

## **MAPPING BASED ON PARTICLES (LESESTEIN) IN THE AREA OF THE FIELD TRAINING CAMPUS IN LYUTIBROD VILLAGE, VRATSA DISTRICT**

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**ABSTRACT.** Mapping based on particles is a method, used widely in covered terrains. In German literature, for it has a special term – „Lesestein“. It allows identification of the geological boundaries based on particles of indigenous rocks, which are stored in deluvial deposits after their weathering. These may be just pieces of the rocks or persistent characteristic elements of rock as concretions, fossils or minerals. This article is devoted to a problem that is not addressed in the guide for geological training in the area. It examines the use of reworked concretions of the Sumer Formation (Aptian) in the Upper Cretaceous sandstones marking the Late Cretaceous transgression in the Western Balkan. The basal conglomerate at the base of these sandstones is composed of polished rusty-brown phosphorite-hematite nodules that are very distinctive and easily recognizable marker. During the weathering of the basal conglomerate they fill deluvial deposits in covered areas, giving levels below the boundary between the Aptian and Campanian-Maastrichtian sandstone. The long years of training in geological mapping in the area indicates that it is a very efficient and practical approach for mapping of the transgressive boundary between the lower and upper Cretaceous in the area, which is easily perceived and stored permanently by students.

## **THE GEOPARK POTENTIAL OF NORTH RILA MOUNTAIN**

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**ABSTRACT.** Rila and Pirin are among the highest and beautiful mountains in Eastern Europe. On their territory are situated National parks and Pirin National Park is in the UNESCO World Heritage List for a long time. National Park "Rila" is not yet available for inclusion in the list, but "Rila Monastery" Natural Park, which in the past was part of the National Park "Rila" includes a UNESCO site - Rila Monastery. Recently, the new category "Geopark" is widely developed in many countries of Europe and the world. In economic terms, this category was proved to be more vital than the natural and national parks with their conservative and restrictive regimes. It does not impose new restrictive measures in view of the development of the territories. The main objective of the Geopark is to preserve, study and promote geological heritage of a region, develop and strengthen its relations with all other aspects of the natural, cultural and historical heritage. From this point of view, North Rila is very suitable for the development of Geopark, which will unite the geological heritage of Samokov district with its cultural and historical values and will contribute to sustainable local development. In terms of geodiversity the potential of the region is enormous. It includes the highest peak in Eastern Europe - Musala and beautiful ice formations such as the alpine peaks, glacial valleys, cirques, lakes and moraines. The area is characterized by a wide variety of sedimentary, igneous and metamorphic types, and dozens of mineral springs, the most remarkable of which is the geyser in Separeva Banya. These are good conditions for the development of a new national geopark, to be proposed for inclusion in the European Geoparks Network as UNESCO Geopark.

## **ARCHITECTURAL-ELEMENT UNIT CHARACTERISTICS OF THE PETROHAN TERRIGENOUS GROUP SECTIONS IN PART OF WESTERN STARA PLANINA MOUNTAIN. I. CHANNEL COMPLEXES**

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**ABSTRACT.** The channel complexes recognition in fluvial deposits - an element CH, depends directly on the ability to be defined the shape and the rank of the bottom-forming erosion surface, and in case it is possible to be done this well enough, to be identified several varieties, mainly related to the occurrence of auto- and llocyclic processes. The development of a composite (multistore) internal structure, complicated by multiple internal erosional surfaces of different ranks is typical for this element. Channel complex in which the lower bounding surface is of sixth rank - variety CH<sub>(6)</sub>, is most large-scale identifiable element in the fluvial flood plain system. All other architectural elements may be present partly or wholly therein, in which both they as well as the lithofacies ensembles that build them form cyclic sequences, often marked by the fourth rank bounding erosional surface. Element CH<sub>(6)</sub> is interpreted as fluvial paleovalley with the whole complex of depositional environments and processes in it, formed as a result of a sharp change of any of the parameters that define the profile of equilibrium of the fluvial system. The variety CH<sub>(5)</sub> creation is associated with the process of migration (avulsion) of the mainstream, when bottom-forming erosion surface is from the fifth rank, and intra-mainstream (secondary) fluvial channels, when bottom-forming erosion surface is the fourth rank. The formation of the last one is often associated with periods of strong flooding or a sharp drop in water level. The geometry of the element CH is directly related to the style of the fluvial system whose product it is, as well as the nature of sediments in which channel complex cuts.

## **ARCHITECTURAL-ELEMENT ANALYSIS PARAMETERS IN FLUVIAL-DOMINATED CONTINENTAL SEDIMENTARY SUCCESSIONS**

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**ABSTRACT.** The fluvial style interpretation and the role of intra- and extra-basin control recognition during its formation requires a complex investigation of the generated lithofacies units' relationships and their bounding surfaces. Today, among the methods applied to achieve this objective, the widest popularity acquires the architectural-element analysis. The analysis is based on the understanding that the fluvial successions are composed of a limited number of building units – "architectural-element", that represent 3-D variations in the composition and geometry of fluvial lithofacies successions. Their definition is based both on their external form and organization of their internal structure. These features reflect the different style of growth of sedimentary bodies and in most cases are associated with morphological features on the scale of the complex sedimentary macroforms. The identification and the characterization of architectural elements includes establishing the nature, morphology and orientation of the bounding surfaces, the scale, the internal and external geometry of the unit, as well as lateral and vertical lithofacies sequences, their significance and relationship. The applied in the study of Petrohan Terrigenous Group in part of Western Stara Planina Mountain scheme is based on that proposed by Miall (1996) with some additions and modifications tailored to the specificities of the research object.

## **PETROLOGIC CHARACTERISTICS OF THE HYPABYSSAL MAGMATITES FROM THE REGION OF VARBITSA STARA PLANINA MOUNTAIN (BALKAN MOUNTAIN)**

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**ABSTRACT.** Objects of study are not enough analyzed and with local distribution small intrusive bodies and dykes in the northern and southern slopes Varbitsa Balkan Mountain. Determined is the spatial position of these rocks as well as their composition, structure-textural features and the hydrothermal alterations. According to the modern petrographic nomenclature the studied intrusive bodies and dykes are quartz-diorite, subalkaline diorite and subalkaline quartz-diorite porphyrites changing to monzodiorite and quartz-monzodiorite porphyrites with the increase of the K-feldspar content. The magmatites are intruded in Upper Triassic siltstones and sandstones of the flysch, rarely of the marl-limestone and marl suits and in single cases also in the Lower and Middle Jurassic depositions. The rocks are oversaturated in SiO<sub>2</sub> and are medium-K with prevalence of Na<sub>2</sub>O over K<sub>2</sub>O with calc-alkaline and high-potassium calc-alkaline series. The chemical compositions of the rock-forming plagioclases, amphiboles, clinopyroxenes and biotite were determined. Geo-thermobarometric calculations were performed and on their basis the P-T conditions of crystallization were proposed. A petrochemical correlation with similar small intrusive bodies and dykes with analogous composition and situated nearby the region of Rish pass was also performed.

## **GEOLOGICAL PHENOMENA IN THE AREA OF SOZOPOL AND CHERNOMORETS TOWNS - STATUS AND PERSPECTIVES**

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**ABSTRACT.** The area of Sozopol Town and Chernomorets Village is characterized by well-articulated sea coast line providing excellent conditions for exposition of geological phenomena of high aesthetic and scientific value. Three geotopes, included in "Register and cadastre of the geological phenomena of the Republic of Bulgaria", are exposed here – "Chervenka", "Kolokita" and "Agalina Cape". "Chervenka" geotope is situated east of Chernomorets Town and represents the relationships between effusive (the Sozopol Formation) and intrusive facies of the Rossen volcano-plutonic structure. The sea coast line is articulated by beautiful fiord-like inlets and reveals intersection contacts of intrusive, subvolcanic and effusive rocks, prototectonics and initial stages of spherical (onion-like) weathering of the intrusive, block-prismatic fracturing and vesicular (cavernous) weathering in the volcanic products. "Kolokita" and "Agalina Cape" geotopes, developed entirely in the rocks of the Sozopol Formation, represent the relationships between pre-caldera and caldera facies from the neck of Rossen paleovolcano. The most characteristic paleovolcano objects include volcanic breccias, dykes, hydrothermally altered rocks, vesicular (cavernous) weathering, block-prismatic fracturing, contacts between volcanic materials belonging to different facies. In geomorphological aspect both geotopes reveal good opportunity for observation of fiord-like inlets, cliffs up to 10 m in height, as well as rock pinnacles. According to the classification of the geological phenomena all the geotopes are referred to the geosites of aesthetic and scientific value, and according to the original Bulgarian methodology for estimation of geological phenomena "Chervenka" geotope corresponds to the criteria for geosite of national importance, while "Kolokita" and "Agalina Cape" are geosites of regional importance. The observations, carried out during the present investigation, showed that "Chervenka" geotope is partly built while "Kolokita" geotope is entirely covered by modern buildings. This fact put forward the question about their statute of protected areas.

## **„THE ELEPHANT” GEOLOGICAL PHENOMENON NEAR DOLNI KORITEN VILLAGE, KYUSTENDIL DISTRICT**

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**ABSTRACT.** „The Elephant” geological phenomenon, known as „Porous Stone”, is situated at the central area of Kobiliska Mountain in the Ujenshtitsa River valley, 770 m west-southwest of Dolni Koriten village, Kyustendil District at an elevation of 868 m. The phenomenon is formed in the rocks of a subvertical limestone package of flyshoid formation (Upper Eocene-Lower Oligocene). It resembles an elephant body - 17,50 m long and 5,50 m high, with distinct head and proboscis. It resulted of combination of 3 factors: lithology, tectonics and geomorphology. The location of the resistant limestone packet among the incompetent layers of flyshoid formation as well as its subvertical dipping in southwestern limbs of a small syncline, enabled the creator who by means of his tools – selective denudation and erosion, has sculptured this strange relief form. According to the classification of the geological phenomena „The Elephant” is referred to the geosites of aesthetic value (class geomorphologic geosites) and according to the original Bulgarian methodology for estimation of geological phenomena it corresponds to the criteria for geosite of local importance. It also corresponds to the criteria of natural site according to the Protected Areas Act. In combination with the wonderful nature, complicated geological structure, presence of several geosites with scientific and aesthetic value as well as traces of ancient gold mining, „The Elephant” represents a natural part of the local landscape and deserves to be popularized and protected.

## **METABASITES FROM THE NORTHERNMOST PARTS OF THE HIGH-GRADE METAMORPHITE SECTION OF CENTRAL SREDNA GORA, BULGARIA**

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**ABSTRACT.** High-grade metamorphic rocks from the core of the Variscan orogen on the Bulgarian territory are exposed along the margins of both Zlatitsa and Kamartsi grabens. Here, they are involved into an intense ductile deformation along the regional-scale Stargel-Boluvanya tectonic zone, coinciding with the contact between high-grade basement and the low-grade complexes of the Stara Planina zone. The high-grade metamorphic section is dominated by diaphorized two-mica paragneisses, but rare domains of leucocratic orthogneisses are presented as well. Our field studies in the area of Galabets horst and Zlatitsa graben show the presence of several meters, decameters as well as up to hundreds meters in scale bodies of metabasic rocks. Most common are intensively mylonitized metagabbros hosting numerous aplite and pegmatite veins, but locally bodies of diaphorized eclogites are distinguished as well. The latter are playing a key role in reconstruction of the Variscan orogeny indicating deep burial of parts of the high-grade metamorphic section. In addition, the documented here more widespread occurrence of metabasic rocks within this high-grade complex requires reassessment of their structural and stratigraphical position. Namely, the mylonitic metagabbros from the southern slopes of Stara Planina Mountain, which traditionally are attributed to the Stara Planina (Balkan) low-grade metamorphic unit, have to be taken away from this section due to the great contrast of the experienced metamorphic transformations.

## **NATURAL GAS FROM LOW PERMEABLE TERRIGENOUS FORMATIONS (TIGHT GAS)**

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**ABSTRACT.** The study of rocks as collectors for natural gas in terms of their specific petrophysical characteristics is essential for predicting the areas other than the conventional notions of their accumulative characteristics. In the world practice the zones of distribution of natural gas are increasingly gaining popularity, characterized by relatively low collector properties. The name Tight Gas was adopted in the English literature. This specific term holds the meaning of a natural gas contained in terrigenous rocks that are uncracked, high in a pack, the size of a pore channel not exceeding 0,1  $\mu$ , with the matrix permeability of less than 0,1 md, high residual water saturation and certain mechanical resistance. The total supply of Tight Gas, globally estimated at over 45 000 billion m<sup>3</sup>, shows their importance and quality of a promising source of natural gas. A review of the specialized literature allows to separate some general laws regarding the position, distribution, properties of poorly permeable terrigenous sediments and other traits that allow targeting of exploration and mining activities. The prediction of such zones of distribution of Tight Gas and within the territory of Bulgaria is important due to the modernization of the existing knowledge and research of appropriate for carrying out the extraction sites.

## HYDROCARBON RESERVOIR SYSTEMS OF THE EAST PART OF THE SOUTH SAKAR DEPRESSION

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**ABSTRACT.** As regard the clarification of elements of hydrocarbon potential of different regions of Bulgaria an area is selected, which is characterized with relatively poor geological, geophysical and drilling knowledge. It is situated in Southeast Bulgaria, within the East Trakia depression. The region is considered as Northwest flank of the large Thrace basin. Based on the conducted geological exploration and drilling activities in the Bulgarian part of the Thrace basin and the data of the reservoir properties of the same sequences from the Turkish region, within the South Sakar depression, some hydrocarbon potential reservoir systems with Tertiary age are separated and defined. They are characterized with very complex tectonic and lithological environment of sedimentation, caused by tectonic faults. This determines the formation of various types of hydrocarbon potential reservoirs with local and zonal distribution and complex spatial relationships of the constituent reservoir and seal formations.

## GEOHAZARD DESCRIPTION FOR SOFIA IN THE FRAME OF THE PANGEO PROJECT

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**ABSTRACT.** PanGeo project is a 3-year Collaborative Project of the European Commission that started 1st February 2011. During the project PanGeo provide free online geohazard information for 52 of the largest towns in Europe, mapping geohazards that could potentially affect up to 13% of the EU population. The GeoHazard Description for Sofia was prepared as support for the PanGeo Ground Stability Layer (GSL) of Sofia (intermediate product), Bulgaria. The area covered by the GSL corresponds to the administrative area of Sofia Municipality (~1,342 km<sup>2</sup>) and includes the City of Sofia and other surrounding boroughs. The identification of geohazards was performed through combined interpretation of geological, land use and other geospatial layers together with satellite Persistent Scatterers (PS) ground motion data for 1992-2003 for the city of Sofia, by processing ERS-1/2 SAR with the Interferometric Point Target Analysis (IPTA) algorithm. The results of PanGeo project are included also in OneGeology-Europe portal which aims to create dynamic digital geological map data for Europe.

## LASER "RAMAN" SPECTROSCOPY OF ANGLESITE AND CUBANITE FROM DEPOSIT "CHELOPECH"

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**ABSTRACT.** Using a laser "Raman" spectroscopy are found not listed at this moment minerals in the deposit "Chelopech", namely Anglesite (PbSO<sub>4</sub>) and Cubanite (CuFe<sub>2</sub>S<sub>3</sub>). The main advantages of spectroscopic methods are successful chemical and structural characteristics of the samples in sizes less than 1 μm in diameter, as well as rapid and specific identification of minerals and ores. The values of the acquired spectral peaks in the analysis of minerals from the studied rock samples, differed by about 1-2 cm<sup>-1</sup> with those of a database RRUFF and in literature, which is perfectly acceptable, as the difference could be due to the inclusions of another minerals or elements within the researched mineral, or interference in medium during the process of analysis. Anglesite is a typical Pb-containing secondary mineral. Spatial and structural relationships of mineral are the basis to be assigned to galena-sphalerite mineral association in the deposit. In the studied samples are found together with the ore minerals cerusite, pyrite, galena, sphalerite and tennantite, and the gangue minerals quartz, barite, anhydrite and kaolinite. The newly determined cubanite is found in association with pyrite, chalcopyrite, tennantite, sphalerite, quartz and anatase. This Cu-Fe-sulfide is more typical for a high-temperature type of hydrothermal deposits, where occurs together with pyrrhotite. Cubanite from the deposit "Chelopech" is a rare ore mineral deposited in the main stage of hydrothermal mineral formation and belongs to the pyrite-chalcopyrite mineral association.

## APPLICATION OF ELECTRICAL TOMOGRAPHY FOR MAPPING THE NEAR SURFACE SECTION OF SEVERAL ALTERNATIVE SITES FOR CONSTRUCTION OF A NEW ENERGY FACILITY AT THE KOZLODUY NPP

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**ABSTRACT.** The high efficiency of electrical tomography method for mapping of near-surface section is based on the good differentiation of the environment in respect to its specific electrical resistivity. The variation of this physical characteristic is associated with differences in lithological composition, porosity, water-saturation, and composition of groundwater in the studied parts of the sub-surface area. The application of this method in combination with exploration core drilling is a very useful tool for spatial mapping of geological, tectonic, engineering geological or hydrogeological boundaries. This approach is used in order to obtain a detailed picture of the engineering geological and hydrogeological units constituting the near-surface section of four alternative sites for construction of new energy facility in the region of Kozloduy NPP. The presented results demonstrate the possibility to create more detailed models of sub-surface area by the combined application of electrical tomography and other conventional methods of study.

## **AN INTEGRATED GEOPHYSICAL APPROACH FOR LOCATING WATER-PERMEABLE ZONES IN THE EMBANKMENT WALL OF A SURFACE WATER BODY**

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**ABSTRACT.** The presence of non-compacted and water-permeable zones in the walls of surface water bodies violates their normal functioning and could lead to a compromising (destruction) of these facilities. The proposed integrated geophysical approach for locating the problematic areas include the application of two geoelectrical methods – GPR and resistivity tomography. The possibilities for mapping of water-permeable zones and the efficiency of the proposed approach implementation is illustrated by the results of the performed GPR and electrical tomography surveying of the embankment wall of the equalizing dam "Krichim". The presented results confirm the applicability of the employed methodology for measurement, analysis and interpretation of data.

## **GENERAL PRINCIPLES OF THE KINEMATIC MODELS USED IN EARLY WARNING SYSTEMS – EARTHQUAKES AND TSUNAMIS (VENICE CASE)**

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**ABSTRACT.** The seismic early warning systems (SEWS) and tsunami early warning systems (TEWS) are the product of the last and most modern achievements of the recent practical Earth's science. Heavy earthquakes occurred in Japan (2011), Sumatra (2004), Chile (2010), Solomon Islands, etc. These earthquakes demonstrated the need of such systems. All known SEWS are based on the fundamental physical property of the seismic waves propagation: the P-waves (with lower amplitudes and smaller destructive potential) travel approximately 1.71 times faster than the S waves (with several times larger amplitudes and much more destructive potential due to the medium particles movement perpendicular to the wave ray propagation). Up to now – only Japan has fully operative and effective SEWS introduced in operation in 2007 and TEWS some years earlier. Their efficiency was demonstrated during the M9 earthquake on 11<sup>th</sup> March, 2011. All TEWS are based on the time differences between the propagation velocity of the seismic and the tsunami waves. Several very peculiar cases and models have been developed for Venice in two directions: 1) The SEWS about some typical cases – seismic sources defined according the seismic zoning maps of Italy; 2) The TEWS about a case of the tsunami sources located around the Venice in the Adriatic Sea. The results of these models are under investigations and discussion.

## **GEOPHYSICAL COMPLEX STUDY OF THE SHALLOW GEOLOGY IN THE AREA OF PERNIK EARTHQUAKE 22<sup>nd</sup> MAY, 2012**

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**ABSTRACT.** Complex geophysical investigations (in the frame of the SIMORA project) are performed in the area of the Pernik M5.8 earthquake of 22 May, 2014. Electric tomography and georadar measurements have been done massively to establish the electrical inhomogeneities due to the different reasons – faults, ground water's level, etc. The interpretations of the measurements results show different peculiarities of the cross-sections – surface faults, surface underwater level, other electromagnetic anomalies. The georadar gives results of the most surface part of the ground. The low penetration is useful for shallow anomalies generated by the electromagnetic inhomogeneities. The observed relationships and the obtained results could be very useful for the explanation of the damages observed to the different structures and buildings.

## **USE OF ELECTRONIC LEVEL GAUGES AND STATIC GRAVIMETERS WHEN MEASURING HIGH ACCURACY LEVELING CLASS I AND II OF THE REPUBLIC BULGARIA**

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**ABSTRACT:** This publication shows that more attention should be paid to the measurements carried out with electronic leveling and **outline-code** battens on the lines of the state leveling I class. It is mentioned that the existing comparator in Bulgaria for calibration of digital battens is not suitable for **outline-code** battens. Electronic leveling and **outline-code** battens need to be sent to **comparation** in countries that have interference comparators. Instructions on Levelling I and II class from 1980 are made for optical leveling and digital battens, not electronic level gauges and **outline-code** battens. Performing gravimetric measurements based on leveling lines can be done with the available gravimeters in Bulgaria, which can provide accuracy within  $\pm 0,300$  mGal of "g" with a single method of measurement of control points.

## **LOCATING FAULTS IN STRUMSKA SEISMIC ZONE BY GRAVIMETRIC AND LEVEL MEASUREMENT**

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**ABSTRACT:** Based on leveling and gravimetric measurements carried out during different time periods are drawn profiles and maps are drawn which very well localize the Krupnik fault in the region of level benchmark R0, 1047, 30 and 2014. Profiles localize the Jeleznishka and Gradevska faults the region of level 1003 benchmarks, VNR 371 and 1004. On the map with the cards with the remaining / local / anomalies, the Krupnik fault falls about the negative portion of the residual anomaly or we can say that it is the point where the change of sign of the residual anomalies happens. On the profile with the possible change of the density of the intermediate layer -  $\rho$  we also have minimal negative change in the densities in the region of the fault. An analysis of the results of the gravimetric and leveling measurements has been conducted over the different periods.

## **REGIONAL 3D MODEL OF THE HYDROGEOLOGICAL CONDITIONS IN THE PERNIK MINES AREA AFTER TERMINATION OF UNDERGROUND COAL MINING**

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**ABSTRACT.** The conditions for the formation and the movement of groundwater in the Pernik mines area after termination of underground coal mining are simulated by a regional mathematical three-dimensional (3D) model. It is development using the computer program Modflow. The model takes into account the natural and technogenic factors that led to the current state and that have dominant influence over the dynamics of the long term hydrogeological processes. The focus of the research is to perform a detailed analysis of the highly altered and complicated groundwater flow conditions as result of the coal mining environment as compared to the relatively simple natural hydrogeological conditions in the Pernik Valley. The obtained results are a solid basis for the development of local models aimed towards estimating the water balance quantitative characteristics, the groundwater flow structure, and the water levels dynamics in the affected by the coal mining areas in the city of Pernik.

## **FORECASTING A POSSIBLE GROUNDWATER RISE IN THE AFFECTED BY THE COAL MINING AREAS IN THE CITY OF PERNIK**

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**ABSTRACT.** One basecase and two predictive local 3D models are developed in order to assess the current state and the possible future changes in the groundwater flow structure in the areas affected by the coal mining near the city of Pernik. The models are developed using the computer program Modflow and taking into account the results of prior regional modeling studies and the site specific hydrogeological and mining-technological conditions. The basecase local 3D model determines the spatial distribution of the piezometric hydraulic heads (groundwater levels) and estimates quantitatively the inflow and runoff elements of the water balance after termination of the underground coal mining. The two predictive models are used for performing calculations for the expected rise in groundwater and the possible changes in water balance after termination of the open draining and for the conditions of average and maximum values for the infiltration recharge.

## **RELATING PLANT GROWTH AND SPECTRAL RESPONSE TO ECOLOGICAL FACTORS**

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**ABSTRACT.** Remote sensing is recognized as a powerful tool in numerous scientific and application fields. Remote sensing surveys have become an operational technology in managing problems of global importance, such as accelerating environmental changes and ecosystems degradation. The derived information supports solutions for more rational and sustainable land-use, biodiversity conservation and natural resources preservation. Recent developments in environmental studies are greatly related to ecological problems arising from increasing anthropogenic impacts on the biosphere and especially on vegetation. The interrelated nature of many environmental issues imposes the necessity to conduct interdisciplinary research and implement different approaches as well as to share and integrate the acquired data. Remote sensing provides advanced monitoring and alerting techniques, timely information extraction, modeling and forecasting possibilities used for decision-making in environmental control policies. In this paper we report results from an experimental study designed to make use of vegetation spectral features in assessing plant performance under different growth conditions. We investigate and analyze the relationship between growth variables and spectral response of agricultural species to abiotic stress factors (heavy metal pollution, nutrient deficiency and soil acidity). Multispectral data obtained from ground-based optical spectroradiometric measurements are examined in terms of the relation to ecological factors and the ability to serve as an indicator of crop performance.

## **FIELD SPECTROSCOPY MEASUREMENTS OF ROCKS IN EARTH OBSERVATIONS**

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**ABSTRACT.** Remote sensing applications in Earth observation begin with the design and development of equipment for carrying out research of the monitored objects remotely and without disturbing their integrity. Ground-truth data in Earth observation of the environment and in the remote sensing investigations are very important. The main goal in the geological remote sensing is the determination of the chemical and/or mineral composition and the structure of the rocks. For this purpose the field spectroscopy measurements of the samples of the main rock types are performed. These measurements are made to collect, compile and complete guide with spectral characteristics of different rocks for their reliable identification and for the determination of their mineral and chemical composition. The experiments are based on major physical principles such as light scattering, absorption of light, and reflection of light in the electromagnetic spectrum. In the field-based studies the Thematically Oriented Multi-channel Spectrometer designed and constructed in Remote Sensing Systems Department at SRTI-BAS is used. The spectrometer with increased spectral resolution works in (400-900) nm range of the spectrum. The obtained spectral data are compared with similar data from different instruments for Earth observation included in the spectral libraries. They correspond to the shape of the spectral signature in the same spectral range obtained with other spectrometers. These promising results encourage us to plan the next campaigns for the field spectroscopy measurements in different regions of Bulgaria.

## **PERSPECTIVES FOR DIRECTIONAL DRILLING IN HYDROCARBON FIELDS IN BULGARIA**

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**ABSTRACT.** Drilling for hydrocarbons (oil, gas and condensate) in Bulgaria has a history for more than 50 years. The drilled wells (more than 3000) during this period give us full characteristics of the discoveries and exploration of our oil, gas and condensate fields, their structures, working regimes and reserves. Due to the fact that they are all in their last stage of development, with constantly decreasing production and increasing water content, it is rather interesting and challenging to apply the methods of horizontal and directional drilling in such areas of the fields that are not fully extracted yet. Success in these operations could mean that on one hand we would return the investments we give for directional drilling and on the other hand – we prolong the life of the field. This is widely used all over the world with very good economic effect. Having all the geological, geophysical, technological and technical information in mind we can determine the economically perspective wells in some of our Bulgarian fields – Dolni Dabnik, Gorni Dabnik, Dolni Lukovit, Tulenovo etc. This information should contain debts and widths of pay zones, layer pressures and their behavior during the years of extraction, rock characteristics, well working regimes, technological execution of the directional well and the technical means for its realization and last, but not least the methods for making secondary flow in the well and extracting it.