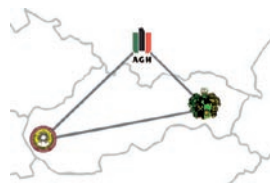


# Herlandia 2009



## 10th International conference of young geologists

### Medzinárodná konferencia mladých geológov, 10. ročník

Herľany 2. – 4. 4. 2009

M. KOVÁČOVÁ, J. KONDELA, B. CHALUPOVÁ, Ľ. ŠTRBA, L. VIZI, L. ZAHRADNÍK, M. GREGÁNOVÁ and J. BAZARNIK

**Abstract:** The 10th International conference of young geologists was held in the former spa resort Herľany (Eastern Slovakia) on 2. – 4. April 2009. During two days of lecturing 71 contributions were presented in several thematic blocks. Participants were informed also about the recently solved EUROCORES project VAMP (Vertical Anatolian Movement Project) researched in Central Anatolia, as well as about expedition Nepal – Tibet 2007. Excursion, accompanying the conference, led through the opal-bearing locality Dubník in Neogene volcanic sequences and so-called Zemplín Island with anthracite mine Malá Trňa, neighbouring the Slovak part of Tokaj area. The article reports the event and principal presentations.



On 2. – 4. April 2009, the 10th anniversary International conference of young geologists was held in the former spa resort Herľany, now in the place of the Training Center of the Technical University of Košice. It was organized under the auspices of the Faculty BERG of Technical University in Košice, Faculty of Natural Sciences of Comenius University in Bratislava and the AGH University of Sciences and Technology in Cracow, as well as the scientific guarantee by Prof. Ing. Tibor Sasvári, CSc., Prof. RNDr. Dušan Plašienka, DrSc. and Dr. hab. Anna Świerczewska. Logistics for the conference was traditionally provided by the members of Geological Club. The attractiveness of the event was magnified by 10 – 15 meter high geyser eruption (water temperature 14 – 18 °C), which some participants saw 3 times during the 10th anniversary year of the conference.

The imaginary Slavic Triangle, deliberately non-respecting national boundaries, is an expression of the principal philosophy of this event and achieving of the main objective as well as the

V termíne 2. – 4. apríla 2009 sa v bývalom kúpeľnom areáli v Herľanoch, v súčasnosti priestoroch školiaceho strediska Technickej Univerzity Košice, uskutočnil jubilejný 10. ročník *Medzinárodnej konferencie mladých geológov*. Uskutočnila sa pod inštitucionálnou záštitou Fakulty BERG TU v Košiciach, Prírodovedeckej fakulty UK v Bratislave a Akadémie Górnícko-Hutníčej v Krakove, ako aj pod odbornou garanciou prof. Ing. Tibora Sasváriho, CSc., prof. RNDr. Dušana Plašienku, DrSc., a Dr. hab. Anne Świerczewskej. Výkonnú organizačnú zložku podujatia už tradične zabezpečovali členovia Geologického klubu. Atraktivitu tohto podujatia podčiarkoval 10 – 15-metrovou erupciou studený Herľanský gejzír (teplota vody 14 – 18 °C), ktorú niektorí šťastlivci mali možnosť vidieť až 3-krát počas trvania 10. jubilejného ročníka konferencie.

Imaginárny slovanský trojuholník, zámerne nerešpektujúci štátne hranice, je výstižným vyjadrením základnej filozofie podujatia a zároveň dosiahnutím hlavného cieľa a realizácie

implementation of ideas of the founders of the conference. Mutual communication, especially in the native language, repeatedly allowed to form the space for the language stress-free diploma theses presentation, or even the first particular results of scientific work of young adepts of geo-sciences disciplines.

Initiation ceremony was taken on behalf of scientific guarantee by Prof. Ing. Tibor Sasvári, CSc. Following his introductory words, the conference gradually started to fulfil its program. During first two days 71 contributions were presented in several thematic blocks. During the first "evening dinner discussion" and presentation of photographs, the participants were informed about the recently solved EUROCORES project VAMP (Vertical Anatolian Movement Project) with a research territory in Central Anatolia, being held by the PrIF UK Bratislava. During the next evening the members of the Geological Club (Kováčová, Chalupová, Zahradník and Gregáňová) presented tourist experiences and rich photographic documentation of the Expedition Nepal – Tibet 2007.

The last day of the conference was traditionally devoted to excursion. The excursion route led through locality Dubník, where we unfortunately did not have the opportunity to visit the opal mine, but the nearby nature trail, passing the old mine works was an interesting alternative. Next route to "Zemplín island" had two reasons. This first was visiting the old mining dump of anthracite mine at the village Malá Trňa, and introducing the geological unit Zemplinicum. The second reason was traditionally focused on the wine region Tokaj, and especially the wine producers "u Macíkovcov". The wine grower Mrs. Macíková presented during degustation the Tokaj wines from their production and participants became familiar with the atmosphere of the Tokaj wine micro-region.

The popularity of the series of international conferences of young geologists in Herlany increases each year owing also to the pleasant and friendly atmosphere. Even now the organizers are looking forward to the 11th continuation in Modra-Harmónia.

See you in Herlandia 2010!

#### R. ARDON: Miocene sharks from the surround of Veľký Krtíš

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In localities surrounding Veľký Krtíš, Horné Strháre, Horné Příbelce and Stredné Plachtince twenty one taxa of selachian teeth have been recovered and described altogether: *Hexanchus* sp., *Notorhynchus primigenius*, *Carcharias* sp., *Carcharias cuspidatus*, *Odontaspis acutissimus*, *Mitsukurina lineate*, *Lamna* sp., *Isurus* sp., *Isurus hastalis*, *Isurus retroflexus*, *Carcharocles megalodon*, *Triaenodon* sp., *Triaenodon* cf. *obesus*, *Otodus* sp., *Otodus* cf. *minor*, *Scyliorhinus* sp., *Carcharhinus* sp., *Carcharhinus similis*, *Galeocercus* sp., *Galeocercus aduncus*, *Physogaleus singularis*, some rests of *Aetobatus* sp. and some rests of angular fish (Osteichthyes) – *Sparidae*. The sharks assemblage includes pelagic and also benthic species.

The article is based on the contemplation and interpretation of sedimentological storage attitude, and together with the described taxons provides the summary about the environmental, paleoecological, paleoclimatological and paleogeographical conditions.

myšlienky zakladateľov konferencie. Vzájomnou komunikáciou najmä v rodnej reči sa nám darí opakovane vytvárať jazykovo bezstresový priestor na prezentáciu diplomových prác, ba dokonca prvotín výsledkov samostatnej vedeckej práce mladých adeptov geovedných disciplín.

Slávnostného otvorenia sa ujal v mene garantov prof. Ing. Tibor Sasvári, CSc. Po jeho úvodných slovách sa začal postupne naplňovať harmonogram konferencie. Počas prvých dvoch dní odznelo 71 príspevkov rozčlenených na tematické bloky. V rámci prvého diskusného večera a prezentácie fotografií sa účastníci oboznámili s aktuálne riešeným EUROCORES projektom VAMP (Vertical Anatolian Movement Project) s výskumným územím v Centrálnnej Anatólii, do ktorého je zapojená PrIF UK v Bratislave. Počas nasledujúceho večera sa prezentovali členovia Geologického klubu (Kováčová, Chalupová, Zahradník a Gregáňová) cestovateľskými zážitkami a bohatou fotografickou dokumentáciou z Expedície Nepál – Tibet 2007.

Posledný deň konferencie bol tradične venovaný exkurzii. Exkurzná trasa viedla cez Dubník, kde sme, bohužiaľ, nemali možnosť navštíviť opálovú baňu. Zaujímavou alternatívou bol však prechod po blízkom náučnom chodníku mŕňajúcom staré banské diela. Presun na „Zemplínsky ostrov“ mal hneď dva dôvody. Prvým dôvodom bola návšteva haldy pri starej antracitovej bani v katastri obce Malá Trňa, ako aj samotné zemplinikum, ktorého geologický fenomén sme sa snažili priblížiť účastníkom konferencie. Druhým dôvodom bola už tradične enologicky zameraná tokajská „logalita“ u Macíkovcov. Riadenou degustáciou nám pani Macíková predstavila tokajské vína z ich produkcie a priblížila atmosféru tokajského vinárskeho mikroregiónu.

Oblúbenosť medzinárodnej konferencie mladých geológov v Herľanoch z roka na rok rastie aj vďaka príjemnej a priateľskej atmosfére. Už teraz sa organizátori tešia na jej 11. ročník v Modre-Harmónii.

Dovidenia v Herlandii 2010!

Locality Horné Strháre represents the most famous Slovak locality, and perhaps one of localities of the world paleontological importance with the appearance of the taxa *Carcharocles megalodon*.

Right selachian represent the majority of found fossil rests.

#### A. BÁGELOVÁ: A GIS based model of geothermal structure in the Poprad Basin

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The Poprad basin is one of the perspective areas in terms of the resources of geothermal energy. Effective exploitation and use of geothermal resources is dependent on their quantitative assessment. One of the possibilities of geothermal structure quantitative evaluation is the establishing of the groundwater flow model. The first step in the modeling protocol is to formulate a conceptual model of the system. The purpose of building a conceptual model is to simplify the field parameters and to organize the associated field data so that the system can be analysed more easily.

This contribution presents data preparation for groundwater flow model (conceptual model) based on GIS project. Required data for the modeling are the geological data such as the geological formations and tectonics, the hydrogeological data including aquifer parameters, overlying and underlying layers and boundary conditions. Complementary data, as existing wells location will be included in the model, too.

The result of the work is a conceptual model converted to shape files using the GIS software (digitizing feature) which is the basis for groundwater modeling in studied area.

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M. BAZARNIK<sup>1, 2</sup>, R. DULA<sup>3</sup>, K. BAHRANOWSKI<sup>2</sup> and J. BAZARNIK<sup>4</sup>: **Copper centres supported on Al-containing mesoporous silica: FSM-16 – preliminary results**

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Mesoporous silicas (FSM-16) derived from a layered polysilicate kanemite possess a regular, mesoporous structure with high specific surface areas. They are potentially available for many applications as adsorbents, catalysts and catalyst supports. However, purely siliceous materials have neutral framework, which limits their applications. As in the case of zeolites, it is possible to modify the nature of the framework by introducing heteroatoms to provide molecular sieves with potential of catalytic applications.

The properties of Al-substituted mesoporous FSM-16 silica modified with Cu ions have been investigated. Al was introduced into FSM-16 by means of direct and postsynthesis method at Si/Al ratio values 20. Cu (<sup>2+</sup>) cations were inserted in a one step cation exchange process using 0.5 M Cu(NO<sub>3</sub>)<sub>2</sub>·x3H<sub>2</sub>O aqueous solution. The products were centrifuged, washed free of nitrate ions, dried and calcined at 500 °C. The EPR spectra of calcined copper doped FSM-16 materials, recorded at 77K, exhibit an axial signal with resolved hyperfine structure. The spin Hamiltonian parameters are similar for both types of supports: g(parallel) = 2.232, A(parallel) = 132 G, g(perpendicular) = 2.085 (for directly aluminated support), g(parallel) = 2.330, A(parallel) = 134 G, g(perpendicular) = 2.085 (for postsynthesis aluminated support). The character of the EPR signals shows that on both supports copper exists in the form of similar, well dispersed, isolated Cu (<sup>2+</sup>) species.

P. BOŻĘCKI: **Chosen heavy metals in natural environment in Wielka Wieś commune (Southern Poland)**

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The main aim of this work was an evaluation of natural environment in commune Wielka Wieś by determination concentration levels of chosen heavy metals. This commune is bordering with Cracow from the south. A total area of this commune is equal about 48.1 km<sup>2</sup> and it is protected (in a many different ways) because of its great natural value. This work is a part of an extended project encompassing an evaluation of natural environment in all bordering Cracow communes.

The area of this commune was divided into 32 squares. Each square had an area equal to 2.12 km<sup>2</sup>. During field work the samples of soils and vegetables (cabbage, carrot) were collected in each square. In all samples after drying and extraction in nitric acid

the concentration level of chosen heavy metals was quantified by Atomic Absorption Spectroscopy. Heavy metals were chosen with regard to specific pollution emitted from nearby Industrial Districts (Olkuski Industrial District, Górnośląski Industrial District, Cracovian agglomeration) as well as their toxicity.

Calculated statistical data are presented in the table. Analyses show a considerable variation of the concentration of harmful elements, but extremely high values are of incidental character and can be related to the point contamination of soils. The distribution of the elements reveals a distinct influence of emissions spreading from the areas of Olkusz, Cracow, and also along the main transport routes.



Fig. 1. Sketch-map of studied area.

Tab. 1  
Statistical description of concentration level  
in S – soil, Car – carrot and Cab – cabbage

Concentration level (ppm)									
Parameter	Zn			Pb			Cd		
	S	Car	Cab	S	Car	Cab	S	Car	Cab
max	180.39	79.34	209.80	50.91	5.45	7.27	4.55	9.09	2.84
min	95.53	18.36	15.20	18.18	0.00	0.00	1.70	0.57	0.00
average	136.72	39.57	46.26	35.81	1.93	2.27	2.96	3.64	0.80
median	140.72	36.81	35.53	36.36	1.82	1.82	2.84	3.13	0.57
Concentration level (ppm)									
Parameter	Cu			Cr			Ni		
	S	Car	Cab	S	Car	Cab	S	Car	Cab
max	21.67	9.44	3.89	12.50	0.00	0.00	20.83	6.25	4.17
min	3.89	2.22	0.00	0.00	0.00	0.00	4.17	0.00	0.00
average	10.79	4.43	1.84	4.92	0.00	0.00	12.63	2.34	2.54
median	10.56	4.44	1.67	5.00	0.00	0.00	12.50	2.08	2.08

# M. BRČEK: Monitoring of the temperature–moisture regime in Spiš Castle rock massif

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Various modelling methods are widely used in engineering geology, predominantly based on analysing of the interaction of mass environment with different kinds of retaining walls, slope stability assessment, forecasting behaviour of mass environment due to the degradation processes, etc. The main goal of the presented contribution is to deal with research in the field of radius of temperature for moisture gradient in the mass environment. Both factors are most interesting in a process of degradation and progressive loosening of rock massif.

Temperature records from Perun's rock at Spiš Castle, recorded by temperature sensors, build in various depth of travertine body; have been used for the study of temperature field behaviour in the rock massif. For the investigation of the temperature variation in surface zones of the Earth crust there is necessary to provide their modelling of penetration in various time periods (daily, monthly, yearly, etc.). Important is the fact that temperature variations are periodical, and then temperature  $t$  and depth  $z$  defined by heat conductivity equation shows the spatial trend of temperature wave, in our case in rock mass. Based on obtained values there is possible accurately construct the temperature wave trend in time and space and consequently to read periodically the shift phases based on the temperature variation.

Four hot balls probes had been installed in various depths (10 cm, 40 cm, 80 cm and 150 cm) in travertine body to assess rock moisture. For moisture regime analysing the comparison of data between individual depths is necessary. Increased variability  $q/T_m$  ( $W \cdot K^{-1}$ ) values pointed to direct relation of the temperature variation as well as atmospheric rainfall, which depend on climatic conditions (Fig. 1). With increased depth, the consistent retardation and consolidation of mentioned parameters effect.

Acquired observations revealed underestimated influence of temperature and moisture as factors inexpressively and vaguely destructing the appearance of the rock mass.

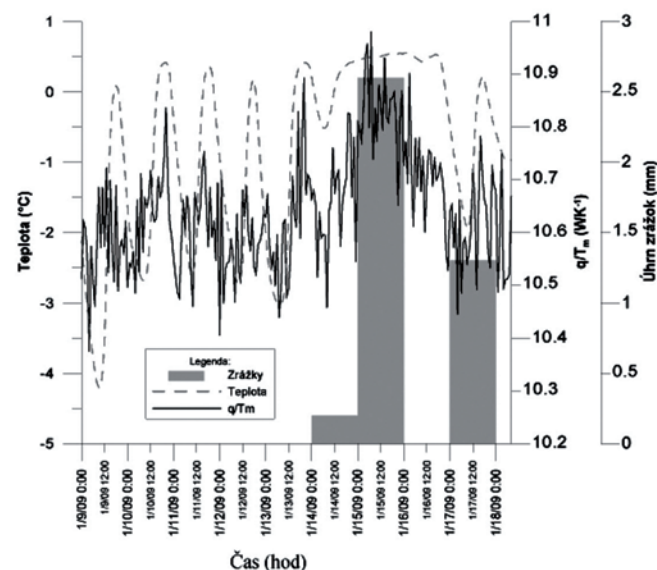


Fig. 1. Relation of the temperature process and parameter  $q/T_m$  in dependency of daily precipitation for depth 10 cm.

# J. BUČOVÁ, M. MATEJOVÁ and P. GAŽI: Reconstruction of paleostress fields of selected localities in the western part of the Pieniny Klippen Belt

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The results of paleostress analysis of two localities in the western part of the Pieniny Klippen Belt (PKB): Žilina – Strážov and Červený Kameň are presented. First measured locality was represented by temporary artificial outcrops along the newly-constructed motorway D3 between the villages Strážov and Horný Hričov. Exposed sediments belong to two PKB units: the Kysuca and Klape Units. They are of Middle-Late Cretaceous age and were strongly folded with the NE – SW trending fold axis. The second locality – Červený Kameň (the Červený Kameň Klippen area, Ilava District) was mainly formed by carbonates of two PKB units: the Kysuca and Czorsztyn Units and of the flysch sediments of the Javorina Member of Campanian – Maastrichtian age (Flysch Belt). We focused primarily on the brittle structures – faults. We have employed the program Win\_Tensor for the computation of stresses and the separation of the faults to homogenous groups. The interactions of the faults observed in the field were used for determination of the time succession of these groups.

The first studied area experienced a complex deformational history, where the strike-slip faults dominated (predominantly dextral faults, in some of them the offset of several meters was observed). These faults resulted from transtension as the oldest tectonic event (compression rotated from E – W to the NW – SE direction) and are represented by strike-slips and normal faults. After transtension, the considerable change of the tectonic regime occurred – the commencement of transpression by NNW – SSE compression (prevalence of strike-slips a reverse faults). The last record of transpression relates with NE – SW compression. The subsequent faulting (the youngest event) was a result of NW – SE oriented extension, during which the listric normal faults were formed.

The Červený Kameň area was overprinted by several deformational phases. The oldest one was transpression, well preserved also in the rocks of the Flysch Belt. This event was accompanied with the formation of strike-slip faults (mainly right-lateral faults) and rarely by reverse faults. The  $\sigma_1$  axis was oriented in the E – W direction. Transpression continued also during WNW – ESE compression; except the strike-slips and rare normal faults, the reverse faults were mainly formed. This adumbrated the change of the tectonic regime: from transpression (E – W to the WNW – ESE oriented  $\sigma_1$  axis) to the compression regime with NW – SE compression. Mainly NE – SW oriented reverse faults were formed; strike-slip faults were preserved occasionally. The next change of the tectonic regime occurred during younger NNE – SSW compression and perpendicularly oriented extension. Predominantly left-lateral and normal faults were formed as the result of transtension. On the contrary, mostly right-lateral and normal faults were created as the last record of transtension (the ENE – WSW oriented  $\sigma_1$  axis). The last deformational phase is characterized by a number of conjugate normal faults and the NW – SE oriented  $\sigma_3$  as a result of extensional tectonic regime.

The different tectonic history during the activity of similarly oriented compression axis of paleostress field in both localities confirms: 1) the complicated and dynamic tectonic evolution of the western part of the PKB, 2) the gradual migration of the compressive-transpression regime from SW to NE in the western part of the PBP.

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**B. BUKOWSKA-BELNIAK: Surface of earth thermal imaging**

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All objects emit infrared radiation (IR) based on their temperatures. Thermography allows seeing temperatures of environment and variations in temperature of the objects with or without visible illumination. Thermal images are recorded by thermographical cameras which detect infrared radiation. Thermography and thermal imaging have many uses, for example in: medicine, condition monitoring, and buildings isolation control.

Thermographical measurements can be used when variations in temperature occur and heat flow by object's surfaces is observed. Thermal images can be recorded by portable thermographic cameras, which are localized in neighborhood of the object or in some distance (even a plane). Thermography is non-invasive method of measurements; it has no influence for measured object. There are a lot of externals, which could affect for ground measurements: atmospheric conditions, insolation, humidity, wind strength. Accurate temperature measurements are hindered by differing emissivities and reflections from other surfaces. Thermal images on the ground should be registered at night or in cloudy day without wind, rain and snow.

Thermographic cameras detect radiation in the infrared range of the electromagnetic spectrum (roughly 0.9 – 14 mm) and produce images of that radiation. Mostly, thermal imaging cameras use specialized focal plane arrays (FPAs) of sensors to record thermal images. Their resolution is considerably lower than of optical cameras – mostly about 320 x 240 pixels. Range of temperature which can be registered depends on particular model of thermal camera. Thermal image is a matrix of temperatures. It can be displayed as coloured image if a colour for each temperature is defined. The same thermal image looks different for different palettes of colours, so interpretation of colour thermal image is possible only when palette and range of temperatures are added. The image processing methods can be used for thermal images. Accuracy of measurements and resolution of thermal images decreases with the distance from observed surface.

Thermal images of the earth's surface distinguish natural environment and the areas with human activity. Thermal images facilitate to show differences in soil and natural geological structure of a top layer of the ground. They can also present thermal changes under the ground, caused by thermal leaks, for example from heat distribution network. Contrast of these thermal images is very low, because of small differences in temperatures of registered surface. Thermography can also be used in vulcanology and thermal water localizations.

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**I. CUPEROVÁ: Sedimentological analysis of the Zlín Formation in the Svidník area, Rača unit, Outer Western Carpathians**

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In the studied area the Zlín Formation (Middle–Upper Eocene) was localized in the quarries south of the town Svidník and also along the creek south of the village Nová Polianka and Olšava creek. In this formation 7 sandstone and 2 mudstone lithofacies were divided. Lithofacies A is the most frequently occurring lithofacies consisting of medium- and fine-grained massive amalgamated sandstones, locally containing dispersed clasts. The lithofacies B is composed of parallelly laminated fine- and medium-grained sandstone. The lithofacies C comprises convoluted sandstones. The ripple-cross laminated sandstone represents the facies D. The lithofacies E is formed by trough cross-bedded sandstones and the lithofacies H consists of parallelly laminated mudstones overlying the sandstones. The dykes are formed

by fine- and medium-grained sandstones and usually they penetrate into mudstones perpendicular to the bedding. They represent the lithofacies I. The sediments in the area were studied by sedimentological logging. According to the development of sediments the depositional environment of deep-marine turbidite system lobes was interpreted by our research as well as depositional environment of submarine slope. In these environments the association I consisting of Makovice sandstone was recognized. The association II starts at the base with claystone passing into several m thick layer of sandstone. The association III occurs in the uppermost part of the studied succession and again it is built by sandstones. The facial associations with the interpretation of the depositional environments give a good picture about the architecture of deep-marine sedimentary system. The lower part represents sediments of depositional lobes overlain by sediments of submarine slope that are again covered by sediments of proximal lobes. This succession shows oscillation of the system – progradation and retrogradation.

**D. ČUNDERLÍKOVÁ: Upper Liassic condensed facies of Manín unit in locality of Butkov, Western Carpathians**

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Numerous Mesozoic pelagic sequences in Alpine-Mediterranean area are determined as condensed; they are characterized with small thickness of layers and high amount of fauna (Jenkyns, 1971).

Most common condensed horizon in Western Carpathians is Toarcian–Bajocian, which is extended in domain of Central and Internal Western Carpathians, mostly in Manín, Vysoká, Choč and Silica nappes.

In stratigraphy the youngest condensed horizons are located mostly in Manín nappe (Manín, Butkov and Kostelec); in Vysoká nappe (Valaská Belá, Čierna Lehota), but also in Czorsztyn succession of rocks (Vršatec).

Collected ammonite fauna of Toarcian in Butkov locality, Manín unit, is situated in condensed sediments. On the base of fossiliferous horizon a typical hardground is developed, being represented with rough surface and limonitic crusts. Shells are concentrated and covered by green film of glauconite and chlorite. It is evident from cuts, that glauconite is more common. Chlorite is only accessory or it is missing.

On Butkov locality this horizon is rich with well-preserved fossils and their fragments. Mixed fauna of fossils from different paleontological zones can be found here. Thickness of horizon is very low. I assume from this information, that there is stratigraphic condensation in this locality.

Presence of mixed fossil fauna of different age, as a criteria of stratigraphic condensation, is major in this horizon. Low speed of sedimentation and accumulation is assumed.

Characteristic signs of hardgrounds by Fürsich (1979) are (1) cementation, (2) corrosion with grain of sediments and (3) production of lithoclasts.

Rough and waved Fe-Mn crust covers the surface of hardgrounds. In cuts the alternation of light and dark irregular lamina of oncoid–stromatolite shape is well visible. By Rakús and Határ (1987) this can be referred to progressive growing and increasing of crust volume, as well as to partnership of organisms (maybe algae Cyanophyceae).

There was separated high amount of oncoids from washed samples, out of this horizon. They are more or less concentric limonitic inlaid laminas, which could originate with cooperation of algae Cyanophyceae.

This Toarcian condensed hardground on Butkov is well engaged to the image of condensed facies of Western Carpathians. This hardground consists of all typical signs of similar horizons. This signs were elaborately described by Rakús and Határ in 1987.

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# D. DIMITROV<sup>1</sup>, Y. SHNUKOV<sup>2</sup> and P. DIMITROV<sup>1</sup>: **Non-traditional resources from Black sea bottom and their possibilities to use as a complex raw material**

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The deep sea organogenic-mineral (sapropelic, diatomic and coccolithophoridic) sediments (DSOMS) of the Black Sea are built mainly of nanosized materials, which can find application in the modern nanotechnologies and new materials.

The first experiments, conducted independently by Ukrainian and Bulgarian researchers, on the raw material applied as a natural organic fertilizer show sharp improvement of the soil structure, alkalinity, the increase of moisture content, absorb the process of maturing and increases yields. The series of DSOMS experiments performed by experts from the Institute of Agriculture under the Ukrainian Agricultural Academy of Sciences on soils from the Polesie and on black earth wooded steppe of lands contaminated with radionuclides (up to 15 Ku/km<sup>2</sup>), show that the amount of the imported fertilizers may be reduced 17 times and their efficiency increases by 20 – 30 %.

The practically unlimited stocks, the low cost estimates for this raw material in its application in the sphere of new materials and the use in nanotechnologies as well as the opportunities for application in agricultural technologies, ceramics, pharmacy, a food additives and other applications makes it a complex raw material for multiple purposes. Contacts will be established both with private companies and with the Organization for Black Sea Economic Cooperation (BSEC) to acquaint them with obtained know-how and to create partnerships supporting the introduction of the new materials and technologies. The project implementation will contribute to the development of the Institute of Oceanology under the Bulgarian Academy of Sciences and the State Science Institution "Department of Marine Geology and Sedimentary Ore Formation" of the National Academy of Science of Ukraine which will become a natural scientific centre in the sphere of new materials and marine resources.

The implementation of the project will allow the joint work on the evaluation of DSOMS deposits and the assessment of the opportunities to satisfy the needs of the industry of both countries with a multipurpose raw material still continue. This will lead to the renewal of the scientific and technical cooperation between these two countries in the sphere of research and utilization of Black Sea resources.

It can be expected that the development and introduction of DSOMS into the agricultural sector will lead to enhancement of the competitiveness of the scientific and technical potential of these two countries and creation of new science-intensive technologies leading to the release of new materials and products on the world market which will contribute for the significant improvement of the quality of life.

The Black Sea DSOMS are currently in a peat stage of their development. Because of the anoxic environment in which the sediments deposit, they do not pass the stage of complete decay and in semi-decayed state they are conserved in the hydrogen sulphide zone. Considering the fact that the sapropelic, diatomic and coccolithophoridic layers penetrate within each other and represent a comparatively homogeneous mixture, they will be discussed as a organogenic mineral raw material, in which the sapropels occupy about 80 % of the total volume. DSOMS are valuable not only for their organic matter but also for their carbonate component and the amorphous silicates. The mineral and organic parts contain micro-components: calcium, magnesium, iron, aluminum, manganese and some others; more than 20 micro-elements are contained in concentrations exceeding many times those in soils, thus being an important stimulant for the plants growth.

DSOMS are used as a complex fertilizer or as a component together with other mineral stimulants – perlite, zeolite. The sediments excel them in agro-technical properties. Sediments can be used directly in the soil in natural state without additional processing of the raw material. Other important advantages are:

- Unlimited supplies of raw material in the water area, which is located at depths of 200 to 2 200 m. The content of the organic matter increases with the increase of depth.

- The possible exploitation of the raw material will not have negative consequences on the marine environment. The industrial supplies are located at great depth within the hydrogen sulphide zone, in which life does not exist. The exploitation will have an ecologically positive effect that will influence, though slowly, the level of the hydrogen sulphide zone.

- The dying flora and fauna of the Black Sea serve as an initial substance for DSOMS. As a result of the activities of the anoxic bacteria, the dying flora and fauna pass the transformation process of animal and plant plankton and benthos and form biolithic-mineral substance with peculiar physic-mechanical and biogeochemical properties.

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# D. DIMITROV, K. SLAVOVA and P. DIMITROV: **Ancient coastlines of the Black Sea and conditions for human presence**

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1. State of scientific research in Bulgaria in the relevant subject.

The subject of ancient coastlines of the Black Sea and the conditions for their habitation, also known as the theory of geo-catastrophic events in the newest history of the basin, is very topical and has triggered lots of discussions.

Convincing evidence was obtained at the beginning of the 1980s of the presence of an ancient coastline in the Black Sea, located at depths of 90 – 120 m and aged about 8 thousand years BP. It was also established that more than 8 000 years ago the Black Sea was a freshwater lake. The undisputable geological evidence for this, resulting from scientific research of the Institute of Oceanology, manifests catastrophic events that took place about 8 000 years ago. It is also complemented by archeological evidence.

- An old coastline of the basin, located at modern depths of 90 – 120 m and aged more than 8 000 years, was discovered.

- A direct consequence of the catastrophe was the formation of deep water organogenic – mineral sediments – sapropels on the Black Sea bed as a single and continuous horizon over a large area of the basin space about 7 500 years ago BP.

- The hydrogen sulphide contamination of the basin occurred about 7500 years ago BP.

- The presence of Neolithic and Eneolithic necropolises along the coast as well as the oldest crafted gold in the world (necropolis of Varna) is evidence of the human habitation of that region.

- Discovery of ruins of an ancient settlement and artifacts pointing to human presence along the old coasts in the valley of Paleo-Provadijska River.

- The genetic investigations show that an ancient human population originated in our lands and migrated about 7 800 years ago to Europe and Asia. The time of the settlement of these people in different places coincides with the time of the occurrence of the geo-catastrophic events in the Black Sea.

- The analyses of the spore and pollen spectra of the studied region show the presence of cereals during the mentioned period evidencing the beginning of agriculture in the region.

The above arguments allow us to presume that the areas of the ancient coasts were inhabited by people who laid the foundations of an ancient civilization.

2. Topicality of scientific problems in Bulgaria and Europe.

The Bulgarian and the European scientific communities were surprised by the theory of geo-catastrophic events in the Black Sea area. Their initial reaction was a complete rejection of the hypothesis,

however after the publishing of the book of the American geologists William Ryan and Walter Pitman "Noah's flood" and later the book of the Bulgarian researchers P. Dimitrov and D. Dimitrov "The Black Sea, the Flood and the ancient myths" the turmoil calmed down. The arguments in favour of the theory were very convincing to be categorically rejected. Numerous expeditions were targeted to the Black Sea and the Mediterranean Sea areas to revise the theory. An international project IGCP-521 (UNESCO), uniting the efforts of European scientists, performed a critical analysis of the existing arguments in the theory of the geo-catastrophic events in the Black Sea. Unfortunately, apart from the Bulgarian-American expeditions performed in 2001 and 2002 to search for remains of ancient settlements and necropolises in the region of the old coasts under the NOAH Project, most expeditions intended to refute the existing geologic and oceanographic evidence of the geo-catastrophe in the Black Sea.

It should be taken into account that the new scientific discoveries are pioneering and their purpose is to change history and disprove the centuries-old ideas of the place of the most ancient human civilization.

The sites to be examined fall within the region of the paleo-valley of Provadijska River and Bay of Burgas. There are numerous rock banks which might be possible sites of ancient metallurgy and salt production. They are poorly studied at the present stage. Especially interesting is the Cockatrice sand bank which was probably formed over the centre of an ancient Neolithic settlement; Chimovo bank, from the surface of which was extracted copper slag – evidence of metallurgic activity. The implementation of this project will lead to a re-assessment of the role of Proto-Bulgarian and ancient European civilization in the world culture and heritage.

The foundations of a theory able to change the existing concepts of the most ancient human history and civilization, which originated along the banks of the ancient Pontic Lake will be laid using a complex of interdisciplinary research works in the sphere of oceanography, geology, geoarcheology, archeomythology and genetics.

**Acknowledgement.** The research was covered by the Project No. 02 – 337 of National Science Fund Ministry of Education and Science. "Ancient coastlines of the Black Sea and conditions for human presence".

#### A. DUŠ-PICHETA: Is it possible to identify an external source of hot fluids in the Magura nappe (Outer Carpathians)?

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Intensity of calcite mineralization filling fractures in the sandstones of the Magura nappe (Outer Carpathians, Poland) shows considerable variation. It suggests that an extent of local remobilization and/or external supply of fluids into studied sandstone were different. Based on published data it seems that the local/external sources of fluids can be identified using illite-smectite indicator.

The mixed-layer illite-smectite (I/S) is useful as a paleo-temperature indicator due to its abundance in sedimentary rocks. However, only studies of I/S separated from claystones give good results concerning estimation of maximum paleotemperatures which affected rocks. In sandstones, degree of smectite to illite transformation is usually different than in adjoining claystones. In sandstones, it depends on composition of rocks as well as on fluid flow. Therefore, it seems that combination of petrographic and I/S diagenetic studies in claystones and sandstones may supply good data about fluid flow as well as about fluid temperature.

In the presented studies, petrographic study of sandstones in three exposures (Gruszowiec, Ropica Górna 1, Ropica Górna 2) was supplemented by chemical and X-ray diffraction analyses. The degree of the smectite to illite transformation was studied in claystones and sandstones based on clay fraction ( $< 0.2 \mu\text{m}$ ).

The results of previous studies on I/S diagenesis in sampled exposures show that the rocks were subjected to diagenesis in the temperature range between 95 and 155 °C. Only at Gruszowiec, the illitization of the I/S is more advanced in claystones than in sandstones. The I/S from sandstones contains about 35 % S, whereas the smectite percentages in the I/S derived from claystones vary from 17 to 26 %.

The variation between smectite contents in I/S from claystones and sandstones collected in other exposures is insignificant. At Ropica Górna 1, the I/S from sandstones contains below 30 % S whereas I/S from claystones contains 33 % S. In the I/S from sandstones at Ropica Górna 2, smectite occurs above 40 % whereas the I/S from claystones contains 50 % S.

The above results do not clearly confirm an influence of hot fluids on I/S diagenesis in the studied sandstones.

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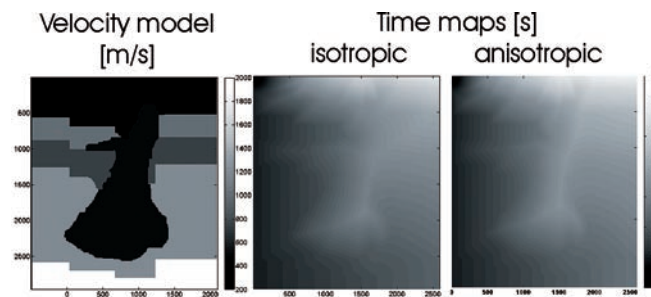
#### M. DWORNIK and A. PIĘTA: Ray tracing in inhomogeneous anisotropic 2D elastic medium

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Knowledge about seismic attributes is very important in coal mine exploitation. One of the methods to estimate these parameters is travel time tomography. Fundamental thing, necessary for inversion, is knowledge about rays paths of first breaks of P-wave.

In this paper method based on the sparse graph theory has been shown. Grid velocity model was used in 2D ray tracing algorithm. Constant velocity parameters inside each cell were assumed. Eclipse model of anisotropy was given by three parameters:  $v_x$ ,  $v_y$  (velocities in orthogonal direction) and angle of rotation eclipse:  $\varphi$  (angle between  $v_x$  and axis OX).

Algorithm bases on the Fermat's principle of the least time. In this case the shortest arrival time and source point coordinates were recorded. In order to increase precision of ray tracing, very dense computational grid was used. Arrival time of the P-wave was calculated among external walls of each cell. Nodes in vertex cell are called primary nodes, nodes on wall between primary nodes are called secondary. Increase number of secondary nodes caused decrease of relative error and increase in computational time and memory requirements of the ray tracing algorithm. One of the ways to overcome problem of time-consuming computationally intensive numerical algorithm is the application of the parallel computing environment. Parallelism was introduced into ray tracing for 2D time tomography problem by decomposition of the computation domain.



**Fig. 1.** The ray tracing: Estimated times of propagation for inhomogeneous isotropic (middle) and anisotropic (right) medium for velocity model (left). In anisotropic case it can be formulated:  $V_y = 0.75 \cdot V_x$

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A. FIGUŁA, T. BAJDA, M. MANECKI and A. KLESZCZEWSKA:  
**Application of modern glass fertilizers in Phosphate Induced Metal Stabilization (PIMS)**

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PIMS (Phosphate Induced Metal Stabilization) is a method of immobilization of heavy metals in contaminated soils through formation of insoluble crystalline phases induced by phosphate amendments. To date, various sources of phosphate are used including apatite rock, phosphate fertilizers and bone meal. Recently, a new generation of phosphate fertilizer was introduced: a synthetic glass which slowly releases Ca, Mg, K and  $\text{PO}_4^{3-}$  into soils without the risk of eutrophication. In this study, the potential application of this fertilizer for PIMS was experimentally tested and quantified.

One gram of fertilizer was reacted with solutions containing Pb (initial concentration of 50 or 500 mg/L, pH range from 2 to 5) or Zn (initial concentration of 140 mg/L, pH range from 3 to 6). The concentration of both metals was lowered significantly. The drop of concentration is faster and more pronounced at lower pH. After one month [Pb] was lowered below the detection limit of AAS (0.05 mg/L) for initial [Pb] = 50 mg/L. Higher initial [Pb] was reduced to 352 mg/L at pH = 5. Contamination of Zn was reduced by 60 % for pH = 3 and by 10 % at pH = 6.

The removal of Pb and Zn ions from the solutions was associated with the formation of pyromorphite  $\text{Pb}_5(\text{PO}_4)_3\text{Cl}$  and hopeite  $\text{Zn}_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$  which were identified with the use of XRD and SEM/EDS. The results suggest that this fertilizer can be efficiently used for PIMS.

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E. GREGOROVÍČOVÁ and M. BANASOVÁ: **Associations of calcareous dinoflagellates from the Sarmatian sequences in the Jakubov area, Vienna Basin**

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Low diverse associations of calcareous dinoflagellate cysts consisting mainly of taxa with an oblique ultrastructure are reported from Sarmatian (late Middle Miocene) coastal marine sediments. Samples were derived from the Skalica Formation of the Jakubov locality. Three boreholes J 64 A2, J 29 and JZ 46 were sampled. 12 samples were studied in details in order to bring information about their content of calcareous dinoflagellates.

The Skalica Formation is rich in fossil remnants: nannoplankton, planktonic and benthic foraminifers, molluscs, ostracods, fish skeletons and ooliths, and also flora fragments and pollens. The age of sequence was determined by foraminiferal assemblages belonging to Porosion granosum Zone and nannofossil local Zones (Kováč et al., 2006).

The study showed the dominance of morphotypes with an oblique ultrastructure of two types of needle-like crystallites and very thick layers of the cyst wall belonging to *Pirumella* genus. The following taxa are newly introduced: *Pirumella gigantea* n. sp., *Pirumella gigantea granulata* n. sp., dominating over *Pirumella edgari* and not so frequent forms of *Cylindratus*, *Posoniella*, *Calciocarpinus* genus.

Lithology, microfaunal and microfloral spectra determine the sedimentation in instable warm-water shallow marine (lagunal) environment (with maximum depth 15 m), with fluctuation of salinity and oxygen content. Obtained results and paleoecological interpretation based on calcareous dinoflagellate cysts distribution coincide very well not only with those shown by planktonic and benthic foraminifera, but also by nannoplankton.

A. HAVLÍN, D. HAVLÍN NOVÁKOVÁ and F. KONEČNÝ: **The impact of not detonated blasts of TNT in the geophysical prospecting boreholes in Halenkovice village**

Czech Geological Survey, Brno, Czech Republic

Within the frame of geophysical prospecting field work 31 boreholes located in two lines were drilled in the flysch sediments in Halenkovice village in October 2000. The maximal depth for the borehole was 26 m; using one 2 kg cartridge of trinitrotoluene (TNT) as a source of seismic signal. But the wells were not drilled in projected position and hence were not approved for further geophysical prospecting and the blasts were not allowed to detonate. Neither exact positions of the wells or petrographic profiles of wells were not recorded.

A possibility of ground water contamination by TNT from not detonated blasts exists in part of Halenkovice village, which is not connected to drinking supply line. Inhabitants are mainly using the ground water from their own wells.

The situation in Halenkovice village was discussed in risk analysis (Vacek et al., 2003, 2006). Monitoring of water solubility of TNT cartridge for the purpose of assessment of potential ground water contamination was realized by Mudruňková, Skládal and Kouba (2007). Hydrogeological investigation was not done and the basic hydrogeological features of the locality are unknown.

A monitoring of potential TNT contamination in ground water in Halenkovice village was realized by the Czech geological survey since 2007. 23 private wells were selected for quarterly analysis of ground water quality and 2 new exploration boreholes were drilled. These wells are periodically sampled for ground water and soil.

Content of TNT was under detection limit in all of the samples of ground water or soil hitherto. But some real risk assessment of ground water contamination will be possible to consider using the detailed rock medium study, such as saturated zone and possibility of TNT migration.

L. HLAVÁČOVÁ: **3D modelling of geothermal reservoirs: Case study from Subtatic Basin in Western Carpathians, Slovakia**

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Renewable energy sources are domestic energy sources which help to increase safety of energy supply and diversification. Plus utilization of the renewable energy sources usually fulfils the conditions of environmental acceptability. The Slovak economy is 90 % dependent on imported energy sources; therefore utilization of this non-traditional renewable energy source is very significant. Geothermal energy is one of the options. Geothermal energy is a potential renewable energy source that should be taken into account by the Slovak government. To aid geothermal exploration 3D modelling is a very useful tool. The objective of research on the project was to model Poprad Basin and northern part of Hornád Basin in the Inner Carpathian system in Slovakia to assess future prospective geothermal areas. The model allowed the visualization of the different layers and surfaces of the studied area. 3D Model of the geothermal reservoir was made in modeling program Petrel Version 2008.1. It is program for subsurface interpretation and modelling. Program allows performing the workflows from seismic interpretation to reservoir simulation. Studied basin is considered as active geothermal area. The main aquifers are built by Triassic carbonates – dolomites and limestones of the Choč and Krížna nappes. On the base of seismic interpretation, the Choč nappe thicknesses from 200 to 1 100 m were found in the central part of Poprad Basin. Thicker nappe from 1 200 to 1 500 m was found in the eastern and southeastern parts of studied area. The average value of the temperature gradient reaches 32.6 – 34.5 °C/km and the average value of the heat flow density was estimated to 67 mW/m<sup>2</sup>. Temperatures on the top of the Pre-Paleogene basement reach 50 – 85 °C. In this work we have also interpreted geological setting

of Gerlachov area, situated in the northwestern part of Poprad Basin. From geothermal point of view the Mesozoic units represented by Choč and Krížna nappes underlying Paleogene rocks are the most potential. Based on geologic composition of Choč nappe we can expect very good conditions for geothermal water reservoir. Krížna nappe has less positive conditions for geothermal waters exploitation. General discharge of groundwater in Choč nappe should be more than  $22 \text{ l} \cdot \text{s}^{-1}$ . Temperature in Choč nappe is between 35 and 45 °C.

#### M. HOFFMAN: New information and methods of tectonics investigation in Malé Karpaty Mts.

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In the Malé Karpaty Mts. we investigated faults and fault related rocks using methods of geomorphology, structural geology and petrotectonics. Analysing tectonic mirrors of faults of several directions by WinTensor software (Damien Delvaux, 2008) we have discovered directions of general paleostress axes. In the Kramáre locality located in the crystalline basement of Bratislava nappe we have calculated direction of  $\sigma_1$  axis of ENE – WSW trend, specifically  $70/7^\circ$  and  $\sigma_3$  was oriented to  $169/46^\circ$ . This is subhorizontal compression. The calculated extension using additional data was oriented NNW – SSE with  $\sigma_3$  axes in  $150/3^\circ$  and  $\sigma_1$  axis in  $40/75^\circ$ , representing subhorizontal extension. These compression and extension parameters were also observed at Čachtice locality (northern part of the Malé Karpaty Mts. – Čachtické Karpaty Mts.): stress axis  $\sigma_1$  oriented to  $4/80^\circ$  and  $\sigma_3$  axis oriented to  $127/6^\circ$  for extension to NNW – SSE. Axes for compression: axis  $\sigma_1$  oriented to  $249/1^\circ$  and axis  $\sigma_3$  to  $340/43^\circ$ . These localities were compared with data from localities Bystrička and Dubná skala in northern part of Lúčanská Malá Fatra Mts. and central part of Krivánska Malá Fatra Mts. where the direction of stress axes lightly differed. Shear zone with mylonites was revealed and its mylonites were investigated for understanding kinematics within the shear zones. The surface of shear mirrors we used for their descriptive characterization.

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#### R. HOVORIČ, T. KLIMKO and B. LALINSKÁ: Mineralogical study of mine tailings material from abandoned Sb deposit Medzibrod (Nízke Tatry Mts., Slovakia)

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In the second half of the 20th century, Sb deposits situated in the Nízke Tatry Mts. belonged among the main producers of antimony ores in the central Europe. Hydrothermal Sb mineralization was mined at the Medzibrod deposit mainly between 1941 – 1945 and finished in 1950. The ore was milled and Sb minerals were collected by flotation. The waste was then deposited in one tailing impoundment.

This study describes oxidation processes of sulphide minerals and mobility of Sb and As within the impoundment. The fine-grained material containing sulphides pyrite, arsenopyrite and stibnite is slowly weathering and releasing toxic elements into surface waters and watersheds and can have potential negative influence on aquatic environment and human health.

The ore minerals and their weathering products were studied in reflected polarized light microscope and consequently analysed by electron microprobe. Ore minerals demonstrate rims in oxidation zone, content of As in the rims of arsenopyrite varies from 16.73 wt.% to 20.56 wt.%, Sb up to 4.51 wt.%, exceeding Sb content in primary arsenopyrite (highest content – 0.65 wt.%). Secondary Sb oxides are the most abundant. We suppose that they are a product of stibnite oxidation.

These oxides consist mainly of  $\text{Sb}_2\text{O}_5$  (from 81.76 wt.% to 85.73 wt.%) with low As content (up to 1.01 wt.%). Fe oxides occur also frequently and can be divided into two types; content of  $\text{Fe}_2\text{O}_3$  in the first one varies from 78.19 wt.% to 86.99 wt.%, contents of As & Sb are close to zero. There were observed also Fe-Sb-As secondary phases where the content of Fe dominates and varies from 24.36 wt.% to 47.56 wt.%. This phase contains Sb up to 26.00 wt.% and As up to 32.28 wt.%.

A large amount of carbonates represented by magnesite and dolomite is present in the tailing material, playing an important role in neutralizing of acid generated by sulphides oxidation.

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#### M. HYŽNÝ: The preliminary results of the systematic research of the fossil decapods in Slovakia

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The systematic research of fossil decapod crustaceans has virtually no history in Slovakia. Although there are sporadically mentioned decapod fossils occurrences in the literature (e.g. Volfová, 1960, 1963; Houša in Špinar et al., 1965; Papšová, 1970, 1973, 1975, 1977, 1978), there were no long-term attempts to study this group systematically. Recently there are big efforts to understand this group from the phylogenetic point of view using both methods neontological and paleontological (Assembling the Tree of Life – Decapoda research group). Decapods were also successfully used in paleobiogeography and paleoecological reconstructions (Schweitzer, 2001; Feldmann, 2003; Feldmann and Schweitzer, 2006).

This work presents the first results of the systematic study of the fossil decapod crustaceans in Slovakia. Up to date there were identified over 20 genera in 13 families comprising 5 new species, mostly from the Cenozoic strata (Upper Eocene, Middle Miocene). The results embrace among others the first record of Upper Jurassic crabs in Slovakia (*Tanidromites insignis* from Štepnická skala Klippe), the first fossil record of the Thomassiniidae in the world (*Crosniera* sp. nov. from the Karpatian of Vienna Basin), the third fossil record of *Munidopsis* in the world (*M.* sp. nov. from the Karpatian of Vienna Basin), the first unquestionable fossil record of the solely Pacific callianassoid genus *Callianopsis* in Europe (*C.* sp. nov. from the Karpatian of Vienna Basin) and one of the oldest records of the genus *Ranina* in the world (*R.* sp. nov. from the Upper Eocene of Subtatic Group). The fossil material from the Karpatian of Vienna Basin will also help to emend the description of until now enigmatic brachyuran genus *Styrioplax* and elucidate its systematic position as well. The material assigned to *Jaxea kuemeli* from the Badenian of Novohrad-Nógrad Basin will help to definitely distinguish it from the extant Mediterranean species *Jaxea nocturna*. The systematic reexamination of fossil decapods deposited in the Natural History Museum of SNM in Bratislava is also given. The collection comprises mainly Badenian decapods from the Bratislava district with strong similarities to coeval faunas from Hungary.

Paleobiogeographic conclusions confirm the affinities of the Miocene decapods of Central Paratethyan realm to Indo-Pacific decapod faunas (Müller, 1984).

**Acknowledgement.** The research was funded by APVV-02-80-07.

#### B. CHALUPOVÁ: Conodont microfauna from Reifling limestones of the Choč nappe (Middle Triassic) from Jasenové and Zbyňov localities (Súľovské vrchy uplands, Slovakia)

Geological Institute, SAS, Bratislava, Slovakia

Dr. Papšová in 1983 has found in samples of the microfossils in brown-grey crinoidal limestones, in bright cherty limestones of Reifling or Schreyeralm type (Jasenové locality) and in the

red nodular limestones (Zbyňov locality). Bulk samples of about 4 – 6 kg were dissolved in dilute acetic acid of technical quality (1 : 10) and separated using by the bromoform. All samples contained more or less biostratigraphical values of microfossils – conodonts, holothurian sclerites, foraminifers and amount of unidentifiable microproblematics.

From **Jasenové/515/A/83/576** locality background contains the rich association of microfossils, represented by fragments of crinoid ossicles, fish teeth, gastropods, foraminifers, holothurian sclerites, conodonts – *Enanthiognathus ziegleri* (DIEBEL), *Hindeodella suevica* (TATGE), *Neohindeodella* div. sp., *Gladigondolella tethydis* (HUCKRIEDE), *Gondolella constricta* MOSHER et CLARK, *G. cf. longa* (BUDUROV et STEFANOV). The finding of a greater number of *G. cornuta* (BUDUROV et STEFANOV) is noteworthy. From **Jasenové/606/B/83/574** locality background contains a lot of foraminifers, fish teeth and less juvenile gastropod shells. Conodont fauna comprises – *Chirodella dinodoides* TATGE, *Prioniodina venusta* (HUCKRIEDE), *Lonchodina hungarica* (KOVÁCS), *Enanthiognathus petraeviridis* (HUCKRIEDE), *Diplododella magnidentata* (TATGE), *Hindeodella spengleri* (HUCKRIEDE), *Gondolella excelsa* (MOSHER) and juvenile forms *Gladigondolella tethydis* (HUCKRIEDE). The lack of holothurian sclerites in the association is conspicuous. From **Jasenové/606/B/83/575** locality after washing association of foraminifers, fish teeth, and holothurian sclerites have been found. Conodonts are very common, representing types – *Hindeodella suevica* (TATGE), *Prioniodina venusta* (HUCKRIEDE), *P. spengleri* (HUCKRIEDE), *Enanthiognathus petraeviridis* (HUCKRIEDE), *Diplodella magnidentata* (TATGE), *Neohindeodella dropla* (SPASOV et GANEV), *Ozarkodina tortilis* TATGE, *Gladigondolella tethydis* (HUCKRIEDE), sole *Gondolella excelsa* (MOSHER), *G. cf. constricta* MOSHER et CLARK and a few individuals like *G. cf. pseudolonga* MIETTO, KOVÁCS et KOZUR. Association of microorganisms from **Jasenové/515/83/579** locality is not too rich. It consisted only of the fish teeth, conodonts – *Prioniodina venusta* (TATGE), *Enanthiognathus petrae-viridis* (HUCKRIEDE), *Gondolella cf. constricta* MOSHER, *G. cf. constricta* MOSHER et CLARK. Fish teeth and singular conodonts – *Prioniodina venusta* (HUCKRIEDE) and *Gondolella trammeri* KOZUR were obtained from **Zbyňov/522/83/573** locality in the bromoform background. Only fragment of *Gondolella* sp. were found from **Zbyňov/522/A/83/583** locality.

Above mentioned community of conodonts from limestones from Jasenové and Zbyňov localities is represented by the common type of Middle Triassic associations. It can be stated that the community of Jasenové 515/A/83 locality indicates Late Illyrian age. Jasenové 606/B/83 locality association is most likely of Early Fasanian age (*A-Z pseudolonga* in terms Kovács & Kozur, 1980). Association of Jasenové (606/83) locality indicates Illyrian-Fasanian boundary. Jasenové 515/83, 522/83 and Zbyňov 522/A/83 localities were not evaluated in detail. Found species are known from the Middle Triassic, having a broader age span. The presence of calcareous foraminifers and macrofauna indicates a shallow marine environment.

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## M. CHUCHRO: The time series structure of flow into Municipal Wastewater Treatment Plant

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Municipal Wastewater Treatment Plant (MWWTP) collects household waste liquid from toilets, baths, showers, kitchens, sinks, and so forth that is disposed of via sewers. In many areas, also includes liquid waste from industry, commerce and storm water runoff. Knowledge about wastewater flow intensity is important for high effectiveness purify of wastewater.

The overall goals of investigation were analysis of time series inflow to a municipal wastewater treatment plant. We have daily data of eight years time period from three MWWTPs: Kraków-Kujawy,

Sandomierz and Warszawa-Czajka. Time series high resolution and length helps in searching weakly visible relationships. We investigated time structure.

The wavelet methods helped to made weekly and monthly model of inflow changeability for data from MWWTPs. A weekly model showed two high values on Wednesday and Saturday and one low value on Sunday for all analysis MWWTPs. Monthly model looks similar, but we can observe fluctuations between similar days in first, middle and the last week of month. The biggest inflow value fluctuations, between Sunday and Wednesday are observed in the middle weeks. The smallest are in the first week of the month, as it is seen in the Fig. 1. Model of monthly averages shows the lowest volume of inflow in November and December, and maximum volume in spring and autumn. It is connected with Polish temperate moderate climate, with both maritime and continental elements.

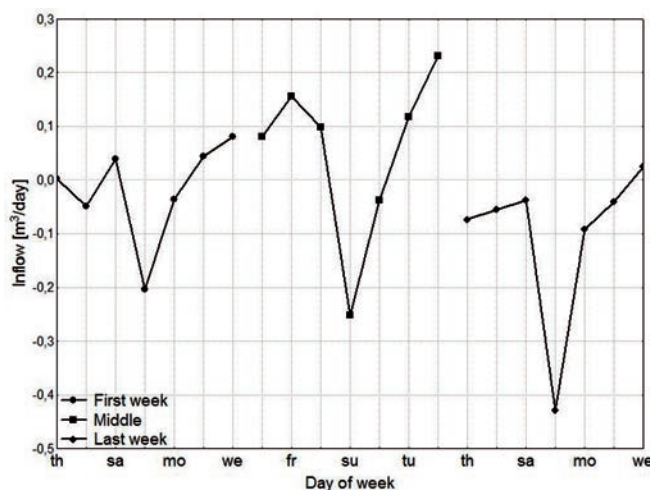


Fig. 1. Monthly inflow model in the MWWTP in Warsaw.

Data from MWWTPs were analysis in frequency domain. High values of periodogram are on the 0.0180, 0.0324, 0.074, 0.1482, 0.284 frequencies. The spectrum analysis confirms wavelet models. Five recurring cycles (3.5 day, 7 days, 1 month, 2 months, and half year) were drawn. The comparison between raw data and the graphs of cycles showed good fit for dry days data.

Wavelet method and spectral analysis showed that MWWTPs inflow data have complicated time structure. Knowledge about structure is the first step of making good predicting model of inflow.

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## M. JAMRICH and E. HALÁSOVÁ: Calcareous nannofossils from the Devínska Nová Ves – clay pit; biostratigraphical and paleoecological interpretation

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The thesis presents new and more precise data of distribution and quantitative representation of calcareous nannofossils in Studienka formation in the Vienna Basin. A statistical methods for interpretation of calcareous nannofossil assemblages were used for the first time in Devínska Nová Ves – clay pit. New information validated and filled in already known facts about occurrence of this group in sediments of Upper Badenian in the Vienna Basin. The results can be used for

biostratigraphical and paleoceanographical interpretation. They were correlated with the results of foraminiferal and calcareous dinocysts assemblages in the same profile.

According to high resolution study of calcareous nannofossils from Devínska Nová Ves – clay pit in Studienka Formation in the Vienna Basin taxonomical biostratigraphical and statistical studies we can conclude: 69 samples were studied in DNV-1 profile. Rich association of calcareous nannofossils was well preserved, diversity 145, 47 Neogene species, 98 redeposited nannofossil species of Cretaceous and Paleogene. Biostratigraphical age of sediments according to calcareous nannofossils was set to Upper Badenian, NN6 – *Discoaster exilis* (Martini, 1971) Zone on the base of LAD *Sphenolithus heteromorphus* and FAD *Triquetrorhabdulus rugosus* and *T. rioi*, correlated with Seravalian in Mediterranean area, corresponding with foraminiferal Bulimina–Bolivina Zone and calcareous dinocyst assemblages. Other important taxa according to NN6 Zone *Calcidiscus premacintyreii*, *Helicosphaera walbersdorfensis*, *Helicosphaera wallichii*, *Coronocylus nitescens*, *Orthorhabdulus serratus*, *Sphenolithus abies* were determined too. *Reticulofenestra haqii* has majority in all 69 studied samples.

Paleoecology according to diversity perform proper conditions for evolution of calcareous nannofossil assemblage (depth/max diversity 2.3 m D = 2.12, 1.8 – 2.1 D = 2.063 – 2.097, 8.9 m D = 1.989).

Dominance graph suppose 7 groups according to water conditions and its (depth/max): warmwater conditions (1.3, 8.9 m), coldwater conditions (1.9, 6.6 and 7.0 m), neritic conditions (6.1 m), pelagic conditions (1.0, 6.4 m), eutrophic conditions (1.6, 5.7, 7.8 m), oligotrophic conditions (1.3, 8.9 m) and salinity changes (6.0 m).

Cluster analysis graph divided into 4 groups as: A – coldwater conditions, B – neritic, salinity changes, offshore nities, C – continental shelf (opensea), (coldwater), D – continental shelf (opensea), (warmwater).

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#### M. JAMRICHOVÁ: Upper Jurassic-Lower Cretaceous calpionellids and calcareous dinoflagellates from the selected sections of the Czorsztyn Unit of the Klippen Belt (Western Carpathians)

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Studied sections Hrebeň and Štepnická skala II. are situated in central Považie and Erdúsky kostol section is situated in Orava region. Malmica Zone was identified on the Hrebeň section. This Zone was found in grey and pink micritic crinoidal limestone of Lower to Middle Tithonian age. Crassicolarian assemblages with the most *Crassicolaria parvula* and *Crassicolaria masutiniana* are abundant in the overlying Korówa Member of Tithonian to Lower Berriasian age and they indicated Crassicolaria Zone. Calpionella Zone was distinguished from the upper part of the Korówa Member with Alpina and Ferasini Subzone. Crassicolaria Zone with Intermedia and Brevis Subzone were identified from the Erdúsky kostol section. Mentioned crassicolarian subzones were distinguished from the Upper Tithonian Korówa Member and lower part of the Sobótka Member of Upper Tithonian to Lower Berriasian age. *Calpionella alpina* is dominated in upper part of the Sobótka Member and *Calpionella eliptica* in grey and red limestones of Aptian to Albian age. This calpionellid assemblages indicate Calpionella Zone with Alpina and Eliptica Subzone. Malmica Zone was distinguished from the Streženice Formation of Oxfordian to Tithonian age and from lower part of the red nodular limestone of Tithonian age of the Štepnická skala II. section. *Cadosina semiradiata semiradiata* is dominated in lower part of the Rogoža Coquina Member of Middle Tithonian age and it indicates Semiradiata Zone. Calpionellid assemblages are dominated in upper part of the Rogoža Coquina Member and Crassicolaria Zone with Intermedia Subzone

was distinguished from this limestone. *Calpionella alpina* is common in the Sobótka Member of Upper Tithonian to Lower Berriasian age and it indicates Calpionella Zone with Alpina Subzone. On the basis of this zonation the Jurassic/Cretaceous boundary (Tithonian/Berriasian boundary) in the Erdúsky kostol and Štepnická skala II. sections is situated between the Crassicolaria and Calpionella Zone. This base is defined by morphometrical change of *Calpionella alpina* tests. In studied locality, Lower Tithonian dinoflagellate cysts show distinct change in abundance and composition. Orthopithonellid forms dominated in the Malmica Zone, but they were replacement by obliquipithonellid species dominated by *Cadosina semiradiata semiradiata*. Vertical calpionellid distribution of the studied sections can be characterized by several events – the onset, diversification and extinction of crassicolarians (Late Tithonian) and the onset of the monospecific *Calpionella alpina* association on the Jurassic/Cretaceous boundary.

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#### E. KALIŇSKA<sup>1</sup> and M. WYSZOMIERSKI<sup>2</sup>: Synthetic profile of aeolian deposits in the southern and eastern Mazovia Lowland (Central Poland) and its interpretation

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The zone build of fine- and medium-grained sands runs along southern and eastern edge of Błonie and Radzymin ice-dammed lake levels. On the basis of 13 profiles the synthetic profile was created. Textural features of sandy deposits and underlying tills were examined. On the basis of grain size distribution, rounding and frosting of quartz grains, light and heavy minerals and scanning electron microscopy (SEM) microfeatures eight series were distinguished. Underlying tills were divided into two series: F, which represents solifluction processes and G, which records active layer during periglacial condition. Sandy-gravelly, well-sorted series E are characterized by more than 90 % content of aeolian grains and represents probably aeolian pavement. Both series D and B are stratified in frosted grains (67–87 %) and garnets (22 %), which record warmer climate conditions (interstadials) during last glaciation. Series C are manifested by the presence of frosted quartz grains strictly, as well as garnets, which indicate strong aeolian activity. Series B, C and D occur alternatively, which reveal changeable climate condition in periglacial zone. Upper part of synthetic profile was characterized both by poor-sorted sands with admixture of gravels (A<sub>1</sub>) and well-sorted sands (A<sub>2</sub>). Hence, the sediments of series A<sub>1</sub> were transformed by rainfalls and thawing during warmer periods, while series A<sub>2</sub> represent typical aeolian condition, when occasionally small dunes might be developed.

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#### E. KALIŇSKA<sup>1</sup> and M. WYSZOMIERSKI<sup>2</sup>: Textural features of selected deposits of Błonie level (Central Poland): Preliminary results

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The Błonie level in Central Poland is a flat and monotonous plain, eroded by Bzura River and its tributary – Utrata River and built of ice-dammed lake deposits. Investigated area was located in Błonie, about 25 km west of Warsaw. Sandy part of profiles, underlying ice-dammed lake clays, was examined.

The grain-size distribution analysis reveals domination of fraction between 0.125 and 0.25 mm (3-2 phi). Cumulative curves are homogeneous. Two types of transportation can be distinguished: traction and saltation, while part of suspension is almost indistinct. Inclination of saltation section contains approximately 60°. The frequency curves reveals unimodality of sediments. The course of curves is relatively high and narrow, which proves good sorting of investigated deposits. Sands are characterized by moderately standard deviation as a rule, while skewness is negative. Mineral composition observed in sandy fraction (0.5 – 1.0 mm) are represented by quartz (84 – 88 %), feldspars (9.5 – 9.7 %) and crystalline rocks (1.65 – 5.9 %). All samples are enriched in transitional rounding and frosting quartz grains (EM/RM) (81 – 88 %), which indicates relatively long-term aeolian transportation. Participation of rounding and frosting grains (RM) achieves 6 – 12 %. Simultaneously the presence of only 0.7 – 6 % polished grains (EM/EL and EL) is observed. Both fractured (C) and angular (NU) quartz grains are very rare. A corollary of mentioned results is probably fluvioperiglacial origin of sandy deposits, connected with first stage of ice-dammed lake existence before standard varved-clay accululation.

#### K. KAMENSKÁ: Geophysical 3D model of a geothermal reservoir rocks in the central part of Košice Basin in the Eastern Slovakia

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Question of energy needed for enhancing of human being comfort is recently very popular and geothermal energy, as one of renewable energy sources; started to be utilized not only for recreational purposes but also for heating and probably for electricity generation in Slovakia. Slovakia is a country, which has proper geological conditions for occurrence of geothermal sources. Košice Basin seems to be the most perspective geothermal area – the reservoir rocks are Middle Triassic dolomites with fissure karstic permeability and basal Carpathian rocks at the depth of 2 100 – 2 600 m with average temperature around 135 °C. Seismic data from central part of Košice Basin enabled demonstration of position, spatial distribution, morphology and simplified tectonic structure of reservoir rocks and their Neogene overlier as an insulator. Based on 3D tectonic model, created in Schlumberger's Petrel software, reservoir rocks are segmented into individual blocks, which probably do not communicate with surrounding blocks in terms of geothermal water flow. Tectonic and geologic aspects affect thickness of sedimentary sequences, what is demonstrated by variable thickness in the whole space of modeled area. Model showed at least one potential geothermal area but for further evaluation detailed geophysical measurements are needed.

Geothermal sources in central Košice Basin as a home source can reduce dependence on gas and other fossil fuels. Utilization of geothermal sources can secure energy supply for town Košice and prevent future shortages in energy as it was in January 2009 when Russia cut gas supply to part of Europe including Slovakia. Geothermal energy produces much less greenhouse gasses in comparison with conventional fossil fuel plants and in the case of reinjection there is no emission to the atmosphere. Probably the biggest disadvantage of geothermal utilization in area of interest is a high capital cost.

#### J. KIERCZAK: Solid speciation of Ni and Cr in lithogenic and anthropogenic materials in the area of the Szklary Massif (SW Poland)

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The geological unit called Szklary Massif comprises two environments containing Ni and Cr from diverse origins: lithogenic (ultrabasic rocks and serpentine soils) and anthropogenic (waste

dump composed of slags and covered by antroposol). The study was dedicated to investigate the distribution and mobility of Ni and Cr during weathering of ultrabasic rocks and pyrometallurgical wastes (slags and related antroposols) occurring within the area. The Ni and Cr bearing minerals in the materials were identified and characterized using analytical instrumental methods (XRD, SEM-EDS, EPMA, micro Raman, TEM, ICP-MS). Complementary chemical extractions provided information on solid speciation of Cr and Ni and other potentially toxic elements (PTE), their potential mobility and interactions with environment, especially in cultivated soils in the vicinity of the slag dump.

The mineralogical study shows that Cr-carriers from both studied materials do not undergo weathering. Chromium mostly occurs in spinel group phases, those from ultrabasic and serpentine soil are Cr-magnetites, whereas those occurring in the pyrometallurgical slags have various compositions between chromite and Mg-chromite. Cr is also present in subordinate amounts in clinocllore in the rocks and serpentine soils. Nickel initially occurs in silicates and crystallized oxides in ultrabasic rocks and soil. The phases transform in numerous secondary minerals during weathering. The secondary phases have potential to immobilize part of the Ni which has been released during transformation of primary Ni carriers. In anthropogenic materials (slags and antroposol), nickel is frequently incorporated in sulphides and intermetallic compounds of Ni and Fe and in lesser amounts in silicates (forsterite), where the first are generally considered as potentially reactive. Small inclusions of sulphides and metallic phases from slags are trapped within the stable silicates or silicate glass and their reactivity seems to be limited.

Chemical extractions show that mobility of Ni and Cr, as well as of other analysed PTE (Cu, Pb, Zn, Co), is different between natural and anthropogenic materials, with the exception of Cr, which is usually found in residual fractions. Cu and Pb are more mobile than Cr, Co and Ni in both studied types of materials. Zn is more stable in the serpentine soil than in the antroposol. PTE of lithogenic origin are generally less mobile, than those of anthropogenic origin, except for Ni, which is more mobile in the serpentine soil compared to antroposol.

Summarizing, the study shows great potential of using combined mineralogical and chemical analytical methods. The results imply larger relative stability of Cr compared to Ni. The environmental risk in the studied site is not only related to Ni and Cr, which are present in significant amounts in rocks and slags, but also to other PTE such as Zn, Pb and Cu, which were found in substantial proportions within fractions defined by chemical extraction as potentially biodisponible.

#### T. KLIMKO, M. CHO VAN and B. LALINSKÁ: Mineralogy of sulphides oxidation of tailings material at abandoned Sb deposits Dúbrava (Nízke Tatry Mts.) and Poproč (Spišsko-gemerské rudohorie Mts.)

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In the second half of 20th century Dúbrava Sb deposit (N. T. Mts.) and Poproč Sb deposit (SGR Mts.) were two of the main antimony producers not only in former Czechoslovakia, but also in Central Europe (especially Dúbrava Sb-deposit). The effect of mining on the surrounding environments was very intensive thus contamination of these regions is very high. One of the contamination sources are tailings impoundments (four at the Dúbrava deposit and three at the Poproč deposit). The major type of contamination is toxification (Sb, As) at both localities. Acidification is significant at the Poproč deposit (pH around 3) but not at the Dúbrava deposit (pH 7 – 8).

The main effect of oxidation can be easily seen in the samples of tailing material taken near the tailing's surface. Different levels of oxidation and various products of sulphides oxidation were observed. Pyrite is the most abundant sulphide mineral at both localities. Additionally, the tailings frequently contain arsenopyrite and less

frequently stibnite. At the tailings of the Poproč deposit the occurrence of ore minerals is lower than in tailings at the Dúbrava deposit. This is probably due to massive oxidation of ore mineral grains that causes the entire degradation of grains and consequential dissolution into different ions (e.g.  $\text{Fe}^{2+}$ ,  $^{3+}$ ,  $\text{H}^+$  and  $\text{SO}_4^{2-}$ ).

Pyrite as well as arsenopyrite grains are altered by oxidation and secondary minerals are formed around these grains in the form of oxidation rims. The rims on pyrite are mostly composed of Fe-oxides (oxihydroxides) containing up to 62.72 wt.% of Fe, up to 2.66 wt.% of As and up to 4.84 wt.% of Sb at the Dúbrava deposit and it is very similar at the Poproč deposit too. The rims developed on arsenopyrite grains contain up to 49.77 wt.% of Fe, up to 25.69 wt.% of As and up to 7.01 wt.% of Sb. Secondary rims around arsenopyrite grains were not seen in the samples from Poproč yet. Secondary rims are mostly destructed and are subsequently extracted from the sulphide core. At the locality Poproč the mineral scorodite was successfully identified, further in a sample this mineral occurs in an association with arsenopyrite. The average chemical compound of scorodite is: 25.47 wt.% Fe, 32.15 wt.% As and 0.15 wt.% Sb.

We have not observed the presence of secondary oxides connected with stibnite grains at both localities. Based on the presence of fractures in stibnite and significant evidence for Sb presence in pore waters we suggest that Sb is leached from stibnite into the solutions; later, aqueous Sb is sorbed by secondary Fe-oxihydroxides present in the system.

Various Fe and Sb, Fe-oxides and oxihydroxides are also common in tailings at both localities and they are the most frequent products of sulphides oxidation of tailings material at the Poproč deposit. Some of them are directly connected with sulphide minerals, such as goethite pseudomorphs after pyrite (especially at the Dúbrava deposit). In other cases the origin is uncertain, but we expect that these forms originate as single grains precipitated from solution directly in tailings environment. Fe-oxides containing up to 54.60 wt.% of Fe bind a large amount of Sb (up to 5.07 wt.%) and only a smaller amount of As (up to 3.37 wt.%) at the Dúbrava deposit and it is very similar at the Poproč deposit too. The chemical compound of Sb, Fe-oxides is very similar at both localities and they contain up to 42.94 wt.% of Fe, up to 64.29 wt.% of Sb, up to 1.50 wt.% of As, and up to 6.39 wt.% of Ca.

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## Z. KOMPANÍKOVÁ: Temperature influence on volume changes of travertine

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The volume changes of rocks are related on temperature changes, being one of the factors affecting the quality of rocks.

Travertine with detected volume changes has monomineral composition. It is distinctly structurally heterogeneous and typical with high and chaotic distribution of porosity. Studied travertine samples were taken from travertine heap in Spiš castle. The samples represented rock blocks with marked spatial orientation, related to their position in rock mass (foliation). The laboratory tests were done on cylindrical samples with 50 mm length and 34 mm diameter, oriented vertically to direction of foliation.

For measurement of temperature expansion we used thermodilatometer, in which the temperature range was experienced under conditions of natural exposure (summer and spring/autumn period). Summer cycle represents the temperature range in summer period and sample is heated up. Temperature range during heating is from +20 °C to +60 °C. Spring/autumn cycle represents the temperature range in spring and autumn period and is achieved by cooling from indoor temperature +20 °C into -5 °C. The tests carried out on travertine from Spišské Podhradie and their results encompass 6 short-term temperature cycles simulating the summer and spring/autumn periods.

The length changes of samples, observed by thermodilatometer and related on temperature changes, are characterized by coefficient of thermal expansion –  $\alpha$ , relative dilation –  $\varepsilon$  and residual strain –  $\Delta L$ . The biggest changes of residual strain were determined in spring/summer cycle following after summer cycle. The tests also proved the idea that permanent temperature deformation may acts as initial factor of slope movements.

## A. KOWAL, A. PIORKOWSKI, A. PIETA and T. DANIEK: Efficiency of selected component technologies for parallel and distributed heat transfer modelling

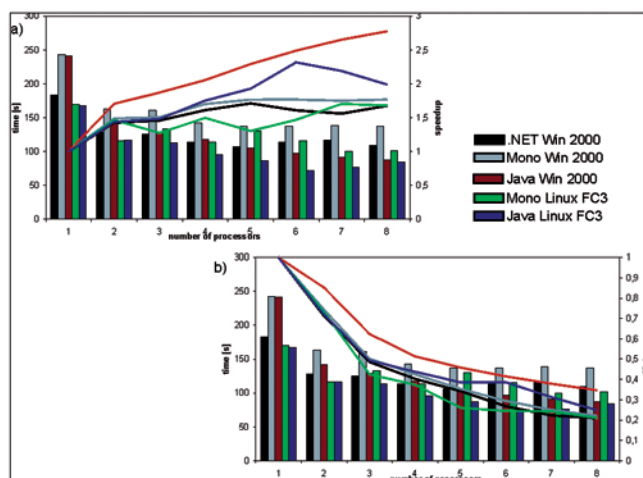
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Geothermal field modelling is very useful in Earth sciences. Numerous physical problems involve heat transfer phenomena including volcanoes, intrusions, earthquakes, mountain building, metamorphism, mantle and crustal heat flow variability. Unfortunately the modelling process for large geological models or for long term temperature field changes is extensively time consuming. One of the best methods to overcome this disadvantage is parallelization of computations. Luckily numerical solution of the heat transfer phenomena using finite difference method (FDM) solutions are very good examples of computational problems which are easy to parallelize by domain decomposition.

Scientific codes written in the conventional way often suffer from low portability, limited code reuse and short life cycle. Component-based software engineering is a new way of software production that gives portability, security and independence of hardware. The most advanced and popular solutions of such software are Sun Java and MS.NET and open source solution, called Mono.

In this paper efficiency of using component-based software for heat transfer modelling is presented. The test computations were performed in a cluster of 30 PC computers, which have following parameters: processor with hyper-threading technology (Intel Pentium 42.8 GHz), 1 GB RAM, Gigabit Ethernet network adapter. Efficiency component heat computing were tested in following operating systems: Linux (Fedora Core 3, kernel: 2.6.12-1.1381 [smp]), MS Windows 2000 (SP4).

Obtained results: computational time for different platform and components (Fig. 1a, b), speedup of computation (Fig. 1a) and efficiency of using parallel environment of such configuration (Fig. 1b) clearly indicate that the component approach is able to



**Fig. 1.** Relation between computational time (bar charts) and speedup (line on Fig. 1a) and efficiency (line on Fig. 1b) and number of processors.

give satisfactory results in this kind of applications. Global solution efficiency can strongly depend on operating system and hardware. Various free and commercial component technologies can be effectively used to eliminate problems of low portability, limited code reuse and short life cycle.

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**K. KRONOME, N. HUDÁČKOVÁ and M. SÝKORA: Application of statistical methods in the study of Upper Triassic Hallstatt limestones near Silická Brezová village, Inner Western Carpathians**

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The Carnian-Norian pelagic Hallstatt limestones are located in the vicinity of Silická Brezová village, in the Slovak Karst area.

These limestones were studied by classic methods of microfacial analysis and by statistical methods too. The quantitative and semiquantitative data acquired from thin sections were then processed by the PAST program for statistical analysis. We applied cluster analysis of data matrices created from the quantitative data of thin sections acquired by classical microscopic study. We decided for using of Ward's data grouping method since this method fit best with the type of our data and is the best for explaining the resemblance of samples. The data were investigated quantitatively as well as qualitatively. Samples and also clasts occurred were grouped for the explanation of defined groups.

The cluster diagram of the analysed thin sections on the level of similarity about 150 was arranged in two main groups – group A and group B. Group A on the similarity level 80 was then divided into two compact subgroups (A1, A2) and group B on the similarity level 90 was divided into four subgroups (B1, B2, B3, B4), where subgroup B4 was inhomogeneous, so we additionally selected similarity level 60 and thus subdivided it into two more compact groups. According to the individual groups defined by the distribution of bioclast types, we can assume, that samples belonging to groups A1, A2 represent deep water sedimentation environment characteristic by high content of filaments, bivalves and occurrence of *Globachaete alpina* LOMBARD, where the A1 group differs from A2 by higher content of radiolarians, thus A1 represents deeper water environment. The samples of groups B2 and B3 represent shallower water conditions, group B2 is a compact group differing by high content of *Globachaete alpina* LOMBARD, radiolarians and agglutinated foraminifers while group B3 shows smaller amounts of filaments, bivalves and globochaetes, but higher amounts of echinodermate detritus. Samples of the B4 subgroup represent probably the most shallow water environment with characteristically low content of globochaetes. Based on Gastropoda content, B4 subgroup can be subdivided into minor groups B4a and B4b, where B4a shows higher content of radiolarians and thick-shelled ostracods and B4b shows discriminating content of sponges. The subgroup B1 is represented by two samples with high content of agglutinated foraminifera only and is separated from the other B groups on the level of similarity 130.

The statistical methods were used only as an additional tool for amending the results of classical microscopic study. Results of the statistical evaluation need to be interpreted with caution on the character of input data: data were acquired by microscopic study of thin sections, thus just a fragment of the rock was investigated, so the bioclasts, which are also fragmented, can cause over- or under estimating of their real content. Influence of bioturbations and water currents would not necessarily be observed in the thin sections and not even be represented by amount and character of bioclasts. In spite of this, the statistical methods provide us new information and

can be used for deciphering paleoecological changes based on the content and type of bioclasts in thin sections.

**Acknowledgement.** This work was supported by the Slovak Research and Development Agency under the contact No. APVV-0280-07.

**J. KUČEROVÁ: Interpretation of the Miocene macroflora from the Locality Veľká Čausa (Slovakia)**

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The locality Veľká Čausa is situated in the Upper Nitra depression of the Handlová-Nováky brown-coal basin. Studied paleobotanical material, stored in the Hornonitrianske múzeum in Prievidza, is fossilized in light-gray clays of Eggenburgian age. Individual morphological data, for each taxon, are used for paleoclimatic reconstruction and ecological interpretation. Different predictive models demonstrate definite relationships both of the climatic variables and leaf characters, but the precision of these relationships varies depending upon the statistical model applied to the data. Application of the CLAMP (Climate Leaf Analysis Multivariate Program) method to the fossil flora assumes that if climatic parameters can explain physiognomic variation, then that variation can be used to predict climatic parameters. The analysis involves relating the fossil flora to group of climate parameters. The climate parameters predicted by this analysis are: Mean Annual Temperature (MAT), Warm Month Mean Temperature (WMMT), Cold Month Mean temperature (CMMT), Length of the Growing Season (GRS), Growing Season Precipitation (GSP), Mean Monthly Growing Season Precipitation (MMGSP), Precipitation during the 3 Consecutive Wettest Months (3WET), Precipitation during the 3 Consecutive Driest Months (3DRY), Relative Humidity (RH), Specific Humidity (SH), Enthalpy (ENTHAL). From all fossil leaves from the collection were chosen dicots only. They were sorted into morpho-species and were examined for the presence or absence of each of the 31 morphological characters used after CLAMP categorization. A total of 246 fossil samples were studied. Vegetation used in the dataset for this study indicates subtropical climate. The study of fossil flora from the geological collection of Hornonitrianske múzeum in Prievidza was made under the permit issued by the relevant authorities of this museum.

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**M. LAHO<sup>1</sup>, M. BEDNÁRIK<sup>1</sup>, R. HOLZER<sup>1</sup> and P. WAGNER<sup>2</sup>: Database of the dimension and crushed stone: Engineering Geological Inventory of Rocks of Slovakia**

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The contribution deals with the behaviour, properties and utilization of the rocks in Slovakia. The variety of geological structures, their high tectonic deterioration and inhomogeneity caused, that only a few rock formations offer rocks usable as a dimension stone (travertine, marble, sandstone, rhyolite, andesite, limestone). Due to the enormous deterioration of rock masses caused by the Alpine orogenesis and younger fault tectonics in Slovakian Carpathians, the majority of excavated rocks are used mostly as crushed stone (aggregate). The tectonically weakened rock masses are subjected of progressive decay, mainly due to the weathering, which is accelerated by the technical excavation in mines, road cuts, by the atmospheric influences, etc. All those aspects are decisive for the optimal application of rocks as dimension or decor dams, river levees, etc., as well as for the deposition of unsuitable rock material.

The investigated engineering geological characteristics and properties of rocks are the subject of the comprehensive "Engineering Geological Inventory of Rocks of Slovakia". Unified documentation records present results from 146 investigated excavation sites (abandoned or under operation).

General excavation site description, main rock mass structural characteristics (characteristics of discontinuity sets, blockiness, loosening, etc.), mineralogical rock composition, properties of the investigated rock material and its utilization were recorded into registration forms.

Main part of the registration form provides the assessment of physical and mechanical rock properties on regular and irregular rock samples reflecting the stone durability. Following characteristics were estimated: density, porosity, water absorption, uniaxial compressive strength (dry  $\sigma_{cd}$ , saturated  $\sigma_{cw}$  and after freeze/thaw cycles samples  $\sigma_{ct}$ ), tension and shear strength, calculated softening ( $C_s = \sigma_{cw}/\sigma_{cd}$ ), freezing coefficients ( $C_f = \sigma_{ct}/\sigma_{cd}$ ) and deformation properties. Porosity, water sorption, strength characteristics, together with tests in  $\text{Na}_2\text{SO}_4$  solution, further micro-Deval test for the determination of the crushed rock resistance to wear, slake durability test (SDT) and laboratory freeze/thaw long – term weathering tests were regarded as most suitable indicators of the stone quality.

The available data concerning the properties (determined according EU standards) and the durability of rocks representing main geological formations of Slovak Carpathians are decisive for their individual use in all branches of the civil engineering.

All the data obtained from the field and laboratory investigation are stored in a relational database. The database is formed by main table, which contains basic information about the investigated site. The main table is joined with the secondary relational tables storing an information about the rock mass structure, rock material, geomechanical tests, rock use, etc. The main advantage of such system is the dynamical data actualization and the statistical assessment of the selected characteristics of the rock environment.

#### P. LEDVÁK: *Traumatocrinus* from the Ladinian–Carnian basinal deposits of the Western Carpathians (Slovakia)

Geological Institute, SAS, Bratislava, Slovakia

In the last few years several works dealt with spectacular findings of entirely whole colonies of *Traumatocrinus* still attached to fossilized driftwood from the Lower Carnian black shales of Xiaowa Formation, Southwest China (Seilacher & Hauff, 2004; Hagdorn et al., 2006; Xiaofeng et al., 2006). Such favourable preservation allowed authors to study articulated *Traumatocrinus* specimens and reconstruct their pseudoplanktonic lifestyle. Unfortunately many localities in the Western Europe including Salzkammergut in the Southern Alps from which this crinoid was described for the first time by Dittmar in 1866, contain in the Hallstadt limestone only isolated ossicles and stem fragments. This is also the case of Ladinian–Carnian facies in the Western Carpathians, which yielded several fragments with different state of preservation.

The material from the Slovak part of Western Carpathians originates from the Upper Ladinian Reifling Limestone, locality Zámotie – Štefánka and from Lower Carnian black shales of Svarín Formation (formerly introduced as Aonian or Trachyceras Beds), locality Svarín. The former is represented by several larger stem fragments of probably younger specimens with partly visible mesh like structure in the lateral profile. The later contains two smaller fragments probably from distal stem portion of fully grown specimens. One columnal of these fragments has visible articular facet composed of V shaped ribs which extend radially from the centre to the rim. It is a typical feature of the *Traumatocrinus* stem morphology which is not present by any other known crinoid group.

As pointed out by recent studies *Traumatocrinus* was a pseudoplanktonic crinoid which attached to the floating logs with its root. It is known from deep sea facies of Paleo-Tethys realm, mostly from Upper Ladinian to Lower Carnian but sporadically also from

Lower Ladinian (Gluchowski, 2002). According to the fossil data we can place *Traumatocrinus* origin and origin of its unique lifestyle into Middle Triassic (probably Lower Ladinian). This is very interesting because it is widely known that the Ladinian was a global dry period. It is therefore questionable how could possibly rise this type of lifestyle in such conditions. Answer on this question could be probably provided by detail study of Ladinian fossil flora.

#### B. MAGULOVÁ and M. BEDNÁRIK: Landslide hazard assessment for urbanized areas: Levoča region case study

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Geohazards present a significant barrier for further utilization of environment. Study area is mostly affected by landsliding, soil erosion and floods. Due to this, landslide hazard assessment, using statistical methods in GIS environment, is able to show proper ways in environment utilization.

The landslide hazard assessment became very common in Slovakia mainly by works of Paudiš (2005), Bednarik (2001, 2007, 2008) and Jurko (2003). The landslide hazard assessment methodology solutions in a GIS environment are based upon suitable selection of those factors, which play a dominant role in slope stability state. The selected factors are processed using the parametric maps and in this form they enter in the statistical processing, underpinned by map algebra in a GIS environment.

In presented case study following factors influencing the slope stability are evaluated: lithology, morphometric parameters, rainfall, actual landuse and registered landslides. These factors have been prepared in a vector form (parametric maps) and consequently processed to the raster form. Bivariate statistical analyses were used for the construction of final landslide susceptibility and hazard maps.

#### A. MACHLICA: Modelling of groundwater runoff in different climatological and hydrogeological conditions

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Groundwater runoff is a compound of total runoff from the catchment. Course of groundwater runoff is depending on more variables. The focus of this study is the influence of various meteorological and hydrogeological conditions to groundwater runoff. There are several methods to solve this problem. Each selected method gives different results by the use of more variables. The issue is how to choose the best method and which method is applicable for specifically hydrogeological conditions.

For the modelling we selected the Upper Nitra river catchment with more sub-catchments, Topla and Torysa river catchments. Groundwater runoff was simulated at selected profiles in the catchments. The time series since 1981 to 2007 was taken for the modelling. The kriging method, lapse rate method, arithmetic mean and nearest neighbours method were chosen for modelling climatological conditions. After finding the best method there was necessary to evaluate the right choice with using BILAN model. The BILAN model has been developed for assessing the water balance components of catchment using a daily step. The structure of the model is formed by a system of relationships describing basic principles of the water balance on the land surface, in the zone of aeration, including the effect of vegetation cover, and in aquifers bearing the groundwater.

The knowledge about using the best method for specifically hydrogeological conditions is very useful for understanding and calculating water balance in the whole catchment.

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### J. MAJKA: The Caledonian orogeny in the northern Barents Sea region

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The recent progress in geochronological and geophysical works in the northern Barents Sea region brought a lot of new data concerning the pre-Caledonian history of the Svalbard's Caledonian basement terranes, timing of the Caledonian orogeny and development of the main Caledonian tectonic structures. The evidence of the purely exotic origin of some metamorphic crustal domains (e.g. in age corresponding to the Timanides) within the Svalbard's Caledonian basement and their juxtaposition with the typical Neoproterozoic rifted continental margin sedimentary successions rises a lot of questions about the timing and style of the deformation during the Caledonian orogeny. Moreover, the lack of the outcrops of the collision-related rock units let to the speculation concerning the location of Scandian suture in the northern Barents Sea region. The unequivocal evidence of dominant Laurentian crustal domains within the pre-Caledonian basement of Svalbard and their offshore southwards prolongation provide unambiguous assumption that the Scandian suture must be located east from Svalbard, but probably does not reach Franz Josef Land. Taking into account a good onshore evidence of the importance of the long-distance strike-slip faulting and thrusting during Caledonian orogeny, the existence of exotic terranes within Svalbard's crystalline basement seems to be not surprising and their origin is rather related to Laurentia, then to Baltica.

### V. V. MAKHNACH: Shells of *Kosmoceras* (*Kosmoceratidae*): An object of studying by students at the laboratory classes on "Paleontology"

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Modern paleontological researches have led to the essentially different representation about systematization and phylogenies of ammonites in comparison with the preceding stages of their study. Simultaneously with the description of extensive materials, the new taxonomical categories, number of which has greatly increased have been singled out. Many former genera have been ranked into families and even superfamilies. In recent years, in connection with making up solid reports and reference-books, the problem of creating of scientifically well-grounded system of ammonites began to draw the increasing attention of paleontologists, and thanks to the joint efforts of many scientists from different countries the solution of this problem has strongly moved ahead. It is also necessary to note the increased interest in biology-ammonites questions. The exit of paleontology "from offices" into an university education system has become the main achievement of the present stage.

Training specialists in the field of geology the theoretical knowledge of the lecture course and laboratory classes on "Paleontology" obtained great importance. Despite the development of absolute stratigraphy methods, paleontological methods have not lost their actuality. During field researches the methods of relative stratigraphy allow to reduce considerably the cost of research work.

For studying the features of the morphological structure of ammonites the shells of the genus *Kosmoceras* are most appropriate. The word "*Kosmaceras*" is derived from Greek meaning "kosmos" – the Universe and "keras" meaning – a horn. The name reflects the universal character of the distribution of ammonites of the given kind.

The family *Kosmoceratidae* includes the following genera: *Garantiana* HUATT, 1900 (*Garantia* ROLLIER, 1911), *Strenoceras* HUATT, 1900, *Spiroceras* QUENSTEDT, 1858 (*Patoceras* MEEK, 1876), *Pseudocosmoceras* MURASHKIN, 1930, *Kepplerites* NEUMAYR, 1892, *Kosmoceras* WAAGEN, 1869 (*Cosmoceras* WAAGEN, 1870), *Mojarowskia* NIKOLAEVA, 1955.

Characteristic features of the family: shells vary from plain-spiral with more or less increased layers to the developed and sometimes considerably straightened spiral. Edges are numerous and simple or branching, having up to three rows of humps or thorns and which end on the ventral side. A mouth has lateral "ears." The line of the shell is considerably dissected, rising in umbilicus parts. The first lateral line of the shell is deep with three-separate parts. There are additional lines varying from one or two.

Important is that during the development of the ammonite the process of phylogenesis in that of ontogenesis was observed. This is shown in specificity of development of the shell lines, causing scientific interest not only in research but also in educational purposes.

Biogeographical features show that the family of *Kosmoceratidae* extended to oceans of the Tethys and Paleopacific. The Tethys was likely the centre of the origin of the family. This is indicated not only by the maximum quantity of genera of family *Kosmoceratidae*, but also by the localization of the representatives of such genera as *Mojarowskii*, *Strenoceras* and *Pseudokosmoceras* in the given place.

The family *Kosmoceratidae* is of archistatigraphic importance. The subzones of Upper and Middle Callovian of the Central part of Russia (Russian plate), the Northern Caucasus, Western Siberia have been distinguished in accordance with the ammonites complex.

The representatives of the given family allow not only to draw the inter-regional correlation of sediments, but also to carry out the coordination of biostratigraphical divisions within themselves and international stratigraphic chart (biostratigraphic subzone *Kosmoceras Jason*).

The Museum of the Earth crust science of the BSU possesses an extensive collection of ammonites, including 32 specimens of family *Kosmoceratidae*, being used in educational process and for research purposes. The specimens of a high degree of preservation have been studied by means of the technique of Raup. The specimens of representatives of other families have also been taken from the museum funds for analysis. According to the technique of Raup, the rate of expansion of ammonites layers of genus *Kosmoceras* WAAGEN 1869 (*Cosmoceras* WAAGEN, 1870) proved to be in limits  $W = 3.4 - 4.9$ , and the degree of overlapping  $D = 0.22 - 0.44$ . These data show evolutionary changes in the group of *Ammonitida*: in early Jurassic periods of forms with more or less extending and overlapping shells ( $D \sim 0.4 - 0.5$ ,  $W \sim 2$ ) prevailed the Cretaceous period shells with moderately extending Layers ( $D \sim 0.3$ ,  $W \sim 2.5$  is traced). This gives the possibility to draw a conclusion that the genus *Kosmoceras* WAAGEN reflects one of the evolution links of group *Ammonitida*. The interconnection of these changes with transition into a new adaptive environment is rather interesting. Ecological aspects probable played an important role in the course of evolution. However it is necessary to notice the specific character of morphological changes at the level of species which generally does not contradict to existing biological and evolutionary theories.

### D. A. MAMONTOV and O. A. ORLOVA: Preliminary palynological analysis of the Upper Visean deposits from borehole 1P/A, south wing of Moscow syncline (Russia)

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Miospores of the Upper Visean terrigenous deposits (the Aleksin and the Mikhailov regional stages) from the borehole 1P/A, located on southern wing of Moscow syncline (the Kaluga region, Russia) have been studied. The spores were found only in eight examined samples (from total 20 samples). Studied palynospectra are characterized by the presence in fixed amount of *Tripartites vetustus* SCHEM. (nearly 10 %), which is the index-species of *Tripartites vetustus* (Ve) Zone of the Mikhailov regional stage. Percentage of *Cingulizonates bialatus* (WALTZ) SMITH et BUTT. is reduced upward the section (from 40 % to 10 %). *C. bialatus* is the index-species of CBd Zone of the Aleksin

regional stage. Increase of spores *Lycospora pusilla* (Ibr.) Som. is observed from lower part (under 10 %) of the section to its upper part (above 30 %). A few (nearly 5 %) spores of genera *Trachytriletes*, *Punctatisporites*, and *Leiotriletes* were found through the section. Percentage of the spores *Schulzospira campyloptera* (WALTZ) H., St. et M. decreases upward in the section (up to 1.5 %). Also a few spores of *Calamospira* sp., *Anulatisporites* sp., and *Triquitrites comptus* Will. were rarely met through the section. So, at least two different palynological palynoassemblages related to the Aleksin and the Mikhailov regional stages appropriately can be marked out.

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### Z. MARCINČÁKOVÁ: Investigation of xenoliths in volcanites on the marginal parts of the Isle of Zemplín

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For getting knowledge about the composition of deeper parts of the earth crust and upper mantle, the study and exploration of various igneous rocks have a great significance. The investigated samples of enclaves came from Neogene rhyodacite volcanic bodies cropping out on the marginal parts of the Isle of Zemplín. The Isle consists mainly of Upper Paleozoic rocks. Products of Neogene volcanism in the investigated area crop out in the form of isolated bodies – Hrčel, Kašov, Cejkov, Zemplín, Somotor, Bara, Velká and Malá Trňa, Luhyňa and its vicinity. Most quarries are not accessible; therefore the study was restricted to three localities bordering the Isle of Zemplín from the east: Hrčel, Kašov and Cejkov. The main aim was to make a record of the primary xenolith occurrences in volcanites of investigated area. Research was based on the petrographic-mineralogical studies (microscopic evaluation of samples) and XRD analysis. It provided exact information about mineral associations which are present in individual samples. The obtained mineralogical data were correlated with data of host volcanic rocks and with rocks constructing the basement of Isle of Zemplín. Via XRD analysis and comparison of mineral assemblage it was assumed the presence of similar minerals in enclosures and also in host rock in localities Hrčel and Cejkov (quartz, K-feldspar, muscovite, clay minerals and goethite). The similarity in mineral assemblage of both enclosures and host rock suggests that these are not xenoliths which could belong to the basement, but magmatic enclaves. The samples from Kašov are tuffitic claystone galls as it is alleged in a literature (Baňacký et al., 1989). One sample from Hrčel – XH-5 is clearly different. The enclosure contains tiny crystals of realgar (?) and lamella of phlogopite (?) which are occurring neither in a host rock – rhyodacite nor in other samples. So we can consider it as an enallogene xenolith as the only one of explored samples. Primary expectations of the occurrence of xenoliths in investigated area were not satisfied. The exploration confirmed badges of silicification, argillization and K-metasomatism in samples.

### J. MATUSIK<sup>1</sup>, A. GAWEL<sup>1</sup>, E. BIELAŃSKA<sup>2</sup> and K. BAHARANOWSKI<sup>1</sup>: Nanotubes derived from kaolinites of different structural order

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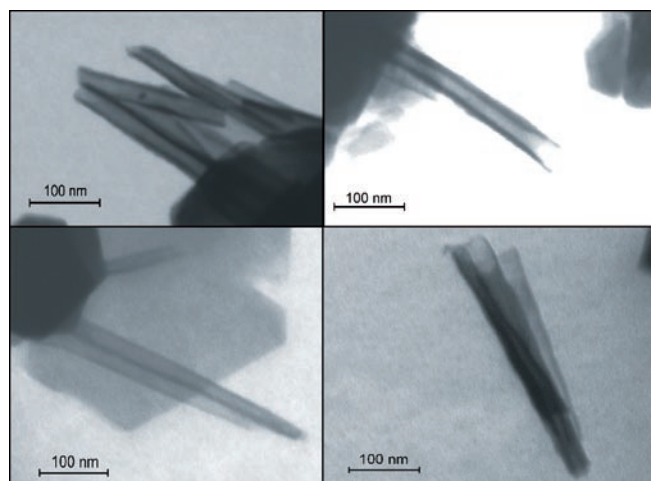
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The ability to combine the properties of inorganic matrix and organic molecules at a molecular level opens the way to design improved nanocomposites. Such materials have wide potential for scientific and industrial applications. Moreover, nanotubular and mesoporous materials have received much attention due to interesting catalytic properties. Therefore, the objective of this study was to investigate the possibility of non-destructive delamination and

rolling of kaolinite layers using intercalation/deintercalation method. Additionally, changes of structural order and particle size of kaolin minerals during experimental stages were studied.

“Maria III” and “Jarosław” kaolinites from Polish deposits, differing in degree of structural order were used for the experiments. The experimental procedure consisted of four following stages: (1) preparation of dimethyl sulphoxide precursor complex, (2) interlayer grafting with 1,3 butanediol (3) hexylamine intercalation and (4) deintercalation using toluene as solvent. Structural perturbations and morphology changes of minerals were examined by XRD, FTIR and TEM.

The particle size of minerals subjected to modifications decreased considerably, which indicates partial delamination. Regardless of starting material, chemical treatment caused a remarkable increase of structural disorder. The amount of rolled kaolinite layers strongly depended on the efficiency of intercalation steps. Nanotubes were more frequently observed for “Jarosław” kaolinite where intercalation processes were more efficient than in the reactions with “Maria III” kaolinite. Kaolinite particles which exhibit tubular morphology or show rolling effects were observed using TEM (see image below). The obtained nanotubes had mean diameter ~30 nm and were on average 150 nm long.



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### M. MATYS<sup>1</sup>, K. ROZIMANT<sup>2</sup> and R. SCHÜGERL<sup>1</sup>: Testing sealing geomembrane effectiveness in the laboratory conditions under dynamic loading

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Geomembranes are synthetic materials. These materials have broad utilization, for example in the railroad-building or municipal waste, where they are laid under constructions. In application we use “sensor damage detection system”.

The article draws an original laboratory test of the efficiency of sealing layers by dynamic loading. Dynamic or static pressure on the model layers is exerted by laboratory press. Primary value was 2 kN. The amplitude of loading progressively grows up in individual steps for 3, 6, 12 or 24 kN. Frequency of the stress is 10 Hz. Efficiency of the sealing layers is measured with the assistance of original laboratory geophysical resistivity method. We present 2 examples of the measurements of the sealing layers model. Geomembrane during laboratory test remained intact.

**P. MIKUNDOVÁ: Research of temperature changes of rock mass in the campus VSB-TU Ostrava**

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The use of geothermal energy for more localized energy requirements is becoming more apparent with the use of geothermal heat pumps. The use of heat from the upper layers of the Earth crust can be a useful and efficient method of saving energy. At around 50 m below the surface of the Earth the ambient temperature fluctuates between around 8 – 12 °C.

Applied research of temperature changes of rock mass caused by deep boreholes used as low-potential energy sources for heat pumps is conducted on the premises of VSB – Technical University of Ostrava (VSB-TUO) in localities of two research polygons. A so-called “Large Research Polygon” situated near the New Assembly Hall + Centre for Information Technologies of VSB-TUO is designed especially for observing the influence of great heat withdrawal from the rock environment. A so-called “Small Research Polygon”, located in the vicinity of a new building of Energy Research Center of VSB-TUO is intended mainly for research into the restoration and accumulation behaviour of rocks in the surroundings of solitary and also dual boreholes connected to the heat pumps and air-conditioning system.

**V. MIKUŠ<sup>1</sup>, R. PAŠTEKA<sup>2</sup>, M. BIELIK<sup>2</sup>, M. ŠUJAN<sup>3</sup> and H. ZEYEN<sup>4</sup>: The first attempts to use geophysical methods in the Pieniny Klippen Belt tectonic research (locality Jarabina)**

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The area, researched in this work, is situated in the Pieniny section of the Klippen Belt in the eastern Slovakia, near the village Jarabina. The aim of survey was to clarify the tectonic structure of the subsurface parts through interpretation of different geophysical methods.

One of used methods was a detail gravity measurement, based on high accurate sectional measurements of the gravitational acceleration and its processing into attributes of Bouguer anomalies. The geological knowledge, lithological mapping and attributes of density from the rocks were important. The interpretation is displayed like the geological-geophysical profile and shows the lithological members and their density parameters. The output of the software GM-SYS is the geometric profile with anomaly bodies and their density parameters. Clearly visible is the influence of surrounding geological units on the south and north. They represent large sedimentary basins, filled by masses of light rocks. The rocks included in the PKB have higher density and the graph of the Bouguer anomalies creates an elevation above it. Then the lateral limitation of PKB was relatively clear. The anomalies within the frame of PKB were not so sharp, what results from small differences between the densities of lithological members. Another problem presented the lack of information about the klippen mantle (the filling material between particular klippen), which were visible only in few outcrops and consequently complicated the modelling process. The small variances on graph curve are caused by the frequent changes of lithology and were modeled by little klippen bodies. Most of them were observed by the geological mapping on the surface, but some klippen in the depth were required during the model compilation. The problem of continuation of the klippen bodies from the surface depthward and their geometrical limitations was defined in the software GM-SYS. The computed graph line responded considerably to the klippen structures continuing to the depth, the bodies on the surface had only weak effect on it.

Interesting is also the comparison with the results of the geoelectrical and seismic methods used on the same locality. The method of vertical

electrical sounding (VES) detects the variability of electric resistivity to the depth and is useful for searching the horizontal geological boundaries. The measured profile is identical with the gravimetric one. The information about Quaternary sediments is relatively accurate. With the gravimetric interpretation is very similar the boundary between Paleogene sediments and PKB and also the information about klippen mantle.

The third used method (120 m short gravimetric profile) is seismic tomography. The velocity of the seismic waves depends on the properties of subsurface sediments. The velocities increase from the surface depthward and high values are also in the area of klippen body. Interesting is that similar high values like in the space of klippen are shallowly beneath the surface (sometimes already from 3 m).

To make the interpreted model more accurate it is necessary to extend the area of geological mapping, clarify the tectonic evolution and relationships between geological members in studied locality.

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**O. A. ORLOVA<sup>1</sup>, A. L. JURINA<sup>1</sup>, N. V. GORDENKO<sup>2</sup> and D. A. MAMONTOV<sup>1</sup>: First finding of *Archaeopteris/Callixylon* trunk in the Upper Devonian of Middle Timan**

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Permineralized wood (up to 24.5 cm long and 19.5 cm wide) was found in the Upper Devonian deposits of Middle Timan (north-west of European Russia) for the first time. The specimen is preserved as a flattened pitted petrification and was identified as a trunk of *Archaeopteris/Callixylon* by the structural features of its secondary xylem. About 30 small wood fragments from the different portions of the trunk have been studied with a scanning electron microscopy (SEM CAMSCAN). The secondary xylem and some elements of mesarch primary xylem are well-preserved in the wood fragments. Metaxylem in secondary branches is characterized by polygonal shape tracheids (12 – 25 µm in diameter) with scalariform bordered pits both on radial and tangential walls of tracheids. Secondary xylem is of pycnoxylic type of the wood. The tracheids of secondary xylem are narrow (19 – 45 µm in diameter) and very long (about 1 mm long). The tracheids on their radial walls show distinct groups of bordered pits horizontally aligned in various tracheids. According to N. S. Snigirevskaya (2000), such type of radial pitting is designated as cohortoid pitting typical for *Callixylon*. There are 2 – 3 rows of the pits in each individual group. The pits are hexagonal in shape, 8 – 11 µm in diameter with inclined split-like apertures. Xylem rays are numerous, low, mostly uniseriate, only some partially biseriate. Ray tracheids are rarely observed at the ray edges on tangential section. Ray cells are various in their sizes, and rectangular in shape. Cross-fields show 6 – 14 cupressoid pits with inclined split-like apertures. Early *Archaeopteris/Callixylon* wood was found in five localities in north-west part of European Russia. This new finding of *Callixylon* in the Upper Devonian flora of Russia extends our knowledge about distribution of *Archaeopteris/Callixylon* forest formations.

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**S. OZDÍNOVÁ<sup>1</sup>, E. HALÁSOVÁ<sup>2</sup> and J. SOTÁK<sup>3</sup>: Paleoecological interpretation of the Rapovce GTL-2 borehole (Lučenská kotlina Depression)**

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Rapovce GTL-2 borehole is situated in the Lučenská kotlina Depression at the village Rapovce in the Southern Slovakia.

The borehole Rapovce GTL-2 was studied for biostratigraphical and paleoecological purposes on the basis of calcareous nannofossils and foraminifers. The age of sediments was Oligocene (Upper Rupel) to Lower Miocene (Upper Egerian/Eggenburgian), nannoplankton zone NP23–NN2 (sensu Martini, 1971) and foraminifers zone P19–P21.

The studied assemblage of the calcareous nannofossils was quantitatively and qualitatively rich.

The nannoplankton zone NP23 – *Sphenolithus predistentus* was composed mainly from species *Dictyococcites bisectus*, *Coccolithus pelagicus*, *Zygrhablithus bijugatus*, *Cyclicargolithus floridanus*, *Helicosphaera compacta*, *Helicosphaera bramlettei*, *Helicosphaera recta*.

The nannoplankton zones NP 24/25 (595 – 315 m) were determined on the basis of first occurrence of the species *Cyclicargolithus abisectus*. The stratigraphically important species *Helicosphaera recta*, *Helicosphaera euphratis*, *Helicosphaera perch-nielseniae*, *Helicosphaera truncata*, *Reticulofenestra lockeri*, *Reticulofenestra hillaie*, *Pontosphaera latelliptica* were found. The most common species were *Dictyococcites bisectus*, *Cyclicargolithus floridanus*, *Coccolithus pelagicus*, *Coccolithus eopelagicus*, *Cyclicargolithus abisectus* and *Zygrhablithus bijugatus*.

The border of the zones NP24/NP25 was impossible to determine due to very rare occurrence of species *Sphenolithus distentus*.

The nannoplankton zone NN1 Triquetrorhabdus carinatus was determined in the interval 315 – 170 m on the basis of the first occurrence of species *Sphenolithus conicus*. The composition of the nannoassemblage is similar as in the previous zones. Species *Dictyococcites bisectus*, *Cyclicargolithus floridanus*, *Coccolithus pelagicus*, *Cyclicargolithus abisectus* dominated. The stratigraphically important species were *Helicosphaera recta*, *Helicosphaera euphratis*, *Helicosphaera truncata*, *Reticulofenestra lockeri*, *Pontosphaera latelliptica*.

Zone NN2 Discoaster druggii (170 – 160 m) were determined on the basis of first occurrence of the species *Discoaster druggii* (Halássová in Vass et al., 2008); this is an index species for the border Oligocene/Miocene and nannoplankton zones NN1/NN2. Miocene species *Holodiscolithus macroporus*, *Triquetrorhabdus cf. carinatus*, *Helicosphaera mediterranea*, *H. cf. scissura* were found.

Upper Eocene and Mesozoic species like a *Reticulofenestra umbilicus*, *Istmolithus recurvus*, *Lanternithus minutus*, *Arkhangelskiella cymbiformis* were found rarely in all samples.

The paleoecological events were observed in the interval 490–495 m, when the subjects were small and the assemblage contained *Diatomaceae* – this indicated the terrestrial stream.

Growth of the species *Pontosphaera latelliptica*, *P. discopora*, *P. rothi* were located in the interval 390 – 380 m, this species occurred in the nearshore conditions.

In the interval 340 – 315 m the nannoassemblage was quantitatively rich; this can signalize stream of the nutrient.

Upper Rupel foraminifers species from the lower part of the borehole – Číž Formation – belonging to the zones P19–P22 (Soták in Vass et al., 2008), determined in this borehole composed from planktonic foraminifers: e.g. *Paragloborotalia nana*, *P. opima*, *Globorotalia ampliaperta*, *Globogerina venezuelana*. Very important species is *Paraglobalia opima*, because its last occurrence is in the boundary between planktonic zones P21 and P22.

The planktonic taxa are accompanied by the benthic foraminifers as e.g. *Lenticulina arquatostrata*, *Lagena sulcata*, *Sphaeroidina variabilis*, *Heterolepa dutemplei*, *Chilostomella tenuis*, *Cassigerinella chipolensis*, *Tenuitella brevispira*, *Stilostomella adolphina*, *Lenticulina budensis*, *Semivalvulina pectinata*.

From the Lower Egerian foraminiferal assemblage there were determined species like *Globigerinoides primordius*, *Tenuitella angustumbilicata*, *Catapsydrax martini*, *Globoturbototalia cf. woodi*, epibenthic forms as *Pellenia bulloides*, *Cibicidoides ungerianus*, *Gyroidinoides soldani*, *Sphaeroidina cipeana*, *Lenticulina cultrata* and others. From rich agglutinated foraminifers there occur *Trochammina globigeriniformis*, *Trochammina inflata*, *Haplophragmoides* sp. and others.

## L. PETRÝDESOVÁ<sup>1</sup>, P. ONDREJKA<sup>2</sup> and P. LIŠČÁK<sup>1</sup>: The regime observations of the landslide Okoličné

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Slope movements negatively influence the quality of the environment in the Slovak Republic. Monitoring of these processes started in 1993. In 23 July 1993 the project "Partial Monitoring System of Geological Factors of Environment in the Slovak Republic" was launched. The objective of the project was to collect and classify information, which contributes to knowledge of mechanism of complicated slope processes as well as to give a prognosis of their evolution.

The landslide Okoličné is situated in the Liptovská kotlina Basin and has been studied in details by this project. The landslide is jeopardizing the main railway Žilina – Košice. Recently an increased attention is paid to this landslide, particularly to the hydrogeological conditions. The aim of our work was to extend the monitoring network and monitoring methods of the slope deformation on the measurement of selected physical parameters of groundwater. The period of landslide measurements was once per two weeks. The fieldwork was realized in the span of one year, from December 2006 to December 2007 during the work on Thesis. The groundwater physical parameters were observed in the vertical and horizontal monitoring boreholes. The following parameters were measured in the vertical boreholes: the oscillation of the groundwater table level, the variation of the electric conductivity and the temporal change in water temperature and in the different groundwater horizons. All measurements were realized using a conductometer. The measurements in vertical boreholes were performed using 20 m long cable with ascending and descending way of measurements per each meter. In the horizontal boreholes the measurements consisted of the following parameters: the yield, the electric conductivity and the water temperature, and their temporal variations.

Changes of the hydrogeological regime and changes of the water properties and their influence on the current stability of landslides were assessed using the results of performed measurements. The more dense frequency of measurements has been practiced the more accurate changes of the hydrogeological regime of the groundwater have been determined. The monitoring of the electric conductivity changes in the vertical direction provided some knowledge about the interaction of two and more horizons of the groundwater, which are present in the landslide body. Following the knowledge of the groundwater regime we are able to better recognize the influence of the water on the engineering geological properties of the landslide rock environment.

## K. POLÍNKOVÁ: Laboratory research of possibilities of CO<sub>2</sub> application for increasing the recovery of hydrocarbon deposits

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Emissions of carbon dioxide due to anthropogenic activities and their growing trend are considered as significant hazards to the sustainable development of humankind. Besides the efforts to reduce systematically CO<sub>2</sub> emissions (clean technologies), the methods of CO<sub>2</sub> subsequent utilization and especially the possibilities of its storage in suitable geological formations are verified at present.

Suitable potential storage spaces are above all exhausted oil and natural gas deposits as well as those where extraction is being completed, in which the recovery of residual oil can be improved by CO<sub>2</sub> injection (method EOR = Enhanced Oil Recovery) by 10 to 15 %. In the ideal case, the benefit of improved recovery may exceed the costs of CO<sub>2</sub> capture and storage.

In the paper, results of laboratory tests of CO<sub>2</sub> applications in the case of oil displacement using the apparatus MAFI are described.

### J. RYGAŁ and G. RZEPA: Mineralogical characteristics of postvolcanic activity products in the island of Vulcano

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Vulcano and Vulcanello are two of many volcanoes on the Lipari Islands. They probably have had the same magmatic source. However, they differ in character and intensity of postvolcanic activity. Vulcano is an older (first eruption was about 136,000 years ago) and bigger structure (500 m a.s.l.) with postvolcanic activity still apparent. Vulcanello is smaller (123 m a.s.l.) and younger volcano (183 BC). Its surface seems to be more altered by gas exhalations and plant succession.

The research aimed at comparing postvolcanic products of these two volcanoes. For this purpose, light microscopy, XRD, FTIR and SEM methods were applied. It was stated that the main postvolcanic activity products on Vulcano are native sulphur and sal ammoniac ( $\text{NH}_4\text{Cl}$ ). Small amounts of opal are also present. As was determined by XRD, despite the colour variability, all the sulphur varieties (yellow, orange and greenish) are structurally identical. Minerals from Vulcanello are much different, including (usually hydrated) sulphates and hydroxysulphates. Native sulphur, sal ammoniac and opal were found as well. In white and whitish-coloured samples the main phases are gypsum, alunogen  $\text{Al}_2(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ , alumes (K, Na,  $\text{NH}_4^+$ ) $\text{Al}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ , as well as tamarugite-type minerals (hydrated Na-Al and  $\text{NH}_4$ -Al sulphates). Yellow-coloured specimens contain, besides alunogen, tamarugite and alumes, also K-Mg-Fe sulphates (having clairite and metavoltine-type structures). In all samples small amounts of barite-celestine were found. Rarely, unidentified REE-compounds as well as Cu and Zn sulphates were detected.

The mineral assemblages on both volcanoes are the results of low-temperature postvolcanic activity. However, substantial mineralogical differences suggest various stages of alteration processes, being more advanced on Vulcanello. Such advanced step of alteration is, in turn, caused by higher oxygen and water activities.

### L. RYŠAVÁ and L. SLIVA: Sedimentary architecture of the Neogene basin fill in the northern part of Vienna Basin

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Case study area, the Hrušky gas and oilfield, is situated in the NE part of the Vienna Basin, at the eastern flanks of the Central Moravian Depression. The hydrocarbons accumulation is situated in the Middle Miocene sediments, deposited in deltaic environment. The Hrušky field development was significantly influenced by tectonic activity of the Lanžhot – Hrušky faulted system.

The Hrušky gas and oilfield area geological pattern is very complicated, due to above mentioned fault activity. The pre-Neogene basement is disintegrated by the Lanžhot – Hrušky faulted system into "lower" and "upper" tectonic block. Above the blocks situated deposits are of the Middle to Upper Badenian and Sarmatian age. The synsedimentary fault activity had a crucial importance on the field development, causing various thicknesses at both sides of fault, as well as of due its sealing properties. On the basis of this fact, the sediments of the Middle and Upper Badenian are characterized from "upper" tectonic block, and sediments of the Sarmatian from "lower" tectonic block.

The main task of interpretation has been monitoring of facial development in the direction of transport of clastic material from SW to NE, using correlation of seismic profiles and well logs. On the basis of analysis of well logs (trend analysis) and seismic profiles was also interpreted the sequence stratigraphy of locality, system tracts and SB1 and SB2 type sequence boundaries were established.

The final output of this research was: (1) SB 1 type boundary is situated between Lower and Middle Badenian deposits, (2) the Middle Badenian sedimentation started with transgression represented by the Láb sands Mb. at the base and litotamnium biostrome unit Mb. in higher part of sedimentary record. Both these members bear typical

feature of transgressive system tracts deposits (TST), (3) between the Middle and Upper Badenian sediments was found an short regression event, which is characterized by downlaps in the seismic profile. The Upper Badenian sedimentation represents transgressive and highstand system tracts deposition (TST, HST).

The Sarmatian record started without apparent erosion (SB 2 type sequence boundary). Lowstand system tracts (LST) are represented by the fresh water deposition, passing upwards into transgressive system tracts (TST) marine sediments (Large Elphidium Zone). The maximum flooding surface (mfs) is in above situated clays of the Porosonion hauerinum Zone of highstand system tracts (HST) deposits. In the Upper Sarmatian Porosonion granosum Zone, further reduction of salinity and sedimentation of lowstand system tracts (LST) were recognized.

From accumulation of hydrocarbons point of view the Láb sands Mb., Litotamnium limestones Mb. and the Sarmatian sands (in lower and upper parts of sequence) are of maximal importance.

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### D. SALA and G. RZEPA: The evaluation of contamination of landslide lakes in the Babia Góra National Park

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The Babia Góra National Park (BgNP) is situated in the Western Flysch Carpathians, being the eastern part of the Beskid Żywiecki Mts. Within the Polish part of the BgNP there are about 19 small landslide lakes. They are located mainly on the northern slope of the Babia Góra massif, within the forest and the pine-dwarf belts. The study aimed at estimating the contamination of ponds. For this purpose the water and bottom sediment samples were collected in the summer of 2007 and 2008. In the sediments, the concentrations of trace elements (Cd, Cr, Cu, Pb and Zn) and hydrocarbons were estimated. Results of detailed water analyses, including main cations and anions as well as trace element concentrations and selected physico-chemical parameters, were presented in our earlier work.

It was stated that the water is acidic to neutral and with low mineralization. The minor and trace element concentrations are usually very low. Higher levels of Fe, Mn and Al are the result of natural geochemical processes. Trace metal concentrations in the bottom sediments are usually low as well, but are more variable, depending on the sediment type and location of the lakes. Concentration ranges are as follows: 9.27 to 65.06 mg/kg for zinc, 6.08 to 22.05 mg/kg for lead, 1.65 to 6.71 mg/kg for copper and 0.19 to 4.63 mg/kg for chromium. Only cadmium contents are elevated, being in the range 1.12 – 25.94 mg/kg, with an average of 10.57 mg/kg. Other authors also showed high Cd contamination levels in soils and mosses, as well as Pb in mosses, suggesting that the pollution is probably caused by emissions from the Upper Silesian and Ostrava industrial districts. However, low contents of heavy metals (including Cd and Pb) in snow, rain and lake water in this area indicate that the pollution has been decreasing in recent years.

### M. SENTPETERY, V. KOTRČOVÁ, I. SLÁVIKOVÁ and J. HÓK: Geological setting of the SW part of the Krivánska Fatra Mts. (NW Slovakia)

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The investigated area is situated in the SW part of the Krivánska Fatra Mts. (NW Slovakia) between Nezbudská Lúčka village and Belianska dolina valley. The area is typical by the contact between tectonic units of Central Western Carpathians and the Pieniny Klippen Belt zone. The geological setting is composed of several superposed Paleo-Alpine tectonic units – the Tatricum, Faticum, Hronicum,

and the Manín sequence, which is considered as the lithotectonic sequence belonging to the Peri-klippen zone. Typical for the tectonic setting is the fold and thrust style with the NE – SW oriented fold axes. Paleo-Alpine (Lower Cretaceous) structures are typical with top to the north-northwest displacement. Neo-Alpine (Lower Miocene) structures have the opposite polarity of tectonic displacement. The nappe contact of the Fatricum Unit is characteristic with southeast vergent superimposed folding. The backthrust tectonic style is documented also by the tectonic contact of the Hronicum Unit with different lithostratigraphic members of the Tatricum Unit. The presence of the tectonic outlier of the Manín sequence overlying sediments of the Central Carpathian Paleogene confirmed the role of the reverse/backthrusting tectonic movements in this area.

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### S. SITEK: **Application of three-dimensional geological mapping for groundwater modelling of the aquifer system MGB Gliwice No. 330**

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Explain prediction and their reliability based on groundwater models considerably depends on how well the models correspond to natural systems. Development of multilayer numerical models in a fractured media very often causes relatively serious problems in the accurate and consistent modelling of groundwater flow systems. Mapping of geometric groundwater medium using data from 2D geological maps, boreholes and geological cross-sections can be insufficient without constructing 3D geological model of appropriate detail based on interpretation of deep geological structure, which often is very complex. The application of new techniques of 3D computer modelling of geological sub-surface helps to make better maps and to understand deep geological setting. In the paper a 3D geological model of multilayer aquifer system is presented on area of 392 km<sup>2</sup>. The main element of this model is abundant groundwater reservoir, a major groundwater basin (MGB) Gliwice in Middle Triassic carbonate bed. MGB Gliwice is a karst-fractured-porus medium about 200 m thick. Numerous faults with relatively large throws form significant horsts and grabens in the area of MGB. Carbonate aquifer is covered partly with well permeable Quaternary deposit up to 40 m thick and Miocene impermeable bed of maximum thickness about 150 m. Geological model of multilayer aquifer system has been developed using Earth Vision software. Data from 171 boreholes have been digitized and verified. About 80 % of boreholes were deep enough to contain information about top and 60 % about bottom of the Triassic carbonate aquifer. Fault traces have been digitized from geological maps without Quaternary deposit in scale 1 : 50 000 and reinterpreted, if necessary, using regional cross-sections. The sub-surface mapping of the MGB geological structure in three dimensions has significantly influenced the correctness of discretization of hydrogeological medium structure for the output flow model FeFlow. The project shows that application of modern 3D geological mapping increases accuracy of producing viable groundwater flow models and makes prognostic simulations on the models much probable.

### K. SLAVOVA and D. DIMITROV: **The fluctuations of the Black Sea Basin after the Last Glacial Maximum to 7 500 cal. yrs BP as a result of Solar Luminosity cycles**

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The aim of this report is to determine the causality between the cycles of Solar Luminosity on one hand, and the paleoclimatic

data for the Black Sea region and the fluctuations of the Black Sea Basin on the other hand. It is ascertained, that for the Black Sea region there is a cycle recurrence in the climate change after the Last Glacial Maximum until present (Slavova, 2001). The solar insolation proxy record in a speleothem from Duhlata Cave, Bulgaria is measured by Stoykova (2003). Furthermore, in Shopov et al. (2001) the variations of the solar insolation in the past climatic conditions, caused by variations of orbital parameters and Solar Luminosity self variations were distinct. A luminescent solar insolation proxy record suggests that the solar insolation resulting from Solar Luminosity self variations can produce climatic variations with intensity comparable to that of the orbital variations (Stoykova et al., 2008). In this paper is considered, that the regression of the Black Sea Basin to the depth of –90 m/–100 m below the contemporary sea level during the Lower Holocene is not abrupt event. The established cycles of Solar Luminosity are recorded in the change of paleoecological setting in the Black Sea region. Actually they can explain the short-periodicity fluctuation of the Black Sea level.

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### M. SMREČKOVÁ<sup>1</sup> and J. SOTÁK<sup>2</sup>: **Radiolarian-bearing horizons in the Upper Cretaceous pelagic sediments of the Manín Unit: Biostratigraphic zonation and environmental bioevents**

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The investigated section is situated near Praznov village, cropping in forest road behind a cemetery. The section is around 30 m thick and represents the Hrabové Formation. It is a part of Manín or Podháč units, which attribution is not solved yet (Rakús and Hók, 2005).

Occurrences of radiolarians here represents by now the first findings of this microfauna in the Slovak territory.

Radiolarians assemblage from the middle part of studying profile corresponds to stratigraphic interval from the Coniacian? to Upper Santonian.

Association from higher parts is characteristic for the stratigraphic interval from the Santonian to Upper Campanian. According to zonation by Hollis and Kimura (2001) both associations belong to zone *Dictyomitra kozlovae*.

The samples were relatively rich in the representations from the family *Pseudoaulophacidae*. According to Višnevská and Basov (2007) they finish their occurrence at the boundary of the Santonian/Campanian. Therefore, in our samples there are apparently present assemblages under the boundary of the Santonian/Campanian, representing only lower part of the zone *Dictyomitra kozlovae* (Dk1), stratigraphically corresponding to the Santonian.

From the obtained proportion of S/N we can assume that attendant assemblage shows likely deterioration of environmental conditions responding to previous significant biotic event during Santonian – Campanian.

On the basis of foraminiferal associations, stratigraphic interval was determined from the Cenomanian to the Upper Campanian. The Middle Turonian part is represented by the species *Praeglobotruncana oraviensis trigona* (SCHEIBNEROVÁ), the interval with the species *Falsomarginotruncana renzi* (GANDOLFI), *Marginotruncana terfayaensis* (LEHMAN), *Marginotruncana pseudolinneiana* PESSAGNO, *Marginotruncana coronata* (BOLLI) and *Contusotruncana cornicata* SALAJ presents stratigraphic interval from the Coniacian to the Santonian. The youngest part of the section presents the Upper Campanian with the index taxon *Globotruncana arca* (CUSHMAN) and *Globotruncana venticosa* (WHITE).

## B. SOPKOVÁ<sup>1,2</sup> and R. PROCHÁČ<sup>2</sup>: Sarmatian sedimentary record in the Moravian part of the Vienna Basin

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This study was focused on Sarmatian sedimentary record in the Moravian Central Depression (MCD) and on the Gbely – Hodonín and Mistelbach blocks situated in the northern part of the Vienna Basin in the Czech Republic.

In our study area several petroleum fields are presented: Moravský Žižkov, Velké Bílovice, Prušánky and Poddvorov fields, situated on the western margin of the MCD – on the Mistelbach block; Hrušky and Josefov fields on the hanging-wall of the Lanžhot-Hrušky fault and Lužice and Týnec fields on the upthrown Gbely – Hodonín block.

When studying well log (SP) records from individual fields, in each field a unique development of sandy horizons can be recognized, which is traceable across the entire field. However, when trying to compare sedimentation patterns among individual fields, no general model valid for the whole MCD can be established. The differences in sedimentary development are particularly evident in the Lower Sarmatian deposits, while the Upper Sarmatian and Pannonian sediments show more common features. This fact is related to the gradual infilling of the basin during the Sarmatian stage and to the direction of sediment input. Resistance logs (RAG) from the analysed boreholes (cca 1 800) reveal a successive change in the pore water composition from marine (Lower Sarmatian), brackish (Upper Sarmatian) to fresh (Upper Sarmatian, Pannonian).

Average Absolute Amplitude (AAA) attribute shows the best results when observing lithological and facial changes. Thus, attribute maps were constructed for selected horizons of interest. These maps demonstrate transition of depositional settings during the Sarmatian stage as well.

In other words, the Sarmatian sedimentary cycle demonstrates a gradual infilling of available accommodation space and associated normal regression, what at the end of the Sarmatian stage resulted in the definitive withdrawal of the sea from studied area and prevalence of lacustrine environment.

## J. STRZELCZYK and T. DANEK: Creation and application of Heterogeneous Parallel Computing Environment for seismic modelling

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Wave field modelling is an important tool for seismic exploration and seismology. It can be used during all stages of seismic investigations and for various earthquake related analyses. But even now serial computations for models of a standard exploration scale are much time consuming and could last many days. Moreover, many new extremely computationally expensive methods which use the wave field modelling are just being developed now. For example full wave form inversion through Monte Carlo sampling sometimes requires hundreds of thousands of models to be computed. Fortunately wave field modelling is a problem which is easy and effective to solve with parallel systems. But access to supercomputers or HPC clusters is usually limited. It is very common that small local problems, which can be easily solved with parallel computations, have to be queued for hours because there are not enough free cluster resources. That is why ad-hoc dynamic creation of small, parallel and usually heterogeneous parallel computing environments can make computationally intensive applications more common and affordable.

New technological developments can be very helpful in solving this kind of problems. In this work authors used a heterogeneous

parallel computer created from currently possessed hardware by the use of Sun Grid Engine software. The hardware consisted from two IBM BladeServer units and one PC machine that were available at the time. Heterogeneity was present on both levels: hardware platform and operating system. Blade machines ran Linux Fedora and PC ran Windows 2000.

Sun Grid Engine (SGE), used in this installation, is a Distributed Resource Management system. Its free version, called The Grid Engine, is the open source software to facilitate the adoption of distributed computing solutions. The Grid Engine project provides enabling distributed resource management software for wide ranging requirements from compute farms to grid computing. In this particular case SGE solution helped in better utilization of available computing resources to calculate important and complex scientific problems. Authors investigated the possibility of accelerating a seismic modelling procedure. As it was expected application of parallel solutions significantly decreased time of wave field modelling algorithm execution. But the results also show that even in the case of computation done in highly heterogeneous and ad-hoc created software and hardware environment obtained speed-ups are more than satisfactory.

## B. STYRNOL: Technological quality of coal seam from the "DRZEWCZE" lignite deposit ("KONIN" lignite mine)

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"Drzewce" exposure is situated in Greater Poland Voivodeship in municipalities: Sompolno, Kramsk and Osiek Mały. It is tenth exposure of KWB "Konin" while its extraction began in 2006. The deposit consists of three mining fields: "Bilczew" field, "Drzewce" A and B fields. In geological terms it is situated on the Polish Lowland, in north-east part of Łódź Syncline. Researched lignite deposit belongs to I-Middle-Polish lignite seam. It is single seam deposit. Industrial resources of "Drzewce" exposure are 35.2 mln tons. Ca. 600 boreholes have been used during this research. Profile is made of two geological floors: Mesozoic and Cenozoic. Cenozoic floor can be divided into three complexes: sub-coal, inter-coal and upper-coal. Subject of research interest is coal complex, in which lignite seam exists. Thickness of barren rock varies from 7.9 m in "Bilczew" field up to 51 m in "Drzewce B" field. These rocks are mainly: sands, clays, gravels and loams. Lignite seam thickness varies from 3 m up to 12.2 m. Detritic or detroxylitic lignite occurs in the seam. Layers with fiber xylite appear occasionally. Reflectance huminite in researched seam is 0.22 %. Coal from researched seam is in 99 % destined for burning in Pątnów and Konin power stations and because of that it was examined mainly in this direction. It contains average 56.9 % of total moisture in "Bilczew" field and 55 % in "Drzewce" field. Ash recalculated to dry basis in "Bilczew" is 26.5 % while in "Drzewce" 24 %. Calorific value of "Bilczew" is 8733 KJ/kg (2068 kcal/kg), in "Drzewce A" is 8 768 KJ/kg (2 094 kcal/kg), and in "Drzewce B" 8 997 KJ/kg (2 149 kcal/kg), content of total sulphur, recalculated to dry basis, is highest in "Drzewce A" with 1.88 %, while in "Bilczew" field it is 1.58 % and in "Drzewce B" 1.2 %. Alkali content (Na<sub>2</sub>O + K<sub>2</sub>O), recalculated to dry basis, is low in whole deposit and not exceeds 0.2 %. Usefulness of researched coal to other purposes than burning was also examined. Researched coal can be partially used to briquetting, on condition that part of the ash would be removed. All examined coal can be used to gasification in modern IGCC generators (integrated gasification combined cycles).

According to the international standards (ECE-UN 2003), lignite code from "Drzewce" deposit is: Ortho-Lignite (huminitic low C) 23 56 24 16. Where: 23 – average heat of combustion recalculated to dry basis, ash removed, 56 – average total moisture, 24 – average ash content recalculated to dry basis, 16 – total sulphur content recalculated to dry basis.

Actually in Poland there is no norm concerning classification of coal, other than brown coal, to energetic purposes.

**M. SULÁK: Classification of white micas from shear zones of the Central Western Carpathians**

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The Central Western Carpathians are composed of nappes, which have been formed during Cretaceous to Lower Tertiary collision. They are structurally subdivided by major Cretaceous to Lower Tertiary thrust-faults into the Infratatic, Tatric, Veporic and Gemeric tectonic units. Formation of these nappes was followed by thrust shearing and metamorphism. The Infratatic unit in the Považský Inovec Mts. contains sheared basement and cover rocks included into the Belice and Inovec nappes. Estimated temperatures and pressures for the Belice nappe Jurassic to Cretaceous metasediments are 200 to 250 °C and 600 MPa. The rocks of the Infratatic Inovec nappe were subjected to anchimetamorphic temperatures up to 300 °C at pressures minimally 500 MPa due to overthrusting by the Tatric Panská Javorina nappe. The hanging wall blastomylonites of the Panská Javorina nappe show temperatures 280 – 330 °C at 300 to 500 MPa. Similar conditions were noticed also in the Malé Karpaty Mts., Malá Fatra Mts. and High Tatras Mts. The North Veporic nappes, with metamorphic greenschist facies overprint with 320 – 420 °C and 400 – 600 MPa. The collision burial of South Veporic nappes was accompanied by metamorphic recrystallization at 400 – 520 °C (locally 550 – 600 °C) and 700 – 1 000 MPa.

K-white micas (muscovite, phengite), generated during metamorphism in shear zones, show chemical changes. K-white micas can be classified according to Rieder et al. (1998) and Tischendorf et al. (2004). The first (IMA) of mentioned classifications is not very suitable for EMP analyses alone, because it does not distinguish amount of Fe<sup>2+</sup> and Fe<sup>3+</sup>. However, this can be solved by application of Mössbauer spectroscopy, which is able to determine ratio between Fe<sup>2+</sup> and Fe<sup>3+</sup>. Classification by Rieder distinguishes three mica end members: muscovite, celadonite, aluminoceladonite, but not phengite. Phengite is characterized as mineral series between mentioned end members. Tischendorf's classification is completing the Rieder's one. It is applicable for EMP analyses and it includes sum of Fe in a sample. On the other hand, it is necessary to know Li content. That is possible to calculate by empiric formulas from F content. In Tischendorf's classification there are distinguished muscovite and phengite, what is very useful for metamorphic petrology, where phengite is diagnostic mineral in low- to medium-grade metamorphic facies. Content of phengite in metamorphic rocks rises with higher pressure and a content of Si p.f.u. in phengite is used as a geobarometer (Massone and Schreyer, 1989).

White micas in shear zones of Central Western Carpathians usually occur in form of coarse-grained muscovite, fine-grained, newly formed sericite-muscovite or newly formed phengite. In the Infratatic Belice nappe phengites are mostly with Si p.f.u. around 3.3. In the Infratatic Inovec nappe an original muscovite can be preserved (Si p.f.u. approx. 3.15) within newly formed phengite (Si p.f.u. approx. 3.3) aggregates. Similar situation is in the hanging wall of the Tatric unit. The North and South Veporic units show different degree of metamorphism, which is reflected by chemical composition of white micas. In the North Veporic nappes newly formed sericite-muscovites are most common. The South Veporic unit, with the deepest syn-metamorphic burial, shows celadonite-rich phengites. This is confirmed by very high content of Fe (4 – 8.5 wt.% oxides). However in some samples rare relics of older muscovite with lower content of Fe (1.5 – 2.8 wt.% oxides) are also present.

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**R. SYNAK<sup>1</sup> and R. PROCHÁČ<sup>2</sup>: Badenian depositional environments and sequence stratigraphy of the Vienna Basin**

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Sequence stratigraphy represents the study of cyclic sedimentary patterns within stratigraphic succession, as they form in response to various factors, such as fluctuations in sea level (fall or rise), variations in sediment supply or space available for sediment to accumulate. These factors have significant influence on the final internal architecture of sedimentary record and also produce some typical attributes observable on geophysical data sets (seismic data, well – log data). Depositional sequence is the fundamental stratal unit in sequence stratigraphy. It represents the final depositional unit of one full cycle of sea level changes and it consist of subdivisions called the system tracts, which interpretation is based on stratal stacking patterns, position within the sequence and types of bounding surfaces.

In the area of the Slovak Neogene basins (Vienna Basin, Danube Basin) system tracts and depositional system were first defined in the works of Michalik et al. (1999), Kováč (2000) and Baráth et al. (2000). In the Miocene sedimentary record eight regional third-order cycles were introduced and defined as CPC 0 (Egerian)–CPC 7 (Pannonian). In the Vienna Basin area there were later defined nine third-order cycles of relative sea-level changes in the Miocene of the Vienna Basin. They are termed VB 1 (Eggenburgian) to VB 9 (Pannonian). The aim of the works mentioned above, was also to correlate these regional cycles with global cycles of sea level changes (sensu Haq et al., 1988). It can be stated that only partial comparison with global cycles is proposed in the Vienna Basin area (Kováč et al., 2004).

The aim of our work was to analyse and divide Middle Miocene (Badenian) deposits into sequence stratigraphy system tracts and to comprise our results with the previous results from the publications mentioned above, eventually with one of the global cycles chart. We have applied the sequence stratigraphic principles in Badenian part of Miocene Vienna Basin fill in its northwest part.

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**M. SYREK: Changes of coalification degree of organic matter in the Silesian Unit formations in the western flysch Carpathians, Poland**

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The main objective of presented study was to investigate the changes of random vitrinite reflectance in DOM (dispersed organic matter) present in the Silesian nappe. Differences in random vitrinite reflectance can be related to tectonic and geothermal history after its inversion stage. At present the Silesian nappe covers the area of western part of flysch Carpathians where it forms the mountain range of Beskid Slaski, Beskid Mały as well as a bigger part of foothills. The Silesian Unit is formed by lithostratigraphic beds from Lower Tithonian (Lower Cieszyn Shales) to Upper Oligocene (the Krosno Beds).

The Godula Beds (Senonian), the Istebna Beds (Senonian, Paleocene) and the Krosno Beds (Upper Oligocene) are characterized by the presence of coalified plant detritus (in dispersed form), forming dark lamina from 1 – 5 mm and are divided by 4 mm thick clay-mud lamina with small admixture of very fine grained sand. Therefore, the analyses of random vitrinite reflectance of those samples were performed. Those lamina occur in mudstone and mud-sand sediments with fractional and diagonal graining. In general, detritus present in dark lamina is very fine-grained and directional orientation is noticeable. However, on the bedding surfaces its thicker fraction is distinguished. Paleotransport directions of organic matter may be described on the basis of detritus fragments ordering. The random

vitrinite reflectance in the samples of flysch rocks enriched in coalified organic matter was measured using Opton-Zeiss Axioplan MPM 400 reflectometer. Measurements conditions were in accordance with requirements established by International Committee for Coal Petrology and Organic Matter.

Obtained results for the Silesian Unit beds indicated that stratigraphic position is not correlated with values of random vitrinite reflectance  $R^0$ . On the other hand increase of coalification degree in the organic matter towards subduction zone, localized in southern range of the Pieniny Klippen Belt, was observed. Factors which mainly influence coalification degree are temperature as well as a dynamic and static pressure. Increase of temperature is related with process of subsidence and postsedimentation depth changes during thrusting of Silesian nappe on the foreground. Additionally, temperature variations may be caused by static pressure due to the present overlay. In turn, overthrusting of separated Silesian nappe on the lower sediments and Subsilesian nappe led to changes of dynamic pressure. Obtained  $R^0$  values and geothermal history of the Silesian nappe suggest that temperature had a significant impact on the coalification process. This process could have been intensified or weakened due to pressure. Parameters affected by static and dynamic pressure should be considered separately. It is necessary to underline that random vitrinite reflectance increases even up to 0.2 % upwards in vertical profile observed in tectonic windows area.

#### V. ŠIMONOVÁ: Analysis of fault kinematics and paleostress reconstruction from the Butkov quarry (Manín Unit, Western Carpathians)

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In the last years the Manín Unit represents perhaps the most discussed and most contradictory tectonic unit in the Western Carpathians. Its paleotectonic development was very complicated. In the Považie region, this originally Central Carpathian unit has become a part of accretionary prism of the front of Central Carpathian block where it was incorporated into the Pieniny Klippen Belt. Later, it was deformed again during the younger phases of the Alpine orogeny together with the Outer Carpathians. Paleogeographically, the Manín Unit is considered to be either the most external part of the Tatric sedimentary area, or an individual paleogeographic zone between Tatricum and Klippen zone (Andrusov, 1972; Rakús, 1977). Alternatively, it is a nappe of Fatic affiliation in the Vysoká development (Mahel, 1978). It is characterized mainly by the shallow-water limestones of the Lower Jurassic and Lower Cretaceous age, but also by the Cenomanian and Senonian flysch. The most typical member of the Manín unit is represented by thick formation of Barremian–Aptian platform limestones of Urgon type. The older members outcrop mainly in two large brachyanticlinal “klippes” – Manín and Butkov klippes.

Mt. Butkov is an expressive morphological dominant of the area on the western margin of the Strážovské vrchy Mts. It was formed during multistage ductile-brittle and brittle tectonic evolution that occurred in several deformation stages producing variable fault structures. Based on their mutual interactions and relative succession, the faults were separated into homogeneous groups. We have used the program Win Tensor for the separation of the faults and determination of stresses.

The oldest recorded deformation phase in this area was transpression. This event is characterized by the WNW – ESE oriented  $\sigma_1$ , as a result of compression tectonic regime. The strike-slip faults (mainly dextral faults) and rarely reverse fault define this event as the WNW – ESE oriented transpression. For the next deformation phase, the change of the tectonic regime from transpression (WNW – ESE) to the compression regime with NW – SE oriented  $\sigma_1$  is typical. This event was accompanied by the formation of reverse faults. The next change of tectonic regime occurred from transpression to the transtension tectonic regime. This event is characterized by the WNW – ESE oriented  $\sigma_3$ . There were formed normal faults and strike-slips (predominantly sinistral) as a result of transtension. Transtension

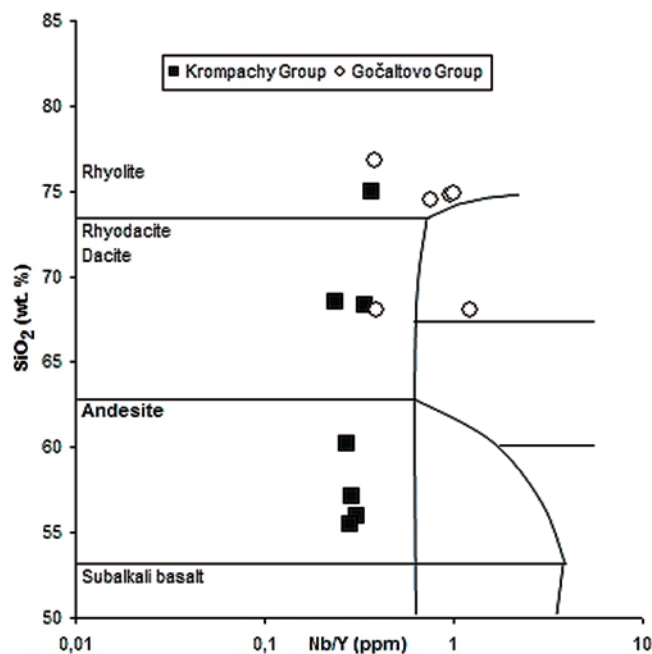
continued during ENE – WSW compression, where strike-slip faults (dextral) and normal faults were dominated. The youngest event was characterized by the NW – SE oriented  $\sigma_3$ . The faults are product of extension tectonic regime and are represented by normal faults.

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#### M. ŠMELKO: Permian volcanism of the Gemic Unit

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In Western Carpathians the rift-related volcanism was active during Upper Paleozoic from the Upper Pennsylvanian to Cisuralian. The Cisuralian age was confirmed by the geochronological dating on zircons (Vozárová et al., in press) and monazites (Rojkovič et al., 1991; Rojkovič and Konečný, 2001; Vozárová et al., 2008). These volcanic rocks, indicating the post-collisional stage of Variscan orogeny, are most abundant within the Northern Gemic Unit in the Petrova hora Formation (Bajaník et al., 1981). Volcanic rocks range from acid to intermediate members (rhyolites, dacites to andesites) and have the  $A_2$ -type, post-collision, calc-alkaline trend, which completes the general geotectonic position of the Northern-Gemic basin in the transpression/transtension regime and extension regime (confr. Vozárová, 1996). Acid volcanites from the Permian sequences of the Southern Gemic Unit were formed by the extension and post-Variscan rifting. These volcanites are interpreted as  $A_2$ -type, post-collision, anorogenic rhyolites and dacites with calc-alkaline, mostly alkaline magmatic affinity (Vozárová and Vozár, 1988; Šmelko, 2007).  $A_2$ -subgroup ( $Y/Nb > 1.2$ ) indicates a crustal source, or mantle differentiated source with no relation to OIB after Eby (1992). It was proved by the typological studies of the accessory zircons from Northern and Southern Gemic units (Broska et al., 1993; Šmelko, 2007). This indicates the crystallization in a high temperature alkaline regime and may suggest a derivation of rhyolite-dacite magmas in deeper parts of the continental crust. The volcanites of the Gočaltovo Group (GG) have higher  $K_2O$  content with average values of



**Fig. 1.** Chemical composition of volcanites of the North Gemic Unit (Krompachy Group) and of the South Gemic Unit (Gočaltovo Group) after Winchester and Floyd (1976).

6.8 wt.%, comparing with the Krompachy Group (KG) volcanites with average  $K_2O$  values of 2.3 wt.%. The  $Na_2O$  content is relatively low (0.1 wt.%) for GG and average values of 4.3 wt.% for KG. GG has very low values of  $CaO$  (average values is 0.02 wt.%), comparing with higher  $CaO$  in the KG (average 2.5 wt.%). The average  $SiO_2$  content is 73 wt.% in the GG and 62.9 wt.% in the KG. The average values of  $TiO_2$ , varied between 0.34 wt.% (GG) and 0.74 wt.% (KG). The  $Al_2O_3$  content of both groups is higher (average values is 15.04 wt.%). Average value of  $Fe_2O_3$  is 2.14 wt.% in GG and higher is in KG (6.72 wt.%). The  $MnO$  concentration is very low (0.06 wt.%) for the both groups. These volcanites have higher average values of Rb (110 ppm), Zr (337 ppm), Y (49 ppm) and rare earth elements REE except Eu (0.6 – 2.2 ppm), and much lower content of Sr in GG (6.5 ppm) comparing to KG (average value is 65 ppm). The studied volcanites incline according to the Zr/Hf ratio to the rocks of mainly crustal origin, rather than peraluminous less metaluminous granitoids.

#### L. ŠTRBA: Deep-water sediments analysis of Teleajen valley, Romanian Flysch Zone

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Major part of East Carpathian Flysch Zone corresponds to Moldavides, consisting of several nappes well exposed in some valleys or road-cuts. The stratigraphic succession, showing different lithofacies, extends from the Lower Cretaceous up to the Lower Miocene. During this interval, the detrital rocks were supplied by two main sources: an external source situated in the foreland, and an internal source represented by the "cordilleras" or, mostly in Cenozoic, by the still structured internal units of the East Carpathians (Săndulescu, 1994). One of these areas can be found in Teleajen valley near Maneciu dam, 45 km northward from Ploesti (Prahova), in the central-southern part of Romania. Along the Teleajen river crop out hundreds of meters of Cretaceous sedimentary rocks of Teleajen nappe (Convolute Flysch). This study is focused on the sedimentological research and analysis of these sediments. Detailed bed-by-bed logging gives information about the thickness, geometry, grain size and sedimentary structures of each measured bed. Two main facial associations were recognized: (I) thick medium- to coarse-grained, mostly massive, sandstones, occasionally alternating with fine sandstone or mudstone and (II) association of thin-bedded fine sandstone alternating with mudstone layers (ratio 1 : 2) with internal features of sandstone beds like parallel lamination, ripple cross lamination, intra-bed slumps and through cross bedding. Facial associations with other features (e.g. dish structure) of these sedimentary rocks indicate that the sediments were primarily deposited in inner fan environment of turbidite distributary channel.

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#### J. ŠURKA: Sedimentological analysis of Borové Formation (Paleogene) in Komjatná and Biely potok (Liptov Basin)

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Sediments of the Borové Formation show a typical transgressive character on the studied localities. A softened character upward is typical for these sediments. These sediments are formed mainly from conglomerates of all size categories (coarse-grained, medium-grained, close-grained) and coarse-grained to medium-grained sandstones. Lithological composition of sediments directly reflected composition of their Mesozoic underlayer (composed wholly of Choč nappe dolomites). Bases of the profiles are formed mainly by coarse-grained to medium-grained conglomerates which are often with normal gradation (Komjatná). Changing of coarse-grained and close-grained layers of little thickness is very often. The layer thickness is

sometimes only up to the size of clasts (Komjatná). These sediments are typical for flash floods deposits on fan delta or deltaic fan surfaces. In many parts of the profiles there was difficult to find the layer border line because layers are strongly amalgamated. Upwards in the profiles conglomerates are changing into coarse-grained to medium-grained sandstones. Sandstones contain nummulites which are typical for sediments of the Borové Formation and show passing into marine environment. Sedimentation took place on the slope, what is indicated by slip bodies of conglomerates in sandstones. At the top of profile in Komjatná there were found the stripes of horizontally arranged nummulites forming Ophiomorpha burrow. Deposition environment interpretation is relatively difficult. Limited amount of profiles shows scattered image of the bigger depositional environments. What we know is that sediments of the bottom parts of profiles are probably continental deposits of fan deltas or coastal plain which upwards gradually changes into sea environment as a consequence of transgression.

#### M. UDIČ: Manifestation of recent tectonic on the Subatric-Ružbachy fault system

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NE – SW to E – W trending Subatric-Ružbachy fault system is the most significant fault structure. This fault system is tectonically bounding from the south the uplifted horst of Tatra Mts. The first manifestations of activity on this structure are accompanied by changes of paleocurrents in Huty Formation (Eocene). Continued activity of the fault system is documented by the formation of pseudotachylites dated to 36 – 28 Ma (Kohút and Sherlock, 2003) and by the FT analysis, which proves uplift of Tatra Mts. during Upper Miocene (20 – 10 Ma, Král, 1977). Recent activity of Subatric-Ružbachy fault system is expressed as the system of fissures of NE – SW direction with dip from N to NW in glacialuvial sediments and travertines, which are along fault line. Several 100 m thick accumulations of glacialuvial sediments near the Štrbské Pleso and Tatranská Lomnica sporadically overlaps the trend of Subatric-Ružbachy fault system. Presence of these glacialuvial sediments is related to the Subatric-Ružbachy fault system and transverse fault structures, which are parallel with course of Mengusovská and Studená valleys. This suggests the more extensive formation of iceberg by reducing the snow line due to intensive uplift of Tatra Mts. granite block in this part. Isostatic movements promoted uplift of Tatra Mts. after retreat of icebergs. It caused intense downward cutting into glacial and glacialuvial sediments together with terraces creation, as an important indicator of vertical movement variability. Based on the dating of travertine accumulations in Ružbachy the opening of fissure systems was recorded since Lower-Middle Pleistocene to Holocene (Vaškovský, 1977), what suggests the extension of Subatric-Ružbachy fault system in this time.

#### P. VRŠANSKÝ: Mesozoic amber cockroaches from France

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Mesozoic ambers are extraordinary rare. New ambers were recently discovered in France, in addition to known ambers from Russian Tajmir, Lebanon, Spain, Jordania and New Jersey.

Cenomanian Sisteron amber revealed a complete immature of *Nula sis*, a representative of extinct Mesozoic family Blattulidae with the central *ocellus* – a photoreceptor reduced in all living cockroaches.

More surprising was the discovery of 98-million-years old relative of the living synanthropic German cockroach.

The most perspective is the amber from Archingeay, which revealed 17 specimens with 2 adults. Dominant were families Blattulidae and Mesoblattinidae, with occurrences of families Librellinidae, Eadiidae and Caloblattinidae. Of special consideration

is studying of opaque amber using synchrotron and visualising samples from inside of rocks. Figure 1 shows phase contrast X-ray microtomography of nearly 100-million-year old sample Arc-037 B 1-2: *Batola nikolai* (Blattulidae) and *Sivis odpo* (Mesoblattinidae) (M. Lak and P. Tafforeau, ESRF Grenoble after Vršanský, 2009).



M. WDOVIN<sup>1</sup>, W. FRANUS<sup>2</sup> and M. FRANUS<sup>2</sup>: **Selected natural and synthetic resources for CO<sub>2</sub> neutralization needs**

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The subject of this study was the surface properties modification of natural and synthetic mineral resources in order to receive carbon dioxide sorbents.

A tested material was represented by glauconite clays that occur as interlayers in Tertiary quartz-glauconite sand-sediments on Lublin Upland.

The synthetic material constituted a zeolite of Na-X structure received on the basis of F class fly ash as a result of a hydrothermal reaction with NaOH.

The tested clay material was processed by acid activation using 20 % sulphur acid during 4 to 7 hours, and then it was calcinated at 350 °C temperature within 4 hours.

Due to the lack of chemical resistance to acid activity, the zeolitic material was processed only by thermal activation at 350 °C temperature during 4 hours.

In order to determine influence of acid and thermal activations onto analysed material the following surface parameters were established: ion capacity, surface area, structure and pore size distribution.

As a result of conducted activation, a BET surface area for clay and zeolite sample has increased from 86 m<sup>2</sup>/g to 236 m<sup>2</sup>/g for clay (after 7 hours acid-thermal activation) and from 262 m<sup>2</sup>/g to 434 m<sup>2</sup>/g for Na-X (after thermal activation), respectively. After activation of clay, cation exchange capacity has decreased almost by half from 33 meq/100 g to 15 meq/100 g, whereas for zeolite CEC was nearly constant at the level of about 218 meq/100 g.

For the zeolite sample preliminary tests of CO<sub>2</sub> sorption were conducted. Measurements of isotherms have shown much better sorption onto activated sample (at equilibrium pressure p/p<sub>0</sub> close to 0.01 it was equal to 0.51 mmol/g), than onto natural sample

where it was equal to 0.18 mmol/g, what explicitly points at surface modification needs of this sort of material in order to receiving CO<sub>2</sub> sorbents.

Further research within match optimal and economic conditions for modification of analysed material will permit to use them for carbon dioxide capture purposes directly from emission sources.

Dynamic flow of pure CO<sub>2</sub> stream conditions experiments will be carried out through specially designed column with bed composed of analysed material in purpose to achieve above mentioned aims. The material will be placed in separated container, in which thermodynamic conditions causing desorption of CO<sub>2</sub> will be changed, and simultaneously regeneration of tested material will have taken place.

This kind of experiments will be stages of considerations that have on aim an effective use of anthropogenic carbon dioxide sorbents for geological sequestration needs of this gas by:

- working out of economic modification of natural and synthetic resources for CO<sub>2</sub> capture needs,
- designing the most efficient equipment allowing profitable usage of analysed material,
- using of obtained results for industrial needs.

These experiments can be useful in development and improving of the technology of CO<sub>2</sub> capture from point emission sources.

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M. WYSZOMIERSKI<sup>1</sup> and E. KALIŃSKA<sup>2</sup>: **The influence of bedding sediments on developing of Quaternary deposits in the northern part of Mazovia Lowland**

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Investigated area is located at the border of three active tectonic Quaternary units: Warsaw Basin, Ciechanów morainic plateaux and Płońsk morainic plateaux. Processes of subsidence have been noticed in Warsaw Basin since Upper Cretaceous through whole Paleogene and Neogene. Aformentioned area is located ca. 30 km north-east of T-T zone (Teisseyre-Tornquist zone), the distal part of Eastern European Plate. Depression of Warsaw Basin was adapted by epicratonic sea during Miocene, were glauconite sands were accumulated. Pliocene was characterized by the presence of 100 m thick lake sediments (clays and muds) of Poznań Formation. River systems developed here during Gelasian (1.8 – 2.6 Ma), forming paleovalleys. The course of these negative forms was parallel and longitudinal, and then inherited by Pleistocene ice streams and river system. Weight of ice mass during many transgressions led to glacitectonic deformations of Pliocene clays, which is manifested by variability of altitudes of deposits: from 40 m b.s.l. to over 70 m a.s.l. Analysis of cartographic profiles reveals the presence of large thickness of fluvial sediments correlated with Mazovian, Lubavian and Eemian interglacials divided and transformed by glacial sediments. Analysis of sediments at the border of Neogene and Pleistocene shows an increased content of resistant and opaque minerals. Moreover, concentration of siderite, pyrite and limonite mineralization was observed. The bottom part of Quaternary deposits profiles are gradually enriched in shiny quartz grains (EL and EM/EL in Callieux analysis).

F. ZALEWSKI: **Characteristic of carbonic rocks which were used for buildings in Ancient Egypt**

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Folk and Campbell (1992) in their article "Are the pyramids of Egypt built of poured concrete blocks?" on the ground of analysis of

two British Museum's probes, state that the Great Pyramid is built from two types of limestones. The first one is micrite-sparite limestone, which was used for facing tile of the Great Pyramid. Second one, which was used for concrete part of pyramid is nummulite limestone containing big amount of fossilized shells.

Paper presents examination of more than twenty probes of Great Pyramid blocks as well as mortar connecting those blocks. Further probes from other pyramids from Old Kingdom of Egypt were also examined. Thanks to this, three types of limestones used for building of pyramids were found. Two of them match the ones described by Folk and Campbell. Third type is a limestone with crushed remains of fossilized marine organisms and flora and it is completely different from the ones described by the authors of mentioned article. After examination of rocks from Giza Plateau's quarry, described in literature as the possible source of building material, before mentioned data were not confirmed.

Some of rocks derived from Abu Roash Pyramid contain chips of limestones joined with gypsum. In pores of those rocks a large amount of non-transparent round and oval-shaped minerals can be found. An experiment was carried out intending artificially connect carbonate rock chips with roasted gypsum. The outcome of this experiment was later examined and its metallographic section was identical to that taken from Abu Roash Pyramid, what leads to conclusion that they were artificially manufactured.

**B. ZYCH-HABEL and A. KĘDZIERSKA: High field strenght elements mobility during albitization in a Variscian granite from Strzegom-Sobótka massif, Poland**

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The high field strength elements (HFSE) are characterized by high ionic potential. The incompatible HFSE with high valence are not favoured for incorporation into crystal lattices despite radius, being sufficiently small for many cation sites. The HREE, Zr, Hf, Nb, Ta, Ti, Y, Th and U are sometimes included in to this group because of their high ionic charge.

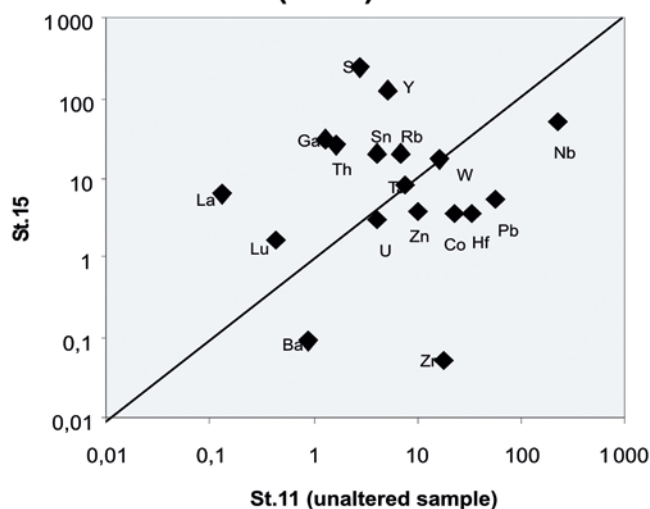
The REE and other HFSE (like Zr, Ti, Nb) have been regarded to be immobile during alteration of rocks. The main diagnostic tools for discrimination between magma types and tectonic settings of their generation environment are based on expected immobility of these elements. However, some evidences suggest that under certain, often extreme conditions of alteration, the HFSE are mobile.

The studied granodiorite from Strzeblów is located in the eastern part of Strzegom-Sobótka massif (Fore-Sudetic Block). Albitization, episyenitization and kaolinization are dominant alteration processes observed in this rock. The REE and HFS elements are mainly accumulated in accessory minerals like monazite, xenotime, cheralite, zircon, ferrocolumbite and others. The mobility of these elements was determined using isocon method by Grant (1986) (see figures).

In all studied samples enrichment in REE in relation to non-altered samples (or sample considered to be only slightly altered) was observed. In most altered rocks the depletion by the LREE with regard to HREE was noted. Zr and other HFS elements are immobile in most slightly altered samples. In strongly albitized rocks depletion in Zr, Nb, Ta, and U was observed.

Mineral behaviour (dissolution of zircon in the most altered samples, formation of cheralite and xenotime in advanced hydrothermal processes, decrease of Nb and Ta oxides during albitization) suggests that HREE could be supplied to the rocks with metasomatic fluids. Simultaneously Zr (and other HFS elements) could be leached by strongly alkaline solid.

**Log-log isocon diagram after Grant (1986)**



**Log-log isocon diagram after Grant (1986)**

