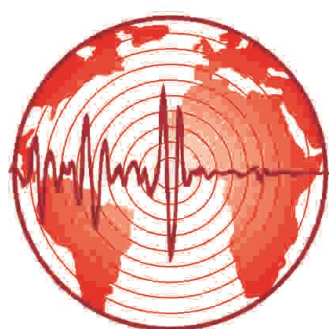




WMESS 2019

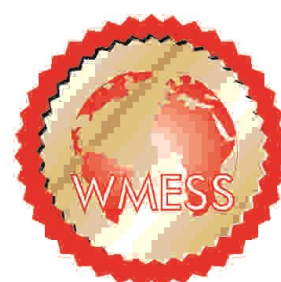
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ABSTRACT COLLECTION BOOK

SEPTEMBER
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Preface

This Abstract Collection consists of the abstracts of papers presented in the “World Multidisciplinary Earth Sciences Symposium – WMESS 2019” in the city of romance Prague (Czech Republic) during 09-13 September 2019. 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 2019 was the 5th 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 2019 from different countries all over the world for their interests and contributions in WMESS 2019. We wish you enjoy the World Multidisciplinary Earth Sciences Symposium – WMESS 2019 and have a pleasant stay in the city of romance Prague. We hope to see you again during next event WMESS 2020 which will be held in Prague (Czech Republic) approximately in the similar period.

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Content

THE AQUIFER RECHARGE POTENTIAL BY INFILTRATION TESTS IN ARID REGION, RAS AL KHAIMAH, UNITED ARAB EMIRATES

Ahmed Murad, Saber Hussein, Hasan Arman, Amir Gabr, Abdulla Al Dhuhoori

ANALYSIS OF IMPLEMENTATION CONDITIONS UNDER DIFFICULT GEOTECHNICAL CONDITIONS USING SWOT

Marcin Gajzler, Piotr Nowotarski

STUDY THE INFLUENCE OF DISCONTINUITIES AND MARLY INTERCALATION ON THE STABILITY OF QUARRIES BY DIFFERENT METHODS

Abderrazak Saadoun, Abdallah Hafsaoui, Mohamed Fredj, Riadh Boukarm, Radouane Nakache

AMBIENT SEISMIC VIBRATION IN THE RUPTURE ZONE NEAR THE CAP MATIFOU FAULT SCARP (ALGIERS)

Machane Djamel, Bensalem Rabah, Oubaiche El Hadi, Moulouel Hakim, Bouchellouh Assia

DETECTION OF THE TARGET OBJECTS FROM SHADOWED IMAGE IN GPR RECORDS

Chih-Hsiung Chang, Young-Fo Chang, Wen-Luh Huang, Jia-Wei Liu

USING MICROTREMORS TO EVALUATE THE SEISMIC VULNERABILITY INDEX IN BLIDA CITY (NORTHERN ALGERIA)

Assia Bouchelouh, Bensalem Rabah, Oubaiche El Hadi, Djamel Machane

GEOLOGIC RISK (EARTHQUAKES, LANDSLIDS, ROCKFALLS, ETC.) IN NORTH CENTRE -WEST OF ALGERIA (ZERALDA-TIPAZA)

Louni Chahira, Belhai Djelloul, Sadou Ouassila

ROCK SLOPE STABILITY ANALYSIS WITH A KINEMATICAL METHOD FOR THE NAM PHOUN DAM SITE PROJECT, LAOS

Djohn Josia Weaver Mboussa, Shulin Sun, Yan Zhang, Hartman Issombo Elenga

THE EFFECT OF A VARIABLE AMOUNT OF NANOPARTICLES ON THE PROPERTIES AND STRUCTURE OF CONCRETE

Janusz Konkol, Wioleta Iskra-Kozak, Grzegorz Prokopski

ANALYSIS OF THE TENDANCY EVALUATION COMPLEX OF THE CAMBRIAN RESERVOIR « Ra » 1A ZONE, HASSI MESSAOUD AREA, ALGERIA

Rabah Chaouchi, Ayoub Bakel, Moussa Sadaoui, Soumya Benayad

REMEDIATION OF DAMAGED WELL BY DRILLING MUD IN THE SIEGENIAN RESERVOIR, BIR BERKINE REGION, SAHARIAN PLATFORM, ALGERIA

Rabah Chaouchi, Soumya Benayad, Moussa Sadaoui, Abdelhak Bentriou

PREDICTING WEATHERING CHARACTERISTICS OF CARBONATE ROCKS UNDER DIFFERENT GEO-ENVIRONMENTAL CONDITIONS

Hasan Arman, Saber Hussein, Haneen Edhar Y Abouhaligah, Malaz Osman, Moza A Baloch, Diab Bakri Abdelrahman Hag, Hamdan Abdo Ali Algaishi

EXPERIMENTAL MONITORING OF MOISTURE CONDITIONS IN THE VARIOUS TYPES OF TRACK BED STRUCTURE

Juraj Pieš, Libor Ižvolt, Peter Dobeš

NUMERICAL MODELLING OF PLATE LOAD TESTS ON UNSATURATED SILT LOAMS IN LABORATORY STAND

Miroslav Broucek, Pavel Kuklik

UNFAVOURABLE SEISMIC BEHAVIOUR OF REINFORCED CONCRETE STRUCTURES DUE TO SOIL STRUCTURE INTERACTION

Mircea Barnaure, Daniel Manoli

ESTIMATION OF THE DYNAMIC CHARACTERISTICS OF THE FOAM CONCRETE

Veronika Valašková, Jozef Vlček, Marian Drusa

A PLASTIC MODEL BASED ON THE BOUNDING SURFACE FORMULATION FOR CYCLIC BEHAVIOR OF SOIL

Yan Zhang, Shulin Sun, Djohn Josia Weaver Mboussa

RESEARCH ON VERTICAL DISPLACEMENTS THE EXPERIMENTAL SECTION OF RAILWAY SUBGRADE WITH SPATIAL GEOMAT STRENGTHENING

Andrzej Surowiecki, Jarosław Rusin

EXPERIMENTAL STUDIES OF A SOIL WEDGE THE PHYSICAL MODEL RETAINING WALL MADE WITH REINFORCED SOIL

Andrzej Surowiecki, Jarosław Rusin

THE SURFACE WAVE ATTENUATION AS THE EFFECT OF VIBRATORY COMPACTION OF BUILDING EMBANKMENTS

Aneta Herbut, Marat M. Khairutdinov, Cheynesh Kongar-Syuryun, Jarosław Rybak

THE IMPACT OF RAPID IMPULSE COMPACTION OF LARGE NON-COHESIVE MATERIAL DEPOSITS ON SURROUNDING AREA

Przemysław Dobrzycki, Alexander L. Ivannikov, Jaroslaw Rybak, Vlada O. Shkodkina, Yulia Tyulyaeva

CORRELATION BETWEEN ELECTRICAL RESISTIVITY AND SUCTION FOR UNSATURATED COASTAL SALINE SOIL

Li Fang, Sun Shulin, Zhang Deheng

DAMAGE TO ROAD PAVEMENTS IN THE AREA OF LINEAR DISCONTINUOUS DEFORMATIONS ON THE SURFACE CAUSED BY DEEP MINING

Marcin Grygierek, Magdalena Zięba

IMPACT OF MINING EXTRACTION ON ABOVE-GROUND PIPELINES

Piotr Kalisz

FOUNDATION OF THE BUILDING ON SHORT CONCRETE PILES IN A THIN LAYER OF NON-COHESIVE SOILS

Piotr Gąska, Grzegorz Straż

EVOLUTION OF THE PHYSICO-CHEMICAL QUALITY OF THE GROUNDWATER OF KHEMIS MILIANA PLAIN - ALGERIA

Sadeuk Ben Abbas Abdelkader, Meddi Mohamed, Boucefiane Abdelkader

HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF GEOTHERMAL WATERS IN IVRINDI-ILICA-GUMELI (BALIKESİR) AND ENVIRONS, TURKEY

Nevzat Özgür, Enver Kermenr

HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF GEOTHERMAL WATERS IN THE AREA BETWEEN GÜVENDİK ANA MALGAÇEMİR (AYDIN); WESTERN ANATOLIA, TURKEY

Nevzat Özgür, Seda Zehra Tekkenat

HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF THE GEOTHERMAL WATERS OF BAKLACI VILLAGE (ALAŞEHİR, MANISA) AND ENVIRONS, TURKEY

Nevzat Özgür, Ezgi Yürük Anılır

THE CHANGES OF WATER BALANCE IN THE EASTERN SLOVAKIA

Marcel Garaj, Pavla Pekárová, Pavol Miklánek, Ján Pekár

USE OF GRACE AND RELEVANT REMOTE SENSING DATA TO ESTIMATE SPATIAL AND TEMPORAL CHANGES IN WATER STORAGE OVER THE NUBIAN SANDSTONE AQUIFER SYSTEM, WESTERN DESERT, EGYPT

Safaa. M. Hassan, Bassam M. Abdellatif

HYDROTHERMAL SYSTEM CHARACTERIZATION BY GEOPHYSICAL METHODS: CASE OF HAMMAM RIGHA, ALGERIA

Amina Hocine, Lamine Hamai, Abdeslam Abtout

MULTIVARIABLE RELATIONSHIP WITH THE CHANGE OF SULPHATE CONCENTRATION AND DYNAMIC MODEL FOR THE WATER DEMAND OF THE HUAMBI PARISH, ECUADOR, SOUTH AMERICA

D. V. Carrera-Villacrés, C.A. Torres-Estupiñan, M.G. Barba-Revelo, J.E. Hernández-Pillajo, P.A. Monge-Franco, E.R. Guerrón-Varela

ASSESSMENT OF SOME HEAVY METALS IN GROUNDWATER OF AWE AND ITS ENVIRONS, PARTS OF NORTH-CENTRAL NIGERIA: IMPLICATIONS TO HEALTH

Gusikit, Rhoda Bernard, Haruna, Ahmed Isah, Dibal, Hyeladi Usman, Ajol Fube

PROPOSAL OF PREVENTION MEASURES AGAINST DROUGHT IN URBAN AREAS

Andrej Šoltész, Michaela Červeňanská, Katarína Živčicová, Jakub Mydla, Richard Honti

POSSIBILITIES OF DESIGN OF FLOOD PROTECTION MEASURES IN THE CATCHMENT

Andrej Šoltész, Lea Čubánová, Adam Janík, Dana Baroková

EVALUATION OF RAINFALL INTERCEPTION ON SOME SHRUBS OF ARID REGIONS

Mohammad T. Dastorani, A. Esmailpour Zarmehre, M. Farzam

TYPE A COMBINED MODEL OF WATER HARVESTING FOR RESIDENTIAL HOUSES OF DRYLAND ENVIRONMENTS: CASE STUDY OF MASHHAD, IRAN

Mohammad T. Dastorani

HYDROGEOLOGICAL, HDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF GEOTHERMAL WATERS IN YENICE (DENIZLI) AND ENVIRONS, WESTERN ANATOLIA, TURKEY

Mehmet Arıcı, Cihan Aslan, Nevzat Özgür

HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF GEOTHERMAL WATERS IN TEKKEHAMAM (SARAYKOY, DENIZLI) AND ENVIRONS, WESTERN ANATOLIA, TURKEY

Mehmet Arıcı, Abdülkadir Yıldız, Nevzat Özgür

HYDRO-CLIMATIC TRENDS IN MOUNTAIN CATCHMENTS (POLISH EASTERN CARPATHIANS)

Mariola Kędra

COMPARISON OF THE DISCHARGE AND FLOW VELOCITY VALUES DETERMINED BY ADV DEVICE AND INDICATOR METHOD

Radoslav Schügerl, Tatiana Kimličková

WATER OF ABANDONED MINES – VARIABILITY OF CHEMICAL COMPOSITION (BYSTRZYCA GORNA AREA, SW POLAND)

Magdalena Worsa-Kozak, Krzysztof Chudy

BRANCHING OF SHEAR ZONE: A POTENTIAL GROUNDWATER RECHARGE ZONE IN PRECAMBRIAN METAMORPHIC ROCKS

Tapas Acharya, Tamal Sur, Monalisa Mitra

INFLUENCE OF HIGH CAPACITY GROUND WATER PUMPING FROM A MULTIPLE WELL SYSTEM IN A HIGH YIELD UNCONFINED AQUIFER

Kristijan Grabar, Ivan Pažur, Filip Dodigović, Stjepan Strelec

HYDROGEOLOGICAL AND HYDROGEOCHEMICAL PROPERTIES OF GROUNDWATERS RECHARGING FROM DIFFERENT LITHOLOGICAL UNITS: THE GROUNDWATERS IN THE SOUTHEAST OF ÇUBUK DISTRICT, ANKARA, CENTRAL ANATOLIA, TURKEY

Seda Uçar, Özlem Öztekin Okan

GEOTHERMAL PERSPECTIVES OF LITOMĚŘICE SITE: WATER-ROCK INTERACTION STUDY OF THE GEOTHERMAL BOREHOLE PVGT-LT1

Jan Holeček, Jan Franěk, Jakub Trubač

GROUNDWATER EXPLORATION IN TROPICAL REGIONS USING GEOPHYSICAL METHODS: THREE STUDY CASES IN THE ISTHMUS OF PANAMÁ

Alberto Caballero, Arkin Tapia, Humberto Edward, Juan Cedeño, Mayubell Alvarado, Eduardo Camacho, José Villarreal, Carmelo Bayard, Mario Miranda, Orlando Leone, Anthony Rodriguez, M. Himi, Albert Casas

CONTRIBUTION TO THE KNOWLEDGE OF TEMPERATURE AND RESERVOIR DEPTH OF SULPHUROUS GROUNDWATER AQUIFER SYSTEMS IN THE DÃO RIVER BASIN, PORTUGAL

Teresa Catarina Gomes da Costa, Luis M. Ferreira Gomes, Alcino Sousa Oliveira

COMPARISON OF METHODS FOR CALCULATING MONTHLY FLOWS ON SMALL CATCHMENTS

Milan Čistý, Roman Výleta, Veronika Soldánová

DISPERSION PROCESS IN SEWER PIPES WITH SEDIMENTS AND DEPOSITS

Marek Sokáč, Yveta Velísková

HYDRAULIC COMPUTER ANALYSIS OF A RIVER SECTOR UNDER ALTERED FLOWING REGIME DUE TO AN EXISTING BRIDGE AND SUGGESTED SPECIFIC CORRECTION WORKS

Ioana - Alina Popescu-Bușan, Gheorghe I. Lazăr, Albert Titus Constantin, Șerban-Vlad Nicoară

NUMERICAL SIMULATION OF SEDIMENTS TRANSPORT ON A RIVER SECTOR AS DISTORTED BY A CROSSING STRUCTURE

Ioana - Alina Popescu-Bușan, Gheorghe I. Lazăr, Albert Titus Constantin, Șerban-Vlad Nicoară

NUMERICAL STUDY OF THE WATER DISCHARGE ON A FISH STEPPED PASSAGE AT A LOW HEAD DAM

Cristian Bratanovici, Ioana - Alina Popescu-Bușan, Gheorghe Lazăr, Albert Titus Constantin, Șerban-Vlad Nicoară

THE EFFECT OF GARDEN TRAACING ON REDUCING WATER TURBIDITY (CASE STUDY: MANSHAD WATERSHED, YAZD PROVINCE, IRAN

Ali Akbar Karimian, Ali Talebi

SIMILARITIES BETWEEN THE HAMMAM MELOUANE FAULT SYSTEM AND THE THENIA FAULT ZONE: SEISMOTECTONIC IMPLICATIONS

Moulouel Hakim, Ait Benamar Dalila

COPPER SORPTION CAPACITY ON NATURAL PEAT

Olga S. Naymushina, Zubakova E.A.

MAPPING OF INDUCED EFFECTS OF AN EARTHQUAKE IN THE REGION OF ALGIERS (ALGERIA) USING THE GEOGRAPHICAL INFORMATION SYSTEM GIS

Sadou Ouassila, H. Bourenane, C. Louni, N. Balla, A. Haddouche

EVALUATION OF THE SOLAR RADIATION IN A SEISMIC ZONE

Victorin-Emilian Toader, P. F. Biagi, Iren-Adelina Moldovan, Alexandru Marmureanu, Andrei Mihai

RISK CHARTER FOR MEDIEVAL DEFENSIVE EARTHEN ARCHITECTURE IN SOUTHERN SPAIN

Jesús Garrido Manrique, María Lourdes Gutiérrez-Carrillo, Emilio Molero Melgarejo

CAN URBAN FLOOD IMPACT BE MITIGATED THROUGH LAND USE PLANNING? A SPANISH CASE

Jesús Garrido Manrique, Teresa Muros García

INTEGRATED APPROACH TO UNRAVEL MECHANICS OF SLOPE FAILURE INDUCING LANDSLIDES IN DEBRE SINA AREA, CENTRAL HIGHLANDS OF ETHIOPIA

Tesfay Kiros Mebrahtu, Stefan Wohnlich, Michael Alber, Bedru Hussien, Andre Banning

CHANGES IN IDF CURVES OF SHORT-TERM RAINFALL IN MOUNTAINOUS AND LOWLAND AREAS OF SLOVAKIA

Silvia Kohnová, Gabriel Földes, Marija Mihaela Labat, Kamila Hlavčová

A COMPARISON OF CURVE NUMBER METHOD (SCS- CN) MODIFICATIONS AND THE APPLICATION OF MEASURES FOR SOIL EROSION REDUCTION AND FLOOD PROTECTION IN SMALL UNGAUGED CATCHMENTS IN THE WHITE CARPATHIAN MOUNTAIN IN SLOVAKIA

Viera Rattayová, Kamila Hlavčová, Marija Mihaela Labat, Silvia Kohnová

ANALYSIS OF GEODYNAMIC PROCESSES DEVELOPED IN GEORGIA

Avtandil Khvadagiani, E. Medzmariashvili, Z. Laoshvili, Sergo Khomeriki, Nikoloz Chikhradze, T. Kikava, G. Shatberashvili, Davit Khomeriki

THE RELATION BETWEEN RAINFALL INTENSITY AND LANDSLIDE OCCURRENCE IN COMPLEX HILLSLOPES

Ali Talebi, Parvin Zarei

EXPERIMENTATION THE HVSR SEISMIC NOISE METHOD ON THE OUED FODDA FAULT (CHLEF, ALGERIA)

Rabah Bensalem, Djamel Machane, El Hadi Oubaiche, Assia Bouchelouh, Hakim Moulouel, Jean-Luc Chatelain

PREDICTING EXTREME RIVER STAGE USING DIFFERENT APPROACHES WITH HISTORICAL AND SYNTHETIC TYPHOONS

Wen-Cheng Liu, Zhe-Young Zhou, Wei-Cher Huang, Hong-Ming Liu

RELATIONSHIP BETWEEN DROUGHT OCCURRENCE AND EL NIÑO PHENOMENON IN SOUTHERN PERU: A SPATIAL COPULAS ANALYSIS

Juan Walter Cabrera Cabrera, Jesús Abel Mejía Marcacuzci

PARAMETRIC ANALYSIS OF URBAN FLOOD RISK BASED ON 'SHALLOW WATER' MODEL; A REAL CASE AT SMALL SCALE

Antonio Pasculli, Jacopo Cinosi, Alain D'Ettorre, Nicola Sciarra

ANALYSIS OF MAXIMUM RUNOFF VOLUMES WITH DIFFERENT TIME DURATIONS OF FLOOD WAVES: A CASE STUDY ON TOPLA RIVER IN SLOVAKIA

Veronika Bačová Mitková, Pavla Pekárová

THERMAL CONDUCTIVITY PREDICTION FROM P-WAVE VELOCITY AND POROSITY ASSESSMENT FOR SANDSTONE RESERVOIR ROCKS

Abdel Moktader A. El Sayed, Nahla A. El Sayed

CALCULATION OF CEMENTATION EXPONENT AND MULTIPLIER USING P- WAVE VELOCITY AND POROSITY FOR SANDSTONE RESERVOIRS

Abdel Moktader A. El Sayed, Nahla A. El Sayed

HYDRAULIC - ELECTRICAL FLOW UNITS AND WATER SATURATION CALCULATION: DAM FORMATION, SOUTH WESTERN QATAR, ARABIAN GULF

Nahla A. El Sayed, Abdel Moktader A. El Sayed

SULPHATE ION INTERFERENCE ON OIL RECOVERY MECHANISM OF LOW SALINITY WATERFLOODING IN DOLOMITE RESERVOIRS

Chanapol Charoentanaworakun, Falan Srisuriyachai

INTEGRATED STUDY OF CAP ROCK EFFICIENCY: A CASE STUDY OF SANTONIAN ILAM FORMATION IN ABADAN PLAIN

Mehdi Qassamipour, Elnaz Khodapanah, Seyyed Alireza Tabatabaei-Nejad

STUDY OF CLEANING OF HORIZONTAL DRAINS DURING UNDER BALANCED DRILLING WELL IN THE SOUTH ALGERIA FIELDS

Khaled Benyounes, Abderrahmane Mellak, Amin Flih, Youcef Azizi

CHEMICAL COMPOSITION AND REE CONTENTS IN COALS AND BITUMINOUS SHALES FROM DİVRİĞİ- SELİMOĞLU COAL FIELD, SİVAS-TURKEY

Nazan Yalçın Erik

ABOUT THE MICROSTRUCTURE OF THE GRAPTOLITE PERIDERM - EXAMPLES FROM THE HOLY CROSS MOUNTAINS (POLAND)

Rafał Morga

**CHARACTERIZATION OF THE LOWER CLAY-SANDSTONE TRIASSIC RESERVOIR IN THE
STRUCTURE OF HASSI BERKINE NORTH-SOUTH - BERKINE BASIN- SAHARAN PLATE FORM
(ALGERIA)**

Khaled Loumi, Mosbahi, W., Asses, A., Kenane, S.

**DIAGENESIS OF THE CARBONATES AND ITS IMPACT ON THE POROSITY OF THE PLIENSCHACHIAN
RESERVOIR IN THE DJEBEL ANTAR (DAR1) SAHARA ATLAS - ALGERIA**

Khemissi Zellouf, Said Amrani, Youssouf Mohamed

**SEQUENCE STRATIGRAPHY OF THE CAMBRIAN AND ORDOVICIAN SERIES IN THE ILLIZI BASIN
COMPARAISON WITH THE AHNET TIMIMOUN BASIN (ALGERIA)**

Khemissi Zellouf, Hamid Ait Salem

**ARSENIC POLLUTION IN GROUNDWATER OF GANGA DELTA OF WEST BENGAL, INDIA: AN
INTEGRATED APPROACH OF GEOMORPHOLOGY AND MEDICAL GEOLOGY**

Tapas Acharya, Alokesh Chatterjee, Tamoghno Basu, Bikramaditya Mondal, Roshni Paul, Tanmay Sarkar,
Archita Bhattacharyya

**ANALYSIS OF FACTORS INFLUENCING THE SPATIAL VARIABILITY OF BANKFULL WIDTH AND
SINUOSITY OF CHANNELS IN SOUTHERN QUEBEC**

Patrice Delisle, Ali Assani

THE BARITE FROM HIGH PLATEAU (WESTERN ALGERIA)

Nacera Hadj Mohamed, And Abdelhak Boutaleb

**GENESIS OF THE MESOZOIC ALKALINE INTRUSIONS OF THE KHOKHOI ORE FIELD (UPPER AMGA
GOLD-MINING DISTRICT, ALDAN SHIELD, NORTH ASIAN CRATON)**

Alexey Ivanov, Alexander Kravchenko, Evgeny Loskutov, Larisa Kondratieva,
Anatolii Zhuravlev, Michil Ivanov

MAIN FEATURES OF YAKUTITES FROM THE EBELYAKH PLACER

Sargylana Ugapeva, Valentine Afanasiev, Anton Pavlushin, Aleksandr Eliseev

**THE FIRST DATA ON THE STUDY OF A RARE FINDING OF GARNET FROM THE SINYAYA RIVER
ALLUVIUM (EASTERN SIBERIA)**

Sargylana Ugapeva, Nadezhda Zayakina, Tatiana Vasileva, Valeryi Baranov, Vitaliy S. Grinenko, Vasiliy
Popov

**TYPOMORPHISM OF FINE PLACER GOLD AND POTENTIAL PRIMARY SOURCES OF THE ANABAR
MINERAL SUBPROVINCE (NORTH-EASTERN SIBERIAN PLATFORM)**

Boris Gerasimov

**MINERALOGICAL FEATURES OF ULTRAHIGH PRESSURE IMPACT GLASSES OF THE KARA
ASTROBLEME (PAY-KHOY, RUSSIA)**

Tatyana Shumilova, Alexandr Zubov, Sergey Isaenko, S.N. Shanina

PHASE COMPOSITION AND MICROSTRUCTURE OF UHPHT VEIN GLASS FROM GIANT DIAMONDIFEROUS KARA IMPACT CRATER BY RAMAN MAPPING

Tatyana Shumilova, Sergey Isaenko

VARIETIES OF IMPACTITES AND IMPACT DIAMONDS OF THE KARA METEORITE CRATER (PAY-KHOY, RUSSIA)

Tatyana Shumilova, Nadezhda Maximenko, Alexandr Zubov, Vasily Ulyashev

KIMBERLITE GENESIS ACCORDING TO DATA ON HOT ACCRETION OF THE EARTH

Vladimir Shkodzinskiy

FRACTIONATION OF ELEMENTS IN WATERS OF THE LOW-LEVEL RADIOACTIVE WASTE STORAGE USING CASCADE FILTRATION

Olga S. Naymushina, A.E. Boguslavsky

MINERAL EXPLORATION AND ENVIRONMENTAL IMPACT IN HALLA AREA IN THE NORTHERN PART OF THE MASAFI-ISMAH METAMORPHIC WINDOW, U.A.E.

Bahaa Eldin M. Amin, Amna M. Faqeer, Aisha Hader, Ahmed B. M. A.

ISOTOPIC-GEOCHEMICAL CHARACTERISTICS OF QUARTZ AND PYRITE IN THE UPPER CARBONIFEROUS ROCKS OF THE SOUTHERN VERKHOYANSK, NORTHEAST RUSSIA: INSIGHTS FOR GENESIS OF VEINLET-DISSEMINATED MINERALIZATION

Lena I. Polufuntikova, Valery Y. Fridovsky, Gennadiy N. Gamyagin

MIDDLE PALEOZOIC BASITES OF THE NAKYN KIMBERLITE FIELD

M.D. Tomshin, Albina G. Kopylova, S.S. Gogoleva

CLASSIFICATION OF WEST ANATOLIAN CRYSTALLINE MARBLES ACCORDING TO CRYSTAL SIZES FOR THE ARCHAEOMETRIC ASSIGNMENT

Ramazan Hacimustafaoğlu, Murat Şentürk

GEOCHEMICAL FEATURES OF THE COMPOSITIONS OF THE MESOZOIC IGNEOUS ROCKS OF THE KHOKHOI ORE FIELD (UPPER-AMGA GOLD-MINING DISTRICT, ALDAN SHIELD, RUSSIA)

Alexey Ivanov, Larisa Kondratieva, Evgeny Loskutov, Alexander Kravchenko, Anatolii Zhuravlev, Nikolay Ermakov

STRUCTURE AND GEOCHEMICAL FEATURES OF THE VOLCANIC ROCKS IN THE TUNGUSKA SINECLISE (SIBERIAN TRAP PROVINCE)

Nadezhda Krivolutskaya, Bronislav Gongalsky, Alexander Krasilnikov, Natalia Svirskaya

FE-TI-V DEPOSITS OF EASTERN SIBERIA: SIMILARITIES AND DIFFERENCES

Bronislav Gongalsky, Nadezhda Krivolutskaya, Anton Yakushev

MINERAL COMPLEX OF THE KOLA REGION, NW RUSSIA: CHALLENGES AND PERSPECTIVES UNDER CONTEMPORARY GLOBALIZATION CONDITIONS

Dmitry Zhironov, Dmitry Zozulya, Nikolay Kozlov

PARTITION OF ALUMINUM IN THE DIFFERENT GEOCHEMICAL PHASES OF FLUVIAL SEDIMENTS

M. Luz Rodríguez-Blanco, M. Mercedes Taboada-Castro, M. Teresa Taboada-Castro

LAND INPUTS OF METALS TO A HEADWATER RIVER DRAINING AN AGROFORESTRY AREA

M. Mercedes Taboada-Castro, M. Luz Rodríguez-Blanco, Alejandro Toral, Enjôlras de A. Medeiros Lima, Margarida Regueira da Costa, Alexandre Luiz Souza Borba, M. Teresa Taboada-Castro

GEODIVERSITY OF THE METROPOLITAN REGION OF RECIFE, PERNAMBUCO – BRAZIL: QUALITY OF UNDERGROUND WATER

Margarida Regueira da Costa, Alexandre Luiz Souza Borba, Fernanda Soares de Miranda Torres, Pedro Augusto dos Santos Pfaltzgraff, Enjôlras de A. Medeiros Lima, M. Teresa Taboada-Castro, Gabriella Melo de Oliveira

ESTIMATION OF INTERNAL TEMPERATURE FIELD INTO MAGMATIC CHAMBERS OF THE NORILSK INTRUSIONS BY CLINOPYROXENE GEOTHERMOMETER DATA

Alexey Asavin, Nadezhda Krivolutsкая

GENESIS OF YOUNGER GABBROS IN THE ARABIAN SHIELD, SAUDI ARABIA: MINERALOGICAL, GEOCHEMICAL AND TECTONIC FINGERPRINTS OF THE NEOPROTEROZOIC ARC MAGMATISM

Ali Shehata, E. Abdallah Shehta

MANTLE SOURCE CHARACTERISTICS OF THE NE-BASANITES FROM NORTH EASTERN EDGE OF THE ARABIAN PLATE

Yavuz Özdemir, Çağrı Mercan, Vural Oyan, Ayşe Atakul-Özdemir

PETROLOGY OF GRANITES THE GERAMDACHANSKY MASSIF (VERKHOYANSK-KOLYMA OROGENIC REGION)

V.A. Trunilina, S.P. Roev

MAGNETIC SEPARATION THROUGH WADI ALHELO, UAE: AN INDICATION OF A MINERALOGICAL CONTROL

Sulaiman Alaabed, Hamdan AlNaqbi, Mahmoud Abdelmaksoud, Mohammed Al-Fajeer

REMOTE SENSING-ASSISTED STRATIGRAPHIC DISSECTION OF THE WADI KAREIM BASIN, EGYPT: FIRST RS ANALYSIS OF A HAMMAMAT MOLASSE BASIN, WITH IMPLICATIONS FOR SEDIMENTARY EVOLUTION

Abdel-Rahman Fowler, Ashraf Baghdady, Karim Abdelmalik, Ahmed Gad

CHARACTERISTICS OF SEDIMENTS IN A CHANGING ENVIRONMENTAL CONDITIONS IN VISTULA LAGOON (POLAND)

Ewa Szymczak

RESPONSE OF THE DIATOM FLORA OF THE HEL PENINSULA VICINITY, PUCK BAY, BALTIC SEA TO ANTHROPOPRESSURE

Dominika Hetko, Jarosław Pędziniński, Małgorzata Witak

SEDIMENTOLOGICAL PROPERTIES OF THE AKCAPINAR FORMATION (KARABUK, WEST BLACK SEA REGION, TURKEY)

Muhammed Sami Us, Erdoğan Tekin

SOFT SEDIMENTARY STRUCTURES AND RELATED FACIES OF THE AKCAPINAR FORMATION (KARABUK, WEST BLACK SEA REGION, TURKEY)

Muhammed Sami Us, Erdoğan Tekin

TEXTURAL AND PETROGRAPHIC CHARACTERS OF COASTAL SANDS (LAZIO, ITALY) TO PLAN A POSSIBLE EFFECTIVE NOURISHMENT

Annamaria Fornelli, Francesca Micheletti

LOGARITHMIC EXPRESSION OF *GLOBIGERINA BULLOIDES* SHELL EVOLUTION THROUGH BIOMETRIC ANALYSIS: PALEOCEANOGRAPHIC IMPLICATIONS FOR THE LATE QUATERNARY

Stergios Zarkogiannis, George Kontakiotis, Assimina Antonarakou

INTEGRATED PALEOHYDROLOGY RECONSTRUCTION AND PLIOCENE CLIMATE VARIABILITY IN CYPRUS ISLAND (EASTERN MEDITERRANEAN)

Efthymios Tsiolakis, Stella Tsaila-Monopoli, George Kontakiotis, Assimina Antonarakou, Maria Geraga, George Ferentinos, Harry Dowsett, George Theodorou

MIOCENE STRATIGRAPHY OF POTENTIAL CAP ROCK GYPSIFEROUS DEPOSITS: THE LOWER FARS FORMATION, AL AIN, UNITED ARAB EMIRATES

Osman Abdelghany, Abdel-Rahman Fowler, Mahmoud Abu Saima, Hasan Arman, Waheed Hashem

CALCAREOUS NANNOFOSSILS OF THE LATE PALEOCENE – EARLY EOCENE INTERVAL AT ZAGROS BASIN, SW IRAN

Azam Mahanipour

LATE ALBIAN – EARLY CENOMANIAN CALCAREOUS NANNOFOSSILS FROM ZAGROS BASIN, (SW IRAN)

Azam Mahanipour, Mozhdeh Hassani Sadi

MESOZOIC PALYNOSTRATYGRAPHY OF POLAND AFTER ARCHIVAL STRATIGRAPHIC EXAMINATION AND MY OWN RESULTS OF FACIES STUDY

Marta Waksmundzka

NEW PLANKTONIC FORAMINIFERA DATA FROM THE UPPER CRETACEOUS PELAGIC LIMESTONES OF THE YÜKSEKOVA COMPLEX FROM THE MADEN AREA (SOUTH OF ELAZIĞ, EASTERN TURKEY)

Melek Ural, Bilal Sarı

LITHOFACIES AND BIOFACIES CHARACTERISTICS OF LOWER CARBONIFEROUS CARBONATES IN CENTRAL TAURIDES, TURKEY

Ayşe Atakul-Özdemir, Demir Altınır, Sevinç Özkan-Altınır

FORAMINIFERAL ASSEMBLAGES AND MICROFACIES ANALYSIS OF UPPER TRIASSIC VOLCANO-SEDIMENTARY SUCCESSIONS IN PALU REGION (ELAZIĞ, TURKEY)

Ayşe Atakul-Özdemir, Yavuz Özdemir, Azat Narin, Sevinç Özkan-Altınır, Vural Oyan

PALEOGEOGRAPHIC AND AGE FINDINGS ON PLANKTONIC FORAMINIFERAL ASSEMBLAGES FROM YÜKSEKOVA COMPLEX (ELAZIĞ, EASTERN TURKEY)

Melek Ural, Meral Kaya Sarı

CLUSTERING PROPERTIES OF THE VRANCEA INTERMEDIATE-DEPTH SOURCE: AN OVERVIEW FOR THE LAST TEN YEARS

Anica Otilia Placinta, Emilia Popescu, Felix Borleanu, Mircea Radulian

SHABLA AREA TSUNAMI MODELING USING TRIDEC CLOUD SOFTWARE

Raluca Partheniu, Anica Otilia Placinta, Andreea Tolea

ATTENUATION OF MACROSEISMIC INTENSITY FOR CRUSTAL ROMANIAN EARTHQUAKES: CALIBRATING THE BAKUN-WENTWORTH'S METHOD

Eugen Oros, Anica Otilia Placinta, Mihaela Popa, Maria Rogozea, Daniel Paulescu

MACROSEISMIC INTENSITY ESTIMATION FROM INSTRUMENTAL GROUND MOTION RECORDINGS IN THE CASE OF SMALL AND MODERATE VRANCEA SUBCRUSTAL EARTHQUAKES

Moldovan Iren Adelina, Constantin Angela, Ardeleanu Luminita, Ionescu Constantin, Grecu Bogdan, Manea Liviu Marius, Toma Danila Dragos, Toader Victorin-Emilian, Partheniu Raluca, Manea Elena Florinela, Tiganescu Alexandru, Placinta Anica Otilia

TESTING AND DEVELOPING THE MACROSEISMIC INTENSITY ATTENUATION RELATIONSHIPS FOR THE VRANCEA (ROMANIA) CRUSTAL EARTHQUAKES

Angela Petruta Constantin, Iren-Adelina Moldovan, Raluca Partheniu, Elena Florinela Manea, Constantin Ionescu

GEOPHYSICAL METHODS OF IDENTIFICATION OF ORE CONTROL STRUCTURES OF OROGENIC GOLD FIELDS IN LOW-CONTRAST TERRIGENOUS ROCKS BY PETROPHYSICAL CHARACTERISTICS

Evgeny Solovyov, Valery Fridovsky, Denis Savvin

SEISMIC ENERGY RELEASE OF INTERMEDIATE EARTHQUAKES AND THE GEOMAGNETIC ANOMALIES RECORDED IN THE VRANCEA ZONE

Mihai Andrei, Toader Victorin Emilian, Moldovan Iren Adelina

THE LOCAL SEISMIC NETWORK OF THE GARGANO AREA (SOUTHERN ITALY): A REVIEW OF RECENT RESULTS AND PERSPECTIVES

Marilena Filippucci, Andrea Tallarico, Salvatore de Lorenzo

NEW INSIGHTS FROM RECENT MICROSEISMICITY OF THE GARGANO (SOUTHERN ITALY) AREA

Simona Miccolis, Marilena Filippucci, Salvatore de Lorenzo, Andrea Tallarico

2D KERNEL-BASED IMAGING OF CODA-Q IN THE GARGANO PROMONTORY (SOUTHERN ITALY)

Filippucci Marilena, de Lorenzo Salvatore, Del Pezzo Edoardo, Tallarico Andrea

HVSR AND ARRAY TECHNIQUES IN SEISMIC MICROZONATION STUDY

Oubaiche El Hadi, Hellel Mustapha, Bensalem Rabah, Chatelain Jean-Luc, Machane Djamel

DATABASE OF FOCAL MECHANISMS IN ROMANIA: STATISTICAL FEATURES AND TECTONIC REGIME REPRESENTATIVE FOR SEISMIC ZONES

Andrei Bala, Mircea Radulian, Dragos Toma-Danila

ELECTRICAL SIGNATURES OF A PERMEABLE FRACTURE ZONE IN CARBONATES HOSTING LOCAL GEOTHERMAL MANIFESTATIONS: INSIGHTS FOR THE DEEP FLUID FLOW IN THE GARGANO AREA (SOUTH-EASTERN ITALY)

Simona Tripaldi

COMPOSITIONAL MULTIVARIATE DATA ANALYSIS ON GEOCHEMICAL AND GEOPHYSICAL DATA AT CAMPI FLEGREI CALDERA (ITALY)

Sergio Scippacercola, Zaccaria Petrillo, Annarita Mangiacapra, Simona Tripaldi, Bellina Di Lieto

SEABED ANISOTROPY EFFECT ON MARINE CSEM RESPONSE OF OIL RESERVOIR IN SHALLOW WATER ZONES

Wang Haijiang, Xiao Lihui, Wang Limin

MOMENT MAGNITUDE ESTIMATION FOR THE SEISMIC SWARM RECORDED IN PETRESTI AREA IN 2014, USING STRONG MOTION DATA

George Marius Craiu, Andreea Craiu, Anton Danet, Alexandru Marmureanu, Marius Mihai

USE OF GROUND PENETRATION RADAR (GPR) IN THE EVALUATION OF GEOLOGICAL-STRUCTURAL ELEMENTS OF ORNAMENTAL CARBONATED ROCKS - CASE STUDY IN VALINHO DE FÁTIMA, PORTUGAL

João Duarte, José Carvalho, Fernando Figueiredo

VARIATIONS IN THE GEOELECTRIC PROPERTIES OF ROCK MASSES AS A RESULT OF THE SEISMIC EFFECTS OF INDUSTRIAL EXPLOSIONS

Nicolay N. Grib, A.N. Uzbekov, V.S. Imaev, G.V. Grib, A.E. Abetov

ASSESSMENT OF SEISMIC EFFECTS OF BLASTING OPERATIONS AT THE HRABŮVKA QUARRY

Andrea Mokrošová, Oskar Molinek, Milan Mikoláš, Vladimír Krenžel, Tomáš Šíroký

LEGAL PROVISIONS CONCERNING SEISMIC EFFECT OF BLASTING WORKS IN THE CZECH REPUBLIC

Lenka Tkačiková, Oskar Molinek, Milan Mikoláš, Juraj Kotrbánek, Michal Vokurka

THERMOELECTRICAL ELEMENT OF EARTH'S CRUST

Arkadiy Nikolaevich Dmitriev

PRACTICAL APPLICATION OF A HORIZONTAL INTRAPLATE VELOCITY FIELD MODEL FOR THE TERRITORY OF BULGARIA

Yuri Tsanovski, Tsocho Danchev

ACCESS, EDIT AND MANAGE GEOSPATIAL DATA - THE AUTODESK CASE

Ivan Kunchev

COLLECTION, STRUCTURING AND ASSESSMENT OF GEOSPATIAL DATA FOR OBJECTS ON THE GROUND BY TERRESTRIAL LASER SCANNING

Ivan Kunchev, Radoslav Nikolov

RELIABILITY OF THE DIGITAL SEA BOTTOM MODEL SOURCED BY MULTIBEAM ECHOSOUNDER IN SHALLOW WATER

Artur Makar

REFRACTION CORRECTION OF ACOUSTIC WAVE IN MULTIBEAM SYSTEMS

Artur Makar

ANALYSIS OF EARTH ORIENTATION PARAMETERS (EOP) TIME SERIES FROM SPACE GEODESY TECHNIQUES

Gourine Bachir, Khelifa Sofiane

CRUSTAL FIELD DEFORMATION CHARACTERISTICS IN VRANCEA SEISMIC AREA FROM GPS DATA

Doru Narvic Mateciuc, Andrei Bala

USING A SMALL UAV FOR NAUTICAL PORTS INVENTORY

Dariusz Popielarczyk

FLOOD ANALYSIS USING SENTINEL IMAGES AND MAPPING

Robert Župan, Stanislav Frangeš, Željka Molak-Župan, Adam Vinković

EVALUATION OF FACTORS, INFLUENCING THE ACCURACY OF THE DIGITAL MODEL, OBTAINED BY LASER SCANNING

Gergana Antova

INVESTIGATION OF CRUSTAL DEFORMATIONS BY THE MEANS OF DIRECTLY DEFINED SPATIAL CHORDS – POSSIBILITY OR PREDETERMINANCY

Slaveyko Gospodinov, Elena Peneva, Tatyana Lambeva

APPLICATION OF LANDSAT-8 AND ASTER DATA IN GEOLOGICAL MAPPING OF PRECAMBRIAN BASEMENT ROCKS AT BIR GAHELIA AREA, SOUTH EASTERN DESERT OF EGYPT

Mohamed F. Sadek, Safaa M. Hassan, Mohamed W. Ali-Bik

IMPLEMENTATION OF A GIS-BASED PILOT APPLICATION FOR ROADS MANAGEMENT APPLIED TO THE CONSERVATION AND MAINTENANCE OF UNPAVED ROADS OF LOW TRAFFIC

Johnny Vega, Luisa Alarcón, Mario Rodríguez

NEXT GENERATION SEQUENCING DATA AND ITS COMPRESSION

Bruno Carpentieri

FIRST ALGERIAN EXPERIMENT OF MANUFACTURED CORNER REFLECTORS FOR AN EMBANKMENT DAM MONITORING: CASE OF KRAMIS DAM (MOSTAGANEM, ALGERIA)

Gourine Bachir, Hasni Kamel

MACHINE LEARNING METHODS FOR CLASSIFICATION OF GREEN INFRASTRUCTURE IN CITY AREAS

Nikola Kranjčić, Damir Medak, Robert Župan, Milan Rezo

THE RESPONSE OF CONTIGUITY AND FRACTAL DIMENSION INDICES TO CHANGING SPATIAL SCALE

Mohammad Noor Alhamad

INVESTIGATING REGIONAL VARIATIONS OF VARIOUS COMPONENTS OF WEATHER SEMANTIC SIGNATURES FOR POINTS OF INTEREST

Ali Sabzali Yameqani, Ali Asghar Alesheikh, Kobra Sabzali Yameqani

MOBILE AUGMENTED REALITY APPLICATION FOR HISTORICAL CHANGES VISUALIZATION IN BUILDING FACADES

Tomasz Templin, Michał Bednarczyk

THE DATABASE FOR THE PROCESSING OF ENVIRONMENTAL DATA

Monika Chuchro, Wojciech Sarlej, Michał Lupa

RETRIEVING SPATIAL VARIATION OF LAND SURFACE TEMPERATURE BASED ON LANDSAT OLI/TIRS: A CASE OF SOUTHERN PART OF JEMBER, JAVA, INDONESIA

Rizqi I. Sholihah, Shozo Shibata

ESTABLISHING A NEW MODEL TO REDUCE THE RISK OF PREMATURE MINE CLOSURE

Mahdi Pouresmaeili, Morteza Osanloo

PASSIVE SEISMIC TOMOGRAPHY AS A TOOL FOR FORECASTING THE ROCK BURST HAZARD IN A DEEP COPPER ORE MINE, SW POLAND

Anna Barbara Gogolewska, Daria Smolak

FACTORS INFLUENCING THE SEISMICITY OF A DEEP COPPER ORE MINE IN POLAND

Anna Barbara Gogolewska, Jagoda Strzeszyńska

STUDY ON WATER-SAND INRUSH MECHANISM FOR MINING UNDER PORE WATER IN CHINA

Herong Gui, Rongjie Hu, Jun Li, Huili Qiu, Hongxia Fan, Hao Yu, Meichen Wang

INTERACTION BETWEEN SHALE FORMATION AND THIAMINE AS A NEW SHALE FORMATION STABILIZER

Saeed Parvizi Ghaleh, Seyyed Alireza Tabatabaei-Nejad, Elnaz Khodapanah

ANALYSIS OF THE EFFECTS OF THE POSITION OF THE AIR DUCT SUPPLYING FRESH AIR TO THE WORKING FACE OF THE MINED DOG HEADING ON METHANE CONCENTRATION LEVELS

Magdalena Tutak, Jarosław Brodny

ANALYSIS OF THE CONSEQUENCES OF METHANE COMBUSTION IN A MINED DOG HEADING

Magdalena Tutak, Jarosław Brodny

BACK-ANALYSIS STUDY OF SLOPE INSTABILITY IN AN OPEN PIT MINE, ALGERIA

Mohamed Fredj, Abdallah Hafsaoui, Riadh Boukarm, Radouane Nakache, Abderrazak Saadoun and Kamel Menacer

GEOSTATISTICAL MODELING BY THE ORDINARY KRIGING IN THE ESTIMATION OF MINERAL RESOURCES ON THE KIESELGUHR MINE, ALGERIA

Lamamra Abdessattar, Neguritsa Dmitriy, Mazari Messaoud

DEVELOPMENT OF MINING PROCESSES WITH REGARD OF LIMITS CORRECTION

Václav Pilný, Eliška Fiedlerová, Andrea Mokrošová

AN ALGORITHM FOR DETERMINING UNLOADING CYCLES IN DUMP TRUCK

Tomasz Kozłowski, Anna Michalak, Radosław Zimroz, Paweł Śliwiński, Tomasz Kaniewski

MODELING OF RESISTANCES TO MOTION AT THE LOADING POINT OF A BELT CONVEYOR

Błażej Doroszuk, Witold Kawalec, Robert Król

THE ANALYSIS AND ASSESSMENT OF GRAIN SIZE DISTRIBUTION ON THE EXAMPLE OF A CHOSEN GRANITE MINE

Witold Kawalec, Robert Król, Natalia Suchorab, Michał Szymański

NUMERICAL SIMULATION OF THE LARGE REMNANT BEHAVIOR IN THE MINING FIELD

Karolina Adach-Pawelus

ELECTROMOBILITY AND RECUPERATION OF ENERGY OF THE AGGREGATES INDUSTRY WITH THE USE OF DESCENDING BELT CONVEYORS

Lech Gladysiewicz, Witold Kawalec, Robert Król

SELECTION OF MINING SUPPORT FOR SPECIAL-PURPOSE CHAMBER WORKINGS SITUATED IN A FIELD OF HIGH HORIZONTAL STRESS IN POLISH COPPER ORE MINES BY MEANS OF NUMERICAL METHODS

Daniel Pawelus

A NEW APPROACH TO TIME-LOAD-DEFORMATION-STRESS HYPERSURFACE OF ROCKS TO STABILITY CONTROL OF UNDERGROUND OPENINGS

Cemalettin Okay Aksoy, G.G.Uyar, S. Şafak

THE REUSE OF MINING AND CONSTRUCTION WASTE FOR BACKFILL AS ONE OF SUSTAINABLE ACTIVITIES

Alexander L. Ivannikov, Cheynesh Kongar-Syuryun, Jarosław Rybak, Yulia Tyulyaeva

ANALYSIS OF MINING INFLUENCES ON A SMALL FRAME RAILWAY VIADUCT

Piotr Betkowski

VALORIZATION OF NATURAL SUPERPLASTICIZERS (LIGNINS) IN ULTRA-HIGH PERFORMANCE FIBER CONCRETES (UHPFC) BASED ON WASTE REFRACTORY BRICKS

Mohammed Saidi, Imane Djefour, Aziza Mechia

Research Unit Materials, Processes and Environment (UR-MPE), Faculty of Engineering

NEW DATA ON THE FORMATION CONDITIONS OF THE DYVOK ORE OCCURRENCE (SOUTH YAKUTIA, RUSSIA)

Veronika Kardashevskaya, Galina Anisimova

ACTIVATION ENERGIES OF PHYSICALLY AND CHEMICALLY CLEAN COALS

Mehmet Bilen

PROXIMATE AND ULTIMATE ANALYSIS BEFORE AND AFTER PHYSICAL & CHEMICAL DEMINERALIZATION

Mehmet Bilen

REACTIVITY OF PHYSICALLY AND CHEMICALLY CLEAN COALS

Mehmet Bilen

CORRELATION BETWEEN ASH CONTENT OF SIZE & DENSITY FRACTIONATED COAL SAMPLES AND THEIR CORRESPONDING CALORIFIC VALUES

Serdar Yilmaz, Sait Kizgut, Dilek Çuhadaroglu, İhsan Toroglu

DOMESTIC UTILIZATION OF COAL IN ZONGULDAK-TURKEY AND UNBURNED CARBON IN ASH

Mehmet Bilen, Serdar Yilmaz

COAL CALORIFIC VALUE AFTER PHYSICAL AND CHEMICAL CLEANING

Serdar Yilmaz, Dilek Çuhadaroglu, İhsan Toroglu, Sait Kizgut

SYNTHESIS OF ULTRAFINE Fe-W-Al-Ti-Ni-C-B POWDERS BY MECHANICAL ALLOYING

Mikheil Chikhradze, Guram Abashidze, Nikoloz Chikhradze, David Tsverava, Kinga Stecula

GROWTH OF INDIUM DIGERMANATE NANOWIRES FOR GAS SENSOR APPLICATIONS

David Jishiashvili, Zeinab Shiolashvili, Nino Makhatadze, Alexander Jishiashvili, Archil Chirakadze, Dimitri Sukhanov

MITIGATION EFFECTS OF A WATER BARRIER ON DYNAMIC LOADS ON THE HUMAN BODY AT EXPLOSIONS

Nika Bochorishvili, Edgar Mataradze, Nikoloz Chikhradze, Karlo Tavlalishvili, Mikheil Chikhradze, Irakli Akhvlediani

C-V CHARACTERIZATION AND ELECTRIC PARAMETERS OF ZrO₂ RECEIVED BY UV STIMULATED PLASMA ANODIZING

Zurab Kushitashvili, Amiran Bibilashvili, Victor Borisenko

RADIATION EFFECT ON THE PARAMETERS OF FIELD EFFECT TRANSISTOR WITH SHOTTKY BARRIER ON GaAs

Amiran Bibilashvili, Zurab Kushitashvili

THE EXPERIMENTAL PROOF OF NON - THERMAL NATURE OF THE MECHANISM OF PULSE-PHOTON ANNEALING IN SEMICONDUCTOR MATERIALS

Zurab Jibuti, Amiran Bibilashvili, Lado Jibuti, Nugzar Dolidze

EXPLOSION SUPPRESSION IN LIMITED SPACES

Irakli Akhvlediani, Edgar Mataradze, Nikoloz Chikhradze, Mikheil Chikhradze, Nika Bochorishvili, Karlo Tavlalishvili

USAGE OF COLLOIDAL GUNPOWDER RELEASED FROM UTILIZED AMMUNITION IN THE MINING INDUSTRY

Davit Khomeriki, Sergo Khomeriki, Nikoloz Chikhradze, Davit Supatashvili, Avtandil Khvadagiani, Nikoloz Elizbarashvili

PRODUCTION OF CORROSION-RESISTANT POLYMER CONCRETE REINFORCED WITH VARIOUS FIBERS

Nikoloz Chikhradze, Fernand Marquis, Guram Abashidze, Davit Tsverava

STATE OF NON-FINANCIAL REPORTING OF POLISH REPRESENTATIVES OF THE MINING INDUSTRY IN A SUSTAINABLE SOCIAL DIMENSION

Justyna Woźniak, Katarzyna Pactwa

EXPERIMENTAL INVESTIGATION ON PURIFICATION OF HE THROUGH ADSORPTION TECHNIQUE FOR EXPLORATION OF HE FROM NATURAL RESOURCES AT BAKRESWAR SPRING AREA, INDIA

Chiranjit Maji, Kankana Seal, Saroj Khutia, Hirok Chaudhuri

SOLAR POWERED DESALINATION, APPLIED SOLUTION IN YEMEN

Ali Aqlan, Abdulmalik Momin

NATURAL GAS LEAKAGE OCCURRENCE ON A SHALLOW GROUNDWATER RESERVOIR

Roberto Heemann, Adolpho Herbert Augustin, Júlio César Gall Pires, Daniela Govoni Sotelo, Cássio Stein Moura

RELATIONSHIP BETWEEN COMPOSITIONS OF GREY HAIR-GRASS (*CORYNEPHORUS CANESCENS* (L.) P. BEAUV.) TISSUES AND SOIL PROPERTIES DURING PRIMARY VEGETATION SUCCESSION

Oimahmad Rahmonov, Jacek Rózkowski, Artur Szymczyk

IS THE VEGETATION SUCCESSION A THREAT FOR RARE AND PROTECTED SPECIES IN A SAND QUARRY? CASE STUDY OF THE KUŹNICA WAREŻYŃSKA SAND QUARRY (SOUTHERN POLAND)

Oimahmad Rahmonov, Jacek Rózkowski, Artur Szymczyk

A THOROUGH STUDY FOR PAHs IN DUMP MATERIALS FROM OPEN-PIT LIGNITE MINING, MARITSA IZTOK BASIN, BULGARIA

Stefan Marinov, Maya Stefanova, Zlatka Milakovska, Achim Bechtel

THE MAIN TYPES OF FORMATION OF MINE WATERS COMPOSITION IN THE EASTERN DONBASS

Anatoly I. Gavrishin

IMPACT OF BIOCHAR ON SOIL WATER CONTENT AND ELECTRICAL CONDUCTIVITY

Maciej Gliniak, Jakub Sikora, Urszula Sadowska, Agnieszka Klimek-Kopyra, Agnieszka Latawiec, Maciej Kuboń

IMPACT OF BIOCHAR ON SOIL TEMPERATURE

Maciej Gliniak, Jakub Sikora, Urszula Sadowska, Agnieszka Klimek-Kopyra, Agnieszka Latawiec, Maciej Kuboń

IMPACT OF BIOCHAR ON WATER RETENTION IN SOIL

Maciej Gliniak, Jakub Sikora, Urszula Sadowska, Agnieszka Klimek-Kopyra, Agnieszka Latawiec, Maciej Kuboń

ADSORPTION OF LEAD ON AGRICULTURAL LAND AT ŽITNÝ OSTROV (SLOVAKIA)

Viera Kováčová

⁵⁷FE MÖSSBAUER SPECTROSCOPY INVESTIGATIONS OF FACTORS AFFECTING THE TRANSFORMATION OF IRON IN THE NATURAL ENVIRONMENT

Patrycja Kierlik, Aneta Hanc-Kuczkowska, Marzena Rachwał, Ryszard Męczyński

MOBILITY BEHAVIOUR AND ENVIRONMENTAL IMPLICATIONS OF TRACE ELEMENTS ASSOCIATED WITH SUBURBAN SOILS FROM THE STEEL INDUSTRY

Oľga Šestinová, Jozef Hančulák, Tomislav Špaldon, Gešperová, Danko

STABLE LEAD ISOTOPIC RATIOS IN SURFACE DEPOSITED SEDIMENT AS INDICATOR OF URBAN GEOCHEMICAL PROCESSES

Andrian Seleznev, Iliya Yarmoshenko, Georgy Malinovsky, Maria Chervyakovskaya, Maria Streletskaia

NEGATIVE IMPACT OF INVASIVE PLANTS ON RIVERBANK VEGETATION

Barbora Vaseková, Zuzana Štefunková

ANALYSIS OF THE DIVERSITY OF MICROSCOPIC FUNGI IN THE SOILS OF ADJARA, GEORGIA

Otar Shainidze, Shota Lominadze, Guram Chkubadze, Shota Lamparadze, Nodar Beridze, Jimsher Diasamidze

THE EFFECT OF ORIENTED STRAND BOARD SUBSTRATE TREATMENTS ON THE ADHESION OF CEMENT ADHESIVES AND COATINGS

Jiří Patloka, Erika Kratochvílová, Jiří Šlanhof

IMPACT E REFORESTATION WORK ON VEGETATION COVER IN SEMI-ARIDE REGION: THE CASE GREEN DAME OF EL BAYAD (NAMAA DEPARTMENT) IN ALGERIA

Kaddour El Heit, Abderrahmane Mellak, Abderazak Hamama

THE CONDITIONS OF SEDIMENTATION OF GDAŃSK BAY SEDIMENTS (BALTIC SEA, POLAND) IN THE LIGHT OF LITHOLOGICAL FEATURES AND CARBON CONTENT

Dorota Burska, Ewa Szymczak

EFFICIENCY OF PHOSPHORUS REMOVAL FROM NATURAL WATERS WITH SORBENTS PLACED IN WATER PERMEABLE NONWOVENS

Dorota Burska, Dorota Pryputniewicz-Flis, Agnieszka Bańkowska-Sobczak, Grzegorz Brenk, Tomasz Woszczyk

ELABORATION OF THE RELATIONSHIP BETWEEN THE GROUNDWATER LEVEL IN UNCONFINED AQUIFER AND THE VALUE OF PRECIPITATION AND EVAPOTRANSPIRATION

Monika Birylo

REMOVAL OF HEAVY METALS IN DRINKING WATER BY IRON-BASED SORPTION MATERIALS

Danka Barloková, Ján Ilavský, Michal Marton, Michal Kunštek

REMOVAL OF THM PRECURSORS BY ADSORPTION, COAGULATION AND UV IRRADIATION

Ján Ilavský, Danka Barloková, Michal Marton, Ondrej Kapusta

MODELING OF THE WORK OF CUT AND STRETCHY SHEET IN SPAN BEAM STRUCTURES WITH THE MIXED REINFORCEMENT

Sofiya Burchenya, Yuriy Famulyak, Justyna Sobczak-Piąstka

INFLUENCE OF FREEZE-THAW TEMPERATURE ON LOAD-BEARING CAPACITY OF STEEL-CONCRETE BEAMS CARRYING TRANSVERSE LOADS

Andriy Hrytsevych, Yuriy FamulyakSurname, Justyna Sobczak-Piąstka

ENERGY EFFICIENT PROCESSING OF GEOTHERMAL WATER FOR ENERGY-HEATING OBJECTS OF THE BUILDING INDUSTRY

Nataliia Zhuravska, Eduard Malkin, Justyna Sobczak-Piąstka

FACTORS INFLUENCING HOUSEHOLDS' VULNERABILITY TO DESERTIFICATION IN NORTHERN KATSINA, NIGERIA

Yahaya Olanrewaju Yusuf

SANDSTONE GRINDING IN ELECTROMAGNETIC MILL: CASE STUDY

Anna Lis

TRANSPORTATION OF WASTE IN THE LIFE CYCLE ANALYSIS

Maciej Gliniak, Anna Lis

APPLYING CONTINGENT VALUATION METHOD IN ASSESSING URBAN PARKS: THE CASE OF NIARCHOS IN GREECE

Eleni Sardianou, Aikaterini Leonti

UNDERSTANDING AND MEASURING SUSTAINABILITY PERFORMANCE IN THE BANKING SECTOR

Athanasia Staupoulou, Eleni Sardianou

IMPACT OF CLIMATE CHANGE AND HUMAN ACTIVITIES, DURING THE ANTHROPOCENE, ON THE OASIS SPACES: THE CASE STUDY OF THE TOUAT REGION - ALGERIA

Saadia Ysbaa, Khemissi Zellouf

TOXICOLOGICAL EFFECT OF TRICLOSAN ON DAPHNIA PULEX (WATER FLEA) AND LACTUCA SATIVA (LETTUCE) THROUGH BIOASSAYS

Edgar Armando Apaza-Aguilar, Roberto Alfaro-Alejo, Yovana Palao-Mamani

ANALYSIS OF A SINGLE-FAMILY BUILDING LIFE CYCLE – CASE STUDY

Anna Lis, Anna Warzeszak, Maciej Gliniak

STUDY ON RADON CONCENTRATION IN AND AROUND DURGAPUR CITY, INDIA

Hirok Chaudhuri, Suvashree Mukherjee, Anant Sukla, Chirajit Maji, Saroj Khutia, Kankana Seal

THE POSSIBILITY OF APPLICATION OF MAGNETIC-MOLECULARLY IMPRINTED POLYMERS FOR THE SELECTIVE RECOGNITION OF LOW-MASS POLYBROMINATED DIPHENYL ETHERS IN WATER SAMPLES

Piotr Paweł Wieczorek, Mariusz Marć

FEASIBILITY OF A RADIOACTIVE WASTE INSULATION MATERIAL STORES IN AN UNDERGROUND SALIFEROUS SITE

Abderrahmane Mellak, Khaled Benyounes, Kaddour El Heit

CONTROL OF CONTAMINATION IN RESIDUAL WATER OF TANNERIES BY HETEROGENOUS PHOTOCATALYST WITH TiO_2

M. V. Masabanda, V. Delgado, D.V. Carrera-Villacrés

EFFECT OF SODIUM BORON HYDRIDE (NaBH_4) ON WASTE POLYETHYLENE TEREPHTHALATE PYROLYSIS

Mikail Olam, Hüseyin Karaca

EFFECT OF MICROWAVE PRETREATMENT ON WASTE POLYETHYLENE TEREPHTHALATE (PET) PYROLYSIS

Mikail Olam, Hüseyin Karaca

PRODUCTION OF ACTIVATED CARBON FROM THE RESIDUES OBTAINED FROM POLYETHYLENE TEREFTALAT PYROLYSIS

Mikail Olam, Hüseyin Karaca, Figen Gündüz

PERFORMANCE MODELING OF A PHOTOVOLTAIC SYSTEM INTEGRATED TO ROAD PAVEMENT

Gino D'Ovidio, Carlo Masciovecchio, Sandro Colagrande

ECONOMICAL ASPECT OF SENSITIVE FLAT ROOF RENOVATION

Marek Kervitcer, David Bečkovský, Lukáš Janda, Vladimír Tichomirov

GEOHERMAL PERSPECTIVES OF LITOMĚŘICE SITE: HYDROGEOLOGY STUDY OF THE GEOHERMAL BOREHOLE PVGT-LT1

Jan Holeček, Jaroslav Řihošek, Lenka Rukavičková

ENERGY CONSUMPTION TREND IN A SHOPPING MALL

Antonio Spagnuolo, Carmela Vetromile, Antonio Masiello, Carmine Lubritto

COMPOSTING OF SOLID MUNICIPAL WASTE, A DETERMINANT PROCESS IN INTEGRATED WASTE MANAGEMENT

Cretan Ioana-Alina

TRANSLUCENT CONCRETE

Georgia Alexandra Covaleov

APPLICATION OF PANEL ANALYSIS TO INVESTIGATE THE RELATIONSHIP BETWEEN ECONOMIC GROWTH, IMPORT, CONSUMPTION OF MATERIALS AND ENERGY

Anna Bluszcz, Anna Manowska

APPLICATION OF EXTENDED HABITAT SUITABILITY CURVES FOR DEPTH IN NITRICA RIVER

Peter Ivan, Zuzana Štefunková

PLANNING TOOLS FOR AGRICULTURAL TERRITORY OF BULGARIA

Milena Moteva, Desislava Parashkevova

NEW INSIGHTS ON MINERAL EXPLORATION (POLAND)

Magdalena Worsa-Kozak, Grzegorz Lipień

BENTHIC FORAMINIFERA OF THE MAASTRICHTIAN SEDIMENTS FROM THE MALIBOĞAZI (KALECIK, ANKARA) AND IRMAK (KIRIKKALE) AREAS IN TÜRKİYE

Muhittin Gormus, Hacer Akoralier

DESCRIPTION CRITERIA FOR EOCENE ALVEOLINIDS: EXAMPLES FROM INNER WESTERN ANATOLIA

Alper Bozkurt, Muhittin Gormus

ANY LINK BETWEEN FLUORIDE ENDEMIC AREAS AND INFESTATION OF POISONOUS SNAKES IN KALTUNGO AND ZAMKO - LANGTANG AREA OF GOMBE AND PLATEAU STATE – NIGERIA

Dibal Hyeladi Usman, Imoh Lucius, Daben Mosas

THE TRACES OF MINING IN LUBSKO (WESTERN POLAND) – THE PROPOSAL OF THE GEOTOURISTIC PATH

Wojciech Kaczan

ARCHAEOLOGICAL AND ECO-TOURISM AREAS IN DAKHLA OASIS (WESTERN DESERT, EGYPT)

El-Sayed Abbas Zaghloul

HERITAGE OF THE POLISH CENTRAL INDUSTRIAL DISTRICT - NEW TOWNS

Anna Sikora

THE PATTERNS OF FORMING OF THE URBAN SURFACE DEPOSITED SEDIMENTS

Andrian Seleznev, Ilia Yarmoshenko, Georgy Malinovsky, Anastasia Ryanskaya, Daria Kiseleva, Tamara Gulyaeva, Maxim Rudakov

LEARNING FROM TRADITION: VERNACULAR BUILT HERITAGE OF MADEIRA (PORTUGAL), A SUSTAINABLE PROPOSAL

Ana Maria Tavares Martins, Elma Vieira, Jorge S. Carlos

SURVEY ON POST-OCCUPANCY EVALUATION OF VERNACULAR HOUSES IN MADEIRA (PORTUGAL)

Ana Maria Tavares Martins, Elma Vieira, Jorge S. Carlos

FROM THE CLOISTER TO THE CITY: APPROACHES TO THE CISTERCIAN LAND MANAGEMENT

Ana Maria Tavares Martins

DENSIFICATION OF CITIES AS A METHOD OF SUSTAINABLE DEVELOPMENT

Janusz Pelczyński, Bartłomiej Tomkowicz

THE IMPACT OF THE ENERGY QUALITY OF A SINGLE-FAMILY RESIDENTIAL BUILDING ON ENVIRONMENTAL BURDEN ASSOCIATED WITH AIR POLLUTION - A CASE STUDY

Beata Sadowska, Adam Święcicki, Robert Stachniewicz

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Adam Rybka, Gábor Dombay, Karolina Kozłowska

SELECTED CHARACTERISTICS OF ATMOSPHERIC PRECIPITATION ON THE POLISH COAST OF THE BALTIC SEA

Mirosława Malinowska

QUANTIFICATION OF NEURAL NETWORK UNCERTAINTIES BY PROBABILITY DENSITY FUNCTIONS ON HYDROGEOLOGICAL PREDICTIONS

Nicolas Akil, Guillaume Artigue, Michaël Savary, Anne Johannet, Marc Vinches

MANAGEMENT MEASURES FOR THE RESTORATION OF DEGRADED ECOSYSTEMS IN ORDER TO INCREASE BIODIVERSITY CONSERVATION IN THE TARNAVA MICA CATCHMENT AREA: CASE STUDY BĂLĂUȘERI, TARNAVA MICĂ, ROMANIA

Cretan Ioana-Alina, Bratanovici Cristian, Constantin Albert-Titus

METHODS OF SPRINGS FAILURES DIAGNOSTICS IN ORE PROCESSING VIBRATING SCREENS

Pavlo Krot, Radoslaw Zimroz

STATISTICAL ANALYSIS OF WORKPLACE ACCIDENTS IN POLISH MINING INDUSTRY

Paweł Strzałkowski

MICRO-LASER-INDUCED BREAKDOWN SPECTROSCOPY-SCAN: A TOOL FOR MORTAR ANALYSIS

Stefano Pagnotta, Sanja Zivkovic, Beatrice Campanella, Stefano Legnaioli, Marco Lezzerini, Milos Momcilovic, Francesco Poggialini, Vincenzo Palleschi

EFFECTS OF USING MARBLE WASTE ON THE PROPERTIES OF MORTARS AND CONCRETES

Letizia Luti, Michele Romano, Andrea Aquino, Stefano Pagnotta, Francesco Di Benedetto, Marco Lezzerini

THERMOCHEMICAL STABILITY OF NATURALLY RELEVANT TERNARY PHASES IN THE CU-FE-S SYSTEM

Andrea Aquino, Marco Lezzerini, Andrea Giaccherini, Giordano Montegrossi and Francesco Di Benedetto

GEOCHEMICAL AND MINERALOGICAL CHARACTERIZATION OF RECENT NILE DELTA INNER SHELF SEDIMENTS FOR TRACING NATURAL AND HUMAN-INDUCED MODIFICATIONS INTO A DELTAIC SYSTEM

Ahmed S. Mandoura, Lisa Ghezzi, Ahmed Elshazly, Marco Lezzerini, Ayman A. El-Gamal, Riccardo Petrini

CHEMICAL-PHYSICAL DECAY OF VOLCANIC STONE FROM SANTA MARIA CHURCH IN TERGU (ANGLONA, ITALY)

Stefano Columbu, Marcella Palomba, Fabio Sitzia, Alberto Virdis

ORIGIN OF THE CONSTRUCTION MATERIAL OF SANTA MARIA DEL REGNO BASILICA (SARDINIA, ITALY)

Stefano Columbu, Fabio Sitzia, Marcella Palomba, Alberto Virdis

CONSERVATION OF THE PERMIAN REMAGNETIZATION IN THE PALEOZOIC FORMATIONS OF THE TASSILI N-AJER (ILLIZI BASIN, ALGERIA): AEROMAGNETIC AND GRAVIMETRIC CONSTRAINTS

Atmane Lamali, Lamine Hamai, Nacer-Eddine Merabet, Abdelkrim Yelles chaouch, Bernard Henry, Abedeslam Abtout, Said Maouche, Mohamed Amenna, Mohamed Hamoudi

**GEODYNAMIC EVOLUTION OF THE ONSHORE–OFFSHORE CENTRAL ALGERIAN MARGIN
CONSTRAINED BY GRAVITY DATA**

L. Hamai, A. Lamali, A. Abtout, A. Yelles-Chaouche, A. Boudelaa, J. Déverchère, S. S. Bougchiche, W. Bacha, L. Djadia

**EXTRACTION AND DETERMINATION OF MORPHOTECTONIC FEATURES OF KARAKOÇAN FAULT
ZONE (KFZ) USING DIGITAL ELEVATION MODEL (DEM), REMOTE SENSING AND FIELD MAPPING,
EASTERN TURKEY**

Ercan Zengin, Murat İnceöz

**APPLICATION OF THE GRAVIMETRIC AND MAGNETIC METHODS TO THE STRUCTURAL
CHARACTERIZATION OF THE HODNA BASIN (ALGERIA)**

Doria Aitadjedjou, Amar Bourmatte

NUMERICAL MODELING OF CENOZOIC COMPRESSIONAL EVENTS OF NW HIMALAYAS, PAKISTAN

Muhammad Armaghan Faisal Miraj, Naveed Ahsan, Muhammad Wajid Manzoor

**TECTONIC SETTING AND PALEOSEISMOLOGICAL CHARACTERISTICS OF GEDİZ GRABEN-
ALAŞEHİR SEGMENT, WEST OF TURKEY**

Murat Şentürk, Fuzuli Yağmurlu

PALEOSEISMOLOGICAL CHARACTERISTICS OF BÜYÜK MENDERES GRABEN, WEST OF TURKEY

Murat Şentürk, Fuzuli Yağmurlu

ARCHAEO-SEISMOLOGICAL INVESTIGATIONS OF CADIANDA ANCIENT CITY

M. Erkan Karaman, Su Güneş Kabaklı, Övünç Şahin

COAL MINES RISK MODELLING USING ENERGY SPREAD

Zbigniew Krysa, Michał Dudek

**THE AQUIFER RECHARGE POTENTIAL BY INFILTRATION TESTS IN ARID REGION, RAS AL
KHAIMAH, UNITED ARAB EMIRATES**

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ABSTRACT

Water flow through soil layers (infiltration) encompasses the key element of the hydrologic cycle, where it characterizes the pathway of contribution to the groundwater aquifers. Infiltration tests are carried out in the field to measure the soil layers' infiltration rate and their corresponding hydraulic conductivity. The investigation site, Wadi Al Bih dam, represents one of the significant locations for water harvesting and storing in the United Arab Emirates (UAE). The dam plays essential role in preventing and mitigating the flash flooding and assist the infiltration process to recharge the shallow groundwater aquifer. This study targets to measure the infiltration rate on both sides of the dam and emphasize the relationships between the precipitation and water percolation downwards as well as the dam ability to accumulate and store the surface water especially during the intensive water storm events. The results reveal a remarkable variability of the infiltration and the hydraulic conductivity values in both the upstream and downstream of the dam. The average infiltration rate varies from 23.9 to 27.71 cm/h and the average hydraulic conductivity ranges between 9.82 and 39.67 cm/s. This shows the noticeable changeability of the soil cover to absorb the surface water and push it down to recharge the shallow aquifer.

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ANALYSIS OF IMPLEMENTATION CONDITIONS UNDER DIFFICULT GEOTECHNICAL CONDITIONS USING SWOT

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ABSTRACT

Difficult and complex geological conditions are often an obstacle to the efficient implementation of construction works related to the erection of objects, in particular earthworks and foundations. In the event of an additional occurrence of adverse weather conditions, there may be a delay in the final effect of the work and exceeding the construction costs. The article presents the stage of the implementation case in which these factors were compiled. The SWOT analysis was an element helpful in analysing the situation and also allowing for making decisions regarding implementation. Through this analysis, the contractor identified the possible activities, including opportunities and strengths, which allowed for the development of a scenario. This is important because the lack of action would cause even greater delays and financial losses than those already existing. The subject of the analysis is the implementation example - the extension of the warehouse and production hall together with the accompanying infrastructure. In the course of implementation, the contractor encountered difficult ground conditions, which combined with the adverse impact of atmospheric factors resulted in a significant delay in implementation and an increase in costs in relation to the ones provided for. It is important that the contract was a lump sum, which limited the possibility of the contractor increasing the amount of remuneration, and the delays that occurred constituted the attitude to calculating contractual penalties. It was reasonable to consider the various potential benefits and opportunities that the contractor could have used in such a complex situation. The analysis was based on the SWOT method. The SWOT analysis method is one of the widely known management support techniques by identifying the situation in order to develop possible scenarios for further action.

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STUDY THE INFLUENCE OF DISCONTINUITIES AND MARLY INTERCALATION ON THE STABILITY OF QUARRIES BY DIFFERENT METHODS

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ABSTRACT

In rock masses the existence of discontinuities causes higher deformability and lower strength. In open pit mining thus joints can change the rock mass behaviour due to the applied loads. For this reason, properties and orientation of the joint sets have a great effect on the stability of rock slope in quarry. In this paper our work consists in evaluating the stability of the cracked limestone deposit with intercalation of the marly layers of the Chouf Ammar quarry. This evaluation is a medium-term evaluation based on the stereographic projection studies for the cracked steps with a progress for the next year and more specifically for the steps with marly intercalation located between the layers of limestone, it was possible to determine their positioning and their necessary dips and determined the different properties and the estimation of the cohesion and internal friction angle of the limestone of the Chouf Amar quarry by Mohr Coulomb's criterion using Hoek Brown's classification of the rock mass by analytical, empirical and numerical methods for the calculation of the factor of safety. Calculations of the stability at the level of the Chouf Ammar quarry were made in two cases. According to the marly intercalations and following the cracks through 3 situations in the normal case, under blasting effect (dynamic case) and in the seismic case. These evaluations have been performed by the limit equilibrium method through the SLIDE software, and the finite element methods through phase 2.

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**AMBIENT SEISMIC VIBRATION IN THE RUPTURE ZONE NEAR THE CAP MATIFOU FAULT SCARP
(ALGIERS)**

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ABSTRACT

The rupture zones analysis at the Cap Matifou (Algiers) fault of by classical geophysical method showed good results. On the other hand, the application of the HVSR, ambient seismic noise method, has given results that are more or less satisfactory and sometimes difficult to interpret. This fault of about 50 km with a seismic activity related to the uplift of the Cap Matifou - Ain Taya block, marks a WNW-ESE straight escarpment. The analysis of the geological and geotechnical and geophysical data of this deformation zone made it possible to determine the different lithological formations and the soil characterization. The compilation of these data with the HVSR seismic noise recordings also made it possible to evaluate the site effects in the vicinity of the fault.

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DETECTION OF THE TARGET OBJECTS FROM SHADOWED IMAGE IN GPR RECORDS

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ABSTRACT

Ground-penetrating radar (GPR) is a geophysical method that uses radar pulses to image the subsurface features and detect underground objects, e.g. cavities, pipelines, tunnels and the like. In view of efficiency and economics, GPR thus can be considered as a powerful tool in environmental engineering to access the underground information. Unfortunately, when the targets to be detected are existed cavities and pipelines those are vertically aligned; the shallower objects may obscure GPR raw data that is reflected from deeper ones. Especially, when the dimension of shallower cavities or pipelines are larger than those ones positioned right below. In this case, the deeper objects might not be imaged in the acquired GPR profile, the phenomenon of shadow effect thus occurs. To get insight into the effects of shadowing, a forward physical model study were carried out. In laboratory, an aluminium block that has three side-drilled holes those possess different dimensions was machined. With respect to the scanning surface, the arrangement of the created holes could be either from large to medium to small or in reverse in vertical. In the processes of ultrasound manipulation, the physical model were individually scanned by a single transceiver in the pulse-echo mode and dual sensors in the reflection mode. While viewing into the profile acquired by a single transceiver, the shadow effect is significant and can be easily aware of. In addition, the shadow effect becomes obvious when the side-drilled holes were vertically arranged from large to medium to small. Interestingly, the shadow effect that was observed in the single transceiver profile becomes mitigation in the profile acquired by dual sensors. In other words, profile acquired from dual sensors provides better image quality than that was obtained by a single transceiver no matter of the order of the created holes in vertical. In order to refocus and position the images of all three side-drilled holes, the raw data were processed by Kirchhoff migration in the post-operation. Leaving the shadow effect out of consideration, results of Kirchhoff migration show the images of the created holes can be satisfactorily restored from GPR records either acquired by a single transceiver or dual sensors. Hence, it is the hope that our research results can contribute to the practical application of environmental engineering, especially in detecting the underground cavities and/or buried pipelines by GPR.

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**USING MICROTREMORS TO EVALUAT THE SEISMIC VULNERABILITY INDEX IN BLIDA CITY
(NORTHERN ALGERIA)**

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ABSTRACT

Historical research teaches us that earthquakes occurred in the past in the sector of studies and these surrounding (1716, 1825...), the city it was entirely destroyed by several earthquakes in the past. Such events will reproduce and have in the future of the serious consequences as regards human lives and loss economic. For this fact and for measurement of prevention so that these earthquakes have less harmful consequences possible, we have HVSR method to determine the predominant frequency (f_0), amplification factor (A_0) and evaluate the seismic vulnerability index ($SVI = A_0^2/f_0$) as a means to determine the extent of seismic hazard; for that, we carried out 129 HVSR measurements on the town of Blida, is built on an alluvial cone characterized by a strong alluvial filling, this type of filling is convenient to the site effect. Finally, it results that the town of Blida is characterized with a resonance frequency weak, that can generate strong site effect, and the seismic vulnerability index is higher than 20 that means that the town of Blida has a strong seismic hazard.

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GEOLOGIC RISK (EARTHQUAKES, LANDSLIDS, ROCKFALLS, ETC.) IN NORTH CENTRE -WEST OF ALGERIA (ZERALDA-TIPAZA)

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ABSTRACT

The North Centre-West of Algeria region (Zeralda-Tipaza) is the seat of a strong seismicity, although it belongs to different geological entities, it is affected by the same tectonic phases, especially those of the recent plio-quaternary period, whatever its evolution, is conditioned by the reactivation of old structures (folds and faults). All these faults provoked earthquakes on the onshore and the offshore for a very long time. It is certainly that this seismic activity will continue in the future because it is bound to a convergent plate's environment (Africa and Europe). So, this seismic activity, beyond as it engenders important human damages, by rough character, it is at the origin of instabilities of ground (landslides) and liquefaction. These landslides are favored by morphological factors (slopes and reliefs), physical factors (the persistent rain falls and cast iron of snow), factors associated to the anthropological activity and geological factors (lithological nature, weak grounds), and the material types. In these littoral regions exist few resistant grounds of sedimentary nature (marls, clays, alternations stoneware pelites of flysch type etc.) and alluvial deposits, but also resistant grounds such as schists and quartzites of the base, the limestones and volcanic rocks. But these grounds, even resistant are weakened by recurrences of taken place earthquakes damaging roads and the infrastructures which threaten the population. These instabilities are observed in several places which are not shielded from these seismic disasters.

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ROCK SLOPE STABILITY ANALYSIS WITH A KINEMATICAL METHOD FOR THE NAM PHOUN DAM SITE PROJECT, LAOS

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ABSTRACT

Rock slope stability is one of the major challenges in rock engineering. In this paper, Kinematical analysis on the right bank slope of Nam Phoun Hydropower station dam site project has been performed according to planar sliding and wedge sliding. Field investigation was realized and geometrical properties of rock mass collected, the objective in this paper is to evaluate the stability of the dam site and predict the probable mode of failure; Lower hemisphere stereographic projection of different joints set was realized using a commercial Rocscience program called Dipv.6. Planar sliding and wedge sliding failure performed, show that no probable planar sliding and wedge sliding failure can occur on the right bank slope and for the excavation process; the slope face is stable for dip angle equal 45°.

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THE EFFECT OF A VARIABLE AMOUNT OF NANOPARTICLES ON THE PROPERTIES AND STRUCTURE OF CONCRETE

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ABSTRACT

Nanotechnology is one of the most active research areas. In the last decade, nanotechnology has aroused great interest in the field of building materials. The introduction of a small amount of nanoparticles into cementitious composites can significantly affect their structure and properties. The article presents the results of our own research and a review of previous studies referring to the properties of cementitious composites modified with nanoparticles. Concretes of various amounts of nanosilica introduced as a partial substitute for cement in an amount of 0.75 and 1% of cement weight were tested. An attempt to describe the relationship between properties and the structure of these composites is presented. An improvement in both compressive strength, modulus of longitudinal elasticity as well as fracture toughness of the concrete described with the value of the critical stress intensity factor and the critical length of the effective crack has been demonstrated. An increase in the compressive strength of concrete by about 10%, an increase in the modulus of elasticity by about 32% and an increase in the critical stress intensity factor by about 18% were obtained. Based on the analysis of the load-deformation curves (CMOD) of concretes, a significant differentiation of curves obtained due to the introduction of nanosilica into the concrete was found. On the basis of the results of fractal parameters (fractal dimension) obtained with the use of a laser profilometer concerning the morphology of concrete fracture surfaces and mechanical parameters of these concretes, the relationship between their structure and properties was shown. Along with the increase of mechanical parameters of concretes, there was a reduction in the fractal dimension of the fractures surface of these concretes, which indicates an increase in their homogeneity due to the use of a nanofiller.

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**ANALYSIS OF THE TENDANCY EVALUATION COMPLEX OF THE CAMBRIAN RESERVOIR « Ra » 1A
ZONE, HASSI MESSAOUD AREA, ALGERIA**

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ABSTRACT

The Hassi Messaoud field has a large anticlinal form covering an area of 4200 km² the Cambrian deposits are composed of Ra, Ri, R₁ and R₂ reservoirs related to sandy fractured quartzite, eroded beneath the Hercynian unconformity covered with thick Triassic deposit. This sandstone reservoir is characterized by heterogeneity traduced by extreme variation of petro-physical parameters. This study concerns the 1A zone with the object of analyze and distribution of the different heterogeneity. Ra reservoir is the focus of this study and consists on analyzing different tendency variation of reservoir parameters and determination of different anomalies allowing doing a projection of the best simulation and hydrocarbons recovering. Following this study, the best producing zones are located within the Western zone of D2, central and southern D4, all the eastern part, southern and a part of the northern D5, western and south eastern D4, central D5 north eastern and southern D3.

Corresponding Author: Rabah Chaouchi

**REMEDIATION OF DAMAGED WELL BY DRILLING MUD IN THE SIEGENIAN RESERVOIR, BIR
BERKINE REGION, SAHARIAN PLATFORM, ALGERIA**

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ABSTRACT

Well drilling tests. Assumed that production lack results from damaged caused by drilling mud, first acidification is done within the well BBK-16 and BBKN-07 using mud-acid Hcl of 6% - Hf of 1,5 When production starts some wells have shown a debit decrease compared to the one evaluated in the %. However due to negative results, there was perforated in order to undertake initial potential. Simulation operation or acid treatment of rock reservoirs (lower Devonian) of Bir Berkine region aims to increase permeability related to wells clogging problems with migration of fined particle, shale swelling and asphelts precipitation. Effectiveness of thus treatments is based upon petrographical analysis, choice of acid fluid, determination of acidification parameters and results analysis. We found that mud of Invermul and Versapro used during drilling are damaged, the rate of clogging is estimated at 80% within the two wells therefore and acid treatment is requested. Knowing that mineralogical composition of sandstone within the unit **C** of Siegenian, the mud and the different shifting tests, the Mud-acid «12-2» is considered as a treatment model. Further the use of Mud-acid «12-3» would promote sandstone grains faulting around the two wells.

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PREDICTING WEATHERING CHARACTERISTICS OF CARBONATE ROCKS UNDER DIFFERENT GEO-ENVIRONMENTAL CONDITIONS

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ABSTRACT

Rock moisture content, temperature and physical and chemical conditions of water in the rock mass vary under different geoenvironmental conditions. This definitely causes mechanical and chemical disintegration of rocks in time. Changes in weathering characteristics of rock mass lead drastic decrements in shear strength and increments deformability of rocks. Therefore, durability is an important parameter for rocks and weathered rocks designate wide range variations in their engineering properties which create short and long term durability problems. Carbonate rocks are considered as a durable and strong rock. Still, it is interesting to investigate their durability since carbonate rocks are accessible in number of various locations in the United Arab Emirates like in Al Ain city. The slake durability index (SDI), several wetting and drying cycling processes, test were widely recognized and used to predict the weathering characteristics of rocks. Carbonate rocks in the Jabel Hafit mountain in Al Ain region have highly fractured and cavernous structures. In this study, degradability of three different carbonate rocks of Rus, Dammam, and Asmari Formations were studied within their mineralogical composition and textural structure before and after slaking. Number of slaking tests were carried out on twenty-one rock samples, seven from each rock formation, to investigate the effect of various geoenvironmental conditions on carbonate rocks weatherability at various pH levels 2, 4, 6, 8, 10, 12 and 14. The detailed mineralogical examinations; thin sections, Scanning Electronic Microscope (SEM) and X-ray diffractometry (XRD) were executed to assess the relationship between mineralogy and weathering characteristics of rocks on representative rock samples before and after slake durability tests. Furthermore, the index properties of all samples such as unit weights (γ_d and γ_{sat}), the water absorption (w_a), the porosity (n), void ratio (e) and the specific gravities ($G_{s(OD)}$, $G_{s(SSD)}$, $G_{s(A)}$) were deliberated. The study reveals that the weathering characteristics of carbonate rocks under different geoenvironmental conditions is highly controlled by their mineralogical composition and textural features. On the other hand, the impact of slaking fluid in the degradability of limestone is very limited due to chemical reaction of $CaCO_3$ especially lower pH level acidic fluid, which reduce the bonding strength between grains. The findings will certainly help to resolve durability problems associated with engineering applications such as tunnels, slope stability, and etc. in the region and elsewhere.

Corresponding Author: Hasan Arman

EXPERIMENTAL MONITORING OF MOISTURE CONDITIONS IN THE VARIOUS TYPES OF TRACK BED STRUCTURE

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ABSTRACT

The principle of designing the railway track structure is based on two baseline assessments. The first assessment verifies the resistance of the railway track structure against the traffic load, which is represented by static and dynamic effects from rail transport. The assessment of railway track structure against the non-traffic load is also important for the correct and relevant design of railway track structure. This load is represented by climatic factors such as frost, water, wind and sunlight. The paper presents the results of experimental monitoring of moisture conditions in the various railway tracks structures. The experimental stand Department of Railway Engineering and Track Management (DRETM) was built for this purpose. The monitoring of thermal regime and water regime of railway track is carried out at this experimental workplace. In the introductory part of the paper are presented individual measuring profiles of the experimental stand DRETM, which were progressively built in a scale 1:1, during the past 7 years. The experimental stand DRETM consists of 6 measuring profiles, which differ from each other by track bed structure and shape of track substructure. The measurement of moisture conditions in individual measuring profiles was performed by a non-destructive method using a TDR test probe. The next part of the paper presents the measured results and the evaluation of the moisture conditions (variation of the moisture conditions) in the individual measuring profiles of the experimental stand DRETM. The final result of this experimental monitoring is represented by the design moisture values of the individual building materials applied to the track bed structure. Subsequently, these moisture values serve for numerical modelling of the non-traffic load on various railway tracks structures.

Corresponding Author: Juraj Pieš

NUMERICAL MODELLING OF PLATE LOAD TESTS ON UNSATURATED SILT LOAMS IN LABORATORY STAND

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ABSTRACT

Interpretation of results of numerical modelling of unsaturated soils for complex tasks presents an enormous challenge on engineers to avoid neglecting known inaccuracies of the approximations due to the used constitutive models and to minimise the potential impacts of uncertainties. While the results of numerical modelling of saturated soils (fine, cohesive as well as coarse, cohesionless) can be interpreted with relatively high degree of certainty, the unsaturated soil mechanics and the numerical modelling of unsaturated soils still present a room for further improvement. The paper summarizes results of the numerical modelling of plate load tests on unsaturated silt loams in laboratory conditions using two different constitutive models and different software packages. First part of the paper presents laboratory measurements on large specimens of compacted unsaturated silt loams with constant degree of saturation during the experiments. It comments on the issues of the classical interpretations of static plate load tests including the influence zone theory and further issues with calibration of numerical models using the parameters gained from classical approach. Second part of the paper dedicated to problems of numerical modelling of these soils presents results of the Cam-Clay constitutive model modified for capturing the influence of the moisture content implemented in the SIFEL software package and results of the Hypoplastic constitutive model for clays implemented in the GEO 5 software package. The paper presents comprehensive analysis of advantages and drawbacks of both constitutive models in details and comments on the possible issues when using them for more topologically complex tasks.

Corresponding Author: Miroslav Broucek

UNFAVOURABLE SEISMIC BEHAVIOUR OF REINFORCED CONCRETE STRUCTURES DUE TO SOIL STRUCTURE INTERACTION

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ABSTRACT

The soil-structure-interaction (SSI) effects can substantially alter the behaviour of structures during earthquakes. Implementation of SSI within the seismic analysis often leads to lower stresses in the structure and therefore a more economical design. The recently introduced provisions in European and American codes allow for this type of approach. However, consideration of SSI can also lead to the observation of unfavourable effects (undetectable in a fixed-base analysis), such as higher global displacements or storey drifts, the increase of storey shear forces due to the modification of the structure's dynamic properties, or the collision of adjacent buildings separated by an insufficient structural joint. These unfavourable effects can be related to various parameters such as the structural system (frames or shear walls), foundation type (shallow or piles), geometry of the foundation, height of the building, soil type, design response spectrum, etc. Under these circumstances, integration of SSI into the current structural design becomes essential. The mathematical formulation of the phenomenon is very complex and involves many parameters. For this reason, the definition of complete numerical models is difficult. The provisions in the codes are often general and do not give practicing engineers clear modelling solutions. An analysis of the current situation in the field of SSI is carried out, with a focus on the design of reinforced concrete structures. Based on an extensive literature review, the unfavourable seismic effects and the main parameters that determine them are identified. Conclusions are drawn regarding the situations when SSI should be mandatory and on the different possibilities of implementing SSI in the structural design.

Corresponding Author: Mircea Barnaure

ESTIMATION OF THE DYNAMIC CHARACTERISTICS OF THE FOAM CONCRETE

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ABSTRACT

Dynamic properties of the building materials are not often under investigation because of complexity and difficulty of the dynamic problems, which need to be solved. Foam concrete (FC) is a material that has wide application and utilization in the civil engineering structures. FC is a mixture of cement, water, additives and technical foam and principle of fabrication is well known for more than 30 years. Currently, it is mainly used in the floor structures of the buildings, thus static parameters are investigated. Its usability can be much wider thanks to its specific properties. A research aimed at the application of the foam concrete in the pavement structures takes place at our workplace. FC could be utilized as a sub-base layer at the road reconstructions, excavations or as a structure layer of the new pavements. This paper presents the preliminary outputs of the experimental and numerical analyses of the selected dynamic properties of the FC. Results were obtained from the dynamic hammer testing and the Finite Element (FEM) simulation as a background for the design procedure of the pavement structures. Relevant dynamic parameters such as dynamic modulus of elasticity at low strain or damping parameters were determined in this article. This paper is also aimed at the estimation of the Rayleigh damping coefficients. For the Rayleigh damping coefficients a half-power bandwidth method was selected. Conclusions indicate some dispersion of the observed quantities and further testing and analysis to increase the reliability of the determined characteristics is required. Obtained dynamic parameters will be a background for the pavement design using the FC.

Corresponding Author: Veronika Valašková

A PLASTIC MODEL BASED ON THE BOUNDING SURFACE FORMULATION FOR CYCLIC BEHAVIOR OF SOIL

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ABSTRACT

Cyclic behavior of saturated soil under cyclic loading. Such as earthquake is one significant cause of strain accumulation which can lead to foundation destruction. This paper presents the relationship between hardening rules in multi-surface plasticity and hardening function in bounding surface plasticity, because both of them need to calculate the plastic modulus at every current stress state, applying the new developed hardening rule into hardening function to calculate the variable plastic modulus, this new idea adds the adversity of plasticity model, and a new bounding surface is established. The simulation result of undrained triaxial test verified the reliability of new bounding surface model.

Corresponding Author: Shulin Sun

**RESEARCH ON VERTICAL DISPLACEMENTS THE EXPERIMENTAL SECTION OF RAILWAY
SUBGRADE WITH SPATIAL GEOMAT STRENGTHENING**

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ABSTRACT

This paper focuses on the vertical displacements the experimental section of railway subgrade with strengthening. The problem of complex systems, such as track-substructure or stratified subsoil, is an important issue for modernized railways. For instance, update a railway infrastructure to high-speed rail needs effective solutions a track bed in the area of load-bearing capacity. In special cases, the considered types of reinforcement are used in modernization main lines at the Polish State Railways. The existing methods of ground reinforcement can be divided into two groups. One is physicommechanical reinforcement and the other physicochemical. Physicommechanical reinforcement includes reinforced soil system (soil cooperating with inserts taking tensile stresses), which is proposed in this article. Construction of a three-dimensional reinforcement is called Mattress or Materac. A reinforcing mattress is a layer of stone aggregate pre-stressed in the openwork shell, made of polymer netting. Detailing, Materac (independent reinforcing unit) is made of two net levels, separated by a layer of stone aggregate. Reinforcing nets creates closed mattress cover. The track on the reinforcement mattress, placed under the bedding layer, shows uniform settlements in the section on the classic rail contacts and outside the contacts. The values of these settlements are much smaller in relation to settlement of the track without the reinforcement mattress. The value of the track bed deformation module with the reinforcing layer is definitely greater than the track substrate deformation module from non-reinforced material. Reinforcement layer, introduced in the track bed, contributes significantly to limiting the track twist. As a result, it is possible to extend the service life of the track between subsequent repairs and at the same time increase the economics of track maintenance.

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EXPERIMENTAL STUDIES OF A SOIL WEDGE THE PHYSICAL MODEL RETAINING WALL MADE WITH REINFORCED SOIL

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ABSTRACT

The subject of the article concerns the problem of estimating the surface of a soil wedge in a body retaining wall. The vertical wall made with reinforced soil in which the ultimate limit state of active pressure was raised. A search parameter is a slip line, separating from the plane of soil wedge belong to retaining wall. The presented method allows reducing the soil wedge's surface in the reinforced massif. This applies to the identical geotechnics structure without reinforcement. The task is solved using physical, large-scale models loaded vertically in a static manner. The investigation is measured horizontal displacements of the massif models and the relative deformation of the reinforcement insert. And the research stand, the measurement technique and the method of estimating the location of the slip line were presented. Based on the model tests the size of the soil wedge in soil massif with the horizontal layers reinforcement was estimated. Additionally, it is possible to search for the maximum range of impact zone this soil wedge on the retaining wall model. Reduction the soil wedge surface was determined, depending on the number and type of reinforcement inserts. It takes into account the change of soil compaction from loosely piled into a pre-concentrated. By generating horizontal pressure on the plane of the retaining wall model, congruence the soil wedge results was found by the method of searching for the zone in the soil massif with the results of measurements of the maximum tensile stresses in the reinforcement inserts using the electro-resistance method. In a ground reinforced layers with tapes with retaining elements, the effectiveness of the reinforcement minimally depends on the change of soil compaction. This rule is explained by the high quality of cooperation of inserts with grains of soil material determined by resistance to displacement of inserts.

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THE SURFACE WAVE ATTENUATION AS THE EFFECT OF VIBRATORY COMPACTION OF BUILDING EMBANKMENTS

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ABSTRACT

There are two different sources of dynamic effects observed on buildings and structures – natural phenomena and human activities. Both may be related to mining production or civil engineering construction. Ground vibrations induced by human activities characterize much lower intensity compared to the natural phenomena like earthquakes. However due to the high urban development and sustainable development ideas, preventing destructive effect of man-made vibrations belongs to the most important problems considering structure and soil dynamics. Construction activities, road and railway traffic, and operation of machines, including crushing of spoil material (debris) from demolition works are main categories in the classification of human activities which can generate ground vibrations. This paper takes a special interest in the first of the factors mentioned above. It is evident that the main construction or demolition activities causing dynamic problems in close proximity of structures are caused by pile or sheet pile driving and dynamic soil compaction by means of vibratory rollers or impulse compactors; as well as by demolition of structures, rock excavation and soil deep compaction by explosives. The vibration monitoring process needed to prevent structures from damage is described by various standards. They give particular criteria depending on various technologies and construction materials. The reduction of man-made ground vibrations is now the crucial scope of interest due to the need of sustainable technologies implementation. The negative environmental impact may be reduced at source. Some new specialized methods are also proposed for minimizing vibration transmission with the use of an active generator. The aim of the presented paper is to describe the modelling of dynamic vibratory soil compaction, using finite element method. The presented solution is addressed to short time vibration, generated by geotechnical works. This conclusion can be helpful by planning geotechnical works in the neighbourhood of vibration sensitive buildings/structures.

Corresponding Author: Jarosław Rybak

THE IMPACT OF RAPID IMPULSE COMPACTION OF LARGE NON-COHESIVE MATERIAL DEPOSITS ON SURROUNDING AREA

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ABSTRACT

Rapid Impulse Compaction technology makes it possible for improving of ground physical properties, especially when large thickness of non-cohesive material layers are considered. It is also very efficient for compaction of large deposits of spoil rock from mining industry or from demolition works. It also allows making columns out of mining recycled aggregate or construction debris to improve weak cohesive soils. Equipment used in this method ensures fast completion of the work, however it may cause large noise and severe vibrations. This environmental impact on neighbourhood and adjacent structures may bring some threats and cause discussions over the technology application limits. Nevertheless, there are effective monitoring tools enabling control over the whole process, achieving good engineering effects and running the work without negative influence (or within acceptable criteria) to surrounding buildings and infrastructure facilities. The presented case studies show: how the intensity of vibrations are dependent on the distance from the source of dynamic impact. In the case of analysed Rapid Impulse Compaction. The results were compared to previously published results of computer modelling of such an impact. All the research activities were granted by DABI SM BUDNY Company as the part of their Research and Development program. Numerous cycles of vibration monitoring control were conducted on the building site in Wrocław (Poland). The major part of readings was made in course of compaction of non-cohesive layers, partially replaced by sorted debris from crushing of concrete elements from demolition works. Similar results were achieved in course of forming controlled fills composed of spoil material (crushed rock) from mining industry. Presented research result is a part of joined Polish-Russian program of training periods under the supervision of Jarosław Rybak, PhD from Wrocław University of Science and Technology.

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CORRELATION BETWEEN ELECTRICAL RESISTIVITY AND SUCTION FOR UNSATURATED COASTAL SALINE SOIL

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ABSTRACT

An experimental research on joint application of engineering-geological and geophysical measurements is presented in this paper. Experimental results obtained from filter paper method and four electrode resistivity measurements were presented to characterize unsaturated saline soil samples collected in a test area in Lian Yungang City (in Jiangsu Province), which aimed at defining both soil suction and electrical resistivity curves versus water content at different salt contents. From the matching of the experimental data, relationship between electrical resistivity and suctions were retrieved for the investigated soil. It was concluded that suctions increase with increase of electrical resistivity and increase of soil salt content. The outcomes of the study would provide proper understanding about the influence of physical characteristics of unsaturated soils on their electrical responses.

Corresponding Author: Li Fang

DAMAGE TO ROAD PAVEMENTS IN THE AREA OF LINEAR DISCONTINUOUS DEFORMATIONS ON THE SURFACE CAUSED BY DEEP MINING

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ABSTRACT

Deep mining extraction causes deformations on the surface, which have a negative impact on road pavements located in the area of their influence. Discontinuous deformations are special case of surface mining deformations, which arise in the area of impact of deep mining extraction where longwalls in subsequent seams are overlapped. These deformations take the form of surface thresholds, which are often accompanied by the discontinuity of the subsurface soil layer. In the article this type of damage which occurs on the road lane, in particular on the road pavement, was characterised. The damage leads to the deterioration of longitudinal evenness of pavement, which causes discomfort during driving, and may even pose a threat to road traffic safety.

Corresponding Author: Magdalena Zięba

IMPACT OF MINING EXTRACTION ON ABOVE-GROUND PIPELINES

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ABSTRACT

The issue of the impact of subsoil deformations on above-ground steel pipelines, especially district heating pipelines, located within mining areas in Poland was discussed. The pipelines constructed from steel pipes joined by welding and supported by slide, guide and fixed rigid supports were taken into account. Expansion joints in district heating pipelines are assembled due to significant changes in their length caused by temperature changes. Subsoil deformations within mining areas cause displacements of supports and thus pipelines are subjected to additional displacements, forces and bending moments. Pipelines are protected against this impact by the use of additional expansion joints or expansion joints with an increased operating range. In the article, the way of assessing the possibility of transferring mining deformations of the subsoil by existing above-ground pipelines was presented. Evaluation of the possibility considers: a. assessment of the technical condition of the pipeline construction and supports based on the inventory data, b. assessment of the current ability to transfer subsoil deformation by pipeline compensators, c. kinematic analysis of support displacements resulting from the predicted subsoil displacements, d. static strength analysis for the selected characteristic sections of the pipeline.

Corresponding Author: Piotr Kalisz

FOUNDATION OF THE BUILDING ON SHORT CONCRETE PILES IN A THIN LAYER OF NON-COHESIVE SOILS

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ABSTRACT

The paper presents measurable benefits resulting from optimization of selection, appropriate for local ground-water conditions, type of foundation of a high residential and service building with ten residential floors, two service and two underground ones. The original design solution expected the replacement of up to 8.5 m p.p.t. soft cohesive soils (including organic ones) on gravel mixed with sands. The foundation of the high building is planned as a direct foundation on depth of 6.9 m below ground surface on a foundation slab under a residential part and the service part on a foundation framework on the prepared substitute-subsoil. After a detailed analysis of the data, the contractor reported the possibility of engineering optimization initially the pre-engineering adopted in the project foundation, significantly reducing the investment costs. It was proposed to change the direct foundation on indirect on short foundation piles with a diameter of 600 mm, the base of which is located in the subsoil, shallowly located layer of gravel mixed with coarse sands, about 2,0 m thick. Below the granular soils layer there is at least several dozen meter thick layer of Krakowiec clays. Numerical simulations of the foundation were made, from which it appears that due to the settlement of the building, it is more advantageous to form the piles shallowly in the non-cohesive soils layer rather than deeper. An additional benefit of the adopted solution - foundation of the building on concrete piles - allowed to reduce the trench by 1.5 m and to protect the sheet piles with only one level of struts inside the trench. The settlements values predicted in the numerical model, have been verified by monitoring, which was carried out during construction as well as during the five-year operation of the building. The real settlements of the building reached the level of 45.8% of settlements values of the numerical model, of which 37.5% of real settlements occurred at the stage of completion shell of the building. The discrepancy between the real and model values of settlements may result from the underestimation of the soil medium parameters in the numerical model.

Corresponding Author: Piotr Gąska

EVOLUTION OF THE PHYSICO-CHEMICAL QUALITY OF THE GROUNDWATER OF KHEMIS MILIANA PLAIN - ALGERIA

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ABSTRACT

This article is for goal with the study of the physico-chemical quality of groundwater, which makes it possible to specify the quantitative distribution of the various dissolved elements, to follow their spatio-temporal evolution and to determine the different inter-aquifer exchanges. The study is focused on the analysis of samples of five periods (2010/2011, 2011/2012, 2012/2013, 2013/2014, 2014/2015) at the level of the monitoring network of the tablecloth of Haut Chelif, the dosage chemical elements carried out in the laboratory of water chemistry, the National Hydrous Resources Agency (ANRH - KHEMIS MILIANA). According to the diagrams of Piper, Schoeller and Stabler we can say that the dominant ions are most often chlorides among the anions and calcium and Sodium among the cations. It can thus be seen that the waters of the studied region have two facies according to the direction of flow; it is chloric-calcic in the central part and chlorid-sodium in the western part, which is explained by the geological formations which are not the same in both parts.

Corresponding Author: Sadeuk Ben Abbas Abdelkader

HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF GEOTHERMAL WATERS IN IVRINDI-ILICA-GUMELI (BALIKESIR) AND ENVIRONS, TURKEY

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ABSTRACT

In this study, hydrogeological, hydrogeochemical and isotope geochemical features of Havran, Gönen and Ivrindi within the province capital of Balıkesir, Turkey were investigated in detail. In the study area of Ivrindi, the Çaldağ limestones are the oldest formation Permian age. Çavdarstepe metamorphic rocks are of Lower Triassic age in which can be observed marbles sporadically. The Kınık formation consisting of conglomerates, sandstones, siltstones and limestones are of Lower Triassic age and display a lateral stratigraphic sequence with volcanic rocks. Upper Miocene to Pliocene Yürekli formation consists of dacites and rhyodacites. Upper Miocene to Pliocene Soma formation is composed of clayey limestone, marl, siltstone, intercalations of sandstone, agglomerate and andesitic gravels and blocks cemented by tuffs. Quaternary alluvium is the youngest formation. The geothermal waters of Ivrindi are Na-Ca-HCO₃ type waters. In the area, a groundwater sample is of Ca-Mg-HCO₃ type water. The geothermal waters have cation abundances of Na+K>Ca>Mg and anion abundances of SO₄>HCO₃>Cl in Ivrindi. In the diagram of Na-K-Mg^{1/2}, the geothermal waters in study area can be classified as immature waters.

Corresponding Author: Nevzat Özgür

**HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF
GEOTHERMAL WATERS IN THE AREA BETWEEN GÜVENDİK ANA MALGAÇEMİR (AYDIN);
WESTERN ANATOLIA, TURKEY**

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ABSTRACT

The study area is located in the N of the town of Sultanhisar in the northern part of the continental rift zone of the Büyük Menderes within the Menderes Massif. In the area, the Paleozoic rocks consisting of intercalations of mica schists and marbles form the basement rocks which are overlain by Miocene and Pliocene sediments. The deep circulated geothermal waters in the area are of Na-HCO₃ type and immature origin and were represented in terms of conceptual modelling in this study.

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HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF THE GEOTHERMAL WATERS OF BAKLACI VILLAGE (ALAŞEHİR, MANISA) AND ENVIRONS, TURKEYNevzat Özgür¹, Ezgi Yürük Anılır²¹ Suleyman Demirel University, Department of Geological Engineering, Department of Geological Engineering, Isparta, Turkey² Suleyman Demirel University, Graduate School of Natural and Applied Sciences, Isparta, Turkey**ABSTRACT**

The geothermal waters of Alaşehir form the biggest potential in the rift zone of Gediz with a capacity of about 100 to 200 MWe. Geologically, the gneisses from the basement rocks in the study area which are overlain by an Paleozoic to Mesozoic intercalation of mica schists, quartzites and marbles, a Miocene intercalation of conglomerates, sandstones and clay stones and Plio-Quaternary intercalation of conglomerates, sandstones and clay stones discordantly. In the study area, Paleozoic to Mesozoic quartzites and marbles form the reservoir rocks hydrogeologically. The geothermal waters anions with Na+K>Ca>Mg dominant cations and HCO₃>Cl> dominant anions are of Na-HCO₃ type and can be considered as partial equilibrated waters. According to the results of geochemical thermometers, the reservoir temperatures are of about 185 °C in accordance with measured temperatures. Stable isotopes of $\delta^{18}\text{O}$ versus $\delta^2\text{H}$ of geothermal waters of Alaşehir deviate from the meteoric water line showing an intensive water-rock interaction under high temperature. These data are well correlated with the results of the hydrogeochemical analyses which also indicate intensive water-rock interaction and reactions with silicates. In the study area, the geothermal waters are of meteoric origin.. Finally, the geothermal waters of Alaşehir are distinguished by a 2,0 percent CO₂ of productions in geothermal power plants especially.

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THE CHANGES OF WATER BALANCE IN THE EASTERN SLOVAKIAMarcel Garaj ¹, Pavla Pekárová ¹, Pavol Miklánek ¹, Ján Pekár ²¹ Institute of Hydrology SAS, Dubravská cesta 9, 841 04 Bratislava, Slovakia² Comenius University in Bratislava, Faculty of Mathematics, Physics, and Informatics, Mlynská dolina, 842 48 Bratislava, Slovakia**ABSTRACT**

No big changes appeared in hydrological balance in Slovakia until the year 2000. Nevertheless, after the millennium the changes have started. In terms of climate change, the mean annual air temperature is rising in the territory of Slovakia. It enhances potential and even actual evapotranspiration amounts in Slovakian catchments. Despite of increasing mean precipitation depth for the whole territory of Slovakia (5% in the period 1991–2015 in comparison with the period 1961–1990), the runoff from Slovakian basins is decreasing. If we consider the mentioned facts, it is necessary to predict possible scenarios of water balance development. Prediction is useful for the mitigation of climate change and preparation of adaptation strategies for the future. Very important tools in that are the rainfall–runoff models. The paper deals with assessment of the changes of the hydrological balance in the Topľa River basin (Eastern Slovakia) up to the hydrological gauge Hanušovce nad Topľou during the period 1961/62–2014/15. Firstly we compared changes of hydrological balance of the Topľa River basin in two separated periods: 1961/62–1987/88 and 1988/89–2014/15. From the 54-years annual data we derived the empirical relationship for the estimation of runoff on precipitation amount and air temperature. From it follows, that if precipitation amount will decrease by 100 mm then runoff will decrease by 50 mm. But if air temperature will rise by 1°C it will bring the decrease of Topľa River runoff by 25.5 mm. Then we applied calibrated water balance model BILAN to assess the share of individual runoff components in monthly step. Base flow creates 50.38%, interflow 28.16% and direct runoff 21.48% from total Topľa River runoff. Finally we used the BILAN model for simulation of runoff volume according to the four incremental scenarios – increasing air temperature and decreasing/increasing precipitation. The simulated mean monthly runoff volumes from the Topľa River basin are the outputs of the model. If precipitation depth decreases by 100 mm, then runoff decreases by 77 mm. If air temperature will rise by 1°C it will bring the decrease of Topľa River runoff by 29 mm. These values are higher than those from empirical equation. The worst scenario (increased air temperature by 1°C and decreased precipitation depth by 100 mm) indicates that the runoff from the Topľa River basin will be reduced by 44% in comparison with actual status.

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USE OF GRACE AND RELEVANT REMOTE SENSING DATA TO ESTIMATE SPATIAL AND TEMPORAL CHANGES IN WATER STORAGE OVER THE NUBIAN SANDSTONE AQUIFER SYSTEM, WESTERN DESERT, EGYPT

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ABSTRACT

The Nubian Sand Stone Aquifer System (NSAS; area: 2.2×10^6 km²) shared by Egypt, Libya, Chad, and Sudan is one of the largest groundwater systems in the world. NSAS consists of three main sub-basins: Dakhla, Northern Sudan Platform, and Kufra. An integrated approach is developed and applied to (1) map the spatial distribution of recharge and depletion areas, (2) quantify the recharge and depletion rates, (3) examine the sub-basins connectivity, and (4) identify role of the structural elements (e.g., uplift, shear zone) on the groundwater accumulation and flow. Temporal (04/2002-03/2016) Gravity Recovery and Climate Experiment (GRACE), land surface models (GLDAS, CLM4.5), rainfall (TRMM, CMAP) datasets were used in this study. Our findings include: (1) the Northern Sudan Platform and the Kufra sub-basins represent the recharge areas of the NSAS, (2) the Dakhla sub-basin represents the depletion areas of the NSAS, (3) the NSAS recharge areas are receiving 65 km³ of rainfall each year, (4) the average annual recharge rates over the NSAS recharge areas are estimates at 4.24 km³, (5) the average annual recharge rates represents ~6.5 % of the average annual rainfall, (6) the average annual groundwater depletion rates over the Dakhla sub-basin are estimates at 1.73 km³, (7) the observed GRACE-derived groundwater depletions over the Dakhla sub-basin are highly correlated with the groundwater extraction activities, (8) the observed groundwater depletion over the Dakhla sub-basin is properly related to the presence of the east-west trending Uweinat-Aswan basement uplift, that impedes the south-to-north groundwater flow within the NSAS, (9) compared to the Dakhla sub-basin, the Northern parts of the Kufra sub-basin is witnessing a steady-state conditions that are probably related to the presence of the major northeast-southwest trending shear zone (Pelusium shear system), and (10) Pelusium is apparently providing a preferred groundwater flow pathway from the northern parts of the Dakhla sub-basin. Based on the results of this study over the Dakhla sub-basin, we recommend the following: (1) detailed gravity survey should be conducted to define the spatial subsurface distribution of the Pelusium shear system, (2) hydraulic conductivity measurements in wells along, and at, both northern and southern sides of the Pelusium shear zone should be collected and examined, (3) temporal groundwater levels data should be collected to validate the GRACE-derived groundwater rates, and (4) new reclamation areas should be centered over the northern parts of the Dakhla subbasin along the Pelusium shear system.

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HYDROTHERMAL SYSTEM CHARACTERIZATION BY GEOPHYSICAL METHODS: CASE OF HAMMAM RIGHA, ALGERIA

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ABSTRACT

In Northern Algeria, thermal springs increase from West to East and are mainly situated along the Tellian Atlas which has a complex geology. In this study, we are interested in thermal site of Hammam Righa, located about 100 km southwest of Algiers, in a developed tectonic region southwest of Neogen Mitidja Basin. Thermal waters emerge in a more or less impermeable outcrop of limestone marls of the Upper Cretaceous with elevated temperatures. The rising of thermal waters is related to geostructural elements of the site. So, in order to determine the elements inducing hydrothermal activity in Hammam Righa and to define the structure and the nature of the top of the aquifer, a hydrogeophysical survey was undertaken in this region; by aeromagnetic data processing and electrical prospecting. The aeromagnetic data used provide from The North Algeria Survey and cover an area of 2250 Km². The interpretation of the different transformed maps (reduced to pole, derivatives...), resulting from aeromagnetic data processing, allowed us to bring out some magnetic anomalies and their depth. Also, among these anomalies, we have determined the main structural contacts some of which are revealed by the regional geology. The electrical soundings (VES, Schlumberger type, AB = 1000m) realized according to 10 E-W profiles cover an area of 2.5 Km². Interpretation of these VES resulted in geo-electric sections and iso-resistivity maps, and allowed us to clarify the lithological nature of the top of the Upper Cretaceous and to demonstrate that there is a variation of depth according to the system of faults highlighted.

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**MULTIVARIABLE RELATIONSHIP WITH THE CHANGE OF SULPHATE CONCENTRATION AND
DYNAMIC MODEL FOR THE WATER DEMAND OF THE HUAMBI PARISH, ECUADOR, SOUTH
AMERICA**

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ABSTRACT

The growth population has generated the need for a greater amount of agrarian, water and land resources this work present a dynamic modeling that allows to know the supply and demand of water for agricultural use in function to the population growth of the parish Huambi in Ecuador, South America. To the year 2039 there will be a water demand of 225,000,000 m³ year⁻¹ which should satisfy an approximate population of 6,000 farmers. However, by 2021 the offer will not cover the existing demand. In addition, correlation studies of the RAS vs Mg+Bicarbonate, Ras vs Ca+Bicarbonate, Ras vs ISP, Ras vs EC+STD, of which the highest correlation was that of RAS vs EC+STD with a ratio of 0.8596, also determinate that the river has a stronger correlation between RAS and Ca+Bicarbonate than the one with magnesium. The potential salinity index (SP) shows values of 3.0 indicating that the water is optimal for irrigation. The low values in the sodium absorption ratio indicate a low probability of sodium exchange. Using the procedure of the US Department of Agriculture where the EC relates to the sodium adsorption ratio allow the results to be located in the C1S1 field, which corresponds to water bodies of very good quality for irrigation. In conclusion it was determined that the water of the Arapicos River is suitable for irrigation, highlighting in all indicators used, despite its high quality this river is close to an excess of demand or shortage.

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ASSESSMENT OF SOME HEAVY METALS IN GROUNDWATER OF AWE AND ITS ENVIRONS, PARTS OF NORTH-CENTRAL NIGERIA: IMPLICATIONS TO HEALTH

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ABSTRACT

The study was conducted in Awe Local Government Area of Nasarawa State, parts of the Middle Benue Trough. The aim of the study was to assess the concentrations of some heavy metals in groundwater. Forty-eight (48) groundwater samples (16 from wells, 4 from springs, and 28 from boreholes) were collected. Inductive Coupled Plasma Mass Spectrophotometer (ICPMS) was employed to determine the concentrations of these heavy metals in the collected groundwater samples. The study revealed that the concentrations of Ba, Cd, Co, Cr, Cu, Ni, Pb, U, and Zn in hand dug wells are within the WHO permissible limits for drinking water. However, in Azara the concentration of As in the well water is above the WHO permissible limit. Also, Mo concentration in a well water sample at Kanje is above WHO permissible limit. Strontium (Sr) concentration (0.131 – 1.711) in almost all the well water samples are above the WHO permissible limit (0.07 mg/l). Akiri and Awe springs have As, Ba, Cd, Co, Cr, Mo, Ni, Pb, and U concentrations above WHO permissible limits but the concentrations of these heavy metals in Kekura I and Anuku II springs are within the WHO permissible limits. The concentrations of As, Cd, Cr, Co, Mo, Ni, Pb and U in almost all the borehole water are within the WHO permissible limits with the exception of the artesian borehole at Tsohongari Awe I. The variation in the content of heavy metals in the groundwater may be associated with the geology (Asu River Group and Awe Formations) and also on the present of minerals such as salt, As, Pb and Ba in the study area. Eighty - eight percent (88%) of the groundwater found in the study area are fresh water while brackish and saline water are six percent (6%) each. Ninety-two percent (92%) of the groundwater in the study area are thermal water while only eight percentages (8%) are sub – thermal in nature based on temperature. The likely health challenges that the people using water from the two hot springs may encounter after long time exposure may includes; skin disease, circulatory system and heart problems, cancer, bone fractures, liver and kidney problems.

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PROPOSAL OF PREVENTION MEASURES AGAINST DROUGHT IN URBAN AREAS

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ABSTRACT

The creation of the adaptation strategy on impacts of the climate change in urban area comes out from assumption that the adaptation is not just a single shot but a cyclic dynamic process which has to be systematic and coordinated taking into account the necessity and effectiveness. Those cities which are or will be able to integrate the adaptation into planning process will better resist to reality which is affording the new period of climate change. One of those cities is the Trnava City in Slovakia. The analysis of the present climate change in the Trnava City and its surrounding assumes growing trend of temperature increase during the year and especially the increased extremeness. The combination of temperature and precipitation trends will affect the soil moisture and changes of run-off regimes of rivers. The main goal of proposal of water retention measures on the Trnavka River flowing through the city is the improvement of the water level by retaining the water what should attract public places and to cool down the air in the residential area of the city. The research was concentrated on evaluation of possible realisation of such water retention measures from water quantity and quality point of view. The solution consisted in design of several inflatable rubber weirs, its analysis and prognosis of water level and discharge regime in the Trnavka River using mathematical modelling connected with field measurements and updated detailed geodetic survey.

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POSSIBILITIES OF DESIGN OF FLOOD PROTECTION MEASURES IN THE CATCHMENT

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ABSTRACT

The goal of the contribution is to present possibilities of a comprehensive and complex procedures for proper design of flood protection measures in several parts of Slovakia. The complex approach consisted of mutual integration of results of partial mathematical models – rainfall-runoff model, sewage system model, 1-D hydrodynamic modelling of open channel flow together with partially covered flows, 2-D hydrodynamic modelling of flooding the town residential area. All modelling works have been done in DTM coming from aerial photography or in conditions of detailed morphological and geodetic survey of investigated rivers basins. According to the modelling process appropriate preventive flood protection measures have been designed and afterwards realised in the territory, i.e. detention reservoirs in the mountain region above the urban regions. Designed flood protection measures should store the flood wave volume and mitigate the effect of flush floods on residential areas of small and even larger cities. Several case studies are presented in the contribution all over the Slovak Republic to emphasize the variety of flood wave progress, its reduction in discharge and postponing in time in different hydrological, morphological and geological conditions of mountain regions. Most of the presented proposals of flood protection measures have been projected and some of them have been already realized.

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EVALUATION OF RAINFALL INTERCEPTION ON SOME SHRUBS OF ARID REGIONS

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ABSTRACT

Rainfall interception of the plants cover is a factor causing decrease and delay on run off, and also reducing the rate of soil erosion. Interception is a part of precipitation which is hold by the leaves and branches of vegetation cover, and is evaporated without reaching ground surface. The rate of interception varies based on climatic conditions and the precipitation characteristics such as form, intensity and duration, as well as type, density and the old of vegetation. Due to the important role of interception on water balance of any vegetated area, it is necessary to have a reasonable estimation of this parameter based on local conditions. This research was conducted in the campus of the Ferdowsi University of Mashhad (FUM) during September 2017 to June 2018. The purpose of present study was evaluation of the process and amount of rainfall interception and its relationship with rainfall characteristics for species of *Artemisia scoparia*, *Rosa persica* and *Peganum harmala*. For this purpose, the amount of precipitation was measured under the canopy of mentioned shrub species as well as in open space near the shrubs, immediately after each precipitation event during the research time period. Cover density of the species were also determined by vertical photography from vegetation cover in different seasons, and using Arc GIS 10.3 software. Then based on the analysis of provided data, the amounts of the interception of the species, and also the impacts of different factors affective to these amounts were calculated. Total amount of precipitation measured in the research area during the research time period (Sept. 2017 to June 2018) was 138.89 mm. Based on the results, the highest measured interception was %79.57 occurred in December on *Peganum harmala*, while the lowest one was %7.09 measured in February on *Rosa persica*. Total annual interception for *Artemisia scoparia*, *Rosa persica* and *Peganum harmala* were respectively 38, 30.83 and 54.32 mm which are %27.35, %22.19 and %39.11 of the occurred rainfall. The bunch form of vegetation cover and higher elevation of *Peganum harmala* can be the reason of its higher interception rate comparing to the other species. The results of regression analysis using SPSS 16.00 showed that between the rainfall amount and the interception of *Artemisia scoparia*, *Rosa persica* and *Peganum harmala*, also between growth season of *Rosa persica* and the interception percentage difference exist in the level of %1. In addition, between the precipitation duration and interception rate of *Artemisia scoparia* and *Peganum harmala* as well as between the vegetative form of the evaluated species and interception rate difference exist in the level of %5. As interception is an important component of the hydrological cycle, and plays an important role on reduction of precipitation reaching ground, affects soil moisture, run off and soil erosion during and after rainfall events. Therefore, it is necessary to take this factor in to account to be able to have precise rainfall-run off modelling, water balance calculations and reliable management of water resources.

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TYPE A COMBINED MODEL OF WATER HARVESTING FOR RESIDENTIAL HOUSES OF DRYLAND ENVIRONMENTS: CASE STUDY OF MASHHAD, IRAN

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ABSTRACT

In this research, harvesting of water from a home-scale combined system consisting rainwater from roof catchment and also relatively clean waste water in the second sink of the kitchen has been evaluated in Mashhad, northeast of Iran. For this purpose, after installation of the required equipment and preparation of the system, process of rainfall-run off and the volume of harvested water as well as its quality from each source (roof catchment and the kitchen second sink) were separately measured each month and the whole year. Results showed that the harvested water considerably varies in different months mostly due to large variation of monthly precipitation which is common in the research area. Mean run off coefficient in the roof catchment which was measured in different precipitation events was 0.7313. the annual value of water harvested during the research period which was a dry year (annual precipitation was about %20 less than the long term annual average) was 36.78 m³. However, based on the obtained run off coefficient, the volume of harvestable water in a normal year is 42.292 m³. From this volume of water %69.6 is provided from the roof catchment and the remaining %30.6 belongs to the second sink of the kitchen. This water covered %27.1 of the water used during the year by the family of four people who are living in the house. The results of the quality analysis showed that harvested water has no problem for the non-drinking uses of households. Although, the values of quality parameters vary in different months but only real color (in most of the times) and Mg (in three months) are higher than the upper limit of the standards of drinking water. All other measured quality parameters were lower than the upper limit of drinking water.

**HYDROGEOLOGICAL, HDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF
GEOTHERMAL WATERS IN YENICE (DENIZLI) AND ENVIRONS, WESTERN ANATOLIA, TURKEY**

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ABSTRACT

Study area is located in the northern margin of eastern Part of the continental rift zone of the Büyük Menderes within the Menderes Massif. In study area, the Paleozoic rocks of the Menderes Massif form the basement consisting of alternation of marbles, quartzites and schists overlain by a Neogene to Quaternary 1300 m thick sedimentary sequence. The sedimentary sequence consists of (i) Late Early to Early Middle Miocene alluvial fan to Kızılburun formation, (ii) Middle to Early late Pliocene lacustrine Sazak formation, (iii) Middle Late Pliocene to early Pleistocene lacustrine to fluvial-lacustrine Kolonkaya formation and (iv) Late Pleistocene alluvial fan to fluvial Tosunlar formation. The lacustrine Sazak formation with a thickness of up to 300 m represents the first shallow reservoir. Due to primary permeability and intensely faults and fractures. The Paleozoic alternation of marbles, schists and quartzites form the deep reservoir rocks due to permeability and fracture systems. The geothermal waters in Yenice and environs can be considered as Na-Ca-(SO₄)-HCO₃ type waters. In the area, there are Na+K>Ca>Mg dominant cations and HCO₃>SO₄>Cl dominant anions respectively. The diagram of Na1/1000-K1/100-√Mg shows that geothermal waters in the area can be considered as immature waters with reservoir temperatures up to 100 °C. In the area, the geothermal waters were represented as a conceptual model by hydrogeological, hydrogeochemical and isotope geochemical data.

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HYDROGEOLOGICAL, HYDROGEOCHEMICAL AND ISOTOPE GEOCHEMICAL FEATURES OF GEOTHERMAL WATERS IN TEKKEHAMAM (SARAYKOY, DENIZLI) AND ENVIRONS, WESTERN ANATOLIA, TURKEY

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ABSTRACT

In the Menderes Massif, the plate tectonical development results in the uplift showing dome shaped structure due to compressional tectonic features from Oligocene to Middle Miocene. From Early to Middle Miocene, the continental rift zones of the Büyük Menderes, Gediz and Küçük Menderes were formed by extensional tectonic features, which strike E-W generally and are represented by a great number of geothermal waters epithermal mineralizations and volcanic rocks of Middle Miocene to recent. The geothermal waters and epithermal mineralizations are related to faults which strike preferentially NW-SE and NE-SW and locate diagonal to general strike of the rift zones. These faults are probably generated by compressional stress which leads to the deformation of uplift between two extensional rift zones. Study area is situated in 2 km NW part of the world famous travertine deposits of Pamukkale located in the node point of the Büyük Menderes and Gediz rift zones. Geologically, there are two rocks units for reservoirs in the area: (1) the Neogene Sazak formation forms the shallow reservoir and (2) the Paleozoic Iğdecik formation forms the deep reservoir and are composed of marble, quartzite and schist alternations. In addition to in-situ measurements such as temperature, pH, Eh, EC, dissolved oxygen, TDS and alkalinity values, we have collected 15 samples of geothermal waters and groundwaters in the study area for cation analyses by ICP-OES and anion analyses by IC. The geothermal waters of Tekkehamam and environs are identified to belong to the Na+K>Ca>Na and HCO₃>SO₄>Cl facies. According to the Cl-SO₄-HCO₃ diagram the geothermal waters might be heated by a magmatic source due to the high content of sulfate and boron in geothermal waters. Geochemical thermometers were applied to the collected samples in the region. According to the Na/1000-K/100-γMg diagram, part of the geothermal waters can be considered as equilibrated geothermal waters. According to the results of geochemical thermometers, the reservoir temperatures of geothermal waters range from 160 to 250 degrees C. The δ²H values of geothermal waters are between -61.9 and -51.8, while δ¹⁸O values range from -9.23 to -5.84. The tritium contents of geothermal waters are between 0.7 to 3.3 TU. These results show that there is no mixing with cold groundwaters. The geothermal waters in Tekkehamam and environs can be considered as Na-(SO₄)-HCO₃ type waters. The conceptual model of geothermal waters was represented within this study.

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HYDRO-CLIMATIC TRENDS IN MOUNTAIN CATCHMENTS (POLISH EASTERN CARPATHIANS)

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ABSTRACT

In a changing climatic conditions and rising surface air temperatures, mountain areas with their characteristic environment and accumulated snow deserve special attention and sustainable management. Thick snowpacks, usually lying in the mountains for most of the year, are valuable resources of fresh water, supplying streams and rivers during spring and summer thaws, that is, during the vegetation period. Obviously, as the air temperature rises, snow melting begins earlier and lasts shorter, while the vegetation requires more water to grow. In this context, updated information on available water resources and their potential changes, including hydro-climatic trends, is necessary to enable sustainable management of mountain areas. The aim of the study was to examine potential trends in hydro-climatic variables (river flow, precipitation and surface air temperature) for the medium-height mountain catchments located in the Polish Eastern Carpathians. The monthly data covering the period 1957–2016 (60 years) were made available for research purposes by the Polish Institute of Meteorology and Water Management—the National Research Institute. In order to assess the magnitude of hydro-climatic trends, the Mann-Kendall test with the trend-free pre-whitening procedure was used. Research has shown that long-term monotonic trends are significant ($p < 0.05$) mainly for air temperature, both on annual and monthly basis (for months from April to August). Increasing trends in air temperature are accompanied by less frequent, but significant trends in precipitation, with increases in precipitation for January and May, but a decrease in precipitation for December. For river flow, significant increasing trends were found only in January, in line with precipitation trends.

COMPARISON OF THE DISCHARGE AND FLOW VELOCITY VALUES DETERMINED BY ADV DEVICE AND INDICATOR METHOD

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ABSTRACT

The flow velocity and discharge is important characters of hydrodynamics of a stream. This article presents the results of measurements of discharge and flow velocity in a cross-section profile by ADV (Acoustic Doppler Velocimeter) device – Flow Tracker device (SonTek / YSI) and by indicator method. In principle, ADV device is used to measure the flow velocity (by 3D probe) at various locations within a cross-section profile of a stream and the area to which each measurement refers is determined as well. Indicator method requires the instantaneous release of a known tracer concentration, and the subsequent measures of the tracer concentration in a downstream cross-section profiles measurement section. There were determined and compared the discharge value, mean velocity of discharge cross section (v_m) and section velocity (v_s) - mean velocity between two cross-section profiles. Measurements were carried out in four cross-section profiles in the Hron River (various distances → 720, 922 and 1109 meters) and in four cross-section profiles in the Váh River (various distances → 414, 558 and 741 meters). Results showed, that values of discharge measured by ADV device are lower than by indicator method (not for all cross-section profiles). When it comes to v_m , values obtained by ADV device are lower than the v_m values of obtained by indicator method for the first and second cross-section profile. In the third cross-section profile the situation is reversed. This fact is valid for Hron River and Vah River, and this fact is also valid for to the v_m and v_s .

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WATER OF ABANDONED MINES – VARIABILITY OF CHEMICAL COMPOSITION (BYSTRZYCA GORNA AREA, SW POLAND)

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ABSTRACT

The aim of the study was chemistry characteristic of mine water of abandoned mines. Mining in south-western Poland has over 800-year-long history. Gold, silver and lead ore, copper, tin, hard coal, arsenic and cobalt constituted a great wealth of the Lower Silesian region. Today we can find tens of former mining activity relics spread around the south part of the Voivodship. Every closed shaft, every adit hidden in the mountains, every mining waste pile could tell us incredible story of its life. All the abandoned mines are connected with some groundwater issues. One of the very interesting research area is former lead and silver ore mining complex located in Sowie Mountains near to the village of Bystrzyca Gorna. The oldest rocks in this area are pre-Cambrian gneisses, biotite-oligoclase paragneisses, migmatytes and veins of amphibolites. We can also find diabase amphibolites, amphibolites with garnets and gabbros amphibolites. Northbound there are Devonian conglomerates and dark gray slates with lenses of limestones. For the study two old mines Marie-Agnes and Michael were chosen. They had been operating from XIV to XIX century for lead-silver-zinc ore in quartz-barite veins exploitation. Nowadays adits and shafts of the mines are partially flooded and water outflows from the mines freely. The chemical composition of water outflows depends on reactions between the rock and the water and it affects surface water in the vicinity of the mine. To analyse the variability of mine water chemistry 7 sampling series were carried and laboratory tests of 27 constituents and stable isotopes ($\delta^{18}\text{O}$, $\delta^2\text{H}$ – in water and $\delta^{18}\text{O}$, $\delta^{34}\text{S}$ – in sulphates) were conducted. Mine water of the abandoned mines in the Bystrzyca Gorna area is the type of HCO-SO-Ca-Mg-Na, low-mineralized and contain specific components - zinc and aluminium.

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BRANCHING OF SHEAR ZONE: A POTENTIAL GROUNDWATER RECHARGE ZONE IN PRECAMBRIAN METAMORPHIC ROCKS

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ABSTRACT

Identifying the recharge zones for groundwater in hard crystalline fractured aquifer systems in Precambrian metamorphosed rock is a big challenge, as the movement of groundwater in such aquifer systems are mostly controlled by the developed secondary porosity. The present study discusses the potential zones for high recharge of groundwater in crystalline fractured rock aquifer system in Precambrian metamorphics, i.e. granite gneisses, Quartzite, mica schist, garnetiferous-sillimanite- biotite schist and phyllite, of Purulia district of West Bengal, NE India. The analyses involve careful studies of groundwater flow-net, soil thickness map, digital elevation map (DEM), stream density map and water yield map in GIS platform to delineate the potential groundwater recharge zones. Remote sensing analysis of the satellite imagery indicates numerous branching of shear zone in the study area. Further litho-structural analysis of the branching domains of shear zone indicates more significant hydrogeological significance when compared to the un-branched region of the shear zone. Results reveal strong spatial concurrence between the potential groundwater recharge zones and branching domains of the shear zone. The study concludes that branching region of shear zone is hydrogeologically significant and acts as potential groundwater recharge zones in Precambrian metamorphics fractured aquifer system.

Corresponding Author: Tapas Acharya

INFLUENCE OF HIGH CAPACITY GROUND WATER PUMPING FROM A MULTIPLE WELL SYSTEM IN A HIGH YIELD UNCONFINED AQUIFER

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ABSTRACT

Ground water heat pumps are very efficient heating and cooling system and are nowadays widely used in industrial plants with a high demand for air-conditioning energy. For that reasons, high capacity pumping wells are designed in a multiple well system. Gravel intergranular aquifers with high values of coefficient of transmissivity "T" and large storage coefficient (S) are considered as high yield aquifers. Tests were conducted in an unconfined aquifer on partially penetrating wells. It is a common problem to determine interference produced on a groundwater levels in an aquifer from a group of discharging and recharging wells. Paper describes pumping test procedures for a creation of a groundwater level contour map on a case study in the Industrial zone Čakovec – east, Northwest of Croatia. Multiple companies in the close vicinity within the Industrial zone use ground water for the air-conditioning purposes, of which LTH Alucast Ltd. is the largest. Pumping tests were conducted with the plant standard operational pumping capacities in a time frame of a 24 hours. At the time of testing period, pumping capacities from the surrounding industrial plants were also collected. Measured and collected data enabled simulation of a radius of influence for any pumping period and capacities on a tested industrial area using the AquiferTest Pro computer program. In this article, simulation for a 1 year time period of constant pumping and capacity of $Q = 23 \text{ l/s}$ is shown. Results showed that no adversely effects on an aquifer, surrounding wells and buildings from the drawdown surface will occur.

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**HYDROGEOLOGICAL AND HYDROGEOCHEMICAL PROPERTIES OF GROUNDWATERS
RECHARGING FROM DIFFERENT LITHOLOGICAL UNITS: THE GROUNDWATERS IN THE
SOUTHEAST OF ÇUBUK DISTRICT, ANKARA, CENTRAL ANATOLIA, TURKEY**

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ABSTRACT

The aim of this study is to determine the hydrogeological and hydrogeochemical properties of groundwater fed from different lithologies in southeast of Çubuk basin. Triassic metaconglomerate, metasandstone, metavolcanite, Middle-Upper Triassic limestone and sandy limestone, Middle Eocene andesite, basaltic andesite and pyroclastics, Miocene conglomerate, sandstone, mudstone, Upper Miocene conglomerates and sandstones, Pliocene conglomerate, sandstone, mudstone and Quaternary alluvium are outcropped in the study area and close vicinity. The flow rates of springs were measured between January and December 2016 by using the specific volume method. The measurement period of the flow rates is performed in 10 days for 1 year. The discharge coefficients of the springs were calculated by using Maillet formula. Pliocene conglomerate, sandstone, mudstone, Middle-Upper Triassic limestones and sandy limestones and Quaternary alluvium are the aquifers for groundwaters in the study area. The discharge coefficient of the spring fed from Middle-Upper Triassic limestones was calculated as $1.2 \cdot 10^{-2}$ days⁻¹. The discharge coefficient indicates that the spring is fed from the groundwater circulating in wide fractures, slits and melting cavities. The discharge coefficients of the springs fed from Pliocene and Quaternary porous aquifers were determined between $2.7 \cdot 10^{-3}$ and $8.32 \cdot 10^{-3}$ days⁻¹. These calculated coefficients are indicated that the springs are feeding from the groundwaters circulating in intergranular pores with laminar flow. The investigated groundwaters are classified in Ca-Mg-HCO₃ type waters. The pHs and electrical conductivity (EC) of the groundwaters are ranged between 7.2 and 9.94 and between 32.3 and 1488 µS/cm, respectively. High concentrations of Iron (Fe), Manganese (Mn), Aluminum (Al) and Nickel (Ni) are determined in some of the investigated groundwaters. Fe, Mn, Al, Ni concentrations in the well water recharging from Middle-Upper Triassic limestones, in Aşağıpınar spring recharging from the Pliocene conglomerate, sandstone, mudstone, in the well water drilled at the south of Aşağıpınar spring and in the well water recharging from the Quaternary alluvium are determined as 453ppb, 16.9ppb, 540ppb, 3.22ppb; 289ppb, 25ppb, 329ppb, 9ppb; 994ppb, 178ppb, 99ppb, 69ppb; 375ppb, 62ppb, 177ppb, <5ppb, respectively. Whereas, lower concentrations of Fe, Mn, Al and Ni are determined in Ulupınar spring recharging from Middle-Upper Triassic limestones and sandy limestones and in Büyükpınar spring recharging from Quaternary alluvium. The major anion, cation and trace element concentrations of the Ulupınar and Büyükpınar springs are determined as suitable for drinking and domestic using purposes according to the TS 266(2005) and WHO(2006) standards. However, the Fe, Mn, Al and Ni contents of other springs and well waters are above the limit value of the standards. The possible sources of high concentrations of Fe, Mn, Al and Ni in groundwaters are (i) the interaction of groundwaters with volcanic and metamorphic rocks and (ii) the interaction of groundwaters with the pebbles in the alluvial material especially originated from volcanic and metamorphic rocks.

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GEOTHERMAL PERSPECTIVES OF LITOMĚŘICE SITE: WATER-ROCK INTERACTION STUDY OF THE GEOTHERMAL BOREHOLE PVGT-LT1

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ABSTRACT

Utilization of geothermal energy in low enthalpy regions is made possible with the use of EGS (Enhanced Geothermal Systems). We focus on the area of Litoměřice in the NW part of Bohemian Massif, where a pilot 2.1 km deep geothermal borehole (PGV-LT1) was drilled in 2007. This site is known as a perspective place for construction of EGS hot dry rock deep geothermal heat plant. The water-rock interaction modelling is important part of the geothermal research needed for further operation of the geothermal heat plant. Samples of garnet-kyanite micashist from the rock core from the depth of 991 m below the surface and representative sample of groundwater has been collected from PGV-LT1 borehole. Subsequently the time-series set of water-rock interaction experiments were performed in autoclave in laboratory. The interaction experiments were conducted at constant temperature of 200°C for weeks to couple of months. The reacted liquid was regularly sampled and chemical composition was analysed. Also the chemical, mineralogical and petrological analyses of rock samples from the PGV-LT1 borehole have been performed. The second part of laboratory experiments were focused on interaction between groundwater and borehole iron casing. The leached solution from water-rock interaction experiments was used in corrosion tests. Some long-term and modified experiments are still in progress. The experimental results were used as an input data for geochemical modelling of water-rock interaction in. PhreeqC and Geochemists Workbench software were used for geochemical modelling. The saturation indices for occurring rock forming minerals and secondary precipitation minerals were calculated. It enabled to evaluate the process of dissolution of host rocks and precipitation of secondary phases at different temperatures. The results will be used for optimisation of fluid circulation in future EGS hot dry rock geothermal borehole exchanger. The knowledge of water-rock interaction mechanism is essential to avoid the risk of clogging the borehole exchanges or the failure of borehole casing and/or heat plant equipment.

Corresponding Author: Jan Holeček

**GROUNDWATER EXPLORATION IN TROPICAL REGIONS USING GEOPHYSICAL METHODS:
THREE STUDY CASES IN THE ISTHMUS OF PANAMÁ**

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ABSTRACT

In some sectors of the Republic of Panama water supply depends mainly on groundwater resources. In this study we applied geophysical methods to analyse the response of the constituent rocks, as a faster and efficient techniques for determining the drilling sites. Seismic and geoelectrical methods have been applied in three locations in the isthmus. These sites have different geology and are affected by intense weathering. Geoelectric measurements were made with a multielectrode instrument, obtaining an image of the electrical resistivity distribution. The seismic refraction tomography was made using a 12 channels seismograph, to obtain an image of the velocity distribution. The first site is formed by outcropping intrusive and andesitic igneous rocks. The andesite are very fractured, slightly dense, with a certain degree of magnetization and a marked pattern of joints caused by fracturing and they are well preserved. The intrusive rock is mostly a large body of diorite. In the area fragments of diorites and microdiorites with a high content of magnetite were observed. The fractured bedrock filled with clayey and water-saturated material reduces the electrical resistivity. The diorite is identified with a high electrical resistivity values. Because of the contact zone the resistivity of the andesite. This rock has a thickness of 40-60 meters, but it must be much larger. The second site is characterized by andesitic agglomerates, limestones and shales. The limestone is found above the andesitic agglomerate. These limestones are altered and fractured, in such a way that the fossils present in it can't be identified and the interstices are filled with different materials. In the higher elevations of the mountains of San José, these are inclined below the shales. In this area the results indicate that the altered limestone reach 10 meters deep and are more resistive in depth. The contact between the limestone and the shale are identified from it geoelectrical properties. The last and third site is constituted by the so-called saprolites, followed by altered andesite or even andesite / basalt, which seems to be fractured, judging by the evidence from the field. The area contains abundant debris from the surrounding hills. In this area, seismic tomography has three zones, defined by the contrast in velocity. These materials are clay, fractured and altered andesitic rock and fresh andesitic rock. The results show that the physical properties of rocks in tropical regions may be different to that specified in the specialized literature, mainly geoelectrical values. Therefore, when interpreting field results, these characteristics must be considered. In all three cases, wells were drilled and their performance was acceptable (greater than 200 L/min)

Corresponding Author: Alberto Caballero

CONTRIBUTION TO THE KNOWLEDGE OF TEMPERATURE AND RESERVOIR DEPTH OF SULPHUROUS GROUNDWATER AQUIFER SYSTEMS IN THE DÃO RIVER BASIN, PORTUGAL

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ABSTRACT

The sulphurous groundwater aquifer systems of the Dão River basin in Portugal have been the subject of studies by some authors, as there are several Medical Spas, where over time there has been a need to increase their flow rates to guarantee more available mineral water and better quality. It is known that those waters resurface with anomalous temperatures, and that they are associated with very deep aquifer systems where the reservoir temperature is relatively high. Thus, the present work aims to contribute to the knowledge of the reservoir temperature and its depth, in the sense of taking to the planning of construction of deep wells, so that their results to be favourable, allow energy utilization, that function of the temperatures to be obtained, can allow from the production of electricity, to heating of buildings, heating of domestic water, to aqua-ludic uses in medical spas and leisure areas. After presenting the generic aspects of geomorphology, geology, climatic elements, and global conceptualization from the numerical models of the Dão River basin, the results of physical-chemical analyses of groundwater are presented. It should be noted that the groundwaters with the greatest geothermal potential are associated with deep aquifer systems, semi-confined to confined, fissured type (very localized), with sulphurous water, with pH values higher than 8,0, conductivity above 350 $\mu\text{S}/\text{cm}$, and surface temperatures between 15,7 and 50,7°C. It is important noting the occurrence of four main sectors with geothermal potential, which from upstream to downstream of the river basin are: Cavaca, Sezures, Alcafache, Sangemil and Granjal. By applying geothermal thermometers, in the results of physical-chemical analyses of the groundwaters of those sectors, the reservoir temperatures were obtained between 92 and 116 ° C and also reservoir depths generally greater than 2200m.

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COMPARISON OF METHODS FOR CALCULATING MONTHLY FLOWS ON SMALL CATCHMENTS

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ABSTRACT

This work considers the determination of flows in river catchments without direct monitoring of this variable, what is a reality in most of the world's rivers. Climatic data usually have better availability, and so their use is considered in presented river flows modelling. This paper considers the determination of monthly data, which are suitable for various engineering purposes. Different parameters of water management structures can be determined on the basis of information from such data series, such as irrigation reservoir volumes or water demand for irrigation. Monthly stream flows can also be used in impact studies of climate change.

While determining unknown flows, it is assumed that historical climatic data for the given area and flows in nearby and similar river catchments are available. So-called analogy methods are currently being developed for this task. In these methods, unknown flows are determined based on "analogy" with known measured flows and other data from similar, nearby catchments. This work includes a description of the process of selecting such river catchments. Authors are comparing hydrological modelling and various regression methods for this task. The unknown flows were calculated using the TUW conceptual rainfall-runoff model, with a genetic algorithm used for its calibration. The calculation was performed in daily step, and the daily flows were subsequently aggregated into monthly flows. The calibration was implemented based on flow and climate data from the catchment which, based on previous analysis, was assessed as being the most similar to the river catchment in which the unknown flows were to be calculated. Similar computations were also accomplished with a model based on the monthly time step. To calculate the unknown flows, various regression methods were also applied (linear regression with LASSO regularization, support vector machines, random forest). As explanatory variables, data from several similar river catchments were used, i.e. climate and flow data. These computations used the assumption that flow measurements had recently started in the stream with unknown flows as a requirement for the determination of a longer series of historical flows. In this work was evaluated, that if short-term measurements are available for the relevant river catchment, as the most suitable method was a regression with LASSO regularisation, as LASSO eliminates the problem of multicollinearity in the input data. Another suitable method is the SVM machine learning method, which also offers good generalisation ability. In some situations, specified in work, only a hydrological model can be used for this task. The precision of its results is slightly lesser than results from regression methods, but authors demonstrated that results which hydrologic modelling offer are still suitable in the context of engineering water management calculations.

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DISPERSION PROCESS IN SEWER PIPES WITH SEDIMENTS AND DEPOSITS

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ABSTRACT

Paper describes the dispersion process in sewer pipes, which is from hydraulic point of view a prismatic and straight stream channel with relatively constant roughness of streambed. In such hydraulic conditions should the effect of “dead zones” not occur, but this effect was observed during the field experiments. The reason for this was presence of bed sediments and deposits, which form together with other small obstacles, irregularities in the sewer pipe such dead zones. Dead zones are areas with small flow velocities, which acts as a zone with transient (temporary) storage, where the pollution is accumulated and released gradually later. This process deforms the transport process in sewer systems and causes irregularities in the dispersion process. Field experiments were performed in a straight sewer sections under dry weather flow conditions, i.e. with relatively low pipe filling, discharges and velocities. Sewer pipes were in flat area, so a lot of deposits and sediments was present (mainly in sewer pipes with small diameters) due to low pipe slope. Paper presents the results of field experiments and analyse the impacts of sediments and deposits in sewer system on the transport and dispersion process.

Corresponding Author: Marek Sokáč

HYDRAULIC COMPUTER ANALYSIS OF A RIVER SECTOR UNDER ALTERED FLOWING REGIME DUE TO AN EXISTING BRIDGE AND SUGGESTED SPECIFIC CORRECTION WORKS

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ABSTRACT

The paper presents a 2D numerical modelling of the water flow transit under an altered regime on Strei River, specifically for a 633m stretch influenced by a driveway crossing concrete structure of four gaps (about 71m total span) on a national road outside of Deva Town, Romania. The analysis considers a possible (and requested by specialized regulations) accidental highwaters flow development as assimilated from a specific hydrologic phenomenon that occurred on site during the special spring season of 2000. Taking into consideration the findings and general flow improvement suggestions of a technical expertise ordered by the rivers national administration, the present developed hydraulic model follows the technical recommendations of a formerly feasibility study with respect to streambed correction in the range of the mentioned bridge, specifically the downstream accomplishment of a bottom step (for scouring re-siltation) and two left side river groins (to direct the stream flow towards the central span of a following railway bridge, not covered by present model), accompanied by banks protection and alluvia deposits removing works. Under the given flow and geometry conditions, the study accomplished by the help of HEC-RAS 5.0.6 specialized software package looks to estimate the water surface level and velocity development in space and time, and so to draw the flow transition future state along the analyzed sector. As about the simulation output, the most important conclusions are that the riverbed would be able to discharge the significant flow of 0.1% overrunning probability at a maximum surface level below the structure safety values. In the same time, the reached velocity and particle tracking visualizations suggest a more stable and efficient riverbed time behavior.

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NUMERICAL SIMULATION OF SEDIMENTS TRANSPORT ON A RIVER SECTOR AS DISTORTED BY A CROSSING STRUCTURE

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ABSTRACT

The paper presents a 1D numerical modelling of sediments transit on Someș River downstream of its confluence with Agrij tributary, specifically for a 352 m sector affected by a driveway crossing bridge right outside of Jibou Town building area, about 25 km from Zalău Municipality in the North-West of Romania. There was considered a quasi-transitory flow regime as assimilated from a three years data available period of time, i.e. from August 1st, 1985, to July 31st, 1988. As considering the on-site findings and concluding general riverbed restoration suggestions of a technical expertise ordered by the rivers national administration, the performed numerical model comes in support of the technical solutions stipulated by a feasibility study conducted by the authors with respect to streambed balance achievement in the range of the mentioned bridge. Specifically, the following main interventions were implied: the accomplishment of a downstream bottom step to break the general scouring phenomenon in the structure vicinity and to produce the re-siltation of the central gaps, and the execution of two upstream river groins designated to lead the flow and carried alluvia towards the bridge central area. Thus, the numerical simulation performed by the help of HEC-RAS 5.0.6 specialized software package looks to establish the optimum location and geometry for the bottom step as correlated with bridge area re-siltation and general scouring on the modelled river sector. Specific structural results and flow parameters outcome – water surface level and velocity development – together with important general sediments transport information (e.g. flexible streambed configuration evolution) was concluded from the reached graphical output.

Corresponding Author: Alina-Ioana Popescu-Bușan

NUMERICAL STUDY OF THE WATER DISCHARGE ON A FISH STEPPED PASSAGE AT A LOW HEAD DAM

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ABSTRACT

Whereby the water course is considered a continuous system with hydrological connectivity – longitudinal, lateral, vertical – and variable in time, the design and implementation of barraging steps on water courses will have to follow the river dynamics and to respect the ecological concepts. Looking to diminish the negative impact on the environment, the promoted technical solution needs to consider a series of principles and criteria specific to the river basin for the conservation of nature and biodiversity. A specific river development assuming the accomplishment of a low head overflowing step ending with a water energy dissipater will have to be additionally endowed, according to nowadays legislation, with a corresponding fishway structure preserving the natural passing. The paper presents a numerical simulation of the water discharge transported by the fish stepped passage associated to the low head overflowing Livezeni Dam on Jiu River in Hunedoara County, Romania, considering the possible accidental high waters phenomenon given as a synthetic levels' hydrograph. The hydraulic model looks to analyse the maximum discharges for the special structure and also to estimate the maximum values for water velocity in the strangled cross sections. As a consequent, the adjustment of the steps geometry or number can be studied in order to fulfil the nowadays regulation on the subject.

Corresponding Author: Alina-Ioana Popescu-Bușan

THE EFFECT OF GARDEN TERRACING ON REDUCING WATER TURBIDITY (CASE STUDY: MANSHAD WATERSHED, YAZD PROVINCE, IRAN)

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ABSTRACT

One of the main factors to decrease water quality in rivers is land use changes. This study was conducted to choose the best way for land use management in order to increase water quality related to the least turbidity. So, the effect of land use changes on turbidity was investigated for 2 to 100-year periods using GIS and HEC-HMS model in the Manshad watershed. The amount of CN and land use planning model were variable parameters in each simulation stage. After preparing CN map, HEC-HMS model was calibrated for observed rainfall-runoff events using CN method. Finally, the best model was chosen among linear and non-linear sediment rating curves. The results showed that there are a lot of conformity between present land use and land use planning model. Terrace removing in land use planning model (as a scenario) increased turbidity in the peak discharge (11.02%) compared to the current land use. Therefore, according to the results, gardens terracing in allowable slopes help to manage water and soil in Watershed.

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**SIMILARITIES BETWEEN THE HAMMAM MELOUANE FAULT SYSTEM AND THE THENIA FAULT ZONE:
SEISMOTECTONIC IMPLICATIONS**

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ABSTRACT

Geological and seismological investigations performed in the area of Hammam Melouane (Southern border of the Mitidja basin) allowed us to incriminate a dextral strike-slip fault zone as playing a role in the seismicity of the southern border of the Mitidja basin. This allowed us to characterize the fault zone at outcrop and map-scale. Similarities in terms of bearing, length, structure and distributed character have been observed with the Thénia strike-slip fault zone located 50 km Northeast, at the eastern end of the continental Mitidja basin. In the present contribution, we compare and discuss results obtained from the study of both Thénia fault zone and Hammam Melouane fault system.

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COPPER SORPTION CAPACITY ON NATURAL PEAT

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ABSTRACT

According to abstract data, peat is a good sorbent of heavy metals (Palmer et al., 2015; Cloy et al., 2009; Gupta et al., 2009; Dousova et al., 2015) and can be used in the form of compact and effective geochemical barriers. The concentration of organic carbon, oxides of iron and calcium, and pH define the efficiency of immobilization of toxic elements along with a number of other variables. The sorption method allows to carry out a treatment procedure to decrease concentration of pollutant and to reuse purified water in the closed systems of water recirculation of the facilities. At the same time, the main practical objective is to select the local materials having low cost, but sufficient depth of cleaning. On the basis of peat it is possible to refer availability, low cost, ecological purity, a possibility of regeneration, etc. to number of advantages of biosorbents. Objective of this research was experimental assessment of a sorption capacity of natural peat for sewage treatment from copper ions (II). For the experiment, samples of high-moor, low-moor, and transition-moor peat were chosen. The dependence of sorption capacity on pH was from 4.3 to 7.3, ideal pH value, at which the extraction of copper reaches the maximum values, ranged from 5.6 up to 7.2. In this interval copper ions are present at solution mainly in the form of Cu^{2+} ions. The sorption capacity depends on initial concentration of copper in solution. Extent of extraction decreases with increasing in copper initial concentration in solution that is explained by the fixed quantity of copper ions which can be absorbed by peat of the given sample. To calculate the maximum capacity of peat, the equations of adsorption isotherms of Langmuir and Freundlich were used. The Langmuir model is that localization of substance on a surface of a sorbent proceeds on the monolayer mechanism, in contrast the Freundlich model is applied to the description of sorption on a heterogeneous surface. Calculations showed high plausibility for the Freundlich isotherm since this equation is suitable for the description of application of such heterogeneous porous sorbents as peat. Assessing the maximum sorption capacity allowed to establish that the transitional-moor type of peat is most effective for extraction of copper ions than high-moor and low-moor peat. Nevertheless, it is necessary to consider the fact that the transitional type of peat is uncommon in the nature; therefore other types should also be taken into account. The maximum capacity for high-moor peat was from 0.14 to 0.23 mmol/g, for low-moor - from 0.17 to 2.9, and for transitional-moor peat - 0.32 up to 0.46 mmol of copper per 1 g of the sorbent.

Corresponding Author: Olga Naymushina

**MAPPING OF INDUCED EFFECTS OF AN EARTHQUAKE IN THE REGION OF ALGIERS (ALGERIA)
USING THE GEOGRAPHICAL INFORMATION SYSTEM GIS**

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ABSTRACT

The main geological hazards related to earthquakes will be mapped in the Algiers region; block falls, liquefaction, soil compaction, surface faulting and flooding. A qualitative and quantitative analysis based on a recognition of soil conditions; geological, lithological, hydrogeological, geotechnical and topographical will be performed and superimposed to arrive at the determination of these areas. The final result of this analysis is to individualize homogeneous zones (according to the soil conditions), which can behave in an identical way during the seismic solicitations, thus one makes maps of the hazards induced with different degrees.

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EVALUATION OF THE SOLAR RADIATION IN A SEISMIC ZONE

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ABSTRACT

The solar radiation affects the life on Earth and it is important in meteorology, climatology, solar energy, agriculture, hydrology and seismology, too. The Sun warm the earth which reflect a part of energy. An effect of tectonic stress is the increases the ground temperature that is radiated into atmosphere. We study the possibility to use the variation of reflected energy in correlation with seismicity, radon concentration, CO₂ emission, ULF radio waves, telluric currents, air ionization, temperature in borehole and acoustic noise. In this case the solar radiation is a precursor factor. This research is important for study the effects of climate change. Analyzing the solar energy budget we find information about the atmosphere: aerosols, ozone, sulphure dioxide, carbon dioxide, nitrogen dioxide and pollution. Our multidisciplinary network (AeroSolSys) monitors Vrancea, a Romanian area characterized by deep earthquakes. For this study we use two stations, Plostina and Vrancioaia, where we have a net radiometer and a pyranometer. The first sensor includes two pyranometers (up and low) and two pyrgeometers (up and low), a Pt-100 and a Thermistor. The spectral range covers both the Solar Radiation, 0.3 to 3 micrometers, and the Far Infrared Radiation, 4.5 to 42 micrometers. In this case we measure and determine the temperature of sensor necessary for pyrgeometers, pyranometer short-wave radiation up and low EyU - EyL, pyrgeometers long-wave radiation up and low EgU - EgL, Albedo, net solar radiation NSR, net far infrared radiation NFIR, net total radiation NTR, sky temperature SkyT and, land surface temperature LST. In Vrancioaia we have a pyranometer with range 0.3 – 2.8 micrometers and maxim 1600 W/m². Two video cameras monitor the sky and the measurement are correlated with meteorological equipment installed in each location. We use information about solar activity from NOAA satellites and Copernicus CAMS. The humidity of ground is important in energy budget and it is estimated from meteorological data and telluric currents. The interval of analysis is 3 hours, between 2016.01.01 – 2018.05.31. It is difficult to notice the effect of tectonic stress since the daily and seasonal variations of solar radiation are high but global warming is obvious. Solar radiation monitoring helps us to understand other phenomena like radon emission or air ionization.

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RISK CHARTER FOR MEDIEVAL DEFENSIVE EARTHEN ARCHITECTURE IN SOUTHERN SPAIN

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ABSTRACT

Medieval defensive earthen architecture is typically represented by big and well maintained defensive walls, lookout towers or castles despite mostly represented by remains of tower walls or defensive walls. While studies on natural hazards have been carried out concerning these castles or lookout towers, there are no studies on defensive walls. Both are certainly significant from a cultural heritage perspective, despite the fact that the latter are less popular for the general public. In Southeast Spain, most of this kind of architecture has been affected, and occasionally reconstructed, by destructive earthquakes and/or landslides, in accordance with historical chronicles or field evidence, however there are no records of low-scale natural hazards. Hence, aware of the importance of the prevention of natural hazards regarding the conservation of the cultural heritage, a National Emergency and Risk Management Plan for the Cultural Heritage, a National Plan for Preventive Conservation as well as a National Plan for Defensive Architecture have been enacted by the Spanish Ministry of Education, Culture and Sport. According to these plans, a risk charter, including natural and man-made hazards, should be completed in order to improve investment programming. Cultural heritage risk and cultural assets maps should be connected in order to become an instrument for managing preventive conservation. Natural hazards studies should be conducted in order to protect cultural heritage, though they are not usually performed, most likely due to their cost. However, some natural hazards studies have been published in scientific journals, mainly signed by university researchers or various Spanish research institutions such as the Geological and Mining Institute of Spain. Some of them, including the Spanish Seismic Network or the old Ministry of Environment (currently known as the Ministry for Ecological Transition), have published several hazard and risk maps which can be usually used in GIS format. Yet, most of them are not even known by researchers on cultural heritage due to the different administrative levels in charge of natural hazards. In this paper, some recommendations to prevent natural hazards in medieval defensive earthen architecture will be discussed. This study is part of the project entitled (BIA2015 69938-R) "Sustainable methodology for the Conservation and Maintenance of medieval rammed-earth fortifications in the South-East of the Iberian Peninsula" funded by the State Research Agency (SRA) and European Regional Development Fund (ERDF).

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CAN URBAN FLOOD IMPACT BE MITIGATED THROUGH LAND USE PLANNING? A SPANISH CASE

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ABSTRACT

Most of the socio-economic losses produced by natural hazards in Spain are due to floods. Usually the human settlements are placed near the rivers which frequently are flooding them. Because floods are happening worldwide they are the most legislated natural hazard. In the last years non structural measures, like land use planning, are used to prevent natural disasters instead of structural measures, because they are cheaper and more efficient. Legislation has been amended and improved to diminish socio-economic losses. However, the legal theory is no put into practice so floods are not prevented as legislation had established. Flooding areas should be classified as non developable land according to the Land Act and the natural hazard maps included in the Master Plans, but they are not usually taking into account the available risk maps o hazards maps delineated according to the Royal Decree 903/2010, on flood risk assesment and management, or even the maps included in the Master Plan. Then, sometimes cities are growing to the flood prone areas so the floods are not prevented. Municipalities are responsible for the possible damage caused by floods and they should indemnify to the people affected. The case of Guadalquivir river basin and the city of Seville (Southern Spain) have been studied through the Master Plan and the National Flood Zone Mapping System (SNCZI), developed according to the Hydraulic Public Domain Regulations (Royal Decree 9/2008) and the aforementioned Royal Decree 903/2010.

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INTEGRATED APPROACH TO UNRAVEL MECHANICS OF SLOPE FAILURE INDUCING LANDSLIDES IN DEBRE SINA AREA, CENTRAL HIGHLANDS OF ETHIOPIA

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ABSTRACT

Landslides and ground failures are among the common geo-environmental hazards in many of the hilly and mountainous terrains of the world. The study area is located in the central western highlands of Ethiopia forming spectacular escarpment along the margins of southwestern Afar depression that is tectonically active since the beginning of Cenozoic Era. Owing to this, the area remains potentially unstable environment in terms of slope stability leading to landslides and mass movements at Debre Sina town and surroundings. Particularly, the Yizaba Wein, Shotel Amba, Nib Amba and Wanza Beret localities are repeatedly affected by rainfall-driven landslides. This study aims at understanding the processes leading to initiation and propagation of slope failure, the influencing factors and the failure mechanisms. Comprehensive field and laboratory investigations have been carried out including detailed geological, geomorphological, hydrogeological, seismic refraction survey as well as analysis of geotechnical properties of rocks and their role in slope stability. The rock samples obtained from the landslide localities are characterized by uniaxial compressive strength (UCS), triaxial compressive strength, tensile strength, Young's Modulus, Poisson's ratio, bulk density, porosity, permeability, and ultrasonic pulse velocity (v_p). The seismic refraction 2D P-wave survey was carried out using a high resolution 24-channel seismic unit and measurements were taken at three orthogonal survey lines, within the recently affected area. Integrated analysis of all acquired data indicates that the landslides are dominantly influenced by the inherent variation in the physical properties of the lithologic sequence, complex structural setting, slope gradients which generate adequate stress to promote failure, heavy rainfall and pressure formed during precipitation, bedrock types with low shear strength and low permeability values, seismicity, and active gully erosion. Moreover, the concave shape of the terrain is enhancing the convergence of groundwater flow into the landslide area. This integrated approach and the findings of this study can be used to understand mechanism of landslides in similar tectonic setting.

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CHANGES IN IDF CURVES OF SHORT-TERM RAINFALL IN MOUNTAINOUS AND LOWLAND AREAS OF SLOVAKIA

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ABSTRACT

Rainfall intensity-duration-frequency (IDF) curves are of a great practical importance in water resources management e.g. for the design of hydraulic structures and urban drainage systems, for the estimation of flash flood risk and flood protection design. Due to climate change impact, there is an evidence that short term rainfall are observed in higher frequency than before in Europe and the need of reevaluation of design values of short term rainfall became therefore important. This study analyses observed and projected changes in short-term rainfall events during the warm season (April – October) in an ensemble of a set of regional climate model (RCM) simulations. The analysis was aimed to seasonality, trend changes and changes in scaling exponents. The comparison was done for the selected stations in southwestern part of Slovakia. The characteristics of maximum rainfall events were analyzed for two scenario periods, one past and one future (1960 – 2000 and 2070 – 2100) and compared to the characteristics of the actual observed events in the past. The main findings from the analysis show shift in the seasonality, and changes in trends, which are different for the rainfall durations and differ also for the station analyzed.

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A COMPARISON OF CURVE NUMBER METHOD (SCS- CN) MODIFICATIONS AND THE APPLICATION OF MEASURES FOR SOIL EROSION REDUCTION AND FLOOD PROTECTION IN SMALL UNGAUGED CATCHMENTS IN THE WHITE CARPATHIAN MOUNTAIN IN SLOVAKIA

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ABSTRACT

Knowledge of soil erosion and runoff processes leads to changes in attitudes towards a rational use of soil. Agricultural practices have a wide range of negative environmental impacts, including accelerated soil erosion, degradation, and increases in the volume of surface runoff. It is therefore necessary to investigate these negative influences on arable land. The study area is the municipality of the village of Vrbovce. It is situated in the north-western part of Slovakia in the White Carpathian Mountains. Due to its specific geological (heterogeneous rock masses of flysch) and geomorphological conditions (hilly country, uplands), that part of Slovakia is prone to accelerated soil erosion and mud flood formations. Nevertheless, a significant part of the municipality of Vrbovce is classified as agricultural land. The aim of this study is soil erosion and runoff volume modelling that is focused on changes in the land cover/land use. We calculated soil loss with the Universal Soil Loss Equation (USLE) for agricultural parcels in the cadastral area of the village of Vrbovce. We are offering a set of suitable measures and agricultural procedures for this area as a result of our research. We estimated the direct runoff for the Teplica River basin up to the Teplica water gauge and five ungauged subcatchments in the cadastral area of the village of Vrbovce (Haluzníkov potok, Lulovský potok, Zahutník potok, Zápasečník, and an unnamed creek). The Teplica river is poorly gauged with only a 10-year observation period. That length of hydrological measurements is not enough for the required period for calibrating a hydrological model. We used 3 modifications of the CN method for estimating the volume of the direct runoff with various return periods, i.e., the standard CN method with values for the current land use, the worst land use alternative, and the DesQ program method. We also applied the Pearson Type III distribution for the estimation of the peak flow with a higher frequency of occurrence for the Teplica gauging station. The results of the specific runoff were compared with the values of the specific runoff calculated for the Sobotište water gauge, which is situated downstream of the Teplica river. The results show that the most suitable modification of the CN method is the standard CN method with the use of the values for the current land use. The predictions of the long-term average annual rate of erosion on each parcel from the land parcel identification system (LPIS) was calculated by the Universal Soil Loss Equation (USLE), using the topographic factor calculated by the USLE2D.

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ANALYSIS OF GEODYNAMIC PROCESSES DEVELOPED IN GEORGIA

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ABSTRACT

In the paper the landscape-geographic disasters, caused by natural spontaneous events (landslide-gravitational, mudflow, rock fall, snow slides) are considered. It has been noted that at such locations the use of constant monitoring and creation of single system of communications plays the important role in the activity of state institutions and of the organizations, the operation of which is associated with the control of natural disasters or used for reduction of negative effect caused by catastrophic events.

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THE RELATION BETWEEN RAINFALL INTENSITY AND LANDSLIDE OCCURRENCE IN COMPLEX HILLSLOPES

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ABSTRACT

The occurrence of a landslide relies on various factors, for example, geological, geomorphological, hydrological, biological, and human. However, the basis in making a landslide is mainly a trigger factor where precipitation is recognized as the most common one. The present study aims to determine the threshold of critical rainfall in the occurrence of shallow landslides in complex hillslopes using the physically based model. This model has three parts: complex topography, subsurface hydrology and hillslope stability. This model analyze subsurface hydrology and slope stability in hillslopes with different plan shape (convergent, divergent, and parallel) and different profile curvature (convex, concave, and straight). Then, critical rainfall would be determined for the studied hillslopes according to the calculated safety factor in the physically based model. In the present study, 12 hillslopes, including 7 unstable hillslopes and 5 stable hillslopes were chosen as the samples in the field (Javanrood watershed). All the alternatives of slope stability analyses were found using field studies, experimental data, and topographic analysis of the landslides. According to the obtained results, the amount of critical rainfall for unstable slopes is less than 50 mm/d, although it is more than 100 mm/d for the stable slopes. The results of the model are completely coincide by the observed unstable hillslopes in the field. As in hillslopes with safety factor upper than 1.5 (stable slopes), the hillslopes have convex profile and divergent or straight plan shape. The concave profiles have least safety factor in model and are also unstable in the field. Finally it can be stated that concave and convergent hillslopes become unstable with less rainfall comparing to other hillslope shapes.

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EXPERIMENTATION THE HVSR SEISMIC NOISE METHOD ON THE OUED FODDA FAULT (CHLEF, ALGERIA)

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ABSTRACT

For testing the HVSR seismic noise method in the faults localization, we targeted the Oued Fodda fault which generated El Asnam earthquake ($M_s = 7.3$) of October 10, 1980. Where HVSR recordings made on the fault zone, with an electrical resistivity tomography (ERT) profile to constrain the HVSR results. The HVSR seismic noise technique gives good results for study of trace of large fault. On the Oued Fodda fault, the high-resolution power of the HVSR method to follow the fault corridor was clearly highlighted, as well as to find the contact separating the hanging wall from the footwall and to highlight the disturbed zone related to the fault. A good correlation obtained between the HVSR results and the geo-electrical method.

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PREDICTING EXTREME RIVER STAGE USING DIFFERENT APPROACHES WITH HISTORICAL AND SYNTHETIC TYPHOONS

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ABSTRACT

Taiwan is an island surrounded by sea, located between the Continental shelf of China and the Pacific Ocean. Typhoon hits Taiwan frequently from July to October every year. The sea level rises as the results of decreasing atmospheric pressure and increasing wind speed during typhoon events. The probability of inundation would increase and result in serious damage on property and life losses when the high tide is assembled with strong rainfall. The issue of storm surge and river flooding is necessary to be further investigated. In the current study, Taiwan's coast and the Danshuei River system in northern Taiwan were selected as the study area. We collected 44 typhoon events that had attacked northern Taiwan in the past. The frequency analysis was applied to analyze the parameters of typhoon and thus to generate the synthetic typhoons. 44 historical typhoon events and 360 synthetic typhoons were used to simulate surge heights through the Advanced Circulation model (ADCIRC). The maximum surge heights were then employed to conduct frequency analysis to generate the surge heights under different return periods in accordance with historical and synthetic typhoons. The combination of surge height and astronomical tide was applied to drive the downstream boundary condition using one-dimensional unsteady model for simulating flooding river stage. The simulated results indicate that the generated surge height under 200 and 500 return periods based on historical typhoon events will result in overbank flow. The generated surge height under 100, 200, and 500 return periods based on synthetic typhoons will produce overtopping in river. The results of this study provide the valuable information to government for planning flood strategy.

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RELATIONSHIP BETWEEN DROUGHT OCCURRENCE AND EL NIÑO PHENOMENON IN SOUTHERN PERU: A SPATIAL COPULAS ANALYSIS

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ABSTRACT

Peru is a country with a big number of different climates like consequence of Andes mountains and interannual phenomenon like El Niño. This high variability divides its territory in wet and dry regions: Northern Peru, with periodical floods, and southern Peru, with water scarcity and drought hazard. Drought occurrence is usually associated with occurrence of El Niño Phenomenon however; this relationship has not been fully confirmed. This article shows results of the second part of relationship between the occurrences of drought and El Niño Phenomenon assessment in Southern Peru under a copula's analysis. The initial analysis shown a relationship between ENSO34 region with drought occurrence to elevations until 3200 m.a.s.l. however, more evidence is necessary. In this second part, number of weather stations and study area were increased, and methodology was replicated. Analysed indicators were SPI3 for drought and ENSO34, ENSO1+2, ICEN Anomalies of surface temperature of the sea for El Niño Phenomenon occurrence. First, SPI was estimated for every gage station, and the marginals' distributions to be fitted to every group of data included ENSO indexes. Then, significance to relationship between SPI3 and ENSO indexes was evaluated with Tau Kendall, Rho Spearman and p-value. Finally, Gumbel, Clayton, Normal and Frank copulas were evaluated looking for the best correlation. Copulas analysis shown good fit to Gumbel copula with θ parameter near to 1. Results are summarized in maps to different joint probabilities. This article is a second advance about a more complex research to evaluate and build a copulas model to agricultural drought for Tacna region in Southern Peru.

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PARAMETRIC ANALYSIS OF URBAN FLOOD RISK BASED ON 'SHALLOW WATER' MODEL; A REAL CASE AT SMALL SCALE

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ABSTRACT

In this study, we examined the increased risk of urban flooding due to incorrect or insufficient maintenance of small hydrological basins. In particular, the effects of a peak rainfall event on a water drainage canal next to a town in central Italy were considered. By means of the RiverFlow2D commercial computational software, the *Shallow water* technique was chosen, which is based on the Finite Volume Element and on the Godunov-Riemann technique. We also experimented with parallel computing, by performing the same calculations with GPUs (Graphics Processing Units) and we were able to significantly reduce the total time by 80 times. The study area is located in Pianello di Ostra district (Ancona, Marche, Italy). The peak rain data, which is publicly available, were recorded by the Corinaldo pluviometric station (9.1 km from the area) between April 26th and May 2nd 2014 and it caused a subsequent flooding event lasting two days. We integrated pluviometric data with available cartography, a rigorous site inspection, interviews with inhabitants and a high-resolution topographic survey (30 x 30 cm) acquired with a drone. To process rainfall data, we selected the Curve-Number (CN) empirical method, developed by the USDA Natural Resources Conservation Service (SCS). The parametric simulations on Fosso della Trocca basin were performed considering both pre-flooding maintenance state, with obstructions of the channel and the presence of a small bridge, and optimal maintenance state, with no obstructions and no bridge. The computer-simulated depth of the flooding water was compatible with what was observed during the real flood. Thus, the effects of increasingly intense rainfall events were estimated. However, we found that threshold values exist above which no ordinary maintenance is sufficient to avoid flooding phenomena.

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ANALYSIS OF MAXIMUM RUNOFF VOLUMES WITH DIFFERENT TIME DURATIONS OF FLOOD WAVES: A CASE STUDY ON TOPL'A RIVER IN SLOVAKIA

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ABSTRACT

In applied hydrology, it is problematic to assign the flood wave volume values with a certain probability of exceedance to given corresponding T-year discharges. This dependence is highly irregular, and requires to knowledge of the flood wave course of the given probability exceedance. For this reason, this work deals with the determination of the annual maximum discharge volumes on the Topľa River for the time duration of 2-, 5-, 10-, and 15-days (V_{tmax}). The series of 84 - years (1931–2015) mean daily discharges of the Topľa River at Hanušovce nad Topľov station was used to calculate the maximum annual volumes of runoff. Subsequently, the theoretical curves of exceedance of the maximal discharge volumes V_{tmax} were determined by the Log-Pearson distribution of the Type III. This type of probability distribution is used to estimate maximum (extreme) values across a range of natural processes. The results showed relatively small differences in estimated T-year volumes with comparison of other types of theoretical distribution functions used in hydrological extreme analyses in Slovakia (Gamma, Log-normal distribution, etc.). The second part of the work was focused on the bivariate analysis of the relationship between T-year maximum volumes with different duration and peak discharges by the three Archimedean copula functions (Clayton, Gumbel-Hougaard and Frank). The LP III distribution was used as marginal probability distribution function. Subsequently joint and conditional return periods of the T-year maximum annual flows and T-year maximum volumes with different time duration on Topľa River were calculated. The first one defines joint return periods as the return periods using one random variable equalling or exceeding a certain magnitude and/or using another random variable equalling or exceeding another certain magnitude. The second one is conditional return periods for one random variable, given that another random variable equals or exceeds a specific magnitude.

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THERMAL CONDUCTIVITY PREDICTION FROM P-WAVE VELOCITY AND POROSITY ASSESSMENT FOR SANDSTONE RESERVOIR ROCKS

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ABSTRACT

Empirical relationships between thermal conductivity (TC) and other petrophysical properties depend on local conditions such as the type of diagenesis for the rocks. Therefore, we studied sandstone core samples obtained from two different geographic locations, geological provinces and ages. The relationships between thermal conductivity and other petrophysical properties have been analyzed for sedimentary sandstone sequences of both the Bahariya (Upper Cretaceous, Egypt) and the Szolnok (Miocene-Pliocene, Hungary) formations. We approved three reliable regression petrophysical models [1] connected to these formations that permit us (R^2 ranges from 0.74 up to 0.92) to build an innovative nomography. It predicts rock thermal conductivity from either seismic, logging or laboratory data such as rock porosity (ϕ) and longitudinal seismic wave velocity (V_p). A regression analysis of thermal conductivity measured data for dry (λ_d) and water saturated (λ_s) rock samples yields very moral opportunity ($R^2 = 0.80$ for average, and 0.60 for all data) to estimate thermal conductivity (λ_s) with an average accuracy of better than 0.2 (W /m K). The results can be used to infer thermal conductivity for boreholes without appropriate core data that are drilled in a similar geological setting. The present nomography is verified by laboratory measured thermal conductivity data for dry and saturated sandstone core samples. These samples are collected among five wells [2] in Perth Basin, Western Australia (Jurassic in age) and Soultz-sous-Forêts Basin, Eastern France (Permian – Triassic). The obtained predicted thermal conductivity data (λ_d and λ_s) by using the present models are close to the measured data values and confirmed by reliable and robust (R^2 ranges from 0.80 up to 0.93) coefficient of correlations.

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CALCULATION OF CEMENTATION EXPONENT AND MULTIPLIER USING P- WAVE VELOCITY AND POROSITY FOR SANDSTONE RESERVOIRS

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ABSTRACT

The formation resistivity factor is important as reservoir property because it is required to calculate volume of hydrocarbon in reservoir rocks. It depends on Winsauer's multiplier (a) which is a function of fluid tortuosity and cementation exponent (m). Cementation exponent is a major source of uncertainty in the calculation of hydrocarbon saturation for a given reservoir condition. A small error in the cementation exponent and/or multiplier could give a huge error in the formation factor and have serious consequences. The empirical relationships between reservoir parameters such as P-wave velocity and formation factor depend on local conditions such as environment of deposition, rock type, mineralogy, and diagenesis. For promoting hydrocarbon reservoir development; numerous petrophysical parameters are required. Some of them are measured but the others are sometimes assumed such as cementation exponent (m) and the multiplier (a) of Archie's general equation. The present work offers some empirical models and charts to be used for resolving the cementation exponent and the Winsauer's multiplier. Thirty-nine core samples obtained from the Upper Cretaceous reservoir zones; Gebel Nazzazat, Western central Sinai (Raha, Wata and Matulla formations) were laboratory analyzed for porosity, density, electrical resistivity, and ultrasonic wave velocity. They are composed mainly of clean sandstone, with some limestone and dolomitic limestone. This paper introduces seven innovative charts to estimate formation factor parameters using electrical quality index concept (EQI). They are classified according to the value of multiplier ($a = 0.5 - 4.0$) which is a function of electric tortuosity. The first chart estimates the multiplier (a) from P-wave velocity. The other six charts estimate the cementation exponent (from $m = 1.0$ up to 3.0) using fractional porosity and P-wave velocity at the previously determined multiplier (a). The present charts are based on a reliable empirical relationship ($R^2 = 0.82$) connecting elastic-electrical parameters as formation resistivity factor and P-wave velocity. The model reliability verification is accomplished using 82 laboratory measurements of porosity and P-wave velocity for sandstone core samples from the Bahariya Formation side by side with 51 empirical estimated multiplier and cementation exponent for different lithofacies (sandstones and carbonates) and obtained from several geographic locations.

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HYDRAULIC - ELECTRICAL FLOW UNITS AND WATER SATURATION CALCULATION: DAM FORMATION, SOUTH WESTERN QATAR, ARABIAN GULFNahla A. El Sayed ¹ Abdel Moktader A. El Sayed ²¹ Department of Exploration, Egyptian Petroleum Research Institute, Cairo - Egypt.² Department of Geophysics, Faculty of Science, Ain Shams University, Cairo - Egypt.**ABSTRACT**

Hydraulic-electric flow units represent two different concepts with different measuring units. They are frequently used to confirm each other's for distinguishing the different reservoir flow zones but sometimes give undesirable results. 60 limestone samples were collected from the upper part of the Dam Formation exposed in the Al-Nakhsh area, Southwestern Qatar Peninsula. These samples represent the Upper Dam sediments which are considered as an important aquifer for underground water in its subsurface occurrences in Qatar and nearby areas. Porosity, gas permeability and electrical resistivity were laboratory measured for the collected samples. Saturation exponent (n), cementation exponent (m) and pore throat radius (r35) were calculated for each sample. The vertical profile of gas permeability and pore throat radius (R35) is accomplished. Also, gas-permeability versus porosity is performed. Numerous useful and applicable relationships have been found. The obtained reservoir flow units which are distinguished according to hydraulic flow indicators (RQI and ϕ_z) are only three units. However, the hydraulic-electric cross-plots (i.e. n- R35 and n -FZI) indicate three and four reservoir flow units respectively. In conclusion, the obtained number of reservoir flow units in the study area ranges from 3-4. It means that the hybrid hydraulic-electric combination sometimes shows flow units in concordance with the single type parameter, but occasionally give dissimilar results. An innovative nomograph is constructed according to an empirical equation related to the Dam Formation (El Sayed, 1990) to estimate the water saturation (S_w) in oolitic carbonate facies. The present nomograph is verified by carbonate facies, deltaic distributary channel and barrier bar sandstone. The obtained values of water saturation from the proposed model are acceptable in case of both resistivity ratio (R_t/R_w) and porosity (ϕ) are available.

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**SULPHATE ION INTERFERENCE ON OIL RECOVERY MECHANISM OF LOW SALINITY
WATERFLOODING IN DOLOMITE RESERVOIRS**Chanapol Charoentanaworakun ¹, Falan Srisuriyachai ²

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ABSTRACT

This study focused on the sulphate ion concentration interference with different divalent cations ratio, used in low salinity water flooding in dolomite reservoirs by comparing the oil recovery with the additional or lost amount of divalent cations in brine, occurred from rock surface equilibrium alteration. The oil recovery from injecting different potential determining ions concentration is measured by core flood experiment. The process of detecting the amount of divalent cations begins with establishing oil adsorption on the dolomite grain surface. Then, the grain is stirred in brine with different formula, which is later titrated in order to gather the desired data. Finally, the phenomena occurred during flooding with different potential determining ion concentration is described by combining the result of oil recovery with altered amount of divalent ions. The results showed that at high temperature (70°C), the oil recovery from each case is not much different because high amount of calcium sulphate precipitation can be compensated by high rate of rock dissolution and magnesium carboxylate complex formation. However, at low temperature (30°C), the oil recovery tends to be lower when the sulphate concentration is higher because calcium ion tends to form or precipitate with sulphate ion rather than forming the carboxylate complex. Due to low dissolution rate, the amount of calcium ion is insufficient for oil recovery mechanism, especially when the sulphate ion concentration exceeds the solubility limit. Furthermore, for the case that the ratio of magnesium to calcium ion is high, it is observed that some amount of magnesium ion can form the carboxylate complex to compensate the lost amount of calcium ion. From the result, it can be concluded that at low temperature, which the dissolution reaction occurs slowly, the effect of changing the divalent cation ratio, including sulphate concentration, is large because the formation of magnesium carboxylate complex is not much at this temperature, however calcium sulphate precipitation reduces the number of active calcium ions in oil recovery mechanism. On the other hand, because the dissolution reaction occurs faster and the formation of magnesium carboxylate complex is more favourable at high temperature, therefore the values of oil recovery, even at different concentration of potential determining ions, are not much different at this temperature. Furthermore, it is also found that the carboxylate complex formation can be induced by high concentration of either type of divalent ions when the sulphate ion concentration is not too high.

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INTEGRATED STUDY OF CAP ROCK EFFICIENCY: A CASE STUDY OF SANTONIAN ILAM FORMATION IN ABADAN PLAIN

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ABSTRACT

Seal efficiency study plays the main role in exploration, development and production phases of a hydrocarbon field and is the key step in Post-Drill Analysis of dry exploration wells. In Enhanced Oil Recovery and consequently the Health-Safety-Environment approaches, the long-standing stability of cap rock is vital in the fluid injection processes. In this work, a new application of cap rock studies is introduced for volumetric calculations and a field case of shaly limestone overlying the Santonian Ilam reservoir in Abadan Plain is studied. The results showed that a relatively thin shaly limestone acts as an impeccable cap rock which is able to hold an oil column of more than 400 meters without failure. Integrated study of this field regarding its nearby deeper field data demonstrated a communication in the oil column in these two fields. Therefore, a larger oil column was established which is close to the maximum hydrocarbon column obtained from seal study. Then, imperative considerations related to future fluid injections are discussed which ignoring them will lead to environmentally hazardous accomplishments. Moreover, based on some criteria it is probable for this field case to contain a perched water. The presence of perched water must be ignored for calculation of oil column beneath the cap rock under study (since the oil column will be underestimated) and consequently, for the comparison with maximum hydrocarbon column obtained from cap rock efficiency. The results indicate that the seal efficiency analysis is a robust tool for integrated reservoir and geology studies. For the purpose of injections, in order to avoid any environmental risks, the neighboring structures must be considered in the study. In all, before any decision on EOR processes, assurance about real oil-water contact is necessary beside cap rock integrity analysis.

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STUDY OF CLEANING OF HORIZONTAL DRAINS DURING UNDER BALANCED DRILLING WELL IN THE SOUTH ALGERIA FIELDS

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ABSTRACT

Many difficulties can occur during the well is being drilled directionally, as cuttings may accumulate either in a bed at hole high angles. It is to highlight that the speed of the cuttings depends on the geometry of the drilling and the amplitude of the ROP. Hole cleaning is still among the most important problems to solve during the drilling operations. The difficulty in removing cuttings bed during drilling appears due to the interaction between drilling mud and the cuttings in cuttings bed leading to the formation of a cuttings bed gel. Inefficient cleaning of wellbore can cause decrement in stuck pipe, lost circulation, wellbore instability, high torque and drag, loose control on density, bad quality cement jobs, etc. These problems have a major impact on the economics of the drilling process. Optimization of hole cleaning during drilling operations is very important to enhance the drilling rate. In this study, the Rubiandini and Zhou models have been applied to the well for the prediction of the flow rate required to the ascent of cuttings to the day and to prevent the formation of the beds. The results show the critical flow rate value calculated by the Zhou model (544 l/min) is lower than the in-situ applied flow rate (720 l/min), while for the Rubiandini model, the critical flow is higher (843.16 l/min for the rotary and 783.01 l/min for the sliding). The model of Rubiandini was chosen to make the sensitivity study, because the flow rate calculated by this model is close to reality. We highlighted the effect of major drilling parameters, such as ROP, mud rheology, specif gravity of fluid , density of cuttings, dimension of cuttings, flow rate , flow regime, and rotating speed of the drill string on cuttings transport efficiency are analyzed.

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**CHEMICAL COMPOSITION AND REE CONTENTS IN COALS AND BITUMINOUS SHALES FROM
DİVRİĞİ- SELİMOĞLU COAL FIELD, SİVAS-TURKEY**

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ABSTRACT

Coal is one of the most important sources of energy for the economic development of the countries and its worldwide use continues to increase. However, it produces a large amount of waste products (solid, liquid, and gaseous forms) that cause many environmental problems with industrial or domestic use. In addition to these harmful effects, it contains rare earth elements (REE) that are economically important. The aim of this study is to investigate the coal quality of the Divriği-Selimoğlu coal, which is the most important source of energy source of Sivas region, and to evaluate the REE properties that have economic significance besides the environmental impact. The chemical compositions and trace element contents (Zn, Cu, Co, Cr, Ni, Pb, Cd, As, B, Hg, Sr, Se, Be, Ba, Mn, Th, V, U) in coal and bituminous shale samples from Divriği-Selimoğlu coal field in Turkey were studied. This high volatility coal has low moisture and low S contents, moderate to low ash yield, and high calorific value. Many trace elements such as $\text{Ni} > \text{Cd} > \text{Cr} > \text{B} > \text{As} > \text{Cu} > \text{Co} > \text{Pb} > \text{V} > \text{Zn} > \text{Mn}$ in the coal are enriched in comparison with Clarke concentrations. Especially, studied coal is highly enriched in scandium (as high as 14,28 ppm), vanadium (271,3 ppm), Ni (576, 87 ppm) and Stransium (383,25 ppm) compared with their respective Clarke values. Of the major oxides in these samples, SiO_2 and Al_2O_3 indicate the prevalence of quartz and clay minerals. The concentrations of most trace elements in these coals are unremarkably, falling well within the range for Turkish, U.S. and World coals.

ABOUT THE MICROSTRUCTURE OF THE GRAPTOLITE PERIDERM - EXAMPLES FROM THE HOLY CROSS MOUNTAINS (POLAND)

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ABSTRACT

Graptolite reflectance is one of the main parameters for assessing thermal maturity of pre-Upper Silurian rocks in which vitrinite does not occur. However, microstructure of the graptolite periderm has been known only recently, and still little is known about low-reflectance graptolites. The purpose of the work was to determine microstructural features of the graptolite periderm in the oil window shales and compare them to those known from the previous studies, in which more matured organic matter was investigated. Four samples were collected in the Holy Cross Mountains (Central Poland), in two localities (Bardo Stawy and Prągowiec ravine). Reflectance (R_r) measurements as well as micro-Raman analysis were carried out on the sections parallel to the bedding. Micro-Raman analysis was performed on unpolished surfaces to exclude influence of polishing on microstructure. The obtained spectra were curve-fitted using four Lorentzian (G, D1, D2 and D4 band) and one (D3 band) Gaussian lines. Graptolites ($R_r=0.70-0.77\%$; Vitrinite Reflectance Equivalent VRE= $0.67-0.72\%$) occur in the Silurian dark grey clay shales of the Llandovery (Bardo Stawy) and Wenlock - Lower Ludlow (the Prągowiec ravine) age. Graptolite periderm represents poorly organized carbonaceous material, which is inferred from the occurrence of the D3 and D4 bands, and overlapping D2 and G bands. Microstructure does not vary significantly between the samples from the two considered localities which corresponds to the narrow range of graptolite reflectance. Compared to the Raman spectra obtained from graptolites with higher reflectance, the G band is significantly moved to the lower and the D1 band to the higher wavenumbers. The FWHM of the G band is higher, while the I_{D1}/I_G ratio usually smaller. Taking into account the results from the previous study, it can be concluded that in the reflectance range of 0.7-1.8% the G band position first moves to the higher, and then to the lower wavenumbers, while the D1 band gradually shifts to the lower wavenumbers. The G band FWHM decreases with increasing graptolite reflectance, which reflects improvement in structural ordering, while the I_{D1}/I_G ratio starts to increase at $R_r \approx 1.5\%$, indicating the growth of the coherent domains within the graptolite periderm.

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**CHARACTERIZATION OF THE LOWER CLAY-SANDSTONE TRIASSIC RESERVOIR IN THE
STRUCTURE OF HASSI BERKINE NORTH-SOUTH - BERKINE BASIN- SAHARAN PLATE FORM
(ALGERIA)**

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ABSTRACT

The BERKINE basin is located in the eastern Erg, from the Algerian Sahara to the east of the fields of Hassi Messaoud, Rhourde El Baguel and Rhourde Nouss. The studied structure called Hassi Berkine NS is in a strongly structured zone and underwent several deformation phases. The Hercynian phase, which took place over a long period of time with two Visean and late Carboniferous events, first corresponds to a first stress of direction N040 and then a second stress of direction N120. The structural maps show that the zone is strongly affected. by compressive accidents first and then resumed later by extensional and compressive phases. We found fracture permeabilities indicating the presence of major fractures but the reservoir will produce from the matrix. The iso porosity and isopermeability maps all showed NW-SE or NE-SW oriented isolines. This latter direction corresponds to the major tectonic trends of the Berkine Basin, which suggests that there is a relationship between the distribution of petrophysical parameters and the tectonic evolution and certainly much more through the distribution of facies. After this analysis the essential results of our work are: **a.** From a tectonic point of view, the structure has a NE-SW orientation and the same is true for accidents and trends. **b.** The histograms of the porosity show a polymodal and bimodal distribution which indicates the presence of several types of porosity, primary (intergranular) and secondary. The latter is probably fracture permeability but it is mainly related to the conditions of deposition so to lithology. **c.** The correlation curves show that the permeability / porosity relationship is very strong and that these two parameters are closely related with a correlation coefficient R2 near to 1. It is a conventional reservoir. **d.** At the TAGI reservoir, the porosity varies from 10 to 20%. It is considered average to good. **e.** On the iso-porosity maps the bests areas are located in the central and northern part of the region. **f.** On the iso-permeability maps the bests areas are located in the central and southwestern part of the study area. **g.** The results obtained following the analysis of the maps illustrating the different parameters of the TAGI reservoir, we see that the parts with good petrophysical parameters are located in the channels. By moving away from this channel, the hydrodynamics of the water decreases, which will allow the fine particles to settle and there will be a tendency to have a lot more clays than sandstone, this has the effect of the deterioration of the quality of the reservoir. **h.** Isoporosity and iso permeability map isolines are organized in two directions, mainly NE-SW and NW-SE. These zones could correspond to the direction of the channels.

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DIAGENESIS OF THE CARBONATES AND ITS IMPACT ON THE POROSITY OF THE PLIENSBACHIAN RESERVOIR IN THE DJEBEL ANTAR (DAR1) SAHARA ATLAS - ALGERIA

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ABSTRACT

In Petroleum industry, more than 60% of world stock of oil and 40% of gas are in Carbonate reservoirs (Burchett 2012). In this type of reservoir the Production problems are more complicated than in sandstone ones. In Algeria the biggest production fields in Sahara, are located in Sand stones; however a great attention is paid for the carbonate reservoirs that are located in the north part of Algeria, where the tectonic is complex; and, as a result, the fractures, and the heterogeneity make difficult the characterisation of these reservoirs. At this present time, with the voracity of demand of energy, it is important not to neglect the amount of hydrocarbon in these carbonate reservoirs, and a large program of exploration is carried out in the Sahara Atlas. The plienbachian reservoir of Djebel Antar give us a good example of the difficulty to modelize, these reservoirs, because of the complexity of the carbonate microstructure. The DAR-1 is a good case study, where we have noticed the difficulty to analyse the distribution of petrophysic properties in carbonate reservoir. For that, we have done a sequence analysis of the diagenesis and its impact on the porosity. The purpose of this work is to characterize the plienbachian formation on the macro and microscopic scale, give a sedimentological model of its deposit environment, and its diagenesis evolution. Many diagenetic stage have been identified, according to the chronology of their evolution. The diagenesis processes have an important impact on the carbonate deposits and are responsible for the reservoir quality. In fact the Porosity observed is due to the dissolution; particularly in the dolomites; however it remains low because others processes, such as tectonic, have impacted the reservoir in the DAR 1 well.

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**SEQUENCE STRATIGRAPHY OF THE CAMBRIAN AND ORDOVICIAN SERIES IN THE ILLIZI BASIN
COMPARAISON WITH THE AHNET TIMIMOUN BASIN (ALGERIA)**

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ABSTRACT

Presently there are difficulties to point out the different lower paleozoic's formations in the Sahara Platform. The purpose of this paper is to propose an homogenized nomenclature valid in all the basins. To do so, the sedimentological study and the diagraphic correlation enable us the use of the genetic sequence. In fact, the Cambro-Ordovician sediments of the South East Saharan platform (Tassili outcrops and Illizi basin) show a facies evolution from continent to platform rather than platform to basin; that is the reason why the faciological stratigraphy (Homewood and al., 1992) is applied. The genetic sequences, are limited at their bases and tops by MFS (Maximum Flooding Surfaces); these surfaces mark transition between retrogradation and progradation; therefore, they are not only the best isochrone surfaces and also easy to identify. The "Infra Tassilian Surface" or "Panafrican Surface" marking the contact between the basement and the sedimentary facies is absolutely flat and no horizontal alteration is visible, the sediments are anisometric and cleaned, they contain conglomerates with rounded, gravelly and sandy quartz grains; Kazi Tani (2000) considers it as a marine abrasion surface. Evidence exists for eight cycles of third order and the key surfaces (MFS), which define them, have been dated by biostratigraphy. Correlations have been done between the Tassilis Outcrops series and wells which helped in finding new oil stratigraphic traps and argillaceous seal rocks. In the same way The Cambro-Ordovician sediments of the South West Saharan platform (Ahnet Timimoun basin) show the same evolution; however, there are only six cycles that are interpreted as a result of Geodynamic evolution of this region. On top of that, in this study we have noticed that the flooding surfaces, between two MFS, presents two important characters in the formation of the stratigraphic traps: a. formation of pinch out reservoirs, b. argillaceous facies very widespread consisting most of the cover of the trap. Therefore, the flooding surfaces appears to be a new way to develop oil exploration in this region.

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ARSENIC POLLUTION IN GROUNDWATER OF GANGA DELTA OF WEST BENGAL, INDIA: AN INTEGRATED APPROACH OF GEOMORPHOLOGY AND MEDICAL GEOLOGY

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ABSTRACT

Pollution of arsenic in groundwater is a major problem in aquifers of Ganga delta in West Bengal, India. Consequently, arsenicosis disease is one of the vital issues of public health in this region. In this aspect, determination of the spatial distribution of vulnerable zones for arsenic pollution in groundwater is essential to provide a better public health condition. Detailed study of concentration of arsenic in groundwater is studied spatially to get the hot-spot of such arsenic pollution in Malda district of West Bengal, India. Thematic maps of geomorphology, land-use, palaeo-channels and lithology are studied in details. Spatial correlation of these thematic parameters and distribution of hot-spots of arsenic pollution reveals close association of arsenicosis with newer and recent alluviums in such region. It is further influenced by presence of palae-channel to the proximity of newer alluviums. The study indicates the close spatial correlation of arsenicosis with the newer alluvium and palaeo-channels in the Ganga delta region of West Bengal, India. Such regions in the whole Ganga delta may be considered as the vulnerable zone to arsenicosis. These zones are susceptible to public health condition and close comprehensive monitoring of groundwater quality might provide better public health condition in Ganga deltaic region.

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ANALYSIS OF FACTORS INFLUENCING THE SPATIAL VARIABILITY OF BANKFULL WIDTH AND SINUOSITY OF CHANNELS IN SOUTHERN QUEBEC

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ABSTRACT

This study is part of a research program designed to determine the influence of channel morphology on the intensity, duration and frequency of flooding in southern Quebec. One of the program's objectives is to identify factors that influence the longitudinal and spatial variability of bankfull channel width and sinuosity. To achieve this objective, we analyzed the bankfull width and sinuosity of 49 rivers spread across the three geological landform regions of southern Quebec: the Canadian Shield (north shore of the St. Lawrence River), consisting of intrusive and metamorphic rocks; the Appalachian Region (south shore), consisting of pleated sedimentary rocks; and the St. Lawrence Lowlands (both shores), consisting of schist and carbonated sediments. Bankfull width and sinuosity were determined using aerial orthophotos taken between 2002 and 2006. These two variables were calculated over a 10 km distance for each river. Bankfull width was measured every 100 m. To determine spatial variability factors, the sinuosity and average bankfull widths of 49 river channels were correlated to 10 variables (watershed area, stream length, average watershed slope, lithology, 2-year recurrence interval flow rates, average annual daily peak flow rates, spring peak flow rates, number of islets, number of banks, forest area and lake and marsh area) using canonical correlation analysis. The results of this analysis revealed that bankfull width averages show a strong positive correlation between watershed area and flow rates. However, the ANOVA revealed that, where watershed area is equal, average bankfull widths are greater in the Appalachian Region than in the two other geological landform regions. Sinuosity, however, correlates negatively to the same variables (area and flow rates). One of this study's contributions is to highlight a very strong connection between watershed area and bankfull width. Accordingly, this connection makes it possible to estimate the bankfull width of all rivers in Quebec without using flow rates, and to quantify the impact of dams on bankfull width at locations downstream from the dams.

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THE BARITE FROM HIGH PLATEAU (WESTERN ALGERIA)

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The Oran High Plateau (Northwestern Algeria) hosts numerous barite deposits. Two areas. Beni Snouss and Tifrit contain stratabound and barite veins. The veins cut cross Hercynian granite and Lower Jurassic rocks. They are associated with quartz and tourmaline veins in the calcalkaline granites. The veins vary in thickness from a few centimeters up to 2 meters, and their length varies from 10 up to 100 m. Most of the veins are N50 - N75 and 60 to 90 dip. They show massive, brecciated and drusy textures. Barite is white, pink or transparent. The important minerals of the vein, in the order of their abundance, are barite, pyrite, chalcopyrite, galena and sphalerite, and small amounts of Fe-hydroxides. Secondary malachite, cerusite, covellite and azurite appear locally. A microthermometric fluid inclusions study was carried out on barite, sphalerite and calcite from the mineralized areas to characterize the salinities and approximate temperatures of the ore-forming and regional fluids. Fluid inclusions from barite, calcite and sphalerite have the eutectic temperature (Te) or first ice-melting range from -55 to - 48, this indicating the presence of aqueous solutions in the NaCl-CaCl₂-H₂O system. The homogenization temperatures (Th) of the aqueous inclusions range from 100 to 130°C in sphalerite and calcite. Lower temperatures have been measured in the samples from the occurrences in the cover rock. Homogenization temperatures between 135 and 164°C have been measured in barite (from basement and cover). The interpretation of these data in their geologic context favours a basinal fluid of the mineralisation of the study area.

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GENESIS OF THE MESOZOIC ALKALINE INTRUSIONS OF THE KHOKHOI ORE FIELD (UPPER AMGA GOLD-MINING DISTRICT, ALDAN SHIELD, NORTH ASIAN CRATON)

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ABSTRACT

The article discusses petrography and features of chemical composition of the Mesozoic alkaline intrusions of the Khokhoi ore field located within the Upper Amga gold mining district in the Aldan Shield. This gold mining district is located in the Aldan-Stanovoy Province rich in gold. Tectonic position and magmatic events of this Province is close to those position and events of Shandong Gold Province of Sino-Korean Craton. The investigation of the genesis of the magmatic rocks and comparison of the Provinces can shed light on the genesis and regularity of location of the gold deposits in them. Intrusions of the Upper Amga gold mining district passed through the metamorphic rocks of the Precambrian and intruded into the Cambrian carbonate rocks and the Jurassic sandstones. Petrographic observations found that large intrusive massifs of the ore field consist mainly of potassic feldspar and plagioclase. Mineral composition, structure and texture of the rocks correspond to syenite and monzonite. Blocks of melanocratic rocks – presumably tephrites, are rare on the surface. Several generations of feldspar and dark-colored minerals are observed within all these rocks, indicating melt fractionation. High Sr and K contents were identified in the rocks. Contents decrease in the series of tephrite-syenite-monzonite. This feature, judging by other petrochemical data, can be associated not only with magmatic differentiation, but also with the melting and interaction of the lithosphere. In sienites, ovoids of quartz and the first-generation potassic feldspar melting margin were found. It could be possibly resulted from the capture of surrounding rock material and changes in the thermodynamic conditions of crystallization. It is found out that, potassium and silicon contents in rocks depend inversely on calcium content. Interaction of melts and the host carbonate rocks with removal of silicon and potassium and formation of gold-bearing sericite-quartz and feldspar-quartz metasomatites is assumed. The loss of potassium probably has led to potassium metasomatism at the contacts of intrusions. This metasomatism produced the gold ores.

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MAIN FEATURES OF YAKUTITES FROM THE EBELYAKH PLACER

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ABSTRACT

Yakutites (polycrystalline diamonds with lonsdaleite admixture) from the Ebelyakh placer (Yakutia, Russia) have been studied by optical microscopy, Raman spectroscopy, and neutron diffraction in order to reveal their difference from tagamite-hosted diamonds of the Popigai impact crater. The yakutite aggregates are 2.0 mm to 13.0 mm in size and have a shapeless morphology or sometimes preserve hexagonal contours of primary graphite. Raman spectra are characterized by a broadened line in the region of cubic 3C diamond, which is interpreted as the sum of spectra from cubic 3C diamond and three peaks related to Lonsdaleite: 1338 (E1g), 1280 (A1g) and 1224 (E2g). On the surface of yakutites revealed the presence of a silicate glass film. The main elements are iron, silicon from the surrounding silicate matter. Neutron stress diffractometry showed the content of diamond and Lonsdaleite in the sample of yakutite by 50%, two cases of preferential orientation of two phases were recorded: (110) diamond // (110) Lonsdaleite; (111) diamond // (001) Lonsdaleite. Both yakutites and tagamite-hosted diamonds are of impact origin and share similarity in the phase composition consisting of more abundant diamond and subordinate amounts of lonsdaleite. Differences between them depend on the place of their formation. Yakutites were formed in the epicenter of the explosion and were thrown out of the crater at a distance of more than 550 km in radial directions, and from the vertical ejection - they got back to the crater. In tagamites, impact diamonds were formed simultaneously with the rock melting due to the shock wave that came from the epicenter. The presence of a silicate glass film on the surface of yakutites indicates that they were hardened after ejection from the crater. Yakutites represent distinct mineral fraction outside the crater. They are found as placers along with common diamonds and other detritus. Within the crater they are genetically related to suevites – tuffaceous component of the impactites and enter the crater placers due to the physical weathering of suevites. Tagamite diamonds practically do not occur in the crater placers, because tagamite is a very hard rock and in the absence of chemical weathering these diamonds can't be released. Thus, diamonds from tagamites and yakutites, having a common impact nature, differ in some properties determined by the place of formation and post-impact history.

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THE FIRST DATA ON THE STUDY OF A RARE FINDING OF GARNET FROM THE SINYAYA RIVER ALLUVIUM (EASTERN SIBERIA)

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ABSTRACT

The first data on the study of a rare finding of garnet from the alluvium of the lower courses of the Sinyaya River – a left tributary of the Lena River (Eastern Siberia) are presented. A rounded boulder weighing more than 200 kg – garnet-staurolite-muscovite schist was found on the left river bank. Muscovite 34 %, staurolite 28%, almandine 20%, quartz 10% and a mineral from the group of feldspar 8% are the main minerals of the rock. The maximum size of garnet crystals extracted from the rock is 10 mm. The color of garnet crystals varies from brown-red to purple. The garnet crystals were determined to be close to almandine (MgO 1.95–3.43 wt. %) by scanning electron microscopy and X-ray phase analysis. Some garnets contain admixture of MnO (1.65–1.82 wt. %). Rutile, quartz, ilmenite, rare earth phosphate close to rhabdophane, zircon and graphite inclusions are identified by optical electron scanning microscopy and Raman spectroscopy. Rutile inclusions dominate in the garnets. They are presented by oriented short- and long-prismatic needle crystals with a length of 10-100 μ m. Rutile inclusions, brought to the surface, mostly pure, without admixture, are often found in coalescence with ilmenite. Needle inclusions of rutile and ilmenite are products of solid solution decomposition. It is easy to trace the process of decay of elongated inclusions on the number of fragments and subsequent change of their form to isometric by optical methods. Studied garnets are characterized by almandine composition with high content FeO (36.58–39.81 wt. %). Crystal chemistry formula for the average composition of garnets was calculated on the basis of 12 anions to be $(\text{Fe}^{2+}_{2.61}\text{Mg}_{0.32}\text{Mn}_{0.07})_3(\text{Al}_2\text{Fe}^{3+}_{0.01})_{2.01}(\text{Si}_{2.99}\text{Al}_{0.01})_3\text{O}_{12}$.

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**TYPOMORPHISM OF FINE PLACER GOLD AND POTENTIAL PRIMARY SOURCES OF THE ANABAR
MINERAL SUBPROVINCE (NORTH-EASTERN SIBERIAN PLATFORM)**

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ABSTRACT

Typomorphic features of placer gold of the Anabar and Bolshaya Kuonamka river basins are studied with the aim of determining its indicators and forecasting potential primary sources. All analytical work was carried out in the department of physico-chemical methods of analysis IGABM SB RAS. A detailed study of the morphology, surface microrelief, photographing was performed on a JSM - 6480 LV scanning (microscope) microscope of JEOL company with Oxford Instruments analytical prefixes (wave and energy dispersive spectrometers). Gold fineness is determined on Camebax-micro X-ray microanalyzer a «Cameca» firms. It is shown that the main sources for the gold are auriferous reservoir rocks of Neogene-Quaternary age. The indicator typomorphic features of the gold include a small size (<0.5 mm), scaly and platy forms, rough shagreen surface with casts of minerals pressing, and high fineness (900-999‰). The most highly informative feature is a strongly modified internal structure of the gold showing evidence of granulation and recrystallisation. Autochthonous gold of ore habit is also found. Characteristic features of this type of gold are a very small size (<0.2 mm), angular-cloddy forms of individual particles, rough porous surface, widely ranging fineness (535 to 999‰), heterogeneous chemical composition, and a complex, multi-phase internal structure. This indicates presence of neighboring primary sources. Hydrothermal-metasomatic formations with disseminated gold-sulfide mineralization, discovered at places of tectonic jointing of carbonate rocks, developed in fault zones could be such sources. Considering epigenetic mineral associations, quartz-potassium feldspar and quartz hydrothermal-metasomatic formations are identified. Ore mineralization of disseminated type is represented by (in decreasing order) pyrite, gold, chalcopyrite, galena, sphalerite and silver. Gold is found in native form, and in association with pyrite (quartz metasomatites) and potassium feldspar metasomatites). Thus, as a result of performed studies, indicator typomorphic features of autochthonous fine gold are identified. Near-fault hydrothermal-metasomatic formations with gold-sulfide disseminated mineralization are discovered at the studied area for the first time and examined.

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**MINERALOGICAL FEATURES OF ULTRAHIGH PRESSURE IMPACT GLASSES OF THE KARA
ASTROBLEME (PAY-KHOY, RUSSIA)**

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ABSTRACT

The behavior of the disordered systems in the conditions of the strong compression attracts particular interest in materials science. Natural impact glasses, being with a metastable state, can keep features of the structure for millions of years, form essential volumes compare to experimentally possible high-pressure products. The complex analysis of geological, mineralogical-petrographic, petrochemical features and degree of crystallinity of tagamites, vein glasses and vitro-clastic formations of the origin type of melt impactites of the Kara astrobleme including their phase state composition have been studied. The melt Kara impactites have dependence on the initial character of the melted sedimentary target and cooling velocity of an impact melt. The lowest order has been described for ultrahigh pressure vein-type glasses which contain silica drops with single crystalline coesite and firstly found melt-crystallized high pressure variety of smectite. The vein melt impactites consist of solidified impact melt presented by totally amorphous alumina silicate glass with augite microcrystallites and ultrahigh pressure silica glass with coesite microcrystals and “drops” of firstly found melt-crystallized high pressure variety of smectite. The boundary between alumina silicate and silica glass is characterized with liquated amorphous Fe-rich drops. The special feature of the studies melt impactites is low alteration in spite of 70 Ma age and high content of water. The large volumes of an impact melt created massive tagamite bodies have longer cooling underwent with the almost complete crystallization. The obtained data indicate the specific nature of melt glasses of vein type and prospects of their further research for fundamental study of amorphous state under ultrahigh pressure and propose new materials.

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**PHASE COMPOSITION AND MICROSTRUCTURE OF UHPHT VEIN GLASS FROM GIANT
DIAMONDIFEROUS KARA IMPACT CRATER BY RAMAN MAPPING**

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ABSTRACT

2D and 3D Raman mapping allows to observe "in situ" distribution of phases and relationship of minerals in rock samples, different mineral aggregates, mineral inclusions within crystals and other quantitative spectroscopic studies of mineral substances and materials. The method is realized in accumulating and processing of big data array of Raman spectra (RS) from selected areas of a studied sample with subsequent visualization in XY plane at 2D mapping or in the form of 3D experimental models with XYZ coordinates in a case of 3D Raman mapping. During the mapping different analytical data can be visualized as maps such as spatial distribution of mineral phases, degrees of their crystallinity, orientation of crystallites and their size, residual tension in minerals and inclusions and many other parameters. As 3D Raman mapping demands higher requirements to quality of samples, takes significantly long time expenditure and big data for processing, 2D Raman mapping looks to be the most effective for different mineralogical applications. In this work we demonstrate advantages of 2D Raman mapping on the example of studying of the impact ultrahigh-pressure high-temperature (UHPHT) vein glasses with melt-crystallized ultrahigh-pressure silica phase - coesite, for the first time found within diamondiferous impactites of the giant Kara meteorite crater. The mapping was produced with processing of typical spectra ranges of recognized mineral phases met in analyzed areas. As a result of the conducted studies it has been established what according to spectroscopic data coesite belongs hangs to central parts of UHPHT silica glass located in general matrix of aluminosilicate glass. The sites of silicate glass are characterized by fully amorphous state that is obviously shown in its typical ranges. The areas with a high luminescence correspond to inclusions of smectite micro-drops in UHPHT silica glass isolations that has been confirmed with the accompanying study with use of electron probe microanalysis (EPMA), energy dispersive spectroscopy (EDS) and electron diffraction (ED). The used 2D Raman mapping to the impact vein glasses of the Kara meteorite crater allowed to reveal distribution of mineral phases in UHPHT glass, showing distribution of amorphous and crystalline phases that is undoubted advantage of the Raman spectroscopy. In full text of the paper technical features of Raman 2D mapping are shown that can be useful for similar mineral objects and materials with complex phase structure and different degree of ordering. The work has been provided with financial support of the Russian Science Foundation, project #17-17-01080; the analytical equipment has been used at the Center for Collective Use "Geonauka" financed through NIR # AAAA-A17-117121270036-7.

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**VARIETIES OF IMPACTITES AND IMPACT DIAMONDS OF THE KARA METEORITE CRATER
(PAY-KHOY, RUSSIA)**

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ABSTRACT

Impact diamonds are valuable technical material with the value mechanical properties. Despite of quite long story from their discovery and found huge diamond storages at the Popigai astrobleme (Siberia, Russia) they were not involved in industrial production, first of all because of remoteness of objects, complexity of extraction and economically more favorable synthesis of technical diamonds for the 70th years of the 20th century. However, the essentially value properties of the impact diamonds and also high demand of new carbon materials, including nanomaterials, the interest to the sort of natural diamonds is grown with a new force recently. The mentioned Popigai astrobleme is set in a wild part of Russia, but it has been more studied. At the same time, the less known Kara giant meteorite crater (Pay-Khoi, Russia) is set essentially closer to industrial infrastructure of the European part of Russia. The astrobleme is enriched in impact diamonds too. But, till recent time it was not deeply studied at the modern level. During the provided studies in 2015 and 2017 at the territory of the Kara meteorite crater we have divided and described 5 varieties of impactites – bulk melt impactites, forming cover-like and thick dike bodies; melt ultrahigh-pressure vein bodies and at list 3 types of suevites formed after specific sedimentary target rocks. The divided varieties have typomorphic features in the crystallinity level and mineral composition. As it was established that all of them have high concentrations of microdiamonds formed with specific high-pressure high temperature pyrolysis mechanism after coal and organic relics. Using a complex of modern mineralogical methods we have found two principle different diamond within the Kara impactites – sugar-like after coal diamonds and diamond paramorphs after organic relics found for the first time. The Kara diamonds have a number of accompanied carbon substances including newly formed graphite, glass-like carbon and carbyne. The studied diamondiferous Kara impactites bring a new knowledge about impact processes and mechanisms with sedimentary targets.

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KIMBERLITE GENESIS ACCORDING TO DATA ON HOT ACCRETION OF THE EARTH

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Analysis of modern geological and planetological data indicates hot accretion of the Earth. Impact melting during its formation led to origin of layered global magma ocean. Kimberlites were from residual melts of its lower peridotite layer. This explains high content of meltphylic (lithophylic) components in kimberlites. Prolonged cooling and crystallization of magma ocean from top to bottom in the Earth's history is the cause of mainly the Phanerozoic age of kimberlites. Moving apart of lithosphere and products of magma ocean fractionation contained therein when oceanic areas are formed, explains absence of kimberlites in these areas and Clifford rule nature. Low temperature of kimberlite magmas and high content of volatile component in them was caused by formation from residual melts. Increased temperature of crystallization of volatile-poor melts and emission of volatile components from magmas at shallow stages of upwelling led to solidification of upper parts of magmatic columns and their explosion during further upwelling under impact of high pressure of gas phase preserved by solidification. This explains the fact that, kimberlites formed mostly explosion pipes, and that kimberlite lavas are lacking. Diamonds were crystallized as a result of carbon accumulation in residual melt. Evolution of its composition during crystallization from peridotite through eclogite to kimberlite was responsible for existence of xenoliths of the same composition in kimberlites and inclusions in diamonds, and decrease of their average isotope age in this sequence. Degree of the saturation of the melt with carbon during its fractionation increased. Due to that, layer growth was followed by radial one, and morphology of originating diamond crystals was evolved from octahedrons to dodecahedrons and then to cubes and aggregates, and sculptures were formed on them. Accumulation of meltphylic components in residual melts is causes increase of nitrogen, light carbon isotope and other admixtures content in later diamonds.

FRACTIONATION OF ELEMENTS IN WATERS OF THE LOW-LEVEL RADIOACTIVE WASTE STORAGE USING CASCADE FILTRATION

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ABSTRACT

Detailed studying of elements speciation is important for understanding substance transport in aqueous media, providing insight to key agents of radioactive elements behavior for designing migration models and long-term forecast of their state in the system. We used the method of cascade fractionation with filters of 10 μ m–50Nm allowing to separate particles from a solution depending on their size and to distribute suspended, colloidal, and dissolved species of elements. Slurry sample, three groundwater samples, and two samples from eutrophic bog at the boundary of sludge depository have been studied in the low-level radioactive waste storage system of Novosibirsk Plant of Chemical Concentrates (NPCC). In-situ experiments were conducted straight after the sampling procedure. 5-filter cascade was prepared to find uranium species and other elements in water, including pre-filtration via nylon sieve filter with 10 μ m pore size and cascade filtration through membranes of 450, 200, 100, and 50 Nm. Concentrations of elements in solution was identified by ICP-MS and total organic carbon (TOC) was analyzed by catalytic combustion using Vario TOC cube. Percentage of elements species was computed based on the all concentration amounts in the fractions. Distribution analysis of element species in NPCC waters has shown certain patterns and made it possible to split the elements into three groups. 1) No change or decrease in concentration was observed during filtration. Such behavior was characteristic of the following elements: Ca, Mg, Na, K, Si, Cu, Fe, Zr, Li, Sr и Rb. The elements migrate in the form of dissolved compounds - ions and simple complexes, passing through the 10 Nm membrane. 2) Element concentration decreased gradually when filtered through cascade. Up to 15% from total amount of B were entrapped in cascade, 20-70% of Co (excluding for bog waters), about 25% of Ba (only for bog waters), 30-55% of Ti, 10-30% of V, 20-80% of REE, and particularly Eu up to 90%. These elements are related to colloids and organic substances and removed in filtration with the noted components of natural waters. 3) Concentration of elements varied in different sample types. This group included Mn, Ni, As, P, Sb, and Mo. Quantitatively found in all fractions U varied from 16 to 28% (fraction over 450 Nm), from to 37 to 52 (200-450 Nm), and from 15 to 25% (less than 200 Nm). Therewith our investigation discovered relevant relations between uranium content in colloidal fraction and pH.

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MINERAL EXPLORATION AND ENVIRONMENTAL IMPACT IN HALLA AREA IN THE NORTHERN PART OF THE MASAFI-ISMAH METAMORPHIC WINDOW, U.A.E.

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ABSTRACT

The Masafi-Ismah Metamorphic Window is an approximately triangular-shaped area of sub-greenschist to locally upper amphibolite facies metamorphic rocks, which widens from a narrow point at its southern termination near the town of Masafi, northwards to the southern boundary of the Dibba Zone. It contains polydeformed metasedimentary and meta-igneous rocks that structurally underlie the mantle succession of the Khor Fakkan block of the Oman-UAE ophiolite along a contact interpreted as a sole thrust (Searle and Graham, 1982; Lippard et al., 1982; Searle, 1985; Robertson et al., 1990; Searle and Cox, 2002). The study area is located in the northern part of the Masafi-Ismah metamorphic window in a series of folded volcanics and cherts referred to as the Tayibbah Metavolcanic Formation. The aim of exploration is to find useful mineral deposits and appraise their suitability for further investigation and, where appropriate, assess the environmental impact of radioactive or other hazardous minerals in the study area. The study area has many occurrences of carbonatites, which are found as dikes, sills, and veins. They are usually associated with continental rift-related tectonic settings, however, in the study area they have an oceanic setting. The studied carbonatite rocks are fine to coarse-grained, and consist of magmatic silicate and carbonate material. Twenty-three samples were collected from the study area. The geochemical data indicate high values of metals usually found in important economic ore minerals of elements Th, U, La, Mn, Ag, Zn, Sr and traces of gold. The geochemical data also include a number of detectable thorium and uranium values. In excess, the radioactive isotopes of these elements could have negative effects on the quality of the soils and groundwater in the region, depending on the mobility and dispersion of these elements in the near surface. The rock geochemical data lean towards acceptable levels for thorium and normal levels for uranium, however, soil chemical and hydrogeochemical surveys, especially in the areas of mineralization, warrant further investigation.

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ISOTOPIC-GEOCHEMICAL CHARACTERISTICS OF QUARTZ AND PYRITE IN THE UPPER CARBONIFEROUS ROCKS OF THE SOUTHERN VERKHoyANSK, NORTHEAST RUSSIA: INSIGHTS FOR GENESIS OF VEINLET-DISSEMINATED MINERALIZATION

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ABSTRACT

Upper Carboniferous rocks of the South Verkhoyansk are developed in narrow and extended belt along western boundary of the South Verkhoyansk tectonic zone. OGD occur in these ore-hosting rocks. Rocks are formed at passive continental margin of the North-Asian craton, and they have terrigenous composition. Veinlet-disseminated mineralization is studied in the northern part of the South Verkhoyansk, in sections significantly distant from the known deposits and composed mostly of siltstones with intercalations and lenses of calcareous sandstones of the ekachan formation of the Upper Carboniferous. In the course of the study, mineralogical-geochemical analysis and study of stable isotopes of oxygen in quartz ($\delta^{18}\text{O}$) and sulfur in pyrite ($\delta^{34}\text{S}$) were carried out. Quartz forms series of quartz, quartz-carbonate and quartz-chlorite veinlets of zonal and banded structure. Brecciation of wall rocks is observed on vein salbands. Pyrite in siltstones is represented by spheroids of zonal structure, bedding-plane veinlets, euhedral cubic crystals, less often framboids. Microinclusions of later sulfides – chalcopyrite, sphalerite and galena are typical for pyrite. Co, Ni and Sb, less frequently As, Cu and Zn are essential trace elements in pyrite. Values of cobalt-nickel genetic index is ($\text{Co/Ni}=1.01.. - 14.6$). Isotopic composition of sulfur in pyrites is shifted to light values ($-2.7 \dots -7.1\text{‰}$). Significant content of Sr, W, Co is identified in quartz, few orders higher their content in quartz from gold deposits of the South Verkhoyansk. Cobalt predominance over nickel is typical. Content of rare-earth elements in quartz is one order of magnitude greater than chondrite and varies widely within 6,9 – 73,4 ppm. Significantly weighted isotopic composition of oxygen $\delta^{18}\text{O}$ (18,2-19,1‰) is typical for quartz. Data presented indicate that, veinlet-disseminated mineralization in the Upper Carboniferous rocks of the northern part of the South Verkhoyansk was formed as a result of metamorphogenic-plutonogenic processes.

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MIDDLE PALEOZOIC BASITES OF THE NAKYN KIMBERLITE FIELD

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ABSTRACT

Within The Nakyn kimberlite field kimberlites are spatially combined with a unique diamond content, basites of different age with a wide range of composition and explosive breccias. The paper presents a detailed analysis of the features of the material composition of the Nakyn kimberlite field basites, sequence of their formation, the relationship with kimberlites and the age of the formation of magmatites of the region. Intrusions of the Vilyui paleorift were formed first 368.5 - 374.4 myr ago (Tomshin et al. 2018). The most common are basites, formed during prevailing extension of magma-controlling faults within the rift structures. These are typical basites of the Middle Paleozoic paleorifts of the Eastern part of the Siberian platform. They are composed mainly of prismatic-ophitic gabbro-dolerites. According to the total content of potassium and sodium, compositions of dolerites vary within the limits of the tholeiitic and subalkaline series. Paleomagnetic data indicate that the extension mode of rift valleys was repeatedly replaced by compression conditions. This resulted in the closure of magma permeable zones and formation of local conditions for the origin of deep-seated intermediate chambers. The fractionation of a tholeiitic melt at depths of 35–40 km contributed protocrySTALLIZATION of the main plagioclase and the formation horizons and lenses of anortosite gabbro-dolerites. Bitovnite, chrysolite, moissanite, garnet, and chrome spinel are identified in the early magmatic minerals. Next manifestation of the deep evolution of the basite melt is represented by a complexly differentiated two-phase dike, which includes monzonite-porphyry. Such bodies are formed when the processes of crystallization differentiation of the tholeiitic melt are combined in a shallow (not more than 20 km) intermediate focus (melting spot, center, hearth) and in intra-chamber conditions. The dike is located in kimberlite pipe and divides it into two bodies. At the turn of Devonian and Carboniferous (363-364 Ma), kimberlite bodies were formed in the Nakyn kimberlite field. In the Lower Carboniferous (338.2 - 345.6 Ma) received magma of post- kimberlite basites located near kimberlite pipes. High content of potassium and titanium acidity are distinctive features of post- kimberlite basites. Formation of the bodies of this group of basites was followed by eruptive activity with formation of explosive breccias. This is a characteristic feature of the intrusions of post- kimberlite alkaline magmatites. Most of the intrusions are composed of fine-grained almond-stone rocks with slightly crystallized glassy mesostasis. Magmatic activity completed within the Nakyn kimberlite field 331-324,9 myr ago with the formation of explosive breccias on bodies of alkaline basites and their host sedimentary rocks. Disintegration of rocks was followed by the manifestation of active Mg-K-metasomatism. Alkaline-type basites together with accompanying explosive breccias are good indicator of fluid-permeable zones, thus emphasizing the kimberlite-controlling structure. Their temporal and spatial proximity with kimberlites make it possible to use intrusions of alkaline basites as one of indicators of primary diamond deposits.

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**CLASSIFICATION OF WEST ANATOLIAN CRYSTALLINE MARBLES ACCORDING TO CRYSTAL SIZES
FOR THE ARCHAEOLOGICAL ASSIGNMENT**Ramazan Hacımustafaoğlu¹ , Murat Şentürk²¹Dokuz Eylül University, Torbalı Vocational School of Higher Education, İzmir, Turkey²Süleyman Demirel University, Department of Geological Engineering, Isparta, Turkey**ABSTRACT**

This study was carried out to determine the crystal size range of the crystalline marbles in Western Anatolia and to classify them according to crystal size. These marbles have been used as a building stone since ancient period. Literature survey showed that a number of researchers has measured the crystal sizes of Western Anatolian crystalline marbles and data obtained from these measurements have been used as a reagent in the identification of these marbles. However, on the studies performed on the crystalline marbles those belong to the same locality, different researchers indicated different crystal size classes and this causes complexity. To eliminate this complexity, thin section analyses with different directions were conducted on the eight known crystalline marbles in Western Anatolia. Thin sections were photographed in a polarizing microscope and the crystal sizes of the samples were measured by computerized image analysis method. An average of 500 size measurements were used for each sample and the average crystal size and the maximum crystal size of the marbles were determined. For archaeological evaluation of these marbles, a crystal size classification is suggested. According to this suggested classification, crystal sizes between 100-250 µm, 250-1000 µm and larger than 1000 µm are defined as fine crystal, medium crystal and large crystal, respectively.

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GEOCHEMICAL FEATURES OF THE COMPOSITIONS OF THE MESOZOIC IGNEOUS ROCKS OF THE KHOKHOI ORE FIELD (UPPER-AMGA GOLD-MINING DISTRICT, ALDAN SHIELD, RUSSIA)

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ABSTRACT

The article considers features of geochemical composition of the Mesozoic igneous rocks of the Khokhoi ore field, spatially located in the Upper-Amga gold-mining district of the north-western part of the Aldan-Stanovoy shield, at the junction of two large structural units the Olekma granite-greenstone region and the Aldan granulite-gneiss area, in zone of meridional deep Amga fault. Magmatic formations are represented by the Northern Boskho, Western Boskho and Upper Khokhoi massifs of the Lebedinsky monzonite-syenite-granite complex, intruding rocks of crystalline basement and terrigenous-carbonate complex of the Siberian platform cover, and by rare tephrite dikes. Due to the accessibility of the study area, little attention was focused on the mentioned igneous rocks until recently. The study showed that, magmatic formations of the ore field are geochemically specialized in lithophile and siderophile elements, and they belong to derivatives of trachy-andesite and andesi-basalt magmas. All studied rocks have sufficiently close spectra of rare-earth element distribution, in particular the rocks are poor in heavy rare-earth elements relative to light ones. Presence of low negative Eu-anomaly for the Northern Boskho and Upper Boskho massifs may indicate the fact that, they were formed from residual differentiates during fraction crystallization of rock-forming minerals with involvement of plagioclases. Low Eu/Eu* values also indicate the fact that, these rocks were formed during the late stage of the area evolution. Negative niobium anomaly, identified for all igneous rocks of the ore field, indicates magma contamination with continental crust. Considering interpretation of rare-earth elements and their ratio, it was supposed that, igneous rocks of the ore field were formed in intracontinental conditions. It was generally concluded that, there was an intensive mantle-crust interaction throughout magmatism evolution of the Khokhoi ore field, beginning from intrusion of tephrite dike bodies to intrusion of syenite rocks. Presence of long-lived mantle source, as well as contamination with crust material, were responsible for heat and fluid inflow, that supplied circulation of thermal spring in the system. Heat and fluids caused additional mobilization of ore material from surrounding rocks, with further formation of gold-sulfide mineralization close to tephrite dikes and the Northern Boskho massif.

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STRUCTURE AND GEOCHEMICAL FEATURES OF THE VOLCANIC ROCKS IN THE TUNGUSKA SINECLISE (SIBERIAN TRAP PROVINCE)

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ABSTRACT

Siberian trap province is the largest continental province of flood basalts in the world (LIP). Its origin is under discussion for several decades. Geologists suggested many models of the province formation but almost of them do not take into account the real geological structure of magmatic rocks. We have studied basalts and tuffs from the middle part of the Siberian province (Tunguska sineclise) and compare them with very well studied rocks of the Norilsk area. Samples from two representative sections of volcanic rocks have been analysed by XRF and ICP-MS to get major and rare elements and contents. We have studied their petrography and mineralogical composition using EPMA as well. All studied rocks belong to three formations: Korvunchansky, Nidymsky and Kochechumsky. The first formation consists of tuffs and rare basalts flow, its thickness is 200-300 m. It is overlapped by poikilitic basalts of the Nidymsky formation with many tuffs horizons in its lower part. The full thickness of this formation changes from 300 m to 500 m. The Kochechumsky formation have the highest position in the cross-section and comprises many basaltic flows of poikilitic basalts. The structure of this section of volcanic rocks is similar to the structure of the Morongovsky and Mokulaevsky formations of the Norilsk area. Nevertheless, the thickness of basalts in the Tunguska sineclise is less than in the Norilsk area and changes from 5 to 10 m in comparison with 15-40 m in Norilsk. Our geochemical data support this conclusion: the lower part of the cross-section comprises basalts with $\text{TiO}_2 = 1 \text{ wt\%}$ while the upper part consists of the basalts with average TiO_2 content 1.4-1.5wt%. Thus, despite many similarities between the volcanic rocks of the two areas the basalts and tuffs of the Tunguska sineclise have their specific features and were formed under another conditions that occurred within boundary part of this large structure.

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FE-TI-V DEPOSITS OF EASTERN SIBERIA: SIMILARITIES AND DIFFERENCES

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ABSTRACT

Fe-Ti-V deposits related to basic-ultrabasic intrusions are widespread within the Eastern Siberia. The two largest of them are located in the Kodar-Udokan trough (Siberian Platform) and Taimyr Peninsula in the Chineysky and Dyumtaleysky massifs consequently. The problem of ore origin includes an estimation of parental melt composition and its evolution. To solve it we have studied the internal structure, composition of rocks and ores from these massifs. The first one (lopolith) has thickness 2.5 km and consists of four rock groups formed during different stages. These are the following: 1) coarse-grained anorthosite, 2) high-Ti gabbro and gabbronorite, 3) low-Ti gabbronorite and norite, 4) lamprophyre. Layering is a typical feature of the second group of rocks enriched in titanomagnetite. Disseminated ore consists of 10-80 vol% titanomagnetite and massive ore contains 80-100 vol% titanomagnetite. Orebodies occur as layers or irregular bodies. Economic Cu-Ni sulfide mineralization (Cu/Ni=10-100) concentrates within the lower boundary of the massif and includes the endo- and exocontact ore. The main ore mineral is chalcopyrite. Chineysky massif essentially consists of basic rocks with typical crustal characteristics (Ta-Nb negative and Pb positive anomalies). Dyumtaleysky intrusion represents tabular body of 600 m in thick. It consists of two groups of rocks – gabbro (upper zone, 300 m) and peridotites (lower zone, 300 m). It was suggested that they were formed at two stages. The upper zone is characterized by layering which is similar to the layering of the Chineysky massif. Concentration of titanomagnetite forms disseminated and massive ores. There is no massive ore of irregular form. Sulfides are concentrated within the massif (between upper and lower zones) and in the endocontact zone. The mineralization consists of chalcopyrite, pyrrhotite, pentlandite, millerite, cubanite; Cu/Ni= 1-0.5. In contrast to the rocks of the Chineysky massif the rocks of the Dyumtaleysky intrusion are characterized by patterns without Ta-Nb anomaly. Gd/Yb ratio demonstrates the origin of these two massifs from different magma sources: shallow for the Chineysky intrusion and deep (with garnet) for the Dyumtaleysky one. Thus, Fe-Ti-V deposits could be formed from different magmas but contain the same type of ores because the leading process of ore formation is multiple fractional crystallization.

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**MINERAL COMPLEX OF THE KOLA REGION, NW RUSSIA: CHALLENGES AND PERSPECTIVES
UNDER CONTEMPORARY GLOBALIZATION CONDITIONS**

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ABSTRACT

The Kola region is located on the NW of Russia and is identified with the Murmansk region. In addition to military and political importance in connection with the Navy bases and infrastructure of the Northern sea route, it is one of the largest and most effective mining centers of the country. There are more than 400 known ore occurrences, of which about 200 are explored or evaluated with greater or lesser degree of detail. About 100 mineral deposits have a fairly high investment potential in modern conditions. There are more than a dozen world-class deposits of strategic and economically important types of minerals. Currently, the mining complex (MC) of the region provides a significant part of Russia's production (in %): phosphate ores (95-100), phlogopite and vermiculite (80-90), nepheline and ceramic raw materials (35), iron (10), baddeleyite (100), nickel (12-13), as well as copper, cobalt, niobium, tantalum, rare earth metals, etc. The value of the annual product of MC (ores, concentrates and other semi-products) varies at the range of 1.5-2.2 billion USD. However there are a number of problems that can arise in the next 5-15 years. First of all, it is the depletion of the raw material base of giant deposits of traditional minerals after intensive exploitation for last 50-90 years. Other problems include: a significant deterioration of mining conditions during exploitation of deep horizons, barriers to small mining business by the state and vertically integrated companies; tightened environmental legislation; competition in the context of globalization of the mineral commodities market, etc. Nevertheless, the mineral resources of the Kola region have an extremely high investment potential. First of all, this applies to world-class deposits of highly marketable minerals. These include: 1) deposits of platinum group metals with significant palladium mineralization in the Paleoproterozoic layered complexes of the Fedorovo-Pansky massif and intrusions of the Monchegorsk district; 2) deposits of rare metal pegmatites (Li, Ta, Nb, Be, Cs, etc) of the Archean greenstone zone of Kolmozero - Voronya, which are unique in terms of reserves and quality of ores; 3) rare-metal eudialite ores with significant zirconium mineralization of Lovozero massif; 4) titanium ores of Afrikanda massif, etc. Poorly studied areas of the Eastern and Central parts of the Kola region have high prospects for the discovery of new large deposits. In general, the development of even a part of the existing deposits allows launch up to 10 large mining enterprises with an annual output of dozens - first hundreds millions USD each. This will improve the socio-economic development of the municipalities of the Murmansk region in the medium-long term (10-50 years). The research conducted in the Geological Institute of the Kola Science Centre RAS helps to justify the target areas for non-traditional types of raw materials for the Kola region and to increase the investment attractiveness of known large deposits due to the advanced detailed study of applied and fundamental character.

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PARTITION OF ALUMINUM IN THE DIFFERENT GEOCHEMICAL PHASES OF FLUVIAL SEDIMENTS

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ABSTRACT

Natural fluvial sediments are predominantly composed of river-transported debris resulting from weathering and erosion of the basin. Understanding both the concentration and distribution of metals in river bed sediments in headwaters is essential to provide a scientific reference for the protection of water resources and the control of water pollution downstream. Sequential chemical fractionation studies of elements in various phases in the environment are widely used in investigating the effects of a particular element in the ecosystem. In this work, determination of aluminum bound to six phases operationally defined (soluble/exchangeable/specifically adsorbed, bound to manganese oxides, associated with amorphous compounds, bound to oxidizable organic matter, associated with crystalline iron oxides, and residual fraction) in river bed sediment samples (NW Spain) was performed in order to evaluate its potential bioavailability in the monitoring area. The results showed that aluminum is mainly in the residual phase, which represents aluminum incorporated in the lattice minerals, and consequently unavailable to plants and animals.

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LAND INPUTS OF METALS TO A HEADWATER RIVER DRAINING AN AGROFORESTRY AREA

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ABSTRACT

The chemical composition of stream water depends on natural factors and anthropogenic activities. Understanding the concentration and distribution of metals in aquatic environments is essential to provide a scientific reference for the protection of water resources and the control of water pollution. The specific objective of this paper is to examine levels and variability in metal concentrations and partitioning during baseflow periods of a headwater stream, draining from an agroforestry catchment in NW Spain. Aluminum, iron, copper and zinc were the metals studied during four years. Metal concentrations were measured with an ICP-MS. The mean concentration of the considered metals was determined as arithmetic mean of the samples analyzed. The results showed that concentrations of the five metals were highly variable. All metals exist predominantly in particulate form, suggesting that the transport of these metals is linked to particle transport. Mean particulate fractions in baseflow were about 90% for aluminum and manganese, 80% for iron, 70% for zinc and 50% for copper. In dissolved and particulate fractions, the highest concentrations have been reached by iron, followed by aluminum, manganese, zinc and copper. Metal concentrations were relatively low, consistent with the absence of contamination sources in the study headwater area.

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GEODIVERSITY OF THE METROPOLITAN REGION OF RECIFE, PERNAMBUCO – BRAZIL: QUALITY OF UNDERGROUND WATER

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ABSTRACT

Brazil has one of the largest water resources in the world, but its distribution is extremely unequal among its physiographic regions. In the Northeast, there is a large deficit in relation to households without access to treated water provided by general network or even with an irregular supply. In this study the quality of the waters exploited through shallow and deep wells located in the Metropolitan Region of Recife – RMR was evaluate. The results presented several parameters in disagreement with the determinations of the Ministry of Health - MS No. 518/2004 and No 2914/2011 and 36/90 for human consumption. Water samples were collected at 127 points. It was verified that only 58.27% of the samples conform to the microbiological standard for total coliforms and coliforms. Of the samples in disagreement with total coliforms, 79.25% were collected in shallow wells and 20.75% in deep wells. For fecal coliforms, 12.6% of the groundwater samples do not comply with the microbiological standard established by determination n ° 2914/11 of the National Health Foundation of the MS, where it is highlighted that 100% of these were shallow wells. In relation to the concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX), it is observed that only one sample was out of the standards for toluene. The physical-chemical potability parameters analyzed showed that 79.57% of the shallow wells and 55.8% of the deep wells presented non-standard results, with the shallow wells presenting more data at odds, indicating a significant surface contamination. The manganese and iron, with values above that established in Ordinance 36/90, indicate anthropogenic pollution. About 38% of the water samples from the wells had nitrate levels above the maximum permissible value. This information provides a partial picture of the poor quality of the RMR groundwater.

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ESTIMATION OF INTERNAL TEMPERATURE FIELD INTO MAGMATIC CHAMBERS OF THE NORILSK INTRUSIONS BY CLINOPYROXENE GEOTHERMOMETER DATA

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ABSTRACT

Temperature's fields gradient into magmatic chamber during its cooling has important influence on crystallization differentiation of magma and ore formation. Until now it was estimated by thermophysical models using an initial temperature of parental magma and heat capacity of surrounding rocks. For the first time we have estimated paleotemperatures in a vertical sections of the intrusions using a monopyroxene geothermometer (Dal Negro et al. 1986). This tool gives a possibility to calculate the temperature from high-T magmatic pyroxene crystallization to its low temperature formation, i.e. we calculate the temperature range for pyroxene crystallization for each hypsometric level of the intrusive chamber. To understand history of cooling we selected a number of ore-bearing intrusions of the Norilsk complex (Kharaelakh, Bolshaya Bariernaya, South-Maslovsky) penetrated by vertical boreholes. All intrusions are sub-horizontal bodies (100-300m in thick) with very similar petrographic and chemical composition. Pyroxene was found both in the form of large idiomorphic crystals and in the form of xenomorphic grains between large olivine crystals. Calculations revealed at least two types of intrusions with different temperature distribution over the section. The South-Maslovsky intrusion (about 400 m) is characterized by a strong gradient (about 150 degrees) of the temperatures from early stage of pyroxene crystallization to the end of its formation. Sharp changes of temperatures took place in several meters from the contacts. While in the central parts of the intrusive body there is a smooth decreasing of temperature. The temperature trend of interstitial pyroxene crystallization almost completely repeats the trend of high-temperature idiomorphous differences. The lowest temperatures are typical of the lower parts of the intrusion. Temperature of the pyroxene formation within the upper endocontact zone is in 100-150 degrees higher. In comparison with the South-Maslovsky intrusion, the Khaeraelakh massif (about 200 m in thick) is characterized by the absence of noticeable gradient of temperature. In the vertical section of this intrusion equilibrium temperature is uniformly distributed while temperature for late pyroxenes changes dramatically. Our data demonstrate different regime of cooling for intrusions of the Norilsk area.

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GENESIS OF YOUNGER GABBROS IN THE ARABIAN SHIELD, SAUDI ARABIA: MINERALOGICAL, GEOCHEMICAL AND TECTONIC FINGERPRINTS OF THE NEOPROTEROZOIC ARC MAGMATISMAli Shehata ¹, E. Abdallah Shehta ²¹ Geology Department, Faculty of Science, Minia University, El-Minia 61519, Egypt² Geology Department, Faculty of Science, Zagazig University, Zagazig 44519, Egypt**ABSTRACT**

Younger gabbros in Saudi Arabia constitute significant part of the mafic magmatism in the Neoproterozoic Arabian Shield. This study records the first detailed geological, mineralogical and bulk-rock chemical data of younger gabbros located at Gabal Samra and Abd areas in the Arabian Shield. The data was used to understand the tectonic emplacement of the Neoproterozoic mafic magmatism in the Arabian Shield and to constraint the nature of the mantle source as well as the crystallization and melting conditions. Cr-spinels have compositional characteristics comparable to those of arc-related rocks, particularly back-arc basin basalt (i.e., BABB). Their Cr# (37.65–39.28) indicates that they were derived from oceanic lithosphere which formed at mid-oceanic ridges and shows affinity to the range of Alaskan-type intrusions. Amphiboles show relative oxygen fugacity (i.e. ΔNNO ; nickel–nickel oxide) of (–0.31–2.88) and water content in the melt ($\text{H}_2\text{O}_{\text{melt}}$) of (3.98–5.98 wt.%) consistent with the typical value of subduction–related magmas. The estimated pressures are low and variable (–0.34–2.86 kbar) suggesting polybaric crystallization with magma chamber located at relatively shallow crustal levels. The existence of An-rich plagioclases ($\text{An}_{52.92-99.93}$) reflects Na-depleted and Al- and H_2O -enriched primary melts. Their Ca-rich nature supports crystallization from arc-related magmas at subduction zone. Moreover, the compositions of olivines (up to $\text{Fo}_{82.23}$) and clinopyroxenes (up to Wo_{51}) reveal crystallization of these minerals from mafic magmas under hydrous conditions. Consequently, mineralogical data indicate crystallization from hydrous mafic magmas at subduction zone comparable to fresh gabbros in the Arabian Shield and global Alaskan–type intrusions. The studied gabbros have wide range of Mg# (54.57–80.17), MgO (1.6–13.8 wt.%), Cr (19.36–1383 ppm) Ni (7.14–149.41 ppm) and Sc (2.69–93.77 ppm) reflecting variable olivine and pyroxene crystal fractionations. Their geochemical characteristics indicate derivation from sub-alkaline mafic magmas belonging to arc tholeiite series with slight calc-alkaline tendency. Moreover, they show affinity to arc-related mafic cumulates, fresh gabbros and Alaskan-type intrusions confirming mineralogical data. The trace element patterns exhibit fluid mobile element enrichment (e.g., Cs, U, Pb and Sr). This characteristic enrichment together with the elevated average ratios of Ba/Th (796), Ba/La (38) and Ba/Nb (232) suggest interaction with sediment-derived fluids. The mineralogical and geochemical features are consistent with a depleted MORB-like mantle source with input of water-rich marine sediments from the subducted slab in a back-arc tectonic setting. Thus, the origin of the studied gabbros could be explained by an adiabatic decompression melting of hydrated and depleted mantle source.

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MANTLE SOURCE CHARACTERISTICS OF THE NE-BASANITES FROM NORTH EASTERN EDGE OF THE ARABIAN PLATE

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ABSTRACT

The Quaternary nepheline basanites are firstly observed volcanic products of Arabia-Eurasia collision on Bitlis Suture Zone which is an accumulation of Precambrian to Cretaceous metamorphic rocks, Late Cretaceous – Eocene and Middle Eocene volcano-sedimentary units thrust over the Arabian platform between late Eocene and Middle Miocene after the convergence between Anatolian and Arabian plates. Nepheline basanites are composed of clinopyroxene, olivine, Ti-magnetite, Cr spinel, and nepheline. They are characterized by low SiO₂ (40.16-41.96 wt %), high MgO contents (8.54-9.73 wt %) and similar Sr-Nd isotopic compositions with Arabian Plate volcanics. Independent barometers indicate that crystallization takes place over a wide range of pressure 8–20 kbar and melt cooled from about 1301°C-1035°C. Trace elements together with Sr isotopic compositions inferred negligible assimilation of the local upper crustal material. The calculated average pressure and temperature of mantle melting for ne-basanites is 2,85 kbar and 1353oC respectively. FC3MS (wt. % FeO/CaO-3*MgO/SiO₂) parameter and melting models using REE data reveal that Çatak basanites are products of amphibole and phlogopite bearing metasomatised lithospheric mantle in garnet stability field. Results of thermobarometric calculations together with the recent geophysical data point out melting originated from the base of Arabian lithospheric mantle.

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**PETROLOGY OF GRANITES THE GERAMDACHANSKY MASSIF (VERKHoyANSK-KOLYMA
OROGENIC REGION)**

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ABSTRACT

The authors identified several varieties of different ore content of the late-orogenic and anorogenic granites of the North-east of the Verkhoyansk-Kolyma orogenic region. The purpose of the research was a detailed study of petrography, chemistry, crystallization conditions and geochemical features of granites of one of such massifs – Geramdachansky, which is associated with rare-earth mineralization. The belonging of granites to A-type of the late-orogenic or anorogenic geodynamic setting and wide development of dikes of leucogranites and pegmatites is determined. Typomorphic features of composition of rock-forming and accessory minerals of granites indicate the beginning of crystallization from the high-temperature melt of the lower crust genesis and saturation of the residual melt with water. Isochronous Rb-Sr age of granites 86-94 million years. Considering value of primary isotopic ratios of strontium (I_0 from 0.71246 $\pm$ 0.00072 to 0.7213 $\pm$ 0.0034), granites are derivatives of melting of crustal material with a model age of protolith on average 2223 $\pm$ 151 million years. The presence of almandine-grossular garnet, comparable to eclogite garnets, among the minerals of granites; high-temperature zircon of crust-mantle morphotypes D and J and enriched with native iron chromium can be explained by presence of the basic rocks within the magma-forming substrates. A rapid increase of the content of all rare earth elements, as well as uranium and thorium from the granites of the main facies to leucogranites and pegmatites up to commercial values was identified. The melts that formed all these rocks have close and stable high (920-1000°C) temperatures, which suggests the presence of an external heat source, constantly active during the process of formation. These facts and the presence of the dikes of alkaline-basic composition near the granite outcrops, with high concentrations of REE allow us to conclude that, massif was formed the under the impact of heat and fluids produced.

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MAGNETIC SEPARATION THROUGH WADI ALHELO, UAE: AN INDICATION OF A MINERALOGICAL CONTROL

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ABSTRACT

Wadi Alhelo is one of the largest wadis at the northeastern part of the UAE. It forms a smooth braded channel across igneous rocks of the northern Semail ophiolite mountain, and discharges at the Gulf of Oman with a wide alluvial plan. A group of sediment samples was collected throughout wadi Alhelo's channel mainly for assessing the magnetic materials concentration. After conducting a sieve analysis on all samples with a constant amount, a magnetic separation and other analyses were performed on a fine-size sand and mixed sand respectively. The sorting and mean size distribution of all samples is mainly poorly sorted coarse sand size with mostly saltation population in fluvial agitated environment. A careful magnetic separation process resulted in dividing the examined sediments into ferro-, para- and non-magnetic materials. However, the ferro-magnetic materials show a very low concentration in all samples, while para- magnetic materials are the highest and non-magnetic materials are next. Although, the progression direction of these magnetic divisions is not well constant and fluctuating in places, a general increase of the magnetic materials and decrease of non-magnetic materials can be illustrated in a direction toward the discharge zone. Major elements concentrations of the samples show some shifting in the progression system from one zone to another throughout the wadi channel. However, they are almost constant in a particular zone, with an exception of Na₂O, TiO₂ and Al₂O₃, which display some increase toward the discharge zone. In addition, iron oxides (FeO & Fe₂O₃) also reveal a very slight progressive rise. Comparing all resulted data with the setting environment and rock types of the wadi's host area, it can be inferred that the magnetic materials concentrations are very well controlled by the rock mineralogy of the host, and a slight alteration activity might have developed on the channel sediments during water seasons.

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**REMOTE SENSING-ASSISTED STRATIGRAPHIC DISSECTION OF THE WADI KAREIM BASIN, EGYPT:
FIRST RS ANALYSIS OF A HAMMAT MOLASSE BASIN, WITH IMPLICATIONS FOR SEDIMENTARY
EVOLUTION**

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ABSTRACT

The Ediacaran Wadi Kareim basin is one of the largest post-amalgamation Hammamat molasse basins in the Central Eastern Desert of Egypt. It preserves a fill of > 4,500 m of alluvial fan, braided stream and lacustrine clastic sediments (red, green and grey conglomerates, sandstones and mudstones). Knowledge of the mechanisms of Hammamat basin initiation, evolution and inversion is vital to extracting the wealth of information these basins potentially contain for understanding the latest stages of cratonization of the Arabian-Nubian Shield at the end of the Proterozoic. A major impediment is the lack of stratigraphic data on these basins, due in part to the monotonous character of the sediments and the shortage of marker formations. In this study we have applied remote sensing techniques (Landsat-8 imagery integrated with measured spectral signature curves of the collected samples from the basin to determine the most sensitive response bands to be used for preparing the object-oriented PCA sequentially) to prepare PC composite images for mapping the Kareim sequence. The optimal image is composed of three principal components PC4, PC3, PC2 which reveal fine lithological differences, allowing tracing of most units (typically either conglomerate-dominated or sandstone-dominated bed packages). The image was used to outline eight basin depositional units (Units 1 to 8) with generally discordant contacts, interpreted to represent a succession of alluvial fans each cutting down into the fan sequence before it. The RS interpretation was supplemented by structural mapping, detailed stratigraphic logging, paleocurrent data, facies analysis, petrography and geochemistry. Our studies show the following: 1) lacustrine and distal fan deposits dominate in the south while midfan and possible proximal fan deposits prevail in the north; 2) this is supported by the general trend of increasing grain size from the south to the north in the basin; 3) paleocurrent directions are dominantly from the north and east, consistent with alluvial fans sourced from areas to the north and east of the basin; 4) greenish sediments of andesitic and rhyolitic provenance increase in grain size and abundance from stratigraphically lowest to highest sections, however, the opposite trend is seen for reddish sediments of basaltic provenance; 4) the previous observation points to an early reddish basaltic source area being progressively covered by later green andesitic/rhyolitic volcanics north of the basin. These conclusions offer a significantly different depositional model for the Wadi Kareim basin than previous studies, and underline the potential of remote sensing for facilitating stratigraphic studies of the other Hammamat molasse basins.

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**CHARACTERISTICS OF SEDIMENTS IN A CHANGING ENVIRONMENTAL CONDITIONS
IN VISTULA LAGOON (POLAND)**

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ABSTRACT

The Vistula Lagoon has been evolving since its formation in the late Atlantic period. At the beginning, the changes were mainly driven by the stabilization of the Baltic Sea level, and the development of hydrographic network. Later on, anthropogenic activities have become an important factor. Hydrotechnical works conducted at the turn of the 20th century, aimed at regulating the outflow of the Vistula River waters, have significantly limited the riverine input into the lagoon. In the past, the Vistula Lagoon contained freshwater and was constantly filling with sediments that made the basin shallow. With time, the lagoon has filled with brackish water, while its area became subjected to strong interactions between the driving forces of marine and terrestrial origin. As a result, the regime of sedimentation processes in the lagoon have been changed. The interpretation of sedimentation conditions for clastic sediments was based on the analysis of grain-size parameters that had been determined on the samples of bottom sediments and suspension collected in November 2016. The obtained results were compared to the pertinent data on bottom sediments collected by the Polish Geological Institute National Research Institute in 1994. Significant contrasts in particle size distributions were found. Also, the conducted study allowed the determination of underlying causes of these changes. Due to the shallow depth of the Vistula Lagoon, the sedimentation processes in this basin are significantly influenced by resuspension phenomenon. Resuspension is responsible for the differentiation and redistribution of sediment, that originates from various sources, on the bottom of the basin. The process takes place in shallower areas, but this study indicates that its effectiveness increases in the deeper areas of the lagoon, which manifests itself in the replacement of clayey silt with silt. In connection with the plans of the Polish side of the cross-cutting of the Vistula Spit, the sedimentation conditions of Vistula Lagoon will be changed.

RESPONSE OF THE DIATOM FLORA OF THE HEL PENINSULA VICINITY, PUCK BAY, BALTIC SEA TO ANTHROPOPRESSURE

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ABSTRACT

The subject of this study was the diatom taphocoenoses preserved in the surface sediments of the northern part of Puck Bay, southern Baltic Sea. Three subbottom sedimentary cores ZP1/0518, ZP2/0518 and ZP3/0414 collected in the vicinity of the Hel Peninsula from a water depth of 65 m, 47 m and 50 m, respectively were analyzed with respect to diatom flora. Over 500 valves of diatoms were counted in each sample in order to estimate the percentage abundance of particular taxa. Habitat, salinity, trophic and saprobic requirements of all identified species were established according to literature. The percentage content of distinguished ecological groups were counted in each core. Diatomological analysis indicates that the diatom flora observed in muddy and silty sediments of the study area was generally abundant, taxonomically diverse and well preserved. However, some valves were mechanically broken or/and chemically destroyed. In all cores anthropogenic assemblage with small sized planktic diatoms tolerating higher nutrient and pollution concentration as well as lower transparency of water column predominated. The most important components were euhalobous species *Thalassiosira levanderi* and mesohalobous one *Cyclotella choctawhatcheeana*. Both species achieved the highest frequency (up to ca. 70% and 40%, respectively) in core ZP1/0518. Other eutraphentic, α/β mesosaprobous taxa belonged to oligohalobous halophilous (*Actinocyclus normanii* f. *subsalsa*, *Cyclotella atomus*, *C. meneghiniana*) and oligohalobous indifferent (*A. normanii* f. *normanii*, *Cyclostephanos dubius*, *Aulacoseira* spp.) were observed rarely. Benthos was also dominated by diatoms preferring the high content of nutrients and organic matter. This group was represented by marine/brackish-water taxa (i.e. *Catenula adhaerens*, *Cocconeis hauniensis*, *C. scutellum*, *Diploneis didyma*, *D. smithii*, *D. stroemii*, *Opephora krumbeinii*) and freshwater ones (i.e. *Amphora copulata*, *A. pediculus*, *Cocconeis neodiminuta*, *C. neothumensis*). Our results clearly indicate the apparent human impact on the structure of the diatom flora in the northern part of the Puck Bay. At least two sources of anthropopressure can be determined in the vicinity of Hel Peninsula i.e. (1) at a local scale harbor in Hel city and municipal sewage linked to development of tourism, and (2) at a regional scale the Vistula River waters, which is the major source of pollution in the Gulf of Gdańsk.

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SEDIMENTOLOGICAL PROPERTIES OF THE AKCAPINAR FORMATION (KARABUK, WEST BLACK SEA REGION, TURKEY)

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ABSTRACT

The study area to the north of the Izmir-Ankara-Erzincan Suture Zone, which is located on the intra-pontide belt in the Sakarya zone and the transition of the Istanbul zone, is represented by a very thick rock assemblage from Paleozoic to Paleogene. The study deals with the Akcapınar Formation in the Paleogene sequence. The formation conformably on the Soğanlı Formation (platform carbonates) and Pürçükören Formation which is evaporitic in character (gypsum and anhydrite deposited). It is conformably overlain by the Yunuslar Formation, which is composed of terrestrial clastic units (sandstone, conglomerate) to the northwest of the basin. Its main lithology is clayey limestone. It also includes clayey limestone layers intercalated with satin-spar gypsum and cherts ranging from 1 to 5 cm in thickness. The Akçapınar Formation, overlying an evaporitic basement is a kind of brackish water deposits. A number of measured cross-section were studied. Gastropoda fossils were seen rarely in the deposits. These fossils show fresh water interference. Sedimentological characters such as thick clayey limestone facies with leave and plant fossils, laminated limestone levels with pelloides, organic material rich claystone levels, soft deformed chert levels with clayey dolomitic limestone, bioturbations in some limestone facies and stratigraphical contact relations of Akçapınar Formation are under discussion.

Corresponding Author: Muhammed Sami Us

**SOFT SEDIMENTARY STRUCTURES AND RELATED FACIES OF THE AKÇAPINAR FORMATION
(KARABÜK, WEST BLACK SEA REGION, TURKEY)**Muhammed Sami Us ^{1,2}, Erdoğan Tekin ¹¹ Ankara University, Engineering Faculty Department of Geological Engineering, Ankara, Turkey² Munzur University, Engineering Faculty Department of Geological Engineering, Tunceli, Turkey**ABSTRACT**

The Akçapınar Formation was deposited in the Karabük and Ovacık sub basins, which are the significant Paleogene basins in the Intra Pontide belt of the Western Black Sea region. The formation, approximately 180-200 m in thickness is lithological represented by thin-thick bedded clayey limestone, dolomitic limestone, organic matter rich claystone, secondary satin-spar gypsum layers, laminated clayey limestone and dark coloured abundant chert layers. Unlike the Soğanlı Formation limestones and Pürçükören Formation gypsum-anhydrite facies, which are conformably overlain by the Akçapınar Formation, there are many anticlines, synclines, folds, twist and slump structures dm to a few cm in size in the Akçapınar Formation sediments. Limestone of the Akçapınar Formation contain dense claystone layers and exhibit more ductile behaviour with various types of deformation; some hard textured limestones of the formation include laminated clayey limestones. Its chert layers are generally brittle and comprise small scale normal fault, reverse fault and brecciated textures. Especially dark coloured chert levels which are more or less equivalent sedimentation of the light coloured clayey limestone of the Akçapınar Formation, are seen as guide strata in order to understand the soft sedimentary deformation structures. The bottom contacts of the Akçapınar Formation are clearly seen in the high angle valleys in E-W direction which were formed as a result of the Soğanlı river erosion effects. However, chert levels which are guide strata for the soft sedimentary structures of the Akçapınar Formation are observed frequently in new road cuts in the dense vegetation areas.

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TEXTURAL AND PETROGRAPHIC CHARACTERS OF COASTAL SANDS (LAZIO, ITALY) TO PLAN A POSSIBLE EFFECTIVE NOURISHMENT

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ABSTRACT

Three samples of actual sands from beaches in erosion (Tyrrhenian coasts, Lazio, Italy) were analysed for their textural and petrographic features with the aim to plan a possible effective nourishment. Selected sites are: 1) Torre Flavia (TF, Ladispoli, Rm, about 40 km north of the outfall of the Tevere River), Lido dei Pini (LP, Anzio, Rm, about 40 km south of the outfall of the Tevere River) and Sabaudia Seafront (SA, Latina, about 40 km south of the outfall of the Tevere River). TF and LP samples have the same grain size distribution, with 70-75% of coarse material (>250 microns) and a remaining 25% of medium grain material (250-125 microns). SA sample, on the other hand, is predominantly made up (at 94%) of coarse material (>250 microns). This is also reflected in the trend of the cumulative curves. In the first instance, it has been necessary to analyze the final segment of the Tevere River, the main watercourse in the studied area. In the last 80 km, the river crosses the volcanic rocks of the Roman Comagmatic Province and debris-alluvial rocks. As the third watercourse in terms of transport volume in Italy (after the Po and Ticino) and with its 240 m³/s average annual flow at the outfall, Tevere introduces large quantities of debris into the Tyrrhenian Sea. This detritus is pushed along the Tyrrhenian coasts by superficial sea currents directed mainly towards the north (towards the Ligurian Sea). Regarding Torre Flavia site, only small watercourses with reduced flow rate are present in the hinterland. The fundamental detrital contribution is due, consequently, to supplying of Tevere, as evidenced by the abundance, in TF sands, of fragments of alkaline volcanic rocks and their typical minerals (clinopyroxene, brown hornblende and leucite). Lido dei Pini (LP) and Sabaudia Seafront (SA) sites are not affected by natural waterways, since, in historical times, these areas were reclaimed and they are still today only crossed by artificial canals. LP sands are still affected by the local redistribution of Tevere debris, as clasts and minerals having a clear volcanic origin are being found, even if carbonatic detritus becomes more abundant. SA sands, on the other hand, seem to be affected only minimally by the Tevere supply. These sands, in fact, are essentially characterized by clastic carbonate material, coming from rehash of the limestones making up the Circeo Promontory (immediately to the south) and from local marine bioclastic material with, only marginally, sporadic amount of volcanic material. Considering these evidences, a proposal for a possible effective nourishment of these beaches in strong erosion could include: for the Torre Flavia site the employment of volcanic material from tuff quarries widely present in the next internal areas (from Cerveteri to Bracciano Lake) whereas for Lido dei Pini (LP) and Sabaudia Seafront (SA) beaches the employment of predominantly carbonatic marine sand from near seabeds (after appropriate granulometric selection).

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LOGARITHMIC EXPRESSION OF *GLOBIGERINA BULLOIDES* SHELL EVOLUTION THROUGH BIOMETRIC ANALYSIS: PALEOCEANOGRAPHIC IMPLICATIONS FOR THE LATE QUATERNARY

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ABSTRACT

Fossil foraminifera are a treasure trove of information in applications ranging from microevolution to paleoclimatology. The architecture of their tests is of key importance in systematic and phylogenetic studies and can reveal micro-evolutionary traits through biometric analyses. In the present paper we analyse the laws of growth that control planktonic foraminifera shell morphology. We report the results of a biometric study of the temporal variation in shell shape and chamber size of the cosmopolitan, subpolar to temperate species *Globigerina bulloides* d'Orbigny from core top sediments in the eastern tropical Atlantic Ocean. Morphological variation in terms of test shape and adult chamber size in *G. bulloides*, has been measured in 116 down core sediment samples from the tropical waters (19°N) of the northern Antarctic Ocean and has resulted in a model that simulates the basic morphology (chamber size and spatial arrangement) of planktonic foraminiferal shells of that species. The investigated samples comprise a continuous record that spans the last 200 kyrs. The specimens for this morphometric study were picked from a restricted sieve fraction and were mounted for Scanning Electron Microscopy (SEM) analysis. The restricted size of the specimens constrained the analysis to adult specimens and minimized ontogenic effects while also allows the documentation of very small overall changes in the parameters under investigation in time. The dimensions that were measure for each test were its height, width and the diameters of the last seven chambers. This allowed the determination of chamber centers and their analogies resulting in a mathematical model based on a logarithmic spiral equation that describes the evolution of the test with growth during their adult phases. The model presented herein belongs to a family of so-called "fixed-axis" coiling models.

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INTEGRATED PALEOHYDROLOGY RECONSTRUCTION AND PLIOCENE CLIMATE VARIABILITY IN CYPRUS ISLAND (EASTERN MEDITERRANEAN)

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ABSTRACT

The present study describes the Pliocene paleoenvironmental evolution and the main paleoclimatic trends of Cyprus Island (southeastern Mediterranean) reconstructed using planktonic foraminifera. The Essovouyes-Exovouyes section, which is located on the boundary of Messaoria basin in the north and Larnaka basin in the south, corresponds to a continuous record from 5.21 to 1.8 Ma and therefore provides good data for the paleoclimatic reconstruction northeast of the Troodos mountain range. The sedimentary sequence of the studied section is about 90 meters thick and characterized of pinkish to brownish massive marls, rhythmic sedimentary cycles of yellow to light grey homogeneous marls and brownish organic-rich laminated layers, brown to light grey sandy marls, light yellow marly sands enriched in macrofossils, and yellow massive fine- to coarse-grained bioclastic calcarenites at the top. We particularly focused on its middle part (3.9-3.0 Ma time interval), which consists of well-preserved cyclic marine sediments, including organic-rich laminated brownish sapropelitic layers alternating with grey homogeneous marls. This part of the section was measured and sampled at 0.1 to 0.55 m intervals, which allowed us to perform detailed biostratigraphic analysis. Seven astronomically dated planktonic foraminiferal bioevents were recognized and constrained the age model of the studied interval through linear interpolation. Within this biostratigraphic framework, the first occurrence of *Globorotalia crassaformis* is highlighted in this study and confirms the presence of Zanclean/Piacenzian boundary (3.6 Ma). Integrated micropaleontological, sedimentological, and geochemical (Total Organic Carbon; TOC, and stable oxygen and carbon isotope; $\delta^{18}\text{O}$, $\delta^{13}\text{C}$) analyses revealed the presence of numerous cycles that resulted in the sapropelitic/homogeneous marl alternations. The sapropelites developed around the Zanclean/Piacenzian boundary suggest a climate characterized by fluctuations of warm/temperate to humid conditions associated with a highly stratified water column at times of precession minima. Moreover, long term trends in oxygen isotopes are correlated with sea surface temperature (SST) record derived from the planktonic foraminiferal assemblages (Planktonic Paleoclimatic Curve; PPC) and mostly reflect changes in global climatic conditions, with a more local or regional signal superimposed on this record. In particular, both the PPC and $\delta^{18}\text{O}$ records indicate three distinct warm periods interrupted by two cooling events centred at 3.62 and 3.54-3.36 Ma respectively. Furthermore, the statistical analysis of the planktonic foraminifera revealed that the surface primary productivity and temperature show the highest explanatory power for their distribution, and influence the hydrological regime of the studied area. Overall, this work confirms that multidisciplinary strategies and multiproxy study performed on Neogene sections can provide a powerful tool for monitoring the palaeoclimatic evolution of the eastern Mediterranean in relation to the global climatic system over the Pliocene.

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MIocene STRATIGRAPHY OF POTENTIAL CAP ROCK GYPSIFEROUS DEPOSITS: THE LOWER FARS FORMATION, AL AIN, UNITED ARAB EMIRATES

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ABSTRACT

Tertiary limestones of the Jabal Hafit area, Al Ain city, United Arab Emirates (UAE), are locally succeeded by Miocene evaporites and clastic sediments of the Lower Fars Formation. The Miocene rocks are represented by lagoonal or supratidal shoreline deposits of gypsite, anhydrite, gypsiferous mudstones, marls, sandstones, conglomerates along the eastern flank of Jabal Hafit anticline. This study provides the first stratigraphic and sedimentological details of the near surface Miocene in the UAE, exposed in gypsum quarries in the Jabal Hafit area. The exposed Miocene measures 30 to 140 m in thickness, and is probably equivalent to Unit 1 of Alsharhan and Nairn's (1997) Gachsaran Formation in the UAE. The thickness variations may be due to tectonic folding of the basin at the time of deposition. The Hafit exposures span only the Lower Miocene (Aquitanian and Burdigalian, 23 - 16 Ma). Following mild uplift in the Late Oligocene, the Lower Fars Formation is separated from the Lower Oligocene (Rupelian, 33 - 28 Ma) Asmari Formation by a disconformity. There are no special features (i.e. conglomerate or paleosol) marking this contact between the Oligocene and Miocene that represents a 5 My depositional hiatus. The key Miocene fossils *Pseudoeponides miocenicus*, *Heterolepa dutemplei* and *Globigerina ciperoensis* were found in the Miocene mudstones. The main economic aspect of the UAE Miocene deposits lies in its potential to act as a cap rock sequence in the trapping of petroleum fluids. This is even more important as the underlying Asmari Formation has been characterized as a reservoir formation. An additional economic aspect is the presence of celestine (SrSO₄) which forms lenses associated with the gypsum near the base of the Miocene succession. The celestine may be related to the upwelling of Sr rich saline ground water during the Miocene.

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**CALCAREOUS NANNOFOSSILS OF THE LATE PALEOCENE – EARLY EOCENE INTERVAL AT
ZAGROS BASIN, SW IRAN**

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ABSTRACT

The Pabdeh Formation at Zagros Basin (SW Iran) deposited under pelagic conditions, mainly consists of marls and marly limestones, which is very similar to pelagic-hemipelagic successions in other parts of the Tethyan Realm. Based on calcareous nannofossil data, the lower part of the Pabdeh Formation (about 50 m) is spanning from CNP9 to CNE3 biozones of Agnini et al. (2014). Discoaster mohleri is recorded from the first sample at the studied interval, suggesting the base of Pabdeh Formation begins within CNP9 biozone (early Thanetian). The next bioevents is the FO of Discoaster backmanii marks the base of CNP10 biozone. Base Discoaster multiradiatus is also recorded identify the base of CNP11 biozone. At the studied interval, there is about 10 m cover, so we cannot record the top of Fasciculithus richardii group which marks the top of CNP11 biozone. Above the covered interval, Fasciculithus tympaniformis and F. richardii group disappeared and several new species like Tribrachiatus contortus, Tribrachiatus orthostylus and Discoaster lodoensis are appeared, which are the markers of Eocene sediments and the middle part of CNE3 biozone. Base common Discoaster lodoensis is also identified above the covered interval which marks the top of CNE3 biozone. The last bioevents is top T. orthostylus which extends to the top of the studied interval. A marked increase in the size of D. multiradiatus is also recorded at CNP11 biozone similar to other parts of the Pacific Ocean and the Weddell Sea (Tremolada et al., 2008), which is mainly recorded at the Paleocene – Eocene thermal maximum (PETM) and is considered to be the result of the PETM.

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LATE ALBIAN – EARLY CENOMANIAN CALCAREOUS NANNOFOSSILS FROM ZAGROS BASIN, (SW IRAN)

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ABSTRACT

This study focuses on the late Albian – early Cenomanian strata from a pelagic-hemipelagic section at Zagros Basin (Kazhdumi Formation), SW Iran with regard to calcareous nannofossils. The studied interval is mainly consists of marls, shaly marls, with thin limestone layers. The most important calcareous nannofossil bioevents recorded at the studied interval are the FO of *Eiffellithus turriseiffelii*, the LO of *Hayesites albiensis* and the FO of *Corollithion kennedyi*. The FO of *E. turriseiffelii* marks the top of NC10/CC9. The LO of *H. albiensis* and the FO of *C. kennedyi* are used as markers for subdivision of CC9 a, CC9b and CC9c subzones that are recorded within NC10/CC9 biozone. The FO of *Lithraphidites acutus* which marks the top of NC10/CC9 was not recorded at the studied interval. A marked increase in the relative abundance of *Biscutum constans*, *Discorhabdus ignotus* and *Zeugrhabdotus* spp. are recorded at the studied interval. Simultaneously the relative abundance of *Rhagodiscus asper* is decreasing which is a marker for warm surface water environment. These data indicate cool and eutroph environmental condition for the studied interval at the late Albian-early Cenomanian.

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**MESOZOIC PALYNOSTRATYGRAPHY OF POLAND AFTER ARCHIVAL STRATIGRAPHIC
EXAMINATION AND MY OWN RESULTS OF FACIES STUDY**

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ABSTRACT

The taxonomic analysis Mesozoic miospores from Poland my some characteristic forms:

T ? Cyclotriletes, Hamulatisporites, Praecirculina, Gibeosporites; higher frequency

Alisporites, Infernopollenites, Klausipollenites, Lunatisporites, Ovalipollis;

J ? Apiculatisporites, Baculatisporites, Neoraistrickia, Tigrisporites, Dictyophyllidites,

Cibotiumsporites, Leiotriletes, Foveosporites;

K1 ? Cicatricosisporites, Clavifera, Densoisporites, Gleicheniidites, Pilosisporites

Detail analysis T, J, K1 miospores from Poland with difficult morphology study of relation with sedimentary in a base palynofacies and sedimentological analysis of sedimentary environment defined before in a base of palynofacies and sedimentological analysis of sedimentary environment allow to find corrosional structure on a surface of the miospores; study some various facies (defined by G. Pieńkowski, M. Waksmundzka, 2009)

- continental facies (alluvial plain close lake)
- upper delta plain
- lower delta intradistributary embayment
- lagoons replaced by intradistributary embayment
- lagoon and intradistributary embayment
- delta distributed by waving
- shallow foreshore with high waving energy
- shallow brackish foreshore basin
- foreshore/offshore transition
- offshore brackish basin with waving and currents
- offshore marine basin

analysed this morphology structure an effect of the pre-depositional corrosion

- mechanical
- biochemical (algae, fungi)
- epigenetic

and post-depositional corrosion

- thermal (colour & morphology)

Summarizing, changes of palynofacies (with application of sedimentary data allow to define geological more precisely than taxonomic spectra.

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NEW PLANKTONIC FORAMINIFERA DATA FROM THE UPPER CRETACEOUS PELAGIC LIMESTONES OF THE YÜKSEKOVA COMPLEX FROM THE MADEN AREA (SOUTH OF ELAZIĞ, EASTERN TURKEY)

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ABSTRACT

The age of the units situated in southeastern Orogenic Belt within the Bitlis-Zagros suture zone, is still controversial. Therefore, it is important to obtain new data from the subduction/accretion complexes along the southeast Anatolian-Zagros suture belt in the Eastern Mediterranean. Hence, this study was carried out to find out whether the pelagic limestones overlying the volcanogenic rocks in the Maden area (south of Elazığ) belong to Yüksekova Complex or Maden Complex. The thick-bedded limestones are mainly represented by rare planktonic foraminifera bearing wackestone and mudstone depositional texture. Rare planktonic foraminifera in the rocks are mainly represented by double keeled marginotruncanids, which are characteristic organisms of the Turonian-Santonian interval of the Late Cretaceous. Poor planktonic foraminifera assemblages obtained from the micritic limestones comprise *Marginotruncana* aff. *marginata* and *M. cf. paraconcavata*. According to these taxa, the age of the volcanogenic formation is Turonian-Santonian. The volcanoclastic sequence discussed in this study, were considered to be part of the Maden Complex in previous studies. But, the results show that the studied volcanoclastic succession belong to the Yüksekova Complex as the age of the micritic limestones is Late Cretaceous but not Middle Eosen. Consequently, Late Cretaceous planktonic foraminifera have been identified from the Maden area to south of Elazığ. The results indicate that the volcanosedimentary rocks were deposited in relatively deep marine environment and belong to Yüksekova Complex.

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LITHOFACIES AND BIOFACIES CHARACTERISTICS OF LOWER CARBONIFEROUS CARBONATES IN CENTRAL TAURIDES, TURKEYAyşe Atakul-Özdemir¹, Demir Altınır², Sevinç Özkan-Altınır²¹ Van Yüzüncü Yıl University, Van, Turkey² Middle East Technical University, Ankara, Turkey**ABSTRACT**

The studied successions in the Central Taurides were mainly deposited in a shallow marine environment during the Early Carboniferous time. Conodonts are one of the most important microfossil groups for the Lower Carboniferous biostratigraphy. The measured sections are not rich in conodonts but important species including those of the Lower Carboniferous boundary conodonts. The conodont elements recorded in this study include *Gnathodus cuneiformis*, *Gnathodus girtyi girtyi*, *Gnathodus girtyi simplex*, *Kladognathus* sp., *Lochriea commutata* and *Vogelgnathus campbelli*. Based on the recovered conodont assemblages, Viséan - Serpukhovian boundary has been recognized by the first occurrence of *Gnathodus girtyi simplex*. Conodont faunal variations in Paleozoic to Triassic marine deposits are generally environmentally controlled. Within the context of paleoenvironmental interpretations, different microfacies types could be determined by microfacies criteria reflecting patterns of the depositional environments. The types of microfacies and their environmental interpretations can provide a framework for conodont paleoecology. The defined facies types in BSE section are mainly crinoidal bioclastic packstone, bioclastic grainstone, sandy oolitic grainstone, quartz-peloidal grainstone and quartz arenitic sandstone facies. Crinoidal bioclastic packstones and bioclastic grainstones are suitable facies for conodonts owing to environmental conditions. Bioclasts associated with the conodonts are mainly crinoids, fusulinids, algae, echinoids, brachiopods and ostracods. Conodont elements could not be recorded from sandy oolitic grainstone and quartz arenitic sandstone facies due to the deposition in high energy environments under unstable conditions.

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FORAMINIFERAL ASSEMBLAGES AND MICROFACIES ANALYSIS OF UPPER TRIASSIC VOLCANO-SEDIMENTARY SUCCESSIONS IN PALU REGION (ELAZIĞ, TURKEY)

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ABSTRACT

This study focuses on the Upper Triassic recrystallized limestone units alternating with volcanic rocks at southeastern parts of the Elazığ village (eastern Turkey). The Upper Triassic successions are mainly consists of recrystallized limestones particularly rich in benthic foraminifera, megalodonts, and algae. Comprehensive microfacies analysis and faunal assemblages have been commenced throughout the studied sections. The micropaleontological analysis highlights foraminiferal assemblages, dominated by the involutinids, lagenids, and textularids. The *Triasina hantkeni* biozone has been established based by the presence of an index species of the late Noriyan-Rhaetian interval. The stratigraphic range of this zone is defined by the range of the key species as late Norian-Rhaetian. In addition to eponymous species, *Aulotortus sinuosus*, *Aulotortus friedli*, *Involutina* sp., *Galeanella* sp., *Duostomina* sp., *Glomospira* sp., *Glomospirella* sp., *Duotaxis birmanica*, *Siphovalvulina* sp., and *Reophax* sp. are the other foraminiferal taxa recorded in the Upper Triassic carbonates. Based on the detailed microfacies analysis, the Upper Triassic carbonates of the section are represented by the following microfacies types representing shallow marine environments: mudstone, wackestone-packstone, peloidal bioclastic packstone-grainstone. These defined microfacies types are characteristics of the subtidal and intertidal deposits. Alternating volcanic rocks are mainly alkaline basalts with aphanitic texture. They have P-MORB affinities with enrichment of light rare earth elements over heavy rare earth elements and would be originated from garnet bearing mantle source.

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**PALEOGEOGRAPHIC AND AGE FINDINGS ON PLANKTONIC FORAMINIFERAL ASSEMBLAGES
FROM YÜKSEKOVA COMPLEX (ELAZIĞ, EASTERN TURKEY)**

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ABSTRACT

The Yüksekova Complex is the oceanic crust representative in the eastern Turkey of the Bitlis-Zagros suture zone. The volcanosedimentary rocks belonging to the unit, which widely outcrop around Elazığ (E Turkey) province, are located in Seki-Hacıhasan district (north of Elazığ) and Asker Mountains (Northeast of Elazığ). In the area, the planktonic foraminifera bearing pink-red micritic limestones which are laterally related to the volcanogenic rocks have been examined and aged. These rocks consist mainly of thin- to- medium- bedded limestone and muddy limestone. The pelagic red carbonates in thin sections are represented mostly by biomicrite and rich in planktonic foraminifers with subordinate thinshelled bivalve fragments, radiolaria, and echinoderm fragments. The planktonic foraminifera are mainly composed of *Globotruncana arca*, *G. lapparenti*, *G. cf. falsostuarti*, *Globotruncanita stuarti*, *Gt. stuartiformis*, *Gt. conica*, *Gt. calcarata*, *Globotruncanella citae* and *Rosita fornicata* scattered into a micritic matrix. Small amounts of silt and sandsized quartz grains are observed in some thin sections. Accordingly, the age of the Yüksekova Complex is late Santonian-Maastrichtian in accordance with the planktonic foraminifera bearing micritic limestones intercalated with volcanogenic rocks belonging to Yüksekova Complex around N and NE Elazığ. In the Elazığ region, thus, the late Santonian-Maastrichtian aged red pelagic carbonates of Yüksekova Complex were deposited in the deeper parts of the late Cretaceous sea, probably on the deep shelf edge.

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CLUSTERING PROPERTIES OF THE VRANCEA INTERMEDIATE-DEPTH SOURCE: AN OVERVIEW FOR THE LAST TEN YEARS

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ABSTRACT

The Vrancea zone, located in Romania, at the sharp bend of the southeastern Carpathians, is a well-defined seismic region in a continental convergence area with unique properties and generating the most destructive subcrustal earthquakes in Europe. The seismicity is concentrated in a confined, high-velocity, focal volume in the depth range 60–200 km. The continuously increasing amount of waveforms digitally recorded by the National Institute for Earth Physics (NIEP) provides the opportunity to systematically evaluate individual source properties and to investigate collective scaling properties in order to understand the overall seismogenic process in this particular geotectonic area. The purpose of the present study is to investigate the source parameters of the largest Vrancea subcrustal earthquakes occurred in the last ten years using the Empirical Green's function deconvolution and spectral ratios techniques and to determine the scaling laws characterizing the Vrancea subcrustal activity. The largest events generated during this time interval in the subcrustal domain occurred on April 25, 2009 (17:18, 45.68°N, 26.62°E, h=110 km, $M_w = 5.4$), October 6, 2013 (01:37, 45.67°N, 26.58°E, h=135 km, $M_w = 5.2$), September 23, 2016 (23:11, 45.70°N, 26.60°E, h=95 km, $M_w=5.6$), December 27, 2016 (23:20, 45.70°N, 26.60°E, h=99 km, $M_w=5.3$) and October 28, 2018 (00:38, 45.60°N, 26.40°E, h=148 km, $M_w=5.5$). In order to apply the relative deconvolution techniques, we selected a set of Green's events in association with the main events, as co-located events. The resulted source time function and source spectrum for the most of moderate-magnitude earthquakes are relatively simple, compatible with a circular source model with homogeneous rupture process. The source scaling properties are essential elements to understand and model the tectonic processes responsible for generating earthquakes in the confined lithospheric volume beneath Vrancea. In order to determine scaling laws characterizing the Vrancea subcrustal activity, we combine the source parameters for an enlarged data set adding to the present results the results obtained in previous studies. The scaling laws appear to be self-similar over the entire magnitude range spanned by the whole database ($M_w \sim 2.8$ to $M_w 7.7$). Particular high stress drop values, for moderate and large events, indicate fast and efficient rupture processes at different scales, possibly explained by fast running shear melting processes. Clustering properties show some specific alignments depending on depth, which are supposed to be in connection with the generation of the large events.

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SHABLA AREA TSUNAMI MODELING USING TRIDEC CLOUD SOFTWARE

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ABSTRACT

Twenty-one tsunamis were documented in the past in Black Sea area, from which three triggered in Shabla area, the most dangerous for the Romanian and Bulgarian shores. The first documented event is from Bisone area, 1st Century BC. In year 543 AC, an earthquake of 7.5 M lead to waves of 2-4 m; The latest event was on 31st of March 1901, when a 7.2 M earthquake triggered 2.5-3 m height waves. The purpose of this paper is to emphasize the tsunami potential and the maximum possible wave heights for the studied area. A number of 60 tsunami scenarios were modelled with TRIDEC Cloud software, provided by the German Research Center for Geosciences (GFZ), Potsdam, Germany, using past earthquake parameters (location, focal mechanism) as input for the Shabla area. The tsunami modeling was based on the parameters of 2 recent earthquakes (5th of August 2009, with a magnitude M 5; 3rd of December 2012, of magnitude M 4.2). The magnitudes were increased and varied from 7 up to 8, with steps of 0.2, the depths were also varied with 5, 10 and 30 km, and the earthquakes' fault plane solutions were used in the simulations. The worst case scenario shows maximum waves of 3.05 m in Varna (Bulgaria), for an earthquake of M 8 at a depth 10 km, and 0.6 m waves in Constanta (on the Romanian shore). Waves of 2.65 m (Varna) were obtained for a depth of 5 km and same magnitude (M 8), with values of 0.32 m in Constanta. For magnitude M 7.8 and depth of 10 km, possible waves of 1.95 m in Varna might be triggered, with 0.25 m wave heights in Constanta. Moderate tsunami waves were given by a scenario of M 7.5 and a depth of 30 km, of 0.87 m height in Varna, displaying 0.13 m heights at Constanta. The results show values of 0.72 m waves in Varna for the same magnitude (M 7.5) but a depth of 10 km, and 0.16 m waves in Constanta. The modeling estimates low waves of 0.41 m in Varna and 0.07 m in Constanta for M 7.2 and 10 km depth. For the case of magnitude M 7 and a depth of 5 km, 0.25 m waves are estimated in Varna and 0.05 m in Constanta. The lowest results are displayed by a scenario with magnitude M 7 and 10 km depth, showing 0.15 m waves in Varna and 0.06 m in Constanta. In conclusion, tsunami modeling for Shabla area estimates comparative waves values to those of past documented events, reflecting the need of similar studies in order to evaluate the maximum possible tsunami waves in the western Black Sea area. Moreover, the results were compared to previous modeling accomplished with a different software. In case of a real event in the future, the modeling results might be compares to real time sea level measurements from the stations located along the shore.

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ATTENUATION OF MACROSEISMIC INTENSITY FOR CRUSTAL ROMANIAN EARTHQUAKES: CALIBRATING THE BAKUN-WENTWORTH'S METHOD

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The purpose of the present study is to elaborate a new relationship for computing the macroseismic intensity attenuation of the form $I_i = f(M_w, D_i)$, using observed intensities data for the crustal earthquakes in Romania and then, based on this relationship, to calibrate one of the most used modern methods for estimate historical earthquakes (localization, moment magnitude determination, M_w), respectively the Bakun-Wentworth method. The method uses all observations obtained from an earthquake (intensity on points, IDPs) and apply technique of research in a grid type network, in order to minimize residuals. The results are probability functions and for assessing the uncertainties of the estimated parameters the rms values corresponding to the confidence level of 95%, estimated according to the number of observations, are used. The study is based on observation data from 11 standard earthquakes ($4.5 \leq M_w \leq 5.7$, 811 IDPs) and 7 validation earthquakes ($3.5 \leq M_w \leq 5.4$, 215 IDPs) produced mainly in western Romania and for which the reported macroseismic intensities were revised in a homogeneous manner. The magnitudes (M_w) were instrumentally determined. The obtained results were also tested on earthquakes produced in neighboring areas, expanding their application space for earthquakes produced, for example, in the extra-Carpathian area and Pannonian Depression. The comparative analysis of the results obtained with other methods / relationships confirms: 1) the high performance of the new attenuation relationship and of the Bakun-Wentworth method of estimating the Romanian historical earthquakes and 2) its effective applicability both as a viable alternative for testing and validation in the process of the Romanian earthquakes catalog revision as well as in the practice of seismic hazard estimation and the rapid assessment of the effects caused by the strong crustal earthquakes, as a requirement for the efficiency of specialized rescue operations.

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MACROSEISMIC INTENSITY ESTIMATION FROM INSTRUMENTAL GROUND MOTION RECORDINGS IN THE CASE OF SMALL AND MODERATE VRANCEA SUBCRUSTAL EARTHQUAKES

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ABSTRACT

Romania is one of the most seismic-prone countries in Europe due to the periodically occurrence of strong intermediate-depth earthquakes in Vrancea seismogenic zone. The Vrancea area is located beneath the South-Eastern Carpathian Arc bend, at the contact between the East - European plate and the Intra-Alpine and Moesian sub-plates. An intense seismic activity is recorded in the mantle, within a narrow, almost vertical descending volume between 60 and 180 km depth. Earthquakes with magnitudes larger than 5.0 (M_w) and macroseismic effects exceeding V MSK degrees on extended populated area occur in Vrancea seismic zone, with a return period of around 2 years. Besides the extended scientific studies, the near real time estimation of the macroseismic intensity recently became mandatory for the insurance companies to cover some of the losses and damages that earthquakes might cause to houses, belongings, and other buildings. The first approach to obtain intensity values was to develop an online environment for collecting people feedback regarding the effects of earthquakes and for the automatic approximation of the intensity. The automatic intensity estimation code from the online feedback proposed by Wald (1999) and adopted by Ionescu and Dragoicea (2010) for the Romanian earthquakes was improved and used for this study. Additionally, there were used ground motion prediction equations (GMPEs'), to obtain intensity values from the epicentral intensity, and epicentral and hypocentral distances. Besides the estimation of macroseismic intensities from online people feedback and from GMPEs', equations for conversion of peak ground acceleration in macroseismic intensity were also required for a rapid evaluation of ground motion effects. In order to avoid the increase of the prediction uncertainties, the data must be selected in such a way that they represent the parameters' rank for which the prediction will be accomplished and the selected data must be representative for the investigated regions and seismic source. In this paper were developed conversion methods from PGA to macroseismic intensity for moderate intermediate depths earthquakes with $4.5 < M_w < 6.0$. All the studies were realised in the case of Vrancea recent (2014-2019) moderate intermediate depth earthquakes, felt on the extra-Carpathian region

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TESTING AND DEVELOPING THE MACROSEISMIC INTENSITY ATTENUATION RELATIONSHIPS FOR THE VRANCEA (ROMANIA) CRUSTAL EARTHQUAKES

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ABSTRACT

A correct seismic hazard assessment and intensity-based shake maps of a seismic zone depend on the determination of parameters that emphasize the distribution and the macroseismic intensity attenuation for that seismogenic zone. Due to the reduced number of strong ground motion records, macroseismic intensity information available for previous earthquakes which have occurred in studied area were the only source of information utilized for developing attenuation relationship for that zone. The aim of this paper is to test the existing equations published for various crustal seismic sources and develop a new macroseismic intensity attenuation law for the Vrancea crustal seismic source. The Vrancea crustal seismogenic zone had experienced moderate earthquakes in the past with magnitudes which did not exceed 5.9 (Romplu catalogue 2019) and macroseismic maps had been constructed by various authors for these earthquakes representing intensity pattern and decrease of this parameter with distance on different azimuths. The selected attenuation laws were tested for different values of epicentral intensity and with reference to twelve directions. The input data consist of macroseismic intensities collected for 4 small and moderate earthquakes ($M_w \geq 4.0$) that had occurred during the last hundred years with epicentral/maximum intensity in the range IV to VI MSK degrees. The seismic events used to verify the attenuation laws were selected based on the magnitude and number of macroseismic observations collected for each event. Using this data, attenuation relationships of macroseismic intensity with distance will be tested and modified. The deduced attenuation equation might be used for rapid intensity assessment of the potential future earthquakes occurred in this seismic zone.

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GEOPHYSICAL METHODS OF IDENTIFICATION OF ORE CONTROL STRUCTURES OF OROGENIC GOLD FIELDS IN LOW-CONTRAST TERRIGENOUS ROCKS BY PETROPHYSICAL CHARACTERISTICS

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ABSTRACT

The paper presents the analysis of characteristics of abnormal geophysical fields of the ore control of the Malo-Tarynsky orogenic gold field in Verkhoyano-Kolymsky folded area, the Northeast of Russia. It is located in terrigenous rocks of the top Triassic, poorly contrast on petrophysical characteristics. Ore bodies of the Malo-Tarynsky field are presented by the mineralized crushing zones with veinlet-disseminated and vein-disseminated mineralization. The material structure of veins is simple. They are put by quartz (85-95%), a carbonate (5-15%), ore minerals (pyrite, arsenopyrite, galenite, blende, chalcopyrite, etc.) (about 1%). To identify the features of manifestation the ore control in geophysical fields land geophysical surveys are conducted by the methods of high-precision magnetic exploration and electroinvestigation. Magnetoprospecting works have established the low-amplitude mosaic structure of magnetic field of the Malo-Tarynsky field. The main magnetorevolting structure is the Samyrsky granitoid massif which is allocated with a magnetic minimum (-99 nT). On the nature of change of intensity of regional anomalies it is possible to assume immersion of the Samyrsky massif in the northwest direction. Extreme positive values of magnetic field are connected with hornfelsed ores in the zone of contact metamorphism (170 nT). Various anomalies as low-magnetic, mainly linear ones caused by explosive violations are distinguished (-12 – 20 nT). In the electric field the abnormal zones have the linear nature of various extent and intensity. Pro-deleting of anomalies changes from sublongitudinal to northwest. The anomalies of low electrical resistance, generally trace zones of crushing and jointing (208-2300 Om*m). In general, they are grouped in three "regional" abnormal areas of the northwest and North northwest orientation of low electrical resistance and correlated with situation of the ore control zones of the Malo-Tarynsky split (208 – 1600 Om*m). Sites with frequent alternativeness and alternating electric anomalies indicate lithologic heterogeneity of the environment (2500 – 10000 Om*m). The study has shown magnetoprospecting to be effective when mapping magmatic formations and explosive violations. They allow to delineate intrusive bodies, to allocate hornfelsed zones. The electric profiling application by method of a median gradient solves a wide range of geological tasks. Apart from allocation of the structures controlling gold mineralization in faint terrigenous ores, electro-investigation allows to carry out the lithologic partition of permafrost rocks in the territories blocked by friable deposits of considerable power.

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SEISMIC ENERGY RELEASE OF INTERMEDIATE EARTHQUAKES AND THE GEOMAGNETIC ANOMALIES RECORDED IN THE VRANCEA ZONEMihai Andrei ^{1,2}, Toader Victorin Emilian ¹, Moldovan Iren Adelina ¹¹ National Institute for Earth Physics, Romania² University of Bucharest, Faculty of Physics, Romania**ABSTRACT**

This paper utilizes a statistical technique to investigate the seismic energy distribution in Vrancea zone. The seismic energy is calculated during each geomagnetic anomaly to see if there is a statistical link between energy release during the anomaly and the magnitude of geomagnetic decrease. The geomagnetic field measured in Vrancea zone can variate from multitude causes and the majority of them are represented by the variation of the external magnetic field. To better distinguish the local anomalies from external geomagnetic variations (geomagnetic storms), the datasets recorded at Muntele Rosu (MLR), located inside the seismogenic zone were compared with datasets recorded at Surlari (SUA), located at 100 km away from the seismogenic area. The nature of these anomalies may be caused by the thermal processes localized at intermediate depth, like mineralogical phase changes, thermal demagnetization of rocks due to high temperature and the dehydration of rocks. The earthquakes mechanism related to these intermediate earthquakes could not be explained using only the brittle failure, and the rock could fail by the mechanism of progressively self-localizing thermal runaway. In this mechanism, the ductile deformation leads to heat and then to a thermal softening and weakening of rock. So far, the anomalies show two patterns, anomalies which last between two weeks and one month and anomalies which last between five months and eight months. Usually, the geomagnetic decrease is visible only on B_y component (E-W component) and the anomalies morphology is represented mostly by V-shape for short anomalies and a step-type for long anomalies. The seismic energy release during these geomagnetic anomalies are directly proportional to the B_y component decrease (anomaly magnitude), but there are exceptions and were noticed some unequal distributions of seismic energy which could be explained by the different depth occurrence of the main shocks. Seismic energy release calculation for each geomagnetic anomaly can be useful to determine the draft patterns of the seismic energy distribution during geomagnetic anomalies and shows a link between geomagnetic behaviour in Vrancea zone and the associated seismicity.

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THE LOCAL SEISMIC NETWORK OF THE GARGANO AREA (SOUTHERN ITALY): A REVIEW OF RECENT RESULTS AND PERSPECTIVES

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ABSTRACT

The historical seismicity catalogs report that the Gargano area (Apulia region, southern Italy) was the site of earthquakes of medium to high magnitude estimated from intensity scales, while from the instrumental seismicity it is possible to identify in 1995 the most energetic Apulian earthquake with a main shock of $M_w = 5.2$. Although the Gargano area has been struck by strong past and recent earthquakes, it is poorly covered by the seismic stations of the Italian National Seismic Network. To better understand the seismic trend that characterize this seismically active area, in 2013 the OTRIONS seismic network, managed by the University of Bari (Italy) in cooperation with the National Institute of Geophysics and Volcanology (Italy) (INGV), was deployed. Several hundred micro-earthquakes, never recorded previously, have been recognized since the first months of activity of the seismic network. For this purpose, a large amount of manual picking on the waveforms after the recognition and the association of the seismic events on helicorder was made to obtain a dataset suitable for different objectives regarding the seismological studies of the Gargano area, so far little explored. The first work concerned the development of a crustal seismic velocity model suitable to improve the quality of earthquake localizations. This study was based on a two-step procedure that used also previous regional seismic recordings collected by INGV. Then, the recorded seismic activity was analyzed after observing that it occurs at depths that are systematically different in the northeastern zone with respect to the south-western zone of the Gargano promontory. In correspondence with the change in depth of earthquake foci, a change in the value of surface heat flow is also observed. So, the thickness of the seismogenic layer in the two zones was inferred by a thermo-rheological model which, assuming a constant strain rate, provides the stress as function of depth. These important results were realized despite the critical issues related to data transmission and storage which the OTRIONS network suffered in the first years of activity. In the next future, through the recent collaboration with the RECAS-Bari computing center of the University of Bari (Italy) and of the National Institute of Nuclear Physics (Italy), the implementation of a cloud infrastructure for receiving, processing and storing data from the seismic networks of the region will allow the realization of a centralized acquisition system for seismic monitoring resources. Thanks to this great improvement of the seismic network infrastructure, new and important geodynamic knowledges of Gargano area and surroundings are expected.

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NEW INSIGHTS FROM RECENT MICROSEISMICITY OF THE GARGANO (SOUTHERN ITALY) AREA

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ABSTRACT

From a structural point of view, the promontory of Gargano is part of the Apulia foreland (Southern Italy) that protrudes into the Southern Adriatic Sea. The promontory and its surrounding area are subjected to a frequent seismic activity and it is known that strong earthquakes of the past occurred in this area. The RSN (Italian Seismic Network) covers the Gargano area with only three broad band seismic stations while it is denser in the Apennine axis, which is the main Italian seismogenic area. The inadequate coverage of the Gargano area has made difficult carry out seismological target-oriented studies. The resulting lack of the low magnitude seismicity in the Italian seismic catalogue in the Gargano area motivated the installation of the OTRIONS local seismic network by the University of Bari. The analysis of seismic data, collected by the OTRIONS network in the first 2 years of activity, revealed an intense micro-seismic activity that was already reported in recent papers dealing with the velocity model for the area and the rheological model of the crust. In this work we analyze the data collected in the first 5 years of seismic monitoring. This analysis outlines the main problem occurred during these years of activity, linked to the management of the instrumentation and to the data transmission. Nevertheless, a high number of microearthquakes was recorded and allowed to reveal new insights about the main structures which give rise to the Gargano seismicity.

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2D KERNEL-BASED IMAGING OF CODA-Q IN THE GARGANO PROMONTORY (SOUTHERN ITALY)

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ABSTRACT

Crustal seismic attenuation in the Gargano Promontory (Southern Italy) was inferred by analyzing coda waves of about one hundred small magnitude earthquakes recorded by the OTRIONS local seismic network (managed by the University of Bari ALDO MORO, Italy). Coda attenuation Q_c was computed under the assumption of single back-scattering, at different lapse times and at different frequencies. Average Q_c is comparable with the same quantity measured in the adjacent area of the Umbria–Marche region (central Italy). A recent kernel-based imaging technique for Q_c was then applied and the results evidence a well confined zone located South West of the investigated area, showing a sharp Q_c anomaly. While Q_c cannot be directly related to the physical properties of the propagation medium, its spatially-dependent modeling allows an interpretation in the light of other geophysical and geological information. Our results were then interpreted following the two extreme hypotheses according to which Q_c could be representative of the effect of only intrinsic attenuation or of only scattering from the heterogeneities. Both the hypothesis correlate with the observation of anomalies in several geophysical parameters, such as heat flow, magnetic field, gravity, density, seismic velocity in the southwestern Gargano. Moreover, the Q_c images support the results obtained in a recent study that shows clear variations in the rheological properties of the Gargano. The results obtained at local scale confirm and detail previous regional scale studies on attenuation and highlight for the first time the presence of a positive Q_c anomaly in the south-western part of the Gargano Promontory.

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HVSR AND ARRAY TECHNIQUES IN SEISMIC MICROZONATION STUDY

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ABSTRACT

Evaluation of site effects in seismic microzonation studies requires knowledge of soil dynamic parameters. Different methods of seismic prospecting can be used, such as seismic boreholes (seismic downhole and crosshole methods), and the surface seismic (seismic reflection and refraction methods) or seismic surface wave methods (MASW, SASW). All These methods are expensive and difficult to implement especially in urban environment, which led in recent decades to the development of methods based on ambient vibration noise analysis. Generally, two methods of ambient vibration noise are used, the Horizontal-to-Vertical Spectral Ratio method (HVSR) for estimating the amplification and resonance frequency of study site, and the method based on the ambient vibration array measurement analysis, which extracts the surface wave dispersion and determines by inversion, the shear wave velocity profile of the soft sediments and the underlying bedrock. Based on the combination of 330 single-station HVSR and six array ambient vibration recordings, a seismic microzonation study was performed at Boumerdes city (Algeria). The results have established a zoning according to the HVSR curves typology and has permitted to classify these zones according to the Algerian seismic code (RPA 2003). The results were very satisfactory and were able to show the important contribution of these methods in seismic microzonation studies.

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DATABASE OF FOCAL MECHANISMS IN ROMANIA: STATISTICAL FEATURES AND TECTONIC REGIME REPRESENTATIVE FOR SEISMIC ZONES

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ABSTRACT

Seismicity in Romania takes place on two depth regimes, in the crust ($h < 50$ km) and in the mantle at intermediate depths ($50 \leq h < 210$ km, which appear to be largely decoupled. The intermediate-depth seismicity concentrates in an extremely narrow active volume, descending almost vertically beneath the continental crust, at the south-eastern corner of the highly arcuate Carpathian Arc, in the Vrancea region. The density of the seismic energy release is very high taking into account the strong clustering in space and relative high rate of producing major shocks (magnitude above 7). The situation is totally different for the crustal seismicity, which is much more dispersed and significantly smaller as rate of seismic energy release. Zones with increased seismicity are located in front of the Carpathians Arc bend and at the contact between the orogeny and the Pannonian Basin. In order to assess seismic hazard of Romania, it is important to define as accurately as possible the main characteristics of the seismicity regime in the earthquake-prone areas of the country both in terms of space-time-size pattern and of focal mechanism (e.g., Radulian et al. 2000). The paper of Radulian et al. (2018) focused the analysis on the seismogenic zones of the south-eastern part of Romania for a fault plane solutions catalogue extending from 1998 to 2012. This analysis was complemented by a similar one in a subsequent paper (Radulian et al., 2019) which was based on earthquake mechanisms data from several sources revised and updated for all the available fault plane solutions of earthquakes recorded in 20th century in Romania. One important element in characterizing the seismic regime and tectonics of an earthquake-prone area is the focal mechanism. Several previous works (such as Malița and Rădulescu, 2010, Craiu et al., 2017) have addressed this issue, but based only on a limited number of earthquakes (10-20 events), usually the stronger events. The present paper combines the two catalogues of focal mechanisms, as well as other informations in the area, in order to investigate the fault plane solutions characteristics and their quantification within the earthquake-prone areas identified in Romania, as well as the correlation of these seismic areas with the tectonic provinces in Romania.

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**ELECTRICAL SIGNATURES OF A PERMEABLE FRACTURE ZONE IN CARBONATES HOSTING
LOCAL GEOTHERMAL MANIFESTATIONS: INSIGHTS FOR THE DEEP FLUID FLOW IN THE
GARGANO AREA (SOUTH-EASTERN ITALY)**

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ABSTRACT

Western Italy is typified by high heat flow with local picks up to 600-1000 mW/m² in the geothermal areas, such as Larderello (Tuscany) where the pioneering experiences for energy exploitation has been carrying on. However, heat flow anomalies occur also in the peri-Adriatic areas (eastern Italy), where the regional heat flow is lower (25-35 mW/m²) and a carbonatic platform (up to 5 km thick) occurs. In northern Apulia (Gargano area), a few geothermal evidences can be associated to structural conditions. Notably, the area is characterised by a thick calcareous and dolomitic succession, affected by seismogenic faults and karst dissolution, and the presence of some surficial geothermal evidences (coastal springs and well waters). In order to contribute to a better understanding of the deep circulation, an audio-magnetotelluric (AMT) survey was carried out. Soundings were acquired at twenty-two sites along a 27-km-long profile in the frequency range 0.1-10⁵ Hz. The profile crosscuts the main heat flow anomaly and the main morpho-tectonic elements characterizing the study area (Tavoliere delle Puglie, to the SW, and Gargano Promontory, to the NE). Data dimensionality analysis revealed different degrees of complexity along the profile, manifesting three-dimensional (3D) effects mainly for soundings located in the NE area. 2-D inversion was undertaken providing a resistivity model down to 3 km b.s.l.. The resistivity values vary over a wide range, although the model highlights a simpler resistivity signature in the SW-area with respect to in the NE-one. Indeed, in the Tavoliere delle Puglie, resistivity mainly increases with depth; very low and shallow resistivity values, associable to alluvial clayey sediments, overlie a high and thick resistive layer, related to the carbonate bedrock. The top of the bedrock is shallower in the transition zone leading to the Gargano Promontory. Further to the NE, the deeper part of a model is characterized by lower resistivity values and several lateral discontinuities suggest a more heterogeneous context. A deep and wide low-resistivity zone is embedded between well-defined faults, probably due to a change in the physical state of the bedrock, considering the almost homogeneous characteristics of the platform. By the way, the recognized electrical anomaly is interpreted as a fracture network which may favour fluid circulation. The supposed geometry of the permeable zone, as obtained by the geophysical investigation, is consistent with the structural interpretation, proposed by independent studies. It derives that the present AMT study allowed to reconstruct first order geological structures reasonably channelling deep fluids, of which evidence is only locally recognized by boreholes and rare natural manifestations at surface.

COMPOSITIONAL MULTIVARIATE DATA ANALYSIS ON GEOCHEMICAL AND GEOPHYSICAL DATA AT CAMPI FLEGREI CALDERA (ITALY)

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ABSTRACT

The unrest of Campi Flegrei caldera is primarily characterized by ground level variations and by an increase in the amount of discharged volcanic fluids. Between 1994 and 2004, there was a decreasing trend of the phenomenon with a subsidence of the ground. In the following years (2005-2016), however, the bradyseism showed a reversed trend, and the ground started to rise at a fairly high velocity. Our work is based on the hypothesis that the ground deformations at Campi Flegrei caldera depend on competing processes, which can be revealed by the analysis of a cross mix of geochemical and geophysical variables. The ground deformations time series represent our first dataset, the second one consists in the fluids chemical composition discharged by the Solfatara fumaroles and the third dataset in the hypocenters of earthquakes recorded in the caldera area between 1994 and 2016. In this study, we refer to the Compositional Data Theory (CoDA) to avoid spurious correlations that happens when the sample data present a constant sum for each observation. Therefore, CoDA and Multivariate statistical analysis were applied, for the first time, aimed at exploring and assessing a robust methodological approach that may discover relevant patterns. The main outcomes of our study show that: **a.** there is a migration of earthquakes hypocenters to shallower depths starting from the year 2013; **b.** The correlation between ground displacement and earthquakes increases as shallow depth classes are considered: this finding implies that during the unrest periods at CF, an increased number of earthquakes toward the surface results in a more marked vertical ground displacement, **c.** the 2015-2016 earthquakes occurred at the shallowest depths and exhibit the highest correlation with ground displacement; **d.** the compositional data analysis shows which gas ratio indicates a variation of the velocity of the bradyseismic phenomenon; **e.** the variation of carbon monoxide is in the maximum log-contrast with respect to all the other gases emitted by the Solfatara fumaroles; **f.** the relative variability of CO and CH₄ differs among all the others variables respect to the barycenter. In the factorial plane the variance of CO is explained during the last period of uplift, while the CH₄ during the period of down-lift. The study's results show a significant relation between earthquakes, cumulative earthquakes and ground uplift velocities, highlighting a close temporal relationship among the hypocentral clusterization towards shallower depths and the evolution of the bradyseismic phenomenon. Up to now, in the literature is reported that the volcanic gas concentrations follow the evolution of the ground uplift, in this study, we can instead state that the discharged volcanic gases are more correlated with the variation of the ground displacement velocity. In conclusion, we underline that the Compositional Data Analysis (CoDA) are applied, for the first time, to geochemical data of Campi Flegrei caldera and the outcome of the methodology avoids spurious correlations leading to different outcomes reported in previous works. Notably, the velocity of vertical displacement is found to be the main geophysical indicator of vertical displacement and CO and CH₄ gases are the two main indicators for monitoring active volcanoes. These findings may be helpful for monitoring activities at Campi Flegrei, as well as in any active volcanic area.

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SEABED ANISOTROPY EFFECT ON MARINE CSEM RESPONSE OF OIL RESERVOIR IN SHALLOW WATER ZONES

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ABSTRACT

In shallow water zone, marine CSEM response due to high resistivity oil reservoir is normally weak due to the impact of air waves. Data processing and interpretation in shallow water have been a main topic in marine electromagnetic research. Recently EM data interpretation in shallow water zone has been improved which requires more developments on fundamental theory. At this aim, we study the effect of electrical anisotropy on MCSEM data in shallow water zone. We tested different anisotropic models for seabed media. The corresponding marine CSEM responses are calculated with COMSOL software. We analyze the characteristics of calculated amplitude, phase of inline Ex component, and current density. Thus we can analyze the physical mechanism of the anisotropic effect on the response of oil reservoir. We compared our results with those from deep water zone and found difference. It is suggested that attentions should be paid to the difference when interpreting and inverting the marine CSEM data. The results presented can be helpful to promote marine CSEM data interpretation in shallow water.

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MOMENT MAGNITUDE ESTIMATION FOR THE SEISMIC SWARM RECORDED IN PETRESTI AREA IN 2014, USING STRONG MOTION DATA

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ABSTRACT

The seismicity of Romania is significantly affected by earthquakes produced by the Vrancea seismic source with intermediate depth events (3 shocks/century with magnitude M_w greater than 7.0). The seismic activity on the Romanian territory consists on both shallow and intermediate depth earthquakes. The crustal seismicity is moderate and more scattered in comparison with the intermediate depth one. The recent upgrade of the seismic network in Romania with high dynamic range accelerometers (114 real time seismic stations equipped with episensors) allows recording of moderate to large magnitude earthquakes at very close epicentral distances (less than 10-20 Km). A network for monitoring the strong motion that can occur in a given area records data that provide an excellent opportunity to study how source, path and site influence the ground motion, specifically that in the near-source area. Such data are essential for updating seismic hazard maps and consequently building codes and earthquake-resistant design. A fast seismic data analysis is essential to provide rapid and useful information to Authorities that have to take decisions immediately after a strong earthquake occurrence. Modern accelerometers are the only instruments that can provide near-source high-quality data during a strong earthquake. The purpose of this work consists mainly in the estimation of moment magnitude M_w using the strong motion network of NIEP. A stable and automatic method developed by [1], has been implemented in real time data acquisition and processing system (ANTELOPE) to estimate in real time the seismic moment, the moment magnitude and the corner frequency of events recorded by accelerometers, using [2] method applied to S waves. The main goal is the independent estimation of seismic moment and corner frequency for all events recorded by the strong motion network.

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**USE OF GROUND PENETRATION RADAR (GPR) IN THE EVALUATION OF GEOLOGICAL-
STRUCTURAL ELEMENTS OF ORNAMENTAL CARBONATED ROCKS - CASE STUDY IN VALINHO DE
FÁTIMA, PORTUGAL**

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ABSTRACT

In the extractive industry of carbonated ornamental rocks, the presence of discontinuities, size of grain, colour, textural anisotropy and porosity are factors that determine the extraction planning and their economic viability. This characterization is important for the planning and scaling of the exploitation. The objective of this work was in first, using the penetration radar in the soil (GPR), to identify and determine the spatial distribution of these elements. The choice of this non-destructive geophysical method to perform the work was because it is a fast method of inspection, having a good horizontal and vertical resolution, and relative precision. for this purpose, a PULSEEKKO GPR (SENSORS & SOFTWARE) acquisition equipment was used, with a system of two bi-static antennas (transmitter and receiver), unshielded, with a frequency of 100 MHz, using the reflection method with a common offset and with an antenna separation of 1,00 meter (m), at the pre-defined locations at each level of the quarry. The acquired data were subsequently processed in the software REFLEXW® vers. 7.5.9, from SANDMEIER-GEO®. The multiple profiles obtained (radargrams), which were compared with the corresponding exploitation fronts. This comparison allows validating the methodology used in the identification of existing structures, their vertical and horizontal limits and spatial relations between them. The profile was executed in the quarry at the location marked by Profile A-A'. The corresponding front consists almost entirely of oolitic limestone with cross-stratification. In the radargram, it was identified in its upper part what would correspond to the oolitic limestone, structures, and discontinuities above the blue line. Below this line, which corresponds to the stratification, it is possible to identify layers of oolitic limestone with cross-stratification. The bench front was disassembled later in blocks and from its observation, it is possible to correlate some of the existing structures in the radargram, the cross stratification. The proposed methodology was validated by the observation of the fronts and blocks extracted, and the objective of the preliminary study was reached. The GPR method proved to be versatile, allows to vary the acquisition parameters in an expedited way and to visualize in real time the result of the acquisition.

VARIATIONS IN THE GEOELECTRIC PROPERTIES OF ROCK MASSES AS A RESULT OF THE SEISMIC EFFECTS OF INDUSTRIAL EXPLOSIONS

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ABSTRACT

In order to obtain some clarity in the matter of assessing the seismic effects from industrial explosions of the state rock massif. Variations of the electrical properties of rock mass before and after explosions were studied by electro tomography. The monitoring studies on the experimental profile selected across the strike one of the regional faults that cut across the career field of the Neryungri was conducted. Observations were made before the explosion, immediately after the explosion, and subsequent observations at intervals of one hour. The electrical resistance increases in the rock solids of tectonic disturbance on the geological structure, which located on the side of the explosion. The electrical resistance decreases in the fault zone, some changes in the electrical resistance of the hanging geological structure. It has been found that the spatial orientation of the fracturing of the rock solid affects the pattern of change in the geoelectric properties of the rock mass. The electrical properties changes in the rock mass from the location of the explosion block in concern to the direction of fracture of the rock mass. In the case when the front of the blast wave propagates along the strike of fractures, the fractures open and the intensity of moisture migration increases significantly, which involve a significant decrease in electrical resistance not only in the zone of tectonic disturbance but also in the underlying geological structure. When the wave front propagates perpendicularly to the stretch of rock mass fractures, cracks also close and moisture migration along the cracks caused by changes in the stress-strain state of the rock mass, is not significant, which is reflected in a slight change in the geoelectric properties of the rock mass in the section of the profile under study.

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ASSESSMENT OF SEISMIC EFFECTS OF BLASTING OPERATIONS AT THE HRABŮVKA QUARRY

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ABSTRACT

Hrabůvka Quarry is one of the Moravian quarries of company Českomoravský štěrk, a.s. The establishment is located in Moravia about 5 km from the town of Hranice na Moravě. Quarry is a prominent supplier of quality natural crushed stone, especially for the construction and renewal of railway lines. Mining here since 1900. Mining of raw materials is carried out at the level of seven levels with a length of about 1 km and a width of 400 m and is characterized by great hardness. The mined rock is Moravian offal. The Hrabůvka quarry offers crushed aggregates of many fractions and a material for mechanically reinforced aggregates. Hrabůvka Quarry is one with a production of 1,000,000 tons per year of the largest producers of crushed aggregate in the Czech Republic. Crushed aggregate or crushed gravel has a wide range of uses. It is used in concrete, reinforced concrete, prestressed concrete, prefabricated components, water-concreting concrete, cement-concrete pavements, for railway construction, for road construction - into asphalt layers, unbound layers, MZK, into coatings, gritings, backfill, under paving, etc. In the production of mechanically reinforced aggregates (MZK), is used the most modern technology in the Czech Republic. MZK is usable for reinforcement of forest and agricultural roads, cycling paths, and is also suitable as a base layer on buildings, playgrounds and under parking areas. In addition to crushed stone and MZK, Hrabůvka quarry also offers railway aggregates for the needs of Czech Railways. Hrabůvka Quarry was one of the quarries, on the way with the change of seismic after blasting works. It was a large-scale blasting job - a screen shot. Measurements using two BRS 32 devices. The BRS 32 is a battery pack with a three-component seismic geophone recording on internal flash memory up to 32 GB. Data download and other parameters are adjustable via USB interface. Values obtained from individual measurements and the sequence of Bohemian-Moravian gravel to project further blasting. At the same time they are in progress and research on how seismic is spreading across different rock environments.

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LEGAL PROVISIONS CONCERNING SEISMIC EFFECT OF BLASTING WORKS IN THE CZECH REPUBLIC

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ABSTRACT

The implementation of blasting works brings many negative effects on the surroundings around us. One of the negative influences is an artificially created seismic, or artificially created concussion, which is called seismic shock. The source of artificial seismic energy in seismic shocks is the tugs, vibrations and punches created by tearing, in which artificially induced elastic waves spread in all directions. These elastic waves emerge from blasting operations and have negative effects on objects, buildings in the vicinity of blasting. Seismic influences, ie seismic loads affecting objects, are subject to extensive legislation, primarily Czech technical standards and adopted European technical standards: CSN 730040 - Technical Seismicity of Building Objects and Their Response, as well as CSN 731001 - Foundation Engineering. Foundation ground under foundation foundations and CSN EN 1990 730002 - Principles of structural design. These standards provide guidance and procedures on the issue in our country. CSN 73 0040, which is used to determine the seismic load due to technical seismicity and the response of residential, civic, agricultural and industrial buildings in the Czech Republic, is considered to be the most beneficial and important standard regarding seismic shocks. The standard also applies to structures and other objects unless specific standards and regulations apply. The main objective of the article is to acquire and approximate the legislative overview of the impact of seismic on buildings and objects. These standards specify seismic measurements and further define computational models, on the basis of which, and subsequent assessment of artificial seismic effects on objects, results in the evaluation and results of these negative effects. Individual objects are classified into resistance classes. The negative effects of seismic on buildings are expressed both by the degree of damage to the object.

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THERMOELECTRICAL ELEMENT OF EARTH'S CRUST

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ABSTRACT

A model of the natural thermoelectric element was developed. The basis of the element is long-lived deep faults with graphite ores inside, which provide continuous electrical connection between the upper part of Earth's crust and the mantle. Temperature difference between them can reach 1000 °C and more because of the geothermogradient. That is why thermopower and thermoelectrical currents, which move directly upwards to arise (from the hot end to the cold one), appear in the geothermogradient because of the Seebeck effect. That is the reason why natural electric potentials of high intensity up to -2...-10 V are registered over graphite ores because of the presence of thermpower. Electrical characteristics of the geothermoelectric element of the Earth's crust (thermoelectrical current, its density, total natural potential) were quantified. There is found a mathematical solution which allows to calculate the temperature of the geothermoelectrical element's lower part, which is directly related to the overheated area of the deep tectonic process. There is also suggested a method of watching the dynamics of the total electric potential which is registered in the upper part of the geothermoelectrical element. Eventually, systematical observations over those total potentials can help to study tense zones of Earth and control the dynamics of thermal deep processes, which are often related to volcanic activity and seismic events. As a result, the resources of the geophysical method of the natural electric field can broaden greatly. It can help science to study directly both the dynamics of deep thermal processes of the Earth's crust and its areas related to sources of tensions of exogenous and endogenous nature.

PRACTICAL APPLICATION OF A HORIZONTAL INTRAPLATE VELOCITY FIELD MODEL FOR THE TERRITORY OF BULGARIA

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ABSTRACT

Republic of Bulgaria is situated on the edge of the Eurasian tectonic plate. This is defined by active tectonic and seismic activity, which is an issue in the implementation of the official coordinate reference system in the country - the ETRS89, as far as precise solutions are concerned. The reason is that the intraplate, relative to Eurasia, tectonic movements south of Stara Planina are about 5 times larger than those north of it. Over a period of time (about 10 years), the coordinate errors of the points from a static network becomes bigger than the uncertainties of GNSS measurements and thus limit their potential. Thanks to the presence of networks of continuously operating reference GNSS stations (CORS networks), and advanced methods of processing and analysis of the results, it is possible to monitor the crustal deformations with sufficient precision. A model of horizontal intraplate velocities was developed based on measurements from different epochs of the CORS networks operating on the territory of Bulgaria. Precise coordinates and velocities of the stations were estimated using the Bernese GNSS Software v5.2, and the deformation modelling was performed using a method of determining parameters of local deformation and Euler poles of distinctive tectonic blocks to which the country is divided according to the authors. This paper presents the practical applicability of this model for interpolation the velocities of stations from static networks and verification of the official results for the points of the National GPS Network. The results are encouraging for the practical realization of ETRS89 on the territory of Bulgaria.

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ACCESS, EDIT AND MANAGE GEOSPATIAL DATA - THE AUTODESK CASE

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ABSTRACT

Nowadays, it is increasingly important to properly handle geospatial data associated with certain surveying and geospatial activities. This paper presents Autodesk's AutoCAD Map 3D toolset approach to incorporate geographic and Computer Aided Design data with an industry-specific toolset for Geographic Information System and 3D mapping. AutoCAD Map 3D toolset bridges not only the gap between Computer Aided Design and Geographic Information Systems, but provides true direct access to the leading data formats used in spatial planning, investment design and GIS. Key issues are discussed (how to and advantages) - work with both Computer Aided Design objects and geospatial features, organization and storage of the geospatial data, as well as commenting on the meaning of some terms, work with data in a central data store and how to move data from one data store to another. Particular attention is paid to the advantages of the Feature Data Object Data Access Technology for direct Read/Write or Read-only access to feature data in geospatial data access, as well as the File-based Industry Model which contains predefined industry-specific schema of geospatial data to manage this type of data. The difference between industry models and drawing classification is presented from a point of view how to organize objects in drawings based on the real-world features that they represent. Finally, the developed converter for maintaining the national formats for storage and exchange of geospatial data (including module of data transformation as well) in the Republic of Bulgaria for Autodesk software - AutoCAD Map 3D toolset is presented with high-level diagrams.

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**COLLECTION, STRUCTURING AND ASSESSMENT OF GEOSPATIAL DATA FOR OBJECTS ON THE
GROUND BY TERRESTRIAL LASER SCANNING**

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ABSTRACT

Since 2018, the Faculty of Geodesy at the University of Architecture, Civil Engineering and Geodesy (UACEG) - Sofia has been working on a project to create a unified information platform for environmental modeling. The aim of the project is to explore the possibility of developing a common information data model of geospatial data to be applied in the fields of cadastre, spatial planning, investment design, land use, environment. One of the important task of the project is to carry out measurements to obtain characteristics of geospatial objects. The activity includes the use of Global Navigation Satellite System measurements, terrestrial laser scanning, photogrammetric and remote sensing methods to collect geometric and other characteristics of the geospatial objects. This paper presents the results of the performed direct georeferenced measurements using Global Navigation Satellite System receivers and Trimble SX10 scanning total station, including an assessment of the accuracy of the characteristics of a geospatial object – façade of an office building. The results obtained are used as a basis for creating definitions of the geospatial object characteristics and the corresponding nomenclature tables for them.

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RELIABILITY OF THE DIGITAL SEA BOTTOM MODEL SOURCED BY MULTIBEAM ECHOSOUNDER IN SHALLOW WATER

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ABSTRACT

Reliability of Digital Terrain Model created with geospatial data is a parameter in evaluation of its quality that takes into consideration both the method as well as the quality of data. Bathymetric surveys – dynamic measurements of a moving transducer of a (singlebeam or multibeam) echosounder used for depth measurements in water are a string of interrelated phenomena, that determine the quality (accuracy) of geospatial coordinates. Inclusion of all factors influencing accuracy of measurements, such as echosounder's calibration, is a prerequisite for minimisation of systematic measurement errors. Random and gross errors are inevitable, and are eliminated during the cleaning process of geospatial data. High reliability, preliminarily filtered cloud of data is the initial source of data for creation of the Digital Sea Bottom Model. Comparison of two models using interpolation methods on the basis of discrete data carries the risk of the outcome being blurry. Cell size optimization on the basis of echosounder beams geometry is one of essential parameters in quality assessment – two surface models comparison. Dynamic calibration of multibeam echosounder, based on comparison of depths of outer edges of the bathymetric swath, is carried out utilizing raw data. Correct spatial orientation of echosounder's head(s), due to angular regulation of the echosounder's head, minimizes discrepancies and increases reliability of the data that is to be used to create the Digital Sea Bottom Model. This article presents the results of analysis of accuracy of DSBM created with geospatial data acquired by multibeam echosounder, based on calibratory soundings that are the enabling stage for hydrographic surveys using MBES. The data used was recorded by R2Sonic multibeam echosounder in shallow waters (up to 30m depth), deriving from general rules of depths carting on nautical charts.

REFRACTION CORRECTION OF ACOUSTIC WAVE IN MULTIBEAM SYSTEMS

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ABSTRACT

Dynamic surveys of sea bottom, that rely on determination of reflection points of acoustic wave transmitted by the echosounder, use the wave field theory for determination of the trajectories of the acoustic ray. Complicated multibeam echosounder systems, that use diagonal beams to determine the coordinates of reflecting points on the sea bed, must take into consideration the refraction phenomenon. Beam inflection depends on variability of sound's velocity in water. It is increasingly more important for beams most inflected from the plumb line. It is a determinant of the angle zone of echosounder's beam and swath width. Efficiency of bathymetric surveys relies on swath width. It is 3-5 times the water depth for a multibeam echosounder and up to 12 times water depth for an interferometric one. High value of swath width achieved for high beams inflection decreases the reliability of the Digital Sea Bottom Model built by data recorded during bathymetric surveys. This article presents results of correction of the phenomenon of non-linear propagation of the acoustic wave in multibeam echosounder calibration process in the area where depth does not exceed 30m. A calibration test was utilised on perpendicular profiles to determine the variance of depths. Depths measured by diagonal beams were verified using a vertical beam during surveys on perpendicular profile. Popular models for determining the trajectory of an acoustic wave were used – one based on Snell's law and another new one developed by TU Delft. The geospatial data was sourced using R2Sonic multibeam echosounder during preliminary stage of bathymetric sounding.

ANALYSIS OF EARTH ORIENTATION PARAMETERS (EOP) TIME SERIES FROM SPACE GEODESY TECHNIQUES

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ABSTRACT

The Earth Orientation Parameters (EOP) describe the irregularities of the earth's rotation. Technically, they are the parameters which provide; as a function of time, the rotation of the International Terrestrial Reference System (ITRS) to the International Celestial Reference System (ICRS). The EOP are the pole coordinates, polar motion, Universal time (UT1) and the length of day (LOD). The space geodesy techniques such as Satellite Laser Ranging (SLR), Very Long Baseline Interferometry (VLBI), Doppler Orbitography by Radiopositioning Integrated on Satellite (DORIS) and Global Positioning System (GPS), provide, with high quality, the observation time series of these parameters. The present work aims to characterize and analyse the signals and noises of EOP time series, obtained from different space techniques. The adopted methodology is based on the estimation of periodic signals by performing frequency analysis with FAMOUS program and evaluation of level and type of noises by Allan variance technique. The available data concern 13 years (from 1993 to 2006) of daily series of EOP (pole motion and Length of Day - LOD), according to ITRF2000. The results reveal that the estimated periodic signals amplitudes are about few mm per technique. The EOP variations are well estimated by VLBI and GPS techniques at millimetre level. The noise analysis these variations shows a dominant white noise in the SLR and DORIS solutions. However, the VLBI and GPS solutions are characterized by a flicker noise at millimetre level.

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CRUSTAL FIELD DEFORMATION CHARACTERISTICS IN VRANCEA SEISMIC AREA FROM GPS DATA

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ABSTRACT

The researchers attention has focused also in monitoring of the Vrancea seismic region by the aid of an extensive GPS observatories network, in order to highlight the land's movements in the range of the investigated area and to provide, as far as possible clear evidence of any observed anomalies. In the same time an attempt was made *to determine the crustal deformation parameters*, based on data exclusively obtained from satellite measurements using GPS technology with which to try to construct some maps of the specific strain fields. In front of the Carpathians Arc Bend, geographically corresponding to the Focșani Depression, characterized by a very thickened crust, the Vrancea area is located. This major seismic zone is responsible for the most important number of large intermediate earthquakes, which generates approximately 95% of the entire seismic energy released per year in Romania. In 1997 the designed geodetic network in Romania was "centered" on the Vrancea seismic area; it has originally consisted of 25 points, which for reasons easy to understand has also covered some of the neighbouring regions of the concerning zone. The network has been repeatedly measured every year since 1997, aiming to make it possible to determine the points' movement velocities each year, implicitly drawing some conclusions on the characteristics of the kinematics of the crustal blocks. The measurement network, hereinafter referred to as the "*Vrancea Extended Network*", consisted of more than 50 measuring points, of which only 26 points were used, which overlap very well on the maximum seismic activity in Vrancea zone, covering both the subcrustal and crustal earthquakes development area. Considering that the analyses carried out to achieve this main goal have incorporated a huge working volume, resulting in a comprehensive written material, in the present paper the systematization of the working material and its presentation in concise form was attempted.

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USING A SMALL UAV FOR NAUTICAL PORTS INVENTORY

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ABSTRACT

Reliable knowledge of marinas is crucial for water tourism. The tourist information base of sailing ports on inland waterways should be updated every year. In addition to basic information about the marinas, aerial photographs of the port and its surrounding are now in demand. A small four-rotor Unmanned Aerial Vehicle (UAV) can be an ideal tool for such an inventory. Unlike airplanes or fixed-wings, small and cheap unmanned aircrafts do not require much open space to start an air mission. A properly configured Unmanned Aerial System (UAS) can bring camera equipment to the location where the pictures are to be taken. The drone can hover over an object allowing the operator to take the right shots. After the mission, a UAV can automatically return and make a safe landing. Photos taken with the drone provide potential users (sailors or fishermen) with basic information about the object's location: size, number of mooring spaces for boats, difficulty of manoeuvring in the ports, as well as attractiveness of the adjacent area. The article presents an example of the application of DJI Phantom 4 Pro to the inventory of sailing ports on the route of the Great Masurian Lakes in Poland.

FLOOD ANALYSIS USING SENTINEL IMAGES AND MAPPING

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ABSTRACT

The consequences of climate change can be felt in all parts of the world. Croatia is increasingly affected by extreme heat and drought, followed by rain and floods. In the practical part deals recordings Sentinel-2 satellite mission. Selected area of Nin affected by flooding in September 2017. The theoretical part contains a brief description of Copernicus program, which was developed in the European Community. As an indicator for assessing the condition and size of the area affected by the flood used a normalized index of water. Also, made a visual representation of the area affected by the flood as well as analysis of the situation before and after the flood. The aim is to propose a method which is very helpful in managing the crisis, and in moments when you need very quickly get to the relevant spatial data in the so-called. Real-time, and dynamically change and are particularly important for decision-making in saving property and people from the flooded areas. The expected result of the map and other indicators of the justification of the proposed method, which includes all available resources and technology that can now be used also for the assessment of damage after floods. The proposed method is very helpful in managing the crisis, and in moments when you need very quickly get to the relevant spatial data in the so-called. Real-time, dynamically changing, and are particularly important for decision-making in saving property and people from the flooded areas. Timely spatial information in the form of a series of thematic maps, with the help of not only maps, but also of photogrammetry and remote sensing can provide and help in predicting the development of the flood, and soon decisions will be left to the so-called. artificial intelligence.

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EVALUATION OF FACTORS, INFLUENCING THE ACCURACY OF THE DIGITAL MODEL, OBTAINED BY LASER SCANNING

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ABSTRACT

Measurements in terrestrial laser scanning (TLS) are not perfect and are subject to errors caused by various factors affecting the quality of the capture process and the resulting final product. Careful consideration of all these factors and errors provides a good basis for assessing the quality of the data and the information received. The accuracy of the 3D model obtained from laser scanning is influenced by the density of the measurements and the modelling methods. 3D modelling algorithms allow accuracy to be improved, but modelling software cannot solve all the problems, and it is impossible to achieve high quality 3D modelling without taking into account the factors that affect the accuracy of the measurements. The investigation of error sources in TLS measurements is rather complicated due to the large number of influencing factors that are interconnected. In addition to angular and longitudinal measurements, most scanning systems also offer a measure of the intensity of the reflected signal. Because the TLS is a non-reflective geodetic technology, it means that the measurement results are highly dependent on the reflectivity of the materials. The energy of the reflected signal depends on the following physical factors: object material properties, surface colour of the object, surface temperature, surface humidity, illumination. From the experimental studies it has been confirmed that the illumination and humidity of the scanned surfaces have a significant impact on their reflecting ability and the density of the received point cloud. Evaluation of digital model accuracy is made with a plane approximation and comparison with control points. Areas with different point densities were created in order to analyze the accuracy of 3D model and to determine the optimum scanning density.

INVESTIGATION OF CRUSTAL DEFORMATIONS BY THE MEANS OF DIRECTLY DEFINED SPATIAL CHORDS – POSSIBILITY OR PREDETERMINANCY

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ABSTRACT

The possible effect of the reductions to the measured distances between the points in a geodynamic geodetic network on the reliability of the subsequently calculated deformations has been analyzed. Experimental investigations on the basis of doubly measured spatial chords from the real network and their analogues in UTM-projection have been planned and implemented. Reduction adjustments have been indisputably found to lead to distortion of the deformation model. The problem about block-determined Earth crust deformation has been discussed. A method for calculation of the elements of deformation by geodetic determined linear deformations has been proposed.

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APPLICATION OF LANDSAT-8 AND ASTER DATA IN GEOLOGICAL MAPPING OF PRECAMBRIAN BASEMENT ROCKS AT BIR GAHELIA AREA, SOUTH EASTERN DESERT OF EGYPT

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ABSTRACT

The Precambrian basement sequence exposed at Bir Gahelia area in the South Eastern Desert of Egypt consists of gneisses and island-arc metavolcano-sedimentary rocks. These rock units are tectonically overlain by serpentinite-talc carbonate rocks which form the Abu Dahr ophiolitic mass. Gneisses, ophiolitic rocks and the island arc metavolcanics are intruded by syn-to late-tectonic intrusions including granodiorite-tonalite, gabbro and monzogranite. The whole sequence of the exposed basement rocks is intruded by post orogenic dykes and veins of variable composition. The main objective of the present study aim is revealing the geological setting and detailed geological mapping of the study area using remote sensing data. The present study concluded that, the landsat-8 principal component images (PC4, PC5, PC2) and ASTER principal component images (PC2, PC6, PC5), in addition of their various band ratio images are very effective in discrimination the exposed basement rock units in the study area. On the other hand, the ASTER ratios (indices) including kaolinite, clay and sericite-muscovite, calcite and carbonate indices images successfully identified the exposed basement rock units in the study area. Detailed geological map for Bir Gahelia area has been produced based on the integrated remote sensing data, field study and petrographic investigation.

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IMPLEMENTATION OF A GIS-BASED PILOT APPLICATION FOR ROADS MANAGEMENT APPLIED TO THE CONSERVATION AND MAINTENANCE OF UNPAVED ROADS OF LOW TRAFFIC

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ABSTRACT

The lack of updating and unreliability of information has become one of the main problems that occur in the area of management of unpaved roads (Pavement Management System - PMS) in developing countries as Colombia. Therefore, a GIS-based application was developed which allows keeping updated all information at the structural and functional level of the road, and to control the premature pavement deterioration favouring the support for making decisions in management activities of the unpaved road network. In the municipality of Urrao (Antioquia), a research proposal on "La Encarnación" road was proposed. The study section (SS) is part of a bidirectional 3th level road, which has 240 m-length and a 4 m-width. The SS was divided into eight segments or cells (30 m-length), where each of them was stabilized with different conventional and unconventional materials (cement, hydrated lime, coal ash, brick dust, sulfonated oil, polymer and sugarcane sludge). Based on the results gathered in six pavement performance follow-up and evaluation campaigns, a geospatial database (GDB) was designed. This GDB is the core of the application 'SGVVT Urrao v1.0', able to represent graphically the behaviour of the tests of functionality and the bearing capacity carried out (International Roughness Index, slip resistance, surface macro texture, lightweight deflectometer and visual inspection). The application is able to forecast the deterioration values that allow the prioritization of rehabilitation activities for the most affected sections in a given time period which it is possible to extend the useful life of the roads, reduce the operation cost of the vehicles, and guarantee the road safety and the comfort of the unpaved road network users.

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NEXT GENERATION SEQUENCING DATA AND ITS COMPRESSION

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ABSTRACT

NGS (Next-Generation Sequencing) sequencing technologies have allowed DNA sequencing at a surprising low speed and costs. Over the past 8 years, the amount of digital memory used by sequenced biological data has increased dramatically. Genomic projects such as HapMap, 1000 Genomes, etc., have come to the collection and description of genomes of 2,504 individuals from 26 populations, and they contributed to exponential growth of databases of this type and to the development of increasingly efficient technologies. Thanks to the large-scale sequencing of samples of DNA, the interest and the new research in these areas by the scientific community are suddenly grown. In a very short time researchers have developed hardware tools, analysis software, algorithms, private databases and infrastructures to support genomics. In this paper we analyse different approaches for compressing FASTQ, BAM and SAM files generated by Next-Generation Sequencing tools containing nucleotide sequences. In the first part of this paper we will present the fundamental concepts that are necessary to understand the application domain: i.e. DNA sequencing workflow and the file formats generated by the machines that are currently used for these operations. In the second part of our work we will discuss and evaluate the compression performance of generic compression tools such as *gzip* and *bzip2* by confronting them with a specific system that was designed specifically for genomic file compression: *quip*.

FIRST ALGERIAN EXPERIMENT OF MANUFACTURED CORNER REFLECTORS FOR AN EMBANKMENT DAM MONITORING: CASE OF KRAMIS DAM (MOSTAGANEM, ALGERIA)

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ABSTRACT

Currently, the use of Satellite Synthetic Aperture Radar Interferometry (InSAR) technology for ground surface displacements detection knows a fast development within the remote sensing field. Indeed, in the last years, the monitoring techniques of satellite borne SAR, such as Persistent Scatters Interferometry (PSI), have become wider spread, thanks to great accessibility of SAR data and of new missions, for research purposes and commercial projects. In this technique, stable natural or artificial reflectors (permanent scatters) are detected and studied over long temporal series of interferometric SAR images, in order to measure and monitor displacements. The paper deals with the usage of low cost reflecting targets in spaceborne monitoring of an Algerian Dam. For the first time in Algeria, manufactured reflectors (corner reflectors, CR) for Sentinel1-A and Sentinel1-B are installed *in-situ* of the embankment Dam of Kramis (Mostaganem, North West of Algeria), in the framework of a geodetic auscultation project. This later is a collaboration project between the Centre des Techniques Spatiales (CTS, Arzew) and Agence Nationale des Barrages et Transferts (ANBT, Algiers), which started earlier of 2019 and aims to assess Kramis's Dam deformations zones (settlement, displacement and landslide phenomena) using GNSS and InSAR techniques. The steps of manufacturing and installation on ground of these corner reflectors (CR), and their interferometric processing with PS-InSAR method, are presented and described.

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MACHINE LEARNING METHODS FOR CLASSIFICATION OF GREEN INFRASTRUCTURE IN CITY AREAS

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ABSTRACT

Reducing green urban infrastructure pose a huge threat to cities sustainability. It is important to monitor and track health of vegetation. For efficient planning of urban development and maintenance of green urban infrastructure key is to have up to date maps. Using satellite imagery is the easiest way to cover large city areas. In order to map vegetation, there are many possible solutions, however most effective way is using machine learning methods. Machine learning is divided into supervised and unsupervised classification and each can be divided into several different methods. Many authors have considered different methods and they use them to access accuracy on satellite image information extraction. They have used different satellite images and naturally higher resolution imagery results in better classification. However, there is still lack of comprehensive analysis of more supervised machine learning methods on similar cities. This paper aims to provide analysis of four different machine learning methods: support vector machine, artificial neural network, naïve Bayes and random forest. The objective of the support vector machine algorithm is to find a hyperplane in an N-dimensional space that distinctly classifies the data points where hyperplanes are decision boundaries that help classify the data points and support vectors data points that are closer to the hyperplane and influence the position and orientation of the hyperplane. Artificial neural network are brain-inspired systems which are intended to replicate the way that humans learn. Neural networks consist of input and output layers, and hidden layers. They are excellent tools for finding patterns which are far too complex or numerous for a human programmer to extract and teach the machine to recognize. A Naive Bayes classifier is a probabilistic machine learning model that's used for classification task and the crux of the classifier is based on the Bayes theorem. Random Forest creates a forest and makes it random and is an ensemble of Decision Trees, most of the time trained with the bagging method which general idea is that a combination of learning models increases the overall result. All of the mentioned methods will be tested on Sentinel-2A imagery. Sentinel-2A multispectral imager has thirteen sensors which is useful in vegetation extraction. Methods will be compared using error matrix and kappa statistics.

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THE RESPONSE OF CONTIGUITY AND FRACTAL DIMENSION INDICES TO CHANGING SPATIAL SCALE

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ABSTRACT

Landscape metrics have been developed to quantify landscape spatial pattern. The quantification of spatial heterogeneity is essential to understand the relationship between landscape structure and ecological process. Remote sensing derived data can be used to calculate many landscape metrics. Landscape metrics have been used to investigate the impact of humans on landscapes, conservation planning, as well as to compare spatial heterogeneity between different landscapes. In the present study we aimed to measure the response of four metrics to a large range of grain sizes in arid Mediterranean landscapes. The investigated metrics were mean contiguity index (CONTIG_MN), contiguity coefficient of variability index (CONTIG_CV), mean fractal dimension index (FRAC_MN) and fractal dimension coefficient of variability index (FRAC_CV) within four land use types (Urban, Agriculture, Forestry and Shrubland). Results showed uniquely clear domain of scale-like behavior. The power law was highly and significantly model the response of fractal dimension coefficient of variability index to changing spatial scale in Urban ($R^2 = 0.97$), Shrubland ($R^2 = 0.98$) Forest ($R^2 = 0.90$) and Agriculture ($R^2 = 0.89$) landscapes. Also, the contagion indices showed stair type response to changing spatial scale. This domain of scale may be attributed to the unique characteristics of arid Mediterranean landscapes; where both natural processes and ancient human activities play a significant role in shaping the pattern of the landscape.

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INVESTIGATING REGIONAL VARIATIONS OF VARIOUS COMPONENTS OF WEATHER SEMANTIC SIGNATURES FOR POINTS OF INTEREST

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ABSTRACT

Humans are interested in visiting different places in different climates. For example, visitors are interested in visiting zoo in a cool and sunny weather while this may not be the case for an indoor site seeing. On the other hand, users of different location-based social networks are checking-in at different weather conditions in different place types. Collecting and aggregating weather information related to the check-ins of people in different categories of location-based social networks (like Swarm and Yelp) leads to the production of powerful weather semantics signatures. These signatures can be used to improve various geolocation services. For example, such signatures can be applied as context information to improve the POI recommendation. The weather semantic signatures can be generated based on various weather data such as air temperature, humidity, wind speed, and cloudiness. Each of these data results in small or big differences between different types of places (such as restaurant and zoo), and the total of these differences leads to a tangible distinction between different types of places. In this study, Swarm service check-in data were collected by Streaming API of Twitter service for both California and New York during one year from 01/03/2017 to 01/03/2018. Also, weather information, including air temperature, humidity, wind speed, and cloudiness were instantly provided with OpenWeatherMap service. This information was applied to provide weather semantic signature related to air temperature, humidity, wind speed, and cloudiness. The differences caused by the weather semantic signatures vary between different regions for different categories. This study examines the regional variations of the weather semantic signatures of different types of points of interest by examining the 599 swarm service categories in two states of California and New York. Finally, the amount of these differences is also examined by various indicators (i.e., Gini coefficient, Jensen-Shannon Distance, and Earth Mover's Distance).

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MOBILE AUGMENTED REALITY APPLICATION FOR HISTORICAL CHANGES VISUALIZATION IN BUILDING FACADES

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ABSTRACT

The use of mobile devices has increased dramatically over the last decade. Mobile geo-applications are usually related to the widespread application, including location-based services (LBS), social media, and Augmented Reality (AR). They support precise GNSS localization, and interactive, immersive real-time visualizations. The article presents a prototype Mobile Augmented Reality (MAR) Application for temporal changes visualization in the building facades with the use of 3D models. It allows combining the original look of the selected buildings located on the University of Warmia and Mazury in Olsztyn campus with past, historical state. As a part of the test, a prototype of the MAR application for Android has been prepared. A computer-generated 3D reconstruction of historical buildings is superimposed on the object observed by a mobile device camera and shows the past appearance of it. The paper discusses some critical AR problems, positioning in an urban environment, accurate registration of 3D virtual objects, and the real world. In the end, the potential stages of the system's development were presented.

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THE DATABASE FOR THE PROCESSING OF ENVIRONMENTAL DATA

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ABSTRACT

The main purpose of the research was to design a database for collected measurements of the Computer System for Monitoring River Embankments (ISMOP) project. The ISMOP project aimed to conduct research on comprehensive monitoring and forecasting the flood embankments condition. As a part of the project, measurement data were collected continuously, transformed, interpreted and analysed using computer simulations. The assumption of the database was to achieve high availability of data in a short time, allowing quick (in less than 15 minutes) decision about the state of the flood embankment. Warehouse project contains large amount of time series data sets, 2D numerical models, analysis results of flood embankments condition and additional measurements like thermographic simulations. Simple database structure was proposed. Data were loaded into small number of tables; data types were adjusted for high accessibility. Such structure allows to use quick data selection for analysis and visualization and prevents from unnecessary data redundancy. To effectively visualize and analyse sensor's data an additional ArcGIS plugin tool was created using the .NET programming language. The plugin offers the spatial visualization functionality of sensor placement (2D and 3D views), their selection, distance and area measurements, statistical calculations and spatial analysis. The tool also provides ability of manual modification and exporting data into shape and spreadsheet files for further analysis. For the examples that were carried out, the database structure and the plugin were efficient and results were quickly achievable. Data were presented in a manageable way in form of 2D charts and 3D visualizations.

Corresponding Author: Monika Chuchro

**RETRIEVING SPATIAL VARIATION OF LAND SURFACE TEMPERATURE BASED ON LANDSAT
OLI/TIRS: A CASE OF SOUTHERN PART OF JEMBER, JAVA, INDONESIA**

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ABSTRACT

The study analysis of land surface temperature (LST) is crucial to maintain the environmental quality of climatic condition, particularly in Jember as the forest buffer region in the eastern part of Java, Indonesia. In this paper, land surface temperature (LST) distributions were investigated using Landsat 8 OLI/TIRS images in about 24,008.67 ha of the southern part of Jember. The land surface emissivity (LSE) is also provided in deriving the land surface temperature (LST) from satellite images. The LSE value in the Earth Surface is retrieved from NDVI (Normalized Difference Vegetation Index) and fractional vegetation cover (Pv). In this case, the reflectance of NIR (Near Infrared) and red bands of Landsat 8 OLI sensor have been acquired to derive NDVI and Pv distribution. Therefore, the LST can be obtained from the LSE coefficient result and brightness temperature (BT) of Landsat 8 TIRS. The results showed that the LST average in the study area increased significantly from 20°C in 2013 to 26°C in 2018. This condition was triggered by the decreasing area with high vegetation density about 5% of the study area from 2013 to 2018, which figured out from the spatial distribution of NDVI and LSE.

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ESTABLISHING A NEW MODEL TO REDUCE THE RISK OF PREMATURE MINE CLOSURE

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ABSTRACT

Pre-mature mine closure can cause serious economic loss to the mine projects. Pre-mature mine closure happens due to many factors including economic, environmental, and social aspects. In order to reduce the side effects of pre-mature mine closure, one can use the risk assessment techniques. The present study aims to propose a new model, which can calculate the risks rooted in mine closure and also determine a safety factor for investments in mining industry. Using the statistical analysis and the MCDM methods, risk matrix method and its compounds such as probability and intensity are developed and risk factor is calculated. In the aforementioned model, the types of mineral (K index) and the types of ore (O index) are added to the risk matrix and the risk of mine closure is calculated for all types of minerals and types of ore, separately. On the other hand, the risk factor for all types of minerals are calculated. For supporting the validity of the model, 2400 Iranian pre-mature mine closure events (until the 1st of August 2017) were investigated to pave the path for calculating the risk of mine closure for each group of minerals along with each type of minerals in their corresponding group. The risk factor of pre-mature mine closure in Iranian building stone mines and safety factor of investment were found to be 1.52% and 0.9848, respectively. The results show that equipment efficiency, lack of technology, high amount of royalty, decreasing price, loss of market and high mining and processing cost are the main reasons for pre-mature mine closure in Iran.

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PASSIVE SEISMIC TOMOGRAPHY AS A TOOL FOR FORECASTING THE ROCK BURST HAZARD IN A DEEP COPPER ORE MINE, SW POLAND

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ABSTRACT

In Poland, underground mines of copper ores, which belong to KGHM Polish Copper JSC, have been struggling with seismic dynamic events such as tremors and rock bursts since almost the first years of exploitation i.e. the 70s of the twentieth century. Mining activities infringe the original stress balance and make the rock mass accumulate energy and then release it, which triggers seismic hazard even far away from a tremor epicentre. Therefore, prediction of the position, time and energy of tremors plays a significant role in mining operation especially in work safety. For this purpose, many observation methods including seismology, seismic, geotechnical-geological monitoring, are used; unfortunately, most of them help describe the state of the rock mass after but not prior to the occurrence of the seismic phenomena. Only passive seismic tomography is promising since it can be used to forecast, to some extent, the location of places of seismic energy excessive accumulation. In this method, on the basis of seismic events recorded in a given period, zones of high and low seismic wave velocity are determined (calculated), which in the near future may pose areas of increased seismic activity. The phenomenon of the increase of seismic longitudinal wave velocity with the increase of stress in rocks makes the ground of tomography calculations. The prime purpose of the paper is to assess passive seismic tomography as a means for forecasting and evaluation of seismic and rock burst hazard. To accomplish this, the analysis of seismic activity and archival seismic tomography results (seismic wave velocity zones and seismic anomalies) with reference to seismic phenomena, their energy, number and location were carried out. On the basis of obtained the results, the effectiveness of seismic hazard forecast with the use of passive seismic tomography was assessed. The research was carried out for one mining division of the Polkowice-Sieroszowice mine and covered ten years. This unit was selected due to its high seismic activity and the permanent use of the passive seismic tomography to assess the seismic risk. Linear correlation and determination coefficients between seismic activity characteristics and seismic anomaly as well as longitudinal wave velocity were calculated. It was found that in the study area the effectiveness of passive seismic tomography in forecasting the seismic hazard is relatively satisfying since about half of the tremors were located within zones of high seismic activity (big velocity of P-waves and seismic anomalies).

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FACTORS INFLUENCING THE SEISMICITY OF A DEEP COPPER ORE MINE IN POLAND

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ABSTRACT

In underground mines of copper ores, which are situated in Lower Silesia in SW Poland, the most common and dangerous threats pose seismic tremors and rock bursts. Copper ore exploitation is carried out in three mines, which are owned by KGHM Polish Copper JSC, i.e. Lubin mine, Rudna mine and Polkowice-Sieroszowice mine. Despite many rock burst preventive operations carried out over several decades of mining activity and aimed at counteracting seismic dynamic events, these phenomena have not been eliminated. The applied rock burst prevention measures only limit or mitigate the effects of seismic events. In mining, a concept of seismicity is used, which is defined as the tendency of an intact rock mass to seismic tremors induced by mining work in an area that was previously aseismic. Tremors and their results i.e. rock bursts affect not only excavations and underground infrastructure, but also the terrain surface. In the KGHM's mines, seismic activity is monitored by the Mining Geophysics Stations. The number, coordinates and energy of tremors and rock bursts are registered, which helps determine the rock mass reaction to the adopted system and operation technology. The main purpose of the paper is to analyse seismic dynamic phenomena damaging mining excavations, i.e. rock bursts, in the Lubin mine, which took place from the beginning of the mine's operation in 1975 to 2016 (over 41 years) and to identify and investigate geological and mining factors (parameters) facilitating the growth of seismic and rock burst hazards. The following factors favourable for the occurrence of dynamic phenomena with damaging effects in excavations were taken into consideration: seismic activity of the rock mass (spontaneous and provoked tremors), deposit depth, geomechanical properties of the rocks, exploitation system, the method of elimination of mined-out space, occurrence of gobs, tectonic disturbances and the lifetime of excavations. Observation of these parameters made it possible to determine the causes of rock bursts as well as to evaluate the impact of the exploitation system including technology and rock burst prevention on seismic and rock burst hazard. Moreover, seismic activity of rock burst prevention of mining divisions with the highest number and energy of rock bursts was analysed. The effectiveness of rock burst prevention measures used in these divisions was analysed and assessed too. The results of analyses indicated interdependencies between factors that affect the phenomena discussed.

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STUDY ON WATER-SAND INRUSH MECHANISM FOR MINING UNDER PORE WATER IN CHINA

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ABSTRACT

In China, Pore water is one of the major water hazards of coalmines, accountable for severe pit flooding and human casualties. This article introduced the two types of water-sand conducting channels, primary and man-made, contributing to water-sand inrush when mining under pore aquifer of the bottom Quaternary loose strata; the four situations of water-sand inrush mechanism caused by man-made channels channelling pore aquifer, man-made channels involving pore aquifer via primary channels, and waterproof coal pillar caving when mining on steep-slope coal seam; as well as analysis of the correlation between the critical hydraulic gradient and the coarse particles ratio based on results from penetration test. It is to provide references for countries confronting similar problems and to facilitate international discussions on pore water control.

Corresponding Author: Herong Gui

INTERACTION BETWEEN SHALE FORMATION AND THIAMINE AS A NEW SHALE FORMATION STABILIZER

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ABSTRACT

One of the main factors of wellbore stability during drilling shale formation is the reaction between montmorillonite (Mt) and the aqueous phase. Based on the experimental methods and conceptual principal which were used to study high-performance shale inhibitors, in the present paper, thiamine is introduced as a new shale inhibitor and as an ecofriendly substance in water-based drilling muds. The inhibitory properties of thiamine were investigated by various tests such as sodium bentonite inhibition, sodium bentonite sedimentation, particle size, scanning electron microscopy, cutting dispersion. In contrast to deionized water, a large amount of sodium bentonite can be load in aqueous thiamine solution without causing severe changes in rheological properties. Stable aqueous solution of sodium bentonite in two forms of prehydrated and non-prehydrated became unstable after contact with thiamine. The particle size of clay in the presence of Thiamine was increased from 574 to 7920 nm in comparison with deionized water. According to the SEM analysis, the particle cross section becomes larger in the presence of thiamine. The amount of recovered shale cuttings in the presence of Thiamine is 24.19% higher in comparison with deionized water. Therefore, the inhibition property of Thiamine on long-term interaction between the shale cuttings and fluid is fully evident. Based on the results obtained in this study, it was found that thiamine has a high potential to prevent swelling of shale. It can be concluded that the inhibitory potential of thiamine is due to its cationic part influence on the space between the layers of sodium bentonite through the exchange of cations.

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ANALYSIS OF THE EFFECTS OF THE POSITION OF THE AIR DUCT SUPPLYING FRESH AIR TO THE WORKING FACE OF THE MINED DOG HEADING ON METHANE CONCENTRATION LEVELS

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ABSTRACT

Each year, more than one hundred kilometres of new dog headings are mined in underground hard coal mines. Such headings are ventilated by means of an air duct system. A stream of fresh air is supplied to the working face of the mined heading through an air duct with a view to ensuring proper chemical composition and temperature of the mining atmosphere. This is because this heading is being exploited and the ventilation must provide adequate working conditions for the crew. While dog headings are being mined in the body of coal, they are additionally filled with methane, which is released in this process. Due to the risk of its combustion and explosion, methane is a highly dangerous gas. It represents one of the greatest hazards in underground mining. Therefore, a particularly essential issue during the mining of dog headings is to reduce the potential for dangerous methane concentrations to occur. To prevent this from happening, it is necessary to select adequate parameters for the fresh air supplied through the air duct and the position of this air duct. It is the position of the air duct that appears to be a very significant element in the ventilation process of dog headings. Model-based tests were conducted to determine how the position of the air duct affects methane concentration levels. Their results have been presented in the paper. The purpose of the tests was to determine whether and to what extent the position of the air duct, which is used to supply fresh air to the mined dog heading, influences methane concentration in this heading. The tests were conducted for an actual mining region in which a dog heading was mined. The input parameters for the model (boundary conditions) were therefore adopted from the actual system. The model-based tests helped to determine the distributions for methane concentration depending on the position of the air duct. The analysis mainly encompassed the distance between the outlet of the air duct and the surface of the mined body of coal. The use of model-based tests which employed numerical methods made it possible to determine a series of significant physical and chemical parameters of the resulting mixture of gases. Their distributions and values in selected points for the variants under analysis have been presented in the paper. The results obtained unambiguously demonstrate that the position of the air duct has a significant impact on the distributions of methane concentration levels in the mined dog heading. In the Authors' opinion, these results may constitute an essential source of information for service teams responsible for ensuring ventilation-related safety in mines. This is because they allow for predicting the distribution of methane concentration and other parameters of the gas mixture that occurs in dog headings during the mining process.

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ANALYSIS OF THE CONSEQUENCES OF METHANE COMBUSTION IN A MINED DOG HEADING

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ABSTRACT

One of the most common and, at the same time, the most serious threats in underground hard coal mining, which often requires long rescue operations, is the methane hazard. It is related to the potential ignition and/or explosion of methane in mixture with air. The hazard grows along with the increasing depth of mining works and the concentration of production in mine headings. Methane, as an organic gas, is released to the mining atmosphere in the exposed body of coal. Accumulation of explosive concentrations of methane in a mine heading, as well as adequate oxygen concentration levels and the presence of a trigger (e.g. in the form of a spark) may lead to methane explosion or combustion. Methane ignition and combustion leads to a series of chemical reactions, which cause the emission of harmful and poisonous gases of high temperature into the mining atmosphere (the temperature of methane combustion in mixture with air is approx. 1,875°C, with methane content of approx. 10%). These gases are formed during methane combustion. Countering the methane hazard primarily involves elimination of the potential for dangerous methane concentration levels and application of suitable protective measures to prevent methane ignition. However, despite the preventive measures in use, there were 34 incidents related to the methane hazard in Polish hard coal mines in the years 2008–2018, including 10 cases of methane ignition in the mined dog headings. Therefore, it is necessary to carry out research in order to predict the consequences caused by methane combustion in mine headings. Taking into consideration the remarks above, it was assumed that the numerical analysis of methane combustion in the mined dog heading and of the impact of this combustion on the parameters of the air stream flowing through this heading would be conducted using the CFD method. The objective of the analysis was to determine the effects of methane combustion on the composition of the mining atmosphere and the physical parameters of the gas mixture generated in this process. The paper presents the distributions for the physical parameters of the resulting gas mixture and the concentration of fire gases. Moreover, it demonstrates the distributions for temperature and oxygen concentration levels in the heading under analysis.

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BACK-ANALYSIS STUDY OF SLOPE INSTABILITY IN AN OPEN PIT MINE, ALGERIA

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ABSTRACT

The failure of natural and man-made slopes has become a common phenomenon all over the world, often causing great loss of human life. In 2007, a major landslide affecting the northern slope of the Kef-Essnoun open pit mine, located in North-eastern part of Algeria. Knowing all the factors causing this failure is an important aspect of understanding the mechanical behavior of the sloping material. Back analysis is a much reliable and consistent method to estimate the mobilized parameters in-situ. This paper explores the application of three methods, limit equilibrium method (LEM), Difference finis Method (DFM) and Finite Element Method (FEM) to perform back analysis and find out the probability of failure of slopes.

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GEOSTATISTICAL MODELING BY THE ORDINARY KRIGING IN THE ESTIMATION OF MINERAL RESOURCES ON THE KIESELGUHR MINE, ALGERIA

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ABSTRACT

The most important step in a feasibility study of a mining project is the determination of reserves in situ. But the question which arises that no method of estimation can give exact value since there is inevitably an associated error which it is important to know the order of magnitude. Decision-makers need to know if the estimated content is correct or not. Geostatistics can help the mining engineer to obtain from the available information, and thus enable him to decide if the project deserves more investments. Geostatistics provides not only the estimated value but also, with the kriging variance, a measure of the accuracy of the estimate. This is one of the superiorities of geostatistics over traditional methods of estimating reserves. In this article, the Kieselguhr deposit reserve of the Sig mine (western Algeria) was evaluated according to the linear geostatistical method with ordinary Kriging (OK), to know the economic value of this mine that allows the exploitation of this deposit, and to carry out study cartography accompanied by 2D modelling of deposit. Finally, we obtained maps in which we could estimate exploitable and geological reserves, and know the characteristics of the deposit.

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DEVELOPMENT OF MINING PROCESSES WITH REGARD OF LIMITS CORRECTION

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ABSTRACT

The Bílina surface quarry belongs to the largest brown coal mining company in the Czech Republic, Severočeské doly a.s. Mining activities within the POPD quarry Bílina takes place in the territory of this quarry for the period 2010 to 2030. For a smooth, safe and economical process of the whole quarry in new territorial ecological limits, the process of overburden cuts needs to be extended as soon as possible to the south to the limit of new mining limits. However, this extension is limited by the current line of valid POPD. For the continuation of mining in the territorial ecological limits pursuant to the Resolution of the Government of the Czech Republic No. 827/2015, which is entirely in accordance with §30, par. a) of the Mining Act No. 44/1988 Coll., i.e. when using reserved deposits it is necessary, in particular, to extract the reserves of the reserved deposit as completely as possible, with the least possible losses and pollution. It is necessary to have a new POPD based on mining – technological procedures of OPV DB (Mining to new territorial environmental limits by 2035) approved by 2021 at the latest. However, these procedures will require a more complex methodology, because it will be necessary to mine in places, which could not be extracted within a valid POPD. Another intention is also to prolong the life of the quarry, and securing supplies to heating plants, power plants ČEZ, a.s. (joint-stock company), as well as supplying quality low-sulfur brown coal to small customers throughout the Czech Republic.

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AN ALGORITHM FOR DETERMINING UNLOADING CYCLES IN DUMP TRUCK

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ABSTRACT

In copper ore deep mines of KGHM Polska Miedź S.A., the first stage of the transport department is to deliver the spoil to the screen. This stage is carried out by self-propelled mining machines. Transport can be done in two ways: by loaders or loaders cooperating with dump trucks. The amount of dump truck cycles during a single work shift can be used as indicators of a machine and operator performance evaluation. In order to increase the mining potential, it is necessary to continuously acquire and analyze information on work efficiency. The ability to synthesize the obtained data and case-study the relationship between them allows deepening knowledge of industrial processes and supports decision-making. Dump trucks used in the KGHM copper ore mines are equipped with a self-unloading mechanism. The paper describes a developed method and described an algorithm for segmenting signals coming from a dump truck with a self-unloading crate. The operation of the algorithm has been verified on data from a machine operated by several operators, taking into account various operational events.

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MODELING OF RESISTANCES TO MOTION AT THE LOADING POINT OF A BELT CONVEYOR

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ABSTRACT

Belt conveyors are widely used for transporting a large number of bulk solids, mostly in the mining and raw material processing industry. Due to the rising needs to increase the effectiveness of every process of a production chain, which is mainly inspired by, but not limited to, energy efficiency issues, belt conveyors are constantly improved in terms of an optimized equipment selection and substantial reduction of their energy consumption. Though the most significant savings can be obtained by implementation of low indentation resistance belts and efficient idlers which are responsible on the main resistances to motion (that act along the whole route of a conveyor), the improvements of the key construction nodes like loading points and drive units should not be neglected. The inertial and frictional resistances to motion at the loading point, as well as frictional resistances between handled material and the skirt plates, are extensively investigated by the most prominent researchers, design offices and belt conveyors equipment suppliers. Various arrangements of transfer chutes, impact plates, lining and additional belt protection against impacts have been more or less successfully introduced to address the problems of excessive belt wear and unwanted material fragmentation at loading points. However, still the commonly used methods of calculation of belt conveyors (drive power requirements, belt wear estimations) base on the rather simplified analysis of the interactions at a loading point. The proposed approach of implementation of the discrete element methods (DEM) with the innovative focus on careful modeling of the transported material granularity allows to model and analyze the phenomena of material flow through a loading point in more detail. The variant of a typical angular transfer point with a rock box was modeled to simulate the loading of the different actual output of mined ore which consists of both lumps with different dimensions and shapes and fine particles. The simulations provided the data of resulting forces and loss of energy to be used for the calculations of the specific resistances to motion of a belt conveyor loading point. These results were compared with the standard belt conveyor calculations (like the ISO 5048 Standard) and used for the enhancement of the detailed, in-house algorithm of the exact calculation of the belt conveyor resistances to motion. The calculation results of the alternative design solutions of a loading point were then applied for the estimation of specific energy consumption of the copper ore divisional haulage in the chosen mining department of KGHM company underground copper ore mine.

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THE ANALYSIS AND ASSESSMENT OF GRAIN SIZE DISTRIBUTION ON THE EXAMPLE OF A CHOSEN GRANITE MINE

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ABSTRACT

The rock blasting is the first phase of production in surface and underground mining operations. Because blasting works affect the efficiency of every activity that follows it, they are considered to play a significant role in the whole mining process. Furthermore, it is stated that the most significant parameter is an ore material fragmentation. Information about particle size distribution are relevant from blasting methods point of view. It enables, not only to examine the results of blasting operations but also to select proper parameters of blasting operations. This paper presents the analysis and the assessment of grain size distribution of blasted rock in open pit granite mine using indirect image analysis method. The photogrammetric techniques and the Split Desktop 4.0 computer application were used to perform the research. The photographic documentation of the entire blasted muck pile was prepared in two variants: the first one after blasting operations and the second one after removing 50% of the blasted ore material. Moreover, the whole process of preparing photographs, scaling and delineation are discussed as well as results generated by Split Desktop 4.0. The main objective of the paper is to determine the particle size distribution and the percentage share of oversized fraction both in two variants individually and in the entire blasted muck pile. As a result of analysis, some relationships between particle size distribution and blasting operations parameters are outlined. The obtained values of size distribution analysis of the rock fragmentation may play a significant role in the blasting operations optimization in the analysed granite mine.

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NUMERICAL SIMULATION OF THE LARGE REMNANT BEHAVIOR IN THE MINING FIELD

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ABSTRACT

In Polish copper mines, in the Legnica-Glogow Copper Mining District copper ore is extracted by using room and pillar mining system. Due to various situations e.g. high rockburst or rockfall hazard the mining operations are carried out in the vicinity of large remnants. Rock remnants left in the mining field become sites where stresses of high value are concentrated. Remnants have an impact on the stress distribution and rock mass stability in their vicinity. They can have a negative effect on the occurrence of dynamic phenomena. Remnants can cause seismic events for example pressure bursts. The purpose of this paper is to show the large remnant behavior in the mining field and its influence on the rock mass located in the remnant vicinity. The numerical simulations were conducted for the model mining field with the geological and mining conditions characteristic for Polish underground copper mines in Legnica-Glogow Copper Mining District belongs to KGHM Polska Miedz S.A. Behavior of a large 100 m wide ore remnant was analyzed. Simulations were conducted for three different types of remnant geology: sandstone remnant, dolomite remnant, sandstone-dolomite remnant. An elastic model was accepted for the rock mass. It was assumed that the medium is homogeneous and isotropic. The parameters of the rock mass accepted for numerical modelling were calculated on the basis of the Hoek-Brown classification. The Mohr-Coulomb strength criterion was applied. Numerical simulations were performed in a plane strain state by means of Phase 2 v. 8.0 software, based on the finite element method.

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**ELECTROMOBILITY AND RECUPERATION OF ENERGY OF THE AGGREGATES INDUSTRY WITH
THE USE OF DESCENDING BELT CONVEYORS**

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ABSTRACT

Aggregates are extensively mined in a hilly terrain, where pits are conveniently located on the slopes and mined material is hauled down to a depot, usually placed by the roadside or a sidetrack in a valley. Trucks are predominantly used there as a reliable, efficient and probably the most flexible mode of transportation. However, the increasing environmental awareness brings out the disadvantages of trucks – noise, vibration, degradation of local roads and emission of exhaust fumes and GHGs. The replacement of trucks with belt conveyors not only can address most of these issues but often, due to a descending profile of the transportation route, the gravity of transported material can be recuperated into electricity which puts the mining company into a position of an energy prosumer. The effectiveness of the regenerative mode of a conveyor depends on the inclination angle of its descending profile and actual capacity. Keeping low the belt conveyor main resistances to motion (due to the implementation of decreased indentation resistance belts and efficient idlers) helps to get the maximum use of the gravity of transported material. A bunker at the loading station should be installed to support the operational control of the conveyor, oriented to avoiding its idle work and to maintaining the high level of the use of a conveyor maximum capacity. The novel solution for belt conveyors of top belt support is proposed to address the unavoidable periods of the low load of conveyor work. The top idlers are fitted with the mechanism of an automatic adjustment of their spacing according to the actual loading which is done by disconnecting of some idlers. Thus, in the case of a low load, the total idlers' rolling resistances are decreased. The solution therefore enables to decrease the specific energy consumption and helps to increase the effective working time period of installed idlers. The case study was analysed with the use of the specialized belt conveyor designing software which allows to estimate the possible savings of the use of proposed idlers. Simulations of the operation of transporting aggregates down from the pit area to the depot provided the data for the estimation of the benefits (caused by the increased eco-efficiency) of the considered replacement of trucks with a regenerative belt conveyor.

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SELECTION OF MINING SUPPORT FOR SPECIAL-PURPOSE CHAMBER WORKINGS SITUATED IN A FIELD OF HIGH HORIZONTAL STRESS IN POLISH COPPER ORE MINES BY MEANS OF NUMERICAL METHODS

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ABSTRACT

This article concerns the problem of selecting mining support for special-purpose chamber workings driven in a field of high horizontal stress in Polish copper ore mines. This problem is very important due to the special safety requirements for mining excavations that have been in use in mines for over a decade. The tests on three-dimensional stress pattern in Polish copper mines made in 1996, 2003 and 2012 confirmed the occurrence of high horizontal stress in the Legnica-Glogow Copper Belt (the LGCB). Conditions and rules of applying rock bolts in special-purpose chamber workings specifying minimum rock bolt length and the basic scheme of bolting the roof and side walls are applicable in Polish copper ore mines in the Legnica-Glogow Copper Belt. No procedures have been defined for proper selection of mining support for special-purpose chamber workings situated in a field of high horizontal stress, including roof bolting scheme as a function of roof class and excavation width above roof. These procedures should include, inter alia, values and directions of high horizontal stress. The finite element method (FEM) was applied to assess the stability of special-purpose chamber workings under the conditions present in the Rudna mine (one of the copper ore mines in the LGCB). Stress field parameters were determined on the basis of underground tests performed in the Rudna mine in 2012. Numerical modelling was performed by means of RS2 software in a triaxial stress state and plane strain state. Rock parameters for numerical modelling were determined on the basis of the Hoek-Brown classification. Numerical modelling was performed for two load variants: longer axis of special-purpose chamber workings was perpendicular to the direction of the maximum horizontal stress component (load variant 1) and longer axis of special-purpose chamber workings was parallel to the direction of the maximum horizontal stress component (load variant 2). The Mohr-Coulomb strength criterion was applied in numerical analyses. An elastic-plastic model with softening was applied to describe the rock medium. Based on obtained results of numerical analyses, an example of protection special-purpose chamber workings situated in a field of high horizontal stresses by rock bolts is presented.

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A NEW APPROACH TO TIME-LOAD-DEFORMATION-STRESS HYPERSURFACE OF ROCKS TO STABILITY CONTROL OF UNDERGROUND OPENINGS

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ABSTRACT

The most important developments in rock engineering are about time-dependent deformation behavior of rocks under different loads. Many studies have been done for the purpose of identifying mathematically time-load-deformation (TLD) characteristics of the rocks. These studies have made an important contribution to the research on the stability of constructions built in rock masses and rock material is the main part of the rock mass in which the engineering constructions. When considered from this point of view, the time-dependent deformation behavior of the rocks under different loads is important to determine unstable conditions of the rock constructions in the long term. Researches in rock masses use surfaces based on TLD data. On the other hand, the strength of the rock is also part of these analyzes. The new model developed in this study has four variables such as time, load, deformation and strength. Therefore, TLD surfaces developed for time-load-deformation has been associate with another variable and three components (TLD) surfaces eventually transformed into four component (time-load-deformation-strength; TLDS) hypersurfaces. Hypersurfaces, which illustrate new TLDS behaviors of the rocks developed in underground openings in different rock constructions in different areas. It is thought that the TLDS hypersurfaces will especially be contributed to the numerical modeling studies of rock constructions analysis.

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THE REUSE OF MINING AND CONSTRUCTION WASTE FOR BACKFILL AS ONE OF SUSTAINABLE ACTIVITIES

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ABSTRACT

Human civilization brings the need for energy sources and construction materials. Large amount of materials are extracted from deep and open pit mines. Mining activities are inevitably related to large direct impact on local environment (dewatering, landscape). A lot of spoil material is produced in course of mining production and further processing of extracted products. Various issues of the use of waste material from empty rocks, enrichment tailings and demolition works in civil engineering as a backfilling material should be analyzed. All factors must be considered depending on the amount of the material to be used for construction of embankments or fillings, the cost of its processing before reuse and environmental cost of the transport. The implementation of sustainable technologies may reduce the costs for the mining waste disposal in dumps, as well as minimize the negative impact of mining enterprises on the region ecology and comfort of inhabitants. The same benefits can be observed on smaller scale when construction waste material (debris) is considered. The work presents overall conditions for abandoned working in the deposits underground development in selected regions of Russia and some experiences gathered at numerous construction sites in Poland where the working of machines (rollers, impulse compactors) imposed vibrations on neighboring areas. In order to take into account the totality of all forms of the impact of geotechnology on the natural environment and neighboring human activities in course of the extraction of minerals and to improve measures for the rational use of natural resources, a complete change in the concept of environmental protection is necessary. It is necessary to move from purely protective measures to planned management of natural resources and to develop a mathematical model of the impact of geotechnology on the environment. It is also crucial to increase the role of environmental issues in mining and civil engineering education at universities and specialized institutions to form a new generation of mining engineers and civil engineers who will take into account all aspects of sustainable and responsible works.

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ANALYSIS OF MINING INFLUENCES ON A SMALL FRAME RAILWAY VIADUCT

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ABSTRACT

In the article, the example of the rebuilding of the real bridge object shows, how to take into account the impact of mining area deformations on small frame railway viaducts integrated with the embankment. General principles are given, how to determine additional forces induced in the construction, such forces arise as a result of mining deformations on the surface of the area. It is discussed, how to shape the geometry of the bridge structure, so that in the future it will be possible to raise the level of the railway track even by several meters (in order to eliminate the local mining hollow), without rebuilding of the viaduct. Attention is paid to the necessity of shaping the foundations so that the impact on the subsoil under the embankment and under the viaduct was the same, so that the viaduct can settle in the same way as the adjacent railway embankment. In addition, technological aspects related to the adjustment of the viaduct to ground conditions (shallow thin layers of plastic soil typical of post-glacial areas in Poland on Silesia Upland) and the protection of railway traffic continuity through a bridge type relieving construction are shown. This bridge object is located on the area of active mining exploitation. The article is supplemented by the results of 8-year measurements of subsidence and displacements of the viaduct on the deforming mining ground and conclusions from observations. The described method of analysis and conclusions may be used in further studies of the interaction between the embankment and the viaduct embedded in the embankment in the situation of active mining deformations of the area. In Poland mining exploitation has been carried out in the vicinity of railway lines for over 150 years, hence there is undoubtedly a lot of practical experience here. Therefore, the article briefly discusses the impact of mining operations also on other types of bridge structures (general review), there are links to open access publications (mainly English-language) showing interesting examples and containing valuable research results.

VALORIZATION OF NATURAL SUPERPLASTICIZERS (LIGNINS) IN ULTRA-HIGH PERFORMANCE FIBER CONCRETES (UHPFC) BASED ON WASTE REFRACTORY BRICKS

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ABSTRACT

The aim of this work is to study the effect of the addition of refractory and ultrafine bricks by total replacement of silica fume and the possibility of using natural adjuvant (lignin) instead of commercial adjuvant, on the physico-mechanical and thermal properties of ultra-high performance fiber concretes (UHPFC). The bending and compression strengths increase (20%) when an amount of refractory brick waste (10 to 15% addition relative to the cement mass) is added compared to the control (UHPFC). The action of the adjuvant natural ratio is comparable to that of the artificial adjuvant with very low solids content (0.060 g) which is 32 times lower than that of the commercial adjuvant extract for all specimens prepared from waste of refractory bricks. The addition of waste refractory bricks improves the thermal properties of these concretes (start of shrinkage at 850 °C for the control and 1330 °C for the 10% Brick waste additions).

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NEW DATA ON THE FORMATION CONDITIONS OF THE DYVOK ORE OCCURRENCE (SOUTH YAKUTIA, RUSSIA)

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ABSTRACT

The article presents new data on the mineralogical and thermobarogeochemical research of Dyvok ore occurrence. The aim of the research is to learn about the mineral-geochemical characteristics of the ore occurrence as well as about the formation of auriferous mineralogical associations at the occurrence. At the moment, Verkhnealgoninsk auriferous area consists of several ore occurrences and a deposit. The area is located within famous Stanovaya auriferous area, South Yakutia. Dyvok ore occurrence is subjected to the influence of Tyrkandinski fault. The host rocks are Early-Archaean K-spar-quartz metasomatites, beresited and argillated rocks with sulphide-quartz veins and mineralised zones of beresited rocks with sulphide and quartz-sulphide mineralisation. Now, there are 3 productive ore zones at the ore occurrence. We found mineral associations that contain native gold and described the variety of its forms, sizes and composition. The mineral associations are 1) gold-arsenopyrite-pyrite-quartz; 2) gold-sphalerite-chalcopryrite; 3) quartz-boulangerite; 4) quartz-telluride. We carried out thermobarogeochemical investigation of fluid inclusions in quartz to learn about the formation conditions of productive mineral associations, the quartz was extracted from gold-arsenopyrite-pyrite-quartz, gold-sphalerite-chalcopryrite and quartz-telluride associations. Microanalyses helped to discover monophase, diphasic and three-phase inclusions. Early association had the temperature of 270-335°C. The rated pressure is 0.4 kbar. The inclusions contain carbon dioxide, water, methane and carbonate ion. The solid phase contains dawsonite and native sulphur. The deposition temperature of gold-sphalerite-chalcopryrite association is 186-219°C, and the one of quartz-telluride association is 199-200°C. The pressure of the latter two associations remains unknown due to the lack of coexisting three-phase inclusions. Raman spectroscopy showed the presence of carbon dioxide and methane in early association, as well as of carbon dioxide, methane and nitrogen (impurity) in late-phase quartz. Therefore, we claim that all the associations in question were formed in shallow- and mid-depth and oxidizing conditions with the involvement of deeper sources for the ore constituents.

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ACTIVATION ENERGIES OF PHYSICALLY AND CHEMICALLY CLEAN COALS

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ABSTRACT

In this study, a total of 12 coal samples were collected. Physical and chemical cleaning were employed on these collected coal samples. In order to characterize the kinetics of each coal sample, activation energies of each corresponding coal sample were determined. Arrhenius equation was employed for the determination of above mentioned activation energies. Activation energies for both physically and chemically clean coal samples were determined. Activation energy of coal sample after chemical cleaning is observed to be higher the one that is obtained after physical cleaning. Referring to these differences, increase in activation energy after chemical cleaning was considered to be side effect of chemical cleaning, since higher activation energy means higher heat requirement for sample to be activated. Corresponding differences of activation energies were compared with the calorific values change respectively after physical cleaning and after chemical cleaning.

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**PROXIMATE AND ULTIMATE ANALYSIS BEFORE AND AFTER PHYSICAL & CHEMICAL
DEMINERALIZATION**

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ABSTRACT

In this study, a total of 12 coal samples were collected. Physical and chemical cleaning were employed on these collected coal samples. In order to understand the effect of physical & chemical cleaning on these samples, samples characterization were performed in terms of proximate and ultimate analysis. Calorific values of each corresponding clean coal samples were also determined. After chemical cleaning calorific values of each sample decreased, while chemical cleaning resulted in ultra-clean coals as regards to ash content (average of 0.5 % ash content). Volatile matter content each corresponding sample after chemical cleaning have higher percentage with respect to the ones after physical cleaning. However for some specific sample, the increase in volatile matter content after chemical cleaning is more than 200 %. Fixed carbon percentages do not show tremendous changes as regards to chemical cleaning, however they decrease for some and increase for some other after chemical cleaning. Calorific values decreases for the all samples after chemical cleaning. Ultimate analysis (C, H, N and O) was also determined after physical and chemical cleaning. Sulphur decreased for all samples after chemical cleaning as expected. Taking these variations into consideration, calorific value decrease were deducted and possible reasons of this decrease was inferred. Corresponding differentiations were compared to calorific value differentiation and the most significant reasoning of the calorific value decrease was evaluated.

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REACTIVITY OF PHYSICALLY AND CHEMICALLY CLEAN COALS

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ABSTRACT

In this study, a total of 12 coal samples were collected. In order to have reactivity determination samples were thermo-gravimetrically analysed. Thermo-gravimetric analysis was carried out not only on physically clean coal samples but also on chemically clean coal samples. Reactivity program within thermos-gravimetric analysis consists of volatiles burning in N₂ atmosphere which is fast reaction and residual carbon burning in dry air atmosphere which takes places right after. Reactivity parameter for each coal sample is considered as an important parameter since it characterize the burning profile of residual carbon matter after de-volatilization. In order to have reactivity determination, samples were objected to temperature increase up to 700 °C in N₂ atmosphere and then the temperature was set to 500 °C in dry air atmosphere. Reactivity of each corresponding sample after physical and physical-chemical cleaning was determined. The determined reactivity (R₅₀₀) values changed between 0.06 and 0.221 for physically clean coal samples and they are between 0.11 and 0.24 for the chemically clean coal samples. Reactivity (R₅₀₀) values increased after chemical cleaning. Due to coal structure difference, the increase in reactivity (R₅₀₀) after chemical cleaning is different for each sample. For example for TB6 sample, reactivity (R₅₀₀) increased more than 60 % while for TB5 sample it only increased by 6 % after chemical cleaning. Chemical cleaning followed by physical cleaning results in increase in reactivity and this increase depends on the nature of the coal type.

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**CORRELATION BETWEEN ASH CONTENT OF SIZE & DENSITY FRACTIONATED COAL SAMPLES
AND THEIR CORRESPONDING CALORIFIC VALUES**

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ABSTRACT

In this study, a total of 12 coal samples were collected. Physical and chemical cleaning were employed on these collected coal samples. In order to characterize the kinetics of each coal sample, activation energies of each corresponding coal sample were determined. Arrhenius equation was employed for the determination of above mentioned activation energies. Activation energies for both physically and chemically clean coal samples were determined. Activation energy of coal sample after chemical cleaning is observed to be higher the one that is obtained after physical cleaning. Referring to these differences, increase in activation energy after chemical cleaning was considered to be side effect of chemical cleaning, since higher activation energy means higher heat requirement for sample to be activated. Corresponding differences of activation energies were compared with the calorific values change respectively after physical cleaning and after chemical cleaning.

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DOMESTIC UTILIZATION OF COAL IN ZONGULDAK-TURKEY AND UNBURNED CARBON IN ASH

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ABSTRACT

In this study, Zonguldak, a Turkish city popular with coal mining, was taken into consideration. Coal was the main source of energy for domestic heating in Zonguldak and tonnes of ash were dumped to environment. The ash samples were containing carbon and this carbon was aimed to recycle from these waste. In the order of this recycling, firstly classification of collected ash samples in terms of size groups was carried out. For each size groups sink and float analysis was carried out. Sink and float analysis was carried out with densities (1.30, 1.45, 1.60, 1.90 g/cm³) for a total of 5 size groups of ash (+18.00mm, -18.00+10.00mm, -10.00+6.00mm, -6.00+2.36mm, -2.36+0.50mm) and each floated product was analyzed in terms of final ash percentage. Size group -18+10 mm was floated at 1.30 g/cm³ and it was observed that this group of coal ash has the highest percentage (%58.84) carbon.

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COAL CALORIFIC VALUE AFTER PHYSICAL AND CHEMICAL CLEANING

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ABSTRACT

In this study a total of 12 coal sample was collected. 7 of these samples are local coal samples and 5 of them is exported coals. These coals samples were fractionated into two size groups, i.e. -10+3.15, -3.15+05. Float and sink analysis was performed on this two size groups of samples with $\text{Ca}(\text{NO}_3)_2$ medium at the density of 1.50 g/cm^3 . Latter within the scope of this study, chemical cleaning was employed on this samples. Chemical cleaning on coal samples was carried out with acids (HF and HNO_3) at specific conditions. Samples have different calorific values after physical and chemical cleaning. Although some impurities have been removed with both cleaning methods, physical cleaning resulted in higher ash content coals at the end while with chemical cleaning almost no ash content coals were obtained. However, it was observed the fact that chemical cleaning resulted lower calorific values of samples. This might be because of chemical cleaning results in the decomposition of the coal matrix structure

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SYNTHESIS OF ULTRAFINE Fe-W-Al-Ti-Ni-C-B POWDERS BY MECHANICAL ALLOYING

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ABSTRACT

The goal of the presented research was syntheses of the ultrafine and nanopowder blends by Mechanical Alloying from Fe-W-Al-Ti-Ni-B-C compositions for further application as precursors for fabrication bulk High-Entropy Alloy (HEA) by explosive compaction technology. The presented paper describes the preliminary investigations of mechanical alloying of Fe-W-Al-Ti-Ni-B-C powders. Laboratory vibrating sieve equipment was used for sorting the initial powders for the reduction of particle size. For the experiments were used powders of Fe-W-Al-Ti-Ni-B-C system consisting of five major metallic and two minor non-metallic B and C elements were used for mechanical alloying. The crystalline coarse Aluminum, Titanium, Carbon and Nickel, fine-grained iron and tungsten and amorphous Boron powders were used as initial components. The Fe, W, Al, Ti and Ni powders were preliminary checked by "Explorer 5000 XRF" by Skyray instrument and verified. Based on the literature review, theoretical investigation and phase diagrams for mechanical alloying were selected two compositions with the following molar ratio: **a.** Fe₂₀W₁₅Al₁₅Ti₂₀Ni₂₀B₅C₅ **b.** Fe₂₅W₂₅Al₁₀Ti₁₅Ni₁₅B₅C₅. The mechanical alloying was realized on the high energy ball mill with zirconium oxide jars and balls. The ball to powder mass ratio was 10:1, the rotation speed was 500rpm. The process was carried out in dry conditions. The time of mechanical alloying was 5h, 10h and 14 h. The powders were prepared for preliminary analyses and assessment of particle size. The SEM and optical microscopy results of mechanical alloying are presented in the paper.

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GROWTH OF INDIUM DIGERMANATE NANOWIRES FOR GAS SENSOR APPLICATIONS

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ABSTRACT

Gas sensors employing nanowires attracted great interest during the last two decades due to their extremely high sensitivity, which for some gases reach even tens of ppb levels. The purpose of this work was to develop new technology for the growth of $\text{In}_2\text{Ge}_2\text{O}_7$ nanowires. The second goal was to fabricate the nanowire network-based gas sensors on these nanowires and examine their characteristics. The nanowires were synthesized using the vapour-solid growth mechanism realized in the gaseous ambient formed after pyrolytic decomposition of the moistened hydrazine (N_2H_4), containing water (3-10 mol.%). After pyrolysis, the ambient was simultaneously consisting of such oxidizing, reducing and nitriding species like O_2 , H_2O , NH and NH_2 radicals, atomic hydrogen, ammonia and hydrogen molecules. Annealing of $\text{In}+\text{Ge}$ solid sources in such ambient caused the formation of volatile suboxide precursors (In_2O and GeO) that were accomplishing the mass transfer to the substrate, located in the cold zone, and subsequent growth of nanowires. It was shown that the process temperature has a great influence on the composition and morphology of nanowires. At temperatures below 400°C , only indium oxide nanowires were formed that were growing from the In self catalyst. The mixture of pure Ge and In_2O_3 nanowires were obtained when the substrate temperature was in the range of $400\text{--}420^\circ\text{C}$. At 450°C the $\text{In}_2\text{Ge}_2\text{O}_7$ nanowires were synthesized, which were decorated with InN nanocrystals. Scanning and transmission electron microscopy, together with X-ray diffraction and energy dispersive X-ray spectroscopy were used to study the composition, structure and morphology of synthesized nanowires. The gas sensor was fabricated by forming the nanowire networks on areas between interdigitated gold electrodes, deposited onto the Pyrex glass substrate. The initial experiments revealed that for such sensor the detection limit for ammonia was 0.8 ppm at 300°C , while the response and recovery times were 15 and 9 seconds respectively. The results of this work clearly demonstrated that hydrazine technology can be successfully used for producing $\text{In}_2\text{Ge}_2\text{O}_7$ nanowires decorated with InN nanocrystals. The ammonia gas sensor, fabricated using these nanowires, was able to detect NH_3 at the level of 0.8 ppm.

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MITIGATION EFFECTS OF A WATER BARRIER ON DYNAMIC LOADS ON THE HUMAN BODY AT EXPLOSIONS

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ABSTRACT

According to standards ISO 6184/4 and EN 14373, the efficacy of explosion suppression systems is estimated by maximum reduced (suppressed) shock wave overpressure, recorded in a suppressed explosion event. In addition to this, a significant interest is the capability of explosion protection systems to reduce the dynamic loads on the human body. This task is not considered in standards. The G. Tsulukidze Mining Institute has been studied mitigation of dynamic loads on human by water barrier, generated using protective system. The system composed of a blast detector, a wireless device for activation and an absorber. During an accidental explosion, the proposed system immediately forms a protective water barrier in the zone to be protected to reduce the overpressure generated by a shock wave. A prototype model has been manufactured, installed and tested under real explosion conditions in the underground experimental base of the G. Tsulukidze Mining Institute. An anthropomorphic test device Hybrid III 50th was used during testing. To register dynamic load generated during an explosion, 7 sensors were installed in different zones of the dummy. Tests were conducted both with the use of the protective system and without it, in conditions when the charge weight was 2 kg, and the distance from the charge to the dummy was 8,5m. Comparative analysis showed that the protective system, which contains one absorber (may contain several absorbers), reduces the dynamic loads generated in different zones of a human body by 30-50%.

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C-V CHARACTERIZATION AND ELECTRIC PARAMETERS OF ZrO_2 RECEIVED BY UV STIMULATED PLASMA ANODIZING

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ABSTRACT

Low temperature technologies creating metals oxides are promising solution for formation integral circuit elements. In this report have been investigated the electric properties of zirconia (ZrO_2) received by low temperature ($\sim 400^\circ\text{C}$) UV stimulated plasma anodizing. Zirconia is a potential high-k dielectric material with potential applications as a gate insulator in transistors. This dielectric is distinguished by good electric parameters. For this purpose we used C-V characterization technic and calculate dielectric constant, flatband voltage, threshold voltage, bulk potential, work function, oxide effective charge, charge concentration. The C-V measurement was carried out on Keithley Instrument – Semiconductor Parameter Analyzer 4200, oxide thickness was measured by reflectometer – MprobeVis System. The MOS structure was characterized with C-V methodic. The experiment was carried out in the tree modes: $1\text{mA}/\text{cm}^2$, $0.5\text{mA}/\text{cm}^2$ and $2\text{mA}/\text{cm}^2$ anodizing currents densities in order to define the optimal experimental mode for creating gate dielectric. In the process of formation of dielectric at $2\text{mA}/\text{cm}^2$ anodizing current, the structure of the dielectric is better in quality. It means that created dipoles in the anodizing process are less and surface charge and interface state density also is small than in other modes. Calculated dielectric constant is about 23, which is in good accordance with dielectric constant of ZrO_2 known in the scientific literature. The main parameter for characterizing the dielectric is a dissipation factor and from the analyze of data the minimum dissipation factor is corresponding to $2\text{mA}/\text{cm}^2$ anodizing current density.

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RADIATION EFFECT ON THE PARAMETERS OF FIELD EFFECT TRANSISTOR WITH SHOTTKY BARRIER ON GaAs

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ABSTRACT

In the present work we report the result of study of electron and γ -radiation effect on the parameters of normally open and normally closed field effect transistors with Shottky barrier on GaAs. It has been shown that normally closed transistors are more sensitive to the action of radiation than normally opened transistors. Both transistors are more sensitive to electron radiation. As substrates were used epitaxial structures of GaAs of n-type conductivity doped with tellurium with $N_D=2 \times 10^{17} \text{ cm}^{-3}$ with surface orientation [100]. Electron irradiation was conducted on linear accelerator of RELUS type with electron energy 4 MeV at room temperature, with the intensity of electrons flow of $2.5 \times 10^{12} \text{ e/cm}^2 \text{ sec}$. Integral doses made $1 \times 10^{14} \text{ e/cm}^2$, $5 \times 10^{14} \text{ e/cm}^2$, $1 \times 10^{15} \text{ e/cm}^2$ and $3 \times 10^{15} \text{ e/cm}^2$. The γ -radiation was conducted using the source ^{60}Co at room temperature with the intensity of $5 \times 10^3 \text{ P/sec}$. For the γ -radiation visible changes of saturation flow current are observed at the doses of more than 10^5 Grey (GaAs). As whole the γ -radiation makes an action on the parameters of MESFET in the less degree than electron irradiation. The annealing of the irradiated samples of MESFET at the temperature 573 K in the nitrogen atmosphere for 45 min provides complete restoration of their parameters. The possible reasons of the mentioned effects are given.

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THE EXPERIMENTAL PROOF OF NON - THERMAL NATURE OF THE MECHANISM OF PULSE-PHOTON ANNEALING IN SEMICONDUCTOR MATERIALS

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ABSTRACT

Development of semiconductor electronics strongly depends on the quality of basic materials – micro and nanolayers. As the basic method of updating of semiconductor materials is the ion implantation with the subsequent pulse-photon (laser) annealing, the ascertainment of mechanism of these processes is very important. In spite of many experimental publications, the mechanism of carrying out this process remains disputable. At short, nanoseconds laser pulses, a process of annealing proceed through the melting of thin surface layers of substance with the subsequent recrystallization. The problem is reduced to fundamental problem of physics, as understanding of the mechanism of melting of semiconductor material when power transmission happens with the help of light absorption with energy of quantum greater than forbidden band of semiconductor. In the present work, on the basis of experimental studies of electro physical, optical and mechanical characteristics of semiconductor materials, necessary conditions (temperature, concentration of generated minority carriers) for efficient melting of thin surface layers with the help of pulse laser action are defined. It is shown, that: **a.** Process of pulse laser melting has non - thermic character and is determined by concentration of antibonding electron-hole pairs generated by light; **b.** The theoretical model of the electronic melting, based on a modification of a quantum state of an electronic subsystem of a crystal due to light absorption, is proposed; **c.** Necessary critical concentration of antibonding electrons and holes (n_{cr}) for reaching melting is theoretically considered; **d.** It is experimentally proved, that at reaching n_{cr} in shallow layers of the semiconductor due to light absorption, melting happens at much smaller energies, than are necessary for reaching melting temperature only by thermal heat.

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EXPLOSION SUPPRESSION IN LIMITED SPACES

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ABSTRACT

Despite strict guidelines on safety, security, and preventive measures, unexpected explosions and fires in explosive storage magazines every year to cause unacceptable human losses and property damage. During 2016-2018 at least 30 accidental explosions occurred in explosive storage magazines of different countries, almost all of which were followed by fire that spread to large areas and affected buildings and structures. It is therefore extremely important to ensure the perfection of protective systems against accidental explosions in limited spaces. This paper presents outcomes of the study of energy suppression processes of an accidental explosion, conducted in the G. Tsulukidze Mining Institute. The research led to the development of a new concept for protecting explosives storage magazines from accidental and terrorist explosion, allowing to increase a level of security without significant additional expenditures. The application of the new method enables to reduce overpressure and deformation of the wall. The presentation deals with the basic project parameters of a new protection method.

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USAGE OF COLLOIDAL GUNPOWDER RELEASED FROM UTILIZED AMMUNITION IN THE MINING INDUSTRY

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ABSTRACT

Disposal of obsolete munitions is a permanent process, during which colloidal gunpowder are liberated and accumulated. Especially large quantities of such materials were accumulated in the countries of the former Soviet Union, including Georgia. Warehousing and storage of such materials and/or direct application may cause a serious threat /risks in terms of ecological and unauthorized use. Therefore, today colloidal gunpowder is mainly stored and the expenses of their storage permanently increase, in addition, there is a permanent threat of their unauthorized use, because they belong to the class of explosives. The long-term storage of the overdue gun powders and rocket fuels contains of self blasting risks. So, this problem is urgent at the local and global levels. Traditional ways of problem solution is a simply creation of new explosive materials on the base of application of ingredients possessing better properties. In distinct from the traditional methods the essence of the offered works is creation of new type industrial explosive compounds and application of fuel removed from utilized missiles/shells of military designation in the role of components of explosivematerials. A number of hints have been identified in the process of studying the exploitation of industrial explosives on the base of gunpowder and solid rocket fuel. They have created a prerequisite that the cartridges made on the basis of colloidal gunpowder can be initiated using the malware. This method of initiation allows us to a gradual increase the gas pressure in the chamber of the critical size at which the pressure of gas will break through the impact of the shaft and thus the breaking of the rock. In the process of research, explosives characteristics of pyroxyline and ballistic fuel mixtures have been studied. It was established that the granulomatrium composition of the mixture is significantly influenced by these characteristics. For example, if the diameter of the granules varies between 3-20 mm, the reaction of the collapse of the mixture is carried out steadily with blast mode, without switching to the detonation. If 10% or more granules in the explosive mixture are small than 1 mm, the combustion process can be transferred to the detonation.

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PRODUCTION OF CORROSION-RESISTANT POLYMER CONCRETE REINFORCED WITH VARIOUS FIBERS

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ABSTRACT

Polymer concretes (PC) unlike common concrete (produced based on cement, as cohesive material) are notable for high durability on compression – 50...90 MPa, and especially, on tension – 6...10 MPa, with unique corrosion resistance. However, they are also associated with such negative properties, such as high deformability, creep. Because PC works well on tension, their application is perspective for production of shock resistant construction material, but for this, it is necessary their strengthening by additional reinforcing mechanisms. In addition, because of differences in the durability and deformability on compression, as well as on tension, is important that stipulates the necessity of reinforcement of PC tensile and bended elements. This work presents and discussed the reinforcement of PC by hybrid fibers. The major goal of this work is the production of such hybrid fiber-reinforced polymer concrete (HFRPC) with high durability on tension and high shock resistance that preserves these properties in conditions of aggressive environments. The primary cohesive methods are unsaturated polyester resins, as polymers. The fiber reinforcements (course and fine) are primarily basalt and steel fibers, andesite selected for their chemical resistance and durability the technological parameters for the production and processing of nano and ultrafine dispersive powders from rock using vibration and planetary mills, and the physical and mechanical properties of these concretes are presented and discussed. The data on the corrosion resistance coefficient of these processed PC (corrosion resistance coefficient - K_{cr} , diffusion coefficient of aggressive liquids - K_d) is also presented and discussed.

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**STATE OF NON-FINANCIAL REPORTING OF POLISH REPRESENTATIVES OF THE MINING
INDUSTRY IN A SUSTAINABLE SOCIAL DIMENSION**

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ABSTRACT

An important problem faced by mining enterprises is the impact of their activities on the natural environment as well as on health and life of people. Exploitation of mineral deposits leads to changes in land relief, degradation of soil and lands, damage to vegetation, hydrogeological and hydrological transformations and atmosphere pollution. Nevertheless, perceiving mines only in terms of the damage resulting from the exploitation is unfair. Therefore, the article presents three Polish representatives of the mining industry in the context of the requirements they have met, acting in accordance with the principles of sustainable development. Selection of KGHM Polska Miedź S.A. (copper ores and other accompanying elements), Lubelski Węgiel Bogdanka S.A. (hard coal) and the Capital Group Polska Grupa Energetyczna S.A. - Mining and Conventional Energy S.A. (lignite), dictated by their significant share in the mining industry in Poland. The article lists and groups aspects related to the society both in terms of working conditions and the relationship of companies with the local community. The analysis of aspects resulted from a detailed study of reports of integrated mining companies prepared annually, in accordance with the guidelines of global corporate social responsibility standards. The benefits resulting from the care of enterprises for the society in the region of their activity were specified, and furthermore, aspects which are omitted, and according to the article authors should be included in reports, were indicated.

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**EXPERIMENTAL INVESTIGATION ON PURIFICATION OF HE THROUGH ADSORPTION TECHNIQUE
FOR EXPLORATION OF HE FROM NATURAL RESOURCES AT BAKRESWAR SPRING AREA, INDIA**

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ABSTRACT

Helium (He) is the only non-radioactive, inert gas which plays an indispensable role in the domain of modern science and technology due to extraordinary properties. Presently, India consumes as much He as 23% of the total global consumption. But, there is no commercial He plant in India to extract the same in large scale till now. The major amount of He in the world is commercially recovered from the natural petroleum gas resources. But, Indian natural petroleum gas resources are lean in He and India imports 100% of its total He demand. However, the good news for India is that Indian geothermal systems are enriched with He of high concentration. These sources may serve as the potential and indigenous resources of He to make India self-reliant on He production. It is well established that in India, Bakreswar geothermal area is the most preferable and suitable location for installation of a commercial He plant as the geothermal system here shows a long term stable activities with high out flux of He emanation. Here, focus has been given towards an experimental investigation on He Purification System based on Pressure Swing Adsorption (PSA) technique by selecting proper adsorbent material for the future development of He exploration and purification plant to be installed at the study area. Utilizing the principle of Adsorption, the enrichment of He contained in the raw gas released from the hot springs at Bakreswar has been achieved upto a purity of 99% by our experimental study. Moreover, considering the experimental outcomes here, a PSA He Purification System is proposed in terms of schematic diagram, which will be very much helpful during actual installation and commissioning of the proposed He Recovery and Purification System to be installed at Bakreswar spring area.

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SOLAR POWERED DESALINATION, APPLIED SOLUTION IN YEMEN

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ABSTRACT

Access to clean water and energy during disasters, such as the current crisis in Yemen, is critical to health and survival. Utilizing natural renewable resources, which rely on no fuel have more resilience and could solve a part of water and energy problems. So far purification/desalination device that can be deployed quickly and affordable to people in need of clean drinking water does not yet exist on the marketplace. There is a high need for such hand-held device mainly during humanitarian crises. Yemen is rich with solar energy. Solar radiation average in Yemen is 5.2 – 6.8 kWh/m², and the average sunshine exceed 9 hours a day of clean blue sky. Utilizing solar energy in Yemen could solve a part of current water/energy shortages. This paper discussed the fabrication and development process and results of the newly developed solar still device combined with parabolic concentration. Fieldworks and manufacturing, laboratory experiments and water quality analysis, mathematical modeling and simulation using ANSYS (CFD) software were the tools used in this study. The clean water productivity of the second version of developed device reached 5 L/ m² a day. The study proposed further plan for a conical shape unit for the same device, which seems more promising and easier to handle, install and maintain. With this new shape/plan of device, it is expected to increase the productivity to 9 L/m² a day. This study showed feasible/viable results and verifies the importance of renewable energy/water transition to achieve secure sustainable water and energy management.

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NATURAL GAS LEAKAGE OCCURRENCE ON A SHALLOW GROUNDWATER RESERVOIR

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ABSTRACT

Natural gas can be found in geological reservoirs from shallow structures down to profound depths. If the sealing rocks on top of the reservoir present fractures or high porosity, the gas may reach the surface. From the economical point of view, if large amounts of gas are available, it can be commercially exploited. On the other hand, for sub-commercial situations, the gas may simply leak to the atmosphere, contributing as a greenhouse gas to global warming. In this work, we investigated a reported natural gas leakage in the coastal region of Laguna near the banks of the Tubarão River, in the state of Santa Catarina. The water bed is very close to the soil surface and gas bubbles are easily observed permeating water and reaching the atmosphere. This investigation aimed at estimating contrasts of lithologies and saturated zones in subsurface (water/gas) using geophysical tools (electroresistivity and refraction seismic). The studied region has been considered for real estate investments and therefore it is very important to acquire a better knowledge of the subsurface gas reservoir prior to any decision on establishing a construction area. The occurrence of natural gas leakage on the surface was investigated with the execution of geophysical surveys (resistivity and refraction seismic) to identify the gas saturate zone. The leaked gas is mainly composed by methane of biogenic origin, according to isotopic studies. The gas origin is probably related to the burial of ancient Tubarão River branches enriched with organic matter. The geophysical surveys identified that the gas concentration in subsurface has an inverted mushroom shape with the base occurring at 15 meters depth. The natural leakage probably should originate from fractures that occur in overlying seal rock.

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RELATIONSHIP BETWEEN COMPOSITIONS OF GREY HAIR-GRASS (*CORYNEPHORUS CANESCENS* (L.) P. BEAUV.) TISSUES AND SOIL PROPERTIES DURING PRIMARY VEGETATION SUCCESSION

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ABSTRACT

This study focuses on the concentration of trace-, microelement- and organic components in initial horizons of sandy soil (Arenosole) and of the tissues of *Corynephorus canescens*, a pioneer species typical of unstable environments that initiates pedogenic processes by enriching poor quartz sand in organic- and mineral matter from its own tissues. Soil samples were taken from a root-zone humus horizon (A) averaging ~15 cm in thickness and from parent rock. Concentrations of Ca, Mg, K, Na, Fe, Si, Al, Zn, Mn, Co, Cd, Pb, Sr, Mo, C, N and P in plant material and soil were analyzed. High concentrations of Si (6368 ± 16.3 mg·kg⁻¹), K (2310 ± 165.2), Ca (302 ± 24.6 mg·kg⁻¹), Fe (2196 ± 316.3) are found in the above-ground part of the plant whereas Si (9150 ± 20), Fe (5948 ± 43), K (3752 ± 3.21) and Al (2370 ± 52.6 mg·kg⁻¹) dominate in the roots. Soil organic carbon (OC) contents in the humus horizon and in parent rock are 0.276 ± 0.041 and $0.206 \pm 0.041\%$, respectively. The concentration of nitrogen in the humus horizon shows a high (0.92) correlation with OC. The soil shows both acid (4.2 ± 0.51 in KCl) and low-acid (5.1 ± 0.23 in H₂O) characteristics. Heavy-metal contents differ significantly among the study sites. Organic compounds of *Corynephorus canescens* and of soil organic matter (SOM) were investigated by pyrolysis-GC/MS (Py-GC/MS). In the organic content of the grey hair-grass tissues, typical compounds such as normal chain aliphatics (29%), and furane- and pyrane derivatives (12%), dominate. Nitrogen-containing substances such as amines, nitro compounds, heterocycles and amines are also important (27%). The main ecopedological role of *C. canescens* involves the fixing of loose sand thanks to its well-developed root system. The xeromorphic structure of stems and leaves allows it to function in such extreme open areas of unstable ground and high insolation. The initial stage of the formation of a humus horizon involving *Corynephores canescens* is documented.

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IS THE VEGETATION SUCCESSION A THREAT FOR RARE AND PROTECTED SPECIES IN A SAND QUARRY? CASE STUDY OF THE KUŹNICA WAREŻYŃSKA SAND QUARRY (SOUTHERN POLAND)

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ABSTRACT

The work focuses on analyzing and reason of occurrences of rare and protected species by European and Polish law. These species are growing in the areas of former sand exploitations quarry and have different ecological requirements. The origin of such quarries is strictly connected strictly connection with development of coal mining in the Silesian Upland (Southern Poland). From the end of exploitation here the processes of spontaneous vegetation ecosystems have been observed. The research was conducted in Southern Poland in the area of the Kuźnica Wareżyńska sand quarry with an area of approximately 8 km², exploited in the years 1972 - 2003. In results of work has been confirmed by 2 types of habitats which are included in I Annex Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora forms in zone of groundwater outflow. They are 7140-transition mires and quaking bogs and 7230 – alkaline fens. In these communities numerous population of 22 protects species as *Dactylorhiza maculata*, *D. majalis*, *Epipactis atrorubens*, *E. helleborine*, *E. palustris*, *Malaxis monophyllos*, *Lycopodiella inundata*, *Pinguicula vulgaris*, including *Liparis loeselii* found in Annex II of the Habitats Directive occur. These are early-successional species, whose numbers in next successions phases decrease or after several years completely disappear. The analyzed flora differs in terms of life forms, ecological requirements related to the habitat mosaics. The fragments of sand quarry that were where are not reclaimed can play important role in nature conservation not only in local level but even on supra-regional scale. Hence, this object is a place for many rare, threatened with extinction species and plant communities as substitute habitats. The conservation of such species and plant communities in sand quarry needed active protection. It consists in maintaining the initial stages of succession and preventing the formation of the forest.

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A THOROUGH STUDY FOR PAHs IN DUMP MATERIALS FROM OPEN-PIT LIGNITE MINING, MARITSA IZTOK BASIN, BULGARIA

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ABSTRACT

Polycyclic aromatic hydrocarbons (PAHs) in the environment are directly related to the health and quality of life. Their presence is referred to the development of various diseases. Hence, monitoring environmentally harmful compounds is of great importance for the life of humans and animals. The main sources of PAHs are volcanic processes, forest fires, anthropogenic activities, etc. Releases of organic compounds from dump materials could be a result of natural and anthropogenic weathering processes, mainly surface/groundwater leaching. The aim of the present study is to determine qualitatively/quantitatively PAHs in Maritsa Iztok dump materials, Bulgaria. PAHs in six dump samples were under consideration. For PAHs isolation, ca: 40 g of powdered sample were Soxhlet extracted by chloroform. After asphaltenes precipitation, malthenes were separated *via* column chromatography in neutrals (*n*-He), aromatic/slightly polars (DCM), and polars (Ac). The first two fractions were further analyzed. Gas chromatography-mass spectrometry (GC-MS) was used to appreciate organic matter sources and to identify and quantify PAHs in samples studied. The set of PAHs determined pointed out that 3 and 4 ring unsubstituted PAHs as dominant in the dump extracts. Total organic carbon (TOC) values of the samples varied in the range 1.18-5.63 wt.%. Amounts of Phenanthrene + Methylphenanthrenes were in the range of 0.44-2.98 mg/kg TOC. The values measured were compared with the norms for PAHs in soils. All magnitudes were under the regulation norms for harmful substances of the soil published by the National Legislation (2008). Fluoranthene + Pyrene determined amounts were in the range 0.06-0.52 mg/kg TOC, values again beneath the norms according to the above cited regulation. In conclusion, the study is an equivocal proof for the negligible amounts of PAHs in dump materials from Maritza Iztok lignite mining. However, their amounts in dumps should be measured and monitored bearing in mind the huge territories covered by these waste materials.

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THE MAIN TYPES OF FORMATION OF MINE WATERS COMPOSITION IN THE EASTERN DONBASS

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The objectives of research is to install the main types (directions) of formation of the chemical composition of mine water; give them a quantitative description and possible genesis. Solving these problems is of great practical and scientific significance, as the coal industry has a significant negative impact on the environmental status environment in the Eastern Donbass. In this regard, having trouble improving rehabilitation methods environment and improving environmental remediation technologies. Analysis of the formation of the mine water with application of standard statistical techniques and original digital technology classification of observations. Application of digital computer technology classification of multivariate observations AGATE-2 allowed reliably identify and interpret Genesis four basic types (directions) composition of mine waters. The genesis of the first type is associated with the influence of intensive processes of oxidation of sulfides and sulfur contained in coals and enclosing rocks. On an anionic composition of water sulphate and contain the highest concentrations of metals. The second type of changes in the composition of mine waters due to the weakening of the oxidation and the beginning of the influx of chloride in groundwater with deepening of mine workings. On the composition of the water, chloride-sulfate. Significantly reduced iron and metals. The third track formed sulfate-chloride waters and their genesis is associated mainly with the influx of chlorine-ion with groundwater. The fourth type of change in the composition of mine waters refers to unique, because formed the original soda water. Their genesis is associated with the influx in the mining allotment of groundwater, which are formed because of the processes of water condensation from water-carbon phase. Typical components are HCO_3 and CL (high content) as well as Ca and Mg (low content). Now an admittedly discoverability in the Eastern Donbass oil and gas accumulations, especially in Gukovo-Zverevsky coal area. Found that the mine waters are the leading factor in negative impacts on environment and cause serious environmental damage in the territory of the Eastern Donbass. This calls for effective measures for the rehabilitation of environmental conditions and improved treatment technologies.

IMPACT OF BIOCHAR ON SOIL WATER CONTENT AND ELECTRICAL CONDUCTIVITY

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ABSTRACT

Water contained in soil influences fundamentally the size of agricultural production but also weather and climate. Knowledge of physico-chemical parameters such as water content, salinity and temperature enable to carry out analysis of water resources, content of plant nutrients and their shift in the soil profile as well as assessment of thermal capacity of soil. Adjustment of soil parameters to plant needs of big agricultural areas known as precise farming requires optimal selection of the above parameters. Thanks to suitable dosing of fertilisers, economic effects are obtained but also environment is protected since excess of fertilisers, that would have permitted to ground water and as a result contaminate water reservoirs and rivers, is prevented. Control of the water content in soil has recently become a significant issue in the light of reduction of water resources. In the presence of increasing weather anomalies related to water excess or its long-term lack, the control of its content in the surface layers of soil and in the soil profile has started to play a decisive role which enables modelling and verification of model and provides information necessary to interpret satellite imagery. The aim of this paper is to use time-domain reflectometry (TDR) method to measure soil humidity and electrical conductivity. The purpose of the present paper is to validate and to clarify the limits of TDR method for long-term moisture and electrical conductivity measurements in field conditions. A relation between biochar dose and water content of soil was observed. It was concluded that with fields, doses of 5-10 Mg·ha⁻¹, the water content maintained at a similar level. The second group with similar parameters of the water content consisted of fields with the dose of 30-50 Mg·ha⁻¹, and the third group were fields with the dose of 60-100 Mg·ha⁻¹. For group 1, average water content was 8.52% for group 2 - 9.68% and for group 3 - 11.96%. Statistical analysis showed that an average dose of biochar from group 1, 2 and 3 should be accepted for further research in order to limit the amount of biochar dose in further research.

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IMPACT OF BIOCHAR ON SOIL TEMPERATURE

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ABSTRACT

Current research proved that the key role in shaping thermal conditions of soil plays a balance of solar radiation and field exposure. The soil temperature, especially, its ground layer, in a daily course is characterised by great changes. These changes are the most often concurrent with air temperature shifts and radiation balance. Knowledge of thermal conditions of the soil surface is significant for the proper cultivation process. The temperature of soil has a significant impact on the dates when biological processes in environment begin and end. It decides on the intensity of respiration processes and biochemical changes that are particularly material in the vegetation period. Water content of soil depends on the soil temperature, which decides *inter alia*, on the speed of germination and health of plants. The objective of the article is to determine the relation of the temperature course in the superficial layer of soil in relation to the applied biochar dose. A relation between a biochar dose and the temperature of soil was reported. It was concluded that with field doses of 5-8 and 100 Mg·ha⁻¹, temperature was at a similar level. In other cases, it was reported that the increase of the biochar dose by 10 Mg·ha⁻¹ causes the increase of the temperature of soil by average 0.5-1.0°C. Analysis of the data used in the paper confirmed the regularity that the scope of daily changes of superficial layers of soil is higher than the range of air temperature changes. It is important, however, to include the temperature of soil delay in relation to the air temperature which is emphasised by *inter alia*.

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IMPACT OF BIOCHAR ON WATER RETENTION IN SOIL

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ABSTRACT

Water is the most important substance which occurs in nature. As a soil solution it is a basis of life for plants, both as an indispensable element of plant tissues as well as a carrier of mineral salts collected by plants through root hair. Ability to collect water by plants depends on the power of its binding with soil and thus on the quality of soil and amount of water. Presence of water in soil determines all its essential functions. Thus, knowledge of water soil properties is a basic condition for understanding and description of its remaining functions. Physical properties of cultivation soil are variable in the vegetation season because they depend not only on the textural group, mineral composition of soil and content of organic matter but also on agri-technical treatments, species of cultivation plants and meteorological conditions. Unfortunately, results of the research on physical properties are often difficult to compare due to a choice of various dates of the research, application of various research methods and various measurement units. The objective of the article is to determine the relation of water retention in the superficial layer of soil in relation to the applied biochar dose. The highest value of full water capacity $0.49 \text{ m}^3 \cdot \text{m}^{-3}$ was observed for soil where $30 \text{ t} \cdot \text{ha}^{-1}$ of biochar was applied. The full water capacity calculated to soil capacity (in $\text{m}^3 \cdot \text{m}^{-3}$), theoretically is equal to general porosity and is often assumed as such in many papers. One should remember that the range of potentials corresponding to pF 2.2 - pF 3 concerns the amount of water grouped in soil pores which is easily available for plants and within the range of pF 3 - pF 4.2 difficult to access by plants, while the value of pF 7 (corresponding to capillary potential $-10\,000\,000 \text{ hPa}$ or $-10\,000 \text{ bar}$) means water content 0. It was reported that the curve for control soil where no addition of biochar was used indicates a slightly lower water content at a field water capacity in comparison to the soil where biochar was added which indicates that biochar influences the amount of water available for plants which the investigated soils were able to store.

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ADSORPTION OF LEAD ON AGRICULTURAL LAND AT ŽITNÝ OSTROV (SLOVAKIA)

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ABSTRACT

Heavy metals are important environmental pollutants threatening the health of human populations and natural ecosystems. Like other inorganic and organic contaminants, the fate of heavy metals in the environment is largely controlled by sorption reaction with soil colloids. The three main active soil colloidal constituents, clay minerals, metal oxides and organic matter are important sorbents of heavy metals owing primarily to their cation-exchange capacity (CEC) and their ability to form inner-sphere complexes through surface reactive groups, such as carboxylic and hydroxyl groups. Mutual interactions between clay minerals, Fe oxides, and organic matter can greatly alter the sorptive properties of these soil constituents for heavy metals, because such interactions usually involve cation exchange sites and carboxyl and OH surface groups, that is, potential sorption sites for heavy metals. The ecological effects of heavy metals in soils are closely related to the content and speciation of the elements in the solid and liquid phases of soils. In connection with the possible binding mechanisms of heavy metals in soils the concept of specific and non-specific adsorption was discussed. Recent results indicated that the adsorption of heavy metals on soil particles is not only restricted to the formation of surface complexes but can also take place in the interior of minerals. Heavy metal sorption by the organic residues at all concentrations was very high. A positive relationship between the rate of adsorption and dosage was obtained indicating that the adsorption process was influenced by increasing the dosage of the residue as well as the shaking period. The sorption data obtained was fitted Freundlich and Langmuir isotherms out of which Freundlich adsorption model was found to have the best fit for Pb. Movement and attenuation of heavy metals in soils is among other processes controlled by sorption onto the surfaces of soil particles. Processes like precipitation/coprecipitation, complexation and competitive effects of other cations may also influence the attenuation, but in all cases sorption will be involved, and at natural and slightly polluted concentration levels sorption may be the predominating attenuation process. The Pb sorption on ten investigated soils from Žitný ostrov area (Slovakia) has been studied in laboratory conditions. The aim was estimation adsorbed amount of lead S, determination of adsorption parameters for several soil types (L1,L2,L3,L4 loam soils, SL1, SL2, SL3, SL4 sandy-loam soils, CL5 clay-loam soil, C6 clay soil) and comparison obtained results with results introduced in publishing works. Batch adsorption experiments were performed with a very wide range of lead concentrations (0,01-500 mg/l Pb²⁺) at a constant soil/solution ratio. The experimentally determined parameters K_F , n of Freundlich isotherm and parameters Q_{max} , K_L of Langmuir isotherm.

⁵⁷FE MÖSSBAUER SPECTROSCOPY INVESTIGATIONS OF FACTORS AFFECTING THE TRANSFORMATION OF IRON IN THE NATURAL ENVIRONMENT

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ABSTRACT

The aim of this study is a complex characterization of natural iron compounds which occur in rock wastes and soils from industrial areas. In the areas where endemic iron compounds are being enriched by industrial emissions, iron compounds transformation could be very complex and unpredictable. The factors which could affect the mechanisms of iron-containing phases will be investigated by correlation of a Mössbauer study and results obtained using XRD and SEM-EDS. Additionally, the characteristics of selected magnetic properties as a function of temperature was carried out. Air pollutants are associated partially with industrial emissions. The components of these emissions are results of high temperature processes and are identified as particulate matter and technogenic magnetic particles. Their accumulation in the environment is concentrated mainly in the upper layer of the soil. The highest absorption occurs in the organic soil horizon and this process could vary depending on many factors, i.e. the geology of the studied area. The chemical composition of the bed rock may also play a role in the transformation of iron-compounds of anthropogenic origin. For that reason, rock wastes were examined. The analysis of the mechanism determining transformation is carried out in the context of the temperature stability of iron-containing compounds as a result of physical and chemical transformations such as: oxidation, weathering, grinding, and as a function of the depth of accumulation. The transformation of iron-containing phases from soils will be compared with the results obtained for rock waste with variable colour intensity. The change in the colour which could depend on the type and proportion of iron compounds naturally occurring in the rocks will be investigated. Varied proportion of iron-containing phases is subjected to changes in environmental conditions (meteorological, hydrological). In the case of this research material, the anthropogenic factor plays no crucial role in the transformation of iron-containing phases and the research material was collected in various climatic zones (moderate, subtropical and tropical). The obtained results in correlation with climatic conditions prevailing in a given area will allow to determine the parameters significantly affecting the final identified phases containing iron in the studied materials. The assessment of the temperature stability of iron compounds under specific conditions will be carried out on the basis of significant natural and anthropogenic factors affecting the phase composition of weathered rocks and contaminated soils.

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MOBILITY BEHAVIOUR AND ENVIRONMENTAL IMPLICATIONS OF TRACE ELEMENTS ASSOCIATED WITH SUBURBAN SOILS FROM THE STEEL INDUSTRY

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ABSTRACT

Urban soils are susceptible to anthropogenic contamination with steel trace elements and can present some potential toxic risks to ecosystems and peoples live in city. Our work was aimed on the study of mobility of steel trace elements (STEs), using single-step extraction procedure (Na₂EDTA) and ecotoxicity in suburban soils from the Košice, Slovakia. Potentially mobile forms represent the sum of risk element forms for the evaluation of soil biotoxicity. The potential environmental hazards posed by steel trace elements have assumed serious proportions due to their toxicity, bioavailability and geochemical behavior. The total element contents were determined by X-ray fluorescence (XRF) analysis, Zn, Pb, Cd, Ni, and As in extracts and elements contents in earthworms tissues by the atomic absorption spectrometry (AAS) after 7 days bioassays (chronic tests of mortality). An ecotoxicological study was performed with earthworms (*Dendrobaena veneta*) for the screening evaluation of element mobility of urban grass and agricultural soils samples. Elements concentrations (Zn, Pb, Cd, Ni and As) in the soils of the around U.S.Steel Košice indicating the significant contamination with Zn, Cd, and As, according to law No. 220/2004-2, Slovak Republic about the quality of the soil. The highest concentrations of studied elements were measured at sites located south of the ironworks in their vicinity. It was found that earthworms (*D. veneta*) in some cases caused decrease of metals concentration in contaminated soils. From the results of Pearson correlation analysis of yields, it can be seen that Pb - Zn, Cd, As; Cd - Zn, As; and As - Zn have obvious correlation, and the correlation between chemical parameters and other element (Ni) is not relevant. The correlation between elements can reflect whether they are from the same source, and the highly correlated elements may have the same source (around U.S.Steel Košice).

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STABLE LEAD ISOTOPIC RATIOS IN SURFACE DEPOSITED SEDIMENT AS INDICATOR OF URBAN GEOCHEMICAL PROCESSES

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ABSTRACT

Urban surface deposited sediments (USDS) play an important role in the processes of geochemical transformation of the urban environment. The content of heavy metals in the sediments is the indicator of environmental aspects of this transformation. When studying the pollution of the sediments with Pb, the additional information is provided analyzing the relations with Pb stable isotopic ratios. The isotopic ratios Pb204/Pb206, Pb207/Pb206, Pb208/Pb206 were determined in the surface sediments from five Russian cities: Nizny Tagil (48 samples), Ufa (43), Magnitogorsk (41), Tyumen (42), and Chelyabinsk (60). The USDS samples were collected during the summer period 2016-2018 from local surface depressed areas of microrelief in residential districts of the cities. The concentrations of typomorphic macro- and microelements, potentially harmful elements (Pb, Cu, and Zn) were also measured in the collected samples. At the first stage of the analysis, the initial geochemical baseline conditions for USDS were determined. A part of the samples was classified as polluted with Pb; for a part of the samples, no changes in the initial geochemical conditions were found. An analysis of Pb isotopic ratios for 'polluted' and 'clean' samples allowed drawing the following conclusions. In a group of polluted samples compared to clean in all cities, there is a decrease in the relative contribution of Pb206 to total Pb content compared with Pb204, Pb207, and Pb208. In the group of samples polluted with Pb, isotopic ratio Pb208/Pb206 is shifting towards the values characteristic to leaded gasoline which was used in Russia before 1995: isotopic ratios in A-76 gasoline Pb207/Pb206 - 0.8811, Pb208/Pb206 - 2.129. For example, in Ufa, the ratios Pb207/Pb206 and Pb208/Pb206 in clean samples were 0.849 and 2.085, respectively, when 0.857 and 2.100 in polluted respectively. The shift in isotopic ratios was the same in all cities. In Nizhny Tagil the largest ratios of Pb207/Pb206 were obtained both in polluted and clean samples in comparison with other cities. Nizhny Tagil is one of the cities with the highest levels of Pb pollution in Russia. Thus, in the cities, there was pollution of surface sediment with Pb, which may be associated with the use of leaded gasoline as fuel for vehicles before it was banned. Lead is still remaining in the environmental compartments in an urban area. The analysis confirmed that USDS is a sensitive indicator of the environmental state of the urban environment.

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NEGATIVE IMPACT OF INVASIVE PLANTS ON RIVERBANK VEGETATION

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ABSTRACT

The research presented in this paper deals with the issue of invasive plant species. Invasive plants are characterized with the high regeneration potential and with a negative effect on populations of our native species and habitats. The occurrence of these plant taxon at a given site is not natural, and their appearance outside of their natural habitat is most often due to anthropogenic activity. Our research is focused on plant species *Fallopia japonica* and *Impatiens glandulifera*. The aim of the study is the determination of suppressing possibilities of their negative impact on riverbank vegetation. From the results of the first stage of the research, it is known that plant material is transported downstream, the ability of reproduction of the plant material maintain for at least for 4 weeks, and after being caught on the riverbank, it can establish a new population. The overgrowth of these invasive species presents a risk to the original riverbank vegetation, and the ecological stability is being disturbed. The eradication and prevention system is a necessary solution to this problem. The research is conducted on the Blatina River in Pezinok, Slovakia. The first method of eradication was the mechanical removal of *Fallopia japonica*. The two selected localities were cut. In the next growing season, an increase in the population of *Fallopia japonica* was recorded, and one new location was created. The second method of eradication was the chemical method. For chemical eradication, spraying based on the Invasive Plant Removal Guidelines for the Slovak Republic was used. An important finding was that the effectiveness of the chemical eradication is dependent on the area of the sprayed leaves and independent on the concentration of the solution. The next step was the comparison of vegetation cover after mechanical and chemical eradication. A soil probe was performed on two selected areas; area after the mechanical eradication and the area after chemical eradication. A root sample was taken from both areas. Subsequently, the viability of the root system and its stabilizing function with respect to bank erosion were evaluated. The effectiveness of chemical eradication was much stronger. The most optimal way is to remove the plant at their early stage of the growing cycle when the leaf area is smaller. The result is then ecologically and economically more advantageous. After chemical eradication, it is necessary to remove dead plant residues in the autumn to create optimal light and wet conditions for the growth of potential natural vegetation. Invasive plants in riverbank vegetation have a negative impact on stability and potential natural vegetation. The best way to control their incidence is eradication.

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ANALYSIS OF THE DIVERSITY OF MICROSCOPIC FUNGI IN THE SOILS OF ADJARA, GEORGIA

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ABSTRACT

The publication deals with the studies on the diversity of species composition of fungi in various layers of soils (red, sod-podzolic, marsh, urban) of the Adjara. The aim of the study was to identify and determine the composition of fungi; Establishment of the scale of development and spread of fungi in adverse and favorable conditions; Ecological status evaluation of soils in Batumi City. For the isolation of fungi in various soil samples, a sterilization method, serial dilution, and a scattering method were used. The presence of fungi was detected in various soil samples based on morphological characteristics, percentage frequency, growth rate, and colony forming units. The study has found 59 species taxa of soil fungi, belonging to the divisions of Ascomyota (39 species), Zygomycota (15 species), Basidiomycota (2 species), Deuteromycota (3 species). 7 species of fungi involved in forming of consortium have been specified as well. Most widely distributed fungi in soil samples were of the genera *Aspergillus* (*A. flavus*, *A. niger*, *A. versicolor*), *Paecilomyces* (*P. variotii*), *Trichoderma* (*T. koningii*, *T. hamatum*, *T. polysporum*, *T. viride*), *Mucor* (*M. circinelloides*, *M. hiemalis*, *M. racemosus*, *Mucor* sp), *Rhizopus* (*R. oryzae*) the genus of phytopathogens *Fusarium* (*F. oxysporum*, *F. solani*), *Verticillium* (*V. lateritium*, *V. sp*), *Phytophthora* (*Ph. sp*), *Rhizoctonia* (*R. sp*), *Pythium* (*P. sp*) and of genus *Sporothrix* (*S. schenckii*). Among them *Aspergillus niger*, *A. flavus*, *Chaetomium* sp and *Acremonium* sp were dominant fungi in all soil samples. Frequency percentage showed that marsh soil is rich in fungal population as compared to red and sod-podzolic soils, yet the greatest biomass is in organic soil. 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 fungi from each ecotype of soil. The soil samples collected from polluted sites were more affected by wastewater which affected the population densities of fungi. Experiments have shown that *Aspergillus niger*, *A. flavus*, *Fusarium oxysporum*, *Trichoderma koningii*, *T. hamatum* and *T. viride* grew well on contaminated soil containing heavy metals. On this basis, we will study them further in order to determine their stability to heavy metals.

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THE EFFECT OF ORIENTED STRAND BOARD SUBSTRATE TREATMENTS ON THE ADHESION OF CEMENT ADHESIVES AND COATINGS

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ABSTRACT

Thanks to its properties, wood as a building material has unbelievable potential. It simultaneously provides answers to frequently discussed questions concerning the renewability of resources and the energy performance of buildings. The material most frequently used as sheathing for timber structures is planar large-format oriented strand board (OSB). The unfavourable effects of the weather on unprotected wood and timber products can cause changes to the mechanical and chemical properties of the wood and if unchecked can do irreversible damage. It is therefore always necessary to apply additional surface finishes to sheathing. In the case of peripheral walls, these surface finishes usually comprise an outer thermal insulation system, while in the case of internal surfaces, extra sheathing made from board materials is added via adhesion or mechanical attachment. It is possible to glue extra layers directly onto OSB but only if suitable adhesives are used, and the range of products is limited. The research described in this article focuses on the treatment of OSB substrate so that it is possible to employ cement adhesives that are commonly used for the gluing of thermal insulation but which cannot normally be used on an untreated base without the danger of adhesion loss. The research concerns a comparison of test specimens with various kinds of penetrative coatings or bonding primer applied under predefined conditions and subjected to different forms of applied loading. The contribution contains a definition of the basic material, test specimens, test methods and a selection of 5 different types of material for the surface treatment of the test specimens. Graphs comparing the influence of the individual finishes on the adhesion itself are included in the outputs. The conclusion contains the test results as well as a presentation of the effects of individual treatments, and potential further research is suggested. The results are of benefit to subjects involved in the preparation and realization of construction work that deal not only with timber structures in particular but also with the general use of OSB structures as a part of the building envelope.

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**IMPACT E REFORESTATION WORK ON VEGETATION COVER IN SEMI-ARIDE REGION: THE CASE
GREEN DAME OF EL BAYAD (NAMAA DEPARTMENT) IN ALGERIA**

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ABSTRACT

Some work on the ground vegetation cover in the Green Dam in semi-arid region known by the scarcity of water volume recorded in the rainy season, recorded their high intensity for a short period and high temperatures recorded during both seasons. Spring and summer can negatively impact the structural stability of the soil under the combined effects of climate changes observed for decades and human activities applied to soils and rare plant cover initially fragile. The imperatives dictated by the urgency to cope with the desertification of this semi-arid region inevitably lead to effects contrary to the desired goal, which is a source of mismanagement of the reforestation program and the technical choices applied. The imperatives dictated by the urgency to cope with the desertification of this semi-arid region inevitably lead to unintended effects whose main causes are the mismanagement of the reforestation program and the applied technical choices, which are also amplified by overgrazing of sheep farming. The final consequences are a greater fragility of the environment, followed by gradual gullying following the disappearance of the meager vegetation cover in place and the opening of networks of tracks used as communication with the reforestation projects that lead to the destruction of the lean vegetal cover present. If we have to talk about the failures of certain plantations in the region, we list the choice of the forest species chosen for the reforestation project, their difficult water maintenance during the summer period; the drought and the high temperatures recorded during this stage, reduce the recovery rate of the plants to less than 50% with wide heterogeneous ranges of missing in the perimeter retained in the plantation. This operation, so commendable for reforestation to cope with the advance of desertification, has only aggravated the fragile balance of the initial steppique ecosystem in certain areas selected in the project.

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THE CONDITIONS OF SEDIMENTATION OF GDAŃSK BAY SEDIMENTS (BALTIC SEA, POLAND) IN THE LIGHT OF LITHOLOGICAL FEATURES AND CARBON CONTENT

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The research has been carried out for many years, the aim of which is to thoroughly identify sedimentation conditions in the area of the Gulf of Gdańsk. This process is conditioned by many factors, among which the quantity, type and quality of sedimentary material subject to sedimentation, the dynamics of the reservoir, its depth as well as the morphology of the bottom should be mentioned. Research sediments were collected in April 2014, during a research cruise on ORP Heweliusz. Sediment cores with a length of approx. 35 cm were taken in parts of the basin characterized by a different bathymetry, dynamics and a different distance from the main sources of supply of the terrigenous material. The GD core was taken from the Gdańsk Deep, the PB from the Puck Bay and the other two cores within the Gdansk Deep slope: UP near Hel and VR at the level of the Vistula estuary. The sediments from collected cores were subjected to wet sieve analysis and pipette analysis. The obtained results allowed to determine the type of lithological sediment and the calculation of graining indices, on the basis of which the interpretation of the sedimentation conditions was carried out. In the sediments, the carbon content was determined using the Perkin Elmer 2400 CHNS / O elemental analyzer. It was found that clayey silts and silty clays dominated in the PB, UP, GD core throughout the profile. Only in the VR core, there was a clayey sand, which proved that the sedimentation environment is more dynamic, conditioning the deposition and the periodic redeposition of sediments. It is the shallowest located station near the source of supply with terrigenous sediments (estuary of the Vistula). In the surface layer of the cores, the total organic carbon (TOC) content exceeds 4.7% and reaches up to 8.3%. The lowest TOC content, ranging from 0.8 to 2%, was found in the VR core. The total inorganic carbon (TIC) ranged from 0.18% (VR) to 1.77% (UP). In all profiles, both carbon forms decreased with depth. The greatest dynamics of changes in the surface layer of sediments (10 cm) characterized the UP core (4.1-6.6%), while the smallest changes characterized the PB station (4.7-4.9%). The parameter relations indicate a close relationship between the carbon content and the dynamics of the sedimentation environment and the proximity of the power sources.

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EFFICIENCY OF PHOSPHORUS REMOVAL FROM NATURAL WATERS WITH SORBENTS PLACED IN WATER PERMEABLE NONWOVENS

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ABSTRACT

An important aspect of lake restoration is the reduction of phosphorus (P) concentrations in water. To achieve this effect, various methods are used, including chemical inactivation by means of addition of different substances into the water column or sediment. Although the efficiency of chemical methods is high, there are numerous concerns related to the introduction of large amounts of atypical compounds to aquatic ecosystems, the possibility of the appearance of their toxic forms, such as aluminium as a result of pH changes. The aim of the research was to evaluate the possibility of using water-permeable nonwovens as sorbent carriers. A bag made of nonwoven is filled with the sorbing material. When placed in the water column, sorbent present in the bag reduces phosphate (PO_4^{3-}) concentration in the water due to water inflow into the bag. The bag is then removed from the water together with sorbent and sorbed PO_4^{3-} , which enables permanent removal of P and sorbent from water reservoirs. Three synthetic sorbents were used: SINO BENT (form: paste, composition: calcium, iron and magnesium embedded in a bentonite carrier), HYDROPHOSBIND (hydrogel capsules, biopolymer with embedded FeCl_3), precipitated calcite (PCC, powder, CaCO_3) and one natural sorbent: ground calcite (GCC, powder, CaCO_3). Water samples for the study were taken from the eutrophic lake from the epi- and hypolimnion zone. Sorbents efficiency was tested in low (0.043 and 0.067 mg PO_4^{3-} /L) and high (0.230 and 0.540 mg PO_4^{3-} /L) concentrations at two temperatures (6°C and 20°C). Sorption of PO_4^{3-} was tested for the sorbents placed in a bag made of permeable nonwovens. The dose of materials was 1g/L, except for HYDROPHOSBIND (5 g/L). Additional experiments were carried out with addition of effective microorganisms to test their effect of the sorption behaviour of the tested sorbents. An unambiguous PO_4^{3-} loss from the solution was observed for three materials: PCC, GCC and HYDROPHOSBIND. Given for 1g of the sorbent, the highest losses (19-79%) were found in PCC and the lowest (5-13%) in HYDROPHOSBIND treatments. For these materials the effectiveness of PO_4^{3-} removal raised with rising temperature and the initial concentration of PO_4^{3-} in water. The addition of probiotic organisms favoured the reduction of PO_4^{3-} concentration, especially in the presence of PCC. The addition of SINO BENT usually resulted in an increase in PO_4^{3-} concentration and pH decrease even to pH=6.45.

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**ELABORATION OF THE RELATIONSHIP BETWEEN THE GROUNDWATER LEVEL IN UNCONFINED
AQUIFER AND THE VALUE OF PRECIPITATION AND EVAPOTRANSPIRATION**

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ABSTRACT

Groundwater is water that is below the surface, below the aeration zone. Their level depends primarily on the abundance of rainfall, so in different places and at different times it is different. The largest fluctuations of the of groundwater level are in a places of rivers surroundings and depressions, which is the reason why regular control is necessary. Moreover, the groundwater level is also dependant on a soil type and hydrological conditions. A very important part of a water cycle monitoring is observing atmospheric energy balance which describe an interaction between atmosphere and land. The balance can be computed as a difference between precipitation and evapotranspiration. Precipitation is the factor that supply groundwater, while water leaves ground by transpiration. In the paper trends and a correlation between the groundwater level in unconfined aquifer and values of precipitation and evapotranspiration is assessed. The groundwater level in unconfined aquifer is measured by the National Hydrogeological Service, while values of precipitation and evapotranspiration are the part of assimilation models.

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REMOVAL OF HEAVY METALS IN DRINKING WATER BY IRON-BASED SORPTION MATERIALS

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ABSTRACT

Adsorption on a suitable adsorption material is among the most frequently used methods in water treatment. In terms of plant operation, filtration (sorption) process represents a simple, effective and economical friendly method of heavy metals removal namely for the possibility of using a large scale of substances with a sorption ability – sorbents. Oxides, oxyhydroxides and hydroxide containing iron are among the most frequently used sorbents of the heavy metal removal. The quality of the treated water (pH, silica, phosphorus, fluorides, sulphates, chlorides, vanadium, total mineralization, iron and manganese, organic matter, etc.), redox conditions and the valency has the impacts on heavy metal removing efficiency. The objective of this work was to verify the sorption properties of granular iron-based sorption materials (CFH12, CFH18, Bayoxide E33, GEH) in removal of arsenic, antimony and nickel from drinking water. Under the given operational conditions (average concentration of arsenic in raw water 52,96 µg/L, average velocity 5.6 m/h, concentration As 10 µg/L at the outlet of media) adsorption capacity of filtration material CFH12 and Bayoxide E33 for arsenic was 1.203 mg/g and 1.463 mg/g, respectively. The limit of 10 µg/L of As was exceeded after 24048 BV and 28623 BV (Bed volume), respectively. According to the model tests (concentration of nickel in raw water of about 50 µg/L, filtration rate 5.8 m/h, concentration Ni 20 µg/L at the outlet of media, pH 7.0) the adsorption capacity of nickel for Bayoxide E33 was set to 198 µg/g, for CFH18 107.5 µg/g, GEH 97.5 µg/g and CFH12 38.1 µg/g. The limit of 20 µg/L of Ni was exceeded after 4808 BV for Bayoxide E33, 1409 BV for CFH12, 3007 BV for CFH18 and 3218 BV for GEH. For the average antimony concentration of 58.35 µg/L in raw water and filtration rate of 5.1 m/h, the limit concentration of 5 µg/L at the outlet of the sorption column was reached at the bed volume 1700 for GEH, 1120 for CFH18, 790 for CFH 12 and 715 for Bayoxide E33. The adsorption capacities were as follows: 83.6 µg/g for GEH, 91.4 µg/g for Bayoxide E33, 54.3 µg/g for CFH18 and 42.4 µg/g for CFH12. The experiments proved that iron-based sorption materials GEH, CFH12, CFH18 and Bayoxide E33 can help reduce the concentration of heavy metals in water below the limit of the Slovak Republic Decree No. 247/2017 on Drinking Water.

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REMOVAL OF THM PRECURSORS BY ADSORPTION, COAGULATION AND UV IRRADIATION

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ABSTRACT

The general characteristics of humic substances (HS) and their negative effect on water quality and its treatment are described. The paper presents the results from the removal of humic substances from the Hriňová (Slovakia) water reservoir using 1) granular activated carbon (GAC) from two producers (Chemviron, Cabot) at three different pH levels, 2) by coagulation with two coagulants (aluminum sulfate and ferric sulfate), and 3) by an advanced oxidation process using UV radiation with the addition of the oxidizing agent hydrogen peroxide. The effectiveness of the removal of humic substances (expressed by the TOC parameter) from water with adsorption by GAC, depending on the contact time with the water, ranged from 14 % for one hour to 50% for eight hours of contact time. The calculated GAC adsorption capacity of the humic substances ranged from 0.05 mg/g for one hour to 0.19 mg/g for eight hours of contact time. The pH of the water had no significant effect on the level of efficiency. A high level of efficiency (50%) and the lowest value of TOC are obtained at a pH of 6.5. The humic substances remain in the water though the optimal dose of the coagulant was used. The ferric sulfate coagulant is more suitable for removing of humic substances from water as aluminum sulfate. A dose of 16 mg/L of 1% solution $\text{Fe}_2(\text{SO}_4)_3$, which is the equivalent of 4.47 mg/L Fe^{3+} , is sufficient for the reduction of humic substances below 1 mg/L. The effectiveness of the removal of humic substances with coagulation using iron sulfate was 83% for a parameter of HS and 50% for TOC or COD_{Mn} . The iron sulfate has the influence on a reduction in pH of water, therefore pH of water should be adjusted after coagulation. A laboratory study of removal of humic acids from surface water by UV radiation and addition of hydrogen peroxide in order to increase the oxidation of organics are presented. The results showed that UV radiation and addition of H_2O_2 during the first few minutes of irradiation increases the concentration of the humic substances, COD_{Mn} and TOC in water. After 3 minutes of exposure to UV radiation, these values were reduced to baseline, and in the next irradiation phase the values of the monitored parameters decreased. The highly reactive OH radicals with a high oxidation potential oxidize humic substances to various intermediates (a lower molecular weight substances). After 20 minutes of irradiation, a decrease in the parameters of approximately 39% for TOC, 62% for COD_{Mn} and 37% for humic substances was observed.

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MODELING OF THE WORK OF CUT AND STRETCHY SHEET IN SPAN BEAM STRUCTURES WITH THE MIXED REINFORCEMENT

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ABSTRACT

The constant growth of the intensity and volumes of automobile transportation causes the necessity of the increasing the requirements to the serviceability of transport facilities. The issue of the serviceability and safe operation of the existing highway or pedestrian bridges, which were built many years ago, is always relevant. Therefore, there is a choice: either to restore and strengthen the existing facilities or to replace them completely. It is expedient and efficient to use a steel cut and stretchy sheet in the form of the external ribbon reinforcement at the strengthening of the reinforced concrete span bridge structures. In the future, the steel cut and stretchy sheet is properly attached to the surface of the structure and the filling of the sheet cell is done by the layer of the cement and sandy solution (the process of concrete spraying) or protected by a concrete layer for the prevention of the sheet corrosion. Such a cut and stretchy sheet can be effectively used in new structural elements at new construction as a working longitudinal or transversal reinforcement. An effective version of the use of the cut and stretchy sheet is possible for the strengthening not only bending structures but also compressed and compressed out of center reinforced concrete and stone ones. Thus, the issue of the research and modeling of the work of the steel cut and stretchy sheet in the array of concrete under the linear stressed state conditions is of vital importance. The article presents the results of the experimental and theoretical research of the work of the steel cut and stretchy sheet under load; provided the physical model of such a process; substantiates the effectiveness of its use and the placement in span beam bridge structures.

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INFLUENCE OF FREEZE-THAW TEMPERATURE ON LOAD-BEARING CAPACITY OF STEEL-CONCRETE BEAMS CARRYING TRANSVERSE LOADS

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ABSTRACT

The use of steel-concrete structures in which, external or extra-strong non-stressed sheet reinforcement are widely used in the stretched (sometimes in the compressed zone) in industrial construction as well as in the process of bridges and tunnels construction. Such structures are continuously thermal loaded during operation. Existing calculation methods of steel-concrete structures do not allow accurate estimation of the influence of freeze-thaw temperatures because there are contradictions considering this problem. The method of frost resistance calculating in Ukraine researches concrete cubes but it does not take into account the existence of reinforcement in the construction, its quantity and placement in the cross-section. This problem became even more relevant under conditions of Ukraine transition to the European design standards. According to the demand of the Eurocode the number of cross reinforcement in the back-up area is increased in comparison with national design standards. Single-span steel-concrete beams were manufactured and examined in order to determine the influence of freeze-thaw temperature on the constructions. Flat deformed reinforcement was adopted for the perception of tensile forces. To determine the strength characteristics of concrete, cubes and prisms were additionally made from the same concrete as the beams. The study of beams was conducted under the following conditions: **a.** Load beams were performed under normal natural conditions at $t = 20^{\circ} \pm 25^{\circ}\text{C}$; **b.** Load beams were performed after a certain number of freezing cycles at $t = -30^{\circ} \pm 4^{\circ}\text{C}$ and thawing at $t = +18^{\circ} \pm 4^{\circ}\text{C}$, not later than 5 days after thawing; **c.** Testing of beams was performed after 20 cycles of immersion in a 5% salt solution (NaCl) during the freezing of the beam (24 h) and drying at a temperature of $t = +18^{\circ} \pm 4^{\circ}\text{C}$ for thawing time for 12 h. To determine the freezing point of the beam and measure its internal temperature, 10 thermocouples were introduced into the beam's body. On the basis of the adopted research method a graph of the freezing rate of the experimental beams and the destructive influence of freeze-thaw temperature on the load-bearing capacity of the steel-concrete beams were obtained.

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ENERGY EFFICIENT PROCESSING OF GEOTHERMAL WATER FOR ENERGY-HEATING OBJECTS OF THE BUILDING INDUSTRY

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ABSTRACT

In the European Commission's biennial report, the European Union increases the share of renewable energy in the energy balance of the EU Member States. Growth occurred in all countries. The EU aims to increase the share of sources of this type of energy up to 20% by 2020. In 2008, the installed capacity of power generating geothermal plants in the world amounted to about 11 million kW with a production of 55 billion kWh of electricity. The Energy Community supports the National Energy Efficiency Action Plan of Ukraine in this direction. Due to the energy crisis in Ukraine, the problem of significant increase in the efficiency of production, transportation and use of energy is of particular importance. Considering the significant role in energy supply of the country, the issues of efficient use of heat energy in all areas of these systems are solved: generation for heating water or for steam generation; transportation to the consumer, as well as when using it by the consumer. On the heat exchange surfaces of the systems, scale occurs, which leads to deterioration of heat and mass transfer processes and heat energy indices [6]. This affects the overall performance of the process. In this paper, the question of determining the parameters of an electromagnetic field in the process of treatment of pure water is solved and physical models of the change of the structure of pure water after treatment in the electromagnetic field and the change in the nature of its interaction with different surfaces are developed. The technology of combating calculi for various technological processes that influence the energy efficiency of power and thermal objects, including in the construction industry, is substantiated. Their ecological indicators are determined with insignificant material and energy expenses on the basis of the use of geothermal waters. To improve the efficiency of the system, perform preliminary cleaning and softening water before feeding it to the heat pump by the method of processing it in fields of constant current and in the field of permanent magnets. Next, filtration and water treatment in the field of electromagnets with certain parameters of high frequency of electric current and field induction are carried out. The scientific principles of changes in structural and thermophysical properties of water, ecological and technical technologies, which include the implementation of its basic principles, in which environmental and anthropogenic factors perform a functionally unifying role, are developed.

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FACTORS INFLUENCING HOUSEHOLDS' VULNERABILITY TO DESERTIFICATION IN NORTHERN KATSINA, NIGERIA

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ABSTRACT

Desertification poses a serious threat to the livelihood of an estimated 30 million people in the desertification frontline states of northern Nigeria. The rural population of Katsina state as in any other frontline state are considered more vulnerable to the menace of desertification. This study therefore examined the factors influencing household's vulnerability to desertification in northern Katsina, Nigeria. Data were collected from both primary and secondary sources. A systematic random sampling technique was employed to select 633 respondents in 18 rural communities from the six local government areas selected for the study. Data were collected on the socio-economic characteristics, perception, causes as well as the factors influencing households' vulnerability to desertification. Findings revealed that 93% of the samples are male - headed farm households, 71% were above 45 years of age and 80% had no basic primary education. 73% are full time farmers and millet is the most important crop grown. The main perceived causes of desertification were deforestation, environmental mismanagement, climate change and act of God. Effects of desertification were manifested in declining crop yields, low income, loss of farmlands and extinction of flora and fauna species. The factors influencing vulnerability of farm households to desertification were age of household head, educational level, farming status, size of the household, access to credit facilities and access to non-farm income ($p < 0.05$). The study therefore recommended the need to promote adult education, increase access to credit and farm input, livelihood diversification, intensified efforts towards effective management of environmental resources, and involvement of vulnerable groups in the formulation and implementation of policies aimed at combating desertification.

SANDSTONE GRINDING IN ELECTROMAGNETIC MILL: CASE STUDY

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ABSTRACT

The milling process is currently used in many industries, from mineral processing to the chemical, cosmetic, construction and food industries. It is a very energy-consuming process, the aim of which is to bring raw materials to an appropriate grain size. Due to the widespread use of this process, solutions are still being sought to reduce energy consumption while increasing efficiency. The selection of the grinding device and its technical parameters determines the obtained degree of fragmentation, and the efficiency is strictly dependent on the type of feed. The purpose of this article is to present the possibilities of grinding sandstone in an electromagnetic mill, taking into account the obtained grain classes. Grain size investigations have shown the effectiveness of using an electromagnetic mill as a replacement for a ball mill. The grain analysis of the feed demonstrated no presence of grains with a diameter of less than 0.1 mm. After finishing the grinding, a total of 21% by volume of clay fraction and over 50% of silty fraction were obtained. When using an electromagnetic mill, 71% clay fractions (so-called flours) were obtained, and grains with a diameter above 0.1 mm were completely reduced. The effectiveness of grinding sandstones in a ball and electromagnetic mill was compared, using the same grain diameters and feed volume. The usefulness of an electromagnetic mill for grinding raw materials in order to obtain mineral flours was observed, obtaining 71% of the fraction with the grain size equal to or less than 0.25 μm . While for this size of grains in the ball mill, only 21% of them were obtained. Considering the smallest possible diameter of grains obtained during the grinding process, the electromagnetic mill turned out to be more effective.

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TRANSPORTATION OF WASTE IN THE LIFE CYCLE ANALYSIS

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ABSTRACT

Waste transportation has a large share in the structure of waste management costs. According to the definition, transportation is the movement of people and objects by means of transport. The transportation of waste involves the shipment of waste from the place of its production to the place of its processing, disposal (including storage) or collection places, including their transfer to and from the recipient of waste. Waste transportation is a difficult and specialized task for carriers. Vehicles transporting waste must be adequately equipped with special equipment and means of protection. Waste transportation can account for up to 70% of the total waste management costs. The purpose of the article was to determine the impact of the organization of waste transportation and its cost-consumption on the product life cycle. The price of the service is an individual value, which is set between the client and the carrier. Before the order is processed, the company performs a balance sheet that shows the profitability of possible transport. The rate per kilometer travelled often depends on the freight carried and the country in which the service is performed. In the case of a company, the rate for waste transportation is 0.87 EUR / km and 0.92 EUR / km for product transportation. The price of transportation of the finished product is higher. The analysis of the company shows that the company generated revenue of 72.37 euros for waste transportation and 96.67 euros for product transportation. Waste transportation has a smaller financial impact on the product life cycle than product transportation, and the analysis has demonstrated that in the product life cycle, the transport in each link should be calculated separately. Waste transportation is profitable for companies with a larger fleet of vehicles.

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APPLYING CONTINGENT VALUATION METHOD IN ASSESSING URBAN PARKS: THE CASE OF NIARCHOS IN GREECE

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ABSTRACT

Urban parks are of great importance for the sustainability in the cities. The multiple influences that the parks and green spaces offer both in humans and in the environment have been widely recognized in the literature and include the physical and mental health of citizens. The urban parks are oxygen sources for cities, they make people feel close to nature, they contribute to the reduction of anxiety and they also offer many activities to people. The impact of green spaces is of vital importance as they contribute to the reduction of temperature and they offer a cool environment improving with this way the microclimate. The purpose of this study is to estimate the value that people attribute to urban parks applying the Contingent Valuation Method (CVM). This value is estimated through urban park visitors' willingness to pay a hypothetical entrance ticket. For the purpose of our study, a survey was conducted to visitors of the Niarchos Park in Attica, Greece from the July of 2018 to February of 2019. Subsequently, the empirical analysis is based on regression models. The demographic characteristics, such as the age, the educational level, the employment and the number of household members were found to be significant prognostic factors for people's willingness to pay or not in order to use the park, as also the importance that people give to green spaces. The visitors' expenses for the park visit were also taken into consideration and they are statistically important. The differentiation that may exist between a hypothetical scenario which is presented to park's visitors and of a real situation should be taken into account.

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UNDERSTANDING AND MEASURING SUSTAINABILITY PERFORMANCE IN THE BANKING SECTOR

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ABSTRACT

The growing demands of business stakeholders have led to the adoption of sustainable strategies and the increase in sustainability reports. At the same time, the assessment and measurement of corporate performance now extends beyond the established financial return. This paper follows the argument that it is important for each company to be an entity that plays an active role in sustainable development. On the other hand, it is commonly accepted that there is no single, integrated way of assessing this performance. The purpose of this paper is to provide a framework for understanding and measuring corporate sustainability in case of the banking sector. More specifically, the paper aims to fill the gap in the corporate sustainability assessment in the banking sector because there is, in fact, a tendency to underestimate the impact these sectors have on their non-direct relationship, particularly in the environmental issues and in social responsibility. A theoretical framework of an integrated composite sustainability index is analyzed based on the adoption of the GRI sustainability guidelines and the application of the analytic hierarchy process. The construction of a composite sustainability index includes the economic, environmental and social dimension of entrepreneurship. Each of the three sub-indices is a synthesis of key performance indicators, which are usually the subject of organizations' annual sustainability reports. This process is used to benchmark each company over a period of time and provide an indicative tool for its analysis of banking companies. Managers can use this analysis as a valuable component for comparing them over time, so as to adopt the appropriate sustainable strategies and to improve the economic, environmental and social performance. A key tool to achieve sustainability in banking sector is to analyze the corporate performance of the organizations. This will give a competitive advantage to bank operators.

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IMPACT OF CLIMATE CHANGE AND HUMAN ACTIVITIES, DURING THE ANTHROPOCENE, ON THE OASIS SPACES: THE CASE STUDY OF THE TOUAT REGION - ALGERIA

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ABSTRACT

The region under study is located in the central part of Sahara, hyper arid (- 10 mm/year). Here the man, since the origin of agriculture (- 12 000 years), has participated in the rebuilt of the big ecosystems. When water is close to the ground or brought to the surface by wells or "foggaras" the date palm appears and the oasis take birth. The Relic Rivers coming from the Atlas Mountains and the Hoggar massif are dry wadis which flow occasionally (some hours or some days) feeding the alluvial phreatic zones. Beside of that, there are water reservoirs such as the "Continental terminal"(Neogene) and the "Continental intercalaire" (Albian). The last one rules the life of this region by permitting the creation of microclimates on the points of emergence; therefore, during many centuries the men have taken benefit from these points of emergence, only ones in this wide aridity. In fact, through more than 5000 years of history the people of this region have rationally exploited the Albian water, but with the progress of technics of drilling more and more deeper, the rate of flow increased from 3,5 m³/s to 8 m³/s (1992) and 13 m³/s (1998), and more and more to satisfy the increasing need for human activities. The consequence is the disruption in the former Oasis systems due to the progressif drying of the ground water linked to the lowering of the Albian water table. Conrad (1969) has shown that during the prehistoric period (- 2000 years) a water table lowering started; this is marked by the difference of hight between the present points of emergence and the Neolithic ones which are higher than the present emergences. The maximum level has been reached during the arid (- 4000 years), that succeeded to the neolithic humid (- 6000 years), this while, which permitted to fill the albian reservoir of this region, shows that the feeding is done outside of the desert region which are more watered (Atlas mountains) Unfortunately, these last decades, these watered zones are suffering an increase in temperature and a dope of rainfall. The decrease of meteoric water combined to the abusive exploitation of water for the agriculture and the projects of unconventional hydrocarbon exploitation, voracity in water for hydraulic fracturation, lead to an inevitable water last. So, it is imperative to determine the critical limit of exploitation and the rate of flow, to prevent this region from drying and the dead of the Oasis spaces. In a desert, there is no superfluous, therefore the waste is not tolerate, each error become funeste.

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TOXICOLOGICAL EFFECT OF TRICLOSAN ON DAPHNIA PULEX (WATER FLEA) AND LACTUCA SATIVA (LETTUCE) THROUGH BIOASSAYS

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ABSTRACT

Triclosan is an antibacterial and fungicidal chemical, currently considered an emerging contaminant due to its wide use in different personal cleansing products (soaps, gels, toothpastes) and for its persistence in the aquatic environment even after treatment of domestic wastewater. The objective of the study was to determine the toxicological effect of triclosan on *Daphnia pulex* (water flea) and *Lactuca sativa* (lettuce) by bioassays. The study was conducted experimentally under a completely randomized block design (RCBD) in two bioassays, six concentrations of triclosan and three times of exposure were used, the acute toxicity evaluation was on an animal and another vegetable organism, the response variable was the mortality and growth of seedlings respectively, for the calculations of mean lethal concentration (LC_{50}) non-linear regression analysis and multiple range test were used. The results were: the mean lethal concentration (LC_{50}) of triclosan on *Daphnia pulex* (water flea) analyzed by bioassay, was estimated at $0.17938 \text{ g} \cdot \text{l}^{-1}$ triclosan, the interval lower than 95% confidence is $0.06036 \text{ g} \cdot \text{l}^{-1}$ and the upper range of $0.28704 \text{ g} \cdot \text{l}^{-1}$. The concentration of medium inhibition (LC_{50}) of triclosan on seedlings of *Lactuca sativa* (lettuce), was estimated at $6 \text{ g} \cdot \text{l}^{-1}$ of triclosan. The concentration with unobservable adverse effect (NOAC) of triclosan on *Daphnia pulex* (water flea) was estimated at $0.1 \text{ g} \cdot \text{l}^{-1}$, and for *Lactuca sativa* (lettuce) it was estimated at $2 \text{ g} \cdot \text{l}^{-1}$ of triclosan. It is concluded that triclosan shows a toxicological effect on an animal organism and another vegetable, causing mortality in the first and inhibiting growth in the second.

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ANALYSIS OF A SINGLE-FAMILY BUILDING LIFE CYCLE – CASE STUDY

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ABSTRACT

Increasing the ecological awareness of society has contributed to the fact that the natural environment is no longer perceived only as a resource, but above all as a system necessary for protection and preservation for future generations. Particular branches of industry as well as consumption cause multidimensional environmental damage. One of the industries that raises the standard of living, but also plays a significant role in environmental degradation is the construction industry. It is therefore necessary to strive to mitigate the effects of erecting building objects. The article made an environmental assessment of the life cycle of a building using the One Click LCA software, which was officially approved by BRE to categorize objects according to the Mat 01 procedure. The evaluation covered the production of construction materials, transport, construction process, use of a residential building, maintenance, repairs and replacements, operating energy and water consumption, total energy consumption and demolition phase. Analysis of the life cycle of a single-family house, which Petrovic and others carried out clearly indicates that the type of materials used directly affects the emission of greenhouse gases to the atmosphere. The cited case concerned a house, located in Sweden, in the construction of which mainly ecological materials were used and the use of concrete was limited. The results of such proceedings have been found in the results in which the values of carbon dioxide released into the atmosphere were as follows: the environmental impact during the adopted test period of 100 years amounts to about 102 tons of CO_{2eq}, and the annual load is equal to 6 kg CO_{2eq} per m²•year⁻¹. In this case, the materials with the highest quotations regarding greenhouse gas emissions were concrete, wood, gypsum, and elements such as roof, doors and windows. The production of these materials had the biggest negative environmental impact. Emission values in the building phase of the analysed object are higher in relation to the values presented in literature for other buildings, however, the share of this phase in the total CO_{2eq} emission, amounting to 1%, is insignificant. Comparing this result with the result obtained in the product phase assessment, it can be concluded that the burden on the environment during raw material extraction processes, their transportation and processing into specific materials is clearly dominant.

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STUDY ON RADON CONCENTRATION IN AND AROUND DURGAPUR CITY, INDIA

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ABSTRACT

In the present days environmental pollution becomes an alarming issue for the industrial cities of India. The city Durgapur in the state of West Bengal is a well-known industrial hub of eastern India. This city has more than 30 industries (both large and small scale) with a population of around 0.6 million. However, till date, no appropriate monitoring mechanism and suitable technology were not adapted to deal with environmental pollution of Durgapur city. In the present work we focused our attention towards monitoring of the radioactive gas radon-222 in Durgapur city. Although radon is chemically inert, it can decay spontaneously and might damage the cells that line the lung when inhaled or ingested. Ingestion of radon is believed to increase the risk of lung cancer and stomach cancer. Hence a survey on detailed aspect of radon activity is a big deal for environmental pollution and health issues. The aim of this paper is to study radon concentration in various water samples in Durgapur city to determine distribution of the radon activity concentration in water sample in order to build database information for future researchers and to explore the health issue. In this work four types of water samples such as pond and lake water, river water, well and bore hole water, industrial discharge water were monitored at different zones to observe variation of radon concentration with location and depth. Moreover other parameters like temperature, pH value, and electrical conductivity and TDS values of water were also measured to examine how these parameters are related with radon concentration. Radon concentration in deep well and tube well water of Durgapur found to be varies from 54.43 pCi/L to 253.28 pCi/L, which is quite high. Moreover, radon concentration in river water (Damodar river and Ajoy river) around Durgapur seems to be moderate ~17.25 pCi/L. The radon concentration in the supply water (drinking water) by Durgapur Municipal Corporation water is low about 4.8 pCi/L and safe for drinking. The measured value of the radon concentration for industrial drainage water, Tamla canal, DPL outlet, Durgapur Chemicals Outlet Limited found to vary from 2.033 to 5.87 pCi/L. TDS values for well water vary from 0.39 to 1.07ppt. On the other hand TDS values for river water sample range from 0.11 to 0.63 ppt. EC values of well water samples seems to vary from 423 to 1017 μ s, while river water has variation of EC from 128 to 634 μ s. The values of EC for industrial discharge water range from 320 to 530 μ s and for pond water sample vary from 309 to 668 μ s. In some places of Durgapur city the values of radon concentraion, EC, TDS in water are alarming and that may cause health hazard to the habitants.

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THE POSSIBILITY OF APPLICATION OF MAGNETIC-MOLECULARLY IMPRINTED POLYMERS FOR THE SELECTIVE RECOGNITION OF LOW-MASS POLYBROMINATED DIPHENYL ETHERS IN WATER SAMPLES

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ABSTRACT

One of the newest groups of chemical compounds classified in 2009 by the experts from the Stockholm Convention as a persistent organic pollutants are the polybrominated diphenyl ethers (PBDEs), which were used as the flame retardants added during the plastic materials manufacturing process. The PBDEs are the potential treat, especially for the aquatic environment, due to their negative impact on immunological and neurological systems, as well as the hormonal balances in aquatic organisms. To receive the reliable analytical information about the PBDEs content level in the aquatic environment it is necessary to perform multistep analytical procedure. To reduce the number of stages in analytical procedure and increase the efficiency of preconcentration of PBDEs from aquatic medium, the application of the molecularly imprinted polymers (MIPs) might be a good solution, especially their new configuration magnetic MIPs (MMIPs). To prepare the appropriate MMIP sorbent, which might be applied for selective recognition of low-mass PBDEs (2,2',4,4'-tetrabromodiphenyl ether – PBDE-47 and 2,2',4,4',5-pentabromodiphenyl ether – PBDE-99) in the aquatic medium, the first step of the analytical protocol was to cover the surface of the commercially available Fe₃O₄ nanoparticles. The nanoparticles were dispersed into the ultrapure ethanol solution in ultrasonically bath. Then, defined volume of NH₃·H₂O and tetraethoxysilane were added dropwise to the glass flask. Next, after reaction for 24h, the nanoparticles were separated using external magnet, washed with ultrapure water with methanol and dried under vacuum at room temperature. Then, the appropriate mass of Fe₃O₄ was ultrasonically dispersed in anhydrous toluene with the defined volume of (3-Aminopropyl)triethoxysilane and stirred under the nitrogen atmosphere by 12 h in 70°C. After the Fe₃O₄ surface modification, the functional monomers and PBDEs dummy template (4,4'-dihydroxydiphenyl ether) were dissolved in the 15 mL of acetonitrile and mixed by 8h. After this, surface modified nanoparticles were added with the defined volume of cross-linker. Next, the whole mixture was stirred and the defined mass of reaction initiator was introduced (1,1'-azobis(cyclohexanecarbonitrile)). Whole thermally initiated polymerisation was performed under a nitrogen atmosphere in 85 ± 2°C for 24h. The final stage of the MMIP preparation process was to dry the prepared nanoparticles under the vacuum and then, the dummy template molecules were washed by ultrapure methanol. Appropriate prepared and modified Fe₃O₄ nanoparticles were the subject of further research associated with the surface characteristic and physicochemical properties, such as adsorption capability, particles surface area and particles volume. Next, after the Fe₃O₄ nanoparticles surface characteristic, prepared MMIPs were used in a screening studies to observe the sorption abilities and application potential in an aquatic medium – research performed with the use of modelling aquatic solutions of pure water, river water and lake water. However, considering the MMIPs as a potential sorbents it should be kept in mind that they are characterised by the relatively slow mass transfer, and in some cases binding capabilities of such materials might be insufficient.

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FEASIBILITY OF A RADIOACTIVE WASTE INSULATION MATERIAL STORES IN AN UNDERGROUND SALIFEROUS SITE

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ABSTRACT

The development of nuclear energy namely in some advanced countries leads to the production of irradiated combustibles that cannot be fully or completely reused after treatment. The growing production rate of such wastes is nowadays a huge problem in terms of storage. The management of hazardous, chemical and, in particular, nuclear waste poses numerous problems according to their importance (large production of nuclear energy) and their nature (short-lived low-level waste, high-level waste and long-lived waste). The storage of radioactive waste is preceded by packaging in manageable form: radioactive waste is generally coated in glass, bitumen, cement or thermosetting resin according to their level of activity with the aim of satisfying, in the both immediate and long-term, to the imperative of safety and protection of the environment. Research progress is being pursued to reduce the volume (melting method) and toxicity of waste, to improve the way in which they are stored at the surface and to study the conditions of their deep storage. The present work aims at using salt and silicafume based cement grouts allowing the cementing (sealing) of holes within deep salt formations (geological structures stable with time and non permeable) containing dangerous and bulky nuclear wastes. A previous physico-chemical study of cured and microsilicate cement slurries (A.Mellak, Ph.Baudeau, 1994) has shown that the hydraulic binder "G" has the properties required for the cementations of salt formations. The incorporation of additives (silica fume, plasticizer, antifoaming agent and saturated brine) and a standardized kneading, made it possible to obtain silica fume concentrations of between 5 and 10% by mass of dry cement, stable cement grout formulations with good injectability and good mechanical strength. Such specific cement grouts will be used as a barrier between the storage area and the natural milieu where highly radioactive wastes will be stored.

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**CONTROL OF CONTAMINATION IN RESIDUAL WATER OF TANNERIES BY HETEROGENOUS
PHOTOCATALYST WITH TiO_2**

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ABSTRACT

This investigation has a purpose study the full degradation of chrome in residual water in the industry of leather by using a prototype of cylindrical parabolic manifold and dioxide of titanium TiO_2 like photocatalyst where show higher removal of pollutant when the source of energy) sun) activate the photocatalyst reach one radiation average of 805.44 Watts/m² resulting 62.05% of polluting abatement. The result of the investigation shows the narrow relation between photocatalyst and the light of sun like source of photonic radiation plus the photocatalytic degradation like very effective technique.

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EFFECT OF SODIUM BORON HYDRIDE (NaBH₄) ON WASTE POLYETHYLENE TEREPHTHALATE PYROLYSISMikail Olam^{1,2}, Hüseyin Karaca¹¹ Department of Chemical Engineering, Inonu University, 44280, Campus, Malatya, Turkey² Department of Mechanical Engineering, Firat University, 23200, Campus, Elazig, Turkey**ABSTRACT**

Polyethylene terephthalate, which is used in many applications today, is very important in terms of nature and source in order to ensure recycling by appropriate methods after use. Because polyethylene terephthalate is a durable and long-lasting thermoplastic which is resistant to many environmental influences. Recovering residual plastics has become mandatory. In this study, the conversion of waste plastic to a new liquid fuel by polyethylene terephthalate (PET) pyrolysis method was investigated. Sodium borohydride (NaBH₄) was used as both catalyst and hydrogen donor in the pyrolysis experiments. Pyrolysis experiments were carried out in a batch reactor under catalytic and non-catalytic conditions, reaction time of 15-90 minutes, reaction temperature of 325-425 °C, solid/solvent ratio of 1/4 and initial nitrogen gas pressure of 20 bar. The waste plastic samples were found to have a suitable reaction temperature of 375-425 °C and a reaction time of 30 minutes as a result of pyrolysis in catalytic and non-catalytic conditions. In the pyrolysis of polyethylene terephthalate samples at a reaction time of 30 minutes and at non-catalytic conditions, the maximum total conversion was 53.1 % at the reaction temperature of 400 °C and the highest oil + gas yield at the reaction temperature of 425 °C was 43.7 %. In the pyrolysis of polyethylene terephthalate samples in the presence of sodium borohydride, the maximum total conversion was 55.3% at the reaction temperature of 400 °C and the highest oil + gas yield at the reaction temperature of 425 °C was 44.6 %. Here is the result; It can be claimed that sodium borohydride used in pyrolysis experiments acts as both catalyst and hydrogen donor.

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EFFECT OF MICROWAVE PRETREATMENT ON WASTE POLYETHYLENE TEREPHTHALATE (PET) PYROLYSISMikail Olam^{1,2}, Hüseyin Karaca¹¹ Department of Chemical Engineering, Inonu University, 44280, Campus, Malatya, Turkey² Department of Mechanical Engineering, Firat University, 23200, Campus, Elazig, Turkey**ABSTRACT**

The use of thermoplastic polyethylene terephthalate (PET) after recycling with appropriate methods is very important in terms of nature and source. Polyethylene terephthalate is long lasting and resistant to many environmental influences. The fact that this remains unbroken as a waste in nature and creates environmental pollution. Today, microwave energy is used efficiently in many applications. In this study, waste polyethylene terephthalate was converted to a new liquid fuel by pyrolysis method and the effect of microwave pretreatment on total conversion and oil + gas yield was investigated. Pyrolysis experiments were carried out in a batch reactor under non-catalytic conditions, microwave pre-treatment time of 3-10 min, reaction time of 15-90 minutes, reaction temperature of 325-425 °C, solid/solvent ratio of 1/4 and initial nitrogen pressure of 20 bar. Waste plastic samples in batch reactor were found to have a suitable reaction temperature of 375-425 °C and a reaction time of 30 minutes as a result of pyrolysis. In the pyrolysis tests of polyethylene terephthalate samples at 400 °C and 30 minutes reaction conditions, the microwave was not pretreated, while the oil + gas yield was 18.7%, as a result of the pyrolysis of the pre-treated sample in the microwave for 8 minutes, the oil + gas yield was found to be approximately 31.7%. In the highest total conversion, 58.5% was obtained in the microwave pretreated experiment and 50.5% in the microwave pretreated experiment. The microwave pretreatment had a significant effect both on total conversion and oil + gas yield. It can be argued that microwave pre-treatment has an effect on the oil + gas yield in pyrolysis experiments.

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PRODUCTION OF ACTIVATED CARBON FROM THE RESIDUES OBTAINED FROM POLYETHYLENE TEREPHTHALAT PYROLYSIS

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ABSTRACT

Activated carbon is produced from the residues obtained by waste polyethylene terephthalate pyrolysis method. Pyrolysis experiments were carried out in a batch reactor under non-catalytic conditions, reaction time of 15-90 minutes, reaction temperature of 325-425 °C, solid / solvent ratio of 1/4 and initial nitrogen gas of 20 bar. Residues collected in a vessel obtained from pyrolysis experiments under reaction time of 15-90 min, reaction temperature of 325-425 °C and non-catalytic conditions. The resulting residues were milled to micron dimensions. It was made in the muffle furnace at 400-900 °C and 30-120 minutes under nitrogen conditions. Residue obtained from polyethylene terephthalate pyrolysis contain about 60% Carbon, 4% Hydrogen and 36% Oxygen in the elemental analysis. According to the XRD results of the tars obtained as a result of pyrolysis of polyethylene terephthalate samples, it was seen that the tars formed terephthalic acid (C₈H₆O₄) in crystal form. X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) analyses were performed to determine the active carbon produced.

Corresponding Author: Mikail Olam

PERFORMANCE MODELING OF A PHOTOVOLTAIC SYSTEM INTEGRATED TO ROAD PAVEMENT

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ABSTRACT

This paper discusses the topic of energy harvesting from urban road pavements illustrating an overview of new integrated green technologies to generate electric power. The work presented is a numerical study for understanding the potential of road energy harvesting technologies in real urban environment. The effect of oil dependency on the European economy is too large to neglect. Low-CO₂ alternatives to oil are also indispensable for gradual decarbonization of the transport sector. For smart, sustainable and inclusive growth, the EU strategy is going towards the drastic reduction of world greenhouse gas emissions by 80-95% below 1990 levels by 2050 (European Commission, 2013). This is the reason why researchers have been looking for other green energy alternatives. The seek for alternative energy sources has also led to the exploration of road pavement integrated piezoelectric and photovoltaic technologies. For what concerns linear transport infrastructures, like roads and railways, research activities are focused to transform them from simple structure only dedicated to vehicles transit to smart backbones of services (vehicular traffic and information), able to also generate clean energy. A photovoltaic integrated road pavement technology for clean electric energy harvesting compatible with adherence requirements and loads and stresses generated by urban vehicular traffic is examined in this study. The main components of the system consist of photovoltaic panels distributed on the road surface able to convert solar energy into electricity. The theoretical electric energy production depends on of the energy conversion efficiency of the photovoltaic panels and environmental conditions (global solar irradiation) of the location. Moreover, it is inversely proportional to the traffic intensity since the vehicular passage causes shading on the photovoltaic panels integrated in the road pavement. A numerical parametric model to evaluate the electric energy harvesting from road pavements has been development by varying system parameters. A performance simulation of the photovoltaic integrated system over road sections belonging to different urban areas of Europe, at same traffic conditions has been carried out. The results are discussed and compared in terms of specific energy production (kW/h/m² per year).

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ECONOMICAL ASPECT OF SENSITIVE FLAT ROOF RENOVATION

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ABSTRACT

The authors have been working for a long time on the development of sophisticated flat roof renovation that would allow renovation without the need of removing the existing roof layers and so will have a positive environmental impact. The solution is based on the detailed hydrothermal analysis of flat roof and using the potential of the original materials. Subsequently, new layers of the flat roof with optimal parameters for a certain case and possible other construction modifications are designed. The aim of the development is to create methodology to achieve equilibrium humidity by perforation of the original waterproof layer. In the paper, the authors describe the key points of this methodology. However, the paper focuses on the economic aspect that this sophisticated renovation brings. Economic evaluation is described through two methodological approaches. The authors compare the developed method with the method involving renovation of flat roofs with the need of removing the existing roof layers. The comparison takes into account the use of different materials for waterproofing and thermal insulation. In order to determine the costs, the authors used the building software to create budgets. The presented economic evaluation confirms the essence of the developed method.

Corresponding Author: Marek Kervitcer

GEOTHERMAL PERSPECTIVES OF LITOMĚŘICE SITE: HYDROGEOLOGY STUDY OF THE GEOTHERMAL BOREHOLE PVGT-LT1

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ABSTRACT

Utilization of geothermal energy in low enthalpy regions is made possible with the use of EGS (Enhanced Geothermal Systems). We focus on the area of Litoměřice in the NW part of Bohemian Massif, where a pilot 2.1 km deep geothermal borehole (PGV-LT1) was drilled in 2007. This site is known as a perspective place for construction of EGS hot dry rock deep geothermal heat plant. The knowledge of hydrogeology and geochemistry of groundwater and dissolved gases present in the geothermal borehole is important for understanding the evolution of the underground environment during the geothermal energy extraction. Two different hydrogeological environments occur in the PVGT-LT1 borehole. The upper part of the borehole reached the cretaceous and permo-carboniferous sedimentary units (up to 900 m of depth) and metamorphic hard rocks are present in deeper parts. Porous permeability or dual porous-fissure permeability prevail in sedimentary basin rock units; fissure permeability occurs in deep metamorphic rocks only. There exists undoubtedly a hydraulic connection between shallower sedimentary units and deeper parts of metamorphic rocks, because draining water from the overlaying saturated rocks causes hydraulic pressure in the PVGT-LT1 borehole. As a result, confined artesian groundwater level occurs in the borehole; the overflow is however very low in order of millilitres per minute. The artesian groundwater level causes constant upward flow from depth to the surface. The high hydrostatic pressure facilitates to dissolve gases in groundwater. The gas evasion can be observed at the wellhead when the borehole is opened. The groundwater from PVGT-LT1 is highly saline with electric conductivity of about $18000 \mu\text{S}\cdot\text{cm}^{-1}$ and total dissolved solids content of $14,7 \text{ g}\cdot\text{L}^{-1}$. The basic chemical composition of groundwater is Na-Cl type with minor HCO_3^- compound. The groundwater is alkaline with pH of 9.1. The groundwater bears significant amount of dissolved organic matter in concentration of $0.45 \text{ g}\cdot\text{L}^{-1}$. The dissolved gas extracted from groundwater consist mainly of methane (84 vol. %), minor parts are nitrogen, oxygen and ethane. The origin and composition of dissolved organic matter is the subject of current research. Results will be used for future optimisation of operation of EGS deep geothermal exchanger and for further geothermal research.

Corresponding Author: Jan Holeček

ENERGY CONSUMPTION TREND IN A SHOPPING MALL

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ABSTRACT

One of the most energy-consuming areas is the private and public buildings. According to the UNEP (United Nation Environment Programme), buildings use about 40% of global energy, 25% of global water, 40% of global resources, and they represent approximately 1/3 of greenhouse gases (GHG) emissions, offering the opportunity for the greatest potential for energy saving and, consequently, of reduction in GHG. The paper shows the results of an annual energy monitoring campaign conducted for a shopping mall located in Caserta (Southern Italy) with 51 shops. It occupies 28,000 m² by 16,000 m² of gross leasable space distributed over 3 floors. The mall is open from Monday to Sunday for 360 days a year. The studies have been focalized on the common services of the mall, including the exterior lighting (parking, entrance, etc.), the interior lighting (commercial gallery, bathrooms, etc.), HVAC and other services, and will exclude the consumption of individual shops which have an independent electricity accounting from the shopping center. In particular, paper focuses on different contribution made by each power sources and hourly, daily, monthly and seasonal energy variation of electricity consumption. For each hour of consumption, the monitoring campaign collected information in relation to the active power and reactive power. The external temperatures were acquired using an Italian Air Force weather station located close to Caserta. This information was acquired with the goal of finding a correlation between outdoor temperature, seasonality and power consumption. Moreover, a survey of the energy-intensive sources used in the mall has been carried out and a model for the analysis of possible energy saving strategies has been developed.

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COMPOSTING OF SOLID MUNICIPAL WASTE, A DETERMINANT PROCESS IN INTEGRATED WASTE MANAGEMENT

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ABSTRACT

Composting municipal solid waste is a beneficial recycling tool. Its use in safe conditions in agriculture depends on the quality of the compost. Composting a maximum amount of greenery and food waste (from households and institutions, courtyards, gardens, parks, markets and street waste) is one of the proposed targets for reducing biodegradable waste. The paper aims at presenting a model of the composting process in the best technical and environmental conditions. Considering that for Romania the most important issue to be addressed is the reduction of the amount of waste to be deposited, this can be done through a real selective collection and the production of compost from biodegradable waste. If the sorting of biodegradable waste is done at the site of production to obtain compost, that means not only the reduction of the amount of waste to be deposited but also a source of money, and the amount of leachate and biogas produced would be much diminished. Also, the presence of the specific creatures of this ecosystem would decrease considerably. Taking into account the limited nature of natural resources, the recovery, regeneration and sustainable use of resources are essential elements of an environmental policy. Composting thus provides the opportunity to create SMEs as well as to increase employment and professional qualifications. Not all wastes have to be dumped, they can be utilized, separated, separated, and thus large amounts of raw materials and energy resources can be saved, and the area occupied by landfills can be reduced. In the waste management process an important role is played by the local public authorities (municipalities and local councils), who have the obligation to collect selectively and transport in time the entire quantity of waste produced.

TRANSLUCENT CONCRETE

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ABSTRACT

Reinforced concrete was invented and developed simultaneously by several people in the mid-nineteenth century. Besides versions "classical" fiber reinforced concrete (by using steel bars, whatever "style" of them), there are new ways to further concrete strength. Transparent concretes (translucent) is gaining much ground in the construction of the West Europe. "Light Transmitting Concrete" is a concrete-like product, which is translucent due to the mixture of fiber glass, plus a combination of finely divided crushed stone, cement and water. After the strengthening of composition, blocks of various shapes are obtained, with features of concrete and glass. Transparent concrete is a translucent material created by the combination of concrete and thousands of optical fiber wires acting as a filler.

APPLICATION OF PANEL ANALYSIS TO INVESTIGATE THE RELATIONSHIP BETWEEN ECONOMIC GROWTH, IMPORT, CONSUMPTION OF MATERIALS AND ENERGY

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ABSTRACT

Nature conservation, or the preservation of the natural capital, is an important factor in ensuring prosperity for present and future generations. The essence of the concept of sustainable development is to ensure the use of natural resources in such a way that society's needs can be met most effectively while maintaining the possibility of biological regeneration of the environment. This concept does not mean abandoning the production and consumption of goods but indicates the need for a number of structural and technological changes that will allow for the relatively smallest depreciation of natural capital. An effective tool for monitoring progress in this area can be the continuously developed material flow account. Studies indicate that in highly developed countries GDP growth is possible with a relatively smaller increase in material demand and energy use. The aim of the article is to examine the dependencies that occur between the GDP growth rate and the growth rate of imports of goods and services, while reducing energy consumption and consumption of materials. The study was based on data concerning the economies of selected European Union and Poland. The article presents the method of modeling the decoupling phenomenon using the panel data technique.

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APPLICATION OF EXTENDED HABITAT SUITABILITY CURVES FOR DEPTH IN NITRICA RIVER

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ABSTRACT

This study assesses the impact of basic stream abiotic parameters on the quality of aquatic habitat and insert them to the aquatic habitat quality assessment of the mountain and piedmont streams. The created methodology was applied on the Nitrica River. The study is based on the objectification and modification of parameters of habitat suitability curve for the depth. The habitat suitability curve is one of the many basic parts of Instream Flow Incremental Methodology (IFIM). IFIM is the methodology where the quality of aquatic habitat is interpreted according to a bioindication. The bioindication is provided by ichthyofauna. For this study the minnow (*Phoxinus phoxinus*) was chosen as a bioindicator. The main reason of selecting the minnow as a bioindicator was that there was a sufficient frequency during the ichthyologic survey on the studied river. The basic result from field measurement is the habitat suitability curve for depth. This measured habitat suitability curve is not adequate to describe the aquatic habitat. The suitability curve derived from just one measurement does not take into account the fact that the increase in flow has not changed the quality of the habitat until the time when the fish starts to be flushed out of the environment. This is the reason why this scientific research was oriented on modification of habitat suitability curve for a wider range of flow. The evaluation was done by System of Environmental Flow Analysis (SEFA). SEFA is a new software that implements the substance of the IFIM. The modification of the habitat suitability curve is applied on the Nitrica River.

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PLANNING TOOLS FOR AGRICULTURAL TERRITORY OF BULGARIA

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ABSTRACT

There is no comprehensive legislation for agricultural territory planning and development in Bulgaria. This causes unofficial, chaotic and non-holistic use of the Agricultural Territory with future negative consequences for farm, regional and state economy development. The objective of this study is to present a concept for strategic and on-farm planning of the Agricultural Territory and to suggest changes in legislation. Documentary analysis of normative, strategic, historical and other documents in respect of spatial and land-use planning was conducted, including the National Strategy for Regional Development 2012-2022 and the National Concept for Spatial Development 2013-2025, Ordinances of the Council of Ministers, acts of Municipal Services of Agriculture, Analytical Reports on sustainable agriculture management at municipal level, land use plans and maps. Quantitative and qualitative methods for collecting and processing economic, geographic and statistical information were used. The paper presents an outline of a modern Agricultural Territory Development Concept (ATDC). Approaches for long-term strategic land planning on municipal level and short-term land planning on farm level are proposed. ATDC offers completion of Master Plan with details of Agricultural Territory; includes recommendatory development zones that are based on nature recourses, quality of land and zoning of agricultural production in the country; outlines regimes and optionality of the territorial elements and development zones. The Concept gives general characteristics of a Land Use Plan (LUP) (instead of the regulated Specialized Detailed Development Plan) and its territorial elements on farm level and outlines the scope and content and the technical implementation of LUP. As a result of the study, amendments to the regulatory framework are proposed.

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NEW INSIGHTS ON MINERAL EXPLORATION (POLAND)Magdalena Worsa-Kozak ¹, Grzegorz Lipień ^{1,2}

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ABSTRACT

Polish standards for mineral exploration are based on legal acts such as Mining and Geological Law as well as on methodology dedicated to specific natural resources written by the most experienced exploration geologists in Poland and issued by Ministry of Environment. Among all the legal issues and restrictions, among all the directions how to design and conduct the exploration campaign, we are sometimes too much focused on the deposit we want to explore. We are taking care about proper sampling of the deposit's zone, taking care about lab tests of the samples etc. And... When it comes to design a mine, to open deposit, to exploit it and finally to close and to reclaim the mine site, we realize that we don't know the geological and hydrogeological conditions we operate in actually. At every stage of life of mining project new data are collected and analysed. Unfortunately sometimes is too late to learn and there is no way back to change some critical decisions. The authors presents in this paper the new insights on mineral exploration based on maximizing the information gathered at the earliest stage of exploration and the holistic approach to the natural resources. Starting from conceptual model of the geology and hydrogeology of the investigated area we should examine every possible layer from the top to the depth we plan to exploit, we should look at our exploration area not only from its local perspective but also at regional and global scale to understand processes which have formed the area and which can affect our future mine. The holistic approach will allow us to find an added value to our targeted project and to define possible sources of future problems and challenges. At first sight it seems to be expensive but life shows that the expenditures on detailed exploration are benefits in the future.

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**BENTHIC FORAMINIFERA OF THE MAASTRICHTIAN SEDIMENTS FROM THE MALİBOĞAZI
(KALECIK, ANKARA) AND IRMAK (KIRIKKALE) AREAS IN TÜRKİYE**

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ABSTRACT

The investigation focuses on benthic foraminifera and their paleoecology, particularly on the *Orbitoides* genus in the Maastrichtian sediments from the northern and western Ankara City (Turkey). The hard and soft rock samples from two measured sections, namely as Malıboğazı (N Ankara) and Daryaka-Irmak (W Ankara, Kırıkkale) were evaluated. More than one hundred equatorial and axial sections of the *Orbitoides* genus were prepared. The benthic foraminifera of the Maastrichtian sediments are as follows: *Dorothia* sp., *Marssonella* sp., *Lenticulina* sp., *Saracenaria* sp., *Oolina* sp., *Cibicides* sp., *Gavalinella* sp., *Orbitoides apiculatus*, *O. gruenbachensis*, *O. medius*, *Pseudomphalocyclus* sp., *Omphalocyclus macroporus*, *Lepidorbitoides* sp., *Sirtina* sp., *Sulcoperculina globosa*, *S. vermunti*, *Siderolites calcitrapoides*, *Laffitteina mengaudi*, *Laffitteina* sp. In the Malıboğazı area, biometric data based on the internal and external parameters of the *Orbitoides* genus present reliable interpretations for paleoecological approaches of the Maastrichtian time. The calcareous siliciclastics comprise abundant *Orbitoides apiculatus* and *O. gruenbachensis* species. We have identified two ichnospecies as *Maendropolydera osmaneliensis* and *Curvichnus semorbis* in the *Orbitoides* tests. It is thought that meandered microboring activity are related to parasitic life modes while cave shaped ones are associated with hermit type life modes. *Orbitoides* bearing siliciclastics overlies reefal sediments including biostromal limestones with rich rudist fauna, *Thalassoniodes* rich carbonates and massive, thick bedded limestones in the Malıboğazı area. In contrast, siliciclastics indicating open sea sediments outcrop widespreadly in the Irmak area. The obtained stratigraphical, sedimentological and paleontological data show that northern part of the Ankara was shallower than western part of the Ankara during the late Maastrichtian. Start your abstract here... The abstract should include the purpose of research, principal results and major conclusions. References should be avoided, if it is essential, only cite the author(s) and year(s) without giving reference list. Prepare your abstract in this file and then copy it into the registration web field.

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DESCRIPTION CRITERIA FOR EOCENE ALVEOLINIDS: EXAMPLES FROM INNER WESTERN ANATOLIA

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ABSTRACT

Anatomical and morphological features which are used to describe alveolinid species, and their changes during Eocene are the subjects of this study. Changes in some of these features in time and place are important when interpreting geological history of the species. Thus, preliminary results of an ongoing research on Eocene of Inner Western Anatolia are exemplified herein, and the relationship between the species is tried to be interpreted. Faunal associations and environmental characteristics of the species are mentioned. The obtained data show that the most important criteria for describing of alveolinids are as follows: test shape, index of elongation, flosculinisation, and coiling types throughout ontogeny. In addition, shape and size of septula and chamberlets, axial thickening, shape and size of the protoconch, and the ratio between the thickness of basal layer and the height of chamber are also important to be considered.

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**ANY LINK BETWEEN FLUORIDE ENDEMIC AREAS AND INFESTATION OF POISONOUS SNAKES IN
KALTUNGO AND ZAMKO - LANGTANG AREA OF GOMBE AND PLATEAU STATE – NIGERIA**

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ABSTRACT

Kaltungo and Langtang areas are both located on the Pre – Cambrian Basement rocks with similar rock types (coarse porphyritic biotite granite with intrusions of phonolites and trachytes in Kaltungo and rhyolites and trachytes in Langtang area). Concentration of fluoride in rocks and soils ranges from 62 – 1110 and 165 – 560 ppm in Kaltungo and 800 – 1470 and 100 – 700 ppm in Langtang area. Highest concentration of fluoride in groundwater in Kaltungo is 4mg/l and 10 mg/l in Langtang – Zamko) with severe manifestation of dental fluorosis and genu valgum in children in Langtang. The Oxford University and the Liverpool School of Tropical Medicine in the UK, declared that Kaltungo in Gombe State and Langtang - Zamko in Plateau State as some of the World's most snake infested towns (Daily Trust, 30th August, 2006). In August, 2017 sixty-two cases of snake bites (comprising of 30 men, 20 women, and 12 children between the ages of 6 and 10 years were reported). In September 2017, 86 cases were reported (comprising of 35 men, 35 women and 16 children) and in October a total of 108 cases were reported comprising of 50 men, 40 women and 18 children)) in Langtang – Zamko, Plateau States with several deaths (Daily Trust, 2017). Cases of snake bites in these areas are on the increase especially at the onset of the raining season. Apart from rats and insects on which snakes prey on, most people in these areas believe that snakes feed on clays. This study seeks to establish if there is a link between these areas of endemic fluorosis and the infestation of poisonous snakes.

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THE TRACES OF MINING IN LUBSKO (WESTERN POLAND) – THE PROPOSAL OF THE GEOTOURISTIC PATH

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ABSTRACT

Lubsko is a city in the Lubuskie province (western Poland) with a population of around 15 000. The utilization of raw clay minerals in this region has its beginning in the Middle Ages. Throughout the years the production has changed to the organised mining industry. The end of this branch has begun in the late 1980s due to the political changes in Poland. Nowadays, many marks of this important part of the city's history are ruined or in a bad condition. The reason for organising geotouristic path is to protect the remaining, mainly old open-pits and the infrastructure. Proposed stops will teach about the mining heritage in Lubsko, the geology of the glacial region, the processing of raw clay minerals and various usages of this material. Moreover, connecting both educational and recreational purposes may give the chance to integrate other touristic sites in the city. The development of such a path may attract tourists from Poland and Germany. Because of the poor conditions for industrial investments, tourism should be considered as a possibility in an improvement of the financial situation of Lubsko. It is crucial to take under the consideration possible obstacles such as the limits of the city budget or the sites land ownership. The article is a result of literature research, field investigations, and consultation with the Mayor of Lubsko. The proposed stops are described, shown on the map and the recent condition is presented with photos. Finally, to compare the possible benefits for the region and obstacles for developing such a path, the SWOT analysis is undertaken.

ARCHAEOLOGICAL AND ECO-TOURISM AREAS IN DAKHLA OASIS (WESTERN DESERT, EGYPT)

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ABSTRACT

In ancient times, since the last rainy season that prevailed in the region about 35,000 BC, there were lakes of fresh water lived by the Stone Age man, with herds of cows, giraffes, and gazelles. The water springs were overflowing and the oases continued until 9000 years ago when these lakes began to shrink and dry, leaving their sediments in what is known as the Playa deposits in the regions of Dakhla Oasis as well as other oases in the Western Desert .Dakhla Oasis is some 80 km west to east and 25 km maximum width from north to south. Dakhla Oasis (the Inner Oasis in Arabic), is one of the seven oases in the Western Desert of Egypt (part of the Great Sahara). It lies in the New Valley Governorate, 350 km from the Nile and between the oases of Farafra and Kharga. The local economy is based in agriculture. It has a continuity of settlement for about the last 8,000 years but only since 2,500 BCE it has been politically tied to the Nile region.

HERITAGE OF THE POLISH CENTRAL INDUSTRIAL DISTRICT - NEW TOWNS

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ABSTRACT

One of the most interesting aspects of the construction, existence and subsequent development of the Central Industrial District (COP) are "new towns". Settlement units, which were created on the 'raw root', are characterized by a similar general system: a newly established industrial plant with a strategic production profile (most often associated with armament production) directly or indirectly connected with the residential and service unit, which later evolved into a town. Analyzing the development of new units in the COP area, four groups can be identified that differ in the effect of transformations and modern status: small and medium towns, villages with urban characteristics and absorbed by historically shaped urban units. It seems that among these groups, small towns deserve special attention because they are an explication of the structure and then the transformation of the urban structure where, due to the size, an attempt can be made to analyse these changes. The article presents the outline of plans and history of the construction of settlement units of the functional and spatial structure of industrial and housing estates built in the Central Industrial District. The aim of the study is a framework analysis of the history of the origin and changes in the tissue of the presented urban complexes. The analysis of the available literature, museum resources and archives, general analysis of cartographic materials and field studies was used to present the genesis and basic urban development transformations.

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THE PATTERNS OF FORMING OF THE URBAN SURFACE DEPOSITED SEDIMENTS

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ABSTRACT

The patterns of forming of the urban surface deposited sediments were determined on the example of Russian metropolis Nizhny Novgorod. Two schemes of the research were implemented in residential districts of the city in summer field season 2018. The first scheme represented a detailed survey of residential quarters. It included a collection of 25 samples of environmental compartments from five residential quarters of the city with multi-storey buildings. The sampling was conducted in various functional landscape parts at the courtyard and facade areas. Each sample was separated into particle size fractions: > 1 mm, 0.25-1 mm, 0.1-0.25 mm, 0.05-0.1 mm, 0.01-0.05 mm, 0.002-0.01 mm. Chemical and mineral analysis of the collected samples was performed in each granulometric subsample. The second scheme represented the urban geochemical study based on sampling the sediments from local surface depressed zones of microrelief in the city. The 40 samples were collected at the territory of the city on an irregular grid. The sampling was carried out in residential areas in blocks with multi-storey buildings. One sample represented a combined sample of sediments from local surface zones of microrelief by 3-5 localizations from the area of the block. Chemical analysis of the collected samples was conducted. The maximum content of dust (0.002-0.01 mm) 39% was found in soil, while lower mean dust content was found in the samples of sediment from local surface depressed zones of microrelief (30 %) and in road-deposited sediments (30 %). The mineral composition of soil and sediment in Nizhny Novgorod is represented by quartz sand (approx. 55 %). In the samples of sediments, the minerals' content is basically characteristic for acid and metasomatic rocks. Building materials' content in the sediments reaches up to 20%. The maximum organic matter content was found in fine dust fraction 2-10 microns 21% in soils and 5% on the roads. Differentiation of the mineral content in the samples is observed for the various particle size fractions and different functional parts of the quarters. The highest content of metals of anthropogenic association (such as Pb, Zn and Cu) was found in the dust fraction. The Pb and Zn concentrations in samples of sediment of depressed areas of microrelief and road dust are significantly lower than in the soil. The contemporary sedimentation processes participate in the formation of fluxes of solid substances in an urban area, being both a source of pollution and a transit and depositing compartment. The sediment represents a geointicating compartment in an urban area along with such compartments as atmospheric precipitations, snow, soil, and others.

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LEARNING FROM TRADITION: VERNACULAR BUILT HERITAGE OF MADEIRA (PORTUGAL), A SUSTAINABLE PROPOSAL

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ABSTRACT

Madeira archipelago (Portugal) of volcanic origin and situated in the intraplate region of the African plate, was formed during the Miocenic and seats in full oceanic domain. Since the settlement of the island (15th century), several destructive landslides happened. In the Island of Madeira, housing is an important expression of the action of man over nature, making emerge a harmonious landscape between the built and its surroundings. In response to the accentuated Topography, terraced platforms appeared to soften this inclination. Vernacular building traditions are repeatedly cited in the academic literature as exemplary models of environmental practice. Therefore, research that addresses the vernacular traditions of the Madeira Island may emphasize its potential for continuity and viability for maintenance and rehabilitation. Sustainability is indissolubly linked to vernacular architecture and the lessons learned with this architecture of the past can teach us knowledge to apply in the future. The demand for sustainable buildings with minimal environmental impacts is increasing, leading the construction industry to adopt new technologies for building design. Achieved for generations, this architecture shows us the art of a population in the construction. The Madeira's rural housing revealed itself as a wise design, where the masters of the craft create a perfect communion between the space, utility, comfort and the volumetric balance, emerging a new artificial element that connects perfectly with the natural space. Passive strategies have been used around the world for centuries. In the last decades, inhabitants became dependent on mechanical systems, with rising economic and environmental impacts. Learning from the past to understand how houses evolved to respond to the surrounding environment is important. The demand for sustainable buildings with minimal environmental impacts is increasing, leading the construction industry to adopt new technologies for building design. The analysis of the local vernacular dwellings will provide insight into well adapted popular solutions to deal with the local climatic conditions in promoting responsive passive building technologies and a sustainable proposal is presented.

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SURVEY ON POST-OCCUPANCY EVALUATION OF VERNACULAR HOUSES IN MADEIRA (PORTUGAL)

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ABSTRACT

Vernacular housing in the Island of Madeira (archipelago of Madeira, Portugal) is built anonymously. This architecture is made by the people, and for the people, without the aid of an architect. This built heritage demonstrates the relationship between the population and its surroundings, through the care with which they treated the climatic constraints and that is clearly related to the seasonal variation of temperature, regardless of cultural differences and of the level of development of each community. Madeira Island has temperate climates, characterized by mild temperatures all year round. The climate is largely influenced by the Eastern branch of the Azores anticyclone, especially from Spring to Fall. These buildings are strongly marked by an agricultural economy and are characterized by a great regional diversity. The agriculture feature took care of the fertile alluvial land, giving rise to the first settlements. However, with the growth of the population began the conquest of the coast, occupying the dense forest that provided them with good timber for local consumption and for export. With the land tamed, the next challenge was to control the waters, the first paths between the places of difficult access, which carried the waters of irrigation at various locations, including the north shore and the South shore. The vernacular built heritage of Madeira island had a primary function of shelter, then housing and nowadays new uses are being implemented. The research and study of the essence, the behaviour, the possibilities of traditional technologies used in a specific territory, is like the rediscovery, always renewed, of the profound meaning of Portuguese architecture. This paper analyses through surveys whether a very specific type of vernacular heritage housing in Madeira Island provides comfort. In fact, questionnaire responses from the initially survey regarding 66 vernacular houses were analysed to understand the residents' satisfaction with existing conditions through post-occupancy evaluation. Several variables were associated with the dwelling and thermal comfort. In this way a post occupancy evaluation is proposed including energy monitoring for fine-tuning and increasing energy efficiency as well as for gathering knowledge for planners and developers. This study provides not only valuable information for future housing sustainable rehabilitation but also may enable the Local Authority, to identify ways of improving the quality of life for residents.

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FROM THE CLOISTER TO THE CITY: APPROACHES TO THE CISTERCIAN LAND MANAGEMENT

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ABSTRACT

The first Cistercian monasteries appeared in Portugal, in the 12th century. The Portuguese Cistercian monasteries were set to the image of Clairvaux, the Cistercian branch where they mostly came from, which defined the typology of the place. Cistercian foundations were usually built in valleys, but many Portuguese Cistercian monasteries are the result of affiliations rather than foundations. There is a great concentration of monasteries in the north and center of the country unlike the territory at south of the Tagus river. History and strong climatic contrasts had their repercussion in the implantation of the Cistercian monasteries in this territory. However, implantation errors happened and for that reason it was possible the change of site (as permitted by Cistercian legislation), that is the change of a monastery from one place to another (as was the case of the Monastery of Santa Maria de Salzedas or the Monastery of S Pedro das Águias). In a Cistercian monastery, water was an essential resource, not only essential to everyday life, regarding hygiene and energy needs, but also had a very specific meaning and symbolism. 12th century Cistercian hydraulic system was something extraordinarily new and water was always a constant element in the choice of Cistercian implantation sites. Some monasteries were at the origin of settlements, reaching some important features and dimensions. This was the case of Odivelas that settled beside of the Monastery of S. Dinis de Odivelas, the city of Alcobaça or Valado dos Frades (former farm of the “Coutos” of Alcobaça). The monastic space can be understood as a territorial organism in the way that it adapts the territory, modelling and altering it according to its needs. In fact, this paper aims to discuss this process regarding not only the specificities of Portugal, as a country, but also the specificities of the Cistercian land management, since the 12th century: this is from the cloister to the city.

DENSIFICATION OF CITIES AS A METHOD OF SUSTAINABLE DEVELOPMENTJanusz Pełczyński ¹, Bartłomiej Tomkowicz ²¹ Rzeszow University of Technology, al. Powstańców Warszawy 12, 35-959 Rzeszów, Poland² Creativa Studio of Architecture and Construction, ul. Lenartowicza 27/4, 35-051 Rzeszów, Poland**ABSTRACT**

Using land resources is one of the basic elements determining the quality of today's economy and having an impact on the shape of the future. The issue of urbanization is among the main areas affecting the preservation of development potential for future generations on which the doctrine of sustainable development is focused from the beginning. The growth of the human population and the civilization changes require an increase in the volume of buildings and urban areas which is an inherent factor of development. However, it is important how the development of the built environment takes place. The problem of urban sprawl occurs globally both in regions with high and increasing population density, but also in regions with a declining population, e.g. in Spain, Portugal, Italy and Eastern Germany or in Central Europe in countries such as Poland or the Czech Republic. The urban sprawl of cities observed for decades is an unfavourable phenomenon, not only diminishing the Earth's resources, reducing ecosystems, but also decreasing the quality of life, worsening people's health conditions, causing social problems. As a consequence, the environment and its resources are used in an incorrect and unsustainable way. This creates specific requirements for spatial policy that regulates the design and implementation processes of new cities and settlements, but also for the management of already urbanized areas which undergo development processes and changes affecting their utilization. The subject of the article is the strategy of densification of cities as a method of sustainable development, allowing better use of the potential of already used natural resources and reducing the need for new resources. Following methods of densification of cities have been characterized: - intensification of development by building on the free spaces in the city (construction, extension, infill, conversions), - replacement of buildings (demolition of existing buildings and construction of new buildings), - increasing the efficiency of use of existing buildings by transforming their functions, - transforming space the roofs of existing buildings (adaptations of unused spaces, superstructures). The advantages and disadvantages of the indicated methods were discussed and the criteria for their application were defined. Application the methods of densification the city requires a proper diagnosis of the initial situation, prediction of the development scenario and appropriate formal regulations enabling densification within the limits set by the sustainability criteria. The effect of a well-performed town densification is achievement a structure close to the assumption of compact city and improvement the sustainable use of the environment.

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THE IMPACT OF THE ENERGY QUALITY OF A SINGLE-FAMILY RESIDENTIAL BUILDING ON ENVIRONMENTAL BURDEN ASSOCIATED WITH AIR POLLUTION - A CASE STUDY

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ABSTRACT

Problems with emission of pollutants during the exploitation of heat sources heating buildings have recently become very important. In many Polish cities, during the heating season, air pollution is more and more common, with PM10 and PM2.5 many times exceeding the permissible level. Gaseous pollutants (SO₂, NO_x, CO, CO₂) emitted during combustion of fuels in heat sources may cause respiratory tract diseases or worsen the health and well-being of people sensitive to air quality. Emission of pollutants associated with satisfying energy needs (heating and ventilation) in an exemplary single-family building was evaluated in the article. Two variants of the thermal quality of the building were analyzed. The first resulted from the applicable building regulations and the second from the guidelines of the energy-saving standard. The research was carried out on an existing single-family building located in Warsaw. The simulations were based on Polish construction law, standards and recommendations applied to low-energy building support programs. The improvement of the energy standard to the level of an energy-efficient building has resulted in a reduction of pollutant emissions. To accurately determine the emission of pollutants from the heat source, before the simulation calculations, the thermal quality of the housing of the building was verified. For this purpose, a thermal imaging inspection and an apparatus for testing the heat transfer coefficient U with the use of heat meters were used. The thermal comfort conditions were also verified. As a result of in-situ testing of the building, it was found that the thermal quality of the housing does not differ significantly from the design assumptions for a low-energy building. Housing tightness tests also confirmed compliance with the recommendations for buildings with mechanical ventilation. The thermal comfort conditions of the residents were also ensured. Analysing the obtained results of simulation calculations, it was established that when the energy standard of the building is increased, the reduction of pollutant emissions in the standard heating season can be as high as 60%. The article also estimated the amount of additional costs related to improving the energy standard of the building from the level compliant with Polish building regulations to the standard of an energy-saving building. The unit cost of avoided CO₂ emissions was also calculated.

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ABSTRACT

The article discusses the nature of the relationship between natural landscape and transformed landscape. The description of these ties was limited to two interdependent and simultaneously contrasting creatures - a river of a fully natural landscape and a city, an artificial landscape resulting from anthropogenic transformations. The relationship between these two opposing types of landscapes is centuries-old and thus constitutes a rich source of search and study of human-environment relations. The direct reason for addressing this issue is a gradual change in the approach to landscape shaping of the river valley coexisting with urban landscape. Clear transformations of these dependencies and the creation of a return of the city to the river can be observed, for example, in the London docks or Mill Island in Bydgoszcz in Poland. The research area is the coastline of two administratively, culturally and historically different European cities: the Wislok coastline in Rzeszow, the capital of the voivodeship in south-eastern Poland, and the Danube coastline in Budapest, the capital of Hungary. In Budapest, the coexistence of the river and the city is very clear, and their mutual connections are historically anchored and clearly visible in the city's urban structure. On the other hand, the dynamic changes that have taken place over the centuries in the riverbed of Wislok in Rzeszow caused that the river is not the urban axis of the city and did not significantly affect its urban layout in the past. Throughout most of its existence, the city was formed in fear of the river. The comparison of the shape of the coasts of the cities mentioned above resembles a master - pupil relationship. The two cities share a historical link with the river valley, but the degree of development of these relations varies considerably. Expert observation was used as a research method. The selected cases are the family towns of the authors, which made it possible to confront the results of literature research, mainly related to the historical layer, with long-term observations of the discussed areas. The article also defines the features distinguishing riverside cities and the advantages and fears resulting from the coexistence of these two seemingly contrasting landscapes.

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SELECTED CHARACTERISTICS OF ATMOSPHERIC PRECIPITATION ON THE POLISH COAST OF THE BALTIC SEA

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ABSTRACT

The length of the Polish Baltic coast is 601 km. As a result of modern climate changes, the level of the Baltic Sea is systematically rising, which may cause, over several decades, an increase in the rate of high coast abrasion and flooding of lowland and depression areas. At the same time, the incidence of storm surges will increase. The fifth IPCC Annual Report indicates an increase in the probability of extreme precipitation in Europe. Intense short-term rainfall with high intensity, moderate rainfall lasting several days or prolonged wet conditions lasting several to over a dozen weeks have an impact on the development of slope processes on the cliffs. Knowing the frequency of occurrence of extreme precipitation phenomena may therefore be of great importance in the study of the functioning of marine geosystems. The characteristics of extreme precipitation, including dominant trends, were analyzed for eight stations located on the Polish coast of the Baltic sea for the period 1952-2015. Maximum 1-day and 5-day precipitation totals, events exceeding the 90th and 95th percentile calculated for the period 1961-1990 applied as indices enabling the assessment of the frequency of wet conditions. Annual trends were calculated using standard linear regression method, while the fit of the model was assessed with the t-test at the 95% confidence level. Annual precipitation reach values from 775 mm on the east coast to 683 mm in the central coast and show positive trends on six out of eight analyzed stations, from 0.8 mm·year⁻¹ in Swibno to 2.5 mm·year⁻¹ in Dziwnow. The maximum 1-day precipitation totals range between 58.7 mm on western coast to 105.0 mm in central coast and show statistically significant trends (0.1 - 0.2 mm·year⁻¹) in this area. There are on average six to seven 5-day rainfall periods recorded annually in the investigated area. The annual number of 5-day precipitation periods shows positive statistically significant trends in central and eastern part of South Baltic coast (0.2-0.3 per 10 years). The median of the maximum 5-day precipitation totals ranges from 21.6 mm in Swinoujscie to 78.6 mm in Ustka. Trends in changes in maximum 5-day rainfall totals reach the level of 0.1-0.2 mm·year⁻¹ and are statistically significant in stations from Swinoujscie to Ustka and in Gdynia. The values of 90th percentile of 1-day precipitation totals equals 8-10 mm. Annually, about 16-18 days with such precipitation are recorded. The trends are positive (0.1-1 day per 10 years) on the central coast. The values of 95th percentile of 1-day precipitation totals reach 11.5-14.0 mm. Annually, there are about 8-9 days with such precipitation are recorded in the area under investigation. The trends are positive (0.3-0.4 days·10 years⁻¹) on the western and central coast.

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QUANTIFICATION OF NEURAL NETWORK UNCERTAINTIES BY PROBABILITY DENSITY FUNCTIONS ON HYDROGEOLOGICAL PREDICTIONS

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ABSTRACT

The risk of drought impacting drinking water and agricultural production is worrying in developed countries, especially in a changing climate context. To manage and prevent this phenomenon, real-time monitoring and predictive systems are emerging as key solutions. In the field of artificial intelligence, neural networks are one of these predictive systems and are known to suit with the requirements of hydro(geo)logical forecasts. This family of parameterized models is a composition of neuronal functions, which apply a non-linear transformation from their inputs to their outputs. These networks are able to learn a hydro(geo)logical system behaviour using a database composed of observed inputs (rainfall, evapotranspiration, etc.) and outputs (groundwater level, discharge, etc.). They are able to find a relation thanks to an algorithm minimizing a cost function between observed and simulated outputs. However, it remains difficult to assess the uncertainty generated by these models, possibly leading to misinterpretations by end users. These uncertainties are mainly of three types. The first is related to input data. Indeed, hydrosystems are surface elements whereas meteorological inputs are punctual elements. The interpolation error can therefore be significant because of the lack of knowledge between gauging stations. The second is the neural network model architecture itself. It is possible to deal with this source of uncertainty using regularization methods that allow to adjust the model complexity to ensure the robustness of the model and to avoid overfitting. Finally, neural networks are submitted to uncertainties related to parameter initialization, before the training step. The initial parameters may have an important impact on the results. In this paper, we address the prediction of the Blavet groundwater level (*Bretagne*, France). In order to assess uncertainties, we will first focus on parameters initialization of the model. Neuronal models are optimized using cross-validation and early stopping. Then, an ensemble model is realized, in which each member is the result of a unique set of parameters initialization. The purpose of the study is to define how many initializations are necessary to obtain a reasonable confidence interval for forecasts, with the smallest interval and the higher rate of observed points inside this interval. The best model will be determined using cross-validation scores thereby ensuring an optimal robustness. We show that, in this case study, an ensemble model of 20 different initializations is sufficient to estimate uncertainty while preserving quality. In the second part, the resulting ensemble model will be used to estimate the global model uncertainty using probability density functions (pdf) applied on distribution of groundwater level data and cross-validation scores of forecasts. It reveals that groundwater level predictions are composed by two mixed distributions. Therefore, we will use expectation-maximization algorithm (EM) to obtain parameters of mixed models. Mixed normal and mixed Gumbel laws, among five mixed distributions assessed, give the best groundwater distribution and are able to generate abacus of uncertainty model.

Authors would like to warmly thank the BRGM, which provided the dataset ; Jérôme Nicolas (BRGM) for helpful discussions and the ANRT, which contributed to fund this PhD thesis.

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MANAGEMENT MEASURES FOR THE RESTORATION OF DEGRADED ECOSYSTEMS IN ORDER TO INCREASE BIODIVERSITY CONSERVATION IN THE TARNAVA MICA CATCHMENT AREA: CASE STUDY BĂLĂUȘERI, TARNAVA MICĂ, ROMANIA

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ABSTRACT

The paper examines the possibilities of maintaining the longitudinal connectivity of the Târnava Mică R water courses in the context of hydrotechnical works execution. The main reason why the longitudinal connectivity needs to be analysed is that the transverse obstacles may prevent the migration of upstream fish species in order to reproduce the species concerned. In this way, the state of aquatic ecosystems is affected, which the Water Framework Directive aims to protect. The European Commission has launched two infringement procedures against Romania due to the destruction of unique habitats by not ensuring the longitudinal connectivity. The current methodology for the restoration of longitudinal connectivity provides that the longitudinal connectivity of a water body is ensured if there are no transverse obstacles on the river, or if these obstacles meet certain criteria which make the pressure given by them insignificant. In addition, longitudinal connectivity is an important criterion for defining natural water bodies and heavily modified water bodies. The most widespread measure is the fish scale. The advantage is given by the lowest cost compared to the other variants and the fact that in many cases it can be applied to already existing constructions. However, there is a construction height limit for which it is recommended. In the National Administration of Romanian Waters methodology the height limit is 15 m. The case study in this paper will also present the numerical modelling (1d) for a fish scale at Bălăușeri on the Târnava Mică water stream from the Mureș River catchment area. The purpose of the case study of the longitudinal connectivity of the Târnava Mică River was to restore water connectivity to ensure favourable conditions for aquatic species dependent on riparian habitats.

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METHODS OF SPRINGS FAILURES DIAGNOSTICS IN ORE PROCESSING VIBRATING SCREENS

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ABSTRACT

Large-scale vibrating screens are widely used in minerals processing industry. One of main components in any vibrating screen is a set of springs supporting the main body of machine with sieving material inside. These springs are subjected to cyclic loading and fatigue. Changing of their stiffness and subsequent failures have influence on the sieving efficiency and are difficult to predict, hence, online condition monitoring is required. Visual inspection and non-destructive diagnostic methods are not sufficient in this case. Noisy signals from vibration sensors installed on bearings supports of rotating unbalanced exciters are preferably used for diagnostics of spring failures. In this research, vibrating screen motion is represented by multi-DOF (degree-of-freedom) dynamic model, which accounts stochastic disturbances from incoming material and impacts on sieving decks. Specific features of vibration signals are analysed to identify springs deterioration modelled as the bilinear stiffness characteristics. Phase space plots (PSP) are considered as the promising method to recognise nonlinear behaviour of system under the presence of spring damage. Advantages are assessed of spring stiffness change and failures diagnostics as compared with other methods.

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STATISTICAL ANALYSIS OF WORKPLACE ACCIDENTS IN POLISH MINING INDUSTRY

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ABSTRACT

The publication presents a statistical analysis of workplace accidents in Polish mining in 2009-2017. Collecting and studying information on accidents at work is essential element necessary to improve the organization of work and to introduce preventive activities that will reduce the probability of the workplace accident. The analysis was based on the data of the Statistics Poland and the State Mining Authority. Based on the collected data, it has been shown that the number of workplace accidents and persons injured in these accidents in the studied years decreased and amount to 30% (according to the Statistics Poland) less in 2017 than in 2009. Whereas, the incidence rate of accidents at work (defined as the number of injured people per 1000 persons employed) in Polish mining ranges from 13.97 (in 2013) to 17.82 (in 2010) and is twice higher than the incidence rate of workplace accidents for all industries in Poland. The accidents at workplace in the mining industry in the analysed period occurred on average every 137.88-223.43 thousand Mg of mined minerals. Additionally, the causes of workplace accidents and the number of persons injured were analysed depending on the age of the persons injured, length of work seniority, specific physical activities performed by the persons injured at the moment of workplace accident and the type of injuries. The highest number of accidents at workplace is related to inappropriate behaviour of a person at work and workplace accidents were most often suffered by persons injured aged 20-49 years (89.47%), who performed different activities at the moment of an accident at workplace: movement (31.46% persons injured), handling of objects (20.22% persons injured), carrying by hand (19.91% persons injured) and working with hand-held tools (13.26% persons injured). The most frequent types of injuries suffered by persons injured at the moment of accident are wounds and wounds and superficial injuries (34.05%), fractures of bones (30.12%) and dislocations, sprains and strains (20.91%).

MICRO-LASER-INDUCED BREAKDOWN SPECTROSCOPY-SCAN: A TOOL FOR MORTAR ANALYSIS

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ABSTRACT

In order to characterize ancient and modern mortars, we have to deal with their highly inhomogeneous nature, due to the nature of the mineralogy of aggregate and binder whose detailed characterization is often complex. Several techniques can be used for this purpose and none can be considered the most effective one. μ -Laser-Induced Breakdown Spectroscopy-Scan (μ -LIBS-Scan) offers interesting advantages with respect to other methodology as its simplicity of realization, the capability to make instantaneous measurements without sample pre-treatment. With this instrument, compositional maps with high spatial resolution can be realized, involving a representative portion of the sample. The ability to highlight the natural inhomogeneity of the samples can be also useful to identify possible chemical interactions inside the scanned area of the mortar, calculate locally the hydraulicity index and the relative area occupied by aggregate and binder.

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EFFECTS OF USING MARBLE WASTE ON THE PROPERTIES OF MORTARS AND CONCRETES

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ABSTRACT

Marble waste has a negative impact on the Environment. The marble quarrying all over the world produces large quantities of marble dust mingled with water (marmettola), which represents a significant and current environmental problem, when it is not properly removed. In order to evaluate the possibility of re-use it in the construction sector, this work reports an experimental study on the influence of the use of marmettola, obtained by dry cutting white Apuan marble, on the physical and mechanical properties of mortars and concretes. The marble waste was used for both replacing Portland cement and sandy aggregate in concrete, and Portland cement only in the mortars. Portland cement substitutions were 5, 10, 15, 20, 25 wt% in mortar and concrete mixtures; the fine aggregate fraction replaced with marble waste was 10 wt%. According to the European Standards, mechanical (compressive and flexural strength at 2nd, 7th, 28th day and ultrasonic pulse velocity, determination of rebound number at 28th day) and physical tests (real and apparent densities, water absorption and porosity) were carried out for evaluating the properties of the handmade products. In accordance with the extensive bibliography on the subject, the obtained results showed that partial substitutions of Portland cement or of sandy aggregate with marble waste can be made successfully. Up to 10 wt% of cement or sandy aggregate replaced with marble waste, the physical and mechanical properties of concrete are better than those of the reference specimens. On the other hand, substitutions of cement with marble dust lead to a progressive decrease in mechanical strength. The obtained data shows that the use of marble waste in the production of mortars and concretes represents an adequate and sustainable waste recycling practice. Moreover, the replacement of Portland cement with marble waste could also help to reduce the amount of carbon dioxide released into the atmosphere, associated with the production of the cement itself, and even favour economic benefits due to the low cost of this by-product.

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THERMOCHEMICAL STABILITY OF NATURALLY RELEVANT TERNARY PHASES IN THE CU–FE–S SYSTEM

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ABSTRACT

A relevant research effort is devoted to the synthesis and characterization of phases belonging to the ternary system Cu–Fe–S, mainly for their possible applications as semiconductors. Among all ternary phases, chalcopyrite CuFeS_2 and bornite Cu_5FeS_4 have been attracted for the high interest due to their optoelectronic properties. Their properties found a new interest in the last years because of the consideration of such minerals as thermoelectric materials. Numerous studies were carried out claiming for the description of new phases in the ternary compositional system. In this study, we revise the existing literature on the ternary system Cu–Fe–S, with a special focus on the phases stable at room temperature and pressure conditions, where at least seven ones are found (idaite Cu_5FeS_6 , fukuchilite Cu_3FeS_8 , talnakhite $\text{Cu}_9(\text{Fe},\text{Ni})_8\text{S}_{16}$, mooihoekite $\text{Cu}_9\text{Fe}_9\text{S}_{16}$, haycockite $\text{Cu}_8\text{Fe}_{10}\text{S}_{16}$ and nukundamite $(\text{Cu},\text{Fe})_4\text{S}_4$). The most relevant ternary phases observed in nature are chalcopyrite, bornite and cubanite (CuFe_2S_3). A numerical modelling of the stable solid phases in contact with a water solution was underwent to define stability relationships of the relevant phases of the system. The numerical modelling of the Eh-pH diagrams was carried out through the PHREECQ v.3 software (a computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations) with the Inl1.dat thermodynamic database. Owing to the complexity of this task, the subsystems Cu–O–H, Fe–O–H, Fe–S–O–H and Cu–S–O–H were firstly considered. The first point-by-point Pourbaix diagram for the relevant ternary phases is then proposed and discussed.

Corresponding Author: Andrea Aquino

GEOCHEMICAL AND MINERALOGICAL CHARACTERIZATION OF RECENT NILE DELTA INNER SHELF SEDIMENTS FOR TRACING NATURAL AND HUMAN-INDUCED MODIFICATIONS INTO A DELTAIC SYSTEM

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ABSTRACT

Geochemical and mineralogical characteristics of sediments in coastal and estuarine areas are subjected to continuous changes due to the depositional and post-depositional processes, including the weathering reactions of the original minerals, the residence time, and the precipitation of newly formed phases from overlaying waters. Moreover, other changes may also result from anthropogenic activities, and control of the sediment flux by barrages and dams. The Nile Delta inner shelf is a typical delta that is predominantly covered by alluvial deposits originating from the erosion of the Abyssinian plateau and that of the Nile basin. Understanding the changes in time of these sediments is important, since they have a record of erosional and transport processes and anthropogenic interferences. This study is dealing with the spatio-temporal geochemical and mineralogical patterns observed in the inner shelf sediments of the Nile Delta through a period of 20 years (from 1995 to 2015). The mineralogical composition was determined by using XRD. Major and minor constituents were determined by using XRF; trace and rare earth elements were determined by using ICP-MS. Significant spatio-temporal variations in the geochemical and mineralogical composition of the Nile Delta inner shelf sediments are observed. The results highlight the difference between Near_shoreline and Far_shoreline sediments, and the difference between the eastern, the middle and the western sectors of the Nile Delta inner shelf. Spatial and temporal shifts in the composition of the Nile Delta sediments result from coastal dynamics besides the change in the origin of sediments and their post-depositional transport. Moreover, the temporary shifts in the sediment provenance are related to the influence of man-made interventions in sedimentary processes, such as construction of coastal protection projects and reduction of fluvial input.

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CHEMICAL-PHYSICAL DECAY OF VOLCANIC STONE FROM SANTA MARIA CHURCH IN TERGU (ANGLONA, ITALY)

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ABSTRACT

The Church of Santa Maria di Tergu is located by the Island's Northern coast, the Gulf of Asinara, a short drive from Castelsardo, in the historical region of Anglona. At the Age of the Giudici the Church was the place of a Montecassino priory, mentioned in 1122 under the title of "Sancta Maria de Therco". Situated over an area where recent archaeological excavations have revealed traces of a thriving late Byzantine domus, the Church features a single nave and a transept, a gabled front and a characteristic deep red bulk counterbalanced by the white arches and the white panels with black inlays in the façade wall surface. In post-Medieval times it was built a cover with a barrel vault (probably in the second half of the nineteenth century, as in many other similar cases dating the same moment) which caused severe static problems to the monument, since nobody had apparently considered the static requirements of the building and the load on the side walls, not large enough to support such a heavy load. The stone vault was later eliminated in favour of a new cover in wooden trusses. The Church was build using in duotone two main different stones: reddish volcanic stones and whitish limestones. The macroscopic and petrographic analysis showed that the volcanic rock are Oligo-Miocenic pyroclastites (i.e., rhyolites and rhyodacites). The volcanic stone show a petrographic affinity with samples coming from a local historic quarry, already mentioned in the restoration work documents of the 1940s. The limestone materials taken from the monument show a variable chemical-physical decay, due to dissolution and decohesion processes of the carbonate matrix. Also pyroclastic rocks show decay problems, consisting of chemical-mineralogical transformations on the outer stone surface, with devitrification of glassy groundmass and formation of secondary phases.

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ORIGIN OF THE CONSTRUCTION MATERIAL OF SANTA MARIA DEL REGNO BASILICA (SARDINIA, ITALY)

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ABSTRACT

The Church of Santa Maria del Regno (St. Mary of the Kingdom) is one of the key monuments of Sardinian Romanesque. Its importance is twofold, both from a historical point of view, because it is the best-preserved and best-documented royal-chapel of the four Sardinian Kingdoms. The Church was located in North Sardinia (Logudoro area) a short distance from the palace of the Giudici (i.e. kings) of Torres. The consecration epigraph in the altar, reporting the year 1107, also certifies the chronology of the building, testifying that by the first decade of the twelfth century the constructive models of the Pisan Romanesque, antedating the conclusion of the Cathedral in Pisa by the architect Buschetus, already entered the Island (see the shape of the rectangular single-lancet window). These Pisan models appear together with decorative modules of different extraction, as shown, for example, by the capitals on the pillars in the interior, compared to Iberian models of Islamic origin (e.g., the Aljafería capitals of Zaragoza), declined similarly in the Spanish Romanesque (Santa Maria di Ripoll) reflecting the fact that in the Sardinian Romanesque, since the beginning, were present different linguistic roots alternatives to the Pisan ones, certainly present in the architecture Island, but not in isolation, as for too long it has been argued. The three-nave Church, covered with wooden trusses in the nave, more, and covered with groin vaults in the aisles, has cylindrical pillars in the interior, with moulded bases and water-leaf capitals. The Church stands in the surrounding landscape and is famous for the dark bulk of the volcanic stone used, lightened only by a short portion of wall surface at the bottom right of the façade, and defined in two colours. The Church was built with "basaltic" rocks, variously bullous and with variable colours from prevailing grey to the grey-burgundy of some ashlar scattered in the structure, related to geological leathery facies that underwent evidently oxidation processes. To define the provenance of stones from the territory, several samples coming from the monument and field volcanic outcrops were studied and analysed. On the base geochemical classification, the "basaltic" rocks sampled from the Church were mainly classified as: latit-andesites, latit-basalts, mugearites. Some samples of the Santa Maria del Regno Basilica show a geochemical similarity to two samples (belonging to different outcrops) classified as alkali-basalt and trachy-basalts, respectively. Results of geochemical and petrographic analysis indicate a probable co-presence of two or more old quarries (a near and a far one) from which materials were extracted.

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CONSERVATION OF THE PERMIAN REMAGNETIZATION IN THE PALEOZOIC FORMATIONS OF THE TASSILI N-AJJER (ILLIZI BASIN, ALGERIA): AEROMAGNETIC AND GRAVIMETRIC CONSTRAINTS

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ABSTRACT

Paleomagnetic studies carried out on Silurian and Lower Devonian formations of the Illizi Basin evidenced two distinct magnetization components. Though positive paleomagnetic tests (reversal and fold tests), the comparison with the African APWP clearly shows that both components are remagnetizations of Cenozoic and Permian ages, respectively (Lamali et al, 2014). The distribution of the directions of these components indicates that the Permian one has been uniquely identified in three sampled sites. However, its preservation exclusively in three levels with moderately southeast plunging and distinct opposite polarity, suggests a relationship between lithology and tectonic evolution of the Illizi basin. Indeed, different polarities have been observed according to altitude and that could be explained by variation of the level of tectonically migrating fluids. Our interpretation of potential data (aeromagnetism and gravimetry) has allowed corroborative evidence supporting these assumptions. This interpretation is realized by cross-checking the results of each potential field transforms, which have been applied to the Bouguer gravity and total intensity aeromagnetic maps. Consequently, the obtained results allow locating horizontally the inferred zone boundaries that assuming essentially vertical contact, which is underlined globally by prevailing submeridian lineaments with higher amplitude magnetic and gravimetric anomalies. Interestingly, these submeridian uplifts are typically associated with fluids migration at origin of remagnetization and controlled by fault-related structures leading to preserve or erase the Permian component. Moreover, uplift and deformation in south of the Illizi basin, around the Hoggar area, are associated with the emplacement of thick basaltic trapps, phonolitic and trachytic lavas. Therefore, due to volcanism, fluids from the Hoggar could have been enriched with chemically active components that affected in a different way the sampled Paleozoic formations of the Illizi basin.

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GEODYNAMIC EVOLUTION OF THE ONSHORE–OFFSHORE CENTRAL ALGERIAN MARGIN CONSTRAINED BY GRAVITY DATA

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ABSTRACT

The geology of onshore-offshore central Algerian margin records a history of accretion and/or subduction modified by the presently active transform motion between the Eurasian and African Plates. Establishing the identity and boundaries of basement blocks or terrains led to better understanding its geodynamic evolution and accretionary history. To this aim, gravity anomaly data have been used in order to determine the structure and evolution of the central Algerian margin. The gravity data set for this margin zone (from Dellys to Cherchell town) were compiled from available land and marine surveys (CRAAG, Maradja 2003). Initially, the data were reduced to complete Bouguer anomaly using an appropriate density to those carried out onshore and offshore respectively. As main results, we have reviewed in details the links between all our compiled gravity data and deep crustal structure within the complex geodynamic framework in this area. We presented a new global Bouguer anomaly map in conjunction with major structural features of this zone. It should be noted that in comparison to other margins, the gravity anomaly at this part of Algerian margin shows a number of distinctive features. Finally, extensive gravity modeling was carried out in an effort to investigate the deep structure and delineate crustal thickness along this margin zone.

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EXTRACTION AND DETERMINATION OF MORPHOTECTONIC FEATURES OF KARAKOÇAN FAULT ZONE (KFZ) USING DIGITAL ELEVATION MODEL (DEM), REMOTE SENSING AND FIELD MAPPING, EASTERN TURKEYErcan Zengin ¹, Murat İnceöz ²¹ General Directorate of Ankara Water and Sewerage Administration, Ankara, Turkey² Department of Geological Engineering, University of Firat, Elazığ, Turkey**ABSTRACT**

In the study, conducted neotectonic studies, covering digital elevation model (DEM), remote-sensing, aerial photographs, geological field mapping demonstrate the existence of a large dextral intraplate newly detected structure, which entitled the Karakoçan fault zone (KFZ). This is an approximately 110-km-long, 0-5-km-wide, NW-SE trending and it transfers the significant amount of slip between the Malatya-Ovacik Fault Zone (MOFZ) and East Anatolian Fault System (EAFS) from segmentation. Seismically active that fault zone is a very young neotectonic structure because it is formed as a result of the movement and propagation of these two fault systems. It is one of the most important intracontinental neotectonic structures as well as the main tectonic structural lines of the East Anatolian Region. In this study, satellite imagery with different bands and aerial photographs, digital elevation model (DEM) was used to reveal morphological and morphotectonic structure of the fault zone. In this way, a great number of fault segments have been defined from that process. It is clearly seen as a structural element on satellite image and digital elevation model, covering the study area and its surroundings. On the DEM and satellite images, the fault zone extends that it starts from east of Altinoluk village in the southeast to Karakoçan district in the northwest, approximately 3 km passes and continue throughout the villages of Hamamdagi and Sütkoç and then extends towards to Tunceli county in the northwest. Several morphotectonic elements with regard to the strike-slip faults have been defined along the fault zone, such as fault surfaces, fault scarps, triangular facets, sequential hills, pressure ridges, shutter ridges, linear escarpments, offset creeks, deflected streams, beheaded streams, thermal springs and fresh water discharge, sag-pond and like its structures, alteration zones, landslides and mutually different lithological rock units. Digital elevation model (DEM), satellite imagery and based on field observations indicate that this right-lateral active strike-slip fault zone has displacement values ranging between 70 m and 9 km. In the study, it is observed that the fault zone is represented by a number of structural fault segments ranging from 0.5 km to 17 km in parallel to sub-parallel trending, close to spaced (100 m) place to place. On the basis of earthquake activity particularly for decade along the fault zone, it is suggested that seismic activity of the fault zone continue and there is potential to produce medium-sized earthquakes in the future and can produce earthquakes in the range of 5.7-6.2

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APPLICATION OF THE GRAVIMETRIC AND MAGNETIC METHODS TO THE STRUCTURAL CHARACTERIZATION OF THE HODNA BASIN (ALGERIA)

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ABSTRACT

Northern Algeria is composed of several large complex complexes, including the Hodna region, where the Mio-Pliocene basin of the same name is located. It seems monotonous on the surface and presents a general orientation E-W. The gravity data used are derived from the International Gravimetric Bureau (BGI). The aeromagnetic map used is derived from the geophysical survey carried out by the American firm AERO SERVICE Ltd from 1971 to 1974 on behalf of SONAREM. The different methods of treatment applied to gravimetric data, the aeromagnetic map, geological and tectonics maps will bring out the structural features of the Hodna Mountains and basin. The gravity maps show a decrease in the Bouguer anomaly from North to South, which suggests a major tectonic phenomenon such as a large fracture. This phenomenon had two major consequences. The first in the North, which is the elevation of the mountainous region and to the South, subsidence of the bedrock followed by filling with low density sediments. The Hodna Mountains present a very complex Atlasic direction influenced by the different anticlinals of the region. Chott el Hodna seems monotonous on the surface and has a general E-W orientation. But the geophysical results show that it is formed by two sub-basins filled with low density sediments. The East sub-basin has an N-S orientation and a depth of 12km. The Western sub-basin is elongated E-W and its depth is 9km. These two sub basins are separated in the center of Chott el Hodna by a shoal whose depth is 5km. A major tectonic event occurred in the Cretaceous creating a rise of the bedrock. The shape, the depth and the strong filling by sediments suggest that the Hodna chott is a pull-apart sedimentary basin.

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NUMERICAL MODELING OF CENOZOIC COMPRESSIONAL EVENTS OF NW HIMALAYAS, PAKISTAN

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ABSTRACT

Numerical modeling of Cenozoic compressional events of NW Himalayas, Pakistan is presented. Our goal is to reconstruct stress evolution along major thrusts belonging to the two different rheological areas including metamorphic/igneous and sedimentary region. Considering the specific geometry of our problem and the available data at hand, a 2-D thin-plate approach was adopted, assuming plane strain conditions. In the model linear elasticity was used and contact elements were introduced to simulate major faults. Variations in material properties and major thrusts were introduced into the model. For this purpose, we used FEM (ANSYS™ WorkBench 19 academic license) to simulate stress and fault slip patterns. We assumed N-S directed regional source of stress associated with collision of Eurasian and Indian Plate. The PT (Panjal Thrust) and its inferred continuation into the Lesser Himalayan Sedimentary Zone form the major mechanical discontinuity in the model. Our results show that the PT (Panjal Thrust) divides the study area into two different stress provinces: the metamorphic/igneous (Higher/Lesser Himalayan Metamorphic Zone) and the sedimentary region (Lesser Himalayan Sedimentary Zone and Sub Himalaya). Compressive structures are observed along all major thrusts including MKT (Main Karakoram Thrust), MMT (Main Mantle Thrust), MCT (Main Central Thrust), PT (Panjal Thrust), MBT (Main Boundary Thrust) and SRT (Salt Range Thrust). The restored stress patterns in NW Himalayas also agree well with the observed present-day stress configuration. Our analyses also suggest significant strike-slip movement along Jhelum Fault (Left Lateral) and Kalabagh Fault (Right Lateral) where maximum principle stress (σ_{hmax}) aligned itself along the strike of the faults. Stress pattern associated with strike-slip movement also to be expected to occur along some segments of major thrusts.

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**TECTONIC SETTING AND PALEOSEISMOLOGICAL CHARACTERISTICS OF GEDİZ GRABEN-
ALAŞEHİR SEGMENT, WEST OF TURKEY**

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ABSTRACT

Geodynamic factors shaping the contemporary tectonic structure of Western Anatolia can be gathered in four main groups. These factors are; (1) northeastward subduction of the African plate beneath the Aegean-Peloponnisos and Anatolian plates along the Cyprus and Hellenic trenches; (2) the movement of the Anatolian Plate towards to southwest under the control of the North Anatolian and Eastern Anatolian faults (NAF and DAF) and (3) the shift of the Aegean-Peloponnisos plate towards the SW in the northern part of the Fethiye-Burdur fault zone. These summarized geodynamic factors have led to the emergence of K-G and NE-SW extension regimes in Western Anatolia since the Late Miocene. Depending on these enlargement regimes, a large part of the E-W and NW graben systems and associated depression areas in the western Anatolia are formed. Gediz graben, one of the most important depression areas of Western Anatolia, has a length of 200 km in east-west direction and a width of 10 to 40 km. Gediz grabeni, which is a narrow and symmetrical depression area between Salihli and Sarıgöl, is transformed into a complex graben system in the area west of Salihli by the influence of Manisa Mountain and Çaldağ ridges. Göl marmara-Akhisar, Salihli-Turgutlu-Manisa, Kemalpaşa-Bağcıva and Menemen-Akhisar grabens are the most important depressions in the Gediz graben system. In this study, the paleoseismological features of the Alaşehir segment of Gediz graben were investigated. In Gediz graben in Sarıgöl region, normal faults, which limit the graben both of south and north and are cut by north-south directional strike-slip faults in some locations. In the Sarıgöl region the northwest-southeast trending normal faults, which limit the graben, are made mainly of stepwise active fault systems, which are parallel to each other. On the other hand, the fact that the alluvial fan and accumulation cone formations are more common on the southern edge of the graben, and that the epicentres of earthquakes are arranged along the southern edge of the graben, indicate that the faults that bound the Gediz graben from the south are more active than those found in the north. In the paleoseismological trench studies carried out in the Sarıgöl region, the obtained data are; The Gediz graben fault, which produced an earthquake in the Holocene period, shows that earthquake-generating potential is present in the future. Besides the data obtained from the paleoseismological trenches, the presence of topographic scarps along the Gediz graben fault line, which can be traced laterally and which can be regarded as a fault trace indicates that the probability of surface faulting is quite high in an earthquake that may occur on this fault.

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**PALEOSEISMOLOGICAL CHARACTERISTICS OF BÜYÜK MENDERES GRABEN, WEST OF
TURKEY**

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ABSTRACT

As a result of the subduction of the African Plate under the Aegean Sea and Anatolian plate along the Cyprus-Crete arc, due to influence of the enlargement regimes developed in the north-south and northeast-southwest directions in the Western Anatolia and the Aegean Region since Late Miocene. Depending on this extensional regime, NW and east-west extended graben systems were formed in Western Anatolia. Büyük Menderes, Küçük Menderes, Gediz and Bakırçay grabens are the most important symmetric depression areas in Western Anatolia, parallel and semi-parallel to each other and bounded by normal faults on both sides. The extension of the Aegean Region in the north-south and northeast-southwest directions at an accelerating rate of 3 cm per year is one of the most important reasons for the Aegean Grabens normal faults to be active. Büyük Menderes Graben is one of the most important depression areas of western Anatolia with a width of 180 km in the east-west direction and a width of 10-20 km. The normal faults of Büyük Menderes Graben, which bounded north and south, were cut in some areas with north-south strike-slip faults. The east-west trending normal faults, which limit the graben, are made mainly of stepwise active fault systems, which are parallel to each other. On the other hand, the fact that the alluvial fan and accumulation cone formations are more common on the northern edge of the graben, and that the epicentres of earthquakes are arranged along the northern edge of the graben, indicate that the faults that bound the Büyük Menderes graben from the north are more active than those found in the south. In the paleosismological trench studies carried out in the Nazilli-Isabeyli region, the obtained data are; The Büyük Menderes fault system, which produced an earthquake in the Holocene period, shows that earthquake-generating potential is present in the future. Besides the data obtained from the paleosismological trenches, the presence of topographic scarps along the Büyük Menderes fault line, which can be traced laterally and which can be regarded as a fault trace indicates that the probability of surface faulting is quite high in an earthquake that may occur on this fault.

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ARCHAEO-SEISMOLOGICAL INVESTIGATIONS OF CADIANDA ANCIENT CITY

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ABSTRACT

In this study Cadianda Ancient City has been investigated about archaeoseismological characteristics. Cadianda ancient city is located in Tekirlik location of Üzümlü sub-district of Fethiye in Southwest Anatolia. It is possible to see the ruins spread all over the hill and hillside around the ancient city. These ruins are monuments from the old glorious times of the city. Cadianda Ancient City has been under the influence of various earthquakes throughout history due to the geological structure of the region. Although local earthquakes occurred in the region after the earthquake of 141 AD which caused destruction in many Lycian cities, the earthquake in 259 AD was equal to the disaster that occurred almost a century ago. The faults in the region have been re-mobilized and the energy accumulated during the century has been released and brought destruction to the region. In preliminary research in the ancient city of Cadianda, it is observed that the cavea of the Ancient Theater is distributed in a chaotic geometry. The temple of the city was completely destroyed. In the Stadion's seating rows there are shifts in the blocks. The agora and necropolis walls in the city are observed to have collapses and cracks. It is highly possible that the earthquakes affecting Kibyra have affected Cadianda as well, due to their geographical proximity and being on the same fault zone. In this connection, the A. D. Although it is likely to have been affected by the earthquake that caused major destruction in Kibyra in 23 A.D, it was restored during the Roman period and then destroyed by earthquakes. If it is considered to be in use until the 7th century, the earthquakes that cause these deformations must have occurred after this date. It is known that there were two major earthquakes in the 7th century in Myra, 84 km away. It should not be ignored that these earthquakes may also have an impact on the abandonment of Cadianda.

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COAL MINES RISK MODELLING USING ENERGY SPREAD

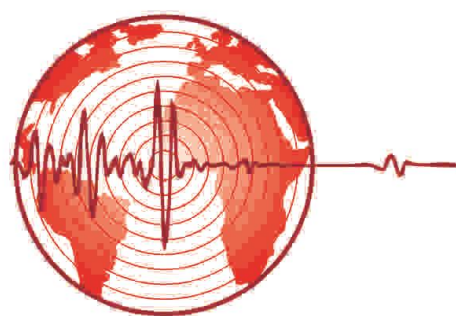
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ABSTRACT

The growing importance of the cost of electricity in coal mining, changes in the value chain in recent years and new commodity exchanges cause that mine operators independently or vertically integrated with power plants have possibility to buy and sell coal and electricity and create a specific spread. The study of risk based on the concept of a new indicator: an intrinsic spread. The intrinsic spread is calculated as a difference between the income from the sale of coal and the cost of purchasing the energy required for the coal production. This indicator shows a market risk in the coal mine in a better way, because except for income it includes a part of the cost of exploitation which can be hedged in the exchange market. Spread calculations were made on historical data and simulation modelling. Based on time series of coal and energy prices for various contracts and spot prices obtained from the EEX the impact of the type of contracts on the volatility of the intrinsic spread in subsequent periods measured by the standard deviation of returns has been analysed. It was found that hedge using futures helps to reduce the risk in the mine. Modelling of coal prices and electricity was carried out by conventional financial market econometric models. The best-fitting econometric models are multivariate models and models based on the copulas. The simulation results show that the use of futures contracts contributes little to reducing the intrinsic spread volatility. An econometric model with the technical and economic parameters of the mine typical for hard coal mine has been built. Changes in fixed and variable costs have been simulated based on triangular distributions. Parameters for simulation were estimated based on the economic data from the mines. Additionally, coal and energy prices were dependent on the market volatility. Based on the economic model and Monte Carlo simulation it has been found that the proposed method may be helpful in reducing the coal mine market risk.

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