference of this effluent with the olive-mill wastewater and contributes to the advancement of the treatment of this waste. Different treatment processes have been investigated to reduce the concentration of chemical oxygen demand (COD) and the total phenolic compounds (TPH). The treatments applied individually were: (i) coagulation/ flocculation, (ii) electrocoagulation, (iii) peroxy-electrocoagulation, (iv) electrochemical peroxidation, (v) Fenton, (vi) electro-Fenton, (vii) photo-Fenton, and (viii) adsorption. Treatments (i) and (ii) obtained the same maximum COD removal of 16% with 1.5 g/L of $Al_2(SO_4)_3$ and 0.042 g/L of Ambifloc 59001 for (i) and with Fe/Al sheets and current of 10 mA/cm² for (ii). The techniques with addition of H₂O₂ (iii, iv, v, vi and vii) presented on average 90% removal of TPH, but the COD removal efficiency was low, 26% on average. The operational conditions for maximum TPH removal for (iii) was 20 g/L of H₂O₂ and 20 mA/cm² with Al/Al sheets, for (iv) with 30 g/L of H₂O₂, 25 mA/cm² and Al/Graphite sheets, for (v) 30 g/L of H₂O₂ and 3.5 g/L Fe⁺², for (vi) 20 g/L of H₂O₂, 30 mA/cm² and Fe/Fe sheets and for (vii) 30 g/L of H₂O₂ and 3 g/L of Fe⁺². The maximum removal achieved through adsorption was 18% of COD and 45% of TPH with 60 g/L activated carbon. Although different techniques were tested for COD removal, no procedure was able to remove more than 50%. This shows how difficult the removal of organic matter in this effluent is, where even coagulation with $Al_2(SO_4)_3$, a usual technique for COD removal was not effective even at high dosage. To achieve 90% average removal of TPH with the addition of H₂O₂ was necessary a dosage of 20 to 30 g/L of the oxidant, and this point in common shows that the peroxide is the main factor in the removal of TPH in the effluent. The complexity of the effluent greatly influences the removal of COD while advanced oxidation techniques are efficient in the degradation of phenolic compounds, although the required dosage of oxidant is relatively high.

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TREATMENT OF POMACE OLIVE OIL WASTEWATER BY PEROXY-ELECTROCOAGULATION WITH ALUMINIUM SHEETS

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ABSTRACT

The wastewater generated in the production of olive pomace oil is complex, with a high toxic organic load, low pH, and high chemical and biological demands, making it impossible to apply biological treatments. To treat this effluent, different processes have been proposed, including direct watering, co-composting, physico-chemical methods, ultrafiltration/reverse osmosis, chemical and electrochemical treatments. Peroxy-electrocoagulation is a technique that involves the application of an electric current to wastewater in the presence of a peroxide compound, such as hydrogen peroxide. The electric current causes the formation of hydroxyl radicals, which can oxidize organic contaminants in the wastewater. The purpose of the work was to reduce the concentration of pollutants in the effluent through the use of peroxy-electrocoagulation with aluminum electrodes as a method of treatment. The peroxy-electrocoagulation trials were planned using the Box-Behnken Design varying the initial pH (2.5, 3.5 and 4.5), current density (10, 20 and 30 mA/cm²) and hydrogen peroxide dosage (10, 20 and 30 g/L). The organic matter (chemical oxygen demand - COD) and the phenolic compounds (total phenolic compounds - TPh) removal were the parameters studied, and the results were analyzed using the Response Surface Methodology and ANOVA Variance Analysis. The peroxy-electrocoagulation process removed on average 21.63% COD and 81.38% TPh. The highest COD removal was 29.35% and 87.63% TPh, both by applying a current of 20 mA/cm² and hydrogen peroxide 30g/L, but for COD at pH 2.5 and for TPh at pH 4.5. By analyzing the ANOVA and RSM tables, the parameter with the most significance for contaminant removal was the concentration of hydrogen peroxide added to the system. The peroxy-electrocoagulation process with aluminum electrodes achieved a satisfactory reduction in the concentration of other phenolic compounds, however, it is necessary to study the application of other processes in series for COD removal.

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ULTRASONIC VELOCITY FOR THE ANALYSIS OF WATER CONTENT INFLUENCE ON ELASTIC AND STRENGTH PARAMETERS OF MALOGNE PHOSPHATIC CHALK

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ABSTRACT

Water content may have a crucial effect on the petrophysical and mechanical properties of high porosity rocks such as chalk. Consequently, the water fluctuations may significantly influence the behaviour of engineering structures that are constructed in chinks. It is the aim of this study to illustrate how the elastic and strength properties of chalk can evolve considering water content variation using P-wave velocity and mathematical modelling. Samples were taken from the Malogne Phosphatic chalk quarry, Upper Cretaceous chalk, Mons Basin. Cylinders with diameter and height of about 40 mm and 80 mm respectively were prepared and their dry and saturated density and porosity were determined. To study the influence of water on the ultrasonic compressional-wave velocity (VP), measurements of travel time of three samples subjected to different water content were performed. The testing procedure consists of samples water-saturation and free drying along with measurements of the VP until no changes in the sample weight were observed. The Uniaxial Compressive Strength (UCS) in dry and saturated chalk specimens was also estimated. P-wave propagation velocity in rock is known to be a function of porosity, lithology, pore fluid, elastic properties and strength. To clarify the possible influence of lithology on the physicommechanical properties of rocks, three samples of phosphatic chalk were studied in thin sections. Automated mineral analysis and textural imaging of the samples were performed using an FEI QEMSCAN®. The rock porosity was characterized by volume, type and size. The analyses of the Ultrasonic tests reveal that changes in the water content are associated with variations in the P-wave velocity which tends to exponentially decrease with water content increase until 76%. Based on P-wave velocity changes as a function of water content, mathematical models have been used to predict the elastic and strength properties, particularly P-wave modulus, static Young's modulus, and UCS. Considering the non-linear correlation between P-wave velocity and water content, the corresponding mechanical parameters were found. The data indicate that the presence of water significantly reduced the elastic and strength parameters of the chalk, a result that is in agreement with the UCS laboratory tests. The derived equations can be used for predicting the elastic and strength properties of high-porous chalk from the P-wave velocity as a function of water content. However, this approach tends to be conservative when estimating rock properties in dry conditions. Nevertheless, it may avoid the necessity for time-consuming laboratory testing.

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EFFECT OF CONFINEMENT STRESS ON ROCK MASS STABILITY

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ABSTRACT

A huge number of factors controls rock mass failure, but it is mainly influenced by the state of stress and in particular on the bearing capacity and failure mechanism of the massif. The evaluation of rock mass strength in confined and unconfined compression, as well as its tension strength, are key issues to understand rock mass behaviour prior to failure. On the other hand, working in complex geomechanical conditions leads to an increase for the requirements of safety and sustainability of the underground mining works. This paper makes a connection between the laboratory analyses of the rock mass and the practical use of the obtained data. The strength properties, confinement effect and failure mechanisms are successfully studied in volcanic rock specimens from an underground mine. In order to estimate the confinement effect on rock mass strength properties, different confined compression stresses on rock specimens are applied. In addition, the crack initiation and propagation in rock samples are observed and rock mass failure mechanisms are studied. It was found that under unconfined conditions the rock specimens typically fail in spalling mode whereas samples tested under higher confining pressure results in a shear failure. Furthermore, the understand the behaviour of the material, the failure envelope of the tested rock has been modelled using the data obtained in the laboratory experiments. The obtained data is used for stability analyses through determination of the safety factor. Thus, a case study of the confinement effect and its influence on the rock mass in an underground mine is presented in this work. On this base, calculations of the safety factors in shear and tension failures are performed which can result in prediction of the rock mass behaviour and safety improvement of the mine. The obtained results of the safety factors underlined the influence of the confining stress on the rock mass. The tendency of increasing values of the shear safety factor and decreasing values of the tensile safety factor as confinement increases is found. This is an important observation that would allowed more accurate predictions of the stable and unstable zones of the underground openings to be carried out, and thus the stability of the rock mass to be improved.

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**GEOTECHNOLOGIES APPLIED TO ANTHROPOMORPHIC STRUCTURES: USE OF GPR FOR
DETECTION OF STRUCTURAL PROBLEMS, CAUSES AND EFFECTS: CASE STUDY IN COIMBRA,
PORTUGAL**

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ABSTRACT

One of the recurrent problems in civil construction concerns the wear and deterioration of structures due to their use over time. There should be a plan for monitoring the structures to assess and quantify anomalies, which will allow the minimization and rehabilitation measures to be carried out in advance. This study aimed to use geotechnologies, specifically the Ground Probing Radar (GPR), to identify and quantify the damage caused by use of a swimming pool inserted in a structure built on a residential property. The methodology comprised the use of georadar Sensors & Software PulseEKKO GPR for data acquisition, with the configuration are shown. The data were processed in the software EKKO Projet considering the following parameters: 1- Grain/Filter: Dewow + SEC2 Gain (Attenuation:10.00 Start Gain:4.00 Maximum Gain: 950). Seven acquisition profiles were performed: 3 on the East side, 2 on the South side, and 2 on the West side of the pool, with a spacing between 0.8 m, and with the direction indicated in figure. From the visualization of the processed radargrams, and the slices elaborated for each profile with a colour palette corresponding to the obtained reflectance values, it was possible to identify the underlying structures of the pavement of the edge of the pool such as beams, beam frames, slope, interior space of the support structure and, most importantly, the degree of subsoil materials alteration, depth and dispersion of water infiltrations. On the East side, the pool is inserted into the rock formation; it is possible to identify up to 1 m depth of the water infiltration and dispersion. To the West and South, the pool is supported by a built-up structure; underneath there is a hall and the engine room. In these places, the infiltration and dispersion of water were identified until approximately 0.7 m depth, as well as the existing structures and their condition. The 0.7 m corresponds to the thickness of the existing slab and beams. Based on these results, an intervention plan was prepared for the rehabilitation of the deterioration of the materials and for the minimization of water percolation through the waterproofing of the pool surrounding areas.

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ENVIRONMENTAL GOVERNANCE ASSESSMENT IN LATVIA: GOOD GOVERNANCE FRAMING AND IMPLEMENTATION REVIEW

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ABSTRACT

Environmental governance implementation at all levels starting from EU up to local level need to have necessary capacity and whole set of governance instruments to ensure that the governance process reaches planned outcomes. The primary aim of the environmental governance assessment in Latvia is to review the implementation of environmental legislation and policy at the national level, but considering importance of municipal level as well. The main part of this study was also part of the European Commission project, realized in the all EU Member States. The assessment framework defined five good governance characteristic features being used for studying environmental governance in the countries: transparency, accountability, access to justice, participation, effectiveness and efficiency. The initial study was following the designed template for assessment and relying on publicly available data and information. All related document studies and additional selected interviews with key experts in the field and the both publicly elected governance levels, national and local, were done representing the views of the researchers. Within European Commission project, the stakeholder workshops were also taking place and the national assessments were used as background material in the preparation by the Commission of the Environmental Implementation Report. There are various related environmental governance instruments at national level, having planned impact on local level governance, but local municipalities, as legal entities in the field of public law, first of all rely on regulatory enactments which define in detail the functions, rights and duties of local governments. The legislative framework is exhaustive and detailed, but it is fragmented in relation to the environment protection. Coordination mechanisms between local, regional, and national levels are complicated. The development of infrastructure at national level is mainly linked to existing standards, regulations and procedures for construction, exploitation, etc., as well as the distribution of available EU funds and monitoring and control of use. The financial-economic framework at national level defines the source of municipal finances – real estate tax, population income tax, natural resources tax, but there is no financial mechanism for local governments of municipalities to stimulate business development in their territory, promote sustainable forms of business, promote the use of renewable energy sources (e.g. wind parks). As regards the institutional and administrative framework and the framework for communication process and its complementary instruments, there are only separate restrictions imposed by regulatory enactments, leaving the local government level with a relatively large freedom of choice, but within their administrative capacities and financial resources available for activities. Effective mechanisms to enable members of the public to make complaints about environmental problems are in place, and for those complaints to be properly addressed, are an important part of environmental compliance assurance. They also reinforce public confidence in environmental laws. There are plans to better inform the public about compliance promotion, monitoring and enforcement by, at least ensuring availability of detailed online information. Environmental governance in Latvia is well enough developed in all five studied good governance features and all levels – national, regional, local and grass-root level.

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**ENVIRONMENTAL SCIENCES AND GOVERNANCE RESEARCH FOR LOCAL DEVELOPMENT:
SOCIALY ENGAGED RESEARCH APPLICATIONS**

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ABSTRACT

There are represented case study research methodology based studies (interviews, focus groups, document and territory studies) to analyse socially engaged research (SER) oriented studies of the research-and-development (R&D) framework project's implementation practices and with both complementary interests – SER development methodologies and their effectiveness, as well as, involved stakeholders understanding, insights and cooperation development. The general objectives were diverse of all the three variously funded projects, being studied for this paper, particularly, projects of environmental/life sciences based applications for different socio-ecological systems and their governance studies in the Eastern-Latvia region, but also being enough similar as looking towards SER approach application into R&D project's practice. General stakeholders groups to be participatory involved SER and during the whole project's life span are to be mentioned as following: local communities and their representatives, local municipalities, also regional up to national level governance agencies from thematically related sectors, local and regional entrepreneurship companies and coordination organizations, as well as, additionally is to be importantly mention - local/regional mediators (media, educators (formal/non-formal), NGO's and finally academia/knowledge institutions. One selected project was taken into more detailed consideration, the EU Horizon 2020 project OPTAIN. Together with local actors, project aims at selecting and optimizing the allocation of retention and reuse of water and nutrients measures and their combination at the farm and small agricultural catchment level. Main challenge: planning and coordination of active stakeholder involvement by developing stakeholder networking, combining various decision-making levels, from local and river catchment level interest groups to regional and national level issue related stakeholders – covering water, nature, environment, agriculture, tourism etc. sectors. Identification of efficient techniques/measures was done in close cooperation with local actors and based on environmental and economic sustainability indicators, but local actors were involved based on initial stakeholder mapping and performing a stakeholder analysis to realize which interest groups are really impacted in the Dviete river catchment area and which and how authorities are defining management systems to realize water retention and reuse measures there, being further followed by establishment and running of so called Multi-actor reference group (MARG). Also qualitative assessment of current governance and management practices related to the water management and agriculture policy planning and implementation was performed to identify gaps and opportunities for cross-sectorial policy analysis and suggestions for improved water management. There was agreed on necessary governance efforts for better coordination and coherence between sectors, including also issue of common terminologies to improve shared understanding between governance fields. Necessary governance efforts for better improved engagement were stressed, particularly, issues of improving consultation process of agricultural experts with farmers and other stakeholders for better solving of discrepancies between agriculture and environment and nature. Also better organization of working groups for NGOs, state and local municipal stakeholders/experts, and, promoting higher environmental awareness for reaching sustainability. Policy mechanisms for awareness, education and communication efforts are to be expanded and diversified, including into directions of non-financial support, motivating schemes, certificates, opportunities to attend courses etc. being important to motivate and support economic sustainability.

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ASSESSMENT OF THE RISK OF THE ACCIDENTAL INITIATION OF SEMI-FABRICATED PRODUCTS CONTAINING PYROTECHNIC ARTICLES WITH A TECHNICAL DESTINATION IN THE AUTOMOTIVE FIELD

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ABSTRACT

The identification of the danger of accidental initiation, respectively the establishment of the causes and the possibilities that can generate the triggering of pyrotechnic devices with a technical destination in the automotive field containing pyrotechnic articles of the P1 category, is carried out for each piece of equipment depending on the phases of the technological process of their manufacture. The protection against the accidental initiation of pyrotechnic devices intended for equipping auto vehicles is of particular interest for occupational safety in the manufacturing process of these types of products, because their triggering can endanger the life and health of workers as a result of the uncontrollable effects of functioning, with the generation of thermal and dynamic effects, as well as the emission of toxic reaction products that can affect the human component and/or destroy the work space. The paper highlights the way to analyse the risk of accidental initiation of pyrotechnic devices actuator type from the P1 category, using the latest generation technical-scientific tools in order to computerize the effects following their untimely triggering and establish the safety distances in relation to the amplitude of the degree of damage to the human component, respectively the destruction caused to the work space. In the case of pyrotechnic articles from category P1 type pyrotechnic actuator, the main risks of their accidental initiation are determined by the following technical factors: the production of an electrical discharge greater than 25 KV, the generation of a current with an intensity greater than 0.4 A at the terminals pyrotechnic device, their exposure to a temperature higher than 165°C. The main effects generated after the untimely initiations of these products are determined by: flame, thermal radiation, dynamic pressure waves, projected fragments and hazardous releases of chemical combustion products. Depending on the results obtained following the estimation and assessment of the assessed risks, preventive and countermeasures of a technical and organizational nature are established, in order to secure the predictable operations of specific operations with these types of products.

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ASSESSMENT OF AQUIFERS' VULNERABILITY DEGREE IN THE EVENT OF ACCIDENTAL POLLUTION WITH PETROLEUM PRODUCTS

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ABSTRACT

Adequate management and protection of underground water resources is a desideratum of the current period of evolution as consumption, requirements and degree of impurity of fresh water is increasing with the development of human society. Also, the limited nature of continental fresh water resources requires additional protection measures for current resources, so the understanding and objective assessment of aquifers' vulnerability degree in case of accidental pollution, represents the basis of environmental policies developed for the purpose of sustainable development of human communities. The study of the vulnerability degree of environmental factors and ecosystems that directly or indirectly interact with groundwater resources was carried out by analysing groundwater quality indicators (BTEX) based on the vulnerability intervals established according to national legislation in force. The aquifers' vulnerability degree was evaluated for 3 possible scenarios of accidental pollution with petroleum products for a well field located in the south of Romania. The effects of BTEX compounds on ecosystems that directly or indirectly interact with groundwater were evaluated according to synergistic effects of xenobiotics, manifested at ecological niche level. The aim of the vulnerability degree study is for it to function as an analytical tool to identify areas vulnerable to pollution phenomenon and to develop the best measures to limit the phenomenon of contaminants' transfer to other underground water bodies. Aquifers and ecosystems' degree of vulnerability to external pressures is an integrated component of the environmental or ecotoxicological risk assessment process associated with the phenomenon of accidental pollution that may have effects on the quality of water stored in aquifers. Results of the conducted research are of interest for engineers and researchers who study the hydrological and hydrodynamic phenomena of underground water in order to develop and apply the best measures to reduce the impact caused by economic activities.

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World 8th

28 August-01 September, 2023– Prague (Czech Republic)

Multidisciplinary Earth Sciences Symposium

MINING POTENTIAL OF THE UPPER CHELIFF AREA (NORTH OF ALGERIA): GRAVIMETRIC EVIDENCES

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ABSTRACT

The Cheliff region (North Algeria) is one of the most seismically active zones of the western Mediterranean Sea. It constitutes a key area to study neotectonic structures and their geodynamical context. However, its eastern part, called Upper Cheliff has a strong mining potential. The gravimetric method is an essential tool for anyone interested in geological formations presenting anomalous densities and located at great depths. It is therefore essential for the mining prospector, for two main reasons: the densities contrast of the mining formations compared with the to the host rock. the deposits that are easiest to discover have already been discovered and it remains to search for those located at greater and greater depths. The mining indices identified in the Upper Cheliff area, are located at the plumb line of the positive gravity anomalies. The gravity observations suggest that the mineralizations are carried by heavy and fractured structures. These heavy structures are situated essentially in the different massifs (Zaccar, Rouina, Timoulga and Doui). Based on the gravity map, we interpret the other positive anomalies identified in the Upper Cheliff area as the continuity of these heavy structures, which do not reach the surface. These new identified structures have remained blind to mining prospectors and could not be explored by surface geological observations. These zones highlighted by gravimetry are important targets for mining reconnaissance.

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GEOMECHANICAL CHARACTERISATION OF THE LYULYAKATA LIMESTONE QUARRY (NE BULGARIA) FOR SLOPE STABILITY OPTIMISATION

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ABSTRACT

Slope stability in hard rocks is a major issue of open pit mining operations. Geomechanical investigations are not only essential for the slope stability but also critical for the short and long term planning and development of the open pit mining. In addition, the grain size distribution of the excavated material is largely dependent on its geomechanical properties. With an annual production of several million tonnes per year, the Lulyakata open pit quarry, located in north-eastern Bulgaria, is the main supplier of raw materials for soda ash and cement production in the region. Two main types of limestone are forming the benches in the quarry, namely the micrite and bio- to lithoclastic limestones. To ensure the sustainable development of the open pit as well as its expansion in depth an assessment of the possible slope instabilities, which are closely controlled by its geomechanical characteristics, is required. The current work presents detailed geomechanical characterisation on the two main lithotypes mined out in the Lyulyakata limestone quarry. To this end, the rock properties of the Lyulyakata limestone quarry are investigated through application of laboratory non-destructive and destructive experiments on both limestone types extracted for the quarry. The data revealed distinct differences in the petrophysical and mechanical properties of both lithotypes. The micritic limestone demonstrated significantly higher strength properties when compared with the results obtained from the bio- to lithoclastic limestones. Furthermore, the analyses performed on the gathered data demonstrated clear correlation between the mechanical properties and the measured porosity and the ultrasonic velocity. By utilising the data obtained from the geomechanical characterisation of the limestone in the quarry, the slope stability of the working benches in the quarry could be improved, as well as the general slope angle. In this way, the safe of the mining operations in the quarry could be enhanced. On the other hand, optimisation of the grain size distribution could be achieved by taking into account the strength properties of the two lithotypes excavated in the quarry.

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GROUNDWATER TEMPERATURE SPATIAL DISTRIBUTION IN WROCLAW

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ABSTRACT

This study is focused on analysis of groundwater temperature spatial distribution in an urban area. The process of urbanisation coupled with climate change has created a phenomenon of elevated ambient air temperatures called the Urban Heat Island (UHI) in cities around the world. Meteorological records for the city of Wroclaw (Poland) - the study area – show an increase of average temperatures by approx. 0.5°C in the last two decades and 2.0°C in the last six decades. The elevated ambient air and surface temperatures penetrate underground and influence groundwater temperature (GWT). The phenomenon of elevated groundwater temperatures is called the Subsurface Urban Heat Island (SUHI). However, the relationship between groundwater temperature spatial distribution and UHI, well as the potential influence of other external factors, such as land use change or hydrogeological conditions are not yet well understood. In the case of the city of Wroclaw, characterized by an increase in average temperatures in recent decades, and experiencing the UHI phenomenon, the distribution of groundwater temperatures is not fully known. Thus, this study is aimed at mapping the spatial distribution of temperature in shallow aquifers in the city of Wroclaw developed with three interpolation techniques, inverse distance weighted (IDW), spline and ordinary kriging, and based on measurements made in a network of piezometers in the 2004-2005 hydrological year. The database of groundwater temperature measurements consisted of 67 locations. Then, global and local spatial regression functions (Generalized Linear Regression and Geographically Weighted Regression) in geographic information system (GIS) were used to analyse and identify potential statistically significant spatial relationships between spatial distribution of GWT and a set of external factors such as distribution of UHI, distribution of Land Surface Temperature (LST), land use, distance from city centre, distance from urban green areas and distances from rivers. The dependent and independent variables, as well as model residuals were represented as raster maps. The quality and performance of local spatial regression models was assessed based on the distribution of model residuals and coefficient of determination and AICc values. The distance from city centre has been identified as the most contributing factor.

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**GEL FORMATION DURING HYDROTHERMAL BRECCIATION. A CASE STUDY FROM THE
EPITHERMAL, LOW-SULFIDATION SURNAK GOLD DEPOSIT, SE BULGARIA**

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ABSTRACT

The formation of gel in hydrothermal deposits is an issue of very long debate and the question has not been definitively resolved. Some authors completely deny the involvement of gel (Grigor'ev, 1961; Roedder, 1968); others emphasize its widespread participation in hydrothermal deposits as a precursor of further crystalline aggregates (Betehin, 1953; Chuhrov, 1955; Saunders, 1990; Marinova et al., 2014), and still, others think that some characteristic textures, such as globular, botryoidal, and colloform, can form either via crystallization from true solutions or from colloidal solutions (Lebedev, 1967). Many researchers believe that the formation of natural colloidal solutions requires special conditions such as high supersaturation of the hydrothermal fluid with respect to certain solutes or strong cooling of the fluid. We present mineral microtextures from the Eocene, epithermal, low-sulfidation Surnak gold deposit, Eastern Rhodope Mountain, SE Bulgaria. The precipitation mechanisms in the deposit are not well constrained, so the studying of mineral textures is a necessary step to resolving this issue. The presented microtextures were studied under an optical microscope, and by scanning electron microscope in backscattered electrons. The microtextures include very fine-grained anhedral (known as jigsaw or mosaic) quartz (grains a few microns across), quartz spheres (a few microns in diameter), globular aggregates of pyrite as well as straight and curved pyrite bands (a few hundred microns wide) among anhedral quartz. These quartz and pyrite microtextures can hardly be explained by crystallization from true solutions. The microstructures discussed were observed in drill cores, which represent a hydrothermal breccia composed of black dusty pyrite and dark gray quartz, which cement clasts of earlier hydrothermal quartz. The hydrothermal breccia is formed by hydrofracturing and indicates the building up of high fluid pressure before the fracturing which dropped sharply as the rock ruptured. We assume that this pressure drop resulted in the boiling of the solution, loss of water as steam, and hydrogen sulfide, and significant cooling of the solution. Boiling was proved by fluid inclusion data (Bozkaya and Marinova, 2022). We expect a high supersaturation with respect both to amorphous silica and iron sulfide to be achieved, resulting in the formation of colloidal suspension which later turned into mixed silica - iron sulfide gel through a solidification process, i.e. gelation. Some microtextures of pyrite, like straight and curved bands among the anhedral quartz, suggest that the colloidal suspension has injected along cracks, i.e. has undergone some transport. Our observations confirmed the particular conditions needed for the formation of a gel in the hydrothermal process since the other ore samples outside the brecciation zone do not exhibit the microtextures described above.

The authors thank Dundee Precious Metals Krumovgrad, Bulgaria for permission to sample and provided geological information. The study is supported by the Bulgarian National Science Fund, contract KP-06- N54/6.

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**LABORATORY TECHNOLOGICAL RESEARCH OF PREPARATION OF CALCINED DOLOMITES
SUITABLE FOR METAL MAGNESIUM PRODUCTION**

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ABSTRACT

Metallic magnesium has been included in the list of critical mineral raw materials (CRM) for European Union countries since 2010. The territory of the Slovak Republic has large reserves of mineral raw materials - magnesite and dolomite, which are the initial source of metal Mg. The supplies of these raw materials in Slovakia are immense in comparison to other European countries. However, the raw material potential is necessary to verify from the technological point of view. The dolomites in Slovakia occur in several Middle and Upper Triassic formations thick up to several 100 metres, or forming intercalations, interbeds, lenses in beds irregularly alternating with surrounding limestones. They are present in numerous geological units, their cover sequences and tectonic nappes. The most significant are the Middle- and Upper-Triassic dolomites of the Hronic unit, bearing the important dolomite deposits in the Choč nappe of the Strážovská highlands. For technological research, the following raw materials were chosen: dolomite from the Stráňavy (ST-1), Sedlice (SED-1) and Kraľovany (KRA-1) deposit, whose are located near the operation of a potential customer of laboratory results for the production of metal magnesium, diversified manufacturer of ferroalloys in Central Europe, OFZ a.s. Slovakia. The aim of the laboratory technological research was to determine the experimental conditions for obtaining Mg intermediates from the dolomite samples, suitable for the subsequent production of metal magnesium. The crushed and separated samples of dolomite raw materials were annealed at two selected temperatures 1000 °C and 1050 °C in a furnace with a holding time of 0.5; 1; 2 and 2.5 hours. The input samples and calcined products were characterized by X-ray diffraction method and differential thermal and thermogravimetric analyses. By optimizing the annealing process the calcined product of sample SED-1 that met all required conditions (molecular ratio, content of impurities and content of CO₂) was obtained.

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FLAMMABILITY BEHAVIOR OF HEMP FIBER REINFORCED EPOXY COMPOSITES

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ABSTRACT

In this study, the behavior of hemp fiber/epoxy composites subjected to flammability properties. for the production of composite samples, hemp reinforcements were used: unidirectional two balanced laminates ($0^0/90^0$) different in thickness were studied: 2 plies, 4 plies. The composites were fabricated by hand lay-up process the flammability properties of composites are analyzed by using UL-94. The effects of two different fire-retardant compounds (Magnesium hydroxide and Aluminum hydroxide) filling on the Underwriters Laboratories (UL)-94 horizontal and vertical tests were carried out for evaluating the effectiveness of these FR treatments. The effects of 2 - 4% Mg (OH)₂ and Al (OH)₃ loading on the composites' burning rate was studied. It was seen that the composite results of vertical burning tests classified these composites under No Classification. The rate of burning of the composites decreased with the inclusion of fire retardants and the rate of burning of 11,60 and 11,22 and 12,20, and 10,60 mm/min was found with 4% wt of Mg(OH)₂ and Al(OH)₃ in composites respectively.

**CARBON EMISSION CALCULATION AND INFLUENCING FACTOR ANALYSIS
BASED ON INDUSTRIAL BIG DATA IN THE “DOUBLE CARBON” ERA**

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ABSTRACT

The arrival of the “double carbon” era indicates that industrial carbon reduction with high energy consumption and high carbon emission is imperative. From the perspective of carbon emission driving factors, industrial carbon emission is decomposed into five influencing factors: energy intensity, energy structure, industrial structure, economic efficiency, and employee scale. Taking the data of 41 sub-industries of industrial industry in Liaoning Province from 2010 to 2019 as the research sample, the carbon emission is calculated. The LMDI model is used to analyze and point out the difference in the driving contribution of carbon emissions of each sub-industry. The results show that the total carbon emission of Liaoning province gradually decreases, decreases for the first time in 2014, and gradually turns from flat to upward. Economic efficiency is the only and most important reason to drive the increase of industrial carbon emissions in Liaoning Province, and energy efficiency is the primary factor to curb carbon emissions. High carbon industries play a significant role in promoting the increase of carbon emissions, while the medium and low carbon industries have a better effect on restraining carbon emissions. It provides reference and theoretical basis for the government to adjust the industrial structure, control industrial overcapacity, and realize the “double carbon” goal as soon as possible. It is of great significance for the country to optimize energy layout, ensure energy security, and implement the new energy strategy.

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THE INFLUENCE OF A FIRE AT AN ILLEGAL LANDFILL IN SOUTHERN POLAND ON THE FORMATION OF TOXIC COMPOUNDS AND THEIR IMPACT ON THE NATURAL ENVIRONMENT

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ABSTRACT

Landfill fires pose a real threat to the environment as they cause the migration of pollutants to the atmosphere and water sources. A greater risk is observed in the case of wild landfills, which do not have adequate isolation from the ground. The aim of this article is to present the results of studies on the toxicity of waste from a fire in a landfill in Trzebinia (southern Poland). Both soil and waste samples were investigated. The samples were analyzed using the GC-MS method and the leachates using ICP-OES. A total of 32 samples of incinerated waste and soil were collected. The organic compounds included naphthalene, fluorene, phenanthrene, anthracene, acenaphthene, acenaphthylene, fluoranthene, pyrene, benzo (c) phenanthrene, benzo (a) anthracene, chrysene, benzo (ghi) fluoranthene, benzo (b + k) fluoranthene, benzo (a) fluoranthene, benzo (c) fluoranthene, benzo (a) pyrene, benzo (e) pyrene, perylene, indeno[1,2,3-cd] pyrene, benzo (ghi) perylene, and dibenzo (a + h) anthracene. In addition, methylphenanthrenes were detected in 15 soil and waste samples. R_c values above 2.0 correspond to a thermally highly transformed organic substance, while significant parameter variations indicate heterogeneous temperatures during the fire. Among the inorganic parameters, sulfates, chlorides, arsenic, boron, cadmium, copper, lead, and zinc were taken into account. Phenanthrene reached values exceeding 33 mg/L. Fluoranthene dominated in most of the samples. Sulfates and chlorides were present in the samples in concentrations exceeding 400 and 50 mg/L, respectively. Compounds contained in burnt waste may have a negative impact on soil and water health safety. Therefore, it is important to conduct research and counteract the negative effects of waste fires.

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MICROFIBER SHEDDING FROM DISPOSABLE TEXTILE PRODUCTS: INFLUENCED CONDITIONS AND FABRIC PROPERTIES

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ABSTRACT

Disposable wipes and masks have come to be considered as underestimated sources of microfiber generation since the emergence of COVID-19. However, research into the creation of microfibers due to wiping with these non-woven products is scarce, and the potential effects of fabric properties on shedding behavior are unclear. This study investigated microfiber release from 7 wet wipes, 5 dry wipes, and 4 masks in response to the use of simulated daily wiping conditions on artificial skin. The dry wipes (77–568 p per sheet) shed more microfibers than the wet ones (21–190 p per sheet) after 2, 10, or 50 wiping cycles under a 9.8 N wiping force. In addition, an average of 56 microfibers could be released from per gram of wipe, and each square centimeter of wipe could release about 1.18 microfibers during wiping. Masks shed fewer microfibers than wipes due to the excellent shedding resistance of spunbond nonwoven fabrics and the strengthened mechanical properties granted by bonding points. Cellulose, polyethylene terephthalate (PET), and polypropylene (PP) were the major polymers in the microfibers shed by wipes, and the microfibers from masks were all PP. With regard to the influencing factors, the number of microfibers shed from wipes was positively associated with the number of wiping cycles ($r=0.983$ and 0.960 , $p < 0.01$) and wiping force ($r=0.980$, $p < 0.05$), while it was negatively correlated with the moisture content ($r=0.992$, $p < 0.01$). Interestingly, a stronger fiber entanglement degree in the wipes significantly improved the resistance to microfiber generation ($r=0.664$, $p < 0.05$). The results highlighted for the first time that the bending coefficient= and fiber extraction force ($\beta=0.077$; 95% CI:-0.123,-0.030; $p < 0.005$) significantly reduced the tendency for microfiber shedding. Although the number of microfibers shed from wiping was lower than those from domestic washing, there is still an urgent need to control the microfiber shedding tendencies of non-woven products through improving the manufacturing processes.

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COPULA-BASED LIKELIHOOD ESTIMATION OF GROUNDWATER DROUGHT USING REMOTELY SENSED DATA AND DEEP LEARNING

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ABSTRACT

According to the IPCC 6th report, the climate crisis has caused a global increase in evapotranspiration, which could imbalance the water cycle and lead to an increased risk of groundwater depletion. While it is crucial to monitor and predict groundwater drought over space and time, previous studies have been based on point data, making it difficult to understand the spatiotemporal variability. To overcome this limitation, we used satellite data and a deep learning model to monitor changes in groundwater storage. A convolutional neural network-long short term memory (CNN-LSTM) model was developed with input variables consisting of terrestrial water storage from gravity recovery and climate experiment (GRACE) and GRACE-follow on (GRACE-FO) satellites, precipitation from tropical rainfall measuring mission (TRMM), average temperature and soil moisture from global land data assimilation system (GLDAS), and normalized difference vegetation index (NDVI) and modified normalized difference water index (MNDWI) from Landsat 5 and 8. The standardized groundwater drought index (SGI) was calculated for mid-watersheds in South Korea along with meteorological and agricultural drought indices. The likelihood of groundwater drought occurrence after meteorological or agricultural droughts was estimated using five copula functions — Gaussian, Student's t, Gumbel, Clayton, and Frank. As a result, the likelihood of groundwater drought propagation was quantified in space and time depending on the intensity of meteorological and agricultural drought. Such information will serve as a valuable resource for drought response policy evaluation and water resources management. Improvements in the data quality and the deep learning model would make it feasible to predict drought propagations more accurately.

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. NRF-2022R1C1C2004417 and No. NRF-2021R1A2C2011193).

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FRACTIONATION OF IRON IN SOILS UNDER FOREST PRODUCTION IN AN ATLANTIC CLIMATE CONTEXT

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ABSTRACT

Iron is an element that possess two oxidation states (ferrous or ferric) under typical environmental status and can easily pass from one to another by changes in environmental conditions. In this research work, the fractionation of iron in soils developed from biotitic schists under forest production in an Atlantic climate context is evaluated, in order to obtain information about its mobilization capacity and environmental availability in the study area. For this purpose, a sequential chemical extraction procedure that allows to define six classes of operational fractions or constituent phases of the soils was applied. These fractions, exposed in their sequential order, are the following: soluble/exchangeable/specifically adsorbed, bound to manganese oxides, associated with amorphous compounds, bound to oxidizable organic matter, Fe in the crystalline iron oxides, and residual fraction. The sampling was carried out in the soil surface layer after removing the litter layer and O-horizons in the forest soils. Iron contents were measured by flame atomic absorption spectrophotometry. The studied soils are acidic, silt or silty-loam and rich in organic matter. The iron mean value was lower in the surface layer compared to the soils of the world. The results of the iron fractionation showed that iron was present in all the analyzed fractions. Most of this element resides in the residual and crystalline iron oxide fractions, i.e. iron is primarily retained within crystal lattices of layered silicates and well-crystallized iron oxide minerals, making it less available in the environmental setting.

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**EXPLORING THE PHYSICOCHEMICAL WATER STATE OF A HEADWATER STREAM IN A RURAL
CONTEXT WITH LOW ANTHROPIC PRESSURE**

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ABSTRACT

The number of fundamentally pristine basins is declining around the world. Stream water quality continues to be threatened globally by anthropogenic activities including excessive use of chemical fertilizers, manures and sewage discharge. Headwater streams are of great importance for the sustainable management of water resources and production of aquatic ecosystem services both in the headwaters as the downstream. Despite this, few studies have characterized the physicochemical state of headwater streams in a rural context. This study focuses on exploring the physicochemical water characteristics of a headwater stream draining a rural catchment where anthropic pressure is limited. The analyzed stream is part of the head section of the Mero River basin (NW Spain). To this end, water samples were collected at the catchment outlet at approximately biweekly intervals over a 3-year period. pH, water temperature, electrical conductivity, dissolved oxygen, chemical oxygen demand, major cations, anions, different nutrient forms (carbon, nitrogen, phosphorus), suspended solids concentrations, and streamflow were determined. Overall, the low mean values of the main physicochemical water quality indicators agree with those found in other rural catchment systems in humid temperate climates with low anthropic pressure, especially in relation to agricultural activity and demography.

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LEVELS OF OUTDOOR GAMMA DOSE RATES IN SELECTED SITES FROM ROMANIA, MOLDOVA AND GREECE

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ABSTRACT

The study presents a synthesis of results obtained in the frame of international cross-border projects, implemented in partnership, for gamma radiation dose rates measured in outdoor environments in various sites in Romania, Moldova, Greece, including urban, rural, touristic and protection areas. The selected sites (n=40) are found in the Eastern Carpathians Mountains, Lower Danube basin, Danube Delta, Lower Prut river Reserve, Dniester river, as well as Black Sea and Northern Aegean Sea basins. The data recorded for targeted spots using portable dosimeters highlight an hourly and daily variation of the outdoor gamma dose rate and the specificity of the geological background and terrain utilization. The mean values of outdoor gamma radiation dose rate, calculated for 50 measurements per each site, are ranging between 75 nGy/h (Constanta, Black Sea coast, Romania) and 394 nGy/h (Nea Peramos, Ammolofoi beach, Northern Aegean Sea, Greece), with a minimum of 41 nGy/h in Vama Veche, Romania, and a maximum of 489 nGy/h in Ammolofoi beach, Greece. A comparison is made with legislated values and other world places. The measurements performed at water surface during boat expeditions on Danube river and Danube Delta lakes and channels point out lower values of dose rate, due to the weak influence of gamma rays emission from bottom sediments. The data of the dose rate temporal variations will be used for the target regions as a base in further investigations and preparation of maps of gamma dose rates (terrestrial and cosmic), and calculation of the health risk for inhabitants and tourists. This work was carried out in the frame of the research grant with contract no. 9187/2023 funded by Dunarea de Jos University of Galati.

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PROBLEMS OF THE ZAGROS OPHIOLITES AND BASALTIC BODIES, EXAMPLES FROM KURDISTAN REGION, NORTHERN IRAQ

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ABSTRACT

In the Iraqi Zagros, there are ten ophiolites and basaltic bodies, the famous ones are Penjween, Mawat, Bulfat and Peshashan Ophiolite complexes in addition to basaltic bodies such as Kata Rash, Avroman, Gercus, Chalki, and Hamrin basaltic bodies. The present study describes more than 12 significant problems concerning the previous assigning of the bodies as igneous rocks. These problems are observable in the field, laboratory, and in most previous literatures that oppose the magmatic origin of these bodies. Our study explicated all aspects of each problem and clarified how the problem contradicts magmatic crystallization and aids the sedimentary origin of these claimed igneous bodies. Finally, the interpretations of all the problems were collected as conjugate pieces of evidence for appraisal of the new origin of all igneous bodies in the Iraqi and Iranian Zagros belt. The outcomes consider the ophiolitic and basaltic rocks metamorphosed volcanoclastic sandstones (greywackes or basaltic sandstone). The previous igneous rocks are sedimentary, as fresh or metamorphosed greywackes belong to stratigraphic units of Paleocene-Eocene Walsh Formation (as distal facies) and Kata Rash Conglomerate (as proximal Facies) which were previously considered volcanic rocks. These sediments are sourced originally from Urumeiah-Dokhtur Magmatic Arc (ADMA) and deposited inside Neo-Tethys, present Sanandaji-Sirjan Zone (SSZ), during the Jurassic-Early Cretaceous. Later, the sediments were metamorphosed and uplifted during the Paleocene and deposited inside the Iraqi Zagros belt by turbidity currents inside the Zagros Foreland basin. These ideas are shown in detail by tectonic and paleogeographic models.

OBTAINING OF GOLD FROM SLOVAK CONCENTRATE BY USING AN INNOVATIVE METHOD

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ABSTRACT

The complicated processing of concentrates with low gold content and the long-time use of non-ecological methods was the motion for the finding of a more efficient process of this noble metal obtaining. From this point of view, this research was focused on obtaining of nano gold from the concentrate White hill (Detva, Slovakia) using mechanical activation and mechano-biological activation in a molecular hydrogen solution. Gold in this complex concentrate occurs physically enclosed in the intercrystalline space of minerals and is also isomorphic and fills defects in their structure. The exclusion of gold from such complex mineral matrixes of the concentrate can be achieved using a mechano-biological process. This innovative method for obtaining of nano gold with the application of a molecular hydrogen solution is an advantageous alternative to the non-environmental reagents used. Compared to the most used worldwide toxic cyanide reagent, a solution with molecular hydrogen represents a low-cost and above all completely harmless reagent with very good kinetics. Mechanical processes use high-energy milling, which has an effect on the more intensive formation of surface and bulk defects in solid substances. The main advantage of mechanical processes is a smaller number of technological operations, a shorter time required to obtain the desired product at favorable environmental temperatures, and also the formation of nanostructures. The use of a biological process with the application of limnetic algae showed that algae with siliceous structures make possible to obtain gold from the White Hill concentrate with nanoscale size. Limnetic algae (diatoms, golden algae) are part of aquatic ecosystems and create the largest matter of biomass from all plants in the Earth. The mechano-biological process is a method that enabled to obtain gold nanoparticles with an average size of 100 nm from the Slovak gold-bearing concentrate from the White Hill deposit (BV-1). Mechanical activation of this concentrate and siliceous shells of the specified limnetic algae (*Dinobryon*, *Surirella*) in a molecular hydrogen solution caused changes in the physical-chemical properties of gold minerals as well as in the constituents of algae minerals. These structural changes had a decisive influence on the exclusion of gold nanoparticles into the molecular hydrogen solution under the defined reaction conditions. The gold nanoparticles were subsequently fixed in the cellular matrix of mechanically activated algae shells. The explanation of this phenomenon was the action of biomolecules, which the algae cells secreted in the course of reactions with metal ions present in the molecular hydrogen solution. Gold nanoparticles from the investigated concentrate were obtained by a new mechano-biological procedure already for four hours. In the case of mechanical activation of the concentrate, but without activation of the used algae, gold nanoparticles were excluded after sixteen hours. It follows from this knowledge that the application of an absolutely ecologically harmless aqueous solution enriched by molecular hydrogen and the use of limnetic algae confirmed the suitability of the innovative method for obtaining of nano gold from the concentrate. From the achieved research results significantly more effective kinetics is evident in the case of activated algae. Nanoparticles of gold obtained by the mentioned procedure can have important practical utilization, such as accelerating of the decomposition of dangerous substances or neutralizing pollutants in contaminated water, soil, and air. Simultaneously, obtaining of gold nanoparticles would also be beneficial for removing algae from the aquatic environment, where they are very dangerous for all living organisms.

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ANALYTICAL SOLUTIONS OF EXPERIMENTAL RESULTS OF DRILLING WITH DIAMOND DRILL BITS

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ABSTRACT

The paper focuses on mathematical modelling of torque as a function of thrust force and a function of penetration depth. The derived mathematical models of the torque and penetration depth presented herein are based on a comparison of experimental data and model data. There was a minimal difference between the measured and the theoretical values identified for four drill bits, without any effects relating to the drilled length. The main purpose of these mathematical models was to identify model coefficients from the experimental data and to evaluate their changes as the drilled length increased. Substitution coefficients of torque and penetration depth were used to describe factors affecting drilling efficiency. The examined coefficients facilitated an assessment of the condition of the drilling tools of four different surface-set diamond drill bits with different-sized diamonds. The series of analytical solutions, mainly conducted under models of the penetration depth and torque, support the existence of a linear relationship between the torque and penetration depth when the rock is chipping. The key output was the proposed analytical solutions for torque and penetration depth depending on an increasing thrust force which may be used to identify an optimal thrust force at which the cutting is effective. In general, the numerical results demonstrated decreased values for the penetration depth in the chipping area and increased values for the thrust forces with an increasing drilled length. Penetration depth per unit of thrust force at given contact surface strength exponentially decreased with an increased drilled length and the ratio of coefficients α/k proportionally increased with an increasing contact surface strength. The drill bits with larger diamonds were determined to be more appropriate for andesite drilling.

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FORAMINIFERAL RESPONSES TO SEA LEVEL CHANGES ACROSS THE MID-CARBONIFEROUS BOUNDARY IN CENTRAL TAURIDES (TURKEY)

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ABSTRACT

The response of benthic foraminiferal assemblages to relative sea-level changes during the mid-Carboniferous succession of the Yarıcak Formation in the Central Taurides is assessed with respect to sedimentary cyclicity and sequence stratigraphy by quantitative analysis. The data derived from the relative abundances of foraminifera have critical significance in the understanding of cyclic patterns and sea level changes in carbonate deposits. Calcareous foraminiferal groups including archaediscids, eostaffellids, irregularly coiled bilocular forms, unilocular forms, paleotextularids, biserialamminids, endothyrids, and pseudoendothyrids have been counted and analysed in this study. The mid-Carboniferous boundary succession predominantly covering uniform lithology of carbonates alternated with sandstone layers involves shallowing upward cycles used for the revealing of sea-level fluctuations. The relative abundances of these foraminiferal groups reveal a striking response to cyclicity with the reductions in the abundances towards the upper part of the cycles. Conversely, the abundances of pseudoendothyrids and endothyrids do not exhibit any considerable variations within the studied interval.

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FORAMINIFERAL BIOSTRATIGRAPHY OF THE TRIASSIC-JURASSIC BOUNDARY BEDS IN EASTERN ANATOLIA

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ABSTRACT

The aim of this study is to reveal foraminiferal assemblages and microfacies types of the Upper Triassic – Lower Jurassic carbonates cover units of the Bitlis massif exposed in the vicinity of the Çakmakkaya village (Palu, Elazığ) by studying meter scale stratigraphic sections. The succession covers highly abundant and diversified benthic foraminiferal associations. In addition, megalodontids are specifically abundant in the lower part of the succession, whereas they disappear towards the upper parts. Based on the stratigraphical distribution of these foraminiferal assemblages, four biostratigraphic zones have been established in the studied succession, from the oldest to the youngest: 1) *Aulotortus sinuosus* assemblage zone; (2) *Triasina hantkeni* interval zone; (3) *Thaumatoporella* sp.; and (4) *Everticyclammina* sp. zones. Consequently, the depositional age of the unit has been interpreted as Late Triassic - Early Jurassic interval. The Triassic-Jurassic boundary is one of the most significant mass extinction events of Phanerozoic. The Late Triassic within the studied sequence is dominated by involutinid forms and the Early Jurassic is mostly characterized by less fossiliferous intervals merely comprising *Thaumatoporella* algae and siphovalvulins. In considering the biostratigraphically important species, the boundary is drawn by a change in foraminiferal fauna. The Triassic - Jurassic boundary was delineated by the extinction of *Triasina hantkeni*, together with the other benthic foraminiferal species, and the dominance of the algae *Thaumatoporella* sp.. In the light of the petrographical properties of Upper Triassic – Lower Jurassic carbonate rocks of Bitlis massif, mudstone, pelloidal bioclastic packstone, bioclastic wackestone-packstone, intraclastic bioclastic grainstone, and micritic coated bioclastic grainstone facies have been presented within the studied sections depicting a shallow marine, nearshore facies setting. The biostratigraphic and sedimentological data acquired in the studied successions emphasized a similar succession with Tethyan realm allowing precise biostratigraphic correlations.

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**MAGMA STORAGE CONDITIONS AT A PLIO-QUATERNARY VOLCANIC ERUPTION CENTER IN
EASTERN ANATOLIA, TURKEY**

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ABSTRACT

Cumaçay consists of genetically related lava flows ranging in composition from basalt to dacite, representing one of the Plio-Quaternary eruption centers of post-collisional volcanism in Eastern Turkey. Our new K-Ar ages and whole rock geochemistry indicate that the volcanism started with the mildly alkaline basaltic lava flows, continued with subalkaline intermediate to acidic members, and ended up with transitional and subalkaline basaltic flows. Deep and shallow storage reservoirs have been recognized based on thermobarometric calculations beneath the Cumaçay. Our thermodynamic modelings reveals that the mantle-derived primitive magma intruded into the lower to the middle crust, where fractionation and crustal assimilation resulted in evolved melts with various SiO₂ contents. Then the generated evolved melts migrate to shallow crustal levels, where they produce a subvolcanic magma reservoir. Petrographical observations, combined with whole-rock major element modeling, reveal that the evolved members of Cumaçay may be produced via combined processes of fractional crystallization, the interaction of colder (e.g., dacite) and hotter magmas (e.g., basalt; basaltic trachyandesite) ascending from depth and recycling of early formed crystals at shallow magma storage region.

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**SEASONAL AND SPATIAL VARIATION OF WATER QUALITY IN THE LUMINA-ROSU LAKES SYSTEM,
DANUBE DELTA, ROMANIA**

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ABSTRACT

The main aim of the present scientific paper is to assess water quality of the surface water of various lakes located in the Lumina-Rosu interdistributary depression, Danube Delta, Romania. As specific objectives, the paper considered to spot the main potential sources of contamination and their environmental impacts on aquatic ecosystems. Equally, the purpose of the article is to emphasize the importance of monitoring the water quality of the Danube Delta, for preserving these unique natural water resources and their ecosystem services (fresh water, biodiversity, flood control, recreation, nutrient cycling, fishing and other traditional activities, ecotourism). Surface water samples collected from several control sections situated on the main tributaries and canals, as well as from lakes were investigated physically (T° - C, EC - $\mu\text{S}/\text{cm}$, TDS - mg/L, turbidity - NTU units, TSS - mg/L) and chemically (pH - units, DO - mg/L, N-NO_2^- - mg/L, N-NO_3^- - mg/L, P-PO_4^{3-} - mg/L, Chla - mg/L, SiO_2 - mg/L, TOC - mg/L, SO_4^{2-} - mg/L, S_2^- - mg/L, H_2S - mg/L and synthetic detergents - mg/L). Generally, the hydro-physical-chemical characteristics and water quality assessment of the surface waters of the lakes manifest the combined effect of both processes occurred in the catchment (weathering, sediment supply and transport), as well as the in situ lake processes (photosynthesis, sediment mixing, biogeochemical cycling, evaporation, eutrophication, productivity changes). Overall, the physical and chemical characteristics of the sampling sites investigated at high waters of the Danube are quite similar to those measured at low waters. The differences that mainly occurred within the lakes are more related to the limnological variables and the local environmental conditions. Anyway, a significant seasonal variation was noticed in the lakes, during the dry period, when different physical and chemical characteristics appeared to be influenced by high air temperature, lack of precipitation, low water level regime, low dissolved oxygen level regime, all related to climate change effects etc. Moreover, the anthropogenic factor that left its mark on some physical-chemical characteristics of water should not be omitted either. However, the results obtained within this study did not show such alarming values as might have dangerous effects on the investigated aquatic environments. The water quality information within this case study may be used for improving the understanding of the water quality issues and to better coordinate and plan for future monitoring activities in and around the Danube Delta environment. The results will contribute to updating the existing database with relevant information for a sustainable future of the Danube Delta and in similar areas that are subjected to such environmental challenges.

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**A POSSIBLE LINK BETWEEN FOREST EXPLOITATION AND GREENHOUSE GASES IN ROMANIA
BETWEEN 2008-2020**

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ABSTRACT

The increasingly obvious impact of climate change, in recent decades, has produced numerous negative effects and a series of measures have been imposed for reducing the emissions and for adaption to climate change. Forestry activities try to find a balance between adapting forest regeneration practices to the needs imposed by climate change. Two important economic activities: Forestry and logging and the second one the Wood processing and manufacturing play an important role on the quality of environmental factors in general and on greenhouse gas emissions in particular. CO₂, CH₄, N₂O resulting from wood processing activities were used in this paper to evaluate the possible correlation between these emissions and the volume of extracted wood. The data were collected by the National Institute of Statistics during 2008-2020. The volume of extracted wood varies between 16,704 thousand cubic meters in 2008 and 19,652 thousand cubic meters in 2020, the analyzed period average being 18,218 thousand cubic meters. The CO₂ emissions from Wood processing and manufacturing are significantly higher than the CO₂ emissions from Forestry and logging, for example in 2008 the emissions from the first source were 230 thousand cubic meters compared to only 28 thousand cubic meters from the second source. The analysis of CH₄ and N₂O emissions shows that the two activities have relatively the same impact on air quality. Until now, there have been extensive studies on Romanian forestry activities from a qualitative and quantitative perspective, but it is important to observe the link between the volume of wood extracted and the emissions of greenhouse gases.

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DESIGN OF A WATER TREATMENT PLANT WITH THE SUPPORT OF LABORATORY MODELS

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ABSTRACT

The subject of the research focused on the possibilities of supporting the design of surface water treatment plants using laboratory models. Within the pilot study, the possibilities of using different water treatment processes in the treatment of water from the water reservoir Nové Mlýny in the Czech Republic were assessed. The planned treatment plant is to supply a future recreational site from a shallow reservoir with significant eutrophication and chemical industry in the drainage basin. Coagulation, sedimentation, dissolved air flotation, membrane filtration processes and adsorption on granular activated carbon were investigated. These processes were identified by the preliminary study as applicable to water treatment and it was necessary to determine which could be applied given the site conditions. Laboratory models for the individual processes were used during the laboratory testing. During the research, problems encountered were debugged and the models were modified and some extensions were added to the original models. The coagulation and sedimentation processes were investigated using conventional jar tests. The dissolved air flotation process was simulated using a modified jar test and a lab scale model. Different types and doses of coagulants, mixing parameters and residence times were investigated in the tests. Turbidity value was used as an optimization parameter due to its rapidity of determination and low cost. For some tests, potassium permanganate oxidizability (also known as the permanganate index) was also used as an evaluation parameter so that different evaluation parameters could be compared. In addition, for the dissolved air flotation process, the parameters of the produced sludge - its quantity, suspended solids content and chemical oxygen demand - were monitored. These parameters are crucial for discharge of waste water into the sewer and its costs. The adsorption tests on granular activated carbon were performed as batch tests. The evaluation parameter was the manganese index. Another possible variant of activated carbon tests is a continuous flow-through column. These columns also allow monitoring of the process of fouling and the evolution of the effluent over time. The pilot project then used the results of the laboratory tests to create a design for a treatment plant in the area of interest and selected parts of the project documentation. The pilot project demonstrated the usefulness of laboratory testing as a tool to support the design of drinking water treatment plants. At the same time, these tests allow for a faster and more certain identification of the appropriate water treatment technology and thus reduce the extent of semi-operational testing at the site, leading to a more efficient use of funds by investors.

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EVALUATION OF THE RESIDUAL COMPENSATION OF ESTARFM IMAGE FUSION MODEL FOR SATELLITE VEGETATION INDEX

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ABSTRACT

Since satellite images provide periodic observation information for a wide area, they have been widely used for monitoring vegetation in forests and farmlands. Vegetation monitoring using satellites was mainly performed using normalized difference vegetation index(NDVI). To monitor changes in vegetation, it is necessary to establish long-term time series NDVI data. However, low-resolution satellite images have limitations in local area monitoring because of their low spatial resolution. High-resolution satellite images are suitable for local area monitoring because they provide detailed information on the characteristics of the surface. However, due to the low time resolution, there is a limit to constructing long-term time series NDVI. These limitations reduce the usefulness of satellite images. Therefore, research on spatiotemporal image fusion, which combines the complementary characteristics of temporal and spatial resolution, is actively being conducted to generate high spatiotemporal resolution fused images. Spatiotemporal image fusion models include STARFM, ESTARFM, Fit FC, among others. STARFM has limitations in that the smoothing pattern is reflected in the prediction results. To compensate for this, ESTARFM combines spectral unmixing method with STARFM to reflect detailed variability. Fit FC performs spatiotemporal image fusion using linear regression, spatial filtering, and residual compensation. In this study, an experiment was conducted to see if accuracy could be improved by applying the residual compensation concept of Fit FC to the ESTARFM method in order to construct a long-term time-series vegetation index with high accuracy. We used Sentinel-2 images and performed experiments on May 9th, 19th, and 29th of 2021. We generated residual images using predicted images from Chapter 3 and performed residual compensation by applying the generated residual images to the predicted images. We observed that the accuracy of predictions on relatively low-accuracy dates improved when residual compensation was performed on ESTARFM images.

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REAL-TIME WILDFIRE SMOKE DETECTION USING YOLOV7 AND YOLOV8

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ABSTRACT

Wildfires are a major concern for communities and ecosystems worldwide. One of the most effective ways to prevent their spread and minimize their impact is through early detection. Smoke detection plays a critical role in identifying wildfires in their early stage. Smoke is typically the first indication of a fire, and detecting it quickly can mean the difference between a manageable and an uncontrollable blaze. In recent years, advances in artificial intelligence technology have enabled the development of new smoke detection systems that can detect wildfire smoke with greater speed and accuracy. A promising approach for detecting wildfires is through the use of real-time object detection deep learning algorithms. These algorithms can detect smoke objects in video streams captured by cameras placed in wildfire-prone areas. State-of-the-art models, YOLOv7 and YOLOv8, were used to build real-time smoke detection models. YOLO series is a convolution based model that has fast inference speed and high accuracy. Especially YOLOv7 and YOLOv8 are state-of-the-art models which were released in July 2022 and March 2023. Each model was trained using CCTV images provided by AlertWildfire and High Performance Wireless Research & Education Network (HPWREN), and evaluated the detecting performance. The best model was able to accurately detect wildfire smoke with average precision of over 0.7 even from distant locations in a short amount of time. The detection speed is sufficient to detect real-time video at frames per second. By incorporating the model into a wildfire detection system, it is anticipated that a swifter and more precise wildfire monitoring system can be established. This, in turn, can minimize the damage caused by wildfires by enabling timely and effective prevention measures to be taken.

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BURNED AREA DETECTION USING LANDSAT8 AND UNET MODEL

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ABSTRACT

Due to climate change, the frequency and scale of wildfires have increased, causing serious damage to humans and property. A large amount of trees and plants are lost, and the ecosystem is destroyed or transformed into a different ecosystem from before wildfires. As a result, the need for accurate assessment of wildfires damage continues to be raised. Remote sensing using satellite images has received high evaluation in burned area detection research, as it enables rapid and large-scale acquisition of damage area images, as well as real-time terrain and weather information after a wildfire. Therefore, this study proposes a burned area detection model by combining remote sensing and CNN-based U-net model. The input data uses spectral characteristic data calculated from Landsat 8, such as R, G, B wavelength bands, Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Normalized Burn Ratio (NBR), and Burn Area Index (BAI) and so on. The study was conducted by selecting California wildfire cases from 2013 to 2021. As a result, the model demonstrated high accuracy with mIOU = 0.8. In addition, in order to evaluate overfitting and objectively present the model's accuracy, the Korean forest fire case was applied to the model. Through this model, rapid detection of extensive burned areas is enabled, which can help improve post-response capabilities for ecosystem recovery. Furthermore, it is expected to contribute to efficient vegetation recovery strategy formulation, such as determining priority of vegetation recovery. In addition, it can effectively contribute to comprehensive wildfires monitoring in conjunction with GIS systems.

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World 8th

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SEMANTIC SEGMENTATION OF HIGH-RESOLUTION SAR IMAGES FOR SMALL-MEDIUM SIZED RESERVOIRS IN SOUTH KOREA

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ABSTRACT

As the frequency and severity of natural disasters due to climate change increase, effective water resource management has become more crucial. Small and medium-sized reservoirs play a critical role in improving safety and living standards in local communities and small-scale farms, while mitigating the damage caused by floods and droughts. High-resolution Synthetic Aperture Radar (SAR) images can be utilized to detect the surface area of these reservoirs, providing essential information for monitoring water levels, storage capacity, and aiding in drought and flood analysis. This study proposes deep learning models, including CNN-based U-Net, HRNet-OCR, and Transformer-based Swin-Transformer techniques, to detect the surface area of a reservoir using high-resolution SAR Capella images. The best model achieved an mIOU of 0.9 or higher, demonstrating the effectiveness of these techniques for detecting reservoir surface areas using SAR Capella images. This study suggests the potential of the models for accurate water volume estimation and efficient reservoir management in the fields of water resource management and environmental protection. Thus, this research is expected to contribute to the estimation of reservoir surface area using SAR Capella images, with potential practical applications in water resource management and environmental protection.

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THE INFLUENCE OF CLIMATIC CONDITIONS ON THE SUNFLOWER PRODUCTION CULTIVATED IN BRAILA COUNTY

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ABSTRACT

In Romania, as a result of the studies carried out, there has been observed a clear tendency to heat the temperature and a decrease in the quantities of precipitation, changes that lead to an increase in the frequency and intensity of extreme meteorological phenomena (drought, floods, heat waves), which is why the need for research on the influence of climatic conditions on the productivity of cultivated species is paramount, as well as finding solutions to counteract these effects on agricultural production. In 2018, Romania became the largest European producer of sunflower and maize, according to the National Institute of Statistics. The main objectives deriving from this work are: to follow the interaction between climatic factors (temperature and precipitation) and vegetation conditions of plants and to establish the sowing age in the context of climate change in order to obtain high yields to the sunflower crop. The experience was located in Brăila County, Scorțaru locality and we followed the evolution of 2 sunflower hybrids seeded in 4 different eras. As a result of the studies carried out, it was found that the sowing period significantly influenced the emergence period, the density of the plants, the number of leaves, the diameter of the calathid, the number of seeds in the calatidium and implicitly the yields obtained.

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GLACIAL LAKE DETECTION USING SENTINEL 2 IMAGES AND U-NET ALGORITHM

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ABSTRACT

Recently, as the climate changes, the size of the glacial lake continues to increase. Accordingly, the damage caused by the Glacial Outburst Flood(GLOF) is also seriously concerned. GLOF not only causes human and property damage in high mountain areas, but also has a serious impact on the global natural environment. Thus, to cope with the danger of disaster, the need to monitor and detect glacial lakes early is constantly being raised. The field measurements method, which was conducted at the beginning of the study, had a big problem with timely detection of large glacial lake areas. But remote sensing methods through satellite data solve these existing problems and enable accurate and rapid detection. In addition, applying the AI model to detection can reduce both human error and time. Therefore, in this study, we constructed a deep learning(DL) model that can perform extensive glacial lake detection with satellite data in a short time. The study area is High-Mountain Asia with Sentinel 2, using the Global Lakes Detection Data Set provided by Institute of Electrical and Electronics Engineers(IEEE). The data contained 1200 cloud free true color images and their truth masks, of which 1000 were used for training and 200 for testing. And we adopted U-Net as a model for glacial lake detection. Results showed excellent performance: accuracy=0.9945, precision=0.9981, recall=0.9963, mIOU=0.906. Therefore, we expect that efficient glacial lake detection using this model can contribute to swift and safe disaster prevention and minimizing damage to mountainous areas in response to rapid climate change.

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SHIP DETECTION IN SAR IMAGES USING YOLO ALGORITHM

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ABSTRACT

Development and utilization of ship monitoring systems play an important role for the efficient operation and protection of oceans and ports. In the case of Vessel Monitoring Systems (VMS), there are difficulties in continuous management and surveillance due to the limited range in which ships can be detected. Information about ships can be obtained based on the Global Positioning System (GPS) or the Automatic Identification System (AIS) but monitoring of ships that do not operate GPS or AIS is not possible. Satellite imaging can identify ships in a wide range and can complement the gaps in VMS, GPS, and AIS-based monitoring and help resolve the problems. Therefore, the purpose of this study is to conduct ship detection that can be a key part of the ship monitoring system for marine monitoring using satellite SAR images. This study aims to detect ships in Synthetic Aperture Radar (SAR) images using the deep learning-based object detection algorithm YOLO. Satellite SAR images can be effectively used for ship detection as they are less affected by weather conditions and can be captured even at night. You Only Look Once (YOLO) is an object detection algorithm that is both fast and accurate. It processes images all at once, making it faster than other methods, while also predicting both the bounding-box and class probability of an object at the same time, which improves its accuracy. This makes it an ideal solution for faster and more efficient ship detection and monitoring. The learning materials used Sentinel-1 satellite images, and an object detection model was constructed using the YOLO algorithm. The YOLO model is trained using 80% of all images, and performance is verified by selecting the model that exhibited the highest mAP (mAP@0.5) value among the models generated after the training process. The results of this study can confirm that monitoring ships in satellite SAR images is possible using deep learning-based object detection algorithms. It is expected that the accuracy of the detection model will be improved through continuous construction of learning materials and can be utilized in the ship monitoring field in major ports and oceans around the world.

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ASSESSMENT OF CULTIVATE SOIL CONTAMINATION BY POTENTIALLY TOXIC METALS AS A RESULT OF A DISASTER EVENT

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ABSTRACT

Research on the physical and chemical properties of arable soil contaminated with potentially toxic metals after a galvanizing plant failure in the village of Dębska Wola (south-eastern Poland) was carried out. The contents of Zn, Pb, and Cd in the soil were determined using the atomic emission spectrometry technique with inductively coupled plasma (ICP-OES) and pH measurements were performed using the potentiometric method, after prior wet mineralisation of the research samples. The failure in the galvanizing plant and the fire resulting from it were of decisive importance for changes in the physical and chemical properties as well as chemical composition of the soil in the study area. In the analysed samples, the permissible concentrations of Zn, Pb and Cd were exceeded several times. Meteorological conditions at the time of the failure and one day after it affected the spread of pollutants in the atmosphere and the place of their deposition in the prevailing wind direction in the nearby agricultural fields. A small typological and species diversity, and especially the similar content of floatable parts and dust fractions, created good conditions for the accumulation and movement of potentially harmful metals. The analysed samples had a varied pH of the organic-mineral horizon from $\text{pH}_{\text{H}_2\text{O}}$ 4.66 to $\text{pH}_{\text{H}_2\text{O}}$ 5.33 and from pH_{KCl} 3.89 to pH_{KCl} 5.06. As a result of a galvanizing bath failure, toxic metal fumes were released into the atmosphere, causing concentrations of Zn in the soil samples from 0-5 cm in the range of 120.99 – 2007.34 $\text{mg}\cdot\text{kg}^{-1}$ DM, Pb (109.07 – 509.7 $\text{mg}\cdot\text{kg}^{-1}$ DM) as well as Cd (4.56 – 17.11 $\text{mg}\cdot\text{kg}^{-1}$ DM). Soils with a degree of contamination found in the vicinity of the plant in Dębska Wola should be subjected to monitoring tests and, if high enrichment parameters of Zn, Pb, and Cd are maintained, excluded from agricultural production and subjected to reclamation treatments.

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**GEOCHEMISTRY OF BOTTOM SEDIMENTS OF SELECTED RESERVOIRS IN THE KIELCE UPLAND
AS AN EFFECT OF NATURAL AND ANTHROPOGENIC FACTORS**

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ABSTRACT

Sediment accumulation is a complex process that occurs in water reservoirs. The formation of bottom sediments is related to the processes taking place in catchments and in the reservoirs themselves, as well as with hydrological conditions. Bottom sediments have a number of functions in aquatic ecosystems, including providing a habitat for many organisms, participating in the biogeochemical process of element circulation, and being the site of deposition and transformation of many compounds found in the water. Due to the structure of sediments, they form a natural geosorbent in which pollutants introduced to the aquatic environment are stored. Therefore, bottom sediments are an indicator of the ecological state of reservoirs, but also of their catchment area, playing the role of a kind of integral indicator of the level of anthropopressure. The aim of the research was (i) to determine the physicochemical properties of bottom sediments, (ii) to determine the content of metals (Cr, Zn, Cd, Co, Mn, Cu, Ni, Pb, Fe) in bottom sediments, (iii) to assess the quality of bottom sediments on the basis of selected criteria. The research was carried out in July 2021 within 3 water reservoirs located in the Kielce Upland. The selected dam reservoirs are Rejów, Borków and Wilków. The reservoirs are differ in age, capacity, catchment area and land use. This suggests that the sedimentological and geochemical diversity of bottom sediments may differ, which may be the result of anthropogenic pressure. Information on the composition of bottom sediments, their formation over the years, and determination of the sedimentation rate is an important database for assessing the functioning of reservoir ecosystems. Based on such a database, it is possible to develop scientifically justified protective measures, especially for ecosystems located in protected areas.

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**EVALUTION OF PHYSICO-CHEMICAL QUALITY OF GROUNDWATER OF KHEMIS MILIANA PLAIN
(NORTH WEST ALGERIA)**

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ABSTRACT

The demonstration of the main phenomena and the predominant chemical reactions in this evolution as well as the qualitative estimation of this water plus the comparison with the norms of the World Health Organization (W.H.O.), indicated that the positive (+) and negative (-) ions have a direct relationship with the geological and hydrogeological characteristics of the region. The maps of variation of hydro-chemical parameters were made for the spatial distribution of chemical components of groundwater, and also the Piper and Schoelleur diagrams were used to know the chemical facies of waters. The groundwater chemistry of the study area shows that the most dominant facies is chloride-calcic in the north and chloride-sodium in the south of the plain. Diffuse pollution, more difficult to identify, which have an agricultural origin affect almost the entire plain according to the concentrations observed in all periods, especially in 2018 with a value of 107 mg / l in the East of the plain, where there is no agricultural activity.

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ASSESSING THE EFFECTIVENESS OF DUNE SAND AS A SUPPLEMENTARY CEMENTITIOUS MATERIAL TO PRODUCE ADHESIVE MORTARS

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ABSTRACT

In order to valorize our natural resources especially dune sand, the physical and mechanical properties of adhesive mortars based on local mineral additions, have been studied in this present work. The experimental study was carried out on various adhesive mortars made with different contents of dune sand by partial substitution of cement. Adhesive mortars were made from Portland cement (PC; at 35%, 30% and 25%wt), Dune Sand (DS; at 60%, 65% and 75%wt), fillers and redispersible polymer powder (RDP; at 0.6%, 1.0% and 1.4%wt.). The physical (Slump test, normal consistency and bulk density) and mechanical and (initial adhesion, adhesion after immersion in water and adhesion after heat treatment) properties of elaborated adhesive mortars were determined and compared to commercial adhesive mortars.

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**FINAL QUALITY EVALUATION OF THE EARTH'S CRUST HEIGHT MOVEMENT KINEMATIC MODEL
ON THE CROATIAN TERRITORY**

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ABSTRACT

The paper presents quality evaluation of the relative height movement kinematic model of the Earth's crust that refers to the territory of the Republic of Croatia. This kinematic model enables determination of vertical displacements and movement speeds of discrete points on the Earth's crust. As the quality of the model is not yet finally analysed regarding the complete Croatian territory, this paper offers conclusive results of such analysis. The data basis for quality evaluation of the kinematic model are the geometric levelling measurements of the 2nd order state network that completely cover the Croatian territory. In the absence of a suitable and independent data set for direct quality assessment, the method of indirect quality assessment is applied. It implies the comparison between the accuracies of original levelling measurements in the measurement epoch and the accuracies referred to the same data reduced to the epoch of the national height reference system realization (1st order state network). Considering that between these two epochs appropriate time lapse exists, reduction of measurements enables their correction for the systematic effect of relative height movements. Consequently, it should be reflected in the quality increase of the reduced measurements compared to the original ones. Accuracy criteria are determined at both levels, i.e. at *a priori* and *a posteriori* level and are expressed by reference probable errors. In the first case, the quality assessment is based on the network levelling misclosures before network adjustment using the original and reduced measurements, and in the second case, on the network adjustment results with the original and then reduced measurements. The results indicate quite successful elimination of the systematic effect of crustal relative height movements from the levelling measurements, leading to the final conclusion that height movement kinematic model on the entire Croatian territory can be reliably used for the determination of regional relative height changes due to vertical crustal movements with the centimetre level of accuracy.

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**CONFIRMATION OF THE DILATANCY-DIFFUSION MODEL IN A LOW-POROSITY FRACTURED
AQUIFER**

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ABSTRACT

The dilatancy-diffusion model hypothesizes the presence of gas bubbles in cracked rock and predicts low anomalous velocities of compression waves precursory to an earthquake. An obvious way of testing the validity of dilatancy-diffusion model is to provide field evidence regarding the presence of gas bubbles in cracked rock precursory to an earthquake. A suitable geological site cited here is Taiwan's A Antung hot spring. Through well pumping tests and radon concentration measurements in a small fractured aquifer at Antung, field data support the hypothesis of dilatancy-diffusion model. A small low-porosity fractured aquifer near an active fault can be an effective natural strain meter for earthquake warning. Recurrences of anomalous declines in the concentration of groundwater radon were consistently recorded at Antung hot spring precursory to four main earthquakes near the Longitudinal Valley fault (the 2003 Mw 6.8 Chengkung, 2006 Mw 6.1 and Mw 5.9 Taitung, and 2008 Mw 5.4 Antung earthquakes). Well tests provide field evidence for in-situ development of gas bubbles in water-saturated fractured rock prior to the 2008 Mw 5.4 Antung earthquake. Anomalous declines in groundwater radon and aquifer transmissivity are two precursory phenomena having a common effect of gas bubble development. This is the first discovery of aquifer transmissivity complementing groundwater radon as an earthquake precursor. The findings have significant merit on a local basis and most importantly, can perhaps be applied globally in the subduction zone with similar tectonic settings and physical-chemical relationships.

CONTRASTING ENVIRONMENTS OF DEPOSITION OF THE NEOTETHYAN CHERTS AND SUB-OPHIOLITIC METACHERTS OF THE NORTHERN OMAN MOUNTAINS, UAE

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ABSTRACT

The dominant metamorphic lithologies of the sole rocks adhering to the Semail Ophiolite in the Hajar Mountains of the United Arab Emirates and Oman, are quartzites and minor schists and metacarbonates, derived from marine basin sediments (the Hawasina Series) of the NeoTethys Ocean. These marine sediments were accreted to the hot sole of the ophiolite during its latest Cretaceous obduction onto the SE Arabian Peninsula. The metamorphic sole rocks were highly sheared and raised to temperatures, reaching granulite facies, but more commonly show amphibolite to greenschist facies grades. A geochemical comparison between the cherts from various sites in the UAE and Oman, and metamorphic quartzites of the two main exposures of metachert sole rocks in the northeast UAE, shows that there is more to the narrative that just “Hawasina Series cherts are the protoliths of metamorphic sole quartzites”. Major and minor element (including REEs) geochemical analyses of the cherts (UAE Hawasina Series and Oman Wahrah cherts) and metacherts (Asima and Bani Hamid metacherts of the UAE) reveal similarities and difference between and amongst these groups. Some of these differences relate to the proportions and styles of chert-forming processes (hydrothermal chert versus biogenic chert). The origin and interpretation of these differences is unclear, however, certainly involves distinctive palaeo-environments of deposition, and perhaps age differences between the chert/metachert groups. Understanding these differences is important for models for the obduction history of the Semail Ophiolite.

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World 8th

28 August-01 September, 2023– Prague (Czech Republic)

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STRUCTURAL AND GEOLOGICAL ANALYSIS OF THE WADI HAM FAULT: A COMPREHENSIVE STUDY OF ITS GEOLOGICAL EVOLUTION, UAE

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ABSTRACT

The Wadi Ham Fault (WHF) is a major NW-trending structure in the Hajar Mountains of the United Arab Emirates. It extends from Fujairah in the SE to at least the latitude of Masafi. Few detailed studies exist to establish its kinematic evolution. In this contribution, structural, field geological, remote sensing and laboratory analyses are presented that reveal the origins and evolution of this fault. In its present configuration the WHF transects the gabbros and peridotites of the Cretaceous Semail Ophiolite that comprises the bulk of the regional geology. The peridotites are oceanic mantle, while the gabbros represent deep oceanic crust. The mapped boundary between them represents the oceanic petrological Moho, preserved in the Semail Ophiolite. The fault offsets the petrological Moho by apparent dextral slip, however, the orientation of the Moho changes from E-W to N-S across the WHF, suggesting some rotation on the WHF. Other structural evidence demonstrates that the WHF history involved multiple phases of displacement as a strike-slip and dip-slip fault structure. These very different functions of the WHF result from its changing role during the tectonic history of the region from Cretaceous to the present time. The WHF plays an important role in the hydrogeology of the region, and may play a part of the local seismicity. Holocene travertine deposits along the fault and in pools adjacent to the fault are of great interest in both aspects, however, there is no physical evidence for displacement in recent times. Base metal mineralization is also known along and near this fault. The findings from this study contribute to the broader understanding of faulting processes and help assess seismic hazards in the UAE and similar tectonic settings. The results provide valuable information for geological and geotechnical studies, infrastructure planning, and earthquake risk assessment in the region.

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CORRECTIVE SURFACE OVER NORTHERN PART OF ALGERIA AS SUPPORT THE GEODYNAMICAL APPLICATIONS BASED ON EGM2008/RTM QUASI-GEOID MODEL

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ABSTRACT

Algeria is one of the most seismically active areas in the Mediterranean basin concentrated, principally, in its northern part and will therefore require an accurate and continuous vertical reference surface for geodynamical applications. In Algeria, the lack of dense gravity data has restricted the production of precise geoid model. The only attempt for gravimetric geoid determination have been done through the combination of global models with the available scattered and few gravity data from only BGI data base. The results are not accurate enough to support the GPS levelling technique. In this case, the recommended RTM approach for modelling the high-frequency gravity field in mountainous regions, is investigated in order to improve quasi-geoid information from EGM2008. For this investigation, the recent and revolutionary global model EGM2008 in which we applied RTM reduction using the 2D lateral density variations model and a homogenous and precise GPS/levelling network, were used to construct of the corrector surface in the northern part of Algeria capable to produce orthometric heights with an acceptable accuracy as support to earthquake monitoring and geodynamical applications. The reference surface of 5' x 5' needed for the RTM reduction has been constructed from DTM2006.0 spherical harmonic model of Earth's topography. The least-squares Collocation technique in iterative process has been used to determine the relationship between the GPS/levelling and EGM2008/RTM quasi-geoid model. Several models for the corrector surface and different local covariance function and prediction techniques for the generation of the continuous surface from the discrete GPS/levelling data have been assessed, and the approach has also been used to detect outliers in the GPS/levelling data. According to our numerical results, this study show that the effect on the EGM2008 based quasi-geoid using the 2D lateral density variations model ranges from 0 to 13cm and remains significant for a precise geoid determination with centimeter level. In addition, the EGM2008/RTM quasi-geoid model shows an improvement in precision and reliability, fitting the height anomalies of GPS/levelling benchmarks better than the EGM2008-only model. Its standard deviation fits with GPS/levelling data are 34.0cm and 3.5cm before and after fitting using the linear trend as corrector surface. The analysis of the results shows that the signals in GPS/levelling benchmarks are dominated by errors in the EGM2008 quasi-geoid model due to the inaccurate and sparse land gravity integrated in its establishment, while the noise level indicates the presence of errors in national vertical datum.

GEOMETRIC LEVELLING DATA AND SOME SYSTEMATIC FAULTS IN THEIR TREATMENT

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ABSTRACT

The aim of this article is to illuminate some latent systematic faults in the mathematical treatment of precise levelling data. The first one is associated with the use of the average of both measurements of the height differences between the terminal benchmarks in levelling lines. Another weak point in the classical treatment of levelling data is the incomplete minimization of the impact of the spatial network configuration on the produced mean standard errors of the nodal benchmarks from the adjustment. Generating sixty random paired samples of size 1000, derived from three continuous distributions, e.g. Normal (0, 1), Uniform (-1.732, 1.732) and Gamma (1, 1), it was found that the average of two same distributed and ordered observations is very nearby to the theoretical expectation, in comparison to both observations, only in approximately 27-30% of all cases. Contrary, in other 70-74% of cases, either the “first” or the “second” observation is in close proximity to the expectation. The miss of this fact leads to a statistically significant deterioration of the final accuracy of the levelling networks. In the current study, it is also shown that the minimization of the standard errors of the adjusted normal heights of the nodal benchmarks in the Bulgarian Levelling Network 1980 cannot be achieved with the weights $w = \text{const} \cdot L^{-1}$, which are the most popular and used type of weights in the adjustment of geometric levelling networks. Finally, it is illustrated that taking into account the above marks and applying an appropriate adjustment algorithm, the mean of the standard errors of the adjusted heights of the nodal benchmarks in the analysed network is possible to be less than 1mm. The standard error of the adjusted height of the most remotest benchmark “Pushkarov”, which is 598 km far away from the datum point located in Varna, is equal to 1.40mm. The obtained from the adjustment mean standard error for the weight unit is estimated to be $0.164 \text{ mm}/\sqrt{\text{km}}$. In comparison, the adjustment mean standard error for the weight unit, but yielded by the classical approach of adjustment of the analysed network, is $1.289 \text{ mm}/\sqrt{\text{km}}$ or almost 9 times higher. Despite being tedious and time-consuming, it is not on point of discarding the precise geometric levelling as a main geodetic method for solving of a couple of scientific and engineering tasks, where differences in heights have to be determined with the highest accuracy.

AN ALGORITHM FOR ADJUSTMENT OF GEOMETRIC LEVELLING NETWORKS

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ABSTRACT

The natural way to reduce the duration of measurement of a levelling network is to cut down on the number of levelling lines without damaging the quality of the final results. The main objective of the study is to demonstrate that this is possible without any lack of accuracy, if some mathematical facts regarding the average of both measurements of the line elevations are taken into account. Based on 60 paired random samples of size 1000, derived from different continuous distributions, e.g., $N(0, 1)$, $U(-1.732, 1.732)$ and $\text{Gamma}(1, 1)$, each of them with theoretical standard deviation $\sigma=1$, it was found that the averages of each pair form new distribution with standard deviation $\sigma\approx 0.707$. However, the samples, which were formed by selecting the nearest to the known theoretical expectation from both measurements and their average have distributions, which standard deviations tend to $\sigma\approx 0.53$, $\sigma\approx 0.46$ and $\sigma\approx 0.43$ for the $U(-1.732, 1.732)$, $N(0, 1)$ and $\text{Gamma}(1, 1)$ distributions, respectively. Therefore, if we choose the more appropriate value from the “first”, the “second” measurement and their average, we will increase the accuracy of the network almost $\sqrt{2}$ times in comparison to the accuracy, yielded by the only use of the averages. If our network contains n lines, the process of finding of these elevation values, which lead to the best fit of the network, is based on 3^n single adjustments of the network. In addition, we can minimize the impact of the shape of the network on the final standard errors of the adjusted heights or geopotential numbers of the nodal benchmarks in the network, if we apply some iterative procedures, e.g., Inverse Distance Weighting (IDW), Inverse Absolute Height Weighting (IAHW), etc. In order to check the above explained algorithm, the Second Levelling of Finland network was adjusted in three variants. In the first variant, the whole network was adjusted as a free one. The classical weights $w=L^{-1}$ were used. In the second variant, the network was separated into two parts. Applying 3^{12} and 3^{14} independent adjustments, the selection of the best fitted values of line elevations was done and the network was adjusted by using them. The IDW and IAHW with power parameter $p=5$ were finally applied. In the third variant, the network was separated in four parts. Applying 3^{13} , 3^{12} , 3^{16} and 3^{12} independent adjustments, the new selection of the line elevations was done and the network was adjusted by them. The IDW ($p=6.5$) and IAHW ($p=6$) were executed. Comparison of the standard errors of the adjusted geopotential numbers in the separate variants revealed that there was no statistically significant difference between the results, yielded in the second and the third variant. However, these variants produced 3-5 times increase of the accuracy in comparison to the classical first variant. The best results were obtained in the second variant with IAHW, where the mean value of the standard errors of the adjusted geopotential numbers is below $1,4 \cdot 10^{-3}$ gpu.

PRECISE GEODETIC SETTING OUT ACTIVITIES IN THE CONSTRUCTION OF ENGINEERING STRUCTURES WITH ORIENTATION IN PREDETERMINED DIRECTION

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ABSTRACT

In the construction practice, there are engineering structures, where some complex requirements in the process of their building have to be met, e.g., their positioning, geographical orientation and geometric determination. The current publication examines the specificity of geodetic activities (in) regarding the orientating of the main construction axes of the foundation and the supporting structures of the terrestrial telecommunication antennas in a predetermined direction, for example, in the parallel direction to the geographical meridian. The focus is on the assessment of the accuracy and the choice of appropriate methods and equipment in order to create the required geodetic network, as well as to perform accurate setting out works. The combination of demands, namely for a specific geographic orientation and precise relative accuracy of the setting elements, implies a suitable transition from the ellipsoidal geodetic coordinates to the projection plane of the setting out project. In this connection, the influence of the meridian convergence on the accuracy of the planning setting out works is examined. A mathematical approach is proposed to assess the need of elimination of this factor, depending on the value of the constructional tolerance and the geographic location of the site. The necessary precision for determining the geodetic ellipsoidal coordinates by GNSS (Global Navigation Satellite System) measurements as well as the required accuracy of the planning and elevation setting out works are shown. Using different geodetic methods and tools, a preliminary accuracy assessment approach and the choice of the appropriate coordinate projection and height reference system is also proposed. The real data, which were obtained in different Earth's locations by the explained methodology, are presented. The established geodetic networks provide orientation of the main construction axes of the bases of the terrestrial communication antennas in the parallel direction to the geodetic meridian with an azimuth standard error - $M_A = \pm 2\div 5'$ (minutes) and allowable error in distances and elevations of the setting out elements, respectively - $M_{ds} \leq \pm 3 \text{ mm}$, $M_{dh} \leq \pm 2 \text{ mm}$.

APPLICATION OF PREDICTIVE RELATIONSHIPS OF SWELLING EFFECTS FOR ROADBEDS

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ABSTRACT

Impact of swelling can be observed in a wide range of civil and engineering structures. In the case of swelling in the subsoil of roadbeds, the destruction of the road pavement in cuts or collapse of slopes of cut is a frequent occurrence. Problems with deformation from swelling can also occur in the case of bridge abutments based on pile trestles. The unpleasant fact is that the impact of swelling can occur even after a long time. In the case of roads, high swelling pressures can lead to total destruction of the structure of the pavement even after years of operation. The susceptibility of soil to swelling can be described using swelling parameters. These parameters can be measured directly in the laboratory and in situ or indirectly estimated from empirical correlations. The paper describes the prediction of swelling processes using indirect measurements based on the methodology "Identification and solution of problems of soils prone to swelling" certified by the Ministry of Environment of the Czech Republic.

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LOCATING GRATE INLETS TO ENSURE EFFECTIVE DRAINAGE OF STREETS IN THE PROCESS OF DESIGNING STREETS AND GRADING PLANS IN BULGARIA

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ABSTRACT

This study analyses the existing requirements and standards for determining the locations of grate inlets on streets in Bulgaria. Effective drainage in street design is essential for managing stormwater runoff and preventing urban areas from flooding during heavy rains. To choose optimal locations of grate inlets plays a crucial role in this process. Solving this task is related with designing street slopes in grading plans and designing sewer systems. This article presents an approach, based on successful practices used in the USA and Australia, by proposing a hydraulic based procedure for locating grate inlets in the design process. The technique is adopted to all Bulgarian requirements and standards. As a main criterion it is suggested to use the maximum allowable water spread on the pavement of the traffic lanes. The proposed method considers various factors, such as longitudinal and cross slope, size of grate inlet, design frequency period, intercepted and bypass flow. It starts with determination of the grate inlet locations on continuous grade, then incorporates the specific sag points in vertical curves and intersections. It can be used in the process of designing streets and their grading plans to optimize the drainage efficiency of streets in Bulgaria. It is hydraulic reasoned, very flexible, and easy to apply for different street sections with different features. Implementing this approach can solve the problem of unclarity in locating grate inlets in Bulgaria. Also, the presented procedure could be used as a base to fill gaps in the existing Bulgarian regulations and manuals, related to the drainage of streets in urban areas.

EVALUATION OF U-NET TRANSFER LEARNING MODEL FOR SEMANTIC SEGMENTATION OF LANDSLIDES IN THE COLOMBIAN TROPICAL MOUNTAIN REGION

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ABSTRACT

Landslides in tropical regions present unique challenges and pose significant risks due to the interplay of various factors. The combination of intense rainfall, steep slopes, and geologically complex terrains found in some tropical regions, as Colombian Andean region, can contribute to heightened landslide susceptibility. The inventory of morpho-dynamic processes plays a relevant role in establishing the relationship between the conditioning factors and the likelihood of landslides. A comprehensive understanding of the spatial extent of historical and current landslide activity, represented through a landslide inventory map, is crucial for effective management of landslide risks, especially in tropical mountainous regions. Satellite-derived high-resolution data is frequently employed to map landslides by identifying morphological features associated with past and/or recent deformation. However, this process can be time-consuming, challenging, and often relies on extensive manual efforts, limiting the availability of landslide inventories in affected regions. In recent years, Deep Learning (DL) models, particularly Convolutional Neural Networks (CNNs), has emerged as a powerful technique for a wide range of remote sensing applications involving High Resolution (HR) imagery. These applications include classification, segmentation, and object detection. However, despite the significant advancements in DL and CNNs, their utilization in landslide detection remains relatively limited in the literature. In this study, we evaluate the potential of a deep transfer learning architectures as U-Net for automated landslide detection using spectral information from the optical satellite imagery (RGB bands), two DEM-derived geo-indices (slope and curvature), and two Synthetic Aperture Radar (SAR) layers (VV amplitude, pre -and-post landslide event in May 2015) through three image models (3, 5 and 7 bands). In the first place, we stack data in a multi-band images. Then, the deep transfer learning model is trained in the “La Argelia” river basin in the Pacific region in Colombia, and finally, the trained model is evaluated in the “La Liboriana” river basin in the western zone of the Andean region. Once obtained the landslide within the inference area, the results were validated considering the conformity between the landslide inventory and the results of segmentation applied method. According to the results, we obtained good performance (F1-score in the order of 0.70) of the U-Net model for landslide detection purposes as has been validated in other geographical contexts. In conclusion, by harnessing the power of DL models and leveraging the detailed information provided by fusion of free high resolution satellite imagery, topographical and SAR data, it becomes feasible to achieve a comprehensive space-time mapping of landslides. This advancement holds the potential to significantly enhance the accuracy and effectiveness of landslide mapping processes, enabling a more holistic understanding of the temporal dynamics associated with these natural hazards.

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**DIGITAL MODELLING TO PREDICT THE LAND SLIDING HAZARD IN A SELECTED AREA:
PONZANO'S (ITALY) TEST CASE**

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ABSTRACT

Creating a digital model is one of the aim of the geotechnical engineer, to predict the land sliding hazard which occur in different regions in the world. In February 2017, an extensive landslide occurred in the hamlet of Ponzano as a sloped area in the Abruzzo region in Italy. In this regard, predicting the land sliding hazard is one of the important issues to prevent hazard to the civilizations. In this project we created a model in the 3D dimension through the Plaxis 3D numerical solution software from the data based of the region Abruzzo in 2007 to evaluate the land sliding hazard before happened and then compare the results with the data from the drone data surveyed recently in the 2022. In this regard, the data from the Abruzzo resources from 2007 imported into the QGIS as the open-source cross-platform software to analysis the geospatial data and then imported into the Recap software to work on the point cloud data and then imported into the Civil 3D software to create a solid surface from the TIN surface and finally since the solid surface contains a large number of irrelative details, they were imported into the Rhinoceros software to create a NURBS surface to be smoothed for better performance in the analysis. The NURBS surface imported into the Plaxis and all of the geometry and geotechnical engineering parameters by considering the investigated geotechnical survey that was conducted in parallel in the area, defined for the model. The “Hardening Soil” model considered for the 1st layer as the “clay and lime” and the “Hoek-Brown” model defined for the 2nd layer as the “marl-flysch”. A fine mesh elements distribution assessed also for the model. The phases defined as the “gravity” to define the unit weight of the soil layers, the “plastic” phase to calculate the instant deformations and the “consolidation” to analyze the plastic deformations in the sloped area of the model. In parallel, the drone data achieved in 2022, were imported into the CloudCompare as the 3D point cloud processing software and different methods such as the “segment”, “statistical outlier Filter”, “CSF filter”, “noise filter”, “cross section” etc. were performed to clean the data and then imported into the Recap software to work on data and then imported into the Civil 3D software to create solid surface of the current data after the land sliding. In this regard, to evaluate the displacement occurred from the year 2007 toward the 2022, a TIN volume surface as the colored map created through the Civil 3D software to show the displacements in the z direction and all of the results were compared with the Plaxis 3D numerical solution software. The results showed that the colored map with the displacement in the positive and negative direction of the z is the same of the analyzed model and the values match each other's and we created a digital model of the slected area to predict the land sliding hazard in the region in the following.

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THE INFLUENCE OF THE APPLICATION OF SOIL CONDITIONERS ON THE TEMPERATURE AND MOISTURE OF THE SOIL ENVIRONMENT

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ABSTRACT

In cities, environmental and social impacts are increased every year due to high temperatures due to the heat island of the city. An effective struggle against the heat island of the city is the green infrastructure, where woody plants such as trees and shrubs play an irreplaceable role. Wood in the city is affected by a number of stress factors, especially high temperatures and lack of precipitation. In order for them to perform all their important functions and help reduce the negative impacts of the city's heat island, all requirements for their successful development and growth must be fulfilled. Soil conditions are an important factor affecting the condition of trees. Unsuitable soil conditions which include lack of water, compacted soil, result in insufficient development of the root system which directly affects the quality of the above-ground part of the plants. A possible treatment to improve the soil environment in the root zone of trees is the use of soil conditioners applied in the form of soil injection. The paper deals with the effect of soil conditioners (Hydrogel[®], mycorrhizal mix Endomyk PROF + Trichoderma, and their combination) in the form of injection on the temperature and humidity conditions of the soil environment in a young plants of trees (species) *Acer campestre* L. in the city of Znojmo (South Moravia region). Plants without application of any preparation served as a Control variant. Before the actual application of conditioners MINILOG data loggers with temperature sensors and VIRRIB moisture sensors were placed in the soil which recorded changes in soil temperature and volumetric soil moisture in six-hour intervals every day in the period from February 2021 till December 2022. These changes were recorded in two profiles 0.1 - 0.4 and 0.4 - 0.7 meters. From the recorded results, it can be said that the application of soil conditioners had a significant effect on the temperature and humidity conditions of the soil environment. The variant with the soil conditioner Hydrogel[®] and the variant with the soil conditioner Hydrogel[®] in combination with the mycorrhizal mix in most cases show higher values of soil moisture and temperature compared to the Control variant. This trend is most evident in the soil profile of 0.4 - 0.7 m in the growing season.

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THE EFFECT OF WATER CONDITIONS ON COLUMN PERFORMANCE IN LIME COLUMN APPLICATIONS

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ABSTRACT

Lime column technique is one of the common methods used to stabilize problematic clayey soils. The stabilization mechanism of this technique is based on ion migration from the lime column. There are many factors effecting ion migration in lime column applications. Water content and water flow are the most important ones among these factors. Even though there have been some studies searching the influence of water on ion migration, there is no an agreement on its effects on column performance in the literature. In this study, the effect of water conditions on lime column performance when stabilizing soils with lime column technique was investigated. For the purpose of the study, 4 small scale laboratory models were created under different water conditions. In all the models, the soil was compacted at its optimum water content. In the first model, no water inlet was provided to the model. In the second model, water entrance was provided only from the upper part of the model. In the third model, water was added only to the lime column. And in the last model, the model was submerged during the curing time which means the soil was saturated with water. After a curing time of 2 months, ion migration distances from the lime column in the models were determined using an acid base indicator named phenolphthalein. The results showed that the biggest ion migration distance was acquired with the saturated condition and then with the water addition to the column. And the condition with no water inlet provided the smallest ion migration distance.

ACCURACY ANALYSIS OF AIRCRAFT POSITION PARAMETERS PROVIDED BY GCA 2000 AIRPORT SURVEILLANCE RADAR

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ABSTRACT

Radars are one of the most important instruments used to provide air traffic control. With the use of radar, it is possible to detect an object and determine its position. The aim of this article is to investigate the accuracy of determining the position parameters of an aircraft by the GCA 2000 airport control radar located at Dęblin Airport (EPDE). In order to analyse the accuracy of determining the position of an aircraft by the GCA 2000 radar, a research flight was carried out. The position of the aircraft was recorded by the GCA 2000 radar and the Thales Mobile Mapper Pro GPS receiver on board the aircraft. The resulting position parameters were compared with each other to investigate the accuracy of the radar's coordinate determination. In addition, a number of analyses and comparisons were performed to determine the reasons for the interruptions in the radar detection of the aircraft. Based on the study, it can be concluded that the GCA 2000 radar located at Dęblin airport meets the requirements set by the International Civil Aviation Organisation (ICAO) for radar performance. According to ICAO, the standard deviation of the distance error should be 70 - 130 metres and the azimuth error for primary radars should be 0.15 - 0.2°, and for secondary radars 0.2 - 0.3°. The standard deviation of the distance error during a research flight by the GCA 2000 radar is 81.1 metres and the standard deviation of the azimuth error is 0.19°. The distance of the object from the radar antenna has a very strong influence on the accuracy of position determination. At a distance of about 45 kilometres from the radar, the position determination error started to increase significantly, which also occurred when making turns at a distance of about 35 kilometres. The largest value of the position coordinate determination error occurred at a distance of approximately 45 kilometres from the radar when the turns were made. The smallest error values were observed during straight flight up to a distance of approximately 35 kilometres. The flight altitude between 200 and 800 metres above the antenna of the GCA 2000 radar has no significant impact on the accuracy of position determination. The occurrence of gaps in the detection of the aircraft by the GCA 2000 radar was influenced by the terrain along the route of the research flight. During departure, the aircraft was flying over terrain higher than the elevation of the radar site. Interruptions in detection only occurred at distances greater than 45 kilometres from the radar when there were changes in terrain. On arrival at Dęblin airport, the occurrence of detection gaps may have been influenced by changing terrain and the presence of a river along the flight path. The occurrence of aircraft detection gaps is influenced by the location of the EPDE aerodrome in a valley and the presence of the Vistula River. Interruptions in detection occurred during changes in terrain and when the radar signal path crossed a river.

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NEW CONCEPT OF MULTIFUNCTIONAL DETECTOR FOR EXPLOSION AND IRRADIATION IDENTIFICATION

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ABSTRACT

The problems of protecting any facility from the threats primarily requires rapid and accurate identification of the event and the transmission of information to the appropriate address, which will activate the protection systems / rescue services and bring the facilities into emergency mode. There are various methods for detecting explosions, fires and radiation. Detectors based on them, manufactured by leading companies operating in the world market. They work mainly independently, in an autonomous mode, and to provide complex protection from these threats requires the installation and service of various types of detectors and devices, which significantly limits their areas of application and capabilities. Therefore, development of new type identification system for detecting explosions, toxic gases, and radiation, still remains as a priority. According to literary sources, Expert conclusions and analysis of the current situation show that the reliability and speed of the systems used in explosion and fire detection do not meet modern requirements, there are frequent cases of methane explosion. The effects of neutron and gamma radiation on the environment during exposure to fires and explosions are particularly dangerous. The concept of modern identification system is developed within the frame of the current project/work. Information-communication system structure is aimed to contain the main following knots: pressure, flame, smoke sensors; temperature sensors; Gamma and neutron radiation sensors; Precision amplifier of sensor signals, modulator of amplitude-frequency characteristics of sensor channels, microprocessor analysis of signals with a known algorithm, creation of an electronic image of the environment and reception of appropriate digitally encoded signals at the output; digital library/database for comparisons; Relevant rescue service notification system; Radio frequency data transmitter; Activator of appropriate protection systems; Ventilation system; Fire system; Explosion neutralization system; Radio frequency data receiver; Activator of appropriate protection systems; Ventilation system; The developed system will be designed and assembled in the laboratories of Georgian Technical University and will be tested at multipurpose experimental base at G.Tsulukidze Mining Institute of Georgia.

This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) [grant number FR-22-4193]

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USING THE GROUND-PENETRATING RADAR METHOD IN THE STUDYING OF HYDROCARBON-CONTAMINATED SOIL IN NAVODARI AREA-ROMANIA

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ABSTRACT

Ground penetrating radar (GPR) is a very useful geophysical method for use in hydrogeologic and near-surface mapping studies. It can be used to study contaminants in groundwater, subsurface faulting, and underground cavities (natural or man-made), all of which pose potentially dangerous geological hazards. The GPR technique is similar in principle to seismic reflection and sonar techniques. The propagation of the radar signal depends on the frequency-dependent electrical properties of the ground. Electrical conductivity of the soil or rock materials along the propagation paths introduces significant absorptive losses which limit the depth of penetration into the earth formations and is primarily dependent upon the moisture content and mineralization present. Reflected signals are amplified, and transformed to the audio-frequency range, recorded, processed, and displayed. From the recorded display, subsurface features such as soil/ soil, soil/rock, and unsaturated/saturated interfaces can be identified. In addition, the presence of floating hydrocarbons on the water table, the geometry of contaminant plumes, and the location of buried cables, pipes, drums, and tanks can be detected. The GPR data are presented as a two-dimensional depth profile along a scanned traverse line in which the vertical axis is two-way travel time measured in nanoseconds. The location of hydrocarbon contamination in the ground using the GPR method is based mainly on information taken from reflected signals. In the cases investigated in Romania contaminated sites (Navodari area), such signals were very rarely recorded. A long time after spillage, contamination takes the form of plumes with different size and distribution, which depends on the geological and hydraulic properties of the ground. The survey discussed in this paper was carried out using the GPR system-Noggin with two antennas (250 and 500mHz) Data collected were processed using software (EKKO_Project™ GPR Data Analysis) to produce 2D radargram in time scale. The presence of contaminant plumes as well as the water table are observed in the GPR sections at depths approximately of 0.5 to 1.5 m. In the GPR section, the oil contaminated layer exhibits discontinuous, subparallel, and chaotic high amplitude reflection patterns. Promising results were also obtained in the GPR survey where three obvious reflection patterns representing the top sand-silt layer, oil-contaminated zone and, the underlying thick soft clay were detected in all 2D radargrams of the GPR traverse lines.

OPTIMIZATION OF A BOAT TRAJECTORIES ESTIMATION IN INLAND WATERS USING DATA MINING METHODS BASED ON CROWDSOURCED DATA

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ABSTRACT

The safety of navigation on inland water bodies is a crucial factor impacting the development of modern nautical tourism developments. The availability of up-to-date, reliable information and the use of this information to determine a safe, tourist-attractive route is an important factor affecting the attractiveness of places, the number of tourists and, consequently, a region's economy. Mobile geo-information systems provide algorithms that allow water navigators to determine a boat's route considering many factors. They are based on bathymetric data, GIS databases, weather parameters, and POI databases. The dynamic development of crowdsourcing systems is leading to the increasing use of real-world information in addition to traditional data. Crowdsourcing is extensively used to collect data and generate information by large groups of users/contributors. The article shows the potential of using historical data for traffic planning on inland waters. We propose a mechanism that uses raw spatio-temporal data (the movement trajectories of users of one of the navigation applications) to analyze the behavior, checking the influence of time, weather, POIs, and events held in the area, and the location of a tourist attraction on the directions of users. The approach takes raw trajectory datasets as input and analyzes them using data mining techniques. In addition, we have extracted some patterns and rules to optimize the algorithm for determining a new route for a succession of users. The tests showed the model's usefulness in content presentation during navigation and nautical tourism purposes.

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PALEOGENE RUS FORMATION, AL-AIN, ABU DHABI: FACIES CHARACTERISTICS OF COMPONENT MEMBERS, WITH EMPHASIS ON CLARIFICATION OF THEIR SEDIMENTARY ENVIRONMENTS

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ABSTRACT

The Paleogene carbonates of the Jabal Hafit area, south of Al-Ain, United Arab Emirates, include the Rus Formation at the base of the sequence. Recent detailed stratigraphic re-investigation of the Rus Formation has revealed that this Lower Eocene unit can best be divided into three component members. These are the Mubazzara Member, Wadi Tarabat Member and the Hili Member. The Mubazzara Member appears to be constrained to the northern part of the Jabal Hafit area, and passes southwards by facies changes into the Wadi Tarabat Member. The Hili Member overlies the other two members. The Mubazzara Member is composed of commonly nodularized micrites with notable dolomitization, and frequent disseminated chert nodules. Its lithofacies include lime mudstones and wackestone/packstones with sparse fauna of small benthonic foraminifera (Nodosaria, Triloculina), echinoid spines, sponge spicules, ostracods, bryozoans and planktonic foraminifera. A characteristic feature is the abundance of tiny limonite particles. The Wadi Tarabat is distinctly white crystalline limestone (packstone/grainstone) with abundant typically micritized macrofossils (Nummulites, Discocyclus, Alveolina, corals, gastropods, echinoids, dasyclad algae) and oolites. The Hili Member has variable lithofacies, including Nummulitic packstones with shell fragments, dolomitized poorly fossiliferous wackestones; and intraclastic oolitic grainstones showing profound micritization of miliolids. The Hili is also distinguished by abundance of microstylolites, pseudoconglomeratic fabrics and minor silicification. The paleoenvironmental interpretation is an inner shelf lagoonal environment for the Mubazzarah Member, which was limited southwards by a mid-shelf shoal for the Wadi Tarabat Member. The Hili Member occupied an inner to middle ramp environment.

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GYPSUM IN FLUVIAL DEPOSITS OF THE UPPER NEOGENE IN CENTRAL POLAND

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ABSTRACT

The poster is dedicated exclusively to gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). It is the most common sulphate mineral, especially in sediments of marine origin. As an evaporite, it is most often associated with halite, anhydrite, sulfur, calcite, and dolomite. However, gypsum can also occur in terrestrial (fluvial) sediments. More precisely, gypsum has been identified both on a macro- and micro-scale within the so-called 'Poznań Clays', which end the lithostratigraphic profile of the Neogene in the Polish Lowlands. All samples and macrophotographs were collected at three sites located in central Poland: Wysoka, Dymaczewo Stare, and Józwin IIB. In order to identify gypsum, powder X-ray diffraction (PXRD) and scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS) were mainly applied. The PXRD method was used to determine the mineral composition of the bulk sample. The SEM technique allowed to present the surface structure of the studied sample at a great magnification, whilst the EDS analysis provided its surface chemical composition in a micro-area. Well-crystallized gypsum (SEM) is widely present in some samples of the 'Poznań Clays' and is confirmed by its chemical composition (EDS). In the case of the Wysoka and Dymaczewo Stare sites, gypsum was also found macroscopically. Its crystals have both single and 'twin' various shapes. In conclusion, gypsum does not occur in all samples and is not the main mineral of the 'Poznań Clays', which are of fluvial origin and of latest Mid-Miocene–earliest Early Pliocene age (ca. 14.3–5 Ma). Nevertheless, if gypsum is present in the sediment, it can be easily identified on a micro- and macro-scale. In both cases, it is well crystallized and takes forms ranging from single to various 'twins', as shown in the photographs.

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**Brief Characterisation of Ochre from the Marta Adit
(Nižná Slaná, Spiš-Gemer Ore Mts., Eastern Slovakia)**

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ABSTRACT

The contribution deals with the study on composition of ochre sample from the Marta adit at Nižná Slaná. Three samples were prepared from ochre by hand picking and screening, which were subjected to GA, AAS, XRF and XRD. Salts precipitated on surface at drying contain 17.7 % S (53 % as SO₄), 16.5 % MgO, 13.6 % Fe₂O₃, 3.54 % CaO and 1 % MnO. As to mineral composition, sulphates such as gypsum, starkeyite and rozenite are dominant. The fraction of grain size under 250 micron contains 30 % Fe₂O₃, 28.6 % SiO₂, 8 % Al₂O₃, 6.6 % CaO, 2.9 % MgO and 1.95 % S. Notable is content of arsenic in this fraction, which attain as high as 1.84 %. Quartz and gypsum occur as dominant crystalline phases. As to coarser fraction, i.e. under 150 microns, 44.5 % SiO₂, 16.8 % Fe₂O₃, 11.3 % Al₂O₃, 6.9 % CaO, 2.4 % MgO a 2.3 % C were assayed. Dominant quartz is accompanied by mica, plagioclase, ankerite and dolomite. It was shown that arsenic is bonded in finer grain size fraction.

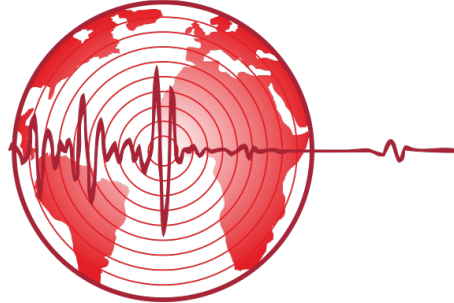
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