4th International Students Geological Conference

Conference Proceedings

April 19–21, 2013, Brno, Masaryk University, Department of Geological Science

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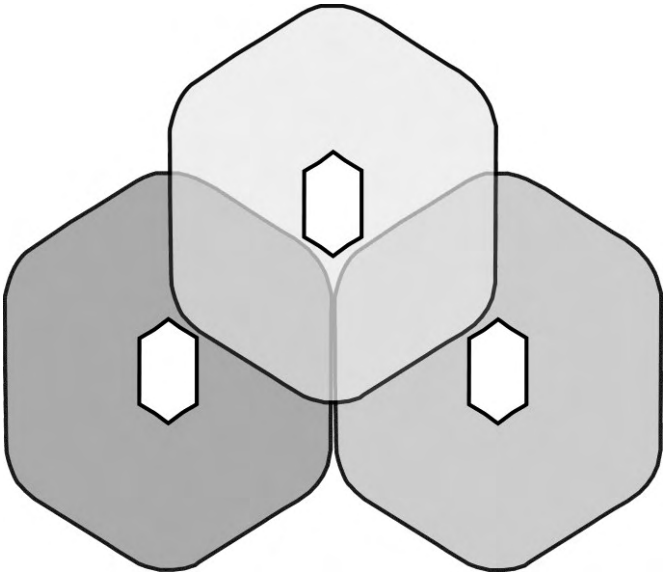

Conference Proceedings

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Masaryk University
Faculty of Science, Department of Geological Sciences
Brno 2013

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Photo on cover: Brno, Lesní lom Quarry – the Late Devonian (Famennian) calciturbidites of the Líšeň Fm. (photo by Tomáš Kumpan)

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Foreword

Dear colleagues,

I would like to welcome you at the Faculty of Science of Masaryk University Brno. Masaryk University is the second oldest and second biggest Czech university. It is, on the other hand, probably the most modern Czech university. You are however in the historical campus, the new campus; research centers and faculty hospital are located on the southern periphery of the city. Whole university has approximately 40 000 students. The Faculty of Science is with 4000 students relatively small. Nevertheless, the scientific output is noteworthy – the faculty produces 35% of the scientific results of the whole university, and it's the most efficient faculty of the university. Both University, as well as Faculty tries to become more international. The amount of foreign students, mainly in PhD programs, as well as the number of visiting and foreign professors increases each year. Faculty supports therefore the student conferences like ISGC 2013 gladly. I hope that such meetings could enable international contacts even for students, to see and compare teaching and science on the different universities and countries.

I wish you a pleasant stay in Brno, and successful conference, and nice weather for the field trip.

Jaromír Leichmann
Dean of the Faculty of Sciences, Masaryk university

Welcome to Brno city, the greatest student city in the Czech Republic with a rich historical and prehistorical background, the city hosting the 4th International Students Geological Conference (ISGC) in 2013.

The 4th ISGC takes place at the Department of Geological Sciences, Faculty of Science, Masaryk University from April 19 to April 21, 2013. The turnout of participants exceeded previous years, with almost 160 participants including 72 oral presentations and about 60 posters. The participants came from 14 european and also non-european countries.

The conference became an important international meeting point for students of geology. We believe the conference will be a memorable event for your geological career, where you can present your topic, share your experience, and meet and discuss together. The organising committee believes the tradition will continue with such plentiful participation and great support of students around the world.

We thank all the partners for support: Society for Geology Applied to Mineral Deposits (SGA), Society of Economic Geology (SEG) and their students chapters, Czech Geological Survey, and all the sponsors. We appreciate the great work of the Scientific Committee with international representation.

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GOLD MINERALIZATION RELATED TO HOSTING-GRANITIC INTRUSION AT FATIRA AREA, EASTERN DESERT OF EGYPT

Mohamed Abd El MONSEF[1], Marek SLOBODNÍK[2]

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The Fatira gold deposits are represented by three sites; highly altered felsite dykes and auriferous quartz vein that are cutting through granitic rocks, as well as shear zone between granite and metavolcanic rocks. The main lode of gold is confined to highly-altered felsite dykes which are cut by several oblique to sub-vertical sets of quartz veinlets. They are always striking discontinuously N-S and dipping 35-45° to the west direction with an average thickness of about 1.5 m. The auriferous quartz vein is always massive, milky white in color with average thickness of about 25 cm and trending N-S with dip angle of 40° W. The shear zone is extending for about 300 m, trending N-S and dipping 70° to west direction in which the foot wall is represented by metavolcanics that occupy the western side and the hanging one is represented by older granites in the eastern side.

The petrographic description and whole geochemical analysis (major oxides, trace elements and REE) for the hosting-granitic rocks revealed that, the studied rocks are of granodiorite composition (I-Type) which were derived form calc-alkaline magma due to partial melting processes. The nature of granitic rocks has a signature of island arc tectonic setting, which is related to immature island arc (post-collision).

The microscopic examination of the studied gold mineralization revealed that ore mineral assemblage is found as disseminated sulfide minerals (pyrite, sphalerite, chalcopyrite and covellite). Goethite, ilmenite, jarosite and rutile are the main iron oxide mineral phases. Gold commonly occurs as minute specks and discrete scattered flakes within the microveinlet of mineralized felsite dykes and quartz vein or as small inclusions in pyrite or goethite, it is also recorded as disseminated grains in the altered wall rocks. The wallrock alteration includes propylitization, sericitization and silicification.

Fluid inclusion study was carried for two groups of samples; 1) Samples taken from quartz veinlets cutting felsite dykes, 2) Samples taken from auriferous quartz vein. The measurements were focused on primary and pseudosecondary inclusions. Petrography and microthermometry of fluid inclusions revealed a great similarity between both groups of samples. With respect to number of phases present at the room temperature (20 °C) there are two main groups of fluid inclusions can be recognized in both zones: A) two-phase – aqueous inclusions (Type I) and B) three-phase – carbonic inclusions (Type II). Type I inclusions could be described as H_2O-NaCl±KCl system, eutectic temperatures range from -22.1 °C to -23.9 °C. Values of homogenization temperatures (Th) are between (152.1 °C to 280.2 °C). Salinity has a range of (0 to 8.41 wt.% of NaCl equiv.) and density of range (0.76 - 0.94 g/cm^3) . Type II inclusions of H_2O-CO_2-NaCl±CH_4 system, yield values of the total homogenization temperatures between (267 °C - 347.8 °C) with salinity between (2.35 - 3.99 wt.% of NaCl equiv.) and bulk density of range (0.44 - 0.76 g/cm^3).

The presence of rutile and ilmenite in mineral assemblage, fluid inclusion data and REEs geochemistry revealed spatial and time relationships between gold mineralization and granitic intrusion as part of the island arc section which is related to Pan-African orogeny. It can be concluded that, the gold was deposited from hydrothermal solutions which were originated in a deeper crustal levels as a result of interplays of metamorphic and magmatic processes.

THE CHEMICAL COMPOSITION OF ALLANITE OF UKRAINIAN SHIELD, AS TECTONIC CONDITIONS INDICATOR

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Allanite (orthite), en epidote group mineral, general formula $A_2M_3[SiO_4][Si_2O_7]O(OH)$: A = Ca, Ce; M = Al, Fe.

It occurs as a characteristic accessory mineral in granite, granodiorite, syenite, monzonite, granite pegmatites and skarns [Lyakhovich et al., 1968] It is found in glaucophane schist and garnet lherzolite as well. There are also allanite phenocrysts in acid volcanic rocks [Hoshino et al., 2005].

Our attention was drawn to the work of our Japanese colleagues (Hoshino et al., 2005), they studied the chemical composition of allanite of granitic rocks of Japanese island arc by EMPA. They placing a data on the diagram of Al_2O_3-Fe_2O_3-ΣREE_2O_3 and comparing them with literature data for allanite from Proterozoic anorogenic granitoids of different tectonic zones of the Earth crust and concluded reduction of oxygen fugacities (f_{O2}) during crystallization of minerals in the series: intracontinental zone - island arcs - continental margin. When reducing of $\mathbf{f_{O2}}$ the quota of Fe^{3+}in the allanite begins decrease, which in turn gives an indication of the tectonic conditions of allanite formation.

We decided to use this diagram to check the possibility of its application to allanite of the Ukrainian Shield (Fig. 1). Allanite in the Ukrainian Shield is common accessory mineral in diorite, tonalite, granite pegmatites and granites; moreover, in some granite of Saltychansk complex it is a rock-forming mineral (Lazarenko et al., 1981). In recent years, in the Azov megablock was strike unique ore occurrences of vein-type also known as “Anadolsk allanite dyke” where allanite content ranges between 10-80% (Melnikov et al., 2012).

In discriminatory diagram Al_2O_3-Fe_2O_3-ΣREE_2O_3 (Fig. 1), figurative points 1 and 2 (Anadolsk ore occurrences, Azov megablock) fall into the opposite fields. We assume the scattering of points are due to different methods of analysis of the samples. However, in this case, the point would be swapped of places, as convincingly shown for beryl family minerals (Platonov et al., 2012), where the excessive of Fe^{3+} content is due to the "wet" analysis. Consequently, I conclude that the points scattering are caused by heterogeneous composition of allanite that, in fact, confirmed by electron microscopic analysis (Melnikov et al., 2012) and optically-microscopic observations.

Allanite-(Ce) from Anadolsk ore mineralization (point 2), as it follows from the diagram (Fig. 1), indicates the formation of it in terms of the active continental margin with low oxygen potential. The most allanite samples of granites and pegmatites of the Eastern Azov region resides in the same field on the diagram. Figurative point of allanite from granites and pegmatites of Saltycha Mogyla ore occurrence (West part of Azov megablock), zhytomyr and tokiv granites located in the field of intracontinental tectonic zone. Obviously, the scattering of points, are caused by uneven content of elements in the various allanite generations which arose due to metamorphic process. That clearly demonstrates two similar analyses from some ore mineralization (points 6 and 7 on the diagram). So Hoshino`s diagram cannot be used to separate of Ukrainian shield allanite because it has the instability composition. However, even taking into account of the discrepancies in the results caused by different methods and techniques of analysis and samples preparation methods clearly recorded a large quota of Fe^{2+} in the allanite of Eastern Azov ore occurrences. Apparently, this is a result of the special status of Azov domain of Earth crust in the Precambrian.

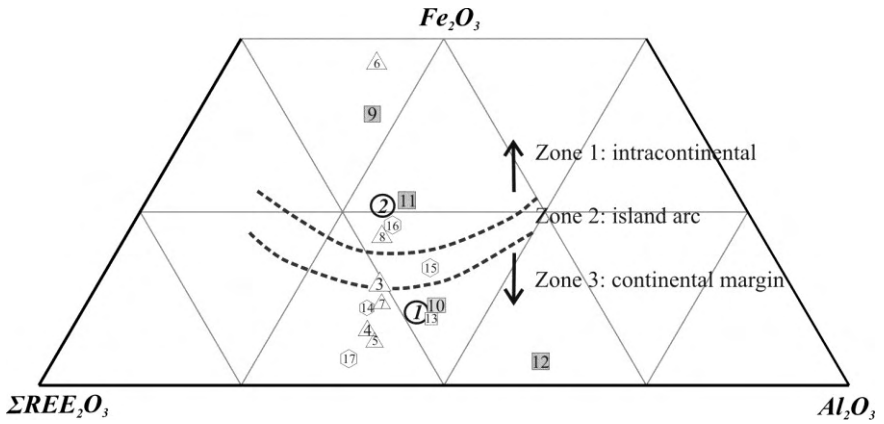

Fig.1 Discriminatory diagram of figurative points of allanites composition of geological complexes of the Ukrainian shield.
Remarks. The places of allanite finding: 1,2 - Anadol ore occurrence; 3-8 – the granites and pegmatites of Eastern Azov region; 9-12 – Saltycha Mogyla granites and pegmatites, 13 – the epidote metasomatites of West Azov region, 14-15 – токiv granite, 16 – zhytomyr granite, 17 – the pegmatites of Korsun-Novomyrgorod pluton.

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SPHERULITIC RHYOLITE PEBBLES FROM PLEISTOCENE DEBRIS OF PALAEO-DANUBE – PRELIMINARY PROVENANCE CASE STUDY

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The fluvial weathering and transport which occurred after the last Ice Age played the mayor role in formation of the well-known Pleistocene pebble deposits in the Pannonian Basin. These pebble deposits are important water reservoirs, mineral resources and remarkable in the aspect of our archeological past. Furthermore they can help in the understanding of the Pleistocene geological, geographical and climatic conditions, thus the changes in these conditions can help in the modeling of the present and future climate.

Our main goal is to identify step by step some special rock types of the Pleistocene debris and to determine the source region of these rocks and the path of the pebble transport. In this case study we present a specific rock type which is spherulitic rhyolite found in the pebble deposits along 250 km reach of the Palaeo-Danube in Hungary. With this investigation we might have the opportunity to clarify a piece of the Pleistocene drainage system.

The composition of the pebble deposits is very diverse and was examined by many but there are no publications about the rhyolite pebbles so far. 3-6% of the pebbles are rhyolites which are varied themselves. Macroscopically we distinguished four different groups of these volcanic rocks by texture, appearance and mineral composition. The common characteristics of all groups are that they are well rounded, have high strength and are not vesiculated. The members of the first group (1) have dark coloured matrix with light coloured porphyritic components. The second and third groups have breccia like textured rhyolites (2) and siliceous and biotitic ones (3), respectively. The last group (4) contains the most specific types of rhyolites. These have light pink or purple coloured matrix with darker pink or purple porphyritic components and spherulites. This last group was chosen to find the source region.

During the macroscopic examination in group four we distinguished two subgroups. The main similarity between these groups is that the matrix is light pink, purple or yellow and contains dark pink, purple porphyritic components or spherulites.

The first group (a) contains at least 35% spherulites which are 2-3 mm in size, have round shape and occur alone, somewhere in groups. The distance between each spherulite is 3-6 mm in average. The matrix is not granular; they contain at most 1% feldspar and quartz. The other group (b) is quite different because the porphyritic components like feldspar and quartz are dominant, but they do not reach 15%. The feldspar is 5-6 mm in size, columnar in shape and is dark pink or purple coloured. The quartz is 2-3mm, roundly shaped, grey coloured or colourless. The distance between the grains is 5-7 mm in average.

Through polarising microscope we observed wavy and multiple twinned euhedral resorbed quartz with undulatory extinction, composite cumulates of sanidine and quartz, large euhedral sanidine, smaller albitic plagioclase and strongly altered questionable mafic components in microcrystalline groundmass.

These observations were reinforced by scanning electron microscopy. In addition the SEM showed the presence of carbonate containing REE, zircon, monazite, sericite, pyrite, fluorite, sphalerite and veins of Fe-chlorite.

This rock type can be followed from Dunavarsány (southward from Budapest) to Hegyeshalom (Hungarian-Austrian border crossing). We did not find any articles related these types of rocks in the alpine drainage system. The small occurrences of the Bohemian Massif are eroded and transported to the north according to the present drainage network. We think the rhyolites of Central Slovakia could not reach the westernmost Hungarian occurrences. First and last the Permian rhyolites in the northern part of the Little Carpathians could be the most likely source region. To determine the accurate source area we need further field and laboratory work.

SPATIAL DISTRIBUTION OF HEAVY METALS IN BOTTOM SEDIMENTS OF THE NORTH-WESTERN BLACK SEA SHELF

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The purpose of this study is to estimate the influence degree of different anthropogenic sources on the heavy metal content and distribution features in the bottom sediments of the north-western (NW) Black Sea shelf using frequency distribution function.

Bottom sediment samples from 47 stations situated on NW Black Sea shelf collected in 2007 were analysed for the concentration of Cr, Ni, Cu, Pb, As, Co, Cd, Hg. The sea depth of the samples taken was 15–31 meters.

Main part of metals (Ni, Cu, Pb, Cd, Hg) is concentrated in the coarse grained fraction (≥1.0–0.5 mm). Other elements (Co, As, Cr) are accumulated in the fine grained fraction (≤0.05–0.01 mm).

Probability cumulative curves have been employed for heavy metals source determination by inflection points on the curves. We have divided heavy metals sources into natural background, industrial-agricultural and point sources. In the statistical sense this division of heavy metals means that in the region of interest the elements came from three populations with distinctive features. This allows us to divide the content of heavy metals to the components depending on their sources. The non-parametric Wilcoxon-Mann-Whitney test (U test) is used to determine if the separated samples (natural and anthropogenic) have come from different populations.

The analysis shows that the industrial-agricultural nonpoint sources influence played an important role in the distribution features of heavy metals in the bottom sediments of the NW Black Sea shelf. The results shows that for metals from anthropogenic sources, for example, Cu accounted for 28 % in their content, 21 % comes from industrial-agricultural sources, 7 % from point sources, Cd accounted for 30 % in their content, 26 % comes from industrial-agricultural sources and 4 % from the point sources.

Separation of heavy metals by their sources and contour map construction we made for Cr, Ni, Cu, As, Cd, Hg, which are neither normally nor log-normally distributed.

In the study area there are different sources of sediment pollution associated with anthropogenic activities. These include: bottom sediments of Ports (Odessa, Yuzhny, Ilychevsk), floating craft accumulation areas, dumping zones, ameliorative waste collection areas, drilling platform locations.

TERRACES OF THE RIVER CIECERE VALLEY FROM LOVER REACHES TO BIDDLE REACHES

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This research aimed to determine and correlate the River Ciecere terraces with palaeo-shorelines of the Venta-Usma ice-dammed lake and terrace levels of the River Abava. The River Ciecere drainage basin is located in the Eastern Kursa Upland and Kursa Lowland. The river itself is right bank tributary of the River Venta. It starts from the Lake Ciecere which is located easterly of the Saldus Town. The total length of the river is 51 km.

Geomorphological and geological field works were carried out in the River Ciecere valley and its adjoining area. The field observation were aimed at detection and mapping of river terraces, fixing tributaries and landslides. During the fieldworks hand-drilled geological boreholes were made. The River Ciecere valley cross sections were made using precise post-processing differential GPS and total station. Vertical error of measured points is less than 0.1 m, and it was achieved by using LATPOS reference station service.

For case study of the River Ciecere digital terrain model was derived from large scale (1:10 000) topographical maps and all field data and results were processed using ArcMap GIS software. Results were compared with outcomes of the previous research.

As a result four different terrace levels can be distinguished in the valley. Number of terraces grows from the lower reaches in direction of the Lašupe village. The River Ciecere terraces IV, III and II topographically correlate with the River Abava terrace levels F, E and D which have developed during the Venta-Usma ice-dammed lake phases V5, V6 and V7 (Veinbergs, 1975, 1979). According to data on glacio-isostatic rebound (Grīnbergs, 1957) of the western part of Latvia based on the Baltic Ice Lake BglIIIb phase shoreline elevation, a relative height difference between River Ciecere terraces and River Abava terraces should be about 5 m. Topographically the River Ciecere terraces IV, III and II might be correlated with the River Abava terrace levels G, F, E which have been developed during the Venta – Usma ice-dammed lake phases V4, V5 and V6 accordingly.

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ANALYSIS OF THE RESULTS OF PETROPHYSICAL RESEARCH FOR POOR-POROUS HYDROCARBON RESERVOIRS MATHEMATICAL MODEL CREATION (ON THE EXAMPLE OF ZARICHNA AREA SAMPLES)

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Nowadays oil and gas exploration is the main area of research in geological and geophysical works. There are three major hydrocarbon provinces in Ukraine - the Dnieper-Donets, Carpathian, Black sea and Crimean region. The object of this research is a part of the Dnieper-Donets Basin (DDb) - Zarichna area - one of the most promising areas of the Rudenkivsko-Proletarskij oil and gas region (central part of the southern near-side zone of DDb). This territory has numerous deposits of hydrocarbons, that allows us to talk about the prospects of the studied sediments. In tectonic terms, this territory is dedicated to the most tectonically active areas of graben with very dislocated sediment cover.

Samples from the well № 3A (interval of depths from 3010 to 3022 m) were taken for the laboratory tests. The composition of samples is predominately clastic and carbonate with organogenic inclusions. Macro and micropetrographic analysis were carried out during the lithological and petrographic study of samples. This study included the determination of textural and structural characteristics of the rocks and their mineralogical composition. Sandstones, limestones and organogenic limestones are the prevailing rocks' types among the samples of collection. Presence of clay fraction is typical for most of them. The presence of clay components and lack of quantitative information about its content can lead to the discrepancy of data.

All petrophysical studies were carried out in the petrophysical laboratory of the Geological Department (Taras Shevchenko National University of Kyiv).

Comprehensive studies of dry samples and samples, saturated by the reservoir water and oil models resulted in the estimation of such parameters of rocks:

- density (the density of gas-saturated rocks varies from 2.4 g/cm^3 to 3.0 g/cm^3 and values for carbonate rocks are higher than those for the clastic rocks, particularly, due to the presence of siderite inclusions; volume density values vary from 2.5 g/cm^3 to 3.1 g/cm^3, depending on lithology (volume density for the limestones is higher) and saturation (rocks, saturated with kerosene, have lower values compared with rocks saturated with the reservoir water model));
- porous (porosity ranges from 1% to 6% and its values for sandstones are higher than for limestones);
- filtration (absolute permeability ranges from $9 \cdot 10^{-3}$ to 13.73 mD, the coefficient of absolute gas permeability ranges from $0{,}01 \cdot 10^{-3}$ to $57 \cdot 10^{-3}$ mm^2; both parameters are higher for sandstones than for limestones);
- electrical (resistivity ranges from hundreds to thousands of Ohm·m (limestones showed higher values than sandstones); the saturation parameter, which ranges from 1.1 to 5.8 relative units and maximum values are typical for sandstones; the porosity parameter ranges from 36 to 640 r. u., the highest values were obtained for limestones) properties.

Statistical analyzes of petrophysical parameters were carried out by the authors. Relationships between the density, porous and electrical parameters for different lithological groups of samples were plotted (an example of the relationship between the saturation parameter and water saturation ratio is shown in Fig. 1).

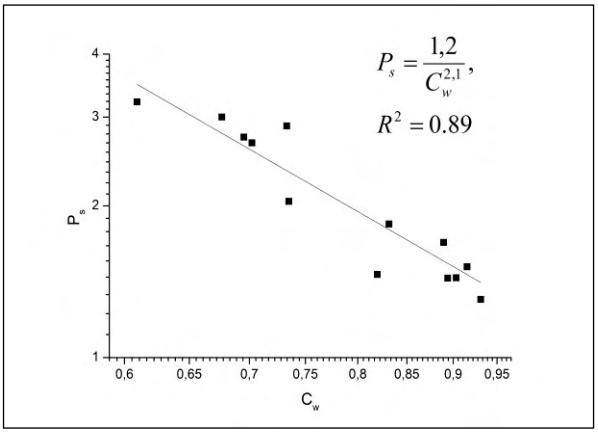

Fig.1. The relationship between the saturation parameter and water saturation ratio (for water-saturated samples of limestones)

The authors have carried out studies of Zarichna area samples petrophysical properties. Obtained results will form the basis of the development mathematical model of poor-porous carbonate and clastic reservoirs of the research area.

PALEOFLOW DIRECTION IN VOLCANOGENIC MASS-FLOW DEPOSITS USING A GIS-BASED PHOTOSTATISTICAL METHOD – A CASE STUDY FROM THE VISEGRÁD MOUNTAINS, HUNGARY

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A GIS-based photo-statistical method was carried out mainly on syn-eruptive epiclastic rocks to infer the source areas of explosive eruptions in the Middle Miocene Visegrád Mountains (North-Central Hungary).

The present-day Visegrád Mountains hosts a deeply eroded remnant of a lava dome-dominated composite-volcano (Keserűs Hill), whose original cone-shaped morphology is little preserved (Karátson et al. 2006). A facies analysis pointed out that a well-developed ring-plain structure with partly submarine epiclastic rocks developed around the strongly eroded core facies (Karátson et al. 2007). Field measurements of fabric of central block-and-ash flow deposits suggested a central vent for most of the deposits.

In the present work, a quantitative 2D grain fabric analysis is presented to get information on the paleoflow directions of volcanogenic – likely resedimented – pumiceous deposits related to the ring-plain. Additionally, the paleoflow data can be used to infer the main topographic features of the original volcano. The results obtained after processing 11 matrix-supported pumice-rich samples from 5 locations show the expected areal distribution on the proposed ring plain.

The grain-fabric analysis were made on oriented, bed-parallel rock slab cuts. The scanned rock surfaces were introduced to ESRI ArcGIS 10.0 Desktop GIS software as pictures with 300 or 600 dpi resolution, georeferred to a coordinate system (HD 1972 EOV) where the whole frame has positive coordinates. To count individual clasts, a shape file containing the outline of the clasts was produced. Manual grain detection was preferred because of the observed low spectral difference between the matrix and the clasts. On average, 200 mainly lapilli-sized clasts/sample were used for directional statistics. Using the Zonal geometry as Table Tool, the orientation of the long axis of each digitized grain, the elongation, and the area of the grain-derived polygons were calculated. The attributes of individual grains, analysed by GEOrient 9.5 software, include Mean Resultant Length (R), Mean Resultant Direction (Vector mean), and ordinary, elongation-, and area-weighted frequency rose diagrams.

The calculated R values vary between 0.09 and 0.39, which correspond to R values obtained from ignimbrite deposits (Valentini et al. 2008). The fabric strength in different samples from the same location, measured by the Mean Resultant Direction, is similar in most cases. When completely different mean directions were obtained for samples taken from the same location, generally the Vector mean was also different. The obtained differences in the R values and Vector mean values call for the necessity of multiple sampling of an outcrop. Classified rose diagrams – where in addition to circular frequency of individual clasts, elongation frequency in each sector was also counted - show that the usage of slightly elongated clast is preferred instead of large ones.

The geocoded Mean Resultant Directions and rose diagrams (except for one location) indicate a source area in the central region of the remnant edifice of Keserűs Hill, in agreement with the previous facies analysis. The roughly centripetal mean resultant directions prove that this GIS-based photo-statistical fabric analysis is a helpful method in the identification of source areas of volcanogenic mass-flow deposits, especially in strongly eroded volcanic terrains.

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IMPACT OF MICROBIAL PROCESSES ON MOBILITY OF TRIVALENT BISMUTH

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Thanks to its low toxicity the studies on bismuth mobility in the environment are very rare, when compared to other heavy metals. However, the broad usage of metallic bismuth and bismuth compounds in the medicine and manufacture of alloys, pigments, cosmetics, and pharmaceuticals, increased the chance of exposure to this element and should be consider as environmental issue. Thus it is necessary to understand fate of bismuth in the environment and its changes in bioavailability.

Mobility of each element in the biogeochemical cycles is affected by many factors, including microbial activity. Therefore, in this work we focus on bismuth(III) biosorption, bioaccumulation and biovolatilization, the important processes ongoing in the biogeochemical cycles of various substances. Biosorption can be defined as a passive microbial uptake of elements onto the cell surface, driven by physico-chemical mechanisms. For bio-accumulation, a substance is translocated into the living cells, where it binds and is stored in different cell structures, or metabolically converted into another form (Gadd 1996). In the presence of certain microorganisms the process of biovolatilization transforms accumulated dissolved inorganic compounds of metal(loid)s into volatile forms.

Prior the bioaccumulation experiments the 7-day-old conidia were collected from mycelia surface of filamentous fungus *Aspergillus clavatus* and used as inocula for 50ml of nutrient media with different bismuth(III) concentrations (0.004–0.25 mmol.l^{-1}). After 15-day cultivation under laboratory conditions (dark, 25°C) the bismuth concentration in grown fungal biomass was measured using ICP OES. Maximum achieved accumulation capacity of biomass was 0.112 mmol.g^{-1}.

Batch biosorption experiments (120 rpm, 25 °C) were performed in Erlenmeyer flasks with pelletized wet fungal biomass/solution ratio 1.8% and with various bismuth(III) concentrations (0.1–2 mmol.l^{-1}). The equilibrium time was studied within the time interval of 0–240 min. The reaction kinetics were well described by both pseudo-first and pseudo-second order rate models, and equilibrium was reached after 50 min. Langmuir and Freundlich isotherm models were used to represent equilibrium data (Fig. 1), and the calculated maximum biosorption capacity of fungal biomass for bismuth(III) was 0.40 mmol.g^{-1}.

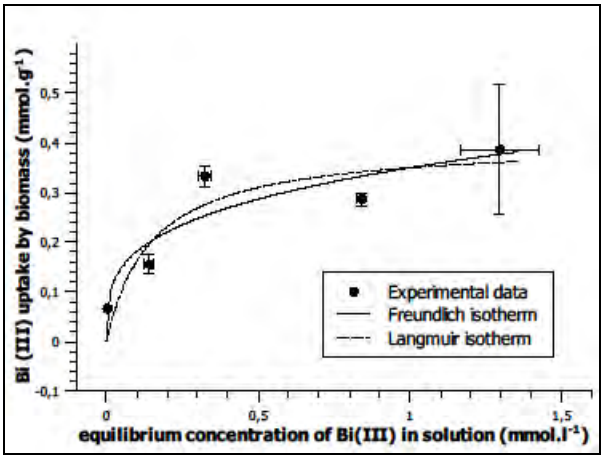

Fig.1: Biosorption of bismuth(III) onto pelletized fungal biomass of *A. clavatus* described by Langmuir and Freundlich isotherm

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THE REFINEMENT OF THE MARCASITE (FeS_2) STRUCTURE FROM HERJA (ROMANIA)

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In the present study we used the X-Ray powder diffraction data and the Rietveld method to refine the crystal structure of the marcasite from Herja mine (Maramures county, Romania). The Herja ore deposit is located between Chiuzbaia Valley and Firiza Valley, about 5km NW of Baia Sprie town. This hydrothermal deposit represented by NE-SW oriented veins is located in andesitic eruptions from the Neogene period (Damian, 2003).

Marcasite is the metastable dimorph of FeS_2, and rapidly inverts to pyrite when heated above 500°C. Minerals with the marcasite structure have the formula AX_2, where A = Fe, Co, Ni, Ru, Os, and X = S, Se, Te, As and Sb. Marcasite is typically formed under low-temperature highly acidic conditions, both in sedimentary environments (shales, limestones, and low rank coals) and in hydrothermal veins formed by ascending solutions.

Marcasite possesses a 6-3 coordination structure. Marcasite, like pyrite, has Fe atoms in octahedral coordination with S, and S atoms tetrahedrally coordinated to three Fe atoms and one S atom. The difference between the marcasite and pyrite structures is found in the linking of the Fe-centered octahedra. In the marcasite structure, Fe-centered octahedra share two edges in planes normal to (001); in pyrite the octahedra are linked at corners (Buerger, 1931; Vaughan and Craig, 1978).

The Rietveld refinements were carried out using the computer program Diffrac^{plus} TOPAS 4.1 (Bruker-AXS GmbH). For the fit of the peaks has been used pseudo-Voigt profile function. Rietveld refinement using X-Ray powder diffraction data of marcasite sample in the space group *Pnnm* (No.62) (Hahn, 2005): a=4.462Å, b=5.423Å, c=3.302Å, Z=4, cry size L=9948.7nm, cry density (g/cm^3)=4,987, Rwp=5.51, Rexp=5.03, Rp=4.26, confirm the basic marcasite structure. The figures of merit (Young, 1996; Pecharsky and Zavalij, 2009) were: goodness-of-fit GOF=1.10, χ^2=1.21 and Durbin-Watson statistic d=2.18. The atomic positional parameters for the marcasite structure resulted from the Rietveld refinements are presented in the table 1.

Atom	Np	x	y	z	Occ	Beq
Fe	2	0.00000	0.00000	0.00000	1	1.05
S	4	0.20000	0.60926	0.00000	1	1.78

Table 1: Atomic positional parameters for the marcasite structure resulted from the Rietveld refinement.

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THE REFINEMENT OF THE STIBNITE (Sb_2S_3) STRUCTURE FROM HERJA (ROMANIA)

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In the present study we used the X-Ray powder diffraction data and the Rietveld method to refine the crystal structure of the stibnite from Herja mine (Maramures county, Romania). This old mine has been producing some of the world's finest well crystallized specimens for over a century. The mine is located near to the small village of Chiuzbaia, 7 km east-north-east of Baia Mare. It is for the first time when is made the Rietveld refinement of the stibnite crystals from Herja. The paper provides a new set of the unit cell parameters and fractional coordinates that define the stibnite structure.

The stibnite crystals shaped like slender prisms there are often striated and or parallel lines on crystal surface or cleavage faces. Where one twin plane bends the crystal one direction and another twin plane bends it in the other direction. The quality of the stibnite sample was good, this being composed only of crystals stibnite.

Stibnite is the most common and widespread antimony minerals, and is one of the end terms of the stibnite-bismuthinite isomorph series, crystallized in the orthorhombic system. The stibnite structure consists of $[Sb_4S_6]_n$ chains parallel to the *c* axis. Each antimony atom within a chain is coordinated by five sulfur atoms forming a square pyramid (Scavnicar, 1960).

The Rietveld refinements were carried out using the computer program Diffrac^{plus} TOPAS 4.1 (Bruker-AXS GmbH). For the fit of the peaks has been used pseudo-Voigt profile function. Rietveld refinement using X-Ray powder diffraction data of stibnite sample in the space group *Pnma* (No.62) (Hahn, 2005): *a*=11.307Å, *b*=3.833Å, *c*=11.217Å, *Z*=4, cry size L=160nm, cry density (g/cm^3)=4.64, (2-sigma=0.016), Rwp=9.68, Rexp=8.13, Rp=10.01, confirm the basic stibnite structure. The figures of merit (Young, 1996; Pecharsky and Zavalij, 2009) were: goodness-of-fit GOF=1.19, χ^2=1.41 and the Durbin-Watson statistic *d*=2.16. The Durbin-Watson statistic "d" was recommended by Hill and Flack (1987) and it is intended to reveal serial correlation between the successive y_i values. The ideal value for it is 2.00, and it can be a useful indicator of the quality of the fit of the calculated Bragg reflection profile functions to the actual observed profiles (Young, 1996). The atomic positional parameters for the stibnite structure resulted from the Rietveld refinements are presented in the table 1.

Atom	Np	x	y	z	Occ	Beq	2-sigma
Sb1	4	0.47387	0.25000	0.31696	1	1.4718	0.0154
Sb2	4	0.34335	0.75000	0.03043	1	1.5862	0.0674
S1	4	0.28649	0.25000	0.21739	1	1.6061	0.0367
S2	4	0.54681	0.75000	0.14126	1	1.6840	0.0155
S3	4	0.37225	0.75000	0.45577	1	1.3476	0.0316

Table 1: Atomic positional parameters for the stibnite structure resulted from the Rietveld refinement.

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STRESS AND STRAIN STATE SOUTH-EAST UKRAINIAN CARPATHIANS (BY JOINTS AND SLICKENSIDES RESEARCH)

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The areas of the investigations are located in the Boryslav–Pokuttya nappe of the Ukrainian Carpathians foredeep and the Skyba nappe of the Ukrainian Carpathians. The research was carried out at natural outcrops, located in the stream and the river beds along the valley of the Cheremosh river (near the city Vyzhnyca) and in the valley of the Putyla river (city Putyla).

The objectives of this work are to determinate the main stress axes (compression σ_1, tension σ_3) during the Paleocene–Miocene and to connect these results with the construction of the balanced cross-section in this region.

The applied methods (analysis of joints and slickensides) are described in detail in works of Gintov 2005, Gintov et al. 2011. The orientations of joints, slickensides and beding were measured at each outcrop along the profile in the flysch formations from the Cretaceous to the Miocene. 95% of joints are perpendicular to stratum.

We can determine four main stress axes in this strata such as: meridional – σ_1=180-190°, carpathian – σ_1=190-255°, latitudinal – σ_1=255-285°, anticarpathian – σ_1=285-345°. The typical feature is that, these stress fields are common for all layers from the youngest (Miocene) to the oldest (Upper Cretaceous). It is determined by the joints and the slikensides as well.

But it is hard to set the age sequence how the stress axes were changing.

The change is related to development of the fold-and-thrust Carpathian belt and shows all main stages of it development starting from Cretaceous to Neogene in such order: 1. meridian, 2.carpathian, 3.latitudinal, 4.anticarpathian (Matenco 2000).

The evidence of four axes of stress in all layers shows that they were repeating in time, but hadn't much influence on structure of Carpathians.

These facts let us conclude that the layers of Boryslav-Pokuttya and Skyba nappes were situated horizontally during the action of stress fields and were deformed after Miocene, and after that joints weren't formed.

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THE DISTRIBUTION OF RAINFALL AND HYDROLOGICAL PROPERTIES OF SOILS IN RECLAIMED AND UNRECLAIMED SITES AFTER BROWN-COAL MINING

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For permanent natural catchment area that have reached the stage of dynamic equilibrim, the vegetation cover was developed hydrological process usually known and identified before any monitoring concept. For newly anthropogenic ecosystems are not recorded from the development experience of the hydrological process, yet (Mazur et al 2011).

The study was focused in unreclaimed and reclaimed sites (20-30 years old) followed between years 2008 to 2012. Distribution of rainfall and hydrological properties of soil were monitored on large post-mining sites on Velka podkrusnohorska spoil heap near Sokolov city (Czech Republic).

The spoil heap occupies 1957 ha and has an average altitude of 600 m a.s.l. Most of the spoil material in this heap consists of alkaline (pH 8) tertiary clay and It may have an unusual texture and a high content of heavy metals, and it may also be hydrophobic (Kribek et al 1998, Kuraz et al. 2012).

Sites were reclaimed by the planting of tree in plantations (*Alnus glutinosa*). Unreclaimed sites had been spontaneously colonized by some mix pioneer tree species (*Salix caprea, Betula pendula*) in two repetition. The surfaces of the unreclaimed sites have a wave-like character created by heaping, and three microhabitats were designated within each study area according to their location on the wave: T, B, and S refer to the top, bottom, and side of the wave (Frouz et al. 2008).

Distribution of rainfall included throughfall precipitation, surface and subsurface runoff and flow water the tree trunk. Increased supply of throughfall rainfall recored on reclamation site with *Alnus*, which had less involvement tree crown and lower value of LAI. The rest of rainfall was involved to herb layer and soil system (Dvorščík 2012).

Subsurface runoff was monitored by gravitional lysimeters in the observed depth in 15 cm. was recorded the highest in site of reclaimed with *Adler*, again. Some results showed the effect of pouring techniques spoil heap, selected local trees and soil development. Surface runoff at any of the surveyed sites were reported.

The water flow after the trre trunk was dependent on wood species, circumference and surface on the trunk, numbers and density of branchces and numbers of trees per ha. Reclaimed sites which have similar characteristics of trees above ground as unreclaimed sites have a higher intake of water after the tree trunk to the tree roots.

It sufficient amount of repetition with soil hydrological properties and establish the balance of the rainfall will be possible to determine the overall balance of subsurface soil water and use and landscape management (Li and Shao 2006).

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LITHOLOGIC-PETROGRAPHIC ANISOTROPY OF RESERVOIR ROCKS IN KAZANSK HYDROCARBON DEPOSIT

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Anisotropy factor is fundamental in updating the essential geological structural alteration of oil-field reservoir rocks. Numerous publications of the last few years [1, 2, 3, 4, 5, 6] have highlighted such a fact as the intrinsic heterogeneity of horizontal permeability.

Kazansk oil-gas condensate field is located in the southern area of Tomsk Oblast, where a number of oil-gas deposits have been discovered. According to the petroliferous zoning, this deposit is located in the south-eastern part of the Western Siberian province within Vasugan oil-gas bearing region. The commerical hydrocarbon potential is associated with Upper and Lower Cretaceous and Jurassic terrigenous sediments and pre-Jurassic basement sediments at the depth interval of 1200 to 3200m. The most productive deposit is within the Upper Jurassic oil-bearing complex. The investigation of the sediments was based on the data from one of the Kazansk oil-field wells. More than 70 meters of core samples were described, 16 rock samples of thin reservoir sandstone sections from U_1^1 and U_1^2 layers were studied in details. The core sampling depth embraced 2481.3-2511.2 m.

The sampling examination involved several stages. All investigated samples were preliminarily oriented by the paleomagnetic method determining the northward direction during rock formation. Sample facies included the structure classification of sandstone reservoirs in respect to the sample volumetric range of oriented cores. Parallel studies of the mineral composition and rock structure-texture features in thin sections were conducted.

The grading test data of thin sections was another effective factor in further dissection. Such statistic parameters of obtained samplings highlighted definite information about the depositional environment, such as, source transportation processes and the source area itself, tectonic conditions, basin-bed features and environmental dynamics. Based on specific granulometric parameters the genetic classification of sandstones was differentiated through the following diagrams: Rukhin's dynamics, Rozhkov's dynamogenetics, Passek's genetics and Gostintsev's genetics.

The next stage involved the measurement of thin sections from paleomagnetic oriented cores. These measurements indicated the following fact: preferred orientation of elongated quartz grains and rose-diagrams of their distribution. It was established that most of the terrigenous quartz grains in the thin sections have a north-eastward orientation or near to this orientation. Further rose-diagram plotting based on obtained measurements of studied magnetic rock characteristics and their correlation to the distribution rose-diagrams of elongated rock grains showed precise result repeatability. This fact also demonstrated the presence of anisotropic components in the studied reservoir sandstone layers. Based on the above-mentioned results the sandstone formations in studied suite are anisotropic. The fact that filtration of the water pumped into injection wells will flow at various velocities and in different directions should be considered in plotting the field strata model. Thus, the existence of anisotropy in reservoirs benefits the pattern optimization of injection and production wells, as well as, the monitoring of enhanced oil recovery operations.

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PETROPHYSICAL PARAMETERS OF DIKES AND THEIR FORMATION CONDITIONS (CRIMEA, UKRAINE)

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The aim of our research was classification of magmatic associations based on the conditions of their formation and relative age as a result of petrophysical measurements. Volcanic rocks of Bodrak complex were investigated. We tried to define how physical properties reflect conditions of rocks formation and chemical composition of dikes.

The Bodrak complex includes dikes and small intrusive bodies (tens of meters) that are interbedded into flysh sediments of Middle Jurassic age (Tavriyska, Eskeordynska suites). Spiridonov et al. (1990) established 4 phases of emplacement. The first phase is represented by basalts; the second phase is represented by olivine basalts, dolerite basalts; the third phase is represented by leucocratic hypersthene basalts, dolerite basalts; the fourth phase is represented by hornblende andesites, dacites, brekccias of andezite lavas. 33 oriented samples of dikes were taken near the village Trudolubivka (Bakhchisarai district, Crimea, Ukraine).

Following physical properties were measured: 1. Velocity of primary waves (Vp, m/s) and shear waves (Vs, m/s) (measured on KERN- 4 device, created in Taras Shevchenko National University of Kyiv). 2. Magnetic susceptibility (æ, 10^{-6} units SI) (measured on KLY – 2 kappabridge, (Geofyzika Czech Republic)) and frequency dependence of æ (measured on MS – 2 Susceptimeter with MS-2B sensor (Bartington instruments Ltd, Great Britain); æ(HF) – measured on high frequency range, æ(LF) – measured on low frequency range; $æ_{fd}$ = (æ(LF) - æ(HF))*100%/ æ(LF)). 3. Natural remanent magnetization (In) its inclination and declination, Koenigsberger ratio (Q). (measured by astatic magnetometer, LAM – 24, (Geofyzika Czech Republic)). 4. Dependence of magnetic susceptibility on temperature (æ (t)). 5. Density (ρ, g/cm^3). Also thin sections and polished sections have been analyzed on optical microscope.

According to rock magnetic data obtained by many authors (discussed by Pecherskiy et al. (2001)) æ of magmatic rocks does not significantly depend on iron content, and is controlled by condition of formation. Pecherskiy et al. (2001) show that low-magnetic rocks are formed under conditions of compression and strongly magnetic rocks are formed under the conditions of tension. Strongly magnetic dikes more often lay irregularly with host rocks. Rocks, which contain strongly magnetic dikes are represented by flysh including considerable component of sandstones. They were interbedded with argillaceous flysh. There is an intrusive body on slope of mountain, which is not a dike. Samples of that intrusive body are characterized by large variations of æ so the body is inhomogeneous.

According to Zvyagincev (1978), growth of ratio Vp/Vs indicates formation of rare-earth pegmatites under conditions of compression. Our research shows significant correlation of Vp/Vs with density, unlike reverse correlation in pegmatites. Probably such a difference in correlation corresponds to decreasing of dike density under the conditions of the closed system, when exsolution of gas-liquid phase is not possible and rock becomes more porous. Closed system is created by compression, unlike metasomatic pegmatites, where under conditions of compression porosity decreases.

We obtained, that dikes include primarily large grains of titanomagnetite of first generation with Curie temperature (TC) of 500-550°C and magnetite of the second generation with Curie temperature of 585°C, which grains are small from outer parts of dikes and coarse-grained from central parts of dikes. It was found that in direction from north to south the magnetic susceptibility of dikes decreases and rate of tectonic deformation increases. Division of rocks on phases might be done by comparison between chemical analysis and relative geological location of bodies.

Dike complex was crystallized from the same primary source and simultaneously, because composition of dikes is nearly the same. In lower horizons, the low-magnetic dikes, inter bedded with layers of plastic argillaceous masses, formed under the conditions of the closed systems and more high pressures. Such bodies are called sills. Nearer to the surface magnetite formed as a result of brittle conditions on the last phase of dikes crystallization. Magmatic activity generally corresponds to rock folding.

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PRESENT ACHIEVEMENTS AND NEW DIRECTIONS IN THE INDICATION OF THE CRETACEOUS – PALEOCENE BOUNDARY IN CENTRAL EUROPE

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The Cretaceous – Paleocene boundary has been accurately determined in many places around the world as in El Kef, Tunisia (Keller et al, 1996), in the Pyrenees (Apellaniz et al, 1997), Caravaca, Spain (Kaiho & Lamold 1999) and many others. Published papers present the results of micropalaeontological analyzes based on occurrence of planktonic and benthic foraminiferids as well as calcareous nannoplankton, ostracodes, dinoflagellates, pollen and plants disputes in deep-sea sediments – pelagic and hemipelagic deposits. However, the most significant were planktonic and benthic foraminiferids, which have also been identified in Husow region of the Skole Unit (Gasinski & Uchman 2009, 2011). On the basis of a very well-preserved and diversified planktonic and benthic foraminiferid species was indicated Abathomphalus mayaroensis Zone and the interval of the Cretaceous – Paleocene boundary occurrence was narrowed down to 3 meters. This is a meaningful success, because long-term studies conducted in this topic in the central Europe estimated the Cretaceous – Paleocene boundary to one meter on Moravia based on dinoflagellates (Bubik et al, 2002) and on the basis of foraminifera and calcareous nannoplankton to tens of meters in Romania (Melinte 1999; Chira et al, 2009).

The biggest opportunities in indication of the Cretaceous – Paleocene boundary in central Europe gives the Skole Unit in Polish Outer Carpathians. It is located in unique and worthy of examination issue, namely, is located at the junction of the two important paleobiogeographic domains; Tethyan and Boreal domains where migration of foraminiferids species can be noted. Therefore it is reasonable to putting the questions: is the lateral variation in the cross-section of the Skole basin only a manifestation of migration between basins? What was involved in this differentiation? Biogenic substances, temperature and water circulation or climate change? Why there are benthic foraminiferids dominate lowest Paleogene foraminiferal assemblages and planktonic ones are very scarce or absent? Could have something to do with changes in the level of CCD?

To find answers to these questions are used standard methods in the field, sludging laboratory, computer laboratory and scanning workshop at the Institute of Geological Sciences at the Jagiellonian University in Krakow, Poland. Firstly, field studies are performed in order to reconnaissance of the studied region, recognition of new assemblages and their documentation, indication of the GPS position, preparation of lithological columns, sampling and marking on the profiles the position of samples. Collected samples are subjected to mechanical disintegration using liquid nitrogen, sludging on the sieves, preparation of foraminiferids in the microscope laboratory. Rock disintegration with liquid nitrogen is a new method (Remin et al, 2012) which gains increasing popularity in micropalaeontological laboratories. It allows to reduce the disintegration time up to two hours. Selected foraminiferids especially index specimens are analyzed and documented using scanning electron microscope (SEM). However, the scope of research in the computer laboratory is processing of the photographs, preparation of detailed lithostratigraphical profiles and statistical analysis.

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THE CRETACEOUS – PALEOCENE BOUNDARY OF THE SKOLE UNIT OF THE PRZEMYSKIE FOOTHILLS BASED ON MICROPALAEONTOLOGICAL STUDIES

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The project includes thematically one of the largest and most significant mass extinction in Earth's history – the Cretaceous – Paleocene mass extinction, and it involves the studies of the Skole Unit that is poorly recognized in terms of biostratigraphy and palaeoecology and the Cretaceous – Paleocene boundary has not been precisely defined in the region. Mainly for the reason, that the basis of precise dating in biostratigraphy are planktonic foraminiferids. However, the deposits of Flysch Carpathians are dominated in benthic forms that are significant tool in palaeoenvironmental interpretations and analysis of lateral distribution of foraminiferal assemblages in the basin. The presence of well-preserved and varied species of planktonic and benthic foraminiferids was confirmed by recent findings in the Skole Unit (Gasinski & Uchman 2009, 2011). It should be mentioned that in the older literature analyses of foraminiferal assemblages, biostratigraphical zonation and palaeoecological meaning were very scarce. The above information as well as carried out samples gives a high possibility of success of this research project on several levels:

- precise indication of Cretaceous – Paleocene boundary in the Skole Unit;
- implementation of a detailed micro-palaeontological analysis based on planktonic and benthic foraminiferid associations;
- the palaeoecological and biostratigraphic analysis of Cretaceous – Paleocene deposits and interpretation of palaeoenvironmental and microfaunistic changes before and after Late Cretaceous extinction;
- correlation of regional biostratigraphic biozones with the standard biozonation and comparison with other assemblages within Skole Unit basin and adjacent basins.

The studies are conducted using methods in the field, sludging laboratory (disintegration using Glauber's salt and liquid nitrogen), computer laboratory and scanning workshop. The basic researches are field studies carried out in the western part of the Przemyskie Foothills in the Skole Unit between localities of Dynow – Krzywcza – Bircza – Temeszow with a total area of approximately 700km^2.

The project gives the possibility to present the first comprehensive analysis of foraminiferids microfauna and complex correlation within the Skole basin and adjacent basins as well as establish biostratigraphic local zonation and execution of palaeoenvironmental analysis. However, one of the continuing of the most innovative aspects of the studies is implementation of foraminiferid associations lateral variability analysis depending on the Skole basin paleobathymetry.

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PALEOSTRESS ANALYSIS OF MOLDANUBIAN ROCKS FROM JIHLAVA AREA

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The tectonic events are one of the basic processes which generate a form of geological bodies. The faults are created by stress that can lead to a brittle failure that cause formation of fault plain, supposing the solid rock. A large number of faults can be faund in the Bohemian Massif.

My bachelor thesis focused on a part of the Moldanubicum around the town of Jihlava. The area under study belongs to two sub-units of the Moldanubicum. The southern part was located in the Moravian Moldanubicum and the nothern part was in the Strážek Moladanubicum. The Varied Group dominate in rock composition. There are amphibolite, serpentinite, marble etc. Different types of paragneisses represent the Monotonous Group. This area include a part of the Variscan Central Moldanubian Pluton, which is composed of the Eisgarn granite, where the most frequent variety is the Mrákotín type. The Jihlava pyroxene-biotite syenite pluton and the Třebíč amphibole-biotite syenite pluton were intruded to this area. The main tectonic structure of the area of study is the Přibyslav Mylonite Zone striking in NNE-SSW direction.

More than 100 fault-slip data were picked up during fieldwork. Overall 29 localities were documented: 18 inactive quarries, 6 active quarries and 5 exposures in the rock cut (road or cycle path). Dip azimuth and dip of fault surphace as well as trend and plunge of striation were measured by Freiberg geological compass. Sense of movement was determined according to kinematic indicators (asymetric elevations, trailed grains, crystal fibers etc.). It was also necessary to determine the relative age of the fault if possible to do so in the field. The relative age can be determined if there are more than one lineations on the fault plain.

The fault-slip data were processed by using the MARK software (Kernstocková 2012) and plotted in diagrams using the software Spheristat 2.2. The main normal-stress directions (σ_1, σ_2, σ_3) were calculated by using the fault-slip data in MARK software. According to the identified stress directions 4 stress phases were defined (fig. 1).

In the phase number 1, there is no any main normal stress direction in the vertical position. This phase may activated the sinistral normal faults or the dextral slip faults; the vertical associated dykes with SW-NE orientation may be formed too. In the second phase, the main normal stress σ_3 is nearly vertical. It may activate reverse faults or dextral reverse faults and it may form almost horizontal dykes striking in SE-NW orientation and inclined to E. The third phase has the main normal stress σ_1 nearly vertical. It may activate normal faults and almost horizontal dykes with SSW-NNE strike. In the fourth phase, no main normal stress is vertical. It may activate the dextral normal faults and associated dykes with N-S strike and with inclination to W. The relative age of phases isn't clearly identified.

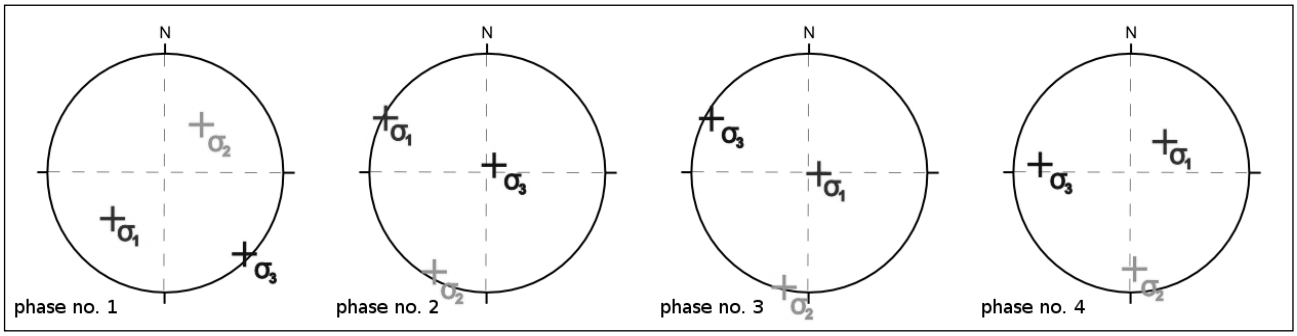

Fig. 1: Identified phases, modified output from MARK.

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ENGINEERING GEOLOGICAL FEATURES OF THE HOST ROCKS IN LUBAVINSKOE GOLD DEPOSIT (TRANSBAIKALIA)

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Baikal - one of the oldest mining provinces for more than 300 years. It's still the largest source of major mineral resources of Russia - gold, tin, tungsten, molybdenum, lead, zinc, rare metals, fluorite, etc. (Spiridonov, 2006). One of the oldest objects of gold mining in Transbaikalia is Lyubavinskoe field (Bindeman, 1968). Now in order to develop this field conducted exploration work including geological engineering investigations.

The geological structure of the Lyubavinskoe field involved intrusive (granodiorites) and metasomatic (beresites) rocks of Jurassic age and metamorphic (fillitopodobnye schists) rocks of the Permian-Triassic age. The main purpose of this work is a detailed study of host rock and study of geological, structural and mineralogical factors on their physical and mechanical properties.

Studies have shown that the host rocks of Lyubavinskoe field vary in their genesis, composition, textural and structural features, the degree of fracturing and weathering. The rocks of all three groups have similar density and porosity, but differ in physical and mechanical properties. In particular, the weakest are metamorphic rocks: their strength is on average two times lower than that of magmatic and metasomatic. A similar regularity is observed for the static modulus of resiliency.

Determined, that the main factor influencing the properties of the rocks is their fracture. At the coefficient of fractured voidness identified four varieties of rocks: slight, medium, strong and very strong fractured (Rac and Chernyshev, 1970). With increasing degree of fracturing of rocks from slight to strong fractured their strength and modulus of resiliency decreased by three times. It should be noted that the properties of rock influences also of the orientation of fractures. So subvertical and slightly sloped to core axis fractures do not affect the dynamic resilient properties (they remain high), but reduce the static modulus of resiliency and strength. Analysis of deformation curves showed that the loading of slightly and medium fractured samples dominated resilient deformation, and the deformation strong and very strong fractured rocks are big residual deformations.

Appreciable influence on the properties has a weathering process, reflected in the development of hypergene fractures ferruginization and pelitization feldspars. By weathering, the values of strength properties and modulus of resiliency of granodiorite down at 2-3 times.

In the group of metamorphic rocks important factor, in addition to the degree of fracture, are also textural characteristics of samples, in particular the orientation of the schistosity. Thus, the values of the dynamic modulus of esiliency perpendicular to the schistosityare reduced in some samples up to 60%.

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INFRARED SPECTROSCOPY AND THE STRUCTURE OF HUNTITE-LIKE ALUMINIUM BORATES $RAl_3(BO_3)_4$, WHERE R = Y, CE – YB

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Anhydrous orthoborate crystals $RAl_3(BO_3)_4$ (R = Y, Ce – Yb) with very similar polytype structures have been grown from high-temperature solutions and characterized by infrared spectroscopy in a crystalline state. The dependence of the realized borate space group from the crystal growth conditions and the sort of rare-earth atom was revealed. They can be considered as multifunctional materials having device potential due to their good thermal and chemical stability and a possibility of wide isomorphous substitutions. Most of them belong to the huntite structure type $CaMg_3(CO_3)_4$ with sp. gr. $R32$ (Mills 1962), some of them also have high temperature monoclinic modifications with sp.gr. $C2/c$.

In the structures of both modifications three kinds of coordination polyhedra are present: trigonal prisms for RO_6, octahedra for MO_6, and two types of planar triangular BO_3 groups.

For the B atoms, there are two kinds of coordination in the both structures. In the space group $R32$ (D_3) B(1) atoms have site symmetry D_3, the B(2) atoms in $9e$ have site symmetry C_2. The Cr atoms in $9d$ site sytes are C_2 site symmetry and R atoms on $3a$ sites in D_3 symmetry. In the space group $C2/c$ (C_{2h}) both BO_3 groups have C_1 site symmetry (structure position $8f$). The Cr atoms occupy two structure positions: $4e$ and $8f$ with C_2 and C_1 site symmetry; and R atoms occupy positions $4e$ with C_2 site symmetry.

A comparison of these structures proves their polytypic nature (Belokoneva at al. 1983). In each of them it is possible to distinguish two different types of layers, identical for two modifications. In the rhombohedral polytype layers of the first type with prisms are multiplied around layers of the second type by two-fold axes, whereas in the monoclinic modification by centers of symmetry. Methods of vibrational spectroscopy coupled with factor group analysis were applied in order to understand the peculiarities of structures of the borates $RAl_3(BO_3)_4$.

Factor group analysis for the compounds, crystallizing in the space groups $R32$ and $C2/c$, which are the polytypes with the very similar structures, has been performed. The differences observed in the spectra have been explained by the differences of symmetry.

The assignment for the stretching and bending vibrations of BO_3^{3-} groups and external modes has been made. The external modes include the translational modes of R^{3+}, Cr^{3+}, and BO_3^{3-} ions, and the BO_3^{3-} librations. The dependence of the realized borate space group from the crystal growth conditions and the type of rare-earth atom was revealed. The main differences are observed in the region of asymmetrical stretching vibrations of BO_3^{3-} units. The borates with rare-earth elements Pr – Nd form the monoclinic structures. The borates $SmAl_3(BO_3)_4$ and $TbAl_3(BO_3)_4$ have been obtained in two modifications respective of crystallization temperature. The borates $RAl_3(BO_3)_4$, were R = Y, Gd - Yb crystallize in sp.gr. $R32$. The formation of aluminium borates with large cations La and Ce do not occur.

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GEOLOGIC AND MINERALOGIC PRELIMINARY DATA ON EASTERN SECTOR OF ROŞIA MONTANĂ AU-AG EPITHERMAL DEPOSIT, APUSENI MOUNTAINS, ROMANIA

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Roşia Montană ore deposit is located in the Apuseni Mountains, west-central Romania, in a historical gold mining region known as Golden Quadrilateral. According to Manske et al. (2006) Roşia Montană is the largest gold deposit in Europe with a current identified reserves of ~400 Mt at 1.3 g/t Au and 6 g/t Ag. Roşia Montană is a Neogene maar-diatreme breccia hosted epithermal low to intermediate sulfidation Au-Ag deposit (Leary et al. 2004, Manske et al. 2006, Tămaş 2010). The maar diatreme complex was emplaced into Cretaceous sedimentary rocks (flysch type) and intruded by dacite domes.

Field work (geologic mapping, observations, sampling) was carried out in two underground stopes (Stope 1 and Stope 2) crosscut by the Cătălina Monuleşti adit. Thin and polished sections obtained from the samples have been investigated on polarizing microscope. Thin sections study allowed to certify the rock types and the hydrothermal alterations, while the polished sections facilitated the identification of the ore minerals.

This adit was recently reopened in the frame of archaeological research financed by the Roşia Montană Gold Corporation mining company. The studied area consists of a breccia structure emplaced between two different Cretaceous sedimentary sequences, i.e. massive sandstone and shale.

The breccia is composed of matrix, clasts and minor open spaces. The clasts are rounded to sub-rounded and their size ranges from 5 to 50 cm. Macroscopically three types of lithoclasts have been identified: volcanic (dacite), metamorphic (quartzite) and sedimentary (clay). A carbonized wood fragment (about 10 cm in length) was found. The matrix of the breccia is a fine-grained comminuted rock flour type and its mineralogical composition is similar with the composition of the clasts. The matrix amount is exceeding 50%, the breccia being thus matrix supported. According to the above mentioned characteristics the breccia structure was genetically interpreted as phreatomagmatic type.

The mineralization occurs as veins formed by injection under pressure of hydrothermal fluids into the phreatomagmatic breccia. Hydrothermal breccia pockets and dykes occur on vein strike being mined together with the veins in one stope. In the other stope the mineralization is localized along the contact between phreatomagmatic breccia and the host shales. A clast-supported breccia with sub-angular clasts, up to 5 cm in size, and hydrothermal quartz cement was identified. The cement of the breccia is mineralized with common sulfides and electrum. The host rocks (shales) have been also silicified.

At microscopic scale, two major types of hydrothermal alterations have been observed: 1) silicification and 2) potassic alteration (adularia formation). The ore minerals identified are represented by pyrite, chalcopyrite, tetrahedrite, sphalerite and electrum. Electrum occurs as small irregular grains hosted in quartz and common sulfides (pyrite).

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CENOZOIC BASALTOIDS AS RAW MATERIAL IN PREHISTORY

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A reason for this study is that no prehistoric source of Cenozoic alkaline basaltoids is accurately known in the eastern part of the Central Europe. In the Late Stone Age (Eneolithic) the Cenozoic basaltoids were a significant raw material for production of polished stone industry. The basaltoids present one of the main raw materials in the inventory of the Corded Ware culture in Moravia. Rarely they appear in the Neolithic and later also in the Older Bronze Age. The Hungarian scientists identified a few possible sources of the raw material in the Balaton Highland and in the Little Hungarian Plain by studying the provenance of the basaltoids artefacts (Péterdi 2011, Oláh et al. 2012). Also Přichystal (2009) solves the provenance of the artefacts from basaltoids.

The Cenozoic alkaline basaltoids are very abundant in the eastern part of the Central Europe. They occur mainly in the Czech Republic in the Ohře (Eger) rift, in Lower Silesia (Poland), Central and South Slovakia and in Hungary. Few occurrences are also in North Moravia (Czech Republic) and Burgenland in Austria. There are mostly basanites and nephelinites, less then basalts, phonotephrites and trachybasalts.

Some localities are easily identifiable thanks to the characteristic geochemical composition. More often it is neccessary to use the geochemical as well as mineralogical composition. For this purpose we use the whole-rock chemical analyses. Rock-forming minerals has been studied in thin sections using electrone microprobe. Very often it is not possible to destroy the artefacts, in this cases we have to use the non-destructive methods, e.g. PGAA, portable XRF or non-destructive study of minerals by electrone microprobe.

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MAGMA CHAMBER PROCESSES PRIOR TO THE 2008 AND 2009 ERUPTIONS OF LLAIMA, CHILE

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Llaima volcano in South-Central Chile is one of the most active stratovolcanoes in the Southern volcanic zone of the Andean Cordillera (Naranjo and Moreno 1991, 2005). Tephra of its two most recent eruptions in 2008 and 2009 was studied in order to investigate pre-eruptive magma chamber processes. The main aims were to determine the relative roles of fractional crystallization and magma mixing immediately prior to the eruptions, to assess volatile degassing and derive an estimate of the minimum depth of the shallow magma chamber. Major and minor element compositions of phenocrysts, matrix glasses and melt inclusions were determined with the electron microprobe. Volatiles in matrix glasses and melt inclusions (F, Cl, S and H_2O) were analyzed with electron microprobe and Fourier transform infrared spectroscopy, respectively. The porous glassy basaltic-andesitic tephra particles typically contain 5-15 % phenocrysts. Plagioclase (Rims: An_{58} - An_{83} (2008), An_{61} - An_{88} (2009); Cores: An_{62} - An_{91} (2008), An_{63} - An_{90} (2009)), olivine (Rims: Fo_{77} - $Fo_{80.5}$ (2008), Fo_{77} - Fo_{82} (2009); Cores: Fo_{72} - Fo_{83} (2008), Fo_{71} - Fo_{83} (2009)) and minor Fe-Ti-oxide phases occur. Plagioclase and olivine crystals show both normal and reverse zoning patterns. Reverse zoning is more common among the olivine phenocrysts. The matrix melt and melt inclusion compositions indicate both fractional crystallization and magma mixing as dominant processes, with different subparallel fractionation trends indicating separate evolution of magma batches prior to the mixing. Calculated fractional crystallization paths indicate a greater extent of crystallization than that recorded by the mineral contents of the erupted material. This suggests the remobilization of crystal rich magma batches through replenishment of more primitive magma. The compositional range of melt compositions, the complex zoning patterns of plagioclase, and the abundance of reversely zoned and partly resorbed olivine phenocrysts indicate magma mixing. Especially the occurrence of disequilibrium between some olivine rims and co-existing glasses suggests magma mixing shortly prior to the eruption in 2009. On the other hand, the occurrence of primitive rims on many olivine crystals indicates influx of relatively mafic magma well before the eruptions, and thus replenishment and mixing was probably not the direct trigger of the eruption. Volatile concentrations are in the typical range for basaltic subduction zone volcanism and indicate significant degassing of Cl, minor degassing of F and almost complete degassing of S and H_2O prior to and during the eruptions. Differences in volatile contents of melt inclusions indicate their formation in different depths during progressive crystallization and rise of the magma. H_2O contents indicate a very shallow uppermost magma chamber (shallower than 4 km). These results are in good agreement with other studies of recent eruptions of Llaima volcano (compare De Maisonneuve et al. 2011).

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STABILITY OF BENTONITE COLLOIDS

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Bentonite was chosen as a suitable material for deep geological repository of highly active radioactive waste and spent nuclear fuel, where it should serve as one of engineering barriers. It provides many properties, such as mechanical stability, hydrological isolation, chemical buffering, swelling and radionuclide retardation. However, experiments have shown that during bentonite-water interaction colloids may be formed (Arcos et al., 2003). The colloids may cause a migration of potential contaminants and so the function of bentonite barrier can be negatively affected.

We performed laboratory experiments simulating bentonite colloids formation during interaction of bentonite with water. Amount of sedimented colloidal particles and its time evolution was measured. There was studied effect of bentonite saturation time, concentration of the electrolyte (NaCl), and type of the electrolyte (KCl, $CaCl_2$ and $MgCl_2$). Industrial bentonite SABENIL (Keramost a.s., Czech Republic) was used as test material.

We found that the sedimentation of colloidal particles occurs in two phases (see Fig. 1). Both phases are influenced by bentonite saturation time, and by concentration and type of the electrolyte.

Addition of NaCl cause that the second phase has come earlier compare to simple sedimentation. The higher the concentration of the electrolyte is, the sooner start the second phase.

The start of the second phase is directly proportional to the bentonite saturation time in the case of the addition of NaCl, and inversely proportional to bentonite saturation time in case of free sedimentation with no additives.

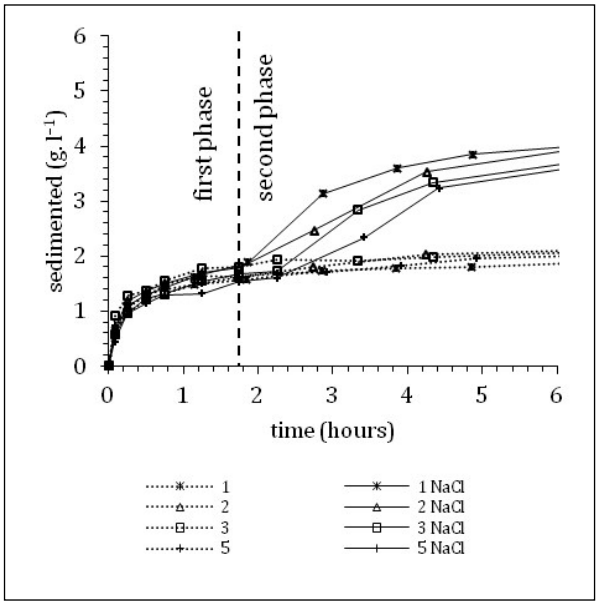

Fig. 1: Amount of sedimented bentonite particles in dependence of time. The start of the second phase of sedimetnation for sample with addition of NaCl is marked with vertical dashed line.

Addition of KCl or $MgCl_2$ causes even earlier start of the second phase than NaCl. The effect of $CaCl_2$ is the same as that of NaCl.

Our very recent experiments showed that there are actually more than two phases of sedimentation. This is related to layers formed during sedimentation. Those layers have different density and particle size. The particle size distribution in those layers will be presented as well.

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HETEROGENEOUS MOLDAVITES FROM THE CENTRAL EUROPEAN STREWN FIELD

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Moldavites, i.e., Central European tektites (CETs), occur on localities in Southern Bohemia, Western Moravia and Cheb area in the Czech Republic, in Lusatia (Germany), and in the Horn area in Austria (Trnka and Houzar 2002). Based on their occurrence, chemical composition and age, moldavites are interpreted as a product of the Ries impact event 14–15 Ma ago (Di Vincenzo and Skála 2009). Several authors have shown that CETs were produced from the Tertiary sediments that covered the surface of the Ries impact site and consist of sands, marly sands, carbonate and clays. The Muong Nong type tektite (MNT) is one of the three commonly distiguished tektite types (the others are splash form and aerodynamically shaped tektites). MNTs have been named after the village in Laos where they have been found first (Lacroix 1935). MNTs are often layered and generally larger than other tektite types. Typical feature of MNTs is their high structural and chemical heterogeneity, which is usually expressed as an alternation of light and dark layers. Other characteristic features of MNTs are the high porosity (which is much higher than in other types of tektites) and substantially elevated content of mineral inclusion (Koeberl 1992).

The occurence of the Muong Nong type tektites among moldavites has been intensively debated. Muong Nong type moldavites (MNMs) have been found only in south Bohemian region so far. MNMs studied in this work were found in the vicinity of Slávče, Besednice, Dobrkovská Lhotka and Veselí n. Lužnicí villages. MNMs as well as MNTs are characterized by high structural and chemical heterogenity (they have wider range in composition than splash form type moldavites – SFMs). Much more lechatelierite inclusions and bubbles occur in this type of moldavites compared to SFMs. They are more often dark in color, e.g., brown-black, dark brown, brown-green or yellowish brown in contrary to SFMs, which have lighter shades of green color. Similarly to the MNTs, some MNMs consist of varied layers or glass – more compact and more porous. The more porous layers are less resistant to weathering and therefore moldavites which contain this type of glass are rare. The MNMs are in average enriched in TiO_2, Al_2O_3, FeO, Na_2O and K_2O and depleted in CaO and MgO compared to the SFMs. The high heterogeneity of Muong Nong type moldavites is manifested by the existence of domains extremely rich in CaO (up to 17 wt. %), Al_2O_3 (18 wt. %), MgO (over 5 wt. %) or FeO (5.7 wt. %). The more porous layers have higher content of SiO_2, TiO_2, Al_2O_3, FeO, K_2O and Na_2O and are depleted in MgO and CaO with respect to the more compact layers. The MNTs as well as their analogues among moldavites, contain inclusions of relict minerals or products of their thermal decomposition. MNMs contain Zr oxides, which formed during the thermal decomposition of zircon. These phases are present in the form of granular aggregates. One of these inclusions was identified as baddeleyite. Relict apatite and monazite were found as well. They were enclosed in lechatelierite grains where they were probably prevented from total dissolution into the melt due to the high viscosity of lechatelierite.

It is supposed that moldavites originated by melting of an unconsolidated sedimentary precursor consisting predominantly of sand complemented by clays and carbonates and by incomplete mixing of these melted components. The different trends in oxide ratios between individual layers of MNMs (more compact and more porous layers) and their high heterogeneity show much more clearly the variability of source rocks than do the SFMs. The average chemical composition of the MNMs more likely corresponds to the composition of sediments with higher content of clay components, especially in the case of the porous layers. On the other hand, the composition of the SFMs complies with the composition of sediments where clay component waspresent in minor amount.

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THE GEOCHEMICAL AND ISOTOPIC COMPOSITION OF NEOARCHEAN SANUKITOIDS FROM EASTERN KARELIA, BALTIC SHIELD

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There are more than 20 Neoarchean sanukitoid intrusions in the Fenno-Karelian craton (Baltic Shield). They intrude deformed metavolcanic-sedimentary greenstone belts, rarely TTG series. Our study was directed on geochemical and isotopic composition of sanukitoids in the eastern part of the Karelian Province. Sanukitoid intrusions form small bodies along the fault that has NW direction and crosses the boundary between the Neoarchean Central Karelian domain and the Mezoarchean Vodlozero domain. The main geochemical features of the Karelian sanukitoids are given in Table 1. These have high mg# values (Mg/(Mg+Fe)), and high Cr, Ni, LILE, LREE and alkalies concentrations. Such compositions can be obtained by melting of enriched mantle source region. East-Karelian sanukitoids have similar age (2.74 ± 0.02 Ga) (Bibikova et al., 2005) and the initial Nd and Pb isotope compositions: εNd(T) = +1.7 ± 0.4 and μ (238U/204Pb) = 9.2 ± 0.2, that are close to those of DM. Consequently, the enrichment of mantle source region occurred simultaneously with or shortly before its melting. However, some samples of the late intrusive phases have lower values εNd(T) and higher μ that are close to the Upper Crust. Heterogeneity in Nd and Pb isotope composition in separate intrusions or in different magmatic phases can be interpreted by assimilation of older crustal rocks during ascent and fractional crystallization of sanukitoid melts, but this effect is not qualify heir deep source.

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Region	Karelia	Finland	Elmus	Bergaul	Bergaul	Panozero	Panozero	Hizhjarvi	Hizhjarvi
Rock name	TTG av.	Sanuki-toids	qtz mon-zonite	monzo-nite	monzo-granite	monzo-nite	qtz mon-zonite	diorit	qtz sienite
SiO_2, w%	68.5	55-70	61-63	51-54	69-72	53-57	62-66	51-55	61-64.5
mg#	41	45-59	58-63	57-60	48-53	52-56	53-59	56-68	36-43
alk, w%	6	av.7.22	9-9.8	6.7-7.2	7.4-9.2	7.5-10	4.6-9.5	3.3-3.5	9.8-11
Ba, ppm	456	600-1800	2030-2960	824-1113	1300-1780	1300-2800	1250-1880	750-920	1500-2500
Sr, ppm	388	300-1000	1200-1340	912-1060	850-1020	1150-2320	720-1050	920-1300	1300-2500
Nd, ppm	17.4	11-40	88-100	70-100	11.5-37	50-80	25-42	90-114	40-100
εNd (2.74Ga)	-10-+1.4	-2.2-+2.1	+1.3-+2.1	+1.6	-4.6-+1.2	+1.4-+1.9	+1.2-+2	+1.9-+2	+1.2-+2.1
μ (238U/204Pb)	> 10.2	> 10	9-9.9	n.d.	12.1	9-9.9	9.5, 11	9	9.4

Table 1: The main characteristics Eastern Karelian sanukitoid intrusions combined after Lobach-Zhuchenko et al., 2005; Kovalenko et al., 2005; Larionova et al., 2007 and new data. The compositions of the Karelian TTG (unpublished data) and Finland sanukitoids (Heilimo, 2011) given for comparison.

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THE INFLUENCE OF GEOMAGNETIC FIELD ON THE ORIGINS AND EVOLUTION OF LIFE ON EARTH

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Earth is an inner planet of the Solar System, similar to its two closest neighbours, Venus and Mars. However unlike them it has an oxidising atmosphere with well-developed ozone layer and relatively stable temperature on the surface. But the feature that differs Earth from its neighbours is its unique geomagnetic field. Currently it is assumed that Earth's geomagnetic field is maintained by a so-called self-inducting dynamo (Stanley & Cowley, 1996). According to this theory, at the beginning of its existence, Earth did not have a magnetic field (Clark, 1979), but before an appearance of life on Earth, about 3,5 billion years ago, it had appeared.

The influence of geomagnetic field on the formation of life on Earth was twofold: 1) direct, that is a protection from the solar wind and cosmic rays and 2) indirect, by protecting an atmosphere and thus maintaining relatively stable environmental parameters. In addition, the magnetic field prevented lighter gases (e.g. oxygen and nitrogen) from being blown out of an atmosphere and enabled the development of the protective ozone layer. Both of these changes have enabled the development of aerobic life (Rao, 1980).

The geomagnetic field was also a factor, to which a life on Earth had adapt to. It is proven that magnetic field regulates metabolism of the cells and transport through cell membranes. In more complex organisms magnetic fields also have an impact on physiological processes of entire tissues and systems. Most, if not all, organisms not only adapted their physiology to the presence of the geomagnetic field, but also learnt to use it as a source of information. The ability of magnetotaxis and magnetonavigation may indicate that magnetoreception is a very early achievement of evolution. To that assumption leads the fact, that the ability of magnetotaxis and magneto-navigation is displayed even by the simplest organisms such as bacteria and protozoa (Maratea & Blakemore, 1981).

The ability of magnetonavigation is popular also among higher organisms (arthropods and vertebrates) which, thanks to the various structures, such as magnetosomes or cryptochromes, have an ability to "view" the force lines of the geomagnetic field (Foley et al., 2010). Also the geomagnetic navigation can take more complex forms (Wiltschko & Wiltschko, 2006). Numerous research on sea turtles, Caribbean spiny lobsters or sparrows shown that magnetic navigation is congenital (Boles & Lohmann 2003; Vaha et al. 2008; Thorup et al. 2007). Of course, it is possible that the similarity of both structures and mechanisms is only the result of the converged evolution, but it is more likely that at least in some part they have a common origin.

As numerous studies have shown, the geomagnetic field is variable in long periods of time. Most of involved changes is relatively small and rather slow. However, there are also changes to a much greater extent, such as whether rapid changes in the magnetic poles or disorders resulting from the individual events affecting the internal structure of the planet (great cosmic collisions). There is a theoretical possibility that when poles change places, geomagnetic field significantly weakens, or even periodically fades, which can produce both positive and negative effects (Glassmeier & Vogt, 2010). The lack of magnetic shield can lead to disturbances in the atmosphere by increasing the number of particles of the solar wind and cosmic radiation reaching Earth's surface thus causing a significant climate change. Increase of radiation may also result in increased frequency of mutations, not only negative, but also positive, which can affect the pace of the evolution. This would have forced us to change our thinking about the pace and the mechanisms governing the evolution of life on Earth.

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THE SIBERIAN TRAPS: NEW CONSTRAINTS ON DURATION, RATE OF VOLCANISM AND MAGNETOSTRATIGRAPHIC CORRELATION BASED ON A NEW HIGH DETAILED PALEOMAGNETIC DATA

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The Siberian traps represent one of the largest igneous provinces over the world and numerous researchers link their formation with the greatest mass extinction in the Earth history, which have taken place at the Permian-Triassic boundary. However if the emplacement of the Siberian traps occurred more or less evenly, then, taking into account their volume and duration values, the mean eruption rate can be estimated as 2-5 sq.km/year. This is compatible with the rate of basalts production in the modern middle oceanic ridges and several times less than it was in a range of historical volcanic eruptions. This casts some doubts on the possibility of causal link between the Siberian traps and P-T mass extinction.

However, there are no much reasons to believe that eruption of the traps may have occurred gradually. On the contrary, we can expect that trap emplacement may have taken place in form of volcanic pulses occurred during pretty short time intervals, as it was shown, for example for Deccan traps (Chenet et al. 2008).

To check the existence of such the pulses during the Siberian trap formation and in order to get some time constraints on eruption activity we have undertaken a detailed paleomagnetic study of several important trap volcanic sections located in the Norilsk and Maymecha-Kotuy areas (Northern Siberia). Obtained results indicate that the most if not overwhelming part of volcanic piles of the Norilsk and Maymecha-Kotuy regions has been formed during limited number of volcanic pulses and individual eruptions. In particular, for consolidated Kotuy section our calculations reveal 17 directional groups and 13 individual directions, for Norilsk section – 23 directional groups and 12 individual directions (the technique is described in Chenet et al. 2008). Taking into account rather conservative time constraints this implies that duration of the volcanic activity when the composite Kotuy and Norilsk sections may have been formed do not exceed time interval of order of 10 000 years. This estimation does not include the quiescence periods, separating volcanic pulses (correspond to directional groups) and individual eruptions.

Our study confirms the occurrence of thick transitional and excursional intervals in sections of the Norilsk region, suggested earlier (Heunemann et al. 2004; Gurevitch et al. 2004). This observation indicates that at least one quarter of the whole Norilsk region volcanic sequence may have been formed during a relatively short time interval over the time of a reversal of the geomagnetic field, i.e. within several tens of thousands years and even faster. Tracing of the transitional interval through the Kharaelakh, Norilsk and Imangdin troughs implies that more than 1000 cubic km have been erupted during only several volcanic pulses and individual eruptions.

The results obtained in this study allow us to calculate the refined Siberian Permian-Triassic paleomagnetic pole based on data from volcanic flows only. Its coordinates and statistic parameters are following: Plat = 54.2, Plong = 147.2; A95= 4.7, K = 18.6, N = 53.

Our results evidence for geomagnetic field variations at the Permian-Triassic boundary were the same as during the Late Cenozoic. We suggest that the paleosecular variations, recorded in the Kotuy consolidated section, are not sufficiently averaged that may be a consequence of a relatively short (less than 10 000 years) time of formation of this section.

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PALEOMAGNETIC EVIDENCE FOR THE LARGE SCALE MESOZOIC REMAGNETIZATION EVENT IN THE FENNOSCANDIAN SHIELD (THE KOLA PENINSULA)

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The Kola alkaline province of the Devonian age is well known due to large plutons, such as Khibina and Lovozero. Also there are a numerous dolerite and alkaline dykes, which are widely spread on a large area of Kola Peninsula. Geochemistry and petrography of these dykes are studied very well; some of them are dated by Ar/Ar and Rb-Sr methods and the ages belong to 390-360 Ma time interval. It is important, that we don't know any evidences of any post-Devonian tectono-magmatic activity within this region. Therefore the described Devonian dykes are very perspective object for detailed paleomagnetic researches with the main goal to obtain the Devonian paleomagnetic pole (or, at best, the range of poles) for Fennoscandian shield. During last three years we have studied 74 Devonian dykes within the northern, western, southern and central parts of the Kola Peninsula. More than 1600 oriented samples were collected and studied in the key paleomagnetic labs of Russia (MSU, IPE RAS, GIN RAS) and the US (MIT) according to modern technique with using the newest equipment. The ChRM component of the Devonian age was found in a part of dykes (slat=68, slong=32.7, N=12, D=63.7, I=7.3, K=10.3, α95=14.2). Overwhelming part of the sampled Devonian dykes contains metachronous magnetization component, characterized by high positive inclinations and eastern declinations (N=27, D=72.6, I=84.8, K=26.1, α95=5.2). Corresponding virtual geomagnetic pole lies very close (statistically indistinguishable) to the Early Jurassic paleomagnetic pole of Scania basalts (Bylund and Halvorsen 1993), so we incline to believe in the Jurassic age of selected metachronous component. The following reasons allow us to suggest the chemical nature of this secondary magnetization component: 1) Ar/Ar spectrum, obtained from step-by-step heating of plagioclase from one of the Devonian dykes, does not show any evidences that K-Ar isotopic system could be disturbed after emplacement of this dyke, so we suppose that studied rocks were not reheated more than 200°C (the closure temperature of K-Ar system in plagioclase); 2) microprobe studies reveal the presence of two and more generations of magnetic minerals (mostly titanomagnetites) in the Devonian dykes, often associated with altered primary minerals; 3) in many samples the secondary magnetization component occupies mid-temperature interval of blocking temperatures; 4) in some samples ChRM and secondary components can be separated by convergent of remagnetization circles only; 5) microprobe analysis show that secondary minerals have been produced by low temperature hydrothermal fluids, probably originated from mafic magma enriched by Fe, Co, Ni and Cu. In our report we will also discuss some tectonic models, which can help us to understand the possible sources of discovered remagnetization event. This study was supported by Minobrnauka grant # MK-3383.2012.5 and RFBR grant # 12-05-00216.

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BENTONITE–WATER INTERACTION: CHEMICAL AND MINERALOGICAL COMPOSITION OF B75 BENTONITE AND POREWATER CHEMISTRY

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Bentonites are being investigated as an engineered barrier for a high-level radioactive waste repository because of its favourable physico-chemical properties such as low permeability, high swelling capacity, high plasticity and rheological stability (Fernández and Villar 2010; Karnland 2010).

The main chemical function of the bentonite barrier is to provide a large alkalinity and redox buffer capacity which is generally assumed to be controlled by dissolution–precipitation reactions of the major clay mineral components and accessory minerals of the bentonite, ion exchange reactions at interstitial layers and protonation–deprotonation reactions at clay edge sites (Bruno et al. 1999; Muurinen and Lehikoinen 1999; Acros 2003; Wersin 2003).

Knowledge of the chemical and mineralogical composition of bentonite and porewater chemistry is essential for evaluating the bentonite-water interactions in repository and predicting the behaviour of benonite barrier. The porewater chemistry in bentonites is the result of different interactions occurring in the clay-water system including interactions between water, solutes and clay. For this reason, it is necessary to know the mineralogical and chemical components of the clay system (Fernández et al. 2004).

The objective of this study was to identify the chemical and mineralogical composition of bentonite and describe the solution chemistry and chemical evolution of free water above bentonite and porewater as a result of bentonite-water interactions.

The laboratory tests were performed with the Czech B75 bentonite which is a potential candidate as buffer material for radioactive waste repository. The experiments were carried out at room temperature and bentonite reacted with water in absence of air in a closed system for 6 months. The solid to liquid ratios (S/L) were 1:5, 1:10, 1:15, 1:20, deionized water was used as the solution. At low S/L ratios (1:10, 1:15, 1:20) the free water above bentonite was spontaneously separated. The porewater was extracted by centrifuging at various values of revolutions per minute (5000, 10000, 15000 rpm) for 15 minutes. The impact of S/L ratios and intensity of porewater separation by centrifuging on solution chemistry was studied by measurements of pH, Eh, electrical conductivity and analysis of the key ions: Na^+, K^+, Mg^{2+}, Ca^{2+}. The chemical composition of the bulk bentonite was evaluated based on silicate analysis and the mineralogical composition was analyzed by X-ray diffraction technique.

The results obtained from the XRD analysis showed that the main clay minerals of B75 bentonite are montmorillonite and illite. Quartz, calcite, siderite, kaolinite, anatase and ankerite were identified as accessory minerals. The S/L ratio had influence on solution parameters, especially on pH and electrical conductivity, and significantly affected the concentrations of Na^+ and K^+. The impact of porewater separation by centrifuging on solution chemistry was not detected, only concentrations of Na^+ and K^+ slightly varied. The solution chemistry, particularly pH, electrical conductivity and Mg^{2+}, Na^+, K^+ concentrations in free water above bentonite were different compare to porewater.

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INTERACTION OF NANOSCALE ZERO-VALENT IRON PARTICLES WITH WATER

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Nanoscale zero-valent iron (NZVI) particles have been investigated for groundwater remediation and potential to reduce contaminants such as chlorinated hydrocarbons, heavy metals, and other reducible contaminants (Liu et al. 2005; Song and Carraway 2005; Henn and Waddill 2006; Li et al. 2006; Li and Zhang 2007; Wei et al. 2010; Yan et al. 2010).

Compared to microscopic or granular iron applied in permeable reactive barriers, nanoparticles exhibit high reactivity due to high specific surface area (Zhang 2003; Nurmi et al. 2005).

Remediation technology with use of NZVI is based on the reducing activity of iron. Pollutants are destroyed or transformed into less-soluble and less toxic forms and/or adsorbed on or incorporated into the structure of newly formed iron oxyhydroxides.

The mechanism of contaminant removal by NZVI particles is not completely understood. Two major possible removal mechanisms are chemical reduction and physical removal through adsorption and co-precipitation with oxidation products (Noubactep 2008).

For understanding of contaminant removal there is necessary to identify and describe interactions of NZVI particles with water and formation of iron corrosion products. These points are important to treatment of contaminants whose behaviour in aqueous solution is determined by their speciation. The composition of iron corrosion products has influence on surface charge and sorption capability.

The specific objective of this research was experimental study and geochemical modelling of NZVI particles interactions with water. The goal of this study was to investigate the impact of NZVI on solution parameters (pH, Eh), describe interactions of NZVI with water, and identify iron corrosion products. Laboratory experiments demonstrate that the application of NZVI dramatically decreases solution Eh and increases pH values. The trend in pH and Eh showed the two different reaction pathways reflecting different reaction mechanisms of iron corrosion product formation resulting in various proportions of iron oxides and oxyhydroxides. Mineral phases identified in products of NZVI oxidation consist of magnetite (Fe_3O_4), lepidocrocite (γ-FeOOH), and goethite (α-FeOOH). The trend in pH and Eh, the reaction pathway, and the proportions of iron corrosion products are determined by initial pH value which is primarily determined by the amount of NZVI added and is modified by contact with the atmosphere.

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GEOCHEMICAL ANALYSES OF THE HYDROCARBON GASES FROM THE SEDIMENTS CORES RECOVERED FROM THE CENTRAL BARENTS SEA

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In the summer of 2011 was 18 scientific expedition in the framework of the international program «Floating University» of the R / V «Akademik Nikolaj Strakhov» in the Central part of the Barents sea. One of the objectives of the cruise detected and further investigated cold seep related structures. Samples for geochemical analyses were taken from each gravity core. Head-space gas was collected from sediments every 15-20 cm from all lithological types.

Three main areas have been investigated in details: 1) Two salt diapirs located in the Nordkapp and Tiddly basins; 2) the Fedynskii High area; and 3) the area with relatively high concentration of pockmarks to the east of the study area.

1)Seven cores were taken from the top and slopes of salt diapirs. Methane concentration is low (up to 20 µl/l). Homologues up to propane were detected. However, unsaturated homologues predominate over saturated ones, which indicate biogenic origin of the gases.

2)Three gravity cores were taken from the pockmarks at the eastern part of the area. The cores sampled from center, slope and periphery of pockmark. They obtained hemipelagic water-saturated sediments. Hydrocarbon gases consist mainly of methane. Methane concentration increase with depth from 6 µl/l to 29 µl/l. All three cores are characterized by similar background level of methane concentration, indicating absence of any HC migration upwards. Origin of insitu gas proved by presence of unsaturated C2H4 along whole section sampled.

3)Six gravity cores were collected from the different part of the Fedynskii High. Gas from these cores mainly compound from methane. It concentration varies with depth from 5 µl/l to 22 µl/l. In the core (TTR18-AR48G) taken from the NW slope of the Fedynskii High, methane content reaches 67 µl/l at the section interval of 160 cm. Nevertheless ethylene and propylene have been detected in almost all samples. Their clear predominance over saturated homologues indicates biogenic origin of the gas.

As the result no recent HC anomaly (gas seepage) have been found. HC gas mainly consist from methane with low concentrations of ethane and propane. Unsaturated homologues are always predominant over saturated ones. All collected gas can be characterized as insitu biogenic origin gas.

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SERPENTINITES AS RAW MATERIALS FOR POLISHED ARTEFACTS

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Provenance of serpentinite artefacts is very discussed to this day. Serpentinites were used for production of polished stone industry in prehistoric times, especially for production of axes, batters and hammers. Serpentinites rarely occur already in the Neolithic period but a greater extension of utilization can be seen during the Eneolithic, namely for battle-axes connected with the Corded Ware culture. The source of raw material for these battle-axes found in northern Moravia and Czech Silesia is assumed the Gogołów-Jordanów massif in southern Poland (Přichystal and Šebela 1992) but also other serpentinite occurrences around the block of Sowie Góry Mts. (Braszowice-Brźeznica and Szklary massifs) can´t be excluded. From the Gogołów-Jordanów massif are known evidence of exploitation on the hill Jańska Góra from the Funnel Baker culture (Wojciechowski 1983; Wojciechowski 1988). The evidence of exploitation from the Braszowice-Brźeznica and Szklary massifs are unknown. The Gogołów-Jordanów massif is in the vicinity of the mountain Ślęża, which was a popular cult place in prehistoric times and in the Middle Ages (Gediga 1995; Domański 2002). From the vicinity of the Mt. Ślęża is described typological connection to the Ślęża type of battle-axes. These battle-axes were distributed by the Oder river to the northern part of the Moravian Gate and to the vicinity of Opava (Přichystal and Šebela 1992).

The raw material from natural sources of serpentinites were compared with the serpentinite artefacts from several archaeological Neolithic and Eneolithic localities. The comparison was based on mineral composition determined on the thin sections using the electron-microprobe and on a whole-rock chemical composition. It was used nondestructive study of rock-forming minerals on serpentinite artefacts implemented on the electron-microprobe in the Department of Petrology and Geochemistry in Eötvös Loránd University in Budapest and nondestructive determination of major elements and few trace elements using Prompt Gamma Activation Analysis (PGAA) implemented in Institute of Isotopes of Hungarian Academy of Sciences in Budapest.

Special attention was paid to the mentioned Gogołów-Jordanów massif. The samples from this massif were confronted with the serpentinite artefacts from the Neolithic and Eneolithic period. Based on the comparison of Polish serpentinite sources and Neolithic and Eneolithic serpentinite artefacts we can state the serpentinite artefacts from the Corded Ware culture (Eneolithic period) show similar features as serpentinites from the Gogolów-Jordanów massif in southern Poland. In contrary Neolithic serpentinite artefacts show different signs comparing the sources in Poland and their sources are probably not in southern Poland, but their origin should be supposed somewhere else. New results show the possibility of the identical source for the Neolithic artefacts from the different localities in southern Moravia. It seems that the source for the Neolithic artefacts found in southern Moravia is not from southern Poland.

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PREDICTION OF SLOPE DEFORMATION IN CLAY SOILS IN BRNO AREA

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Clays and clay soils has due to its specific properties (plasticity, cohesion, swelling, shrinkage, thixotropy) and particular mechanical behaviour special position in soil mechanics. This particular behaviour reflects soil´s mineralogical composition; main impact is carried out by a presence of expandable clay minerals (Smectites, simultaneously Halloysite or Vermiculite). These soils refer to partly suitable environment for shallow strip-foundations mainly due to the possibilities of volume changes in the sub-ground, manifesting differential settlement of subgrade reaction of buildings. Moisture changes (swelling, shrinkage cracks) reduce ground bearing capacity. Slopes constituted by these soils are endangered of arise of landslides. Because of all these unfavourable properties there is essential need for the best knowledge of physical and mechanical properties of these soils. This text is focused on Neogene clays from Brno area, taking importance to Mohr-Coulomb Model only.

Neogene clays in Brno area are formations belonging to the Carpathian Foredeep Basin. They form common foundation soil in this strongly urbanized area. After excerption of various geological-engineer reports we can characterize clays in Brno by the most frequent values of the physical and mechanical properties (see table 1). Also there were found out anomalous, distant values of these properties. These unexpected values could refer to problematic soil behaviour - mainly in slopes, which can be strongly unstable.

Models of slope stability were created for the verification of the influence of these atypical mechanical values of effective stress parameters ($c´$, $\varphi´$) in comparision with the most frequent values (mode $c´$, $\varphi´$ of Neogene clays) in Brno area. Impact of these parameters on the factor of safety was carried out by FLAC/Slope computer software that works on the basis of the Strength Reduction Method.

The results (see Fig.1) show that special attention should be paid to low values of cohesion $c´$, that show the least stable soils in which shallow slide surfaces originate. Low values of cohesion $c´$ in clay could have reference to old landslide deformation or tectonic movement. The most frequent values of effective shear parameters „mode of $c´$, $\varphi´$", present more steady conditions, arising slide surface is deeper. Low values of angle of friction $\varphi´$ don´t have so radical impact to slope stability, due to high value of cohesion of these clay samples. This cause higher stability of slopes, where arises deep slide surface.

	w	I_p	I_c	ρ	n	S_r	c_u	φ_u	$c´$	$\varphi´$
	[%]	[%]	[-]	[kg.m^{-3}]	[%]	[%]	[kPa]	[°]	[kPa]	[°]
Number of samples	452	385	385	278	226	265	95	95	56	56
Minimum value	9.6	8.78	0.55	1676	31	73	4	0	0	8
Maximum value	48.1	72	1.44	2195	61	100	400	37.6	104	30.8
Mode	34.9	44.1	1	1868	48.5	98.7	63.22	3.6	23.1	17.6
Common extent	30,1-39,0	34,1-55,0	0,81-1,1	1781-1960	44,1-52,0	92,1-100	41-100,0	0,1-10,0	4,0-40,0	10,1-25,0

Table 1: Physical and mechanical properties of Neogene clay in Brno area

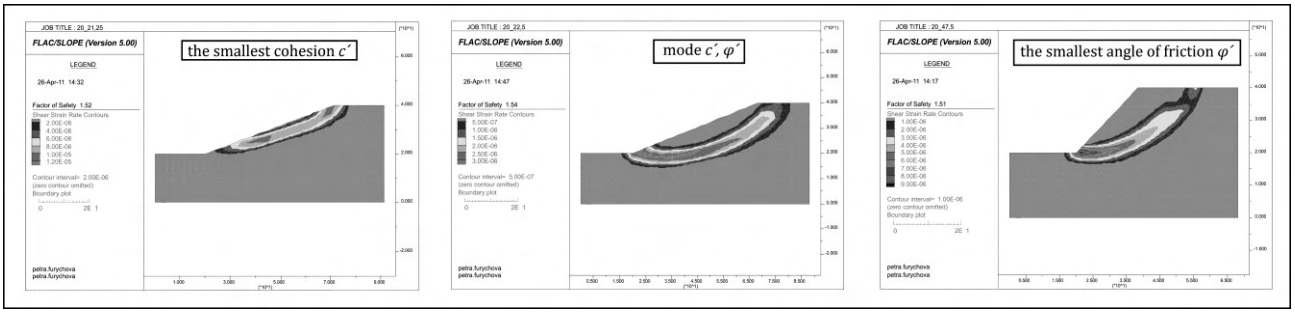

Fig.1: Limiting gradient of slopes (height 20m, factor of safety 1,5): the smallest cohesion $c´$: 21,25°; mode $c´$, $\varphi´$: 22,5°; the smallest angle of friction $\varphi´$: 47,5°

PREPARATION EFFICIENCY, FORAMINIFERA RECOVERY AND PRESERVATION IN FINE-GRAINED DEPOSITS OF TURBIDITE SUCCESSIONS: A COMPARISON OF RESULTS OF GLAUBER'S SALT AND LIQUID NITROGEN ROCK PREPARATION METHODS

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Foraminifera extraction from fine-grained deposits of turbidite successions done with liquid nitrogen and Glauber's Salt methods allows comparison of advantages and disadvantages of both techniques.

A common procedure used for rock disintegration is the repeated freezing and thawing of sample soaked in Glauber's Salt solution [$Na_2SO_4 \times 10H_2O$]. Forming of salt crystals in pores splits the rock into small fractions along surfaces of rock forming particles. Getting a desired grade of rock disintegration can last from several days to several weeks. In the liquid nitrogen method the rock sample is treated with liquid nitrogen (LN_2) and boiling water repetitively (Remin et al., 2012). Ice crystals grow similarly to sodium sulphate while freezing and there is also an effect of a thermal expansion of the rock due to instant change of temperature. It allows extracting microfossils quickly and easily. The time needed for a complete preparation of samples done with both methods has been recorded and subsequently composition of the residuum, particularly the amount and preservation state of foraminifera, have been compared. The investigation has been completed on samples from fine-grained deposits of turbidite successions (Magura Beds, Upper Eocene-Lower Oligocene, Siary unit of Magura Nappe, Polish Carpathians).

The results show that state of foraminifera preservation was not dependent on the applied method. Both Glauber's Salt and LN_2 preparation techniques seem to affect microfossils similarly. The LN_2 method has a significant value though. It enables a better grade of rock disintegration to be obtained and therefore no rock fragments are left undone. With a use of LN_2 total disintegration of a sample can be completed within shorten period of time, in comparison to Glauber's Salt method.

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SELENIUM BIOACCUMULATION IN THE PRESENCE OF MINERAL PHASES AND HUMIC ACIDS

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The selenium mobilized from geological sources as a result of industrial or agricultural activities may be serious threat to ecosystems. Its elevated concentrations may result in toxic effects (Huang et al. 2009). To assess the transfer of selenite into living microbial biomass in the presence of humic acids (HA), amorphous ferric hydrous oxide (FeOx) or/and bentonite, the one, two or three component cultivation systems composed from aforementioned phases and selenite dissolved in culture media (0.21 mmol/L), inoculated with fungal conidia prepared from 7-day old culture of *Aspergillus niger*, were prepared. The fungus was cultivated under laboratory conditions until the stationary growth phase was reached. After 18 day cultivation, the biomass was harvested from culture media and digested prior the analytical procedures. The remaining non-dissolved components (bentonite, FeOx and/or precipitated HA) were separated from the spent media by membrane filtration and after digestion, the selenium concentration was determined in each sample using inductively coupled plasma optical emission spectrometry (ICP-OES). Expect for bentonite, each other component (or their combination) reduced bioavailability of selenium significantly (Fig.1), indicating relative strong influence of HA and FeOx on selenium uptake by fungal biomass. The most efficient component restricting selenium accumulation was complex of FeOx and HA, which reduced absolute selenium content in biomass by 75 %, when compared to control.

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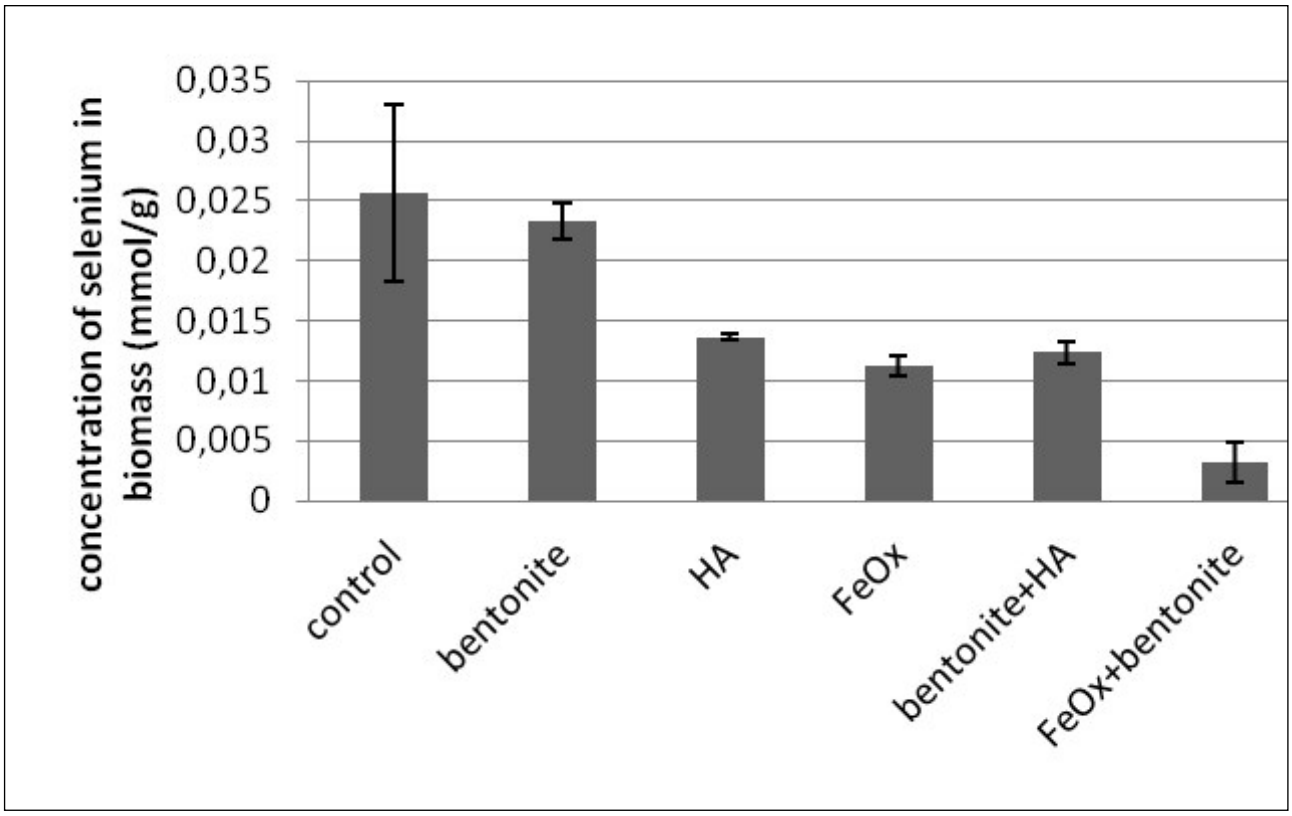

Fig.1: Mean concentration of selenium in biomass of *A. niger* after 18-day cultivation as influenced by the presence of various solid phases, or their combination in culture media, including humic acids (HA), amorphous ferric hydrous oxide (FeOx) and bentonite. Error bars represent standard deviation of experimental data (n=3).

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DEPOSITIONAL HISTORY OF THE AUTOCHTHONOUS PALEOGENE IN THE NESVAČILKA PALEOVALLEY

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This study investigated the thermal maturity of the organic matter in selected boreholes in the Nesvačilka paleovalley. The degrees of coalification expressed as a Rock–Eval pyrolysis peak temperature (Tmax) and random vitrinite reflectance (Rr) were used as calibration parameters for 1D burial models. The Nesvačilka paleovalley is one of the most important oil and gas play in the Czech Republic. Significant accumulations of hydrocarbons can be found in the autochthonous clastic and carbonate formations as well as in the fractured crystalline basement. The sedimentary fill of the canyons ranges from a few hundred meters to more than 1,500m. The coarser clastics, sandstones and conglomerates are distributed mainly in the lower axial part. The overlying mudstones then represent the later phase of abandonment and hemipelagic drape sedimentation (Picha, 2006). Later Jiricek (1994) introduced a new name – the Dambořice group – for the whole autochthonous fill and subdivided it into two formations, keeping the term Nesvačilka Fm for the hemipelagic upper part and Tešany Fm for the turbidity–dominated lower part.

Organic carbon content (TOC), Rock–Eval pyrolysis and random vitrinite reflectance (Rr) measurements were performed in order to determine the thermal maturity of the autochthonous paleogene. The pyrolytic data comprise volatile hydrocarbons S1 (mg HC/g rock), bound hydrocarbons S2 (mg HC/g rock), the peak temperature of the pyrolytic signal Tmax (°C) and the hydrogen index HI (mg HC/g TOC). 100 samples from 20 different wellbores were analyzed altogether. Additional data were collected from drilling reports in the archives (Geofond, MND a.s.). According to the source rock generative potential criteria (Peters 1986) the range of autochthonous paleogene samples is broad, from fair to very good oil and gas prone source rocks. The autochthonous paleogene contains type III and type II–III kerogens according to Espitalie (1986) with a maturity range from immature to oil window. Tmax values varyfrom 416°C to 450°C. Most of the samples examined were rich in terrestrial plant debris with a minor proportion of fluorescing alginite macerals. The hydrogen index (HI) decreased with depth as a result of thermal degradation of organic matter and release of hydrocarbon gases. Burial and erosion history was reconstructed using the Petromod 1D software (Schlumberger). A 1D burial model was applied to each well and calibrated by measured vitrinite reflectance values. 1D modeling combined with GIS interpretation was used for thermal history modeling. A temperature map, using Petromod data about the maximum paleo and recent temperatures at the base and the top of the paleogene fill was created.

Comparison of well logs from the central part of the valley showed that the thickness ratio between Tešany Fm and Bošovice Fm is not similar, but the portion of turbidity of Tešany Fm is lower in the distal part of the valley. Tešany Fm can also be characterized by higher HI values compared to Bošovice Fm. Within the Paleogene and Jurassic intervals evaluated, both the Rr and Tmax parameters showed a continuous increase with depth. This suggests that there was no major erosion or uplift between these two sequences. A shift to an apparent higher thermal maturity was observed in the underlying Paleozoic formations. Results show that the maximum temperature can be found at the base and the top of the autochthonous Paleogene. Maximum paleo-temperature values vary from 100°C to 140°C at the base of the paleogene fill and from 80°C to 110°C at the top of the fill. Recent depth of the intervals evaluated varies from 900m to 3,600m. Temperature differences vary from 40°C to 60°C. This indicates that within the paleogene–recent time interval about 2,000m of deposits were eroded. Significantly higher temperature differences are in the central part and in lateral valleys, which passes into a central depression.

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LITHOLOGICAL AND PALYNOLOGICAL SUBDIVISIONS OF BUG SUITE OF LVIV-VOLYN BASIN (WESTERN UKRAINE)

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Lviv-Volyn coal basin (LVB) is situated within the Volyn-Podillya margin of the East-European platform and composed by coal-bearing Lower and Middle Carboniferous deposits. The Bug suite is a major industrial and coal-bearing object of LVB. Views regarding its structure, stratigraphy, age and subdivision of the suite were changing over the history of its study. The standard section of the suite is not defined still. In order to obtain the detail description of the suite it is made layered lithologically-palynological characteristic of the section of the borehole 6899 – the South Tyagliv, which most complete uncovering the suite deposits and to carry out the correlation with other sections of boreholes. The borehole uncovered the deposits of the Bug suite in the interval 630-854 m, also the underlying deposits of the Lishnia suite and overlying deposits of the Morozovitchi suite. Two parts of the Bug suite were identified with the help of layered lithologically-facial analysis by method of Shulga V.F. (Шульга et al. 2007) in combination with a variety of palynological analysis – method of palynoooryctocenoses (Іваніна 1997).

Lower part is determined in the interval 710-854 m between the limestone N_3 and coal bed n_7. It is consist by mainly siltstones (40%) and sandstones (38%). Mudstones is occupied 20%, thin layers of coal and limestone have approximately 1.5%. By facial composition the sandy and silty deposits of the mouths and rivers lowland and facies of silty, sandy and clay deposits of floodplains are dominated. Mudstones and siltstones from different parts of the section it is obtained the spores of the palynozone **Raistrikia nigra–Bellispores nitidus (NN)**. In general, in the palynozone 74 taxa were identified, including 43 transit, 33 typical. By the composition of the palynomorphs this zone is corresponded to Serpukhovian of Lower Carboniferous.

Upper part is determined in the interval 630-710 m between coal bed n_7 and the limestone B_1. It is consist by mainly siltstones (43%), reduced the content of sandstones to 25% and increased the content of mudstones (29%) and coal (4%). The main industrial coal beds (n_8, n_9 and others) are here. The facial composition of the deposits of the upper part is diverse. The deposits of predominantly continental origin (facies of carbonaceous-argillaceous sediments of peat bogs and sapropel lakes), clay and silty sediments of waterlogged coastal lowlands, sandy and silty sediments of the mouths and rivers lowland, etc are defined here. From this deposits the spores of the palynozone **Neoraistrikia splendidus–Raistrikia fulva (SF)** are distinqueshed. In palynozone 63 taxa were identified: 34 transit and 29 typical. The deposits of palynozone **SF** and accordingly the upper part of the Bug suite is included to Bashkirian of the Middle Carboniferous.

By palynological data at the level of coal bed n_7 the major update of spores-pollen composition is fixed. Thus, it could be assumed that the Bug suite of the borehole 6899 have 2 parts with different age and lithological-facial characteristic.

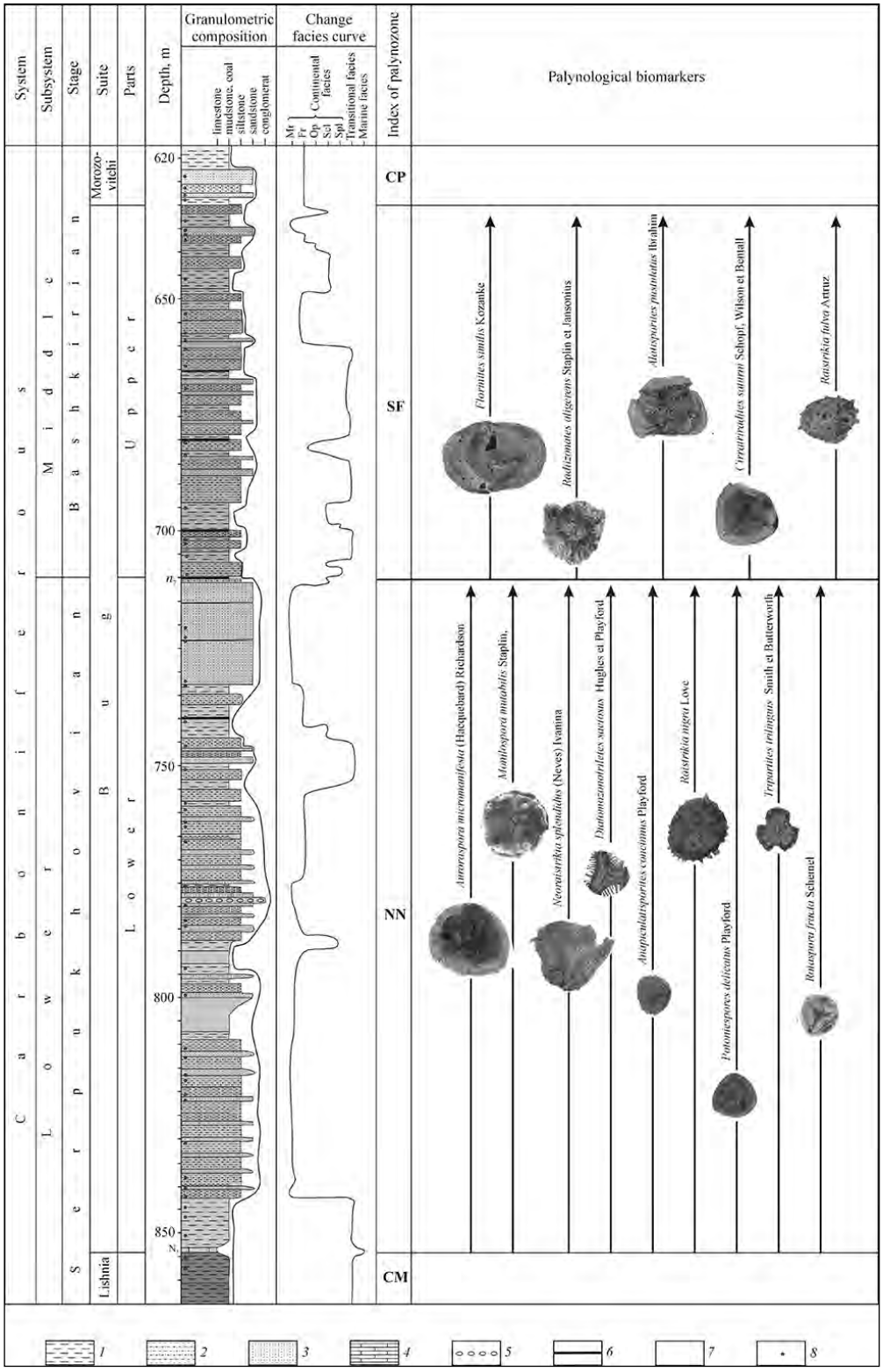

Fig. 1: Lithological and palynological characteristic of Bug suite deposits of the section of borehole 6899 – the South Tyagliv of Lviv-Volyn Basin.

Deposits: 1 – mudstone, 2 – siltstone, 3 – sandstone, 4 – limestone, 5 – conglomerate, 6 – coal, 7 – absence of core, 8 – the place of coring. Facies: Mr – sandy and silty deposits of mouth and shallow of the rivers, Fr – silty, sandy and clayey deposits of floodplain of the rivers, Op – silty and sandy deposits of overgrowing ponds, Scl – clayey and silty deposits of swampy coastal lowlands, Spl – coal-clayey deposits of silted peat bogs and sapropel lake.

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HYDROGEOLOGICAL CONDITIONS OF PALEOZOIC COMPLEX IN NOVOPORTOVSK OIL AND GAS CONDENSATE FIELD

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Introduction. The Novoportovsk field has been characterized by the complex geology structure. The field's basement contains the blocks which are heterogeneous in age and composition. The occurrence of the -low- and -zero-amplitude tectonic faults was specified across the vertical section. They generate the zones of fault-fracture decompression in the low-permeable sediment and impermeable crystalline rocks (Skorobogatov, Fomichev, 1986). The paleo-hydro-geological analysis has demonstrated the existence of infiltration mode during the Early Mesozoic. The water of infiltration was able to penetrate deep enough into the carbonate rocks massif, causing the decarbonization (carbon-bearing karst). The occurrence of numerous karst caverns of the Paleozoic carbonate solid massif has been confirmed by the independent studies (Kuzminov et al. 2000). Also it has been determined that the caverns in the Paleozoic carbonate rocks of Novoportovsk oil and gas condensate field were formed along the ancient north-east faults and increased in the places of their intersect with the fractures of submeridional strike, emphasizing the draining character of these faults (Kuzminov et al. 2000, Zhuravlev, Oblekov, 2000).

Results. The process of the water/carbonates interaction in the Novoportovsk field has been studied using the geochemical modeling analysis.

Using the geochemical modeling methods, the process of interaction of water and carbonate in the Novoportovsk field has been studied, i.e. it was identified whether the water dissolved rocks or there was the salting-up from the water into the reservoir voids. The main evaluative parameter was the code of saturation of water with carbonates (S_{sat}). According to the calculating algorithm where the $S_{sat} < 0$, the leaching of rocks occurs, as the water is not re-saturated with the carbonates, and, conversely, if the $S_{sat} > 0$, there is the carbonate salting-up from the rock. Equilibrium value is determined by the reference data in the physical chemistry field. This condition may occur either when mixing of incompatible waters, or, if there is a real source of water enrichment with carbonate (as in this case, because the lithological section of Paleozoic of Novoportovsk field is rich with the carbonates).

The values of S_{sat} are graphed on the Figure 1. The graphical chart demonstrates the very interesting event to the depths of 2500-3000 meters. The water is not re-saturated with the carbonates, but the situation is changing below: geochemical processes in the "water-carbonate" system change their direction and the calmatation of rock occurs instead of salts leaching.

These processes can be interpreted so that the sedimentation water will penetrate into the underlying rocks through the carbonate rocks massif, besides the fact that it will develop its cavitations. With the depth of 2500 m and deeper the carbonates will drop out, making worse the filtration-capacity properties, especially of Paleozoic basement (with a depth of more than 3000 m).

Conclusions. These points to the fact that from the hydro-geological perspective it is hardly correct to look for the good reservoir with the immersion depth of Paleozoic deposits. The geochemical processes with the participation of free and bound waters contributed in forming of reservoir voids in Novoportovsk field.

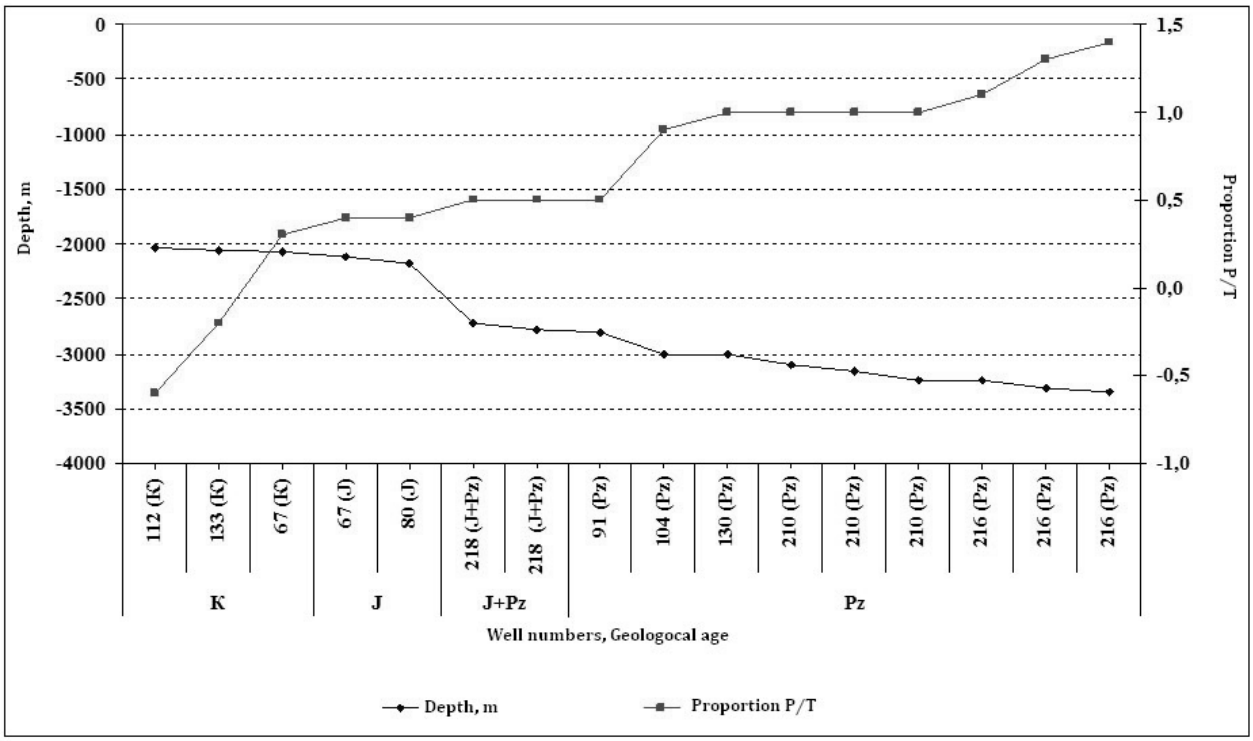

Fig. 1: Graphical chart of carbonates water saturation code behavior depending on depth and geological age of water-bearing material.

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STUDY OF BIOACCUMULATION AND ECOTOXICOLOGICAL EFFECTS OF MERCURY IN HORDEUM VULGARE L. GROWN IN MERCURY-CONTAMINATED SOIL UNDER LABORATORY CONDITIONS

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Transfer and bioaccumulation of mercury in soil-plant system is recently object of serious concern of scientists due to its toxicity and disruptive effects on living organisms (Schwesig and Krebs 2003; Sierra et al. 2009). In our work we studied transfer, bioaccumulation and ecotoxicological effects of soluble form of mercury in *Hordeum vulgare* L. grown in calcareous, „non-contaminated" soil from Slovakia to which we applied water solution of soluble mercury with various concentrations. Experiment was held under laboratory conditions. To obtain "phytoavailable" mercury in soil, the first – acid extractable step of optimised BCR SEP (Community Bureau of Reference three-step sequential extraction procedure) was applied (Rauret et al., 1999). Concentrations of mercury both in soil and plant material (both in solid material and extracts) were measured directly by CV AAS (AMA-254). To assess ecotoxicological effects of mercury, VIS spectrophotometry was used. Actual mercury bioaccumulation and extraction yields from first BCR SEP acid extractable step were determined and correlated and so used to assess the phytoavailability of mercury (Kubová et al. 2008) (Fig. 2). Obtained results indicate positive relationship between initial concentration of Hg(II) in soil and Hg content in plant shoots (Fig. 1). Positive correlation relationship between "phytoavailable" fraction of Hg in soil (determined by extraction with 0,11 M acetic acid) and Hg content in plant shoots may approve the effectivity of 0,11 M acetic acid to predict phytoavailable pool of mercury in contaminated soils (Fig. 2).

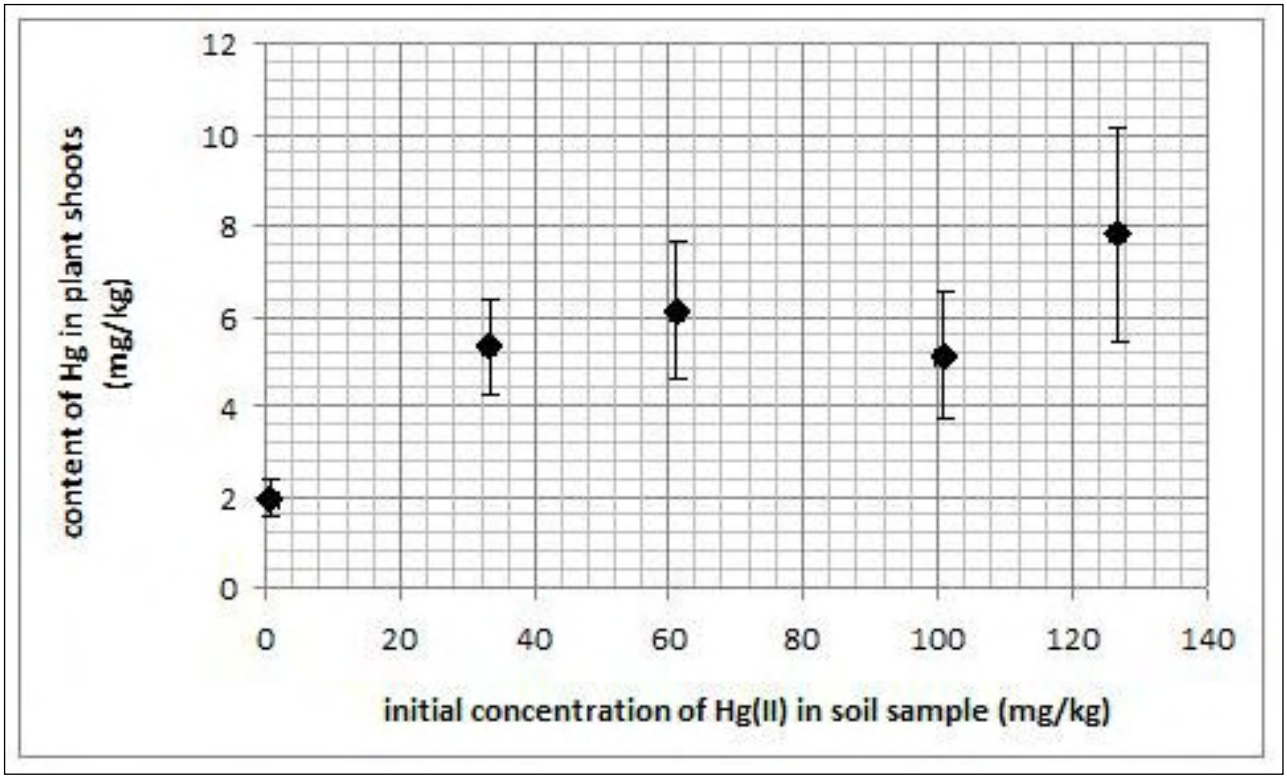

Fig. 1: Relationship between initial concentration of Hg(II) in soil sample (mg/kg) and total Hg content in plant shoots (mg/kg).

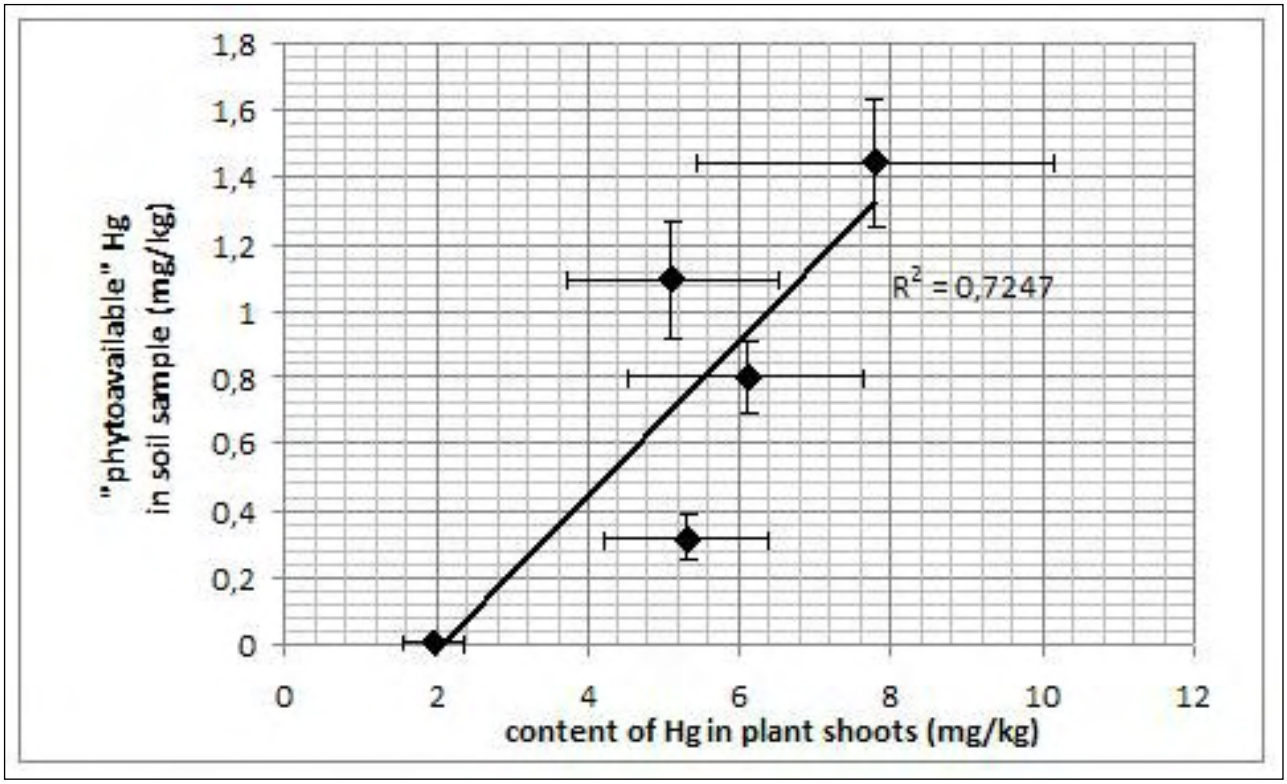

Fig. 2: Correlation between total Hg content in plant shoots (mg/kg) and content of Hg in soil (mg/kg) extracted with 0,11 M acetic acid.

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BEHAVIOUR AND RESIDENCE OF YTTRIUM AND RARE EARTH ELEMENTS WITHIN ANOROGENIC GRANITE DOCUMENTED ON LAYERED DYKES OF HLÍNA SUITE, PREVARISCAN BRNO BATHOLITH, CZECH REPUBLIC

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The relative correlation and behaviour of the yttrium and rare earth elements with respect to a contribution of the individual minerals to Y+REEs budget in the A-type granite rock is presented here. Data obtained by electron microprobe and LA-ICP-MS study of the major (quartz, K-feldspar, plagioclase) and minor to accessory Y+REEs compatible minerals (garnet, muscovite, magnetite, zircon, epidote and LREE bearing phopshates) reveal that significant fraction of Y+REEs is carried by these accessory minerals compared to major rock forming phases, as also suggested previously by (e.g. Bea 1996, Dahlquist 2001, Trumbull et al. 2010). Nevertheless, mineral mass-balance calculations for Y+REEs are fairly infrequent (Bea 1996, Förster and Rhede 2006, Trumbull et al. 2010, Hönig et al. 2013). This paper present Y+REEs mass-balance calculation study (fig. 1, tab. 1) and better understanding Y+REEs compatibility in garnet studied in layered, felsic, slightly peraluminous (ASI 0.90-1.08), garnet lamination bearing granite dykes (up to 50 m thick, several hundred m long) with Within-Plate granite and anorogenous and post-orogenic affinity.

Minor to accessory garnet (<2 vol. %; almandine-spessartine $Sps_{41-46}Alm_{28-44}And_{0-13}Grs_{6-12}Prp_{0-1}$ and Y+ HREE enriched - up 1.54 wt. % Y; up 1 wt. % ΣREE) as the essential reservoir of Y+REE in this granite carries 84 % of the Y and 61 % of the REE. Zircon as another important carrier of REE of the rock carries 13 % whole rock Y and 11 % REE. Based on results at least 63 % of the LREE is hosted probably by monazite, which altered to the mixture of secondary REE-bearing phosphates and clay minerals. The Y+REEs fractions of major rock-forming minerals (quartz and feldspars) despite their high modal amount (94 vol. %) is low (1 % Y; 10 % LREE; 1 % HREE) excluding Eu, which resides predominantly is feldspars (90 %). Minor to accessory muscovite and magnetite contribute each 1 % Y and 2 % REE to the whole rock budget. The amount of Y+REE resides within accessory epidote is insignificant.

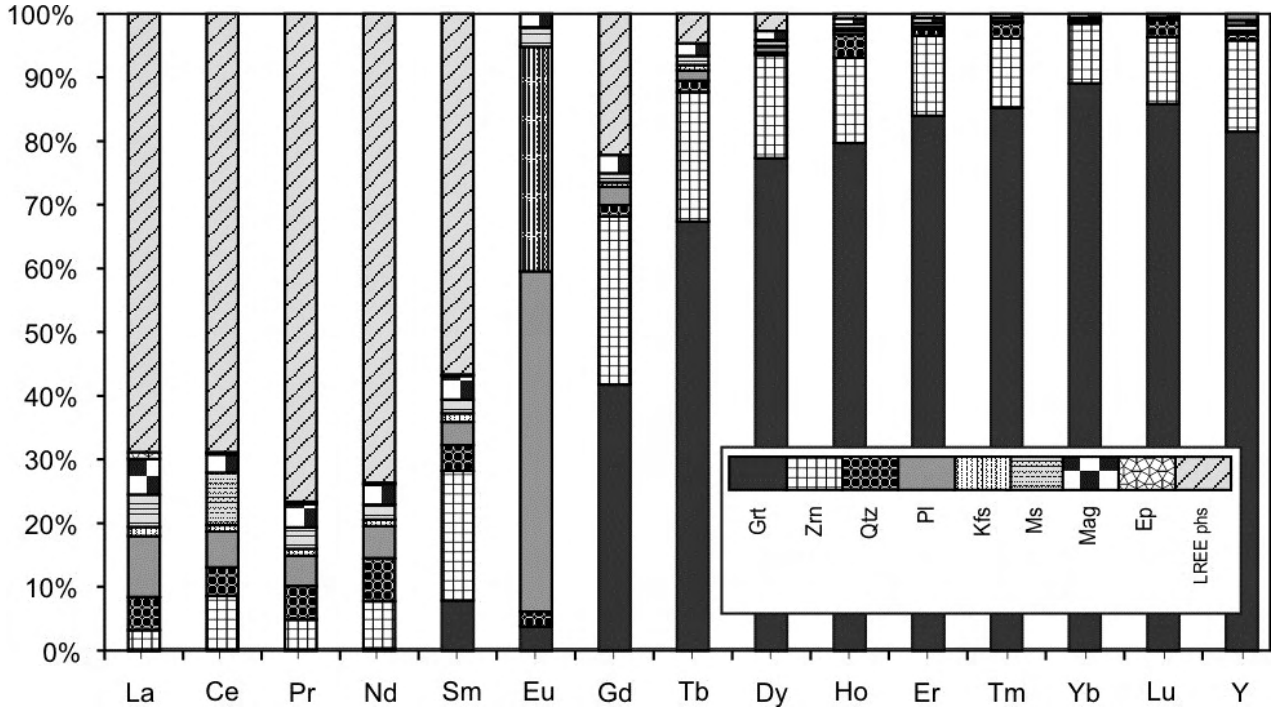

Fig. 1: Contribution of individual minerals distinguished in the rock to the whole rock Y+REEs budget. Plot is normalized to 100 %. Garnet identified as the major Y+HREE carrier of the rock.

	average Y+REE in the WR [ppm]	proportional fraction of Y and REE of individual minerals [%]									
		Grt	**Zrn**	**Ms**	**Mag**	**Pl**	**Kfs**	**Qtz**	**Ep**	**LREE phs**	**Total**
La	7.45	0.0	3.2	5.1	5.5	9.6	1.4	5.1	1.0	68.9	100.0
Ce	7.36	0.0	8.6	8.2	2.9	5.7	1.0	4.4	0.3	68.9	100.0
Pr	8.04	0.1	4.8	3.4	3.7	4.8	1.1	5.2	0.4	76.7	100.0
Nd	7.40	0.3	7.4	2.4	3.1	5.1	1.0	6.7	0.2	73.7	100.0
Sm	11.85	7.9	20.4	2.1	3.7	3.7	1.4	4.0	0.2	56.7	100.0
Eu	2.24	3.8	0.0	3.1	2.1	53.5	35.3	2.3	0.0	0.0	100.0
Gd	15.53	41.8	26.4	1.4	2.8	2.8	0.7	1.8	0.0	22.2	100.0
Tb	23.83	67.4	20.3	1.4	1.9	1.7	0.9	1.8	0.0	4.7	100.0
Dy	29.24	77.3	16.2	0.9	1.3	0.9	0.1	0.4	0.0	2.8	100.0
Ho	27.31	79.7	13.4	0.6	0.9	0.5	0.4	3.7	0.0	0.8	100.0
Er	39.28	84.0	12.5	0.5	0.7	0.3	0.2	1.0	0.0	0.7	100.0
Tm	49.27	85.2	10.9	0.5	0.6	0.2	0.1	2.5	0.0	0.0	100.0
Yb	50.94	89.1	9.4	0.4	0.6	0.2	0.0	0.3	0.0	0.0	100.0
Lu	59.31	85.9	10.5	0.4	0.5	0.1	0.0	2.7	0.0	0.0	100.0
Y	44.27	81.5	14.4	0.9	0.7	0.4	0.2	0.9	0.0	1.1	100.0

Table 1: Individual mineral fraction of the Y+REEs

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MICROFACIES ANALYSIS OF UPPER JURASSIC – LOWER CRETACEOUS CARBONATE DEPOSITS FROM PUI AREA (HATEG BASIN, ROMANIA)

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The Haţeg Basin is located in the south-western part of Transylvania, at the base of the Retezat Massif. The crystaline basement of this area is composed of rocks typical for the Getic domain of the Southern Carpathians (gneisses, micaschistes, quartzites e.g.). The sedimentary cover which overlays this metamorphic suite, consists in succession of deposits grouped in several cycles as follows: the lower Permian cycle, the Jurassic - Lower Cretaceous cycle, the Upper Albian cycle and Upper Cretaceous cycles. The carbonate sedimentation had it's acme period in the Upper Jurassic – Lower Cretaceous when colonial organisms developed large bioconstructions, the end of this cycle being marked by a regression event. For Upper Jurassic limestones in Pui region the following microfacies types can be distinguished:

- peloidal bioclastic wackestone with planktonic Foraminifera (*Globigerinides*), spongies spicules, echinides (*Saccocoma*);
- ooidic, bioclastic, peloidal, fenestral packstone with sponges, bacineloid structures, microproblematics (*Crescentiella moronensis*, *Radiomura cautica*);
- ooidic, peloidal grainstone with *Clypeina sulcata* fragments and rivularian type cyanobacteria;
- coralligenous boundstone with echinides fragments and rivularian type cyanobacteria;
- intraclastic rudstone.

The Urgonian facies are characterized by a wide range of depositional environments, from high or moderate to subtidal low energy, from intertidal to supratidal domains with algal mats and fenestral structures, meniscus cements and vadose pisoids.

METHODS OF CONSTRUCTION NEOTECTONICS MAPS ON EXAMPLE OF UKRAINIAN SHIELD AND ITS SLOPES SCALE 1:500 000

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In the study of active geological structures in the neotectonic period we used a complex of methods: 1) morphostructural analisis of topographic base includes the study of morphographic and morphometric features of relief and comparing obtained results with a priori geological and geophysical data. Areal research morphographic features of relief made by the method of directional directions and anomalies. research morphometric features of relief passed using morphometric methods of finding geostructures, whose foundations developed V. P. Filosofov (Filosofov 1975); 2) structural and geological interpretation and interpretation of large-scale and high-altitude photographic and radar images; 3) visual and instrumental interpretation small scale space of original materials and synthesized images. Using above mentioned methods was constructed map of modern tectonics of the Ukrainian shield and its slopes scale 1:500 000 (Verkhovtsev 2011). Investigated correlation neotectonics of surface and deep structures of the crust. This allowed to select searching perspectives for some types mineral resources and evaluate the impact of hazardous geological processes on the environment.

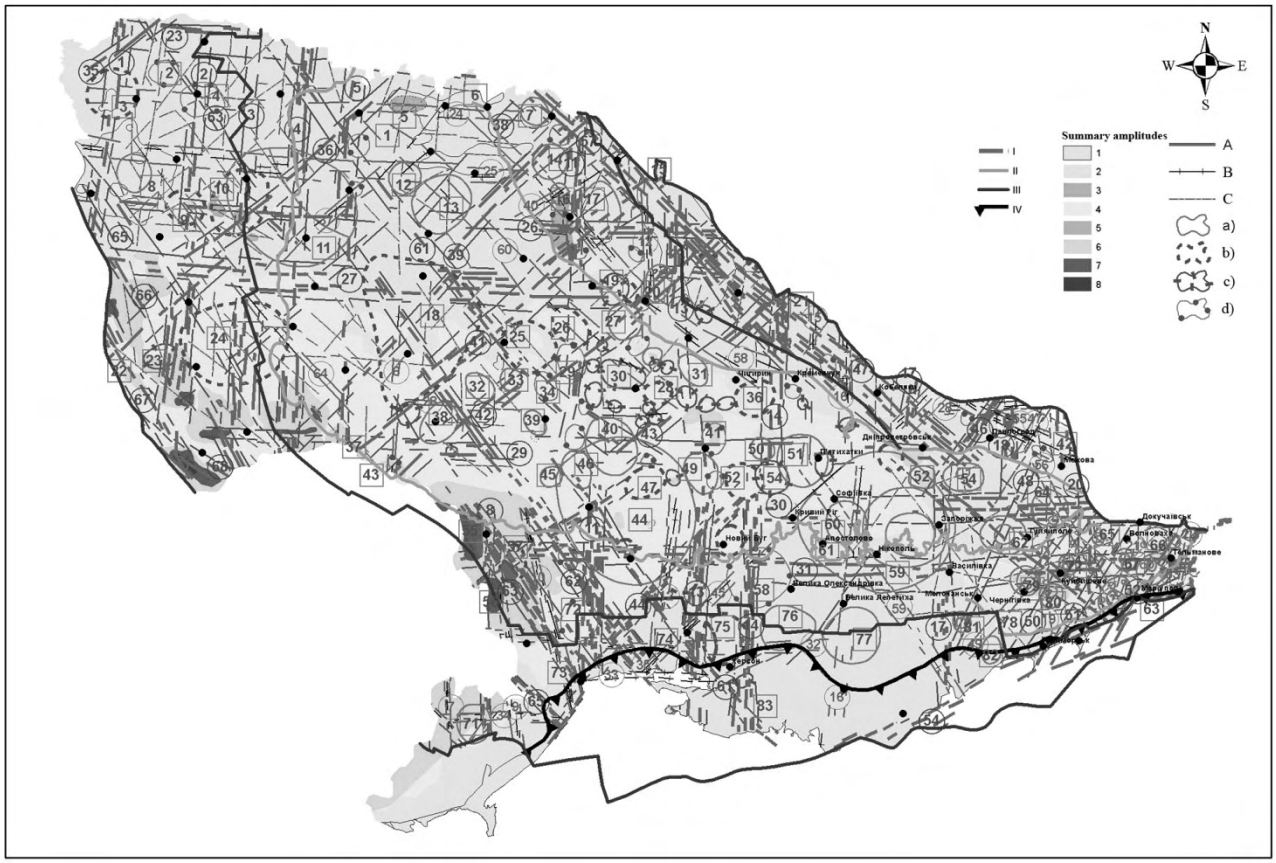

Fig. 1. Map of neotectonics of the Ukrainian shield and its slopes scale 1:500 000 (decreased). I - state border of Ukraine II - zero isohypse of the crystalline basement surface, III - tectonic boundaries; IV - boundary; summary amplitudes Pliocene-Quaternary vertical movements of the terrestrial crust (by morphometric data), mm: 1 - 0-25, 2 - 25 -50; 3 - 50-75 4 - 50-100, 5 - 75-100, 6 - 100-150 7 - 150-200 8 -> 200; lineament zones: A - a trans-regional and regional 1-th order ; B - regional 2-order; C - single lineaments, circular structures: a) - inherited; b) - not inherited; c) - intermediate; d) - without root morphogenetic type (Verkhovtsev 2011).

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THE IMPACT OF CONIFEROUS FOREST SOILS ON KARST PROCESSES

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Limestones dissolution and speleothem growth/corrosion are important environmental karst processes. One factor influencing the former processes is the enhanced acidity of karst soil solutions. Previous studies have indicated that the soil acid-alkaline characteristics are widely derived from vegetation cover. Humic substances produced by karst soils, fulvic and humic acids especially, may be a source of acidity of the water percolating the soil profile. The presence of humic substances has already been proved in dripwaters in the caves (Schwarzová et al. 2005, Ličbinská 2011). So far, however, it is not known whether these substances could cause corrosion of speleothems. This paper deals with the soils formed under coniferous vegetation in the Moravian Karst. The aim of the study was to estimate impact of the subtype karst soils on karst processes. The soils were sampled at 7 locations characterized by coniferous vegetation: Křtiny, Habrůvka-Kočárová Forest Road, Lažánky, Vilémovice-Ochoz, Ostrov u Macochy, Sloup-Holštejn Crossroad, and Koňský Spád sites. Totally, 23 samples were collected, the upper and lower part of the soil profile separately. An exception was at the Lažánky site; the sample was collected from the only distinguishable horizon. On the Koňský Spád site, 12 samples were collected on a straight line of NNE direction in 15 m long steps. The vegetation of the site was mostly spruces with some pine trees. The sampled soils were classified as the rendzina, which is the predominate soil type in the Moravian Karst. pH of leachates of the soils reached up to 2.8 (in KCl solution leachate) and 3.9 (in water leachate). Based on the fact that the soils were classified as strongly acidic. In most cases, the acidity of the upper horizons exceeded the acidity in the lower horizons. Almost all samples showed both acidity (strong acids from 0.2 to 2.4 meq/kg, week acids from 1.2 to 30.6 meq/kg) and alkalinity (0.34 to 2.3 meq/kg). In the samples from the Koňský Spád site, acidity significantly exceeds alkalinity. Very low spatial variability in pH, acidity, and alkalinity indicates nearly homogenous acid-base properties of the soils under coniferous vegetation. The concentrations of humic acids ranged from 0.49 to 2.89 % in the upper horizons and from 0.16 to 0.36 % in the lower horizons. The concentration of fulvic acids ranged from 0.66 to 1.87 % in the upper horizons and from 0.11 to 0.51 % in lower horizons. This is consistent with the lower pH and higher acidity in the upper horizons with respect to the lower horizons. The results indicate that coniferous vegetation makes the underlying soil very aggressive to bedrock limestone. However, it is probable that (i) acidic soil solutions are neutralized at the soil base by reactions with limestone fragments and that (ii) they do not permeate deeper vadose zone (caves).

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CHARACTERISTICS OF THE URANIUM ANOMALY IN THE SOUTHERN PART OF THE BOSKOVICE FURROW

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The radioactive anomaly of coal-bearing sediments in the southern part of the Boskovice furrow – the Permian-Carboniferous basin, in the Rosice-Oslavany basin nearby Oslavany town (30 km SW far from Brno) has been investigated by quantitative methods, such as the portable and laboratory gamma spectrometer, the electron microprobe and the X-ray-fluorescence analysis. The radioactive anomaly occurs in a coal-bearing claystone surrounded by gray sandstones in a so called lower gray strata which was formed in the Carboniferous (Stephan) and Permian (Autunian) periods. The U content in the gray sandstones ranges from 0 to 32 ppm and, for Th, from 0 to 19 ppm. The U content in the coal-bearing claystone ranges from 0 to 60 ppm and for Th, from 0 to 26 ppm measured by the portable gamma-spectrometer. The highest content of 119 ppm of U in a coal-bearing claystone was measured by the laboratory gamma-spectrometer. An electron microprobe and XRF analysis were used to reveal chemical composition in the samples. Millimeter scale veins of the Fe oxyhydroxides and grains of monazite were found in the samples by a polarization microscope. Closer examination by the electron microprobe reveals that the Fe oxyhydroxides partly or completely replaced jarosite which probably originated from the pyrite weathering. It was determined that the U is bond more into Fe oxides a hydroxides than into jarosite. The Th/U ratio of monazite does not fit to the Th/U ratio of the coal-bearing claystone, therefore monazite is not the main source of U in the rock. The element distribution of the studied vein under the electron microprobe showed that U positively correlates with P however, chemical analysis showed insufficient amount of U to form a mineral phase. Considering these facts it could be claimed that U was adsorbed onto Fe minerals during the weathering of the rock. Different U concentration in the studied sediments (from 0 to 119 ppm) is the evidence of high mobility and instability of the dissolved oxidized U^{6+} ion.

The sediments of the so called lower gray strata were formed in the Carboniferous (Stephan) and Permian (Autunian) periods by sediments of river, deltas and lake, therefore the typical sediments comprises from sandstones, siltstones and claystones which gradually converts to the coal deposits. The Moldanubium Zone and Třebíč durbachite (rich in zircon and monazite) are considered to be the sources of the clastic material (Jelínek 2001). The tufitic material can be observed in most types of the sediments, moreover, Přichystal (1994) and Kratinová (2007) described magmatic rocks found nearby Oslavany as basaltic andezites to trachyandezites and the rocks described from the Rosice coal mine as the subalkaline dacite. These rocks were probably formed during the Hercynian orogenesis.

The gained and above mentioned data support the theory of Kříbek et al. (2005) concerning the formation of U deposit in Rožná (50 km W far from Boskovice furrow) when deeply infiltrated and heated mobile brines coming from the Stephan-Autunian basins (such as Boskovice furrow) extracted U from accesory minerals of the crystalline fundament and, subsequently, adsorption and precipitation of U at suitable chemical barriers and pH (in U-deposit Rožná; sediments of Boskovice furrow, etc.) has been processed. The theory meets with the results gained by Kroupa (2010) suggesting that the period of forming the U deposit was characterized by higher volcanic activity and higher geothermal gradient.

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CRYSTALIZATION MECHANISMS IN HIGHLY EVOLVED BORON-RICH GRANITIC MELTS OF THE ŘÍČANY PLUTON, CZECH REPUBLIC

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The textures of magmatic rocks represent a rarely used, but perspective source of information for the interpretation of crystallization and rheological properties of magmatic reservoirs. The knowledge of crystallization mechanisms through the textures in magmatic rocks provides information about the mechanisms of origin, filling, convection and solidification of natural magmatic reservoirs dependant on the thermal regime and time scales of individual processes (Marsh 2005). Because the links between the large, observable and quantifiable textural diversity and the chemical composition of parental melt are frequently seen in highly evolved granitic rocks with elevated contents of volatile components such as H_2O, B and F, we focus on a case study of characterization and interpretation of solidification textures in highly evolved B-rich magmas, which form an aplitic-pegmatitic marginal facies and dyke swarms in the Říčany granite pluton (Central Bohemian plutonic complex). The area provides a unique opportunity to study various textural relationships that help to reconcile segregation, movement and crystallization of highly evolved melts as well as provide record of their solidification mechanisms, that is, insight into cooling histories, nucleation and growth rates.

The belt of tourmaline-bearing aplitic granites is ~4000 m long and 600 m wide, and the presence of line rocks and similar geopetal indicators suggests a rather gentle slope. The studied textures there involve modal banding such as alternating tourmaline- and quartz-feldspar-rich layers (line rock), and grainsize layering, which spans two orders of magnitude, as well as flow and erosion structures implying multiple batches of highly evolved melts. We envision the following genetic scenario: (1) intrusion of the biotite granite magma (Říčany type) into metasedimentary sequences preserved as roof pendants („metamorphic islets"); solidification of the marginal biotite granite that is characterized by smaller K-feldspar phenocrysts; local segregation of biotite- or tourmaline-bearing granitic magma, solidification of pegmatite patches now located in the endocontact of marginal biotite granite. This gives rise to dm-sized patches of fine-grained tourmaline granites or leucogranitic pegmatite pods in the biotite granite host; (2) continuing solidification of the biotite granite inwards from pluton contacts and accumulation of highly evolved residual melts in its centre; (3) upward extraction of boron-rich (tourmaline-bearing) residual melts that represent the bulk of tourmaline-aplite belt and their emplacement along the contact of the Říčany granite with its metasedimentary roof; (4) internal differentiation by progressive solidification and melt extraction within the tourmaline-aplite belt. The original evolved melt is probably preserved in the SW part of the aplite-pegmatite melt where it forms a zone of homogeneous fine-grained aplites with randomly and regularly distributed tourmaline grains. Locally tourmaline aplites contain bands (with sharp boundaries) of tourmaline-free aplites; (5) formation of line rocks in the majority of the tourmaline-aplit belt. The line rocks represent solidification fronts, probably of horizontal paleo-orientiation whose origin was assisted by two self-promoting mechanisms: (a) formation of chemically distinct melt boundary layers that have lead to repetative nucleation of tourmaline vs. feldspars, and (b) periodic fluid segregation, which changes the diffusion rates. These two mechanisms act on distinct length and grain size scales but their products tend to be similar. The crystallization of aplitic layered rocks is terminated by a sudden decrease in nucleation rate of alkali feldspar, that is, formation of large K-feldspar crystals. They do not represent suspended or accumulated phenocrysts but rather branching, fan-like aggregates. This stage probably represents the transition into „pegmatitic" crystallization, characterized by pegmatite patches in situ or dykes of extracted evolved residual melts. This process may have occured in fluid-melt suspension whose diffusion rates would facilitate mass transfer hence growth of large crystals. The late melts appear to escape from their aplitic source regions by combination of buoyancy and local overpressure and deform in a brittle manner its semi-solidified aplitic surroundings.

This study indicates that the aplitic and pegmatitic crystallization had occurred in response to nucleation and diffusion rates in a two-phase, fluid-melt emulsion. If this hypothesis is correct, it would explain the origin of large (pegmatitic) crystals in a variety of situations not restricted to highly evolved, volatile-rich silicic systems and be independent of undercooling. This locality can be compared to the Californian aplite-pegmatite dikes, which are interpreted as records of the thermally and diffusion-controlled kinetics of crystallization of highly evolved granitic melt (London et al. 2012).

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IMAGE ANALYSIS OF STONE STRUCTURE USING AUTOCORRELATION FUNCTION

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Autocorrelation function is a structural function, which is considered as a good method for analyzing structures and deformations (Panozzo, 1992). Any analyzed image may be used in original form, e.g. without any preprocessing, which is the main advantage of this method.

In order to benefit from the advantages of the autocorrelation function, it's necessary to create a program that would analyze images on the base of this function. The output of such program should be the image that would refer to the average shapes of the input image. The output image should than give a read of the features occurring in the structure—both "larger" (e.g. course of the foliation, banding) and "minor" (e.g. average grain size).

A program using the algorithm of the autocorrelation function was made (Jaroš, 2011). It efficiently uses the advantages of the autocorrelation function and its functionality was demonstrated on artificially created textures and images of selected rocks.

This program can be used to analyze and interpret various structures. There are many features which can be red from the output image: quantitative description of the structure geometry; average shape and size of grains; deformation and distance between neighborhood elements; etc. Therefore this program in further development should be useful for example as a help for finding the proper substitute of the (ornamental) stones in the repair sites.

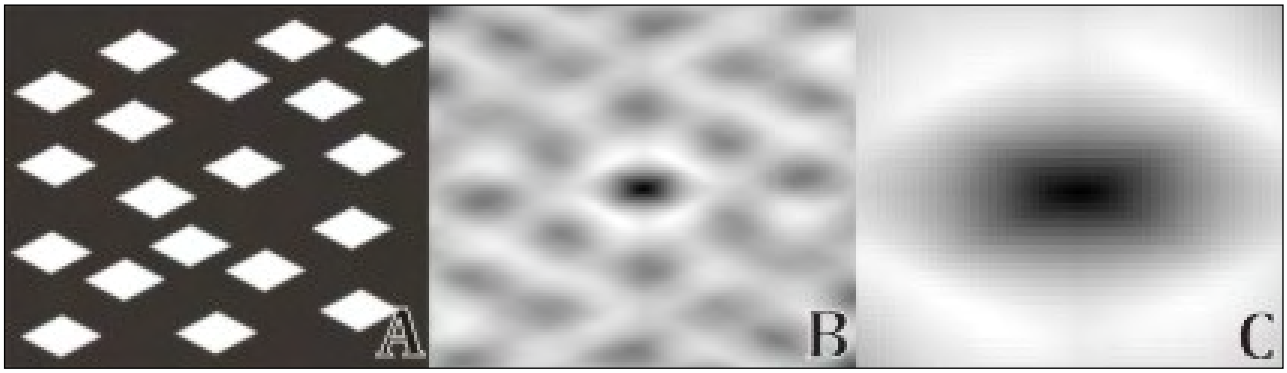

Fig. 1: Artificially made structure with randomly spaced same size rhombuses. A: Input image. B: output image of the autocorrelation function. C: 2x zoomed output image of the autocorrelation function.

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INFILLINGS OF LA TÉNE AND HALLSTATT SUNKEN HOUSES NEAR SYROVICE AND HORÁKOV

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During a rescue survey in 2008 a settlement was found in vicinity of a village called Syrovice near Brno, Czech Republic. Archaeological objects of different shapes and various infillings where excavated and dated by means of archaeology to Latene and Hallstatt period (2800 - 2050 years B.P.). Solid samples (9x4 cm) of houses infilling were taken from two objects in order to make thin sections for micromorphological analysis. The way the houses were used was then analysed by means of archaeology and micromorphology.

Micromorphological samples were first impregnated by resin and then cut thin. When samples were 30 μm thick, protecting glass had been glued on the top of them. All this work was performed in vacuum. Thin sections were then examined under microscope in both Cross polarised light and Plane polarized light. Features of all samples were then described according to Bullock et al. (1985) and interpreted.

Archaeological research was also held in urban area called „Čtvrtě" near Horákov in 2007, where micromorphological sample (9x4 cm) was also taken. Village Horákov is a part of the district Brno - venkov. Geological bedrock constitutes of Palaeozoic *(*Permo-Carboniferous) sedimentary rocks and Miocene sediments. Survey started by removing layer of top soil to the level of underlying loess. Objects contained pottery shreds dated to Neolithic and Eneolithic period (4400 years B.P.) and also to late Hallstatt period (Parma 2008). Micromorphological sample was taken from chosen object.

Latene of Syrovice was due to the countersink and post holes along the shorter wall recognized as a sunken house . Geological bedrock on locality constitutes of Neogene and Quaternary rocks of Svratka and Jihlava River, where these two rivers are forming a continual terrace. According to pottery shreds found in infilling, the building was chronologically dated to 2350 - 2250 years B.P.. Microscopically 4 micro layers in thin sections were recognized. On the base of thin section orange layer was located also with charcoal dust and a thin charcoal layer. Charcoal layer was also found at the bottom of post holes. It suggests that this layer came into existence after the destruction of wooden structures. Due to the presence of both the ceramic material and the process waste (phytolits) object was probably used for living.

Second Latene object has been placed among sunken houses, due to its shape and the other similarities with the previous one. Chronologically it is of Latene age (2350 - 2250 years B.P). Approximately 1 cm above the base of the object 100 μm thin layer was located. It contained charcoal, humic material and bone fragments. Amount of organic matter, excrements (presence of oxalates in thin section) and carbonates, which were used as a sanitation layer, suggests that the object was after its destruction by fire used as a midden.

Layer of ash was found in the thin section of the object from Horákov. This layer could be divided into two sublayers. The first sublayer originated when the roof of the building was still functional (it contained carbonates functioning as sanitation layer), the second one was placed on the destruction, overlying the pieces of daub and charcoal. Infilling of the building was heterogeneous; however, we couldn't implement closer, more detailed inspection, due to lack of samples from each depositional situation. Stone and ceramic fragments have been also found in the infilling.

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MINE WATER GEOCHEMISTRY OF KAŇK ORE DEPOSIT WITH SPECIAL RESPECT ON THE As MOBILITY

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Arsenic is a metal with a negative influence on human health. Some forms of arsenic in environment are toxic and mobile. Ore deposit Kaňk near Kutna Hora was known by silver and polymetallic ore mining since the Middle Ages (Ettler et al. 2008). Arsenic is contained in arsenopyrite that is compound of sulfur, iron and arsenic. In the present day is the mine Kaňk flooded and dissolution of secondary minerals leads to high mineralization in mine water (Kopřiva et. al. 2005). The subject of this paper is determination of processes that cause arsenic mobility in mine water of the Kaňk deposit, the comparison and interpretation of the values that were measured in the mine water and create the geochemical model of stability and speciation of arsenic. The model was made in the software Geochemist's Workbench® (Bethke et al. 2010). Based on these results factors causing arsenic mobility were determined.

Arsenic and iron are two main elements of arsenopyrite. According stability diagrams of iron and arsenic in mine water the high concentration of these elements in mine water high concentration is due to the following factors. The concentration of arsenic is determined by the solubility of scorodite that is product of arsenopyrite weathering. On the other hand at the same geochemical condition the iron concentration is determined by solubility of potassium jarosite.

Mine water geochemistry of Kaňk ore deposit is mainly determined by oxidation-reduction processes and interactions between components in mine water.

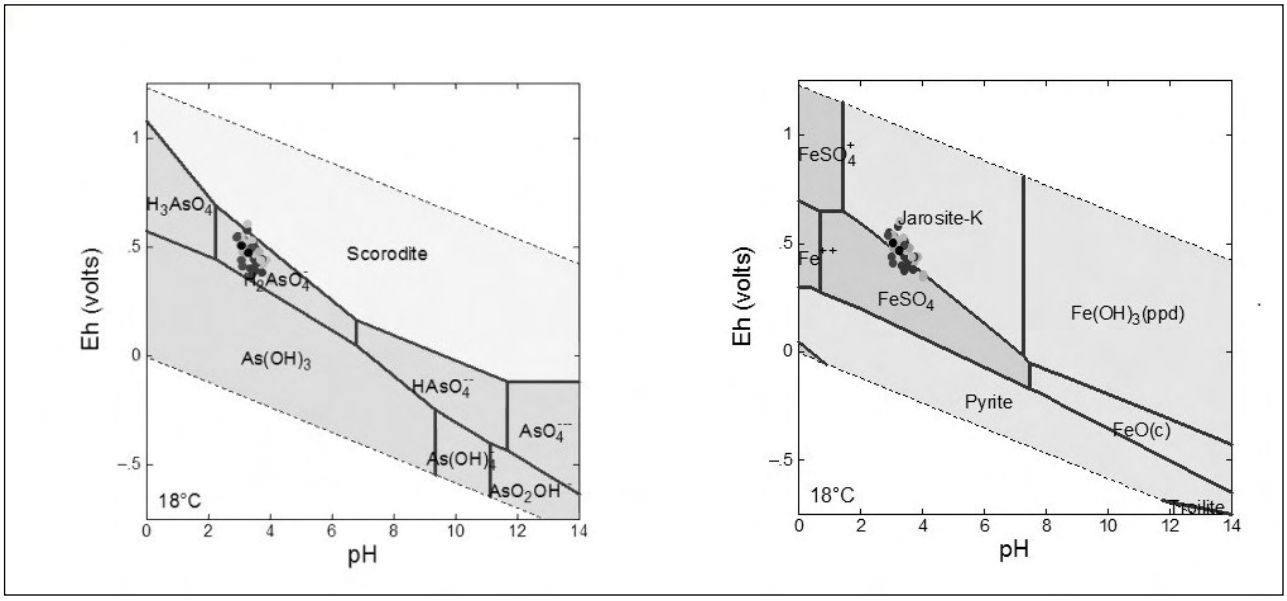

Fig. 1: The stability diagram of (a) arsenic and (b) iron in mine water of Kaňk ore deposit.

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NEW INSIGHTS ON THE CLIMATE CHANGES DURING LATE PLEISTOCENE AND ITS IMPACT ON BIOLOGICAL CONDITION OF NEANDERTHALS AND HOMO SAPIENS SAPIENS IN CENTRAL EUROPE

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There were several important changes introduced during the Late Pleistocene. From the archaeological point of view the most important one was transition of hominids - from Neanderthal groups to *Homo Sapiens Sapiens* communities (Bar-Yosef 2002, 364; Kaufman 2002, 477).

The newest geoarchaeological data introduces us to new information about the character of climate during the Late Pleistocene. Improvement in methods used in climate research made it possible to correlate this general view with the oxygen isotope records of well-preserved Greenland ice-cores. The methods include: oxygen isotope records, pollen sequences, marine cores analysis and collation of data with results of radiocarbon dating from known sequences of sediments (like loess sequences from Eastern Europe and Siberia).

The research conducted during last decade has shown that during the Late Pleistocene the climate in Europe had been changing rapidly (e.g. Beresford-Jones *et al.* 2011, 2). Moreover, there are confirmations of sudden, short-time accidents. They could have had some additional impact on biology balance in Central Europe of that time. The eruption of the Campi Flegrei volcano from southern Italy around 40,000 years ago (Roebroeks 2008, 921) can serve as a valid example. I believe that the mentioned phenomena was not only a serious factor in temporary faunal and floral modification (that influenced humans diet) but also a reason why, already low, temperature started to decline further. Effectively, the volcano had become of a big importance for the already weakened Neanderthal population. Many similar issues (connected with climate) have still not been taken under serious consideration in a matter of its interaction on the Late Pleistocene humans.

The question of the influence of the cold climate fluctuation on the extinction of the Neanderthal population has been raised repeatedly. Rarely however researches associate the differentiation in biology and genetics of Neanderthals and early European modern humans with the matter of the diet and energy-spending possibilities, that were also dictated firmly by climate.

This work is going to emphasize how the results of paleoclimate research might improve archaeological knowledge about the biology of the past societies. The goal of the poster is a presentation of the influence of the climate changes on the development and modifications in the world of Neanderthals and *Homo Sapiens Sapiens*.

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RADUZHNOE – EPITHERMAL VOLCANIC-ASSOCIATED BRECCIA-HOSTED AU-AG DEPOSIT (LOW-SULFIDATION TYPE)

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There are two ultimate subtypes of epithermal low-sulfidation deposits classified by (White et al. 1995; Sillitoe et al. 2003).

1. Low-sulfidation silver-gold-base metal subtype. This deposition style was recognized by R.H. Sillitoe (2003). The examples of this style are the Fresnillo, Pachuca and Guanajuato districts (Mexico), Cikotok (Indonesia), El Bronce (Chile), Toyoha (Japan), Zgid (Russia), Comstock and Creede (USA). They show many of the textural and alteration characteristics of gold-silver deposits, but are usually characterized by domination of silver and lead-zinc mineralization. Gold may be present, but is typically (though not always) much less significant than silver. These deposits commonly extend much deeper than low-sulfidation gold-silver deposits. In some cases there may be an increase in tin minerals at greater depths.

2. Low-sulfidation gold-silver subtype in association with calc-alkaline volcanic rocks. This type consists of many "classic" epithermal gold deposits, such as McLaughlin (USA), Kushikino and Hishikari (Japan), Pajingo (Australia), and Martha Hill and Karangahake (New Zealand). They are typically vein deposits with at most minor amounts of associated base metals, gold and silver being usually the only economically valuable metals. The veins are dominated by quartz or chalcedony and calcite, usually with adularia, and show a great diversity of textures. The veins typically have an extensive envelope of hydrothermal alteration produced by neutral-pH mineralizing fluids: i.e. pervasive propylitic alteration, with the veins surrounded by sericitic alteration, then illite-smectite alteration at shallow levels. These deposits occur widely around the Pacific Ocean. They are also found in parts of the central Asian Tethys belt.

The **Raduzhnoe deposit** is situated in the central part of North Caucasian Mountains within Jurassic depression zone, related with extensional-transtentional tectonic regime, forming horst and graben structures. Intensive tectonic and magmatic activity was associated with the closure of the Tethys Ocean and the Andean type of subduction. Block movements began in the Early Jurassic (Pliensbachian). Jurassic volcanic formations are represented by Aalenian basalt-rhyolite and Bajocian basalt-porphyry-trachytic formations. Rhyolites are the most common volcanic rocks at this area. Epimagmatic hydrothermal activity related to rhyolites led to: broad development of processes of silicification of host rocks, less their kaolinization, carbonatization, sulfidization, baritization, chloritization, the widespread expression of alkaline metasomatism.

The ore occurrences are confined to the PZ granite ledge and zones of intense brecciation. Composition of the breccias is quite diverse - fragments of metasomatically altered Aalenian rhyolites, Toarcian and Aalenian sedimentary rocks with the quartz, chalcedony and calcite cement. Breccias have been changed in a varying degree during gas-hydrothermal activity that took place mainly in the Aalenian and less in the Bajocian. Ore minerals which have been identified at Raduzhnoe are native gold, calaverite, dyscrasite, proustite, sulfides.

Gold mineralization appears in different geological formations: trachytes, rhyolites, quartzites, hornfels, breccias. Au content reaches up to 215 g / t, Ag and 4000 g / t in breccias.

At the deeper levels of the breccias the pyrite content increases and galena, sphalerite and chalcopyrite appear. Polymetallic mineralization is mainly associated with hydrothermally altered basement granites and Pliensbachian sandstones. The main ore minerals are pyrite, sphalerite, galena, chalcopyrite. Gold and silver are being in a finely dispersed state in sulfides.

Thus, at the Raduzhnoe there are allocated two types of mineralization: gold-silver (low-sulfidation gold-sylver subtype) and gold-silver-containing polymetallic (low-sulfidation silver-gold-base metal subtype) (Sillitoe et al. 2003). Spatial-temporal correlation between the two types of mineralization at the Raduzhnoe remains unclear. Probably gold-silver-polymetallic mineralization is earlier process and is associated with developing of the global polymetallic belt of the North Caucasus (the largest scale of mineralization manifested itself in the deposits of North Ossetia). Gold-silver subtype of mineralization is more recent, local and related to the final (solfatara) stage of volcanism.

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INFLUENCE OF THE SWELLING AND SHRINKAGE CYCLES ON THE PROPERTIES OF UPPER CARBONIFEROUS CLAYS

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During construction, excavation often remains open for a long time and because of the influence of cyclic climatic factors swelling and shrinkage developes. It can deteriorate soil strength and deformation properties and subsequently underestimate a bearing power of soil. So, the aim of the present research is to reveal the nature and mechanism of cyclic swelling clay soils, that depend on various factors. Obtained results can be applied for appraisal of the clay soils behavior under repeated wetting and drying. Samples were collected in upper carboniferous deposits in Moscow.

Various physical, physico-mechanical properties and mineral composition of the samples were studied. Mineral composition plays a key role in behaviour of soils under cyclic swelling-shrinking. XRD-analysis showed that samples consist of primary silicates (quartz, feldspar), carbonates (calcite, dolomite, siderite), rare oxides (hematite) and clay minerals (illite, illite-smectitea and kaolinite).

Soil density varies from 2.04 kg/m^3 to 2.08 kg/m^3, porosity - from 36% to 41%. Deformation modulus of soil after swelling-shrinkage cyclic is reduced by 16-23%. Soil density decreased by 6%. Thus, we can determine that the cycles made the soils softened, so deformation properties of rocks deteriorated. And the less the carbonate content is, the less the deformation modulus changes.

Swelling and shrinkage of the samples was carried out for five cycles: in the first and the second cycles shrinkage was carried up till the natural moisture and during the next stages until the hygroscopic moisture. As a result we were able to calculate accumulated deformations of swelling and shrinkage of the samples for each subsequent cycle and the value of deformation for each cycle separately. In general there were diagramed the swelling and shrinking kinetics curves.

Basically, with each subsequent cycle, swelling deformation of the sample increases, due to partial destruction of the initial structure of the samples under cyclic wetting-drying. It can be concluded that the process leads to decompaction of soil. At the same time the values of shrinkage deformation is different. It depends on the initial moisture: when it is natural, the deformation increased, otherwise it is reduced.

Additional experiment was conducted on a disturbed sample. The swelling value in the first cycle was > 40%. According to Osipov (1979), there are strong contacts together with weak phase in clay structure. When strong contacts are destroyed, they become hydrated and behave as weak, contributing to an increase of swelling clays. The presence of carbonates in the soil clearly indicates that there are strong contacts, which mainly determine the behavior of soils under cyclic swelling-shrinking.

As a result the following conclusions were made:

- the process of swelling-shrinking is significantly affected by mineral composition: the more mixed-clay minerals and less carbonates, the greater the degree of swelling and shrinking of the samples;
- this process is also affected by the moisture value to which the dehydration is conducted;
- swelling and shrinking clay soils are accompanied by structural changes: there is a change of the pore space volume and weakened structural connections;
- the higher the number of hydration and dehydration cycles of the soil, the higher the swelling value;
- after cyclic swelling and shrinking soils are softened and their deformation properties deteriorated.

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GEOLOGICAL MODEL AND TECTONIC EVOLUTION ANALYSIS OF THE SOUTHEAST AREAS OF WEST SIBERIAN BASIN

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In southeast areas of West Siberia the most of oil and gas fields is concentrated in upper-jurassic anticlinal traps. At conducting of a prospecting on oil and gas of one of the primary goals facing to seismic survey is allocation of perspective structures.

The present research is executed on the basis of complex interpretation of seismic survey materials, length 12500 km, and deep drilling data of 150 wells.

The area of studies is laid out in the south of West Siberia. Tectonically, the study area is located primarily within Nurolka megadepression – one of the largest depressions in the south of West Siberian Basin. Large positive structures Pudin mezo-uplift and Lavrovskiy swell are allocated in the area. At the junction zone between the Lavrovskiy swell and Pudin mezo-uplift Chuzick-Chizhap mezo-saddle is located. There is a Krapivin-Moiseev uplift in the northwest part of the area. Nurolka megadepression is complicated by two positive structures – Festival swell and Igol-Tal uplift, and three negative ones (Fig. 1).

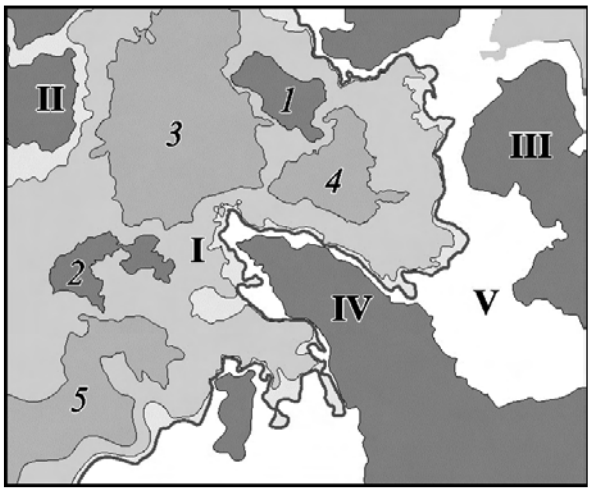

Fig. 1: Schematic tectonic map of the studying area. (I-Nurolka megadepression, II-Krapivin-Moiseev uplift, III-Pudin mezo-uplift, IV-Lavrovskiy swell, V-Chuzick-Chizhap mezo-saddle; 1-Festival swell, 2-Igol-Tal uplift, 3-Central-Nurolka depression, 4-Tamrad depression, 5-South-Nurolka depression).

Seismic markers controlling basic seismogeological sequences are indicated in sedimentary cover of West Siberia: F2 – a base surface of sedimentary cover, IIa – the bottom of the Bazhenov formation (Upper Jurassic, Tithonian), III – the Koshay unit of the Alym formation (Lower Cretaceous, Aptian), IV – the Kuznetsov formation (Upper Cretaceous, Turonian). Reflectors are associated with transgressive clay stacks, formed during the eras of tectonic calm. These stacks are characterized by sustained thicknesses, have spread over large areas of the West Siberian basin, and can be used for the peneplation surfaces (Kontorovich, 2002).

During the held research construction of structural maps by the basis reflectors and thickness maps of the basis sequences (Jurassic, Neocomian, Aptian-Turonian and post-Turonian) has been carried out.

Restoration of tectonic evolution history is based on the analysis of complexes' thickness changes. The analysis of tectonic evolution history showed that at the Jurassic stage all positive structures had active uplift – Lavrovskiy swell, Pudin mezo-uplift, Igol-Tal uplift. All local structures complicating large positive tectonic elements were also actively developed. The epicenter of downwarping was located at the northwest, in areas corresponding modern bent parts of the Nurolka megadepression.

At the Neocomian stage large structures and local uplifts complicating them, existed at the Jurassic, were continued evolve inherited and had a tendency to uplift.

At the Albian-Turonian stage the tectonic processes in this area, as well as the southeast of West Siberia as a whole, were sluggish and had no a significant impact on contemporary structure of the observed area.

At the post-Turonian stage directivity of tectonic movements was changed. There was a regional uplift of the southeast border of the West-Siberian basin at the background of the axial part dipping. These processes have led to the fact that at the southeast part of the study area the closed positive structure Lavrovskiy swell was opened and turned into a semi-closed tectonic element.

At the same time in east part of area above tectonic movements led to the unification of Igol-Tal structure's domes, forming a large trap which one of the largest oil fields in the south of West-Siberian basin is dated for.

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SEISMIC AND GEOLOGYCAL CRITERIA OF PETROLEUM POTENTIAL PREDICTION OF PALEOZOIC DEPOSITS OF WESTERN SIBERIA SOUTH-EAST REGIONS

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The geological column of Western Siberia plate consists of Proterozoic-Paleozoic basement rocks and Mesozoic-Cenozoic sedimentary cover deposits.

The majority of explored reserves are related to sedimentary deposits. However in the south-east part of the plate more than 50 fields were discovered in the basement. The traps in Paleozoic deposits are characterized by complex lithologicaly and fault-controlled traps. Reservoirs can be presented by one of two types: either Paleozoic carbonate rocks (dolomites and limestones) or weathering crust developed over terrigenous deposits. Therefore, south-east of Western Siberia is an interesting and favorable region to develop methods of mapping complex HC traps in Paleozoic rocks.

In this research a methodological approach for indication and mapping of Devonian and Carboniferoues reservoirs with high petroleum potential was invented. Two HC fields: Ostanin and Severo-Ostanin were chosen for the research targets.

In the study area the Pre-Jurassic deposits are highly heterogeneous both in age and composition. Paleozoic deposits can be roughly divided into 4 rock types. ***Marlstones (D_2gv)*** are abundant in the west of the study area. ***Terrigenous rocks (siliceous argillites) (D_3fa)*** are found on the west of Ostanin Field. ***Limestones and dolomites (D_1)*** occupy the major part of Severo-Ostanin field. ***Siliceous limestones (C_1)*** are widely abundant in the east of the study area.

Rocks with different lithology under action of exogenous processes generated weathering crusts of two main types: 1 - ***argillaceous weathering crust*** formed by marlstones (D_2gv) and dolomites (D_1) . 2 - ***argillaceous-siliceous crust of weathering*** generated by rocks rich in siliceous (particularly siliceous argillites (D_3fa) and siliceous limestones (C_1)).

A seismic reflector F_2 confined to the bottom of sedimentary cover is very difficult to be traced. Variability of the basement lithology and acoustic properties of rocks forming the pre-Jurassic basement and the overlying strata as well as faults abundance have an adverse effect on stability of wave field. That is why for reliable correlation of this horizon deep drilling data are required [Kontorovich, 2002].

Rock physical characteristic depends on its composition and disintegration level. So they affect on wavefield parameters in different ways.

There is seismic-and-geological description of Paleozoic deposits along 2 seismic profiles fragments in the fig 1. The profile № 870138 crosses an oil-and-gas pool in Lower Devonian dolomites that is exposed by Severo-Ostanin №№3, 5, 7 wells. All these wells have been drilled out of contrasting an erosion-tectonic protrusion in the submerged zone. Reflecting horizon F_2 has a high dynamic expressiveness in this time-section.

It should be noticed that ***argillaceous*** weathering crust in the study area has bad reservoir characteristics and cannot concentrate hydrocarbons. Moreover presence of such crust has an adverse effect on petroleum potential of underling limestones.

On the contrary ***argillaceous-siliceous*** crust of weathering generated from siliceous rocks (siliceous mudstones, siliceous limestones) has good reservoir quality.

The profile № 940313 is a cross-line of the Upper Devonian-Lower Carboniferous Argillaceous-siliceous rock. A number of contrasting erosion-tectonic protrusions are clearly identified along the cross-section. The erosion-tectonic protrusions are characterized by low F_2-wave amplitude and separated from each other by high-amplitude zones. All wells drilled in the protrusions are productive.

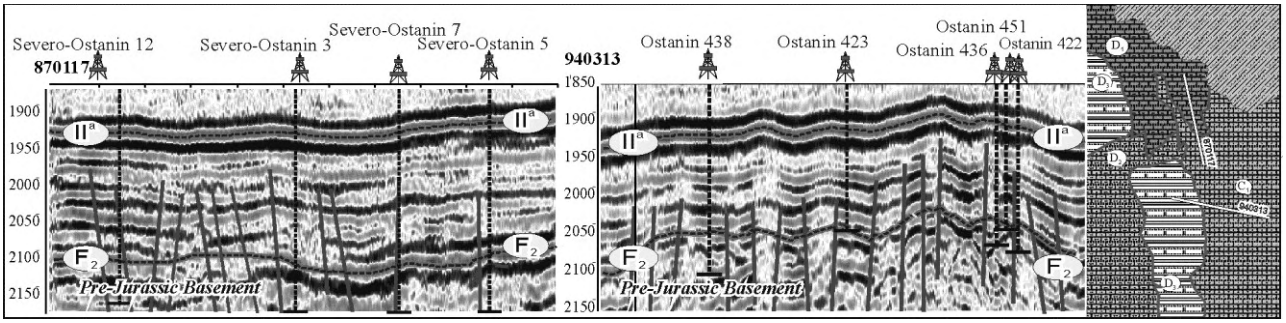

Fig. 1: Schematic map of material composition of deposits composing basement top and seismic time-sections.

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BARBERTON DRILLING PROJECT (BUCK REEF CHERT CORE BARB3)

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The ICDP-funded Barberton drilling project is aimed at the investigation of conditions and processes at the surface of the Archaean earth. Therefore two main targets have been identified: sedimentary sequences as well as successions of ultramafic to felsic volcanic rock. As part of the project, a single drill core (BARB3) with a total length of 899 m was obtained from the c. 3.4 Ga old Buck Reef Chert (BRC).

The Barberton greenstone belt is located on the eastern edge of the Kaapvaal Craton. It covers an area of 120 x 50 km and it consists of a NE-SW striking mid-Archaean succession of supracrustal rocks (3.54-3.22 Ga), the Swaziland Supergroup, which is surrounded by slightly younger granitoid complexes (Viljoen and Viljoen 1969; de Ronde and de Wit 1994; Lowe and Byerly 2007). The Swaziland Supergroup comprises three major stratigraphic units the Onverwacht, Fig Tree and Moodies Groups. The greenstone belt is centrally separated by a major fault zone, the Inyoka-Saddleback fault system (Hofmann 2007).

The Buck Reef Chert is part of the Onverwacht Group and it is a steeply dipping and exceptionally thick sequence of mainly black-and-white banded chert and banded ferruginous chert. The underlying lithology is a shallow intrusive to extrusive sequence of dacitic volcanic rocks of the Hooggenoeg Formation. The BRC is overlain by an ultramafic lapillistone of the Kromberg Formation and subsequently a more than 150 m thick ultramafic sill.

The drill hole was inclined at an angle of c. 45° and the drilling commenced in the ultramafic sill. A total of c. 200 m of serpentinized peridotite were intersected, whereas the remaining c. 700 m of the core consist of a large variety of chert lithofacies and minor intrusive mafic to intermediate igneous rocks. The drilling was conducted over a period of almost seven months, but the base of the BRC was not intersected. Additionally, geophysical logging was done up to a depth of 847 m. A stratigraphic log will be presented that will form the basis of the subsequent studies on the core. Occurrences of organic matter, sulphides and Fe-containing carbonates in specific intervals reflect changes in the depositional environment and/or hydrothermal conditions in a shallow marine early Archaean surrounding. Analysis of the various processes will require a combined sedimentological, mineralogical and geochemical investigation; hence it will result in a better understanding of the habitat of early life, geochemical cycles and marine/hydrothermal conditions.

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SEDIMENTATION RATES AND STRATIGRAPHY OF RECENT SEDIMENTS IN OXBOW LAKES OF THE RIVER MORAVA, EASTERN PART OF CZECH REPUBLIC

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Recent advances in geophysics together with classical stratigraphic methods provide powerful multi-proxy tools for environmental sedimentology of recent fluvial sediments enabling reconstruction of environmental changes and anthropogenic impact during the last decades. The effectiveness of these methods has been manifested in a number of recent studies (Ciesyevski et al. 2007, Kadlec et al. 2008 and Grygar et al. 2009). We took advantage of these methods to obtain the presented results.

This research took place in the floodplain river Morava between the cities of Postrelmov and Olomouc. Typically, the river Morava has numerous abandoned channels and oxbow lakes that act as perfect traps of recent sandy-silty sediments. The aim of this study was to investigate the correlation potential of these fluvial sediments and calculate their sedimentation rates for the last few decades using high-resolution stratigraphy methods.

The sampling took place from autumn 2009 until spring 2011 at six localities with 20 sediment core samples being taken with Multisampler (Eijkelkamp, the Netherlands). Three electrical resistivity tomography profiles were measured using the system ARES (GF Instruments, s.r.o., ČR). Mass activities of ^{137}Cs were measured using GR 320 (Georadis s.r.o., ČR) gamma-ray spectrometer for relative dating. Measurements of magnetic susceptibility (KLY-4, AGICO, s.r.o., ČR) and spectral photometry (SP-62, X-Rite, USA) were used as stratigraphic proxies. The sediments can mostly be described as coarse silts and fine sands with varying amount of clay up to 13 %, 81 % to 90 % of silt and 1 % to 12 % sand as average percentages. The samples typically contain organic matter in different state of degradation. Magnetic susceptibility varies in the range from 10^{-6} to 10^{-8} $m^3 \cdot kg^{-1}$. Photometric research shows very clearly the change of sediment colour due to changes of physicochemical properties, mainly the oxidation state of Fe-oxy-hydroxides (colour changes from orange-yellow to red)., Three colour groups were identified based on position and evolution of the sediment. This study presents new data on sedimentation rates that are very variable due to the variable dynamics of the river system. The sedimentation rates vary in the range from 1 to 2 cm per year between Postrelmov and Litovel. The sedimentation rates in proximal parts of the oxbow lakes are estimated to reach values of up to 8-9 cm per year. The sediment accumulation rates in the distal parts differ depending on the stage of evolution of the oxbow lake. Two stages can be described; during the first 20 to 30 years the sedimentation rates varied between 3.5 and 5.5 cm per year whereas in the later stages they drop to 1.9 -2.3 cm per year. The sedimentation rates heavily depend on the local properties and changes of hydro-climatic conditions during the sedimentation. This study documents the usefulness of the multi-proxy approach in the study of fluvial sediment archives and provides sound data for potential calculations of net erosion rates in the catchments.

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Rb-ELPASOLITE, Rb_2NaAlF_6: A POSSIBLE MINERAL SPECIES?

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Rare natural aluminum dipotassium sodium hexafluoride, elpasolite K_2NaAlF_6, was discovered in amazonite pegmatites where it grows on cryolite. There are few mineralogical data about natural occurrences of the elpasolite; the majority of its findings are connected with alkaline rocks of different genetic types: pegmatites, metasomatites, carbonatites, and volcanic complexes. In high-alkaline conditions elpasolite is often formed as a secondary mineral on the basis of cryolite or other aluminum fluorides of an earlier generation.

The elpasolite crystal structure may be considered as a superstructure for the perovskite one by doubling its unit cell parameters. An ordered substitution of two M^{2+}-cations in the perovskite structure for two B^{+} and M^{3+} cations different both in size and charge, leads to the formation of the elpasolite, $A^{+}{}_2B^{+}M^{3+}F_6$: $AMF_3 \rightarrow A^{+}{}_2M^{2+}M^{2+}F_6$ (Massa and Babel 1988). *M* atoms occupy vertices and face centers of an F-centered cubic lattice of elpasolite, B atoms are located in midpoints of edges and in the body-centered position, and *A* atoms center small octants (fig. 1, 2).

We hydrothermally synthesized the Rb-elpasolite, Rb_2NaAlF_6 as the single crystals in the NaF - Rb_2CO_3 - Al_2O_3 - Rb_3PO_4 - H_2O system. Its crystal structure has been solved by X-ray diffraction (Xcalibur-S-CCD diffractometer) and refined against the F^2 data to residual: R = 0.0188 [for 86 reflections with $I \geq 2\sigma(I)$] in an anisotropic approximation. Crystallographic characteristics of the Rb_2NaAlF_6 structure are as follows: a = 8.3087(1) Å, sp. gr. $Fm\,\overline{3}\,m$, Z = 4, ρ_{calcd} = 3.88 g/cm^3.

Rubidium presents a trace element and shows close geochemical relationship with potassium, - one of the vastly spread elements in the Earth crust. Close sizes of these two univalent K^+ and Rb^+-cations allow an isomorphic substitution of potassium for rubidium, and cause rubidium dispersion in nature. Discovery of several rubidium minerals in late associations of granite pegmatites in the last 10 years (Pekov and Kononkova 2010), the Rb_2NaAlF_6 and elpasolite, K_2NaAlF_6 isotipy proved by our investigation, and known synthetic cubic elpasolites of the mixed K/Rb composition (Babel et al. 1973), allow us suspecting a high possibility of a future discovery of the Rb-elpasolite as a mineral species.

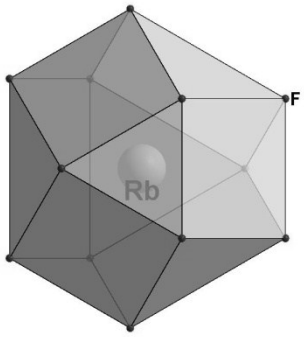

Fig. 1: Thomson cube made by F atoms surrounding Rb^+-ion in the elpasolite structure.

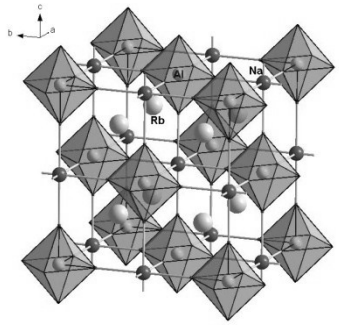

Fig. 2: Axonometric projection of the Rb_2NaAlF_6 crystal structure.

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BASIN ANALYSIS OF LOWER CARBONIFEROUS GAS- BEARING SHALE IN VARISCAN SILESIAN FORELAND BASIN, SW. POLAND

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Shale-gas deposits have been known for over a century. However, their importance had been out of focus of interest for many decades because of economic reasons. The significance of shale-gas deposits has increased since the last two decades. The Early Carboniferous Moravice Formation located in the Silesian Basin (Moravian-Silesian Fold and Thrust Belt) is a possible source rock in southern Poland. Silesian Basin is a northward deepening depression. The basin surface is 20,000 km. The basin sedimentary fill reaches 10,000 m including 4,000 m of flysch deposits. The source rock is Lower Carboniferous, shale-dominated Moravice Formation. The Moravice Formation is black marine (Culm facies) and thermally mature, kerogen type-III, gas prone shale. The thickness of the formation ranges from 10 m to 400 m. The TOC value reaches 0.5-6 wt. %. The thermal maturity ranges from 1.71 to 1.76 % in wet gas window and from 2.03 to 2.29 % in dry gas window. According to the data from some archive wells Ro reaches 2.26-4.59 % (Nowak 2003). The research concerns: depositional environment, tectonic setting, thickness, depth, organic and geochemical properties and thermal maturity. The data used in the research had been collected from three archival cores from Silesia. The microfacies and TOC analysis will be performed. The further study should bring some prerequisites of other more advanced research focused on hydrocarbon potential of the Silesian play. The research is sponsored by Silurian Ltd.

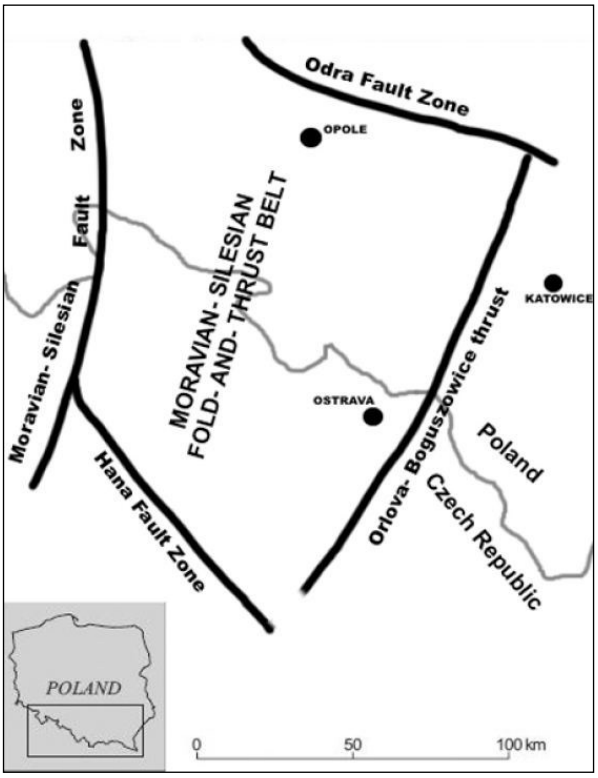

Fig.1. Main tectonic structures of the Silesian Basin (modified after Buła et. al. 2008)

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EXPERIMENTAL STUDY OF REGULAR SPATIAL PATTERNS IN GEOLOGICAL OBJECTS

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The experimental study of the banded structures suggest that a regular pattern formation in geological objects can be determined by reaction diffusion processes and nonlinear dynamics rather than by changing external conditions. Banded structures are common in geological objects such as minerals and rocks. This isssue is focused on a study of inner dynamics of the systems in which regular spatial structures can occur. There was performed an experiment to use experimental parameters for model of banded structure formed in gel matrix. A detailed analysis of the experimental banded pattern is presented. Patterns in gel matrix have been studied by NMR spectroscopy. Diffusion NMR Spectroscopy gives informations over interactions of molecules and is contemporary precise method for study of geochemical processes. NMR Spectroscopy can also be used for measuring of diffusion coefficients. Parameters from experiments were used in mathematical model for study of reaction and disffusion and dynamics of those processes.

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BIOGENIC TETRAD EFFECT OF CLAYEY DEPOSITS IN CAVES

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Due to specific localization of clay deposits in caves there are not well studied type of sediments. Underground karst cavities and caverns provide special conditions for sedimentation and exogenous mineralization. Lack of daylight and as the consequence lack of photosynthetic biota prevent the main top and is keeping the sediments in the condition of minimum change of climate factors. Samples of clay from caves of the Urals (Sumgan-Kutuk, Kapova) the Caucasus (Canyon, Rucheynaya, Crubera) and the Crimea (Cascade) have been studied in this research.

PSD results shows that samples chosen for the analysis have unimodal distribution of particles with the majority fraction of 2-50 μm. Mineralogical composition of clay fraction (<2μm) is presented by following minerals: quartz (40%), illite-smectite interlayerings (35-50%) with predominant illit layers (~60%), kaolinite (4-10%), chlorite (~6%), smectite (~1%), calcite (~1%), iron hydroxides (~1%). Mineral composition of the clay fraction silt from caves of various regions is almost identical.

Microprobe analysis of illite-smectite interlayerings shows two types - low Na_2O (<0.5%) and high (>3.5%). In general, this phase is characterized by a high content of K_2O and significant variations of CaO and SiO_2.

The results of the geochemical analysis of the silt from caves showed that overall cave deposits are similar in composition to the typical of fine-grained sedimentary rocks such as North American shale composite (NASC) or post-Archean Australian average shale (PAAS)(Taylor et. al., 1985). The most significant differences are in the higher content on clay deposits CaO and lower Al_2O_3, Na_2O and K_2O.

The distribution of REE of silt from all caves are quite similar and are characterized by high values of light and middle REE to heavy (La/Lu=8), and a negative Eu anomaly (Eu/Eu*=0.83). The total REE content in the silt of caves is 187ppm. Range of REE distribution and bulk density is close to NASC and a bit vary by higher content of the high middle REE.

The REE spectrum of clay fraction of the silt are similar to the REE spectrum of the rock, the only difference is that the concentration of some elements is slightly higher. The total REE content in the clay fraction is 233ppm. The bulk samples the clay fraction is reach in LREE (La/Lu=13) and negative Eu anomaly (Eu/Eu*=0.77). At the same time there is a clear tetrad effect of the "M" (Kawabe, 1992) (TE4=1.36) in HREE, which is not expressed in other tetrads (TE1=0.97, TE3=1.01). There is a higher concentration of MREE in the clay fraction to compare with NASC, especially Sm. It is more likely that high concentrations of Sm create the effect of the negative Eu anomalies relative to NASC (Fig. 1).

Experimental studies sorption of REE of clays (Takahashi et. al., 2000) shows, that the tetrad effect arise at formation of hydrated complexes, where the REE occupy inner sphere complexes. Sorption from such complexes of clay minerals perhaps in acidic (or neutral) conditions, due to the amphoteric properties side cleavage octahedral network and the formation of the electric double layer.

However, the value tetrad effect for the first tetrad is largest and a minimum for the fourth (Takahashi et. al., 2000, Coppin et. al., 2002). At the same time, experiments on the sorption of REE microbial communities (Takahashi et. al., 2005) showed the change in pH from 2.5 to 4 reduces the tetrad effect in the LREE and a simultaneous increase the such effect for HREE. It is noteworthy that the coefficients of sorption on the surface of the bacteria for REE in the fourth tetrad is several times higher than for the other REE (Takahashi et. al., 2005). Thus the features of the distribution of REE in the clay fraction of cave deposits indicate on the active participation of bacteria in authigenic mineralization, which occurred in moderately acidic environments.

This study was supported by the RFBR (project 12-04-00102-E) and FTP "Frames"(project 2012-12.1-12-000-1007-003).

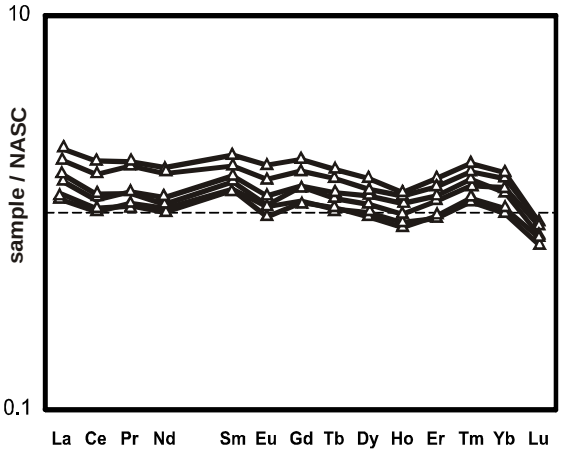

Figure 1 REE spectrum of clay fraction cave deposits.

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USING OF PORTABLE XRF FOR ANALYSES OF DRILL CORES FROM OIL AND GAS PROSPECTION

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During the exploration and exploitation of oil and natural gas it is essential to know actual depth of a borehole and also it's specific stratigraphic position. Nowadays predominating core-less drilling represents significant problem, because fragments from core-less drilling cannot be studied by lithological criteria and palaeontological studies have also many disadvantages. Another methods that haven't been used much often yet are chemical methods. This work is focused on usage of chemical composition of individual layers to estimate stratigraphic position.

Chemical composition was measured using XRF spectrometry method. This method has been chosen because of it's speed and the good manipulation. Next advantage of this method is it's sensitivity even for smaller fractions. Following list of elements has been measured: sulphur, chlorine, potassium, calcium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, rubidium, strontium, yttrium, zirconium.

At first core-less samples with prevailing Tertiary age were taken from two different boreholes . Results indicated notable chemical differences between stratigraphic layers. The larger units were affected by anomalies, which were probably caused by lenses or transgressive horizons.

Content of potassium, iron and calcium is essential for comparison between individual layers. Samples of Tertiary age layers from borehole Bošovice were divided to four groups based on amount of potassium. In the first group amount of potassium was in the range from 14 000 to 26 000 ppm, iron had the lowest content of all groups (6 100 – 19 200 ppm) and calcium was between 2 600 – 5 500 ppm. The second group's results vary from 26 001 to 35 000 ppm for potassium, concentration of iron was approximately the same (from 20 000 to 36 000 ppm) and amount of calcium was from 3 200 to 18 000 ppm.

Third group is characterised by the amount of potassium from 35 001 to 44 000 ppm, amount of iron was higher in comparison to potassium (33 000 – 55 000 ppm) and calcium was from 3 200 to 22 000 ppm. Results from last group for potassium vary from 44 001 to 50 000 ppm, for iron from 29 000 to 57 000 ppm. The results of calcium were in general the lowest from all the previous groups (2 900 – 5 600 ppm).

Concentration of calcium had a wide range of results and distribution of the groups wasn't so visible on the graph. First and fourth group had approximately the same low amount of calcium, second and third group had higher concentration. The graph shows the content of potassium and iron. Distribution to the groups is easy to see on the graph because of the amount of iron in each group.

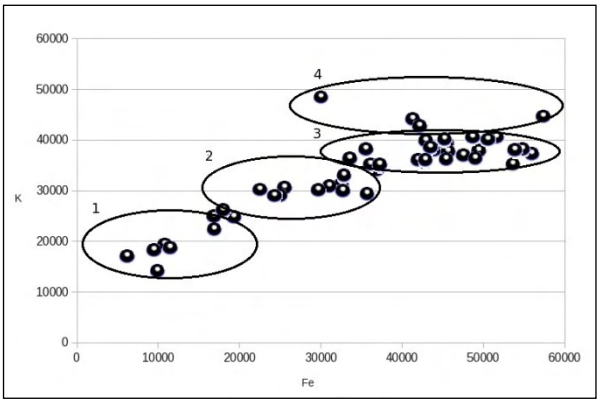

Fig. 1: Graph representing relation between amount of potassium and iron.

CLAY AND ZÁVIST FAULTS AS ONE LARGE VARISCAN STRIKE SLIP FAULT AROUND KOZIČÍN, PIČÍN AND ŘITKA VILLAGES (BARRANDIAN, BOHEMIAN MASSIF)

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The Clay and the Závist faults were described as two different structures. Both these faults are steeply dipping and striking in SW-NE direction. As both faults have reverse dip-slip component but opposite dip direction, it seemed evident that they are really two different faults.

The Clay Fault was recognized in mines of the Příbram and Bohutín ore district and named by ancient miners. The dip varies from 70° to NW in the SW part at the Kozičín surroundings to nearly vertical in the NE part at the Pičín area (Havlíček, 1973). Havlíček (1981) classified this structure as an overturned synsedimentary normal fault. He deduced the Cambrian age of the fault base on his geological map, where lower Paleozoic basalt dike cross-cuts the fault surface. The SW end of the fault is marked by downthrown SE block with the Lower Paleozoic sediments ("Rožmitál Islet"), which is rimmed by tonalitic intrusion (Blatná type).

The Závist Fault was described by Kettner (1911). The main SW part of the fault steeply dips to the SE in the Řitka surroundings. Near Kamýk in Prague, the fault surface splits into two branches. The first one turns to the WSW-ENE direction and dips slightly to the SSE making typical thrust, the second one continues to the NE, e.g. in the same direction as the main part, and after 2.5 km turns in the same way as the first branch.

Havlíček's idea assuming Cambrian age of the Clay Fault was tested with new geophysical data showing the basaltic dike cut by this fault (Šešulka et al., 2011) and therefore the Clay Fault should be younger. We can associate origin of the fault with intrusion of the Blatná tonalite, age of which is 346±10 My (Holub et al., 1997). The Lower Carboniferous age of the Závist Fault was accepted by all authors without any doubt, as the lower Paleozoic sediments are overthrusted by Proterozoic rocks along this fault.

Both of the studied faults are terminated by compensation structures, which indicate theirs sense of movement. Extensional post-sedimentary pull-apart depression of the Rožmitál Islet and intrusion of the Blatná tonalite at the SW end of the Clay Fault indicate sinistral strike-slip movement, which is accompanied by dip-slip component indicating uplift of the NW bock. Small thrusts at the NE end of the Závist Fault indicate the same sinistral sense associated with upthrown SE block. This means, that both faults have the same sense of movement, the other dip-slip components can be explained by the influence of vertical movements produced by considered compensational structures.

Based on these arguments, it is evident that both faults are only parts of one sinistral strike-slip fault originated during the Lower Carboniferous. The fault length is over 60 km. It starts near Rožmitál town, then runs through Kozičín, Pičín and Řitka villages and ends in the SE margin of Prague.

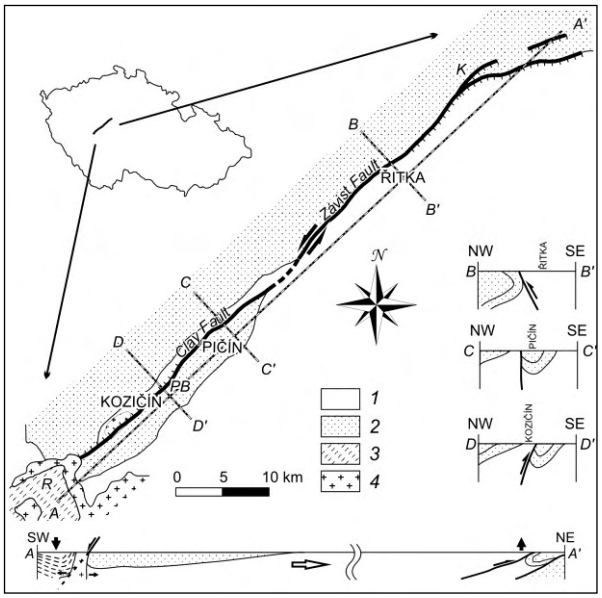

Fig. 1: Schematic map and cross-sections of the Clay Fault and Závist Fault. Key: *1* – Proterozoic, *2* – Lower Paleozoic, *3* – Rožmitál Islet, *4* – Tonalite, *R* – Rožmitál town, *PB* – Příbram town, *K* – Kamýk.

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GEOLOGICAL SURVEY AND THE IMPLEMENTATION OF SOME UNDERGROUND CONSTRUCTION IN THE CZECH REPUBLIC

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According to accomplished a underground constructions it is important to complete every simple stages of survey, realization with advance, adequate knowledge, quality of performance, representative geological and geotechnical specializing. Cooperation of geologist, geotechnical enginee, designer, investor and contractor is important in all phases of construction. Adequate and well-processed survey leads to effective realization and it eliminates the occurrence of emergency situations.

In the sektor of the IV. transit corridor in the part Benešov – Votice was realized 5 new tunnels. From the north – tunnel Tomice II. (252 m), tunnel Tomice I. (324 m), Zahradnice tunnel (1044 m), Olbramovice tunnel (480 m) and Votice tunnel (590 m). During the realization of Olbramovice tunnel was encountered a very rich geological structure of varied Moldanubicum group. The entire massif was constructed by finely to medium granular cordierit-biotite gneiss and biotite migmatites with inserts graphitic gneiss, fine-grained amphibolite, erlan locations transmitted to the amphibole-pyroxene stromatites. This metamorphic complex was in some parts very folding and faulting. In this complex were also observed intrusions medium grained amphibole-biotite granodiorite and fine-grained aplite. The rock complex in this area was not expected and its large spatial variability was not possible to capture by drilling exploration. Apparently this situation surprised even geologist of exploration drilling, which suitably unusual rocks he placed among granitoids for easier geomechanical characterization. But he could not correctly estimate the spatial development. During the realization there occurred problems with different types of rocks, in particular the degree of weathering, and especially different frequencies of discontinuities – then they were the decisive factor in the stability of the excavation face. During the excavation work contractor faced to increased instability unsecured face and excavation. This situation had to be adapted to the length of the construction process (shortened frame) and also necessity of massive primary lining.

On the example of survey for station Červený vrch (Prague Metro V.A) is possible to demonstrate influence of research on the interpretation of geological structures. In the survey of station was realized one coreless shallow borehole, which caught mostly rocks of high quality. Additional 5 wells have shown very complicated structure with unfavorable characteristics. Also there were realized another horizontal wells with special tests from the access adit. The result was very good specification of geological structure and geotechnical parameters. (fig. 1: the individual stages compare to the reality). Thanks to a good background were modified plans of technological progress of the excavation and completed some of the measures. The risk of unexpected events was reduced to a minimum.

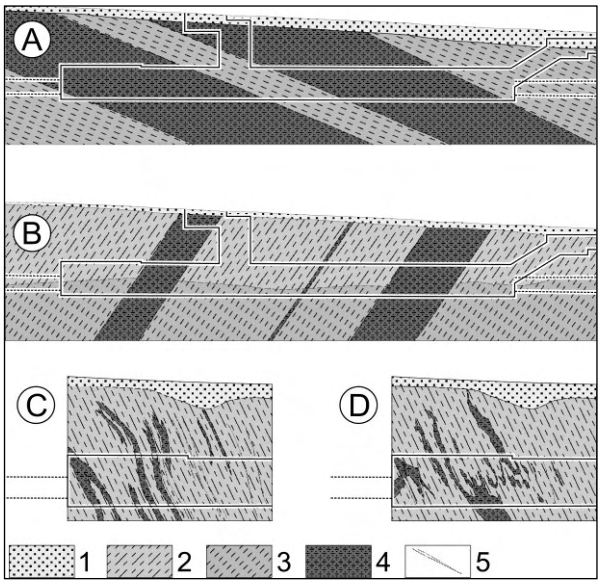

Fig. 1: Simplified geological model in different stages of survey of Červený vrch station: A – tentative survey, B – additional survey, C – completion of exploration of the station, D – actually encountered structure of the station. Key: 1 – eluviums; 2 – Ordovician silty shale, decomposed, blossom, broken; 3 – fresh Ordovician silty shale; 4 – quartzite; 5 – faults and deformation.

From the arguments and the selection of real examples above follows the fundamental position of geological survey in the underground constructions. It is necessary to observe all parts of survey (as their realization in time, sufficient financial reserve, quality of implementation …). It definitely helps to minimize risks and problems during construction. Cooperation among geologist, geotechnical engineering, designer and contractor in all phases of construction on the basis of adequate and well-processed survey leads to cost-effective implementation of project well in advance eliminates the occurrence of unexpected events.

ORIENTATION ANALYSIS TOOLS FOR GIS

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Geographic Information system is often used in geology nowadays. It is a powerful tool for data storage, map construction and data analysis. The process of geological map creation starts by collecting data in the field. Based on this data and their analysis borders of geological units and tectonics can be constructed.

Orientation of structures is represented by dip and dip direction (trend and plunge). This information with x, y coordinates and other description (e.g. lithology) is stored in the table and plotted in the map.

Common software for orientation analysis works without any relation to the map, also the mutual relationship is missing – we cannot say if points plotted in the diagram lie near each other in the map or there is not any spatial connection.

Set of Orientation Analysis Tools presented here can be added to map application of ArcGIS (ESRI) environment. It allows user to plot selected data into diagrams, count and plot fold axis, construct density distribution diagrams, rose histograms, count spatial averages or map of fold axes and construct appropriate maps. The mathematical solution is taken from Fisher et al. (1987) and Wallbrecher (1986). There is a link between diagrams and map, therefore the user can select points in the diagram of particular distribution and do next analysis only with this selection. Selection can be made also by GIS selection tools based on attributes stored in tables (e.g. type of structure) or based on location in the map.

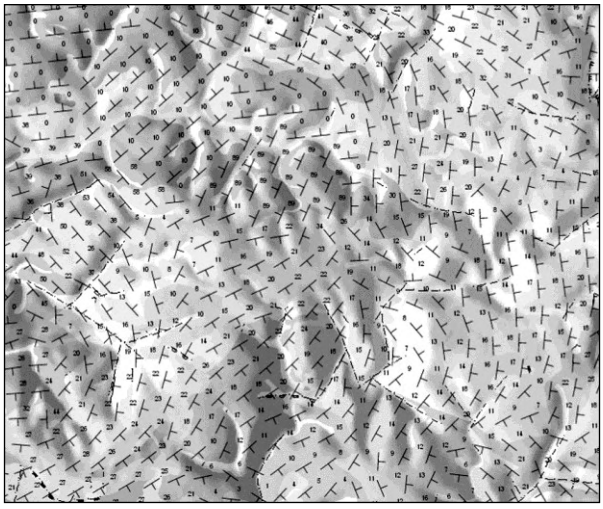

Fig. 2: Spatial averaged map from planar structures on simplified geology and shaded relief

Results are in vectorial form, so the user can symbolize them based on attributes. Also the cartographic level enables to use the diagrams for map illustration or in research papers.

Tools are tested on data from Svratka crystalline unit.

This work is supporetd by Czech Geological Survey (project 541008).

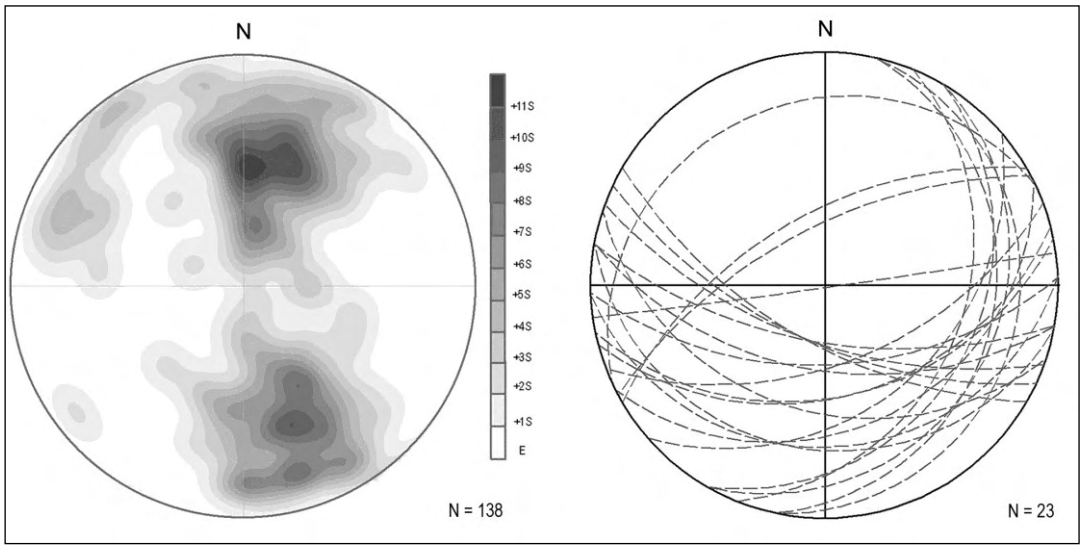

Fig. 1: Density distribution diagram and arc diagram from bedding planes, lower hemisphere (Schmidt projection)

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FLUID INCLUSIONS FROM CRYSTAL QUARTZ ARTEFACTS AND OUTCROP OF THE EASTERN ALPS

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Aims of the research are to identify the characteristics of fluids in samples from the Eastern Alps, and these subsequently use for proving or refusing the local provenance of crystals. Samples were obtained from three localities in the Eastern Alps. The first locality is called Riepenkar and it is situated at the altitude of 2.700 m above sea-level at the southern foothills of the Olperer in the Zillertal Alps, near of the border between Austria and Italy. The other samples have been picked up from locality Kiechlberg, situated in the Inn Valley, north of the city of Innsbruck and last ones come from locality near the Rofental valley, which is located above village Vent in the Ötztal Alps.

Samples are divided into two types. The first type is taken directly from outcrops and the second type comprises artefacts, belongs mainly to the Middle Stone Age. Both sample types were obtained from Riepenkar. Only artefacts were obtained from localities Kiechlberg and Rofental and moreover, at these locations no natural sources are known.

Basic study of fluid inclusions (FI microthermometry) as well as scanning electron microscopy and Raman spectroscopy were used to specify properties of fluids. Microthermometrical parameters as total homogenization ($T_h$tot), melting of CO_2 (T_mCO_2), homogenization of CO_2 (T_hCO_2), melting of clathrate (T_mCLA), homogenization of methane (T_mCH_4), eutectic temperature (T_e), melting temperature of ice (T_mICE) have been measured. Salinity was calculated using T_mICE and T_mCLA resp. (Bakker 1997)

Riepenkar outcrop: $T_h$tot range from 243°C to 272°C, T_hCO_2 is between 27,7°C and 31,1°C, T_mCLA has a range of (6,0°C – 6,8°C), T_e range from −26,8°C to −20,3°C and T_mICE is between (−9,8°C to −3,5°C). Average salinity is around 8,6 wt.% of NaCl equiv and average CO_2 content is 6,4%. This CO_2 content may indicate metamorphism at lower to medium conditions (Diamond 2000).

Riepenkar artefacts: $T_h$tot is between (215°C – 268°C), T_hCO_2 range from 28,7°C to 31,0 °C, T_mCLA is between (−3,6°C to 7,0°C), T_e range from −24,7 to −21,0°C, T_mICE is between −9,1°C and −5,5°C. Average bulk salinity is around 9,0 wt.% of NaCl equiv. and CO_2 content of 7,5%, which again indicate that quartz could form at lower to medium metamorphism.

Kiechlberg artefacts: $T_h$tot is varying from 175°C to 369°C, T_hCO_2 range from 29,7 °C to 30,0°C, T_mCLA is between 3,5°C to 10,5°C, T_e lie between −8,0°C and −4,0°C, T_mICE range between −3,2°C and 0,0°C. Average bulk salinity is around 3,1 wt.% of NaCl equiv. and CO_2 content of 6,0%, so quartz could be formed at similar conditions as Riepenkar.

Rofental artefacts: $T_h$tot range from 335°C to 530°C, T_hCO_2 is between −34,2°C and 27,9°C, T_mCLA vary from −2,1°C to 13,0°C, T_e range from −30,0°C to −18,0°C and T_mICE occurs over wide range of temperatures, varying from −23,3°C to −2,1°C. Average bulk salinity is c. 10,5 wt.% of NaCl equiv. and average CO_2 content is around 15%, which can indicate medium or high temperature metamorphic conditions.

Homogenization of methane (T_hCH_4) is observed in Riepenkar outcrop inclusions, varying from −94,3°C to −89,0°C.

Unique solid phases are detected in inclusions from both Riepenkar samples. Raman spectroscopy and SEM-EDS analysis are performed to recognise their chemical composition.

CO_2 content is verified by Raman spectroscopy within both Riepenkar samples.

Presence of potassium and calcium is observed by SEM-EDS analysis, which suggests presence of potassium chloride and calcium chloride within FI.

Chemical system H_2O-CO_2-CH_4-NaCl-KCl-CaCl is observed within FI of both Riepenkar samples with respect to microthermometrical, Raman spectroscopy and SEM-EDS data. Chemical systems H_2O-CO_2-NaCl±CH_4±N_2±KCl±CaCl and H_2O-CO_2±KCl±NaCl±sulfates±carbonates are observed in FI of Rofental and Kiechlberg resp.

Riepenkar outcrop is the source for artefacts found in the vicinity of the site however provenance for artefacts from Kiechlberg and Rofental is different.

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SEISMIC CRITERIA FOR PREDICTING RESERVOIR QUALITY AND DELINEATING COMPLEX TRAPS IN OXFORDIAN SANDS OF THE SOUTHEASTERN WEST SIBERIA

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In the West Siberian petroleum province, CDP survey is the basic geophysical technique for prospecting and preparing oil and gas trap for deep drilling as well as for delineating the field outlines. The deposits of Western Siberia plate are composed of Proterozoic-Paleozoic basement rocks and Mesozoic-Cenozoic sedimentary cover deposits. Exploration for hydrocarbons showed that the major hydrocarbon traps found in Jurassic and Lower Cretaceous deposits have not only the structural but also lithological, tectonic and stratigraphic control.

In southeastern West Siberia the majority of hydrocarbon resources and reserves are associated with the Oxfordian reservoir, J_1 horizon, Vasyugan Formation. Considered in the present study are the techniques that allow the reservoirs to be delineated and mapped using a combination of geophysical logging and deep drilling data. The field data are presented in the 2D CDP-time cross sections and in the well logs.

Bazhenov formation and U_1 coal bed form the top and base of the over-coal member (Shurygin, 1999). These were formed in the periods of tectonic quiescence and were peneplanation planes. Thickness map for the over-coal member characterizes the U_1 paleorelief in the time of Bazhenov deposition. Increased thickness of the over-coal member is typical of the Oxfordian paleolows, whereas decreased thickness is characteristic of paleohighs. The correlation chart (Fig.1) shows the wells aligned against the Bazhenov base and arranged with gradual decrease in the over-coal member thickness. The study shows that J_1^{1-2} sand beds with the enhanced net thickness were deposited within the paleoslope setting. This formation damages either towards the paleohigh crests or paleolow axes.

Thus, predicting the over-coal member thickness will be enough to evaluate net thickness of J_1^{1-2} sand beds.

Other wave field parameters depending on a thickness of the over-coal member can be also chosen. The decrease in the over-coal member thickness can quantitatively evaluated from visual analysis of time sections. In addition, the thickness of the over-coal member can be determined using paleotectonic criteria.

The map showing net sand thickness for the J_1^{1-2} bed has been generated based on the over-coal thickness map using amplitude attributes of wave field and the above relationship.

A comparison of the net thickness map with a structural map for the top of Oxfordian sands of the over-coal member enabled us to refine geological model of the discovered oil and gas fields and predict a series of the new structural-lithological exploration targets.

The whole body of geological and geophysical knowledge, an integrated approach to seismic, deep drilling and log data interpretation allows us to work successfully delicate problems of predicting geological sections within the Jurassic of West Siberia or develop geological models of a complex lithologically screened hydrocarbon accumulations.

The mapping techniques proposed for sandstone and permeable zones within the J_1^{1-2} beds, which are the most productive in terms of hydrocarbon reserves, have been very effective for a large number of prospects located in the central and southern parts of the West Siberian petroleum basin.

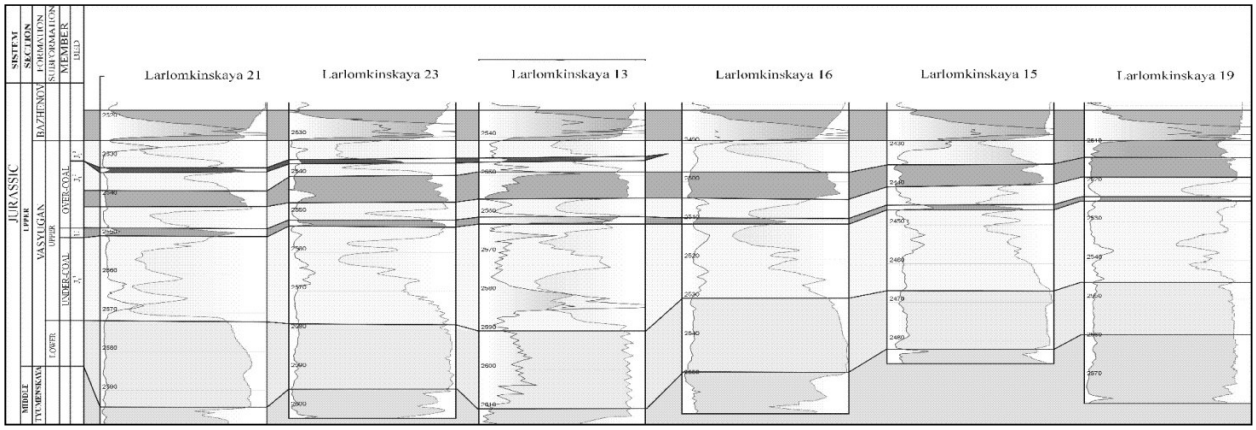

Fig. 1: Correlation chart for Callovian-Volgean sections of the Larlomkino field

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NEW PALEOMAGNETIC DATA FROM THE BAJOCIAN VOLCANIC ROCKS OF THE CRIMEAN MOUNTAINS (UKRAINE)

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The reconstruction of the tectonic history of circum-Black Sea region plays an important role for understanding of geodynamic evolution of this region, especially in connection with its hydrocarbonaceous potential. Nowadays a number of multidisciplinary (such as paleomagnetic and geochronological) studies were performed to decide this question (Meijers et al. 2010), but the geodynamic evolution of some key tectonic units remains insufficiently known. The Crimean Peninsula is one of these tectonic blocks and new reliable paleomagnetic data, obtained from its well isotopically dated objects, are always expected.

The most serious problem of any paleomagnetic works on the Crimean magmatic objects consists on determination of their bedding. Because of that significant part of available Crimean paleomagnetic data cannot be used for paleotectonic reconstructions. We have sampled nine magmatic bodies (mostly dykes and sills) of the Bajocian age, which belong to the Crimean Mountains (the margin of Scythian plate) and have the newest precise Ar/Ar and U-Pb isotopic age (Meijers et al 2010; Morozova et al. 2012). The bedding of these bodies was mostly unknown. Moreover we have taken samples from one outcrop of coeval volcaniclastic rocks (tuffs and sandstones), which lie inclined. We have used detailed AF and/or temperature magnetic cleaning to isolate the magnetization components.

Two components of NRM were found: a) a low-temperature/coercitivity component that probably has viscous origin and the modern age, and b) the most stable characteristic component with high blocking temperatures (up to 580°C). In nine of ten studied magmatic bodies we observe the stable component of normal polarity (N), and only one magmatic body has the most stable component of reverse polarity (R), which direction is opposite to N. Samples from tuffs and sandstones have ChRM of normal polarity (N) and its direction in geographic coordinates coincide with directions of ChRM from magmatic bodies. The bipolar distribution of the magnetization components can be considered as an indication of the primary nature of the stable components of intrusive bodies and sandstones. Thus, the bedding of studied magmatic bodies is secondary and they were dislocated together with volcaniclastic sediments after their sedimentation. This conclusion has an important role for regional geology and tectonics.

We have calculated the paleomagnetic pole which corresponds to the average direction of ChRM of the studied objects in a stratigraphic coordinate system (N = 10, plat = 50.6, plong = 232.2, dp/dm = 4/8). This pole lies close but statistically differs from the earlier obtained Middle Jurassic paleomagnetic poles of the Crimea. We suppose that the most probable reason for the observed difference lies in low quality of the existent data, because most of them were obtained some decades ago without necessary paleomagnetic procedure, commonly used now (principal component analysis, total magnetic cleaning etc). Due to low quantity of studied objects our results are preliminary and have to be checked during following studies, but, as it was shown, they already can be used for solving some regional tasks.

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THE LATE JURASSIC AND EARLY CRETACEOUS OYSTERS (BIVALVIA) FROM SIBERIA: RESULTS OF SYSTEMATIC-PALEONTOLOGICAL AND ISOTOPIC RESEARCH

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Collections of the Late Jurassic and Early Cretaceous oysters, made by V. A. Zakharov in the 1960s from the Kimmeridgian and Volgian sections of the Subpolar (Lopsia, Tolia, Maurynia rivers) and Nothern Urals (Yatria river) and the Kimmeridgian, Volgian, Berriasian and Valanginian sections of Middle Siberia (Boyarka, Bolshaya Romanikha, Dyabaka-Tari rivers), and oysters collected by paleontologists from Institute of Petroleum Geology and Geophysics from the Jurassic/Cretaceous boundary sequences of the Subpolar Urals (Maurynia river) (Alifirov et al. 2008) were studied.

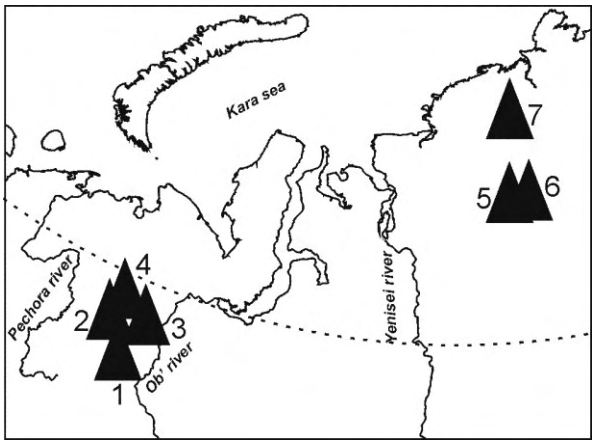

Fig. 1: Schematic map of cross-sections: 1 – Lopsia river, 2 – Tolia river, 3 – Maurynia river, 4 – Yatria river, 5 – Boyarka river, 6 – Bolshaya Romanikha river, 7 – Dyabaka-Tari river

The following conclusions can be drawn from the study of shell morphology and microstructure: 1. High degree of variation in oysters morphological features (e.g. the shape of shell) should be taken into account when describing new taxa. 2. Shell microstructure is a morphological feature of a high rank (subfamily or higher). 3. Wide or, in contrast, narrow range of modification variability (norm of reaction) in shell shape and shell sculpture features can be used as a morphological feature separating genera. 4. Size and shape of ligamental area depends on oysters shell shape. For genus *Deltoideum* this feature can not be used for taxonomic classification, and for genus *Liostrea* its taxonomic value is not readily understood. 5. Shape of the shell is a taxonomic feature of species rank for genus *Liostrea*. For genus *Deltoideum*, shell shape is controlled by its ethology. 6. Thick-shelled oysters, defined as *Liostrea* ex. gr. *delta*, should be included in genus *Deltoideum*. 7. New species *Deltoideum* sp. nov. is described.

Also, we have studied stable oxygen and carbon isotopes composition of shell material of oysters *Deltoideum* sp. from the Volgian stage of Maurynia river and compared it to data on belemnites (Dzyuba et al. in press). $\delta^{18}O$ values for oyster shells reveal higher paleotemperature than paleotemperature indicated by belemnite rostra. This can be explained by different mode of life of this molluscs. Oysters followed benthic mode of life in warm shallow water, and belemnites, probably, lived in deepwater environment. Absolute values of $\delta^{13}C$ for oysters shells are higher than those for belemnites, however, values tend to vary over time. Difference in absolute values of $\delta^{13}C$ between oyster shell material and belemnite rostra is attributable to defferences in carbon isotope fractionation in oysters and belemnites.

This work was performed with the support of RAS programms N23 and N28.

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INVESTIGATION OF THE SOURSE ROCK OF THE TOL`KINSKIY TROUGHT OG THE WEST SIBERIAN BASIN

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Introduction. Investigation of 200 core samples from Tol`kinskiy through was conducted in order to identify source rock potential. Geological section of the study area is presented by following formation (from the top to basement): Quaternary; Palaeogenic: Novomichaylovsk formation (Pg_3r), Altymsk formation (Pg_3r), Tavdinsk formation (Pg_2b-Pg_2p), Lyulinvorsk formation (Pg_1t-Pg_2i- Pg_2l), Talick formation (Pg_1d-Pg_1m); Cretaceous: Gan`kinsk formation (K_2m), Berezovsk formation (K_2cn-K_2cp), Kuznecovsk formation (K_2t), Pocursk formation (K_1a-K_2c), Vartovsk formation (K_1g-K_1a), Megonsk formation (K_1b-K_1v); Jurasic: Bashenov formation (J_3t), Georgiev formation (J_3km), Vasyugan formation (J_3kv-ox), Tyumen formation (J_2a-J_2bt), Koutukhin formation (J_1h-J_2t). Generally all the samples were from Jurassic clastic section. Five potential source rocks were identified as a result of a number of pyrolysis analyses: Koutukhin (J_1h-J_2t), Tyumen (J_2a-J_2bt), Vasyugan (J_3kv-ox), Georgiev (J_3km) and Bashenov (J_3t).

Results. Within the Bazhenov formation: organic carbon content varies between 0.33 and 10.2% with middle value of 5.7%. Generation potential changes from 0.99 to 63.76 kg of hydrocarbons per tonne of rocks, with middle value of 30.05 kg of hydrocarbons per tonne of rocks. Hydrogen index (HI) varies from 6 to 546 milligrams of hyrdrocarbons per gram TOC (Fig.1).

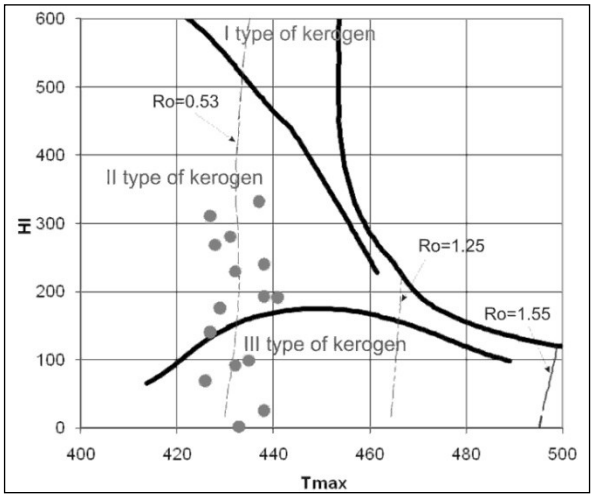

Fig.1: Plot of hydrogen index vs. Tmax (modified diagram Hunt, 1996) and results for samples (red dots) from the Bazhen deposits

In the Tol`kinskyi trough area rocks of Bazhenov formation are in the main zone of oil generation - Tmax values 435-442 °C, characteristic for end of MK1 - beginning of MK2 zone. Samples with catagenetic maturity of MK2 predominate.

Conclusions. To determine the level of catagenetic maturity vitrinite reflectance (Ro) and Tmax were used. Positive correlation between these two parameters is observed, especially in the interval of Tmax values 430-446°C (catagenetic maturity level MK_1-MK_2). According to this correlation catagenetic maturity of Mesozoic deposits within Tol`kinskiy trough was indicated. Jurassic deposits within the study area are now in the main zone of oil generation, mainly MK_1-MK_2, according to Ro and Tmax values. The boundaries of the main zone of oil generation are found at depth 2,4-3,8 km; MK_1 zone is widely spread. Thickness of catagenetic zones decreases with depth, which is characteristic for many oil and gas bearing basins. To our opinion Ro and Tmax values are slightly underestimated, probably due to organic matter composition. It is characterized by high abundance of higher plants leptynite components and presence of migrational hydrocarbons enriched with hydrogen. According to coal petrographic investigations in some of the studied samples vitrinite is presented by parenchynite from leafs material and is closely connected with cutinite included in the leptynite group. Leptynite components are characterized by high content of hydrogen in elemental composition, which leads to decrease of such parameters as vitrinite reflectance and Tmax. According to Parparova and Zhukova (1990) vitrinite of Mesozoic age are characterized by more aliphatic structure.

Generation of oil by Jurassic rocks is proved by presence of migrational (often trace migrational) bitumoids and hydrocarbons within sandy-silty layers. Migrational bitumoids are also found in mudstones, that breaks the negative correlation between concentrations of organic carbon and its bituminous, including hydrocarbon content ("Uspenskyi – Vassoevich" regularity). Break of this correlation is usually observed within the main zone of oil generation, where not only generation, but also emigration of the most reduced bitumoids and hydrocarbons into the pores and cracks. Presence of migrational hydrocarbons is observed according to pyrolysis data. High values of S1 peak (higher than S2) and PI index (S_1/S_1+S_2) and low values of Tmax are characteristic for this type of hydrocarbons, which are on the same level of transformation as syngenetic organic matter; often migrational hydrocarbons are found in rocks of Tyumen and Vasyugan suits.

DRY FRACTURING AS A MORE EFFECTIVE AND SAFE METHOD IN SHALE GAS RECOVERY

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In order to extract natural gas from shale it is necessary to repeatedly fracture the formation to increase the gas flow. The most common method is hydraulic fracturing, HF, which is based on pumping pressurized fracturing fluid that contains water, proppant and other additives, into rocks. Despite the technological development that has taken place in recent years in the use of this method there are still a lot of problems, for example, the cost of carrying out the procedure, the risk of contamination of groundwater and surface water and fracturing fluid disposal. Therefore, it is necessary to develop other methods of stimulation of gas and oil production from shale. To learn about alternatives to HF a short review of available publications and research was carried out. The most promising appears to be the method of so-called dry frac (dry fracturing, DF), which, instead of water as a fracturing material may use a liquid carbon dioxide, a mixture of liquid carbon dioxide and nitrogen, foams or liquid natural gas.

Dry fracturing methods are primarily designed to prevent the absorption of water by clay minerals, especially smectite and illite. (Kuuskraa, Vello A., 2007). This results in better performance of the fracturing process. Swelling of these minerals despite the use of proppant materials results in potential fracture closing. Hence, the use of gas as a medium for proppants is crucial for increasing the efficiency of the process.

The main advantages of the use of gases and foams, apart from swelling clay minerals, are (after Rogała A. et al, 2013):

- an efficient, fast and easy process of fracturing material recovery,
- using gas excludes the use of a number of chemicals used in the HF,
- a wide range of viscosity of foams,
- the possibility of 100% fracturing fluid recovery,
- inertness of gases used for fracturing in relation to the environment.

However, besides these advantages, dry fracturing also has drawbacks, including (Rogała A. et al, 2013):

- possible leakage of gases into the atmosphere, in particular CO2,
- the high cost of CO_2, transport and storage of gases,
- proneness of LPG to violent reactions with heat,
- the shape and geometry of the cracks generated in the process can hinder the arrangement of proppants.

An alternative to the use of liquid gas is to use explosives and propellants that do not use any fracturing fluids (explosive / propellant system - EPS). This method uses series of detonations of the rock formation in order to create perforations and cracks under the influence of injected gas being injected during the combustion of the propellant (Page, J.C., Miskimins, J.L., 2009). The main drawback of this method is the limited range of the resulting cracks. This process yields longer, more regular fractures in all directions, it is completely chemically inert, does not cause swelling illite and its performance is very similar to a conventional hydraulic fracturing at a significantly lower costs.

Each of these methods can be used depending on the geomechanical and mineralogical properties of medium to be fractured. The mineralogical studies of the lower Silurian shale, the most promising sources of European shale gas, show that they contain a significant amount of smectite (U.S. Department of Energy, 2011, Polish Geological Institute, 2012). Thus, the use of HF can reduce the productivity of these rocks. It is therefore necessary to consider the use of dry-fracturing and EPS.

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ZEOLITIC ADSORBENTS SYNTHETIZED FROM FLY ASH RECEIVED FROM POWER INDUSTRY

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The fly ashes are produced during combustion of coal in both pulverized and fluidized bed boilers in power plants (Quant 1997). Fly ashes are known currently to be one of CCP (Coal Combustion Products). Fly ashes are considered to be a valuable material. Wide range of potential applications allow to change the perception of this material from waste to raw material.

The mineral composition of fly ash (especially high content of Si-rich amorphous phase) allows, with addition of alkalis, to use them as raw material for the production of zeolites. Zeolites are an excellent absorbent material because of their internal structure.

The material used for the experimental study were fly ashes captured by electrostatic filter in one of Polish thermal power plants. Fly ashes were generated in pulverized fuel boiler by co-firing of coal (~ 95 wt%) and biomass (~ 5 wt%). Ashes belong to silicate type (SiO_2 ~ 45 wt%) with high content of Al_2O_3 (~ 20 wt%). The main mineral phases present in fly ashes are quartz, mullite, anhydrite and Fe-oxides.

The addition of biomass does not affect the mineral composition of the fly ash significantly: small amounts of lime and periclase appeared in samples. Some important changes in chemical composition were noted due to addition of biomass: the content of alkalies and Fe_2O_3 increases (Wilczyńska-Michalik et al. 2009; Kowalski and Michalik 2011).

The aim of the research was to obtain a diverse zeolite adsorptive material and to investigate the influence of experimental parameters (time, temperature and concentration of reagents) on the synthesis of zeolites.

Zeolitic materials were obtained in process of fly ash transformation. Two methods of synthesis were used: classic hydrothermal conversion (reaction with NaOH at temperatures of 50 and 70°C, with 0.5, 3 and 5M NaOH) and two-stage method (sintering with NaOH and heating in 100°C).

As a result of the experimental work, materials varied in composition were received. They were a mixture of several zeolite phases. Seven zeolite types were received (zeolite A, Na-X, cancrinite, sodalite, faujasite, chabazite and NaP1) during experiments. Material obtained in hydrothermal method was rich in zeolites A and Na-X, while in the two step method most often was Na-X zeolite and cancrinite.

The zeolitic material was more diverse and a greater number of zeolite phases was formed in comparison with the zeolitic material derived from fly ash generated from the same power plant with no co-combustion of biomass (Derkowski and Michalik, 2007; Kowalski and Michalik 2011).

Changing of the reaction parameters allowed to obtain various zeolitic phases. With increasing temperature, longer reaction time and higher concentration of NaOH, the zeolites crystallized in order:

Na-X zeolite A, NaP1 → chabazite → faujasite →

cancrinite → sodalite.

Zeolitic material obtained during synthesis was tested by adsorbtion of lead from aqueous solution (materials rich in zeolite A, Na-X, cancrinite and sodalite). Adsorption capacity of synthesized zeolites was compared with adsorption potential of raw ash. Synthesized zeolites adsorbed two times more lead than raw ash (up to 80 mg Pb on 0.180 g of sorbent). The two-step method of synthesis allows to obtain 15% better absorbent material than the hydrothermal method.

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MORPHOSTRUCTURAL FEATURES OF ZIRCON POPULATIONS OF DIFFERENT AGE FROM BASIC ROCKS OF THE ARCTIC OCEAN RISES

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The results of studying morphological characteristics of zircons from magmatic rocks of Mendeleev Rise and Lomonosov Ridge of the Arctic Ocean and subsequent U-Pb dating of the zircons are presented. Using the techniques of studying internal structure in cathode luminescence (CL) and back-scattered electrons (BSE), the internal structure features of zircons were described. The internal structure of zircon crystals in BSE and CL are established with the use of scanning electron microprobe CamScan MX 25005. Zircon dating was conducted with the application of U-Th-Pb method with mass-spectrometer of secondary ions SHRIMP-II in the Center of Isotopic Research of Karpinsky VSEGEI (Saint Petersburg).

Zircons are characterized by extreme variety of crystal forms. Both isometric and elongated prismatic forms are observed. The grain color varies from slightly colored light yellow to dark and light violet with the predominance of the latter (63.5%). The grain color depends in this case both on inclusions (for example, rutile) and possible metamictization of the zircon itself. Both rounded and flattened grains can be seen. Isometric, prismatic and elongated grains (up to acicular with elongation coefficients > 3) are distinguished. In this case, the share of prismatic crystals is maximum and amounts to 51.0%. Intermediate forms are also noted. Besides, all varieties show considerable roundness (60 % of rounded grains), which in most cases level the facets of prisms and dipyramids.

From U-Pb data (SHRIMP-II) and researches of internal and external morphology, several zircon populations of different ages were established that reflect the major stages of geological development of submarine Lomonosov ridge and Mendeleev rise (Fig. 1): 1) > 2000 Ma (PR-AR) – the formation of paleo basement; 2) 800-500 Ma (PZ) – the formation of terrigenous-carbonaceous sediments of the ancient platform with major intrusions; 3) 250-150 Ma (T-J) – continental, trappean magmatism; 4) 150-127 (K_1) – intraplate rift magmatism; 5) 100-60 Ma (K_2-Pg) – oceanic stage of the Arctic Ocean formation.

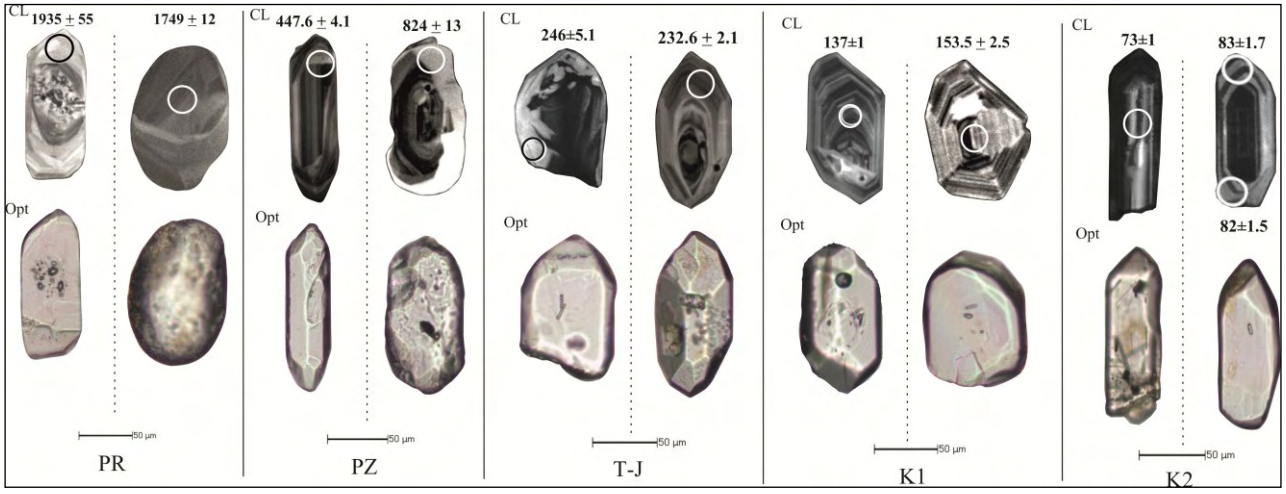

Fig. 1. Morphology types of different populations of zircons (in transmitted light (Opt) and cathodoluminescence (Cl)) from the basic rocks of Lomonosov Ridge and Mendeleev Rise.

STRESS FIELDS EVOLUTION IN RAKHIV-TYSA FAULT ZONE (EAST CARPATHIANS, UKRAINE)

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Research fault zone is located in the South-Eastern part of the East Ukrainian Carpathians. Rakhiv-Tysa fault crossing North-Western part of Marmarosh crystalline massif and Cretaceous flysch Rakhiv, Porculets and Chornohora nappes. In this fault zone a number of water springs with very different chemical composition (including deposits of arsenic waters "GirskaTysa"), current and postorogen vein mineralization (travertine and different veins, particularly carbonate, filled joints in the host sandstones) were found.

We carry out stress-field investigation using paleostress analysis (joint and fault-slip analysis) (Gintov 2005) in Rakhiv-Tysa fault. StereoNett and Win-Tensor software were used for data processing. More than 600 different joints and 50 slickensides in 10 wall points of observation were investigated.

We marked out few different paleostress fields in the fault zone. The first (the oldest) group of paleostress fields was connected with planetary jointing formation during lithification of deposits and similar for Rakhiv, Porculets and Chornohora nappes in fault zone (Rakhiv nappe: σ_1 – 185/09, σ_3 – 275/01, Chornohora nappe: σ_1 – 357/01, σ_3 – 267/03 and Rakhiv nappe: σ_1 – 272/01, σ_3 – 002/07, Porculets nappe: σ_1 – 273/03, σ_3 – 003/06, Chornohora nappe: σ_1 – 257/06, σ_3 – 116/03). These joints, probably, were formed before thrust and fold formation. The second paleostress field occurs only in Porculets nappe and probably shows the beginning of thrust and fold formation (σ_1 – 211/05, σ_3 – 121/01).

Next few groups of joints were connected with orogenic process. The first field occurs in fault zone only in Rakhiv nappe and shows the compression regime of Carpathians direction (σ_1 – 250/20, σ_3 – 020/61). The second (Rakhiv nappe: σ_1 – 192/12, σ_3 – 283/08, Porculets nappe: σ_1 – 222/04, σ_3 – 313/12, Chornohora nappe: σ_1 – 237/09, σ_3 – 333/32) and the third (Rakhiv nappe: σ_1 – 085/01, σ_3 – 354/22, Porculets nappe: σ_1 – 266/01 σ_3 – 176/31, Chornohora nappe: σ_1 –096/02, σ_3 – 188/20) fields were controlled by strike-slip regime.

The youngest (almost vertical) joints are the most common in Rakhiv-Tysa fault zone. There were five stress fields in postorogene time. The first one (Rakhiv nappe: σ_1 – 049/03, σ_3 – 318/04, Porculets nappe: σ_1 – 064/08, σ_3 – 155/07), the second one (Rakhiv nappe: σ_1 – 019/07, σ_3 – 289/01, Porculets nappe: σ_1 – 181/08, σ_3 – 090/11), the third one (Rakhiv nappe: σ_1 – 091/06, σ_3 – 181/02, Porculets nappe: σ_1 – 086/02, σ_3 – 179/10, Chornohora nappe: σ_1 – 086/03, σ_3 – 176/01) the fours one (Rakhiv nappe: σ_1 – 312/12, σ_3 – 042/01, Porculets nappe: σ_1 – 324/15, σ_3 – 056/08, Chornohora nappe: σ_1 – 150/02, σ_3 – 059/12) were active as strike-slip regime. The last common in the fault zone paleostress fields occurs only in the Porculets nappe. Its different orientated tension: σ_1 – 236/56, σ_3 – 136/08 and σ_1 – 316/55, σ_3 – 056/07. This last field could demonstrate the modern tectonic regime of the Ukrainian Carpathians.

Slickenside analysis shows similar results. Five stress fields were studied out in fault zone. The oldest stress field was determinate as strike-slip paleostress field σ_1 – 033/04, σ_3 – 123/09, (R = 0,5). Next one- strike-slip paleostress field σ_1 – 179/07, σ_3 – 090/00 (R = 0,54). The most occurred stress field, more than 35% of slickensides, is: σ_1 – 179/07, σ_3 – 090/00 (R = 0,54). The youngest two tension fields are: σ_1 – 298/01, σ_3 – 028/14; (R = 0,53), σ_1 – 098/88, σ_3 – 233/02 (R = 0,33).

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LATE EOCENE – EARLY OLIGOCENE CORAL BIOCONSTRUCTIONS FROM TRANSYLVANIAN BASIN (ROMANIA): PRELIMINARY RESULTS

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The Transylvanian Basin in Romania is a part of the Central (intra-Carpathian) Paratethys. The Palaeogene post-tectonic cover of marine and continental deposits ranges in thickness between 500 to more than 1800 m. The studied area occurs in north-western part of this basin, between Babeni and Letca, about 70 km north of Cluj-Napoca.

The coral bioconstructions occur within the Upper Eocene–Lower Oligocene Cozla Formation. The best recognized section, at the active quarry at Cuciuclat–Babeni, about 10 m in thickness, consists mostly of shallow-water bioclastic packstones and wackestones, nummulite-bearing packstones, and levels with rhodoliths and red algal–coral bioconstructions (Săsăran and Bucur, 2011). The present studies were performed in abandoned quarries in Babeni and Letca, where levels with coral bioconstructions are better developed and attain up to 2 m in thickness.

Scleractinian corals are dominated by delicate branching growth form. They are relatively common, but taxonomically poorly diversified, representing genera *Acropora, Caulastrea, Goniopora, Actinacis* and *Stylophora*. Corals are commonly encrusted by corallinacean, sporolithacean and peyssonneliacean red algae (which form also rhodoliths), less commonly by bryozoans and serpulids. Locally they are intensively bioeroded by bivalves. Other biota is moderately common, mostly small and includes benthic foraminifera, brachiopods, gastropods, bivalves and echinoid plates. The matrix sediment consists mostly of bioclastic wackestone. The mud-dominated wackestone texture and thin-branching corals, commonly preserved in growth positions, indicate low energy environment. Deposition of calcareous mud might increase turbidity and result in lower light intensity, even though environment was shallow-water. It is suggested that soft muddy substrates and high rate of sedimentation favoured development of branching corals, but limited growth of other corals and more diversified organisms.

In contrast to the Middle Eocene, the Late Eocene–Early Oligocene reefs are much more common, particularly in the central Tethys. Most bioconstructions were coralline algal-dominated, whilst coral-dominated were rarer, with corals mostly poorly diversified. However, until now coral bioconstructions from the Transilvanian Basin were not the subject of studies. Further research of the present MSc project will focus on detailed coral taxonomy, environmental constraints controlling growth of coral bioconstructions, taphonomy and more precise age determination. The last aspect is important in the context of global cooling and marine biota turnover at the Eocene–Oligocene boundary (Perrin, 2002).

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STRUCTURES AND FABRICS OF SELECTED MOLDANUBIAN ORTHOGNEISSES

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The aim of this work is structural analysis of selected Cambro-Ordovician orthogneisses cropping out in a part of high-grade rocks of western Moldanubian Zone. These rocks have been affected by high temperature / medium pressure metamorphism and polyphase deformation during the Variscan orogeny (Schulmann et al. 2009). In the **Blaník orthogneisses** (Qz + Kfs + Plg + Bt ± Ms ± Sill ± Ky) an early deformational banding dips steeply to SW - S or NE – N. These fabrics were overprinted by NW slightly dipping foliation with well developed stretching lineations plunging to N. Rare kinematic indicators (e. g. fold and pressure shadows asymmetry) reveal a strong subvertical contraction and stretching in ~N-S direction. Based on microstructural observation, this contractional event was connected with the activity of "Grain Boundary Migration recrystallization (GBM; Vernon et al. 2004). At least, localized normal steeply dipping, brittle-ductile NW – SE shear zones were identified.

Bechyně orthogneisses (Qz + Kfs + Plg + Bt ± Ms) is a N-S elongated body with presence of regional pervasive metamorphic foliation dipping homogenously under low angles to ~W. These foliations bear well developed mineral or stretching lineation of quartz, biotite and feldspar aggregates plunging to ~NNW. According to Blaník orthogneisses a kinematic indicators in L-par section here show subvertical contraction and stretching in ~N-S (NNW-SSE) direction. The regional fabrics in the Bechyně orthogneisses reveal a microstructural evidence for the activity of Sub-Grain Rotation recrystallization (SGR; Vernon et al. 2004)

Choustník orthogneisses (Qz + Kfs + Plg + Bt + Ms ± Sill) have a NE – SW elongated shape. In these rocks a relics of steep magmatic to submagmatic fabrics were observed. Planar preffered orientation of feldspar phenocrysts originally dipping under steep angles to SE or NW was strongly affected by subvertical contraction and formation of flat-lying deformational banding. Based on microstructural evidence both deformational activities GBM and SGR recrystallization were identified. Next, on these regional fabrics were transposed a steeply NE to SW dipping normal shear zones.

The results of structural analysis of deformational history of the quartz-feldspatic rocks of the Moldanubian Zone provide a unique interpretation of geodynamic evolution of lower to middle crust during the Variscan orogeny.

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TRACE ELEMENTS IN ECTOMYCORRHIZAE: THEIR DETERMINATION BY INAA

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It has been repeatedly demonstrated that macrofungi (mushrooms) significantly interfere in biogeochemical cycles of chemical elements in soils (Gadd 2004, 2007). The active role of macrofungi involves degradation of organic matter (especially plant biomass) and several roles in weathering processes. Biomechanical weathering is mainly driven by penetration of fungal hyphae in mineral grains (mineral soil layers and geological bedrock). However, macrofungi also produce a wide range of organic acids and enzymes, which influence soil organic matter, mineral surfaces and soil solution. In consequence, this chemical action of macrofungi increases mobility and bioavailability of chemical elements, including heavy metals. Furthermore, macrofungi are known for their ability to take up a wide range of elements and accumulate them in their fruiting bodies (Falandysz and Borovička 2013).

Many macrofungal species belong to the large group of ectomycorrhizal fungi (ECM), living in mutualistic symbiosis (reciprocally profitable relationship) with vascular plants. The role of ECM fungi in this symbiosis is the uptake of mineral nutrients (mainly phosphorus, but also alkali metals) and water and their transport to host plants. On the other hand, plants donate products of photosynthesis (sugars). This exchange of nutrients and water takes place in a mutual organ called ectomycorrhiza (pl. *ectomycorrhizae*) composed of plant biomass and fungal hyphae. Ectomycorrhizae are formed on the fine roots of the plant hosts and can be found in both organic and mineral soil horizons.

It has been repeatedly demonstrated that ectomycorrhizal symbiosis enhances plant growth and protects plants against heavy metal toxicity (Adriaensen et al. 2006). However, there is a lack of data on concentrations of metals in ectomycorrhizae. Berthelsen et al. (1995) discovered that some elements are highly accumulated in ectomycorrhizal tips and it has been suggested (Krupa and Kozdroj 2004, 2007) that ectomycorrhizae form an effective biological barrier for heavy metals and thus protect the host plant against their toxicity.

Accumulation of metals in ectomycorrhizal tips, if exist, might represent an important factor of heavy metal retention in soils. However, chemical analysis of ectomycorrhizae is difficult due to problems with their isolation from soil and possible contamination by soil particles. We have therefore focused on the determination of trace elements in the ectomycorrhizae and fine roots by instrumental neutron activation analysis (INAA). The advantage of this method is the possibility to provide results for a large number of elements in low-weight samples without chemical decomposition. We have tested possibilities of short- and long-term thermal and epithermal INAA. Analyzed samples of ectomycorrhizae were determined by molecular methods (DNA sequencing).

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ICHTHYOLITS AND ECHINODERMS FROM THE FAMENNIAN AND TOURNAISIAN OF THE MORAVIAN KARST (CENTRAL EUROPE, CZECH REPUBLIC): PRELIMINARY REPORT

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Abundant microfauna was obtained during a biostratigraphic survey focused on the conodonts of the Devonian-Carboniferous boundary in the Moravian Karst (Moravo-Silesian Zone, Central Europe, Czech Republic). Beside the conodonts, diverse ichthyolits (microvertebrate remains), eleutherozoid and pelmatozoid echinoderms, bryozoans, inarticulate brachiopods and rare foraminifers were found in insoluble residues. The scope of this contribution is to present new information about diversity of the first two groups – ichthyolits and eleutherozoid echinoderms. Sections in the Lesní lom, Mokrá and Křtiny quarries were studied in the interval from the Late Famennian Middle *Palmatolepis gracilis expansa* conodont Zone to the Early Tournaisian *Siphonodella duplicata* conodont Zone.

The ichthyolits from the Moravian Karst have not received much attention in the past. Only short reports were published about placoderm dermal bone (Rzehak 1910), acanthodian spine (Jaroš 1922) and chondrichthyan teeth of the genus "*Cladodus*" (Oppenheimer 1930) from the Famennian of the Brno-Líšeň area. Much more actual and detailed information on the Moravian Karst ichthyolits were published by Ginter (*in* Hladil et al. 1991) from the Frasnian/Famennian boundary in the Lesní lom q. and by Smutná (1995) from the same stratigraphic interval in the Šumbera section and from the Devonian-Carboniferous boundary in the Lesní lom q. They determined several representatives of the chondrichthyan families Phoebodontidae, Protacrodontidae and Stethacanthidae and from the sarcopterygian family Onychodontidae. Even less information exist about eleutherozoid echinoderms from the Moravian Karst. It is only brief note about echinoid plates from the Frasnian/Famennian boundary from the Lesní lom q. (Hladil et al. 1991).

The class Chondrichthyes is the most abundant and divers in the new micropalaeontologic material, especially at the base of the Tournaisian (*Si. sulcata* Zone). Teeth of the order Symooriiformes belonging to the families Stethacanthidae (*Stethacanthus* sp.) and Falcatidae (*Denae* sp.) were commonly found both in the Famennian and Tournaisian in the all studied sections. Teeth of the order Phoebodontiiformes (*Phoebodus* cf. *limpidus* - Křtiny q.; Middle *Pa. gr. expansa* Zone; *Ph.* cf. *gothicus* - Křtiny q.; Upper *Pa. gr. expansa* Zone; *Thrinacodus* cf. *tranquilus* and *Th. ferox* - Lesní lom q.; *Si. sulcata* Zone) are less common, and representatives of the cohort Euselachii (*Deihim* sp., *Protacrodus* sp.; - Lesní lom q., *Si. duplicata* Zone) and order Ctenacanthiformes (*Squatinactis* sp. - Lesní lom q., *Si. bransoni* Zone) are rare. On the other hand, ctenacanthiform-type dermal teeth are common in the *Si. sulcata* and *Si. bransoni* Zones. Other ichthyolits are represented by acanthodian scales and tooth whorls, (Mokrá and Lesní lom qs., *Si. sulcata* Zone), ubiquitous sarcopterygian (family Onychodontidae, *Strunius* sp.) and actinopterygian (order Palaeonisciformes) teeth and two jaws assigned to the later order from the Křtiny q. (Middle *Pa. gr. expansa* Zone).

The eleutherozoid echinoderms are generally less frequent, however in two levels from the Lesní lom and Mokrá qs. (*Protognathodus kockeli* and *Si. bransoni* Zones) are relatively common. From the obtained material were determined sclerites of the class Holothuroidea (*Eocaudina* sp. body sclerites, ? *Gagesiniotrochus* sp. wheel sclerites, *Achistrum* sp. wheel sclerites and peripharyngeal elements) and arm vertebrae of Ophiuroidea (*Furcaster* sp. and ?*Eospondylus* sp). This classes are reported from the Moravian Karst for the first time.

The research of the ichthyolits and eleutherozoid echinoderms from the Moravian Karst is at its beginning stage and could bring more detailed taxonomic evaluation in the future and enhanced our knowledge about the Famennian and Tournaisian biodiversity.

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INFLUENCE OF SEDIMANTERY AND POSTSEDIMENTARY PROCESSES ON RESERVOIR PROPERTIES OF STAROOSKOLSKY HORIZON (TIMAN-PECHORA BASIN)

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In order to identify factors that influence reservoir properties of starooskolsky horizon sandstones, the author made an attempt in this paper to summarize numerous available research data. These data include characteristics of fractures found in full-size core samples, descriptions of petrographic thin sections, specimen studies under scanning electron microscope, results of clay fraction X-ray analysis, and reservoir properties data.

Reservoir rock properties are formed under the influence of various processes that are associated with the impact of sedimentation which ultimately defines primary porosity and postsedimentation transformations of strata, which result in secondary porosity.

Starooskolsky horizon`s sediment is deposited at depth from 4,600 to 4,800 m. Layer`s confinement to this depth suggests that it`s reservoir properties have been formed under integrated influence of different processes. In order to better understand the role of these processes in the definition of reservoir capacity, a graphic method has been used, which was recommended by N.B. Vassoevich (Head of Geology and Geochemistry of Fossil Fuel Deposits Department, Geology faculty, Lomonosov Moscow State University, from 1963 to 1981). This method consists of upward (downward) ranking of the main study parameter. The value of this parameter for each measurement is indicated on the the graph, after which all points are connected with a lines, thus forming a so-called ogival curve. In this case, this parameter is the effective porosity determined for 45 samples. As the next step, another parameter is evaluated, corresponding to each point of ogival curve. (Several parameters have been considered: predominant grain size, cement amount, correlation of quartz and clay content in cement.) Thus, a so-called subogival curve is built. Visual series of investigated parameters enable clear evaluation of their relationship.

The most notable was the dependency of effective porosity on the quartz cement to clay ratio in the rock (Fig. 1). In the range of values where porosity factor is estimated from 7 to 12%, the mean value of quartz cement to clay ratio is 1, while in the range of values where porosity factor does not exceed 6%, quartz cement to clay ratio is estimated at 5. This indicates that there is a little amount of secondary regeneration quartz in these sandstone samples and relict primary porosity has been maintained. Thus, even at such depths, one can still see the effect of sedimentogenesis on the formation of reservoir properties, subject to certain initial rock properties. This has been confirmed by samples described during the study.

However, old age and large depth of occurrence of starooskolsky horizon caused significant influence of secondary processes on the formation of reservoir properties. Significant silicification of sandstones is often accompanied by partial dissolution of quartz regeneration cement, which creates conditions for the formation of secondary pores and small cavities. Apart from this, in-situe tectonic stresses caused fractures, which secured high reservoir filtration properties at relatively low porosity values.

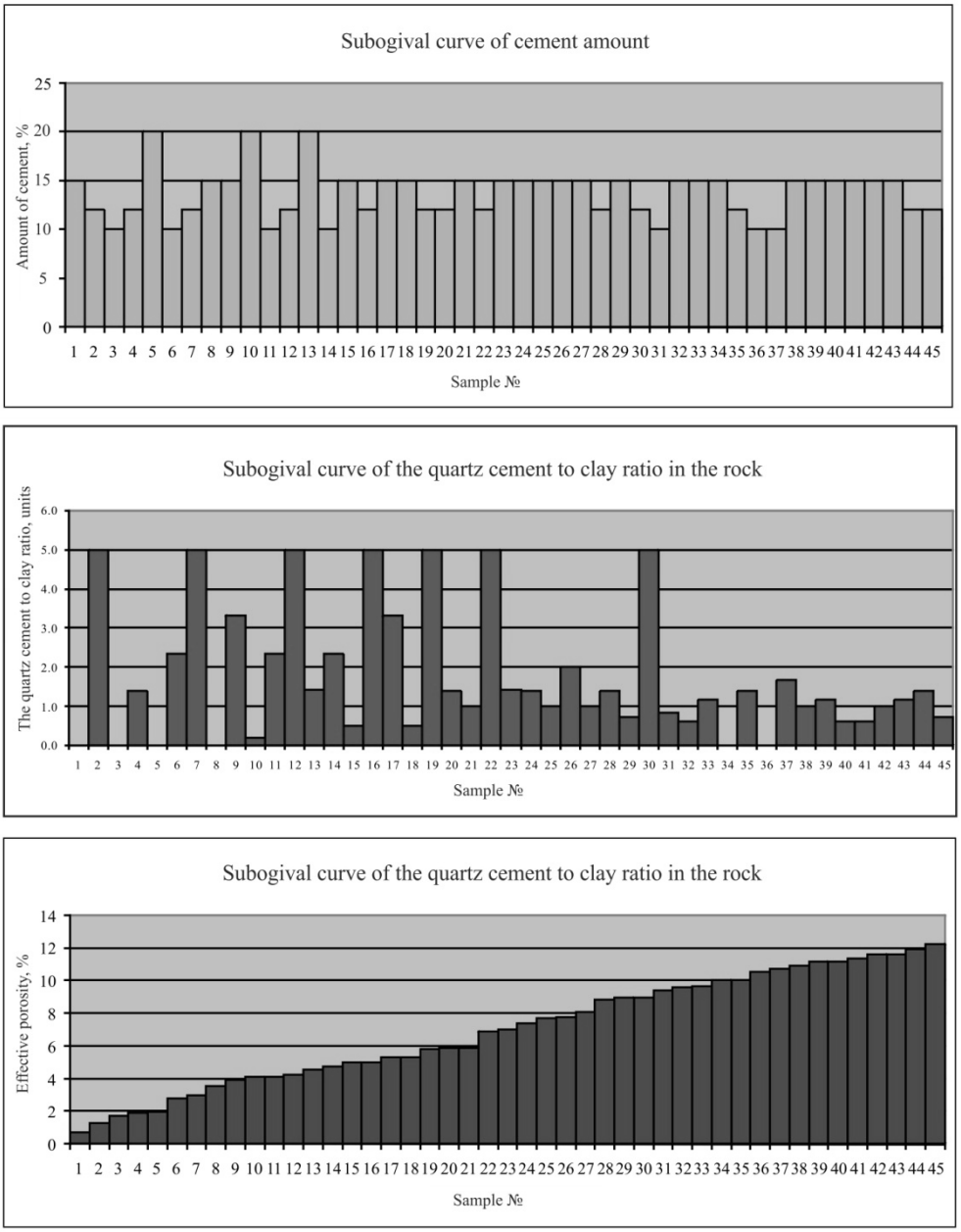

Fig. 1: The dependency of effective porosity on the quartz cement to clay ratio in the rock.

DOES EXTERNAL WIND IMPACT THE SPELEOTHEM GROWTH IN CAVE?

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Carbon dioxide is a key component controlling the karst processes like limestone dissolution and calcite speleothem growth. Principally, driving forces of the latter process are given by the difference between (1) CO_2 partial pressure in soils/epikarst ($P_{CO2(soil/epikarst)}$) and (2) CO_2 partial pressure in a cave atmosphere ($P_{CO2(cave)}$). Low $P_{CO2(cave)}$ supports dripwaters degassing and enhancing the driving forces of speleothem growth (Bourges et al. 2001). The instantaneous $P_{CO2(cave)}$ represents a steady state, at which the total CO_2-flux into a cave is balanced by the CO_2-flux out from the cave (Faimon et al. 2006). The cave input flux includes (1) natural fluxes, e.g., diffusion fluxes from soil/epikarst or the fluxes derived from dripwater degassing (Bourges et al. 2001) and (2) an anthropogenic flux, i.e., the flux stemming from a human respiration (Faimon et al. 2006). The output flux is controlled by ventilation (Fig. 1). Based on the former facts, it may be deduced thow cave ventilation participates on the spelothem growth. The ventilation rate is given by the cave geometry and the differences in densities between the cave air and external air (de Freitas et al. 1982). In general, air density is function of many variables, temperature from which is the most significant. Therefore, the airflow driving forces may be expressed by the temperature differences $\Delta T = T_{exterior} - T_{cave}$ (Faimon et al. 2012). A specific role in cave airflow plays external wind. The wind is generally believed to participate on cave airflows (e.g. de Freitas et al. 1982; Pflitsch and Piasecki 2003; Kowalczk and Froelich 2010). The impact of external wind was studied in the dynamic Císařská Cave (Moravian Karst). Time series of cave airflow and external wind were measured at the cave lower entrance with time steps of 10 seconds. Correlation analysis of the signals showed only weak positive correlation (correlation coefficient of 0.2, significant at confidence level α=0.05), which indicates very slight dependence between cave airflow and external wind, if any. Cross correlation does not confirmed any time shift between the both signals.

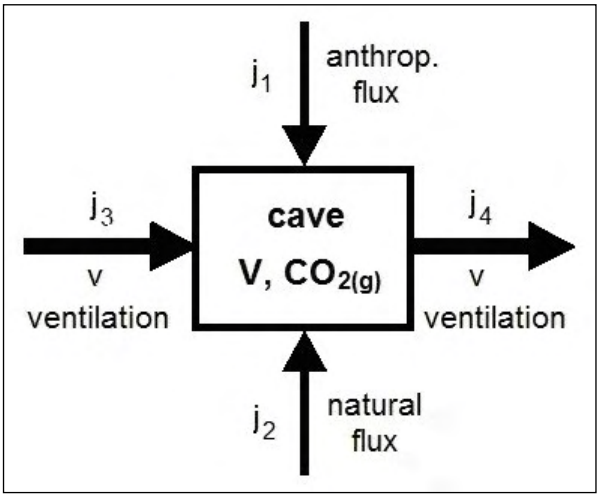

Fig. 1: Conceptual model of CO_2-fluxes in the cave atmosphere. j_1 and j_2 means CO_2-fluxes direct into the cave, flux j_3 external air flowing into the cave and flux j_4 cave air blowing from the cave. The air velocity is given by v.

The spectral analysis showed inconsistentoscillations with the periods ranging from 8.8 to 15.8 minutes at cave airflow and from 10.3 to 23.1 minutes at external wind. Therefore, it may be conclude that this case study does not confirm a direct impact of external wind on cave airflow. For a definite „verdict", however, additional studies are necessary.

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THE PROGRAM FOR USER-MODIFIED PROCESSING DIRECTIONAL DATA AND PALEOSTRESS

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Programs recently used for directional-data processing have fixed formula for calculation of density distribution shown in so-called shade plots. The newly developed software allows us to process directional data by the classical functions as well as by user-defined functions, e.g. user can change formula for the density plot. It may lead to different types of the plots (see Fig. 1–4) with variant smoothing or with best-fit solving for surfaces differs in angle of 30°, for instance. The application also allows us to process paleostress analysis based on vein and styolite orientations because main normal stresses are in simple geometrical relation to theirs directional distribution.

Program is written using Object Pascal language. Original directional data are reworked by above considered user-defined functions leading to densities, which are computed in fine grid and thus the output shade plot is created; contour lines could be inserted in. Considered plots are saved in vector graphics format, where the entire procedure is plot directly into wmf-file, which can be easily used in further processing and editing by software like Corel, for instance.

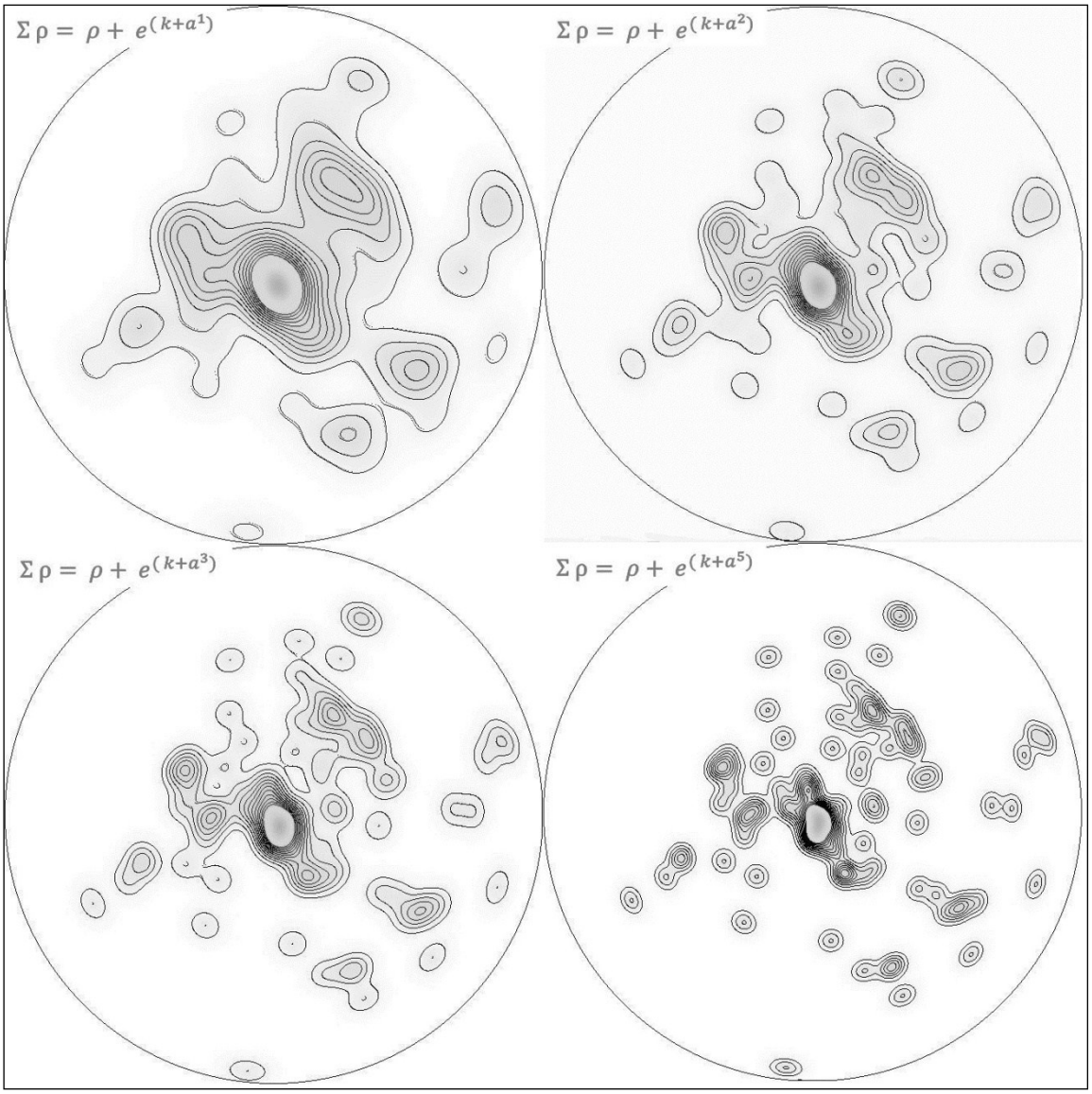

Fig. 1-4: Shade plots with density contours produced by different density functions.

ENVIRONMENTAL SETTING AND STABLE C-O ISOTOPE COMPOSITION OF CARBONATE CEMENTS IN GLACIAL OUTWASH AND BEACH DEPOSITS

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Secondary carbonate precipitates as a cement in primary unconsolidated glacial sediments can precipitate in a variety of geomorphic and hydrologic settings by a variety of mechanisms that lead to dissolution and reprecipitation of carbonates. In glacial settings the carbonate precipitation is mostly a result of inorganic process, such as regelation, evaporation, and freezing-thawing processes. Carbonate cements have been recorded in glacial sand and gravel deposits from several places in Estonia, Latvia and Lithuania which are associated with ice-marginal glaciofluvial forms, end moraines, eskers, drumlins and beach formations accumulated during the Late Weichselian deglaciation about 18-12 ka BP. In North Estonia cementation is observed as cemented layers or lenses within glacial outwash and beach deposits on the edge of the carbonaceous bedrock cliff, the Baltic Klint. During the regression of the Baltic Ice Lake (BIL) in response to the water level fluctuation and accompanying alongshore waves and currents the elevated glaciofluvial ridges were reworked and/or subjected to littoral transport and were favorable for formation of beach ridges along coast lines.

In coarser gravel-facies the cement occurs mostly as a carbonate crust or fringe with a thickness up to 1 mm around detrital grains, occasionally acting like glue sticking clasts together. In finer sandy-facies the cement is distributed uniformly in the matrix filling almost overall intergranular porespace as a massive cement between coarser particles. The cement is exclusively composed of low-Mg calcite appearing angular equant to elongated rhombohedron and scalenohedral or prismatic calcite crystals. Micritic (≤4 μm) calcite often occurs as a massive subhedral calcite with some rhombohedron faces tightly around the grains or fills completely intergranular voids. It is often going over microsparite (4-10 μm) and sparite (≥10 μm) towards the intergranular porespace indicating that micrite preceded microsparite or sparite precipitation. This could refer to several stages of calcite precipitation.

The chemistry of cold-climate carbonates is controlled by the isotopic composition of the parent water from which the calcite precipitation occurred and temperature at which the precipitation took place. The isotopic composition of studied calcite cement varies in a limited range - $\delta^{18}O$ values between -9,1‰ and -5,8‰ and $\delta^{13}C$ values between -6,3‰ and -1,4‰ (VPDB). $\delta^{18}O$ values indicate that the parent water does not represent the influx of the last glacial meltwater. ^{18}O-depleted compositon of the solute bearing water was controlled by the $\delta^{18}O$ of groundwater and surface waters related to the $\delta^{18}O$ of meteoric water. This is supported by the isotopic composition of meteoric water measured nowadays and the composition of modern groundwater. Likewise, during evaporation the $\delta^{18}O$ of water progressively increases because of the removal of the lighter ^{16}O into vapour. $\delta^{13}C$ values of the cement indicate a mixture of different source of carbon and different precipitation mechanism. Vegetation and decomposition of organic matter in soil system could lead to depletion in ^{13}C, whilst anaerobic bacterial decay, dissolution of primary bedrock carbonate, evaporation and influence of atmospheric CO_2 could lead to enrichment in ^{13}C. In case of the studied cement, the important factor that could have affected the isotopic composition is probably dissolved atmospheric CO_2 in surface waters (atmospheric CO_2 with $\delta^{13}C$ values around -7‰). The dissolution of primary carbonates (bedrock and debris with $\delta^{13}C$ values near 0‰) could provide enrichment in ^{18}O. The influence of organic matter should also be considered, but this was probably not the main factor affecting the carbon isotope composition.

The spatial distribution of the cement forming lateral layers and lenses is controlled by the texture of initial sediments but mostly derived from specific hydrologic conditions in limited areas. Near-surface extended cemented layers is ascribed to the near-surface water table produced and controlled by the BIL water level. The cementation occurred close to vadose-phreatic interface, where hydrologic conditions were transitional and/or fluctuating. The presence of bilaminar cement with thin inner micrite laminae and thicker outer microsparite and sparite rims of calcite crystals refers that the cementation started in vadose conditions and continued in water saturated phreatic environment. The cementation is attributed to the carbonate precipitation from waters saturated with respect to calcite by the evaporation in response to the fluctuation of water level and seasonal cold and/or dry climatic conditions, probably somewhat after the ice retreat in periglacial conditions.

THERMOELECTRICAL PROPERTIES OF PIKROILMENITS FROM DIAMOND-PIPE, EASTERN AZOV (UKRAINE)

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Several kimberlite pipes that pertain to the Priazovsk geoblock of the Ukrainian shelf have been located to the East of Ukraine. The pipe "Yuznaya" is one of the most perspective one and it is referred to the joint folded structures of Donbass with the Priazovsky crystalline massif and is controlled by the sublatitudinal South-Donbass abyssal interruption. It is blocked by the Quaternary cledges with the thickness of 8-11 m and is explored by means of pores to the depth up to 320 m. The descend geological dips in the northern part of a body range from 45° up to 60 ° and in the southern part they range from 45° up to 90 °, the general dip is defined as south-south-eastern. The kimberlites with massive structure and with dark-green and bluish-grey colour are subordinated by the eruptive breccia of kimberlites located in the pipe. The eruptive breccia are made up of the kimberlite material itself (60 - 70%) and fragments of granitoid and limestones, sandstones and slates and diabases (30-40%). Kimberlites with massive texture are characterized by well expressed porphyritic structure. The content of anhedral material is very poor. The great majority of kimberlites is made up of the fine grains of monoclinic pyroxene and phlogopite and is bounded with serpentized material. Also in the main rock there are occurrences of perovskite, ilmenite and apatite. Out from the overall rock volume 40-50% of impregnated minerals exists in the form of serpentine metamorphosed over olivine.

While estimating the potential diamond-pipe characteristics of kimberlite rocks it is necessary to take into account chemical properties of ilmenite. The paragenetic type of ilmenite which indicates the possible occurrence of diamonds is presented with high concentration of titanium (up to 60% of TiO_2) and low ferrous pikroilmanite with 15% and more of MgO. Diamond-pipe kimberlites can also contain high concentrated chromium pikroilmanite (up to 11% of Cr_2O_3).

It is known that prospect works aimed at the detection of diamond core deposits need considerable investments. Due to this fact there is a necessity to devise new methods which are of the same efficacy but are cheaper. There one can use such methods, which are based on the study of the diamond accessory minerals. In particular, thermo-e.m.f methods are used to identify thermo-electrical properties of minerals in semiconductors. In kimberlite pipes such mineral is pikroilmenite, prominent for its thermo-electrical properties. The pikroilmenites, which we have studied, are characterized with mixed conductivity and their conductivity values range from +90mkV/degree up to 90mkV/degree. The identifying of the space variability of pikroilmenites thermo-e.m.f values within the pipe "Yuznaya" will give the possibility to devise prospective and estimating criteria of diamond pipes in the future.

DISTINCT COMPOSITIONAL EVOLUTIONS OF PRIMARY TO LATE TOURMALINES FROM CONTAMINATED GRANITIC PEGMATITES; TRENDS TOWARDS SIMILAR COMPOSITIONS

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We studied chemical compositions of late tourmalines which overgrow early tourmalines from four externally contaminated granitic pegmatites: (i) simple desilicated pegmatite situated on the contact of serpentinite and migmatic gneiss from Dolní Bory, western Moravia, Czech Republic; (ii) euxenite-type pegmatite Kožichovice III penetrating an amphibol-biotite syenite of the Třebíč Pluton, two elbaite-subtype pegmatites (iii) Bližná I, Southern Bohemia, Czech Republic (Novák et al. 1999, 2012) and (iv) Tamponilapa, Sahatany Valley, Madagascar, the latter two enclosed in silicates-rich dolomite-calcite marbles.

The compositional characteristics of tourmalines at the individual localities are: (i) early black schorl with Ca 0.04-0.12 apfu, Mn 0.02-0.14 apfu, Al_{tot} 5.07-5.98 apfu, Ti 0.07-0.26 apfu is overgrown by late fibrous greyish dravite (enclosed in opal-CT) with Ca 0.06-0.14 apfu, Mn ≤ 0.01 apfu, Al_{tot} 6.07-6.37 apfu, Ti ≤ 0.05 apfu; (ii) core black schorl-dravite with Ca 0.17-0.34 apfu, Mn < 0.02 apfu, Al_{tot} 5.19-5.88 apfu, Ti 0.05-0.41 apfu has dark blue rim of dravite < 1 mm thick with Ca 0.11-0.15 apfu, Mn < 0.02 apfu, Al_{tot} 6.09-6.24 apfu, Ti < 0.02 apfu;(iii) olive green to brown aggregate of liddicoatite-elbaite-uvite with Ca 0.23-0.79 apfu, Mn 0.03-0.88 apfu, Al_{tot} 6.67-7.66 apfu, Ti 0.03-0.21 is overgrown by fibrous pale blue dravite with Ca 0.04-0.13 apfu, Mn ≤ 0.02 apfu, Al_{tot} 6.15-6.36 apfu with negligible Ti content; (iv) early black schorl Ca 0.13-0.15 apfu, Mn 0.06-0.08 apfu, Al_{tot} 5.97-6.01 apfu, Ti 0.11-0.13 apfu and intermediate black dravite with Ca 0.24-0.33 apfu, Mn 0.04-0.06 apfu, Al_{tot} 5.94-6.01 apfu, Ti 0.02-0.05 apfu are overgrown by colorless fibrous magnesio-foitite with Ca ≤ 0.02 apfu, Mn 0.03-0.06 apfu, Al_{tot} 6.92-7.15 apfu and Ti content below detection limit (Fig. 1).

Textural relations, mineral assemblages and chemical compositions of the individual tourmalines indicate substantial change in crystallization conditions such as (i) decrease in temperature, (ii) transition of parental medium from pegmatite melt to hydrothermal fluids, and (iii) opening of the system to host rocks in subsolidus. Magnesium in late tourmalines is probably sourced from Mg-rich host rocks (serpentinite, dolomite-calcite marble). In contrast, disregarding high Ca content in host dolomite-calcite marbles and common diopside, danburite and high Ca contents in primary tourmalines, the late tourmalines are almost Ca-free.

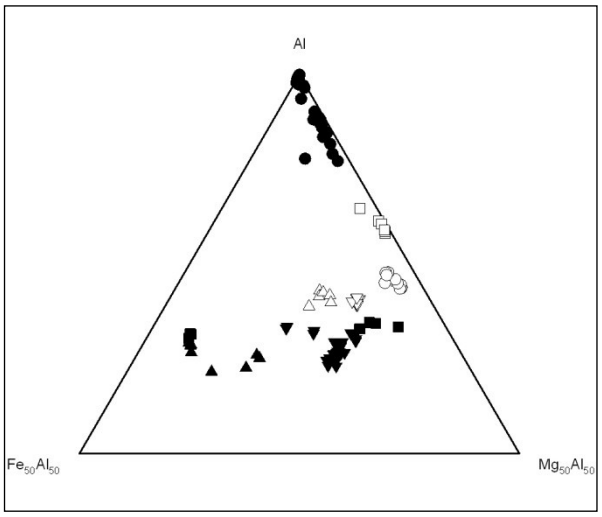

Fig. 1 Chemical compositions of early (solid symbols) and late (empty symbols) tourmalines from the individual localities: triangle – Dolní Bory, opposite triangle – Kožichovice III, circle – Bližná I, square – Tamponilapa.

The compositional trends in the individual localities (Fig. 1) started from highly variable early tourmalines (schorl, dravite, elbaite-liddicoatite-uvite) through dravite or schorl-dravite to the latest tourmalines characterized by high Mg contents, low to negligible Ca, Mn, Ti and Fe concentrations and high vacancy in X-site tending to magnesio-foitite. Such compositional characteristics - chiefly high X-site vacancy - are typical for authigenic tourmalines (*e.g.* van Den Bleekn et al. 2007) and point out that at low-T conditions tourmalines tend to similar compositions (X-site vacant species magnesio-foitite or foitite). This work was supported by the research project GAP210/10/0743 to MN and RŠ.

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CHARACTERISTIC OF BASALTOIDS FROM BLUE DYKE, KING GEORGE ISLAND (SOUTH SHETLAND ISLANDS, WESTERN ANTARCTIC)

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King George Island is one of the biggest islands in the South Shetland Islands. It is situated in the central part of this archipelago. The separation of the South Shetland Islands from the Antarctic Peninsula was caused by the opening of the Bransfiled Strait located between them. It took place presumably in the Pliocene. The magmatic processes have lasted since the late Jurassic to nowadays. They have had a big influence on the type of rocks the South Shetland Islands are built of.

The King George Island is divided into four major mesozoic-paleogene tectonostratigraphic units (from the North to South): the Fildes Block, then the axial Barton Horst, the Warszawa Block and the southernmost Kraków Block (Birkenmajer 2003).

The Blue Dyke is one of the most impressive intrusion on King George Island. It is exposed on the south-eastern coast of the island and continues as a set of small islands inside Bransfield Strait. This intrusion occurs in the Warszawa Block and belongs to the "Sphinx Hill Dykes" unit, one of five units of the Admiralty Bay Group (*sensu* Birkenmajer 2003). The Blue Dyke is built by basaltic andesites. They are dark grey and have a porfiritic intersertal texture. Rocks are strongly altered which could be explained by hydrothermal activity. Chloritization and albitization are the most common alterations. The most common mineral is plagioclase, which occurs in two generations as phenocrysts and as groundmass laths. The groundmass also contains small crystals of apatite, zircon, magnetite, ilmenite, barite and anhedral quartz.

The age of Blue dyke is 27.9 ±0.3 Ma (Late Oligocene). It's determined by the single-grain U-Pb SHRIMP dating using tiny zircon crystals. This result suggest that intrusion can be related to the tectonic processes that occurred during the opening of the Drake Passage (Pańczyk et al. 2009).

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CHARACTERISTICS OF SUFLIDE MINERALIZATION WITHIN THE PAHOMOVSK-1 AREA KHAKASSIA

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During the last 50 years in Russia the so-called formational method has been widely applied in gold metallogenic studies. According to S. Smirnov (1941), within one specific deposit there is only one ore type, for example, tin deposits; while Y. Bilibin (1955) stated that deposits of different ore minerals are consolidated into ore complexes based on their associations with a specific magmatic complex. The above-proposed methods, as well as, the principles of ore deposit-typing to identify metallogeny, especially in hydrothermal ore deposits, have become contradictive (Kucherenko I., 1983). The studies of the last few decades have not fully analysed the suggested ore-formation method. The objective of this research was to study the composition of hydrothermal altered rocks, stages of mineralization and identify sulfide mineralization characteristics and the connection between gold and some mineral associations. Today Khakassia and Kemerov regions are promising gold deposit areas (Alabin L., 1999; Belonozhko E., 2011). Pakhomovsk-1 area, Khakassia was selected to study sulfide mineralization. The analysis of chemical rocks and ore composition involved drill core samples taken at different depths (well № 303). The major instrumentation was microscope POLAM-312 for petrography and mineragraphy description, spectrophotometer MSFU-K for the measurement of quantitative reflectance characteristics and microhardness PMT-3M for analysis of microhardness of sulfides. After analysis of thin rock sections and polished sections the following was identified: (a) Pakhomovsk-1 area is dominated by regional metamorphised rocks under conditions of green-schist facies (i.e. interbedded carbonaceous chlorite-sericite-carbonate schist and marmorized limestone), metasomatites composed of quartz-albite-actinolite carbonaceous shales, as well as basic propylitic intrusive rocks, subjected to metasomatism of propylitic facies; and (b) the mineralized zones are located in significantly permeable layers, embracing quartz-albite metasomatic veined rocks, with rare relica (carbonaceous shales). Low-sulfur oxidized ores are located in the upper zone of the gold-bearing deposits. Gold-bearing sediments of chemical residual weathering with an average thickness of up to 25 m have developed above mineralization zones and ore deposits. The investigated mineral composition and texture-structure characteristics of ore mineralization revealed the following three mineral complex phases sequences: pyrite-pyrrhotite, rutile-pyrite-pyrrhotite and chalcopyrite, which were determined by the spatial distribution of mineralized complexes throughout the hydrothermal-metasomatic process (Table 1). Based on the research data it can be stated that ore occurrence within Pakhomovsky-1 area includes ore-bearing horizons, adjacent to bulk vein - interspersed and cluster-interspersed gold-sulphide-quartz ore deposits (sulfide content less than 3%) and can be distinguished as gold-quartz and low- sulfide ores, formed in terrigenous-carbonate-volcanogenic sediments of the first Upper-Marssk subsuite layer, which in its turn, is subjected to regional metamorphism. It can be presupposed that this gold-type could be referred to the second phase of ore-bearing hydrothermal solution injection as arsenopyrite. These results are consistent with earlier conducted studies (Belonozhko E.A., 2011) and are based on the application of up-dated criteria for gold deposit exploration. Therefore, these results can be applicable in gold deposit exploration, especially in Khakassia and Kemerov regions as the gold deposits have similar geological formation conditions.

Phase	Mineral complexes	Structure, texture	Association composition
Hydrothermal	Pyrite-pyrrhotite	Hypydiometamorphic, allotriometamorphic, corrosive, nest-interspersed	Quartz I, pyrite I, pyrrhotite I
	Rutile-pyrite-pyrrhotite	Allotriomorphic, corrosive, oriented, interspersed with veins	Quartz II, pyrite II, pyrrhotite II, rutile I, arsenopyrite I
	Chalcopyrite	Allotriomorphic, corrosive, interspersed	Quartz III, chalcopyrite I

Tab. 1Mineral complexes and their formation sequences

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STRATIGRAPHIC DISTRIBUTION OF BIVALVIA IN THE CRETACEOUS SEDIMENTS OF VOLYNO-PODOLIAN

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The representatives of the class of Bivalvia form the largest and the most important group in the fauna of the Cretaceous sediments of Volyno-Podolian due to their variety and numerosity. Considering the fact that extinct Mesozoic families of Inoceramidae, Aucellidae, Modiolopsidae, Tancrediidae, Mactromyidae, Pleuromidae, Epidiceratidae, Requienidae, Gyropleuridae and families which are characteristic only of the Cretaceous period such as Trigoniodidae, Desertellidae, Monopleuridae, Caprotinidae, Caprinidae, Plagioptychidae, Hippuridae, Radiolitidae achieved their flourishing in Cretaceous period. Their representatives are of significant stratigraphic importance.

The collection of Bivalvia is housed in the State Museum of Natural History of the National Academy of Sciences of Ukraine (Lviv). It was gathered by some researchers in the Cretaceous sediments of Volyno-Podolian (S. Pasternak and others, 1968). 279 species and 73 families were identified and described. The family of *Leda, Lima, Lyropecten, Arca, Nucula* and family of *Inoceramus* have the most numerous species diversity.

The sediments of Middle Albian, which are the oldest in the Cretaceous period, are represented by 28 species of Bivalvia (S. Pasternak and others, 1987). The representatives of genera Taxodonta, particularly *Cucullae glabra* Park., *C. mailleana* (Orb.), *Glycymeris sublaevis* (Sow.) take the first place by number of specimens. In Upper Albian the genus of *Liostrea* became the most widely distributed. At the beginning of Upper Cenomanian *Inoceramus* massively multiply. The shells of *Pecten, Ostrea, Plicatula, Amonia* were numerous finds (S. Pasternak, 1959). Among Turonian faunas Bivalvia occurred rarely and were represented by a small number of taxa. However, the fragments of *Inoceramus* shells formed clusters here and there and formed deposits. In Lower Turonian they were the only fossils, suitable for identifying geological age. At Coniacian stage the species composition of Bivalvia was poorer than in Turonian and the fossils were represented by fragments of *Inoceramus.* The taxonomic composition in Santonian was distinguished by increased number of the representatives of Taxodonta. *Liostrea boucheroni* (Cog.) plays an important role in correlation of open-cuts. At Campanian stage the families of *Nucula, Leda, Neithea* were represented by a large number of specimens.(S. Pasternak, 1959; S. Pasternak and others., 1968; 1987). In comparison with Campanian, the Maastrichtian deposits were more saturated with fossils. In Lower Maastrichtian *Leda brevirostris* (Alth.) prevailed and in Upper Maastrichtian – *L.producta* (Nilss). The finds of *Liostrea* were numerous. The representatives of Inoceramidae were also important finds for Maastrichtian stratigraphy.

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EXPERIMENTAL RESEARCH ON THE CHEMICAL COMPOSITION OF HYDROXYAPATITE IN TEETH AND BONES

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Detection of stable isotopes by the modern analytical methods is widely applied in palaeontology and archaeology. The population composition is dependent on the quality of food which directly reflects not only the climatic development of the investigated area but also gives information on the stage of the economy development. Several directions in the study of stable isotope composition in biological material with hydroxyapatite matrice is used including $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratios; moreover, isotope ratio ^{87}Sr and ^{86}Sr is used for the solution of problem of possible migrations (Bentley 2006; Price et al. 2002; Smrčka 2005).

New mineralogical studies focused on the chemism of biominerals show on significant variability in chemical composition of hydroxyapatite in natural environment (Kohn and Cerling 2002; Hinz and Kohn 2010). However, complex studies devoted both to the distribution of matrice vs. minority/trace elements in bony tissue and teeth and chemical composition of hydroxyapatite are still missing .

Hydroxyapatite (OHAp) is the apatite mineral of the most interest and relevance in biological and material sciences. In the mineral structure of hydroxyapatite with ideal formula $Ca_5(PO_4)_3OH$ (and Ca/P stoichiometric ratio 1.67) may occur numerous substitutions which cause changes in physical processes in OHAp (Skinner 2005, Wopenka and Pasteris 2005). Hydroxyapatite in fossil teeth and bone tissue can be highly affected by the character of natural environment, especially by the mineralogy, geochemistry, and hydrology of the rock background.

For experiment was used different biological material with OHAp matrice – fresh bovine tooth (*Bos primigenius* f. *taurus*) and fresh bone – humerus of turtle (*Testudo graeca*). The material was cut into the cross sections. Some samples of bone/tooth tissue remained with collagen, the other were deproteinated by hydrazine hydrate – $NH_2.NH_2.H_2O$ (Nielsen Marsh and Hedges 1999). Numerous simulation experiments were realised (fresh samples vs. deproteinated samples immersed in solutions of Ba, Sr and Zn) to determine the ability of selected elements to incorporate in the bone/tooth tissue and structure of bioapatite. The samples were analysed by the method of electron microprobe and X-ray diffraction.

Some results: It was proved that bioapatite occurring in fresh bone tissue is not stable; it is able to incorporate selected elements to its structure as a result of substitution exchanges. The ability of incorporation of various elements is different in particular parts of bone tissue. It was proved that Sr was preferentially incorporated in the structure of bioapatite followed by Ba; Zn was incorporated minimally.

Results od the study indicate that the application of bone bioapatite could be limited for paleoenvironmental interpretations, mainly as regards Sr and Ba isotopic studies.

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ANALYSIS OF TRACE FOSSIL PRESERVATION IN DOLOMITES OF DAUGAVA FORMATION IN RIGA DISTRICT

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Daugava formation deposits in Latvia mostly are dolomits interchanging with dolomite marlstone and clay, infrequently with limestone and gypsum. Daugava formation is common in the most part of the territory of Latvia, except northern and southeast edges. The thickness of Daugava formation in Latvian-Lithuanian depression changes from 9-15 m at north and east and up to 27 m at southwest (Sorokin, 1981). At the Eastern and central part of the Daugava basin there was a fairly free water exchange with the sea of Moscow Syneclise, therefore Daugava formation in this territory is characterized by plentiful complex of organisms. Of the animals on the friable bed there were a lot of sea lilies, sea urchins, lingulids and mussels, conchostracs, ostracods, miscellaneous and plenty of bottom jawless and other fish forms (Sorokin, 1981).

During the period from 2009 to 2012 trace fossil samples were collected from Daugavas Formation deposits in quarries and natural outcrops. Although the number of collected samples is substantial and often more than ten samples were found in one layer of the quarry, poor preservation of the trace fossils does not allow to determine precise ichnotaxa but Chondrites isp. and Planolites isp. dominate. After mechanical treatment of samples in the laboratory the results did not improve. In comparison, the trace fossils formed in dolomites were less preserved than trace fossils in samples of sandstone, clayey or limestone (Malinovskis, 2012).

In places where the outcrop wall or surface is located in contact with running water or direct rain and wind a denudation in rock has evolved, which highlights the organism burrows. However, it was rarely observed that organism burrows are eroded and matrix has remained better than burrows, formed by organisms. To find out whether trace fossils, mostly consisting of organism burrows, are different from inclusive material, 8 cuts with trace fossil cross-section were made. In samples with well-marked organism burrows in cuts the internal crystal structure and colour of the sample did not differ. Around several organism burrows a border between dolomite matrix and a structure formed by burrows appeared (Meskis, 2011).

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SMALL PEGMATITE BODIES FROM NORTH-WESTERN PART OF UKRAINIAN SHIELD: ACTUALITY OF RESEARCH, STRUCTURE, MINERAL AND ELEMENT COMPOSITION

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In a difference from large pegmatites, which economic significance is obvious (rare elements, semiprecious stones and ceramic raw materials), this work shows small pegmatite bodies (SPB) that are spatially associated with one of the biggest pluto of the Ukrainian shield – Korostensky pluto (KP). SPB accompany with most of world major magmatic massifs but are not well studied. However (along with large pegmatites that often are hard to access in) they are carrying all the information about pegmatite formation process in each parent magmatic complex. This allows us to make representative assay data set that is necessary for geochemical modeling of their magmatic evolution.

A representative assay of SPB-types, which are connected with forming of all main rock types, was formed for KP. SPB-types are determined by: (1) composition of probably parental host-rocks (acidic, basic); (2) morphology (dikes, veins, swellings with apparent SPB thickness 0.2-1.5 meters); (3) inner structure features (zoned, none-zoned etc.). As a result a local mineralogical/geochemical databank has been created (Marchenkov et al. 2012). It is complementary and common according to general KP-databank. For each bulk representative sample an optimal set of elements was determined. It consists from mineral-forming elements for accessory minerals (zircon, monazite and apatite), all major oxides and selected trace elements (with different values of mineral/melt distribution coefficient): SOi_2, TiO_2, Al_2O_3, $Fe_2O_3^{total}/FeO^{total}$, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, S, Cl, Zr, Sr, Ba, Rb, Y, La, Ce, Nd, Nb, Th, Ga, Pb, Zn, Cu. Detection limits are: Zr, TR_{Ce} (LREE) — 10-20, Y — 5-10 ppm, P_2O_5 — 0.00n wt%, other major oxides and trace elements – 0.01-0.1 wt% and 5-20 ppm respectively. The adequate level of precision and accuracy was checked by replicate analysis of rock standards from the specially prepared standard set (Shnyukov 2000, 2002; Marchenkov et al. 2012). Additionally structural features and mineral composition of SPB were investigated.

The multistage forming of SPB related to KP was found. Each stage corresponds to the different ranges of f-values (mass fraction of melt) as well as trace and fluid element content in residual melt of parent magmatic system. Such multistage process of SPB forming was resulted in various metallogenic/mineragenic specialization of pegmatites related to KP.

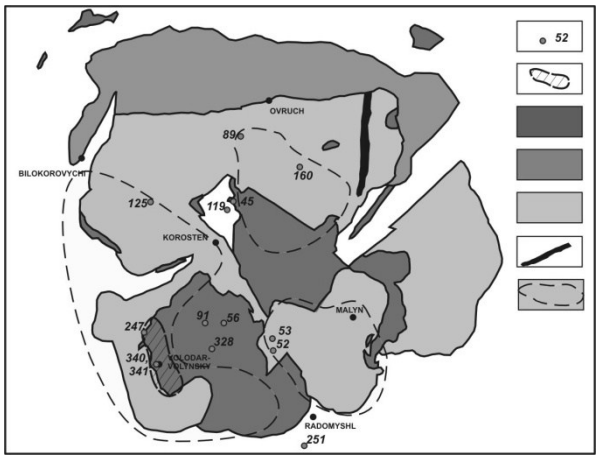

Fig1. Schematic geological map of Korostensky pluto, with major settlements and pegmatite fields where samples were taken. Legend: 1 — names of points where samples were taken; 2 — Volodarsk-Volynske pegmatite deposit; 3 — basic rocks of KP; 4 — rocks of ovruch series; 5 — granitic rocks of KP; 6 — biggest dikes of KP; 7 — pegmatite fields of KP: I)Volodarsk-Volynske 2) Ignatpilske 3) Malynske pegmatite field.

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OIL COMPOSITION AND FACIES CONDITIONS RESERVOIRS ACCUMULATION AT VANKOR AND SUZUN FIELDS OF PUR-TASOVSKA NGO

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West Siberian Plate is the largest young epipaleozoic plate which occupies a large area (3.5 million km2) and is part of the Ural-Siberian platform. The south of plate limited Hercynian and Caledonian fold-block structure of the Altai-Sayan, in the west and north-west the plate is limited late paleozoic fold belt of the Urals, in the east – the Siberian platform and the Baikal units Yenisey Ridge, and in the north-east of fold-block structure Taimyr-Severozemelska area. The structure of the West Siberian Plain is highlighted three structural-tectonic complex - heterochronous (from precambrian to late paleozoic) heterogeneous basement, outcropping in the uplands, interim perm-triassic complex, spreading in grabens and sedimentary cover, which lie unconformably and consist from mesozoic and cenozoic sediments (Kontorovich A, 2000).

Consider two fields are dated to the same tectonic elements - Bolshekhetska megoterasse in the north-east of the West Siberian Plain - Vankor and Suzun. The both fields are confined to the two complexes of oil and gas: neocomian (low. berriasian - low. aptian) and aptian-albian (mid. aptian - mid. cenomanian). The main productive horizons are Nizhnehetsky (oil and gas-bearing), blanket-like accumulation with an overlying seal; Suhodudinsky (oil-bearing), massive, roof accumulation; Yakovlevsky (oil and gas-bearing), massive, roof accumulation, Dolgansky (gas-bearing), blanket-like accumulation with an overlying seal and the amount of produced hydrocarbon fluids from each deposit in each of the fields is different. The main productive horizon of Vankor field is Yakovlevsky horizon and at Suzun - Nizhnehetsky horizon (Posdnyakov V, 2010). The composition of sediments are argillites, shale, sandstone which accumulated on three levels: 1) the open sea, 2) coastal plain, 3) the alluvial plain.

The aim is to identify the source rocks for Vankor and Suzun fields based on a study of facies environment sediments and of oil composition from these fields.

Vankor gaz-kondensat-oil multiplay and Suzun oil multiplay are fields of reflection crustal folding like the most fields of West Siberian oil and gas basin and contain deposits in lower cretaceous sediments (nizhnehetsky, suhodudinsky, yakovlevsky and dolgansky suites).

Published data of pyrolysis (Rock Eval), geochemical date of dispersed organic matter and interpretation of data of the molecular composition of the analyzed oils suggest that source rock is the middle part of the Yanovstanska suite is age equivalent (tithonian - lower berriasian) of the Bazhenovska suite, which contains 2-15% of the organic matter (Corg). The degree of conversion Corg match the gradation of catagenesis MK1-2 in Lodochnoe arch, but in the west it is immersed, and the degree of conversion Corg match the gradation of catagenesis MK3-4 (Posdnyakov V, 2010). The most likely hydrocarbon fluids were migrated laterally from Pendomayakhska megadepression to the area of Vankor and Suzun fields.

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ECOLOGICAL AND GEOCHEMICAL ESTIMATION OF TECHNOGENIC POLLUTION OF THE TERRITORY OF KIEV

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Kiev is situated at the junction of the Plain of Pridniprovya, the morainic outwash Plain of Polissya, and the left-bank Lowland of Pridniprovya. These are separated by the Dnipro River and its tributaries as well as by aqueoglacial, deluvial, and palustrine formations, and loess loams. As to its geomorphological structure, soils of Kyiv are of formations such as the dividing range, surface terraces, gulch slopes, and talus cones. Sod-podzolic, soddy low podzolic, soddy medium podzolic, tophaceous and grey sabulous soils are typical for the forest landscapes. Groups of anthropogenic landscapes are located within the moraine-glacial lowlands, terraces and floodplains; it is thus more diverse (Marinich 1990).

To perform a series of biogeochemical studies, soil samples were taken from the pits up to depth of 130 cm, and separately a selection of shallow soil samples (0-10 cm) were taken. Physicochemical methods of analysis were used for evaluating heavy metal levels in soil. A method of stage-to-stage extraction was used to identify the figures of the heavy metal forms in soils. Mineralogical and geochemical study also took place.

Industrial wastes, construction, and other works, connected with the moving and relocation of soil masses, as well as consumption wastes, they all influence soils of urban landscapes. The force of technogenic silts increases constantly. For example, thousands of cubic meters of consumer deposits build up annually in Kiev. All existing contamination sources in Kiev can be divided into several types: 1) industrial activities and road construction; 2) dumping sites and waste processing; 3) transport (Zhovinskij 2002).

Estimation of urban landscapes of Kiev environmental pollution is usually measured by the level of heavy metal deviation in the soil natural local background. The larger such deviations, the more negative the ecological situation is in the environment.

The study of heavy metals distribution in soil genetic horizon helped to identify a number of characteristics: the overall level of content of heavy metals both in floodplains and eluvial soils is not as high as expected in comparison with medium clarke levels in the pedoshere; the upper horizons of floodplains are characterized by 1,5-2 times more heavy metals content than in eluvial forests (Samtchuk 2006). Conducted research allowed us to recognize specific heavy metal distributions in technogenic anomaly soils. The maximum toxic content of metals was found in industrial zones, and thus concentrations decrease with increasing distance from these zones. Anomalies spread in the direction of main air masses and are determined by contamination sources locations. Studies of translocating forms of elements are especially important, since they can be transferred to plants and natural waters under special physiochemical conditions and can be involved in trophic chains of biogeocenosis. Indexes of biogeochemical conditions in the big agglomerations natural environments are the basis for marking technogenically contaminated territories.

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LIMY MUD INFAUNAL LIFE IN THE EARLY CAMBRIAN OF CENTRAL SIBERIA

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In the Tommotian, burrows produced by bottom animals as shelters against predators were supplemented by burrowing for food by predators and sediment feeders. The limy mud infauna of that age in Siberia was very different from the roughly coeval sand bottom faunas of Baltica. Although zoological identity of the animals forming the infaunal Tommotian traces remains unknown, they probably mostly represented various kinds of early nemathelminthans. No apparent mollusk locomotion traces have been encountered in the early Cambrian, despite mass occurrence of skeletal fossils attributed to mollusks. Possibly the standard muscular foot, typical of modern mollusks was not yet developed that time. The only possible molluskan trace is a variety of *Psammichnites* without 'snorkel', that could be made by a halkieriid-grade animal.

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THE BIOTURBATION STRUCTURES AND A RICH FAUNA OF THE PAVARI SITE, LATE DEVONIAN OF LATVIA

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The stratigraphy and fossils of the Ketleri Formation have attracted the interest of geologists and palaeontologists (Gross 1942; Luksevics *et al.* 1974; Luksevics 1992). The trace fossil assemblage of the Pavari site is important for the understanding of palaeoecology of the Late Devonian in the Baltic palaeobasin. This study concerns the ichnological, sedimentological and environmental locality known as the *Pavāri* (or Ciecere), site in western Latvia. The Ketleri Formation comprises sands, sandstones, clays, and dolomitic marls which overlie the carbonate deposits of the Zagare Formation. In Latvia the thickness of the Ketleri Formation reaches 45 m. The formation is divided into three members separated from each other by the erosional surfaces (Luksevics *et al*. 1974).

The activity of bioturbation is rather high, trace fossils might be identified as *Skolithos* or *Thalassinodes*, forming a system of horizontal and vertical nets. Most likely, trace fossil forming organisms from the Ketleri Formation dwelled in a marine coastal environment.

Considering the results of trace fossils and sedimentologic analysis of the Pavari locality it is concluded that it formed in relatively shallow sea conditions dominated by stream, not wave influence. The deposits were not accumulated in continental or coastal freshwater environment, and there is not enough evidence to support the delta hypothesis regarded previously (Lebedev and Luksevics 1996). The Ketleri Formation existed in a coastal marine environment, although the possibility that the remains have been transported for a more considerable distance can not be excluded. Possibly, rocks of the Pavari locality formed in a low-tidal terrigenous shelf environment between low islands where shallow channel might be formed in tidal processes.

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BEETLES AS THE MOST POSSIBLE TRACEMAKERS OF THE NON-MARINE TRACE FOSSIL *MACANOPSIS*

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Contemporary burrows of the ground beetles (Coleoptera: Carabidae) belonging to the genera *Bembidion* and *Harpalus*, respectively, and callichnial burrows of the scarab beetle *Melolontha* (Coleoptera: Melolonthinae) occur in sandy to muddy non-vegetated or partly vegetated substrate on a well-drained, rarely flooded alluvial plain of the Dunajec River (Sandomierz Basin, southern Poland). The burrows show a characteristic morphology, with a straight or curved shaft and a horizontal to oblique terminal chamber. The *Bembidion* and *Harpalus* burrows are similar and they show a wide range of morphological variability, including forms in which the terminal chamber is poorly outlined. Their inclination changes from oblique (most common) on horizontal surfaces to horizontal in steep scarps.

Macanopsis is the most similar to the described recent beetle burrows. It is typified by *Macanopsis pagueyi*, which is diagnosed as "slightly to highly curved J-shaped burrows terminating in a basal chamber, upper part of burrow essentially vertical" (Frey et al. 1984). *Macanopsis* is mostly known from marine sediments, where it is related to decapod crustaceans. Moreover, *Macanopsis* is reported from non-marine environments since at least Upper Devonian and the Permian-Triassic boundary interval. It is considered as a typical trace fossil of the *Scoyenia* ichnofacies (Buatois and Mángano 2004), which is characteristic of drying out substrates. It was also reported from the *Coprinisphaera* ichnofacies (Fernandes et al. 2002), which is typical of dry substrates above the ground water level.

Interpretation of *Macanopsis* as carabid or melolonthid burrow is limited by the stratigraphic range of these beetles, but knowledge of fossil record of carabids is very incomplete. They occur since 40-50 Ma. The oldest members of Melolonthinae occur since the Lower Cretaceous, and *Melolontha* since the Oligocene. All extant bembidionid species evolved in Pleistocene or post-glacial time. Probably several carabid and other beetles can produce similar burrows before first record of the taxa.

Function of the studied burrows and the literature data shed light on possible ethological interpretation of continental *Macanopsis*, at least these which can be attributed to ground beetles. The *Bembidion* burrows are domichnia in which adults protect themselves against predation and unfavorable weather conditions. The *Harpalus* burrows are not only domichnia but they are used also for feeding on roots. The *Melolontha* burrows belong to callichnia, which are breeding structures. The domichnial and callichnial functions have been invoked by Hembree and Nadon (2011) for interpretation of cf. *Macanopsis* from the Carboniferous of U.S.A. Similar functions are referred to the chambered burrows described in the literature.

All the studied burrows fits better to the environmental settings typical of the *Coprinisphaera* ichnofacies, i.e. soils above the water table, than to the *Scoyenia* ichnofacies, which is attributed to the drying out, rather fine-grained substrate. Flood plains are their typical setting. The *Melolontha* burrows are larger, with vertical shafts and strongly elongated chambers. The *Melolontha* and *Harpalus* burrows occupy more vegetated areas in the distal position, the *Bembidion stephensii* burrows in the intermediate position in respect to the river channel, while the *B. quadrimaculatum* is present in a more proximal, non-vegetated or poorly vegetated flood plain and scarps of the river channel.

A comparison to the trace fossil *Macanopsis* points to ground beetles as its most possible tracemakers (beside spiders or millipedes as presented in the literature) in non-marine settings, in environmental conditions mostly typical of the *Coprinisphaera* ichnofacies, mainly in areas above the ground water table.

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MICROFACIES OF UPPER JURASSIC LIMESTONES FROM THE NORTHERN PART OF PIATRA CRAIULUI MASSIF, SOUTHERN CARPATHIANS, ROMANIA (VLĂDUSCA AND PADINA ÎNCHISĂ SECTIONS)

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Piatra Craiului Massif forms the western flank of a larger syncline unit located in the central-western part of the sedimentary area known in the literature as the Dâmbovicioara Couloir (Popescu 1966; Patrulius 1969; Bucur 1978). Two sections crossing the calcareous massif from West to East were studied. The western end of the sections is represented by the contact between Upper Jurassic limestones and Oxfordian radiolarites while the eastern end made up the boundary between Upper Jurassic limestones and polymictic Vraconian-Cenomanian conglomerates.

Sampling was performed at 4-5 m intervals. All the samples were cut longitudinally and polished to allow evaluation of microfacies. Detailed evaluation of microfacies types was made using 490 thin sections. Microphotographs were taken by using a Cannon Powershot A640 digital camera attached to a Zeiss Axioscope microscope.

Vlăduşca section is located in the southern extremity of the Northern part of Piatra Craiului Massif and corresponds with the upper part of Vlăduşca Valley. At the base of the section two main types of microfacies are present: peloidal bioclastic rudstone and coral-microbial boundstone. Towards the top, the succession develops into bedded limestones represented by peloidal grainstone, oncoidal grainstone, fenestral laminoid wackestone and low fossiliferous mudstone.

Padina Închisă section is located in the northern extremity of Piatra Craiului Massif. In the lower part, bioclastic intraclastic rudstones related to shelf slope gravity flows are present. By comparison with Vlăduşca section, boundstone type deposits are rare. In the upper part, the following types of carbonate deposits were identified: bioclastic wackestones with rudists and gastropods, oncoidal bioclastic coarse grainstones, peloidal wackestones with laminoid structures and levels of limestones wich are pigmented with iron oxides (indicating probably a subaerial exposure wich is also proved by the presence of plant rooths).

The whole carbonate succession forms a shallowing upward megasequence wich is characterized by a transition from deeper water carbonate deposits to more shallower, peritidal deposits.

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MICROTECTONICAL RESEARCH OF THE GRANITOIDS OF THE NOVOYKRAINKA AND KIROVOGRAD COMPLEXES OF THE UKRAINIAN SHIELD

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As objects of the microtectonical analysys paleoproterozoic granits of the Novoykrainka (Novoykrainka massif) and Kirovograd (Nadegdinka, Bobrinets, Chechelivka, Fedorivka, Kukolovka, Bokovyanka, Dolinsk, Krupk, Trikriisk and Mytrofanivka massifs) complexes were chosen, which are situated within Ingulskii district of the Ukrainian shield. Host rocks of both complexes are gneisses and migmatites of ingulo-inguletska series (Sherbakov 2005). According to Sherbakov D.M. age of the granites of the Kirovograd complex is 2065-2026 m. a. (Sherbak 1995), Novoykrainka complex - 2100 m.a. (Sherbakov 2005)

Purpose of the research was to examine microtectonical transformations and effects on mineral composition and structural-textural features of these rocks.

In our opinion, among the problems to be solved in the first place, the most distinguished are:

a) determination of the number of stages of deformational transformations and their sequence; b) typification of revealed deformational transformation; c) determination of mineral paragenesis arising and inherent to stages of deformations; d) determining the characteristics of the transformation of granitoids of complexes of different ages (Kirovograd and Novoykrainka).

In order to solve the problems we used general petrographical, microtectonical, structural-genetical and mineral-paragenetical analysis.

As a result of our microtectonical research we found out that deformational transformation of rocks of studied arrays occurred in two modes after forming feldspar megacrystals: cooling with a gradual decrease in temperature (autometamorphic regressive process) and / or after cooling with repeated local heating (imposed prograde-retrograde metamorphic process of diaphthoresis). In autometamorphism the deformations occurred after crystallization of melt with the temperatures of cooling mode from the level of amphibolite, epidote-amphibolite to greenshist and hydrothermal-metasomatic facies of metamorphism. Early conversion of rocks' deformation took place in conditions of transtension (brittle-plastic deformation up to 40-50%) (Lukiienko 2008). The second phase took place with increasing speed, or change transtension-transpression mode with breaks continuity of rocks. Late stage - stretching mode-characterized by the penetration of hydrothermal fluids, accompanied by muscovitization and chloritization of biotite, and graphite-carbonate crystallization through cracks. Dynamic processes that combine / change modes of stretching-compression, transtension – transpression- simple shear, occur locally and may vary randomly, under conditions of slow temperature decrease after crystallization of feldspar megacrysts (Passchier 1996).

The second type of deformation changes that were detected in the studied rocks of Novoukrainka complex and Nadezhdynka massif of Kirovograd complex of Ukrainian shield, are characterized by deformation of granites during the second heating of rocks. In this part of the retrograde part of trend of deformation changes due to structural and textural features and emerging mineral paragenesis is similar to the first type.

Collection of samples was provided by the depository of crystalline rocks of Faculty of Geology, Taras Shevchenko National University of Kiev.

Special thanks to the supervisor of the research, Assistant professor of mineralogy, geochemistry and petrography, Faculty of Geology, PhD G.Pavlov.

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APPLICATION OF GRAVITY METHOD IN GEOLOGICAL MAPPING

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The study area is located in the southwestern part of Libya between longitudes 16°00' – 16°30' E and latitudes 25° - 25°30'N, in the Majdul sheet (NG33-11) scale 1:250,000. The study involves analysis of gravity collected in this area.

The aim of this study is to identify the significance of the fault zone that extends through the sheets NF 33-3, NG 33-15 and NG 33-11, so called Mourizidie fault zone, and ring structure study which located in SE corner of the area.

So that the field work was carried out in the main fault zone area along 11 profiles by Gravity, measurements, the total number of measured points is equal to 1535 points with total length of 280 km. Two profiles were carried out in the ring structure using Gravity methods. For studying the ring structure, two profiles were carried out by Gravity measurement with total numbers equal to 43 points.

All the gravity data were corrected and processed to produce Bouguer gravity map for the area under investigation.

The produced Bouguer map showed the existence of two parallel faults in the direction northeast - southwest While the eastern fault line locate near by the hills area. The faults are not straight oriented, but changing their direction according to there geological situation in the subsurface. In the central part of investigated area, the parallel faults were broken by two perpendicular faults.

2D gravity modeling was carried out for three profiles to produce geological model of the area, using GM-SYS, software.

Two gravity profiles were carried out cross the ring structure in the SE corner of the sheet, which clearly visible in LANDSAT images, one profile in the center, and the second in the south part of the ring.

The results of gravimetric measurements are finally confirmed with the existence of a batholith in this region which is an intrusion of a basic magmatic body that resulted in an uplift of the hanging wall and the formation of the ring structure.

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BALANCED CROSS SECTION OF THE SKYBA NAPPE, OUTER UKRAINIAN CARPATHIANS (CASE STUDIES FROM SUKIL RIVER AREA)

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We present the results of the investigations carried out in the frame of Academic Software Initiative (ASI). This program is launched by Director of Midland Valley Dr. Alan Gibbs for teaching and research purposes.

Studied region is localized within the Outer Ukrainian Carpathians. It is typical accretion wedge forming during Miocene tectonic events. Stratigraphic succession of the studied region include flysch deposits from Upper Cretaceous through Lower Neogene and Neogene molasses. The structure of the first order is complicated by the folds and slices. Due to the presence of the oil and gas deposits the structure, stratigraphy, lithological relationship are sufficiently deciphered. Previously conducted mesostructural investigations in this area are good constraints for further works.

Typical workflow of the balanced cross section includes the creation digital geological maps; construction of the TIN model of relief; the distinguishing the position of the cross sections. Those data are accomplished by geological structural data gathered in the field – strike and dip of the layers, joint orientations, slickensides, small folds etc.

Next step is the building the section with using modules of Move. First module is the 2D Move for the creation of the horizons and faults on the profile. Second module is 3D Move one designed for the restoration of the equal surfaces between horizons and faults. During this stage of the work we corrected some horizons and fault position drawn by traditional means. Additional result was the obtaining the erosion amount during thrusting processes. Gathered results are input for the different kinds of the forward modeling. We use fault bend and fold-propagation models for the explanation of the regional structure.

The constructed balanced cross section indicates on the peculiarities of the dynamic development of the Skyba nappe. The calculated shortening of the Skyba is 25 – 30 %. The shortening mode was piggy-back process. The thrusts were created by both the fault bend and fault-propagation folding. The detachment levels are situated on Cretaceous and incompetent rocks of the Miocene age.

The dating of these processes is determined on the base of the stratigraphic relationship between synorogenic and postorogenic deposits. The thrusting in the region of interest started in the Lower Miocene and lasted at least to Early Sarmatian. There is fixed also strike-slip regime. The youngest one is normal faulting.

Apart from the regional investigations we mapped out one of the outcrops with several mesostuctures. These structural elements also were restored for the studies of the forming mechanisms. Such multilevel approach gives the possibility to get more complete pictures of the structure development.

ANALYSIS OF THE RESULTS OF PETROPHYSICAL RESEARCH FOR POOR-POROUS HYDROCARBON RESERVOIRS MATHEMATICAL MODEL CREATION (ON THE EXAMPLE OF ZARICHNA AREA SAMPLES)

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Nowadays oil and gas exploration is the main area of research in geological and geophysical works. There are three major hydrocarbon provinces in Ukraine - the Dnieper-Donets, Carpathian, Black sea and Crimean region. The object of this research is a part of the Dnieper-Donets Basin (DDb) - Zarichna area - one of the most promising areas of the Rudenkivsko-Proletarskij oil and gas region (central part of the southern near-side zone of DDb). This territory has numerous deposits of hydrocarbons, that allows us to talk about the prospects of the studied sediments. In tectonic terms, this territory is dedicated to the most tectonically active areas of graben with very dislocated sediment cover.

Samples from the well № 3A (interval of depths from 3010 to 3022 m) were taken for the laboratory tests. The composition of samples is predominately clastic and carbonate with organogenic inclusions. Macro and micropetrographic analysis were carried out during the lithological and petrographic study of samples. This study included the determination of textural and structural characteristics of the rocks and their mineralogical composition. Sandstones, limestones and organogenic limestones are the prevailing rocks' types among the samples of collection. Presence of clay fraction is typical for most of them. The presence of clay components and lack of quantitative information about its content can lead to the discrepancy of data.

All petrophysical studies were carried out in the petrophysical laboratory of the Geological Department (Taras Shevchenko National University of Kyiv).

Comprehensive studies of dry samples and samples, saturated by the reservoir water and oil models resulted in the estimation of such parameters of rocks:

- density (the density of gas-saturated rocks varies from 2.4 g/cm^3 to 3.0 g/cm^3 and values for carbonate rocks are higher than those for the clastic rocks, particularly, due to the presence of siderite inclusions; volume density values vary from 2.5 g/cm^3 to 3.1 g/cm^3, depending on lithology (volume density for the limestones is higher) and saturation (rocks, saturated with kerosene, have lower values compared with rocks saturated with the reservoir water model));
- porous (porosity ranges from 1% to 6% and its values for sandstones are higher than for limestones);
- filtration (absolute permeability ranges from $9\cdot10^{-3}$ to 13.73 mD, the coefficient of absolute gas permeability ranges from $0{,}01\cdot10^{-3}$ to $57\cdot10^{-3}$ mm^2; both parameters are higher for sandstones than for limestones);
- electrical (resistivity ranges from hundreds to thousands of Ohm·m (limestones showed higher values than sandstones); the saturation parameter, which ranges from 1.1 to 5.8 relative units and maximum values are typical for sandstones; the porosity parameter ranges from 36 to 640 r. u., the highest values were obtained for limestones) properties.

Statistical analyzes of petrophysical parameters were carried out by the authors. Relationships between the density, porous and electrical parameters for different lithological groups of samples were plotted (an example of the relationship between the saturation parameter and water saturation ratio is shown in Fig. 1).

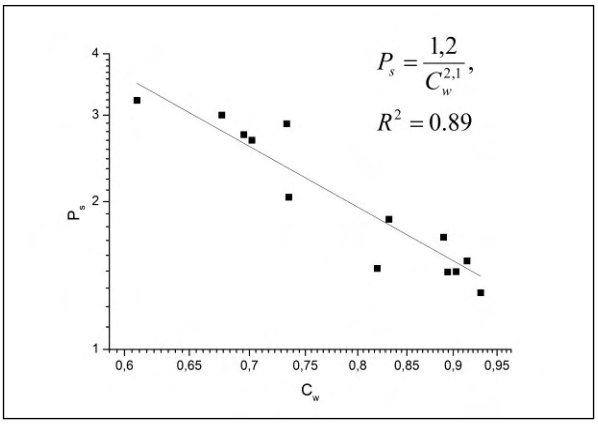

Fig.1. The relationship between the saturation parameter and water saturation ratio (for water-saturated samples of limestones)

The authors have carried out studies of Zarichna area samples petrophysical properties. Obtained results will form the basis of the development mathematical model of poor-porous carbonate and clastic reservoirs of the research area.

GARNET BEARING GRANITES OF BRUNOVISTULICUM

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The garnet - bearing granites have been newly mapped in surroundings of Znojmo in the Thaya batholith. This garnet-bearing granites have similar structure as garnet-bearing granites in the Brno batholith.

Garnet-bearing granites are easily distinguishable by theirs layering parallel to the contact, alternating of major aplite zones and minor pegmatite zones with oriented UST comb-like Qtz, plg and Kfs. The lamination of the rock is pronounced by parallel stripe-like arrangement of the garnet.

XRF measurements and chemical analysis of ACME laboratories in Canada show higher concentrations of K, Rb and Sr in the pegmatite zone, while in aplite zone are lower concentrations of these elements. However, in aplitic zone were measured higher concentrations of Y, Zr, U, Th and REEs and particularly in the zone with garnet form to parallel stripe-like arrangement were these concentrations highest. By using Eletrons microprobe in addiction to main mineral Kfs, PLG, Qtz, Msv, Bt detected the presence of accessory minerals such as zircon, xenotime, apatite, and fluorite. The presence of zircon and xenotime probably explains the higher concentration of Y and Zr, but detailed analyzes have not been performed. Garnet has in some cases sectoral zonation, which is accompanied by the main contents of different almandit-spessartine-grossular component in the garnet.

However the garnet granites from Thaya batholith differ from those from Brno batholith by higher kontent of volatiles F and P in fluorite and apatite (fluorapatite) in granites Thaya batholith. Another diference is presence of glossular – spessartine garnet in the Thaya batholith whereas X - rich spessartine – almandin is common in Brno batholith. The difference is also in concentrations of yttrium garnet, which is below the limit of detection of granites of Thaya batholith.

THE IMPACT OF RADIONUCLIDES CONCENTRATION IN BUILDING MATERIALS ON THE NATURAL BACKGROUND GAMMA RADIATION IN THE BUILDINGS MADE OF BRICKS AND PREFABRICATED CONCRETE

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The radioactivity of building materials is related to their origin. Mineral resources and industrial wastes, used to the production of building materials, contain natural radionuclides. Radionuclides concentration differs in various building materials according to the radionuclides concentration in the used resource.

The natural background gamma radiation inside a building depends on the natural radionuclides concentration in building materials, radionuclides concentration in the bedrock on which the building is placed and cosmic rays penetrating into the building.

According to the UNSCEAR Report (2000) the average person spends 7008 hours per year inside a building (occupancy factor = 0,80), therefore, buildings are places where people are constantly exposed to the radiation.

In order to protect people against the excessive radiation, the limits of the radionuclides content in building materials have been established. Commonly accepted indicator of radiological safety of building materials is an activity concentration index which presents combined activities of natural radionuclides (European Commission, 1999). In Polish law (Rozporzadzenie RM z dnia 2 stycznia 2007 r.) it is known as f_1 index with the limit of 1 for the buildings designed for people and the living stock. Another index which refers to radium ^{226}Ra activity concentration in building materials is f_2 index with the limit of 200 Bq kg^{-1}.

Radionuclides concentration (K in %, U in ppm, Th in ppm) in building materials used in 20 dwellings within the city of Wrocław and the absorbed gamma dose rate (DR in nGy h^{-1}) inside this dwellings, which comes from the building materials, have been measured by means of gamma spectrometer RS230. Also the total equivalent gamma dose rate inside the buildings (DR in μSv h^{-1}) has been measured by means of radiometer EKO D. Investigated buildings were made of bricks and prefabricated concrete. The aim of the survey was to assess the participation of radionuclides concentration in building materials in forming the natural background gamma radiation inside the buildings. The results of K, U, Th content were recalculated into the activity indices f_1 and f_2 (table 1). Subsequently, the participation of K, U and Th in forming f_1 index were analysed. Obtained results indicate that limits for f_1 and f_2 indices are not exceeded. The main role in forming f_1 index, in both types of buildings, play both potassium and thorium.

		DR (μSv h^{-1})	DR (nGy h^{-1})	K (%)	U (ppm)	Th (ppm)	f_1	f_2 (Bq kg^{-1})
Buildings made of bricks	Min	0.14	36.6	0.9	2.0	4.4	0.3	24.9
	Max	0.33	86.1	2.3	4.0	13.3	0.6	49.7
	Mean	0.19	61.1	1.6	3.1	8.7	0.5	38.5
Buildings made of prefabricated concrete	Min	0.14	36.7	1.3	1.5	3.9	0.3	18.6
	Max	0.25	79.1	2.2	4.9	11.7	0.6	60.9
	Mean	0.20	59.7	1.8	2.9	7.7	0.5	35.4

Table 1: Results of radiometric and gamma spectrometric measurements, togther with calculated f_1 and f_2 indices.

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METASOMATIC ZONATION GEOCHEMICAL FEATURES OF LINEAR CARBONATITE COMPLEXES (AT THE EXAMPLE OF PENCHENGA MASSIF, YENISEI RANGE, AND CHERNIGOVKA MASSIF, UKRAINIAN SHIELD)

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Carbonatite massifs of linear structural-morphological type are a potential source of phosphate raw materials and a wide range of rare metals (Nb, Ta, LREE, Sr). The search for mineral deposits associated with carbonatite massifs, is based on geochemical methods that use a broad scattering haloes, coinciding with fenite haloes. Their dimensions are much larger than carbonatite bodies and can be considered as an important search criterion.

Penchenga (PCM) and Chernigovka (CCM) carbonatite massifs are typical representatives of the linear structural-morphological type (Glevasskii et al. 1981; Shnyukov 1988; Vrublevskii et al. 2003). Both of them: are confined to submeridional deep-seated fault zones; lie nearly conformability to the host rocks; form a series of different morphology steeply-dipping bodies; are characterized by apatite-rare metal specialization. Massifs are accompanied by thick exocontact halos of alkaline metasomatic rocks (fenites), developed by replacement of different host rocks. In PCM they are silicate rocks (schists and amphibolites) and carbonate rocks (marbles). In CCM they are migmatized Archean metamorphic rocks (amphibolites, gneisses and schists) and granite-aplite, aplite-pegmatite granite veins. The most significant difference is the absence of marbles in CCM, which considerably influences the character of fenitization products. Modern age estimations of massifs forming are 0,672±0,093 Ga (by Sm-Nd method) for PCM (Vrublevskii et al. 2003) and ~2,0 Ga (by U-Pb method) for CCM (Glevasskii et al. 1981).

Transformation process of PCM silicate and carbonate host rocks consists in disappearance of relict minerals and emergence of newly formed ones such as alkali amphiboles (arfvedsonite, richterite), phlogopite, calcite. Accessory minerals assemblage is characterized by: rising of apatite and pyrrhotite content; emerging of pyrochlore, titanite, titanomagnetite and ilmenite or ilmenorutile. Direction of mineral composition changes in CCM host rocks is similar to PCM: complete disappearance of quartz, relict clinopyroxene, and almost complete of hornblende and plagioclase. The newly formed minerals are: albite, microcline, aegirine-salit, alkaline amphiboles (richterite, edenite, hastingsite), and accessory ones (titanite, apatite, allanite, and magnetite). Carbonatites of both massifs are characterized by predominance of calcite-dolomitic or essentially dolomitic varieties. The silicate minerals content of these rocks do not exceed 30-40%. The common features of both massifs formations are the high apatite content and the similar accessory minerals composition. The main differences: the presence of such alkaline amphibole as hastingsite in CCM carbonatites, in contrast to arfvedsonite in PCM carbonatites; the presence of pyroxene and olivine in CCM ones, indicating higher temperature conditions of rocks forming.

When researching the petrogenic and trace elements behavior during fenitization of both massifs formations three groups of elements have been revealed: elements are gained (La, Ce, Sr, Mn, K, Fe, P,

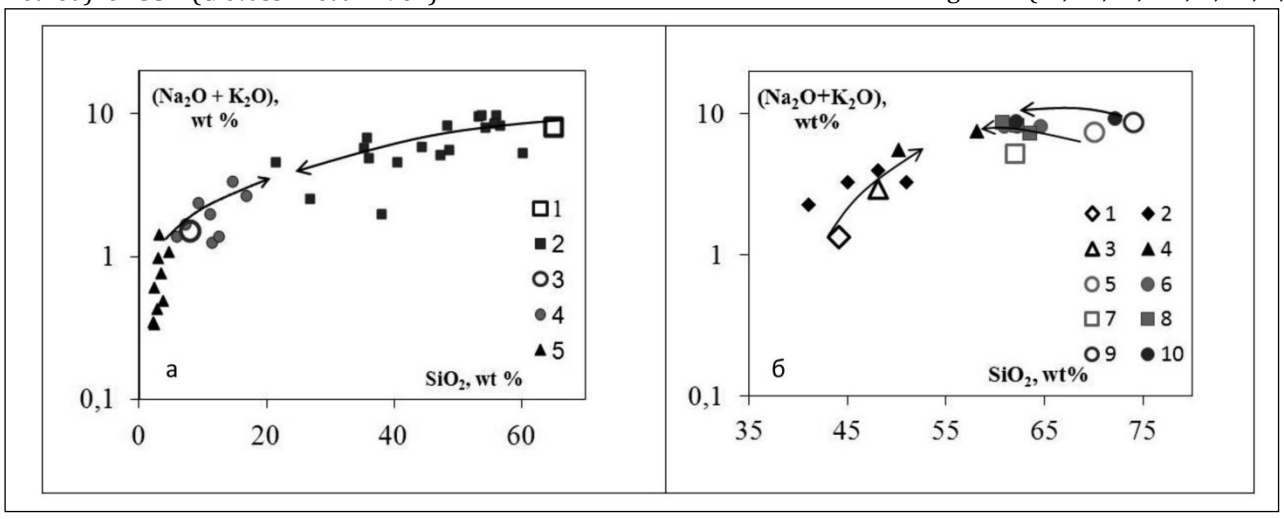

Fig. 1: Dependence of the alkali amount on the silica content for rocks of: a - Penchenga carbonatite massif, unaltered (1) and altered (2) silicate rocks, unaltered (3) and altered (4) carbonate rocks, carbonatites (5); b Chernigovka carbonatite massif, unaltered (1, 3) and altered (2, 4) basic rocks, unaltered (5, 7) and altered (6, 8) intermediate rocks, unaltered (9) and altered (10) acidic rocks. Narrows the direction of rocks alteration during metasomatic process.

Nb – PCM; Na, Sr, Nb, P, La, Ce – CCM), elements are lost (Ba, Na – PCM; V – CCM) and elements are redistributed (Si, Al, Ti, C, Ca, Mg – PCM; Si, Al, Ti, C, Ca, Mg, K, Fe, Mn – CCM). Thus, it was found that the main direction of contrast host rocks changes during fenitization in both massifs is a convergence of their mineral and chemical compositions, which is confirmed for both major (Fig. 1) and trace elements.

The investigation of chemical elements distribution features in rocks of both studied carbonatite massifs and the nature of their behavior during metasomatic transformation process allowed to suggest a single multiplicative geochemical index of the lateral zonation:

$$Kg = La \bullet Ce \bullet Sr \bullet Zn$$

This index objectively displays the increasing of host rocks transformation level and can contribute to the process of area selection and target evaluation.

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HEAVY MINERALS FREQUENCIES AND MICROSTRUCTURES OF GRAINS FROM LOESSES OF THE PODLASIE LOWLAND (WARTA GLACIAL PERIOD, POLAND)

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This paper presents result**s** of heavy minerals studies, which were obtained by quantitative, chemical and microtextural analyses. Samples representing sandy loesses were collected in the Podlasie Lowland near Białowieża and correspond to the Warta glaciation of Pleistocene. The quantitative analyses of heavy minerals revealed the dominancy of garnet (15,7-48,3 %) and amphibole (6,3-30,3 %), while epidote (4,3-21,6 %), zircon (2,8-25,3 %), tourmaline (2,8-10,7%) and pyroxene (2-10,8 %) are less frequent. Grains represent various degrees of roundness and dissolution features. The chemical analysis revealed that garnet is mostly represented by almandine (21-80 % mol), pyrope(2-28% mol) and andradite plus grossular molecules (3-50 % mol), spessartine and uvarovite. Moreover, chemical analysis of tourmaline revealed that it belongs mostly to the alkaline tourmaline group and displays dravitic or schorlitic composition (Hawthorne et.al., 2011). Composition of heavy mineral assemblages and chemistry of garnet and tourmaline suggest their general provenance from various igneous and metamorphic bodies.

Observations of surfaces of heavy minerals as well as of quartz and feldspar grains revealed several types of surface microtextures. Among them chattermark trails, conchoidal fractures, straight or slightly curved grooves, mechanical V-shaped forms, upturned plates, flat cleavage face, cleavage planes (semi parallel lines), adhering particles were recognized (Krinsley, 1973). The microtextures reflect influence of several environmental factors during transport and deposition of the clastic material. Chattermark trails are signs of glacial transport processes; dish-shaped concavities suggest aeolian transport, while V-shaped forms may be a result of water-borne environment or glacial environment. Other microtextures, such as silica plastering, upturned silica plates, dulled solution surface, indicate diagenetic processes. The variability of surface microtextures and different degree of grain roundness suggest polycyclicity and multistage provenance of the clastic material (Gwóźdź, 1968).

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PETROGRAPHIC CHARACTERISTIC OF PROSKUROV MASSIF ROCKS (UKRANIAN SHIELD)

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Ukrainian Shield (USh) is a classical province of Proterozoic (1.8-2.1 Ga) alkaline magmatism. Alkaline rocks of USh belong to two formations of different age: alkaline-ultramafic (~2 Ga) and gabbro-syenite (~1.7 Ga) (Krivdik et al. 1990). PM together with the well-known Chernigovka carbonatite massif (CCM, Azov region) belong to alkaline-ultramafic (carbonatite) formation (Krivdik et al. 1990; Scherbakov 2005). For both massifs the similar features in composition of rocks, rock-forming minerals and some accessory ones were detected as well as the occurrence of classical fenitization halo (Krivdik 1986; Krivdik et al. 1990). The age estimates of PM and CCM are also close (2100±40 Ma and 2000±100 Ma, respectively (Krivdik et al. 1990)). At the same time the Proskurov massif rocks differ from the typical complexes of carbonatite formation (including the CCM) by the number of features: the low content of such typical for this formation rocks trace elements as Cr, Ni, Co, Nb (23-35 ppm) and Zr (25-95 ppm) with moderate concentration of LREE (85-219 ppm); comparatively low concentrations of TiO_2; the absence of carbonatites (Krivdik 1986; Krivdik et al. 1990). Nowadays the search for reasons of mineralogical and geochemical differences in compositions of both massifs are not clear. Neither isotopic-geochemical data, nor petrological or mineralogical studies don't give the unequivocal answer (Zagnitko et al. 2006; Krivdik 1986; Krivdik et al. 1990; Tsarovskiy et al. 1980; Scherbakov 2005). The main reason of these differences considered to be the different geodynamic environments of massifs forming (intraplate for CCM and compression zones for PM) (Zagnitko et al. 2006). The problems of magmas source and generation conditions are unclear.

To approach the solution of these important problems usage of geochemical modeling is proposed. At the early stages of study it is necessary to solve the following problems: 1) the studying of rocks material composition; 2) the comparison of obtained results with data of similar formations; 3) the studying of macro- and microcomponents behavior during the massif rocks forming. The first task has been partially solved in this work.

The Proskurov massif (PM) is situated on the south-western slope of Ukrainian Shield, in 45 km away from Khmelnitsky. Tectonically the massif is located on the Khmelnytsky block periphery and is bounded by Podolska and Letychivska fault zones of north-western trending (Fig. 1). The host rocks are: Chudnova-Berdichev granites, migmatites and gneisses; charnockites and enderbites (Krivdik et al. 1990; Tsarovskiy et al. 1980; Scherbakov 2005). In cross section the massif is an inverted cone with melteigites in its centre, and nepheline syenites, foyaites, jacupirangites, malignites in its flanks (Krivdik et al. 1990).

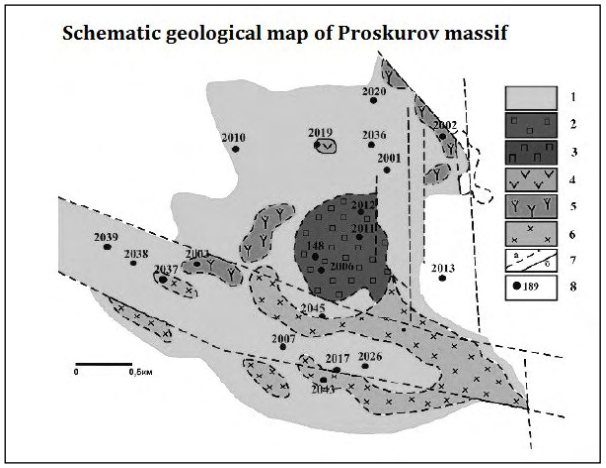

Fig. 1: Schematic map of Proskurov massif (by Tsarovskiy et al. 1980).

Fenites which are formed by replacing of host rocks occupy nearly 80% of massif area. They are represented by alkaline syenites, granosyenites or alkaline granites. During the fenitization process plagioclase is replaced by K-feldspar-perthite or albite; quartz and biotite disappear; alkaline pyroxenes and amphiboles replace the hypersten; titanite appears. The nepheline is absent in fenitizated rocks (Krivdik et al. 1990; Scherbakov 2005).

The results of the research are following: 1) the stone material is processed and systematized; 2) the main PM rock varieties are studied petrographically; 3) the representative samples are selected and the complete data set for geochemical modeling is supposed to get.

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THE CALCAREOUS OLISTHOLITES FROM POIANA ZĂNOAGA (NORTHERN PART OF PIATRA CRAIULUI SYNCLINE). PRELIMINARY DATA

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Piatra Craiului Massif represents a major syncline unit consisting of Cretaceous conglomerates in its central part, and Middle Jurassic terrigenous deposits followed by Upper Jurassic–Lower Cretaceous (Oxfordian-Neocomian) limestones on it's flanks (Săndulescu et al. 1972; Bucur et al., 2009). The conglomerates located in the northern part of this syncline area (Pioana Zanoaga) contain large blocks (olistholiths of limestones atributed by Săndulescu et al. (1972) to the Tithonian and Barremian. The Barremian age of part of these blocks was proved by the presence of cuneolinid foraminifera (Bucur, 1975, unpublished). One of the olistholiths forming an elevation called Silha lui Căiţă is highly fossiliferous. From this olistholite we colected a several samples in order to describe the main types of microfacies and to determine the microfossils.

Within the limestones of Silha lui Căiţă we identified the following types of microfacies: coarse bioclastic grainstone with gastropods, bivalves and corals; ooidic grainstone with gastropods, dasycladacean algae and foraminifera; peloidal bioclastic grainstone; intraclastic grainstone; bindstone with bacinellid structures;, coral-microbial boundstone.

The micropaleontological assemblage consists of foraminifera and dasycladalean algae. The following species of algae are present: *Petrascula bursiformis* (ETALLON) (very frequent), *Petrascula* sp., *Salpingoporella pygmaea* (GUEMBEL), *Pseudocymopolia* cf. *jurassica* DRAGASTAN), *Clypeina sulcata* (ALTH), *Nipponophycus* sp. The foraminifera are represented by: *Andersenolina alpina* (LEUPOLD), *Andersenolina* cf. *sagittaria* (ARNAUD-VANNEAU, BOISSEAU & DARSAC), *Andersenolina perconigi* NEAGU, "*Trocholina*" sp., *Everticyclammina* sp., *Pseudocyclammina lituus* YOKOYAMA, *Nautiloculina bronnimanni* ARNAUD-VANNEAU, *Charentia* sp., *Coscinophragma cribrosa* (REUSS), *Mohlerina basiliensis* (MOHLER), *Protopeneroplis ultragranulata* (SEPTFONTAINE) and *Protopeneroplis* sp.

The micropaleontological assemblage indicates an Upper Tithonian-?Berriasian age.

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BIOTITE FROM GRANITOIDS OF CHERNIGOV FAULT ZONE (AZOV BLOCK OF THE UKRAINE SHIELD)

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As shown by predecessors (Khomenko et al. 1988, 1989), due to some structural peculiarities the dark micas, belonging to iron-magnesium group of silicates (biotite), may be regarded to a certain extent as "key" minerals for elucidation of genesis and formation conditions of biotite bearing crystalline rocks. The main purpose of this investigation is to establish compositional and spectroscopic characteristics of biotites from various carbonatite bearing rocks by microprobe analysis and optical absorption spectroscopy.

The objects of investigation are granitoids and diorite-like rocks of Chernigovka linear carbonatite fault (north-western part of Azov block of the Ukrainian shield). Biotites from the rocks opened by two wells in western (the well 741) and eastern (the well 968) parts of this complex were studied.

The rocks opened by the wells are represented mainly by migmatized diorite-like rocks, plagiogranodiorites and amphibolites. In them the boitites are grown within intergranular space of main rock-forming minerals, filling cracks in plagioclase, amphibole and pyroxene grains.

Despite of heterogeneous composition of the biotite bearing rocks, a rather narrow compositional range is characteristic of all the biotites studied. Thus, most of microprobe determinations show that (Fe / Fe + Mg)-ratio varies within 0.32-0.43 with Al^{VI}-content ranging from 0 to 0.6 apfu. This evidences that the iron-magnesium micas studied should be ascribed to biotites with some minor predominance of Mg over Fe.

Two groups of biotites can be discerned: more ferrous and more magnesia, intrinsic to granitoids and amphibolites (where biotite grows together with amphibole), respectively. By Luhr's (Luhr, J.F. et al 1984) and Henry's (Darrell J. et al. 2002) geothermometer, calibrated according to Fe/Mg ratio and Ti-equilibrium, crystallization temperature ranges within 750-610°C (in amphibolites - 770°C).

Polarized optical absorption spectra were measured on oriented biotite grains in petrographic thin sections using a home-made single-beam microspectrophotometer constructed on basis of a SpectraPro-275 triple grating monochromator, a highly modified polarizing mineralogical microscope MIN-8 and a PC. The spectra were scanned with steps $\Delta\lambda$=1 nm, 2 nm and 5 nm in the range 330-450, 450-1000 and 1000-1800 nm, respectively, by means of digital wavelength-step-scanning procedure with an Acton Research Corporation SpectaCard readout system driven by Windows SC-1 control and data acquisition software (Taran et al. 2008). Measuring of the spectra was accomplished by a routine single-beam procedure.

Electronic spin allowed dd-transition of Fe^{2+} intensified by exchange-coupled interaction with neighboring Fe^{3+} in adjacent octahedral positions of the biotite structure, as well as intervalence charge-transfer (IVCT) transition $Fe^{2+} + Fe^{3+} \rightarrow Fe^{3+} + Fe^{2+}$ in the octahedral layer of the structure (a broad intense band at around 13900 cm^{-1}), together with an intense high-energy absorption edge caused by strong absorption UV-bands of electronic charge-transfer transitions $O^{2-} \rightarrow Fe^{3+}$, Fe^{2+}, are main features of the biotite spectra studied which considerably vary in intensity in different samples causing broad variations in color and pleochroism of biotites. Some samples, especially those from intensively fenitized rocks, show rather simple spectra consisting mainly of strongly pleochroic high-energy absorption edge with weakly, if any, discernible absorption features, dd-bands of Fe^{2+} and Fe^{2+}/ Fe^{3+} IVCT band, mentioned above.

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GENESIS OF THE „GLIMMERITE“ ROCK RELATED TO THE HRUBŠICE PERIDOTITE

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In the Bohemian Massif, various types of reaction zones were described on the contact of ultramafic bodies with neighboring rocks. In its south-eastern part, such bodies of rock can be found on the contact of Hrubšice serpentinized peridotite and Náměšť granulite in the Jihlava river valley near the ruins of the Templštejn castle. These reaction zones are called glimmerites by certain authors (Becker et al. 1999). Glimmerites, according to Becker (1999), occur in a form of veins in the peridotite bodies near to their margins and are thought to have been formed as a result of the contact interaction of peridotite and the adjacent rock. In terms of time, they probably crystallized from fluids coevally to the granulite metamorphism (approx. 335 – 340 Ma). Urban (1988) reports similar occurrences to exist within the Mohelno serpentinized peridotite which also lies on the contact with the Náměšť granulite body. A type of a reaction zone where predominantly intermediate (granodiorites, diorites/gabbros) rocks form bodies several tenths of meters long has been described there. They are believed to have originated as residues that formed during the local anatexis of granulites. Forming processes of these rocks are, however, still questionable. The aforementioned authors´ results are discussed and compared as a part of the study.

Alleged glimmerites related to the Hrubšice peridotite lay, unlike glimmerites according to Becker et al. (1999), in between the ultramafic body itself and a felsic metamorphic rock represented here by the Náměšť granulite. Samples of the contact rocks collected in the Jihlava river valley were examined using light microscopy to define the main rock-forming minerals. Three most abundant rock types have been identified on the contact as following: amf–bt ultramafic type, biotitic felsic type (which can also be classified as tonalite), bt–amf intermediate type (also classified as diorite to quartz diorite).

Field gamma spectrometry measurements were carried out to determine the distribution of radioactive elements such as uranium, thorium and potassium in both the contact rock and the two lateral rocks. Granulite reaches the average potassium content of 4,3 %, while the contact rock („glimmerite“) contents only 2 % of the element. As expected, potassium content of serpentinized peridotite is extremely low (0,3 %). As for uranium and thorium, their contents correlate in each rock. Granulite has highest contents of both elements with 0,9 ppm of uranium and 2,2 ppm of thorium, serpentinized peridotite ranges at 0,2ppm of uranium and 0,4 ppm of thorium. In comparison, the contact rock contents an equal amount of 1 ppm of uranium and thorium, which signifies that the contact zone is visibly enriched in uranium as opposed to the two neighboring rock bodies.

The greater part of the study is focused on a small (approx. 3 cm in diameter) concentric complex enclave of an ultramafic rock enclosed in the intermediate contact rock type. Backscattered electrons (BSE) images show that the mineral distribution in each part of the zone differs greatly as a result of proximity to the enclosing rock, as well as that the element distribution in same minerals varies with respect to the particular spot where the minerals occur in the zone. The central parts of the zone consist mainly of Cr–rich spinel, tremolite, chlorite, orthopyroxene and Fe–rich amfibole. With lowering proximity to the intermediate enclosing rock, Ca– and Mg–rich amfibole starts to occur as well as Fe–rich orthopyroxene with decreasing content of aluminium. Mica, too, varies from the phlogopite type in the centre to the biotite at the immediate contact with the rock. As far as the chemical composition is concerned, high contents of chrome, magnesium and potassium are typical for the central part of the zone, whereas iron and calcium contents tend to increase with growing proximity of the intermediate rock. Negative correlation is represented by magnesium and iron in mutual relation.

As well as in the case of the contact rocks described by Urban (1988), the examined rocks occur on a contact of highly different rock types. Since the Becker´s glimmerite (1999) is an ultrapotassic rock that crystallized from fluids, only the very central part of the concentric enclave can be compared to it. The rest of the studied rock types has probably been formed by different sort of processes, such as mixing and metasomatic reactions.

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FACIES ASSOCIATIONS AND DEPOSITIONAL ENVIRONMENTS OF UPPER JURASSIC – LOWER CRETACEOUS CARBONATE DEPOSITS FROM ARNOTA MOUNTAIN (BUILA-VÂNTURARIŢA MASSIF, SOUTHERN CARPATHIANS, ROMANIA)

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The Arnota Mountain represents the south-western ending of the Buila–Vanturarita Massif, a NE–SW trending calcareous ridge located in the central-southern part of the Southern Carpathians. The carbonate deposits from Arnota Mountain, mainly consist of massive Upper Jurassic reef limestones (Kimmeridgian-Tithonian). Lower Cretaceous (Berriasian–Valanginian and Barremian–Aptian) deposits are known from a small area around the Arnota Peak, being located on the top of the Upper Jurassic succession. Besides corals, a wide range of micro-encrusters and microbial structures, have contributed to their development. Our study is based on the investigation of 500 samples collected from three sections: Bistriţei Gorges, Costeşti Gorges and one section in the southern part of the Arnota Peak. The sampling was performed at intervals of around 5–6 m. Detailed investigation was made in order to reveal microfacies characteristics and micro-palaeontological content. Microphotographs were taken by using a Cannon Powershot A640 digital camera attached to a Zeiss Axioscope microscope. The sedimentary succession of Bistriţei Gorges is composed of levels of Upper Jurassic reef carbonate micro-breccias interlayered with coral-microbial bioconstructions. Within these units we have identified two main facies types: intraclastic-bioclastic rudstone/grainstone and coral-microbial boundstone. Packstone and grainstone occur subordinately. The second studied section, located in the central part of Arnota Mountain, contains besides the Upper Jurassic reef levels, the Lower Cretaceous deposits, which mainly consist in intraclastic peloidal grainstone and peloidal-bioclastic fenestral wackestones. The Upper Jurassic levels beneath are represented by coral microbial boundstone and intraclastic-bioclastic floatstone/ rudstone. The Costeşti Gorges section is similar with Bistriţei Gorges, the Upper Jurassic coral-microbial deposits being dominant through the entire succession. The microfacies analyses corroborated with the taxonomic associations identified in the successions under study from Arnota Mountain, point to similar depositional environments during the Upper Jurassic. We identified slope and external shelf margin sedimentary domains, the distribution of facies associations being typical for the margins of a carbonate platform. The microbial activity and the encrusting micro-organisms have stabilized the carbonates of the slope facies types and favored the development of bioconstruction levels. As a final remark, the Upper Jurassic limestones from Arnota Mountain can be assigned to the ''coral-microbial-microencruster boundstones'', displaying similarities with other carbonate deposits of the Intra-Tethyan domain (Ples et al. 2013).

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DETERMINATION OF SELENIUM IN ENVIRONMENTAL SAMPLES BY MASS SPECTROMETRY WITH INDUCTIVELY COUPLED PLASMA

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Selenium is the rarest trace element. Pure selenous materials have been found at nearly all geological solids: igneous rock contains 0.05 mg/kg of selenium, its least concentrations has been detected in aqueous rock – sandstones and limestone. Selenium content is increasing in the following set of aqueous rocks such as dolomites, limestone, sandstone, argillaceous sediments, schist (from 0.03 to 0.6 mg/kg) (Ivanov, 1997., Kabata-Pendias, 1989). The average selenium content in world ocean waters is, μg /dm^3: 0.09 – 0.20; river waters – 0.2; in sea waters – 0.1; in mineral waters of the Crimea, Carpathians and Western Europe – 1-50.

Recently selenium has drawn much attention of researchers, having strong antitumor and antioxidant properties. The daily "therapeutic dose" of selenium for a human organism is up to 400 μg.

The purpose of this work is to create analytical schemes for sample preparation for ICP-MS analysis of environmental medium and their usage for determination of the selenium content in natural waters, plants, soil and fungi.

Research objects include subsurface rock, soil, plants and fungi. Concentrated HF, HCl, HNO_3, H_2SO_4, H_3PO_4 acids, which were additionally purified by means of Subboiling system, have been used. Water resistance 18.2 mΩ/cm was achieved by means of DIRECT-03 system of MILLIPORE Company. Standard solution of Fluka elements was applied to design graduated graphs.

The selenium content was determined by means of mass-spectrometer (ICP-MS) with inductively connected plasma of Element-2 analyzer. Indium (^{115}In) was used as an internal standard, SGD-1A, SGD-2 standards were used as externals.

Analysis of obtained results showed that when carrying out sample preparation for selenium determination the latter can be lost in the process of disruption during evaporation. Especially the major lost of selenium was witnessed during evaporation of selenium acetous solutions on a tile with loss reaches 80%. It appeared to be more rational to use hydrogen nitrate for sample preparation of sulphide ore soils, minerals for ICP–MS analysis. According to (Nazarenko, Iermakov, 1971, Shestopalov, Ponomarenko, 2011) selenium loss can be witnessed during evaporation of nitrate solutions to dryness only. For complete disruption of samples chloric or sulphur acids are often added. However when the solution is evaporated to dryness, one can witness selenium loss, especially when using sulphur acid and evaporating to SO_3 gases.

Acid mixture of HNO_3 and $HClO_4$ (2:1) appeared to be more efficiently used for disruption of an organic substance. For disruption of organic substance of silicate rock HF:HNO_3 (3:1) mixture was used. It was determined that when using such mixture selenium is not lost.

Recently selenium, its content and its allocation in plants and fungi have drawn particular attention of many scientists. It is one of the most important microelements incorporated in food products and biologically active additives.

Maximum concentration of selenium was discovered in fruit body of King bolete (Boletus edulis), fly amanitas (Amanita muscaria), parasol mushroom (Macrolepiota procera) *Stropharia rugosoannulata,* scotch bonnet (Marasmius oreades) (Ivanov, 1997., Kabata-Pendias, 1989).

Analytical schemes of disruption of subsurface rock, soil, plants, fungi have been developed with both classical and microwave distribution. The developed analytical schemes have allowed to reduce significantly the duration and labor inputs of sample preparation. A complex of ICP–MS methods for determination of selenium content in subsurface rock, soils, plants and fungi was developed within the range of 1 ppb to 100 ppm with relative standard deviation of Sr 1-2.

Selenium content was discovered in water plants and sterile coal. The data of the selenium content and its allocation in Boletales fungi were obtained. The obtained data has shown that wild-growing edible fungi have an increased content of bioactive microelement of selenium within 17-50 ppm.

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STUDY OF SATURATION AND SEDIMENTATION OF BENTONITE

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Bentonite is studied due to its use as one of the barriers in deep geological repositories of high radioactive waste. For experiments were used two kinds of bentonite SABENIL 65 and B 75 of the bearing Rokle supplied by the company Keramost a.s.

This study is concerned with the ability of bentonite to bind water. Experimentally (water saturation by wicks) was found, that the bentonite is able to absorb up to 67% moisture.

Attention has been paid to the behavior of the bentonite sedimentation in distilled water and its influence on solution composition. The experiment was made in a batch reactor, which was a glass graduated cylinder, with different ratio bentonite : water. During the sedimentation of bentonite may arise up to 4 layers. From top to bottom, these layers are: A-pure water solution, B - solution of colloids, C - layer of sewage, D - sediment of bentonite. How many layers are formed depends on ratio bentonite: water and the source of bentonite,. The physico-chemical parameters solution and the composition of water phase (Ca, Na, Mg, K) within each layer is different.

FABRICS AND EMPLACEMENT OF WEINSBERG-TYPE GRANITOIDS (MOLDANUBIAN PLUTONIC COMPLEX)

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We consider new structural and AMS data from the Prášily and Strážný composite plutons composed of Weinsberg and Eisgarn type granitoids (western Moldanubian Plutonic Complex). These both plutons were emplaced into partly exhumed migmatized paragneisses and migmatities of the Monotonous Unit (southwestern Moldanubian Zone).

The Moldanubian Zone (MZ) represents exhumed lower- to mid-crustal high-grade rocks that recorded complex and polyphase tectonometamorphic activity (for reviews see Schulmann et al. 2005). During and after the peak of second regional LP–HT retrograde metamorphic event (~330–320 Ma) rocks of the Moldanubian Zone were intruded by large volumes of crustally-derived magmas, making up a large Moldanubian Plutonic Batholith. The batholith comprises a number of petrographic rock "types" (Vellmer and Wedepohl, 1994; Gerdes et al., 2000): (i) Megacrystic granitoids of the Weinsberg-type (~331–318 Ma), and (ii) two-mica granitoids of the Eisgarn-type (dated at ~330–324 Ma). Eisgarn granitoids have a relatively uniform major-element geochemical signature and characteristic of fractionated, peraluminous high-K granites formed by partial melting of a metasedimentary source (e.g. René 1999). In contrast, Weinsberg granitoids have slight afinity to I-type magmas.

Host metamorphic rocks of the Monotonous Unit exhibit a complex structural pattern. Relatively oldest steep NNE-SSW foliations were heterogeneously overprinted by flat–lying fabrics that also dips predominantly to the NW. Further, in the northern part of the studied area, this flat foliation is overprinted by crenulation cleavage with axial planes dipping moderately to steeply to the ~NNE. The intensity of this overprint increases toward the SSW to the Bavarian part of the Moldanubian Zone, where this fabric becomes dominant. In the studied area NNW-SSE foliations are associated with subhorizontal stretching lineation and bear an evidence for right-lateral kinematics. This youngest ductile fabric is mostly parallel to the Pfahl Shear Zone located more to the south.

Microstructures in both plutons indicate transitional, magmatic to high-temperature solid-state fabrics. Rare host rock xenoliths are enclosed in both plutons. Contacts of both plutons have an intrusive character. Over 300 oriented samples for analysis of magnetic anisotropy (AMS) were taken from the Prášily and Strážný plutons. Both granites are characterized by relatively low degree of anisotropy. In the Prášily pluton the values of P parameter range between 1,012 to 1,129, shape of AMS ellipsoid is slightly prolate (T: -0,89 – 0,75). In case of Strážný pluton the values of P parameter range between 1,013 and 1,168., values of T parameter ranging between -0,94 and 0,91 and indicate both prolate and oblate character. Magnetic foliations in the Strážný pluton are relatively homogeneous in a flat-lying to NNE-SSW steeply dipping fabrics. Corresponding magnetic lineations plunge to NE. In the Strážný pluton observed magnetic foliations dip moderately to steeply to the SSE or NNE. Magnetic lineations plunge to the ~ENE to ~NE. Magnetic fabrics in the both plutons are roughly parallel to the mapped intrusive contacts and orientation of regional metamorphic fabrics in the host migmatized paragneisses of the Monotonous Unit.

The both plutons (dated at 320 and 322 Ma; Pour 2012) were emplaced syntectonically into partly exhumed high-grade Moldanubian rocks and recordered strain-field increment (~NNW–SSE contraction) during the later stages of pluton crystallization. These processes were related to dextral transpressional deformation in the southwestern Moldanubian Zone, and suggesting a close temporal relationship between final crystallization and regional strike-slip shearing.

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HYPOTHETICAL SOIL/EPIKARSTIC P_{CO2} DERIVED FROM DRIPWATER COMPOSITION (PUNKVA CAVES, MORAVIAN KARST)

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Speleothems, the secondary cave sediments precipitated from karst waters, are subjected to wide scientific interest for more than last decade (Fairchild et al. 2000). They contain information about (I) climate in geological past and about (II) processes in karst environment. The karst water parameters are result of the processes occurring on the water flow-paths. The most important process is calcite dissolution/precipitation. The infiltrating water flows through the pores and cavities in soil and epikarst. These spaces are filled with air containing CO_2. This CO_2 dissolves in water and participates in dissolution of carbonate rock calcite based on the equation $CaCO_3 + H_2O + CO_{2(g)} = Ca^{2+} + 2\ HCO_3^-$. This process is quite fast – estimated water residence times for karst profile are sufficient to reach water-calcite equilibrium. The karst water usually discharges in a cave forming a ceiling drip. There is dripwater exposed to different conditions with much lower P_{CO2}, the water-calcite-$CO_{2(g)}$ system gets out of the equilibrium, and the excess of dissolved CO_2 is degassed from solution. This process leads to pH increase and reaching supersaturation of the water with respect to calcite. Calcite precipitates as a result (in process opposite to dissolution) forming secondary carbonate bodies (Fairchild et al. 2000). Recently, some works indicating higher PCO_2 concentrations in epikarst than previously anticipated from concentrations of soil CO_2 have been published (Faimon et al. 2012).

Presented results are based on data collected between February and December 2012 in Punkva Caves, Moravian Karst (Czech Republic). Totally 98 samples from 5 drips are used. The studied drips are situated on a straw (A) in a Tunnel Corridor and on straws in corridor behind Přední Chamber (drip B1-3). The drips have various drip rates Q (slowest A Q=3 drops/min, fastest B1 Q=78 drops/min) and some drip rates are very variable through the year (variation coefficient for B1 is 72.3%), whereas other are very stable (variation coefficient for B2 is 16.6%). The saturation indices with respect to calcite are in range from 0.7 to 1.2. The values of partial pressure of carbon dioxide in cave atmosphere, $PCO_{2(c)}$, were in the range $10^{-2.63}$-$10^{-3.31}$ ($10^{-3.02\pm0.09}$ confidence interval). Calculated partial pressure of gaseous CO_2 that would be at equilibrium with aqueous CO_2, $P_{CO2(w)}$, are in the range $10^{-2.91}$-$10^{-2.35}$ ($10^{-2.62\pm0.03}$ confidence interval). Thes values are slightly lower compared to data published by Faimon et al. (2012), where $PCO_{2(w)}$ values were in the range $10^{-2.98}$–$10^{-1.95}$ ($10^{-2.44\pm0.05}$ confindence interval).

The hypothetical $PCO_{2(H)}$ were found as the CO_2 partial pressure, at which degassed dripwater would return to the equilibrium with calcite. Following the approach of Faimon et al. (2012), we used modeling software PHREEQC (Appelo & Parkhurst 1999). Concentrations calculated for drips B1-3 and A are in the range $10^{-1.77}$-$10^{-1.5}$ ($10^{-1.58\pm0.016}$ confindence interval). Seasonality of $PCO_{2(H)}$ is very small: the summer (May to September) values of $10^{-1.570\pm0.01}$ are almost the same as winter (October to April) values of $10^{-1.568\pm0.01}$.

The $P_{CO2(H)}$ values based on the recent study in Punkva Caves are roughly consistent with the direct measurements of epikarstic PCO_2 in the range $10^{-1.4}$-$10^{-1.7}$ (Benavente et al. 2010) and the values $10^{-1.53}$ found by Faimon et al. (2012) and indicate much higher PCO_2 in epikarst in comparison to directly monitored $P_{CO2(g)}$ in karst soils.

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TOP-10 OF PALEONTOLOGICAL TRAVEL ROUTES IN UKRAINE

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The era of dinosaurs has finally returned to the Earth in the way of entertainment industry. More and more interested people want to see fossilized evidences by themselves, the facts which build paleontology as a science. In accordance to his own experience, the author would like to point out the most perspective travel routes for paleontological tourism in Ukraine. It most cases those places are also good for fossil hunting, in addition to very interesting geology. And here one can find fossils for his own collection.

The paleontological travel routes in Ukraine:

10. Maksymivka, Ternopil Region. Limestone quarry situated in 30 km. to Ternopil, it used to be a great bioherm during middle Miocene in that place, where *Daira speciosa* crabs and a dozen other arthropods lived.

9. Izium, Kharkiv Region. Mid Jurassic limestones of the old №2 Grehovskyi quarry in which lots of Gastropod and Bivalvia inner cores may be find, also it happens to find some ammonites *Peresphinktes biplex*.

8. Malyn, Zhytomyr Region. Sand dumps of Malyn granite quarry in where the teeth of mainly Eocene sharks of *Otodus sp.* and *Striatolamia sp.* may be found.

7. Grygorivka, Kaniv district, Chercasy Region. Clay outcrops of the Kanev Reservoir (the Dnipro River) wash out the ammonite inner cores *Kepplerites species* and belemnites rostrum of Callovian age, Jurassic period.

6. Starunia, Ivano-Frankivsk Region. In the former ozokerite mines in the first half of the 20th century mummified hairy rhinos and mammoths were found. In present times some mud volcanoes, oil and gas spill may be observed up the surface.

5. Donetsk. Waste heaps of Donetsk coal basin, where many interesting specimens of carbonic flora may be found.

4. Bernashivka, Mogyliv-Podilskyi district. Sandstone dumps of granite quarry next to Novodnestrovsk GES are known of many tiles with fossilized vendobionts (Ediacarian fauna) called *Nemiana simplex*.

3. Verhorichchia, Bahchysaray district, The Crimea. The place is famous mainly because of Cretaceous period marine fauna fossils, which are especially appreciated by findings of heteromorphic ammonite inner cores of *Crioceratites sp*.

2. The Kerch peninsula, (Kamysh-Burunskyi quarry and Khrony peninsula), The Crimea. The Kerch iron-ore basin is mostly famous of Tertiary fauna fossils: shellfish, fish, crustaceans, seals, dolphins, *Cetotherium sp.* whales and some others (Fig. 1).

1.Nyrkiv, Ternopil Region. The outcrops of early Devonian Old Red Sandstone formation, situated near by the Dnister River and form beautiful canyon. Here lots of Agnatha species may be found.

Of course, this is an incomplete list of paleontological places to visit in Ukraine. Therefore, the author promises himself to write Top-100 next time, if the participants of the conference visit the entire listed ones.

Fig. 1: The paleontological travel route is the Kerch peninsula

GEOLOGICAL HERITAGE OF UPPER PROTEROZOIC (VOLHYNIAN REGION, UKRAINE): MONITORING AND PROPOSITION

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The protection of geological monuments during their recreational usage is one of the important parts of the nature preservation, and the negligent attitude can lead to their destruction and further pollution, which leads to the destruction of vegetation, animals, fish, and birds. So that's why it is important providing monitoring of such sites.

The monitoring of the geological reserve "Basalt columns" (near village Basaltove) and basalt quarries of Rivne region was conducted in May 2012. All these objects were recently offered to unite to "Berestovets basalt outcrops" (village Berestovets) and give status of regional significance attraction. The outcrops of Upper Proterozoic basalt are attributed to mineralogical and petrographic types of geosites (Bezvynnyi, Biletskyi & ets, 2006). The main feature of these basalts is a columnar jointing, which can be traced in all basalt outcrops and quarries. The height of the pillars reaches 8-15 m (sometimes -up to 30 m) and diameter can reach up to 1,2 m. The pillars cross-section form is polyhedron.

In addition, Upper Proterozoic lavabreccia, which can be observed in most of the quarries and taper out in a westerly direction, outcrops from under the lava flows on the surface. This is an exceptional mineralogical object as it contains big native copper nuggets (some up to 1kg), other copper and quartz mineralisations (cuprite, malachite, chalcocite, amethyst, chalcedony, etc.). The maximum lavabreccia thickness within Rafalivka quarry is 10 m. The tectonic and stratigraphic contacts of lavabreccia, tuffs and basalts can be observed within Rafalivka quarry. In general, the natural and artificial outcrops of Upper Proterozoic rocks are already unique, natural heritage and in need to be conserved for not only Ukrainian but also the world science. The questions about origin of this rock are open to discussion.

In this case, all these listed geological objects are situated in the worked-out parts of quarries. That allowed us to offer to unite them into complex (tectonic, mineralogical and petrographic) Geopark.

Also there is a problem with conservation of geological objects. We have a legislation, which must protect geological reserves, but it's imperfect and doesn't work properly (Gritsenko, Rudenko, Stetsyuk, 2012). Some important geosites even don't refer to protected area. However, the conservation of these geological objects is necessary for further research, scientific conferences and seminars, geological practices, as well as eco- and geotourism in Ukraine.

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SILICIFICATION OF CRETACEOUS SCLERACTINIAN CORALS OF MIECHOW AREA, SOUTH POLAND

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Scleractinian corals are rare in the Upper Cretaceous sediments of Miechow area. This region is located in Miechów Trough, part of the Mid-Polish Trough, extra-Carpatian Alpine tectonic element. Late Cretaceous deposits of Miechow area are dominated of epicontinental marine carbonates (siliceous limestones). Overall, coral specimens are well preserved macroscopically, but microscopic examination shows more or less advanced diagenetic changes. Carbonate and siliceous cements, recrystallization, dissolution, deformation, bioerosional activity and replacement are present. Diagenetic features of the skeletons have been documented by polarizing microscopy and cathodoluminescence analysis. Silica is clearly visible in all specimens. Three types of siliceous cements have been recognized: radial normal length-fast chalcedony (LFC), radial „zebraic" chalcedony, and mosaic microcrystalline quartz. Evidence of silicification are common, significant parts of the skeletons are replaced, mainly by chalcedony. Preservation of each part of coral skeleton is different. Columella is non-silicified in most specimens. The wall is silicified only on the inner side. Three models of replacement in septum are recognized: silica has begun to replace the skeleton from center of the septum, the outer parts of the septum (bundles of chalcedony fibrous are clearly visible and always perpendicular to the axis of septum), or both of these areas. The most altered are the outer parts of the septa and areas connecting the septa and the wall. Silicification has destroyed primary details in most cases. Although it could also accentuate some features e.g. bring out the central line of the septum. Biogenic silica has probably derived from the dissolution of siliceous sponge spicules.

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MEMORY EFFECTS IN ROCKY

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Work is devoted to effects of memory and their manifestation in rocky soil. Object of research was natural and technogenic rocky soil. Work purposes: studying of effect of memory (effect of the Kaiser) in natural and technogenic rocky soil and nature of its manifestation in different types of breeds; studying of possibility of restoration of tension tested by breeds earlier and an assessment of safety of effect in time.

Memory effects with change of temperature and pressure, the nature of manifestation of effect in different types of rocks after several time intervals were studied. Possibility of stress recovery in rocks with different structural characteristics was explored (time intervals – hours, days, weeks, months) . Samples were prepared from uniaxially pre-loaded (at least 35% strength) granite blocks, limestone and concrete. The tests were conducted at several loading rates aligned and perpendicular to direction of the unit load to it. Acoustic emission (AE) was measured during the experiment: AE total account, energy, amplitude of signals, number of pulses. For the analysis of graphics smoothed out on a method of a sliding window and in addition schedules of dependence of total AE from tension were under construction. Test data analysis indicates different character of memory effects in natural and artificial rocks. The most clear manifestation of memory effect was found in limestone not depending on direction of initial orientation of load on the block and in samples of granite without cracks, tested coaxially initial pressure. It was difficult to detect memory effect in concrete.

The effect is manifested by an abrupt increase in emission curve $\Sigma N = f(\sigma)$. The accuracy of restored load for different types of soils ranges from 85% for limestone and drops to 10% in some concrete samples. So in a month after block loading in one of samples of limestone it was succeeded to restore tension with an accuracy about 80%, and in concrete after determination of such tension it was complicated. Besides the effect has impact on restoration of tension "memory deletings" known on cyclic tests when values of the remembered tension "are imposed" at each other at numerous tests (weighting ↔ unweighting).

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ORGANIC MATTER AND CLAY MINERALS AS THERMAL MATURITY INDICATORS IN THE MIKULOV MARLS (CZECH REPUBLIC)

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To get an idea about possible feasibility of the Mikulov marls as a gas-bearing shale, geochemical and clay mineralogical analyses were carried out. The production of the hydrocarbons in the Czech Republic covers about 3% of the local consumption and comes from the southern areas (south Moravia). Production and exploration take place here continuously since twenties of the last century. One of the main sources of local oil and gas (as well as in the northern Austria) is supposed to be the Mikulov Marls (Landwein 1988, Francu et al. 1996, Picha and Peters 1998, Pícha et al. 2006). Dark organic rich - in some areas almost 1500 m thick- marlstone has been deposited during the Late Jurassic (Malmian) (Eliáš 1992, Adámek 2001, Pícha et al. 2006). The Mikulov Marls are now perceived as a one of potential shale gas source in the Czech Republic (Dvořáková et al. 2011).

Geochemical analyses encompass pyrolysis Rock-Eval, organic carbon content (TOC) and random vitrinite reflectance measurements (Rr). Altogether 21 samples from 8 different wellbores and different depths were currently analyzed. Additional data were collected from the drilling reports in the archives (CGS, Geofond, MND a.s.).

The TOC values range from 0.1 up to 4.2% and residual potential (S2, bound hydrocarbons) ranges from 1,7 to 32,18 mg/g. According to the source rock generative potential criteria (Peters 1986) Mikulov Marls are good oil and gas prone source rock. The Mikulov Marls contain kerogen type II and II-III according to Espitalie (1986) with maturity range from immature to early mature.

Tmax values vary in wide interval between 418°C to 455°C strongly reflecting burial depth. Most of the studied samples are rich in fluorescing alginite macerals with small proportion of terrestrial plant debris.

Total number of 10 carefully selected samples was tested in the specialized laboratory. The clay fraction main components (under 0,2 μm) are illite, kaolinite, mixed layer mineral illite-smectite (I-S) and quartz, minor component is chlorite. The major part of the samples is characterized by the ordering of mixed layers I/S type R1 with the expandability of 30%. There are two samples of different features with mixed layers I/S type R0 and expandability of 50-60 %. These samples differ by their tectonic origin – they represent a Jurassic rocks folded into the Flysch nappes.

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GEODYNAMIC CONTROL SCHEME OF NEOGENE VOLCANISM IN UKRAINIAN CARPATHIANS

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Intensive volcanism, that took place in Ukrainian Carpathians over a period from Helvetian to Levantinian age, is characterized by repeatable changes of different types of igneous rocks. Three major volcanic complexes were marked out in previous research by Nikolayev (1984). The lower complex spanning from Ottnangian to lower Badenian age contains mainly ignimbrites, liparites and their tuffs. The middle one, dating from Middle Badenian to Pannonian, is represented mainly by andesites and their tuffs, and to lesser degree, by liparites, dacites and their tuffs. The upper complex consists exclusively of basalts attributed to the Late Pliocene and Early Pleistocene.

In any case, previous investigations associated all volcanic activity with propagation of tectonics. On the hence these investigations mentioned magmatic centers to only partly match with big faults (including deep break). Specifically, Nikolayev (1984) supposed that major part of igneous rocks in the region were mainly associated with faults of regional level or were not associated with large tectonic faults at all.

Besides such ancient structures as Pannonian and Transcarpathian fault, as well as young faults of different orientation, also have an effect on magmatic control. These faults are mainly dated as post-Tortonian. One of these young faults controls the central part of Vygorlat-Huta ridge. Particularly by intensive propagation of such kind of faults is presented in Chop depression.

Preliminary structure-paragenic analysis of the Transcarpathian faults grid as well as magmatic center distribution data permit to suggest the new dynamo-kinematical scheme of Neogene volcanism in Ukrainian Carpathians.

According to this scheme the general submeridional compression process of Carpathian fold system caused the right-side split zone in Transcarpathia. The split zone is restricted on the north by Transcarpathian deep fault that has north-western strike and subvertical decline. The southern boundary is not so clear. It includes the territory between Samozh (Somezh) fault and Pannonian deep fault, where dislocation movements were complicated, probably, by shifting of the tectonic blocks.

The split zone, stated above, is joined by "S"-like Vygorlat-Huta volcanic ridge. The central section of Vygorlat-Huta is oriented with angle of 50° to Transcarpathian deep fault zone. Almost the same orientation has the Preshiv volcanic ridge.

The split zone and magmatic active structures of dilatation form the flaw structural paragenesis, which is complicated by faults of higher degree (synthetic R- splits and antithetic R'-splits). On some geological maps faults with ancillary P-splits can be found. Intensification of noncoaxial movement in the split zone activates the turning of break structures (which causes their extension) and Riedel splits.

The suggested geodynamic control scheme of Neogene volcanism in Ukrainian Carpathians is perspective both in theoretical and research prospects with further substantiation of this scheme.

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ANCIENT GLACIATION INFLUENCE ON BEARING CAPACITY OF DISPERSIVE SOILS IN THE EUROPEAN NORTH OF RUSSIA (THE KOMI REPUBLIC)

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The Russia northern regions have been recently freed from glaciations (The Valdai-Oka glaciations), in the main the soils have a glacial origin in upper parts of profiles and are complicated by the blanket sand and soil layer of plant remains near the surface (Lutoev and Lutoeva 2004). Eternal frozen grounds are widespread in the extreme north, in particular in the Komi Republic. Their upper part can lie at different depths. According to the state monitoring of subsurface condition average temperatures of permafrost have been increasing for last 40 years, what leads the exogenous (cryogenic) geological processes development: permafrost retreating value have been about 30-40 km on The Pechora Lowland and about 70-100 km in The Cirurals for last 35 years (Oberman 2009). Thus, in mind all these factors we can say about ground "imperfection", in which natural compaction processes can begin only after their thawing and permafrost occurrence disappearance as connecting link in the frozen rocks structure. Natural soil compaction is a very slow process and especially in watering conditions. So, we give the example of a comparative analysis of experimental dynamic impact on the ground results achieved in the most common ground and based on the forced oscillations technology (Shushkova 2012). For this we compare our research data obtained on the basis of man-made vibroseis ground impacts of the northern territories (The Izhma Depression) and data of the sourthern territories (The Vychegodskaya Deflection) (Lutoev and Lutoeva 2004), where soils had warmer climatic conditions.

So, we can see on the basis of data obtained by cyclic testing of soils by vibroseis equipment, that;

- middle sands have a less degree of a subsidence and conversion into a quicksand condition in the southern part of The Komi Republic than the same in the northern part;
- sand loam of the southern Komi Republic part has a slight advantage in a resistance to a compaction toward its northern part;
- clay loam of the northern part is more dense and less saturated with water than the same in the southern part so the compression gradient is higher with small and middle cyclic dynamic loads but both go into aquicksand condition at equal values;
- clays as well as sands of the southern Komi Republic part have a less degree of a subsidence and conversion into a quicksand condition than the same of the northern part.

In conclusion, we can note that in general ground 'imperfection' reduces a bearing soils capacity with cyclic dynamic loads quite noticeably.

Study area	Period of glaciation	Type of soil	Degree of compaction	S×10^{-5} м	a/g$_0$	Number of experiments	Soil condition
The Komi-Perm Arch (the southern part of the Komi Republic)	The Dnieper Glaciation (250000 years ago), The Moscow Glaciation (150000 years ago), The Valdai Glaciation (80000 years ago)	Middle sands	I	6	0,303	13	Compacted
			II	23	0,689		Compacted
			III	33	0,731		Quicksand
		Sand loam	I	2	0,251		Compacted
			II	6	0,390		Compacted
			III	10	0,411		Quicksand
		Clay loam	I	1	0,731		Compacted
			II	1	0,731		Compacted
			III	35	0,8		Quicksand
		Clays	I	2	0,162		Compacted
			II	22	0,469		Compacted
			III	35	0,624		Quicksand
The Izhma Depression (the northern part of the Komi Republic)	The Dnieper Glaciation (250000 years ago), The Moscow Glaciation (150000 years ago), The Valdai-Oka Glaciation (10000 years ago)	Middle sands	I	8	0,079	13	Compacted
			II	20	0,223		Compacted
			III	44	0,444		Quicksand
		Sand loam	I	2	0,223		Compacted
			II	4	0,382		Compacted
			III	10	0,444		Quicksand
		Clay loam	I	1	0,257		Compacted
			II	4	0,399		Compacted
			III	15	0,806		Quicksand
		Clays	I	1	0,079		Compacted
			II	4	0,275		Compacted
			III	34	0,444		Quicksand

Table 1: Comparison of bearing alluvial and morainic deposits soils capacities. Notes: a – vibration acceleration, m/sec; g$_0$ – gravity acceleration (10 m/sec^2); S – soil compaction (shrinkage), m; a/g$_0$ – relative acceleration.

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DEVELOPMENT OF THE HOLOCENE VEGETATION IN ČR (MORAVIA) – HUMAN IMPACT

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During the last glacial period (Ice Age) and early post-glacial period (the Holocene), were dramatic changes, which taking place in the global climate. These climatic instability significantly influenced vegetation and human population. The paleobotanical reconstruction of the Holocene vegetation development of the Moravia is based above all on the pollen analysis. One of the important plants of the Holocene for paleobotanical reconstruction is *Carpinus* - hornbeam. The pollen grains for the reconstruction of its expansion were taken from the locality of Pohansko.

Pohansko is situated in the south-east area of the Czech Republic, near the town Breclav and is one of the most significant medieval centre of Great Moravia. Since 2005, archaeological excavations have been taking place, as well as studies of the natural environment. Palynological studies are based on samples, which are collected both from surface collections and conducted drills.

Studied samples come from the depths of 3 and 3.5 m from the V13 borehole. The age of the samples were determined by ^{14}C method to 8240 cal BP (7470 - 7070 cal BC). The macerated samples have been first observed by optical biological microscope and than by fluorescence microscope for recognizing if the pollen grains have been in situ or redeposited.

Both samples of *Carpinus* have been found in Pohansko borehole at a depth of 3 and 3,5m. In these samples, the pollen grains of *Carpinus* appeared to have the same intensity and fluorescence color as the surrounding grains. The grains that have been strictly redeposited from Miocene sediments had lower value of fluorescence. On the contrary, the non-disintegrated *Carpinus* pollen grains are unoxidized and indigenous. In the literature sources, authors reports, that *Carpinus* can be found in subboreal. My findings demonstrate the early occurrences of the genus *Carpinus* in South Moravia, especially in the sediments from Pohnansko 8240 cal BP ± 70.

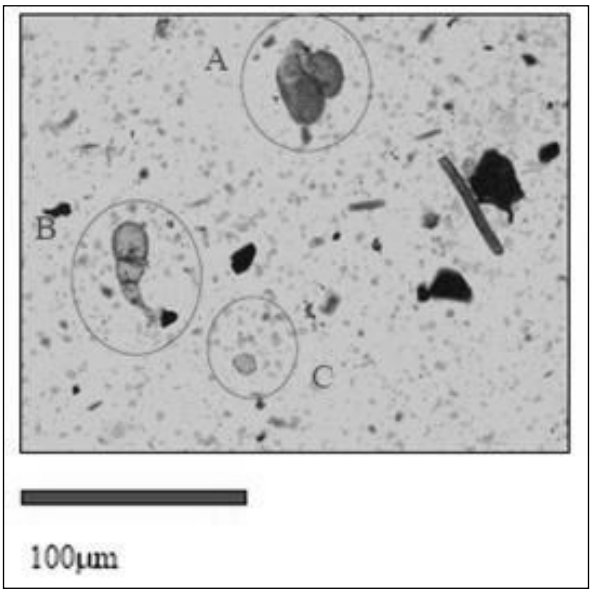

Fig. 1: Photo of pollen grains under normal light. Key: A – Pinus pollen grain, B – Mushroom spore, C – Carpinus pollen grain

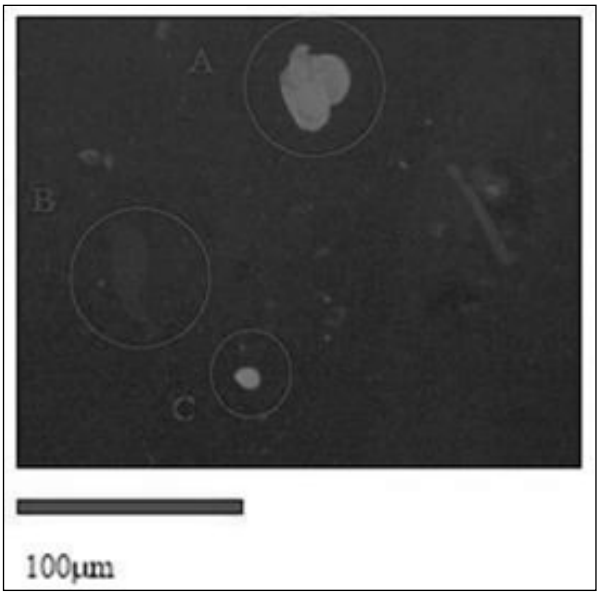

Fig. 2: Photo taken from the fluorescence microscope. Key: A – autochthonous pollen grain of Pinus, B – Mushroom spore, C – autochthonous pollen grain of Carpinus

DETECTION OF SILICA-UNDERSATURATED IGNEOUS ROCKS BY USING REMOTE SENSING THECHNIQUES: A CASE STUDY IN THE SALAVAT MOUNTAIN, NW OF IRAN

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Remote sensing techniques have opened a new era in mapping lithology as a rapid and inexpensive mapping of geological and mineralogical surface. As a new method, using remote sensing could help geologist to detect lithology before field observations. The reflectance spectrum of a rock depends on the mineralogical composition of its surface, which is usually a mixture of the whole rock mineralogy and weathering minerals, therefore, this study examines the use of remote sensing in geology to identify expose of silica-undersaturated igneous rocks of Salavat Mountain in north weastern part of Iran. In this study, Enhanced Thematic Mapper Plus (ETM^+) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) images were used.

In the first stage, to detect rather fresh exposes of silica under-saturated igneous rocks, highly fast and efficient method of ASTER data in shortwave infrared region (SWIR) were applied. False color composition of 4 6 8 in RGB clearly mapped hydrothemal alteration as pinkish pixels. For lithological investigation, use of RGB color composite images with band combination of 14 12 13 and band ratio of 14/10 in the Thermal Infrared (TIR) wavelength region due to construct images that identify quartz index and map silica-undersaturated igneous rocks.

In order to discriminate and delineate the lithological units, image processing techniques such as band combinations (5 3 1, 7 3 1 and 7 4 1 in RGB) and data fusion of Landsat ETM^+ image with band 1 ASTER data in VNIR region were applied and results were accurate and useful for lithological investigation. The following band combinations of ETM^+ were used to investigate different lithologies in this study area: i) band combination 5 3 1 for emphasizing tephrite (pinkish color pixels), syenite (light pink color pixels) and monzogabbro (dark blue color pixels, ii) band combination 7 4 1 for emphasizing lamprophyre dyke (blue color pixels) and, iii) band combination 7 3 1 for emphasizing tephrite dyke (light brown color pixels).

To sum up, the present research represents the discrimination and occurrence of silica-undersaturated igneous rocks within north westrern part of Iran by analyzing the capabilities of ETM^+ and ASTER data. The results show that the processed ETM^+ data in VNIR and SWIR spectral wavelength regions are promising in detecting different lithological unites which were classified and confirmed with ground truth verification based on the geological map of the area, field trip and detailed petrographic description of samples in laboratory.

CONDITIONS OF SEDIMENTATION AND STRUCTURE OF CARBONATE KESS KESS MOUNDS IN HAMAR LAGHDAD REGION IN ANTI-ATLAS MOUNTAINS (NORTH AFRICA)

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The research was focused on determining the composition of fossil carbonate structures known as the Kess Kess mounds and recognizing the sedimentation conditions in which they were formed. The Devonian Kess Kess mounds are located in the area around the Hamar Laghad mountain in eastern Anti-Atlas, approximately 18 km SE from Erfoud in Morocco.

During the expedition, students of the Faculty of Geology, University of Warsaw, have recognized that the mounds represent a system of almost 50 conical hills with oval bases, with an average height of 20-30 m and steep, asymmetric slopes. They are composed of fine-grained, biogenic limestones, with indistinct layering and local accumulations of fauna. Such structures could originate from seafloor hydrothermal vents and/or hydrocarbon effusions. They most likely formed in the absence of sunlight, however in quite shallow shelf sea conditions which surrounded the NE edge of the Gondwana palaeocontinent (Guiraud R. et al., 2005). Hydrothermal fluids migrated through the system of faults resulting from volcanic intrusions under the Kess Kess Formation deposits (Belka Z., 1998).

The origin of the Kess Kess carbonate mud mounds is still the subject of many discussions and numerous studies. A very important recent discovery uncovered rich groups of microorganisms living in a deep ocean environment, closely associated with submarine exhalations of hydrothermal solutions from hydrothermal vents (Mounji D. et al., 1988, Cavalazzi B, 2006). Detailed description and origin of the Kess Kess mounds is of significant importance in the understanding of the development of the whole basin and gives an opportunity to compare them with modern hydrothermal mounds.

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TECTONIC ASPECTS OF GIANT GAS FIELDS FORMATION IN THE NORTH WEST SIBERIAN PLATE

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West Siberian (WS) Plate is the largest young epipaleozoic plate which occupies a large area (3.5 m.km^2) of the WS Plain. Plate consists of two parts: heterochronous (from the Precambrian to the Late Paleozoic) and heterogeneous basement and unconformably overlying Mesozoic and Cenozoic sedimentary cover. Russia is ranked first in the world by gas reserves (32% of world's reserves, 30% of world production). The world's largest gas fields are located in the Nadym and Pur interstream area in the north of the West Siberian plate. These fields are confined to large tectonic structures: ramparts, extending from north to south, and isometric domes. Type of traps is structural anticline. Formation reasons of these fields are still generating a lot of discussions. In papers of Russian scientists has been proved that in the north of WS plate the main source of gas of the largest gas fields was coal organic of Pokur formation (Aptian-Cenomanian), which deposits reached long-flame catagenesis stage (intensive methane generation) in the early Cenozoic. The WS plate cover consists of the transgressive-regressive sediments, including permeable sandstone (potential reservoir) overlain by clay deposits. Kuznetsov Formation (Turonian) is impermeable clay bed of 100 m of thick. At the beginning of the Cenozoic favorable system "source rock+permeable+ impermeable rocks" was created in the study area.Since fields are confined to the structural traps, the tectonic reason of the traps formation is very important for this type of fields formation. The research is based on integrated data of interpretation CDP reflection lines and well logging. Five main reflectors (A, B, M, G, C) was allocated and correlated (fig.1). As a result we analyze the structural maps for these horizons and thickness maps of the seismological complexes. Reflector A is a bottom of Jurassic, B is a bottom of the Bazhenov Formation (Late Jurassic, Tithonian), M is a Koshai shale member lying at the top of the Alymskii formation (Early Cretaceous, Aptian), G is the Kuznetsov Formation (Late Cretaceous, Turonian), C is the Talitskii Formation (Late Cretaceous, Maastricht) (Kontorovich 2002). These seismic markers are transgressive clay beds of stable areal thickness, formed during the era of passive tectonic, sedimented over all area of the WS basin. In reconstractions this reflectors can be used as peneplanation planes. The modern relief of all reflectors are generally similar in the studying area (fig.1). In the relief of A-reflector can be identified all the major positive structures allocated by the overlying horizon: anticlines in Medvezhii, Yamsovei, Yareyskii, Jubilei and Urengoi local areas. There are positive structures in modern landscape (East Medvezhii, West Pestsovii and En-Yakhinskoye domes) that was not identified in the A reflector relief. In M reflector relief there are larger structures (one large dome in Medvezhii and Nyda areas, another one in Yamsovei and Yareyskii areas). With the general alignment of the relief upsection in relief of G reflector the amplitude and square of the Jubilei and Urengoi domes increase. All positive structures have smaller amplitude in the C reflector relief then in G.

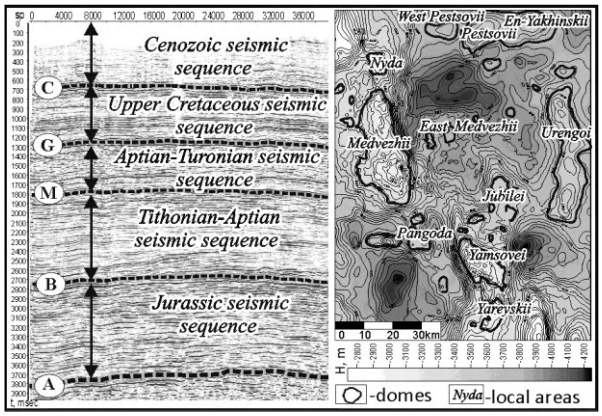

Fig. 1: Seismic cross-section and Structural map of B reflector.

In recent work method of thickness (paleotectonic analysis) is used to reconstruct the history of tectonic evolution of the northern part of the WS Plate in Nadym and Pur interfluve. The analysis shows that the research area landscape was a monocline with a slope to the north-east with a lot of small domes to the Aptian. At that time ridge of domes tend to increase in Sandibinskii-Nyda-Medvezhii-Pangoda-Yamsovei-Yareyskii local areas. Almost all uplifts of landscape were formed during the Aptian-Turonian time, Medvezhii, Yamsovei and Yareyskii domes evolved the maximum growth. During late Cretaceous the epicenter of subsidence moved to the south, that tectonic result in the formation Maretayahinskii and Yagenettinskii synclinal bowls. At the same time East Medvezhii dome formed, Yamsovei and Yareyskii anticlines united into one structure, which rapidly grew during the Late Cretaceous. Cenozoic tectonic processes have had a significant influence on the creation of the East Medvezhii and Urengoi anticlines. Thus, as the most important tectonic phases in the Nadym-Taz interfluve to form giant gas fields are the Aptian-Turonian (forming anticline structures) and Cenozoic time, when there was maximum growth and union of small structures into larger ones.

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GEOPHYSICAL METHODS IN USE FOR THE DETERMINATION OF MAAR-DIATREME STRUCTURE NEAR LOMNICE VILLAGE, CZECH REPUBLIC

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The Late Cenozoic volcanic activity in the eastern Bohemian Massif (North Moravia, Czech Republic) belongs to the Central and Western European Volcanic Province (Schreiber & Rotsch 1998; Wilson & Downes 2001). Lomnice village is located in the easternmost part of this volcanic province in the North Moravia and Lower Silesia in the Czech Republic (Fediuk & Fediuková 1985; Birkenmajer et al. 2007; Lustrino & Wilson 2007). This Plio-Pleistocene (5.5 to 0.8 Ma) anorogenic maar volcanic structure near Lomnice is associated with the Sudetic Fault System (Grygar & Jelínek 2003; Špaček et al. 2009).

Usage of the geophysical methods – magnetics, gravimetry and geoelectrics - enabled us to ascertain the shape and subsurface structure of the Quaternary maar-diatreme structure near the village Lomnice.

For ground magnetometric survey we used NAVMAG SM-5 (Scintrex, Canada) caesium magnetometer. We measured 15 profiles, each 0.5 km long, running in NE-SW direction. Based on this data we have interpolated a contour map of magnetic anomalies, which covers the area of 0.73 km^2. The gravity measurements were carried out along one profile using SODIN 410 centimal gravimeter, with station spacing of 100 m. The overall length of the interpreted profile in NNE-SSW direction was 4.6 km. The 2D multielectrode resistivity profiling was accomplished by ARES automatic geoelectrical system (GF Instruments, Czech Republic) with the Wenner-Schlumberger array of 32 electrodes and 5m electrode spacing. One profile with total length of 890 m running in NE-SW direction across the diatreme was measured using roll-along method of 32-electrode (155 m) array.

According to the geophysical data we assume the maar-diatreme structure to be of a funnel shape. The magnetic anomaly indicates a round structure about 600 m in diameter. The bottom depth of the body filled with lacustrine clay and deluvial sediments is more than 300 m. In the deeper part of the diatreme we expect highly magnetic volcanic body (basaltic feeder dyke).

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MINERAL ASSEMBLAGE AND CHEMISTRY OF XENOTIME-(Y) FROM PÍSEK BERYL-COLUMBITE PEGMATITES

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Samples of xenotime have been studied from Písek granitic pegmatites at the following localities: "U Údražského obrázku" quarry, "U Nového rybníka" quarry, and "Obrázek I." quarry. Pegmatites can be characterized by the presence of tourmaline, beryl with the hydrothermal alterations products (bertrandite and phenakite), minerals Nb-Ta-Ti, Nb-rutile, columbite, písekite, monazite, apatite and rarely garnet, muscovite and triplite. Xenotime from the localities around Pisek have not been studied yet. The work was focused on monitoring the mineral assemblages, successional position, chemical variability of xenotime, to identify ways the input elements can enter the structure of the xenotime (mainly U and REE) and to determine their substitution mechanisms. We evaluated microprobe analyses of xenotime from Písek pegmatites.

In the locality „U Údražského obrázku" xenotime-(Y) occurs together with monazite-(Ce), zircon, schorl, "písekite" and muscovite. The primary xenotime (type I.) with primary zonal structure is strongly metamict, slightly amorphized in association with metamict zircon. The second type of primary xenotime (type II.) was recognized in association with zircon, schorl and písekite or in the form of small grains in písekite. Zircon is metamict or can by found as an inclusion in xenotime. The primary xenotime (type III.) penetrates into monazite fissures in the other sample studied in association with monazite, schorl and muscovite. There was also found slightly sectoral and oscillatory zonal monazite-(Ce), which also contains xenotime as a second phase originated from zircon. The contents of REE in the characterized xenotime have been normalized by chondrite. The primary xenotime have the highest concentration of Dy (0.04-0.08 apfu), Yb (0.02-0.05 apfu), Er (0.02-0.04 apfu) from the group of HREE. Gd (0.02-0.04 apfu) and Sm (0.01-0.02 apfu) have smaller presence from the group of MREE. Xenotime contain less amount of Ho (0.01 apfu), Tb (~0.01 apfu) and Lu (<0.01 apfu). There is significant negative Eu anomaly (Eu b.d.l. EMP). The secondary xenotime has the highest content of Dy (0.07 apfu), Gd (0.05 apfu) and less amount of Sm (0.02-0.03 apfu), Yb (0.02 apfu), Lu (<0.01 apfu).

The primary xenotime was found with spherulite radial fissures in association with metamict zircon, limonite and K feldspar in the locality „U Nového rybníka". The secondary xenotime occurs in fissures of monazite in association with strongly metamict zircon in another sample. The primary xenotime from this locality have the highest content of Dy (0.04-0.05 apfu), significant amount of Er (0.03-0.04 apfu) and low content of Sm (0.01 apfu), Tb (0.01 apfu), Ho (0.01 apfu) and Lu (<0.01 apfu). There is significant negative Eu anomaly (Eu b.d.l. EMP). The secondary xenotime contains the highest amount of Dy (0.05 apfu), Er (0.03 apfu) and less contents of Sm (0.01 apfu), Tb (0.01 apfu), Ho (0.01 apfu) and Lu (0.01 apfu).

In the „Obrazek I." quarry primary xenotime hypoparallely intergrowns with strongly metamict zircon in assemblage with monazite (contains apatite veinlets with the youngest smectite). Xenotime can be characterised by the significant content of Dy (0.04-0.07 apfu), Er (0.03-0.04 apfu), smaller concentration of Gd (0.02-0.04 apfu), Sm (0.01 apfu), Tb (0.01 apfu), Ho (0.01 apfu) and significant negative Eu anomaly (Eu b.d.l. EMP).

The primary and secondary xenotime from Pisek have been mutually compared in terms of distribution of U and Th. It was found that primary monazite from the locality „U Udražského obrázku" have low to higher content of U (0.002-0.05 apfu) and low to medium amount of Th (0.001-0.08 apfu). The secondary xenotimes from this locality are rich in U (0.01-0.03 apfu) and have low content of Th (0.01-0.02 apfu). The primary xenotime from the „U Nového rybníka" quarry have higher amount of U (0.01 apfu) and low to medium content of Th (0.002-0.08 apfu). The secondary xenotime contains very low to higher amount of U (0.002-0.01 apfu) and low concentration of Th (0.003-0.004 apfu). The content of U (0.004-0.02 apfu) is higher and the amount of Th (0.002-0.02 apfu) is lower in primary xenotime from the „Obrázek I." quarry.

Uranium and thorium enter xenotime from granitic pegmatites through huttonite substitution. The cheralite substitution occurs minimaly.

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CATHODOLUMINESCENCE OF QUARTZ AND TRACE ELEMENTS – IS THERE ANY CONNECTION?

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Cathodoluminescence (CL) is a method that enables studying of the internal structure of rocks and minerals not visible when using other optical methods. Quartz is a commonly occurring mineral whose structure retains elements which were present in the melt during its genesis. It is not possible to recognize anything special by observing quartz in optical microscope. Using the CL, however, evolutional zoning can be detected and the origin of quartz can be distinguished by colour. Moreover, the zoning detected by CL corresponds to the certain chemical zoning and therefore can be related to the evolution of quartz. To determine the content of trace elements, this study combines cathodoluminescence with LA-ICP MS.

The study has been performed on rock samples of ATC (Altenberg-Teplice Caldera) as following: older basalt rhyolite (BR) and associated dacite (DC) as representatives of the late orogenic peraluminous S-type magmatism; slightly peraluminous post-orogenic A type co-magmatic suite of three eruptive units of Teplice rhyolite (TR); dykes of granit porphyry (GP) and intrusions of biotite (BiG) and zinwaldite (ZiG) granites. BR quartz grains are rounded and cracked with darker, nearly violet cores and lighter blue rims. The quartz grains in dacite are rounded and they show homogenous blue luminecsence. The rock is, however, poor in quartz. Quartzes from all TR units are cracked and dissolved with dark cores and slightly brighter rims (Fig. 1). As far as the colours and zonality are concerned, GP is close to TR in CL. Quarz grains from BiG a ZiG are nearly without luminescence or have a very weak dark blue luminescence. No zonality has been detected.

Main trace elements, that probably have the greatest significance in relation to the intensity of the luminescence, are Ti and Al. The intensity of CL in all zonal quartz crystals appeared to be directly proportional to the content of Ti in any given zone.

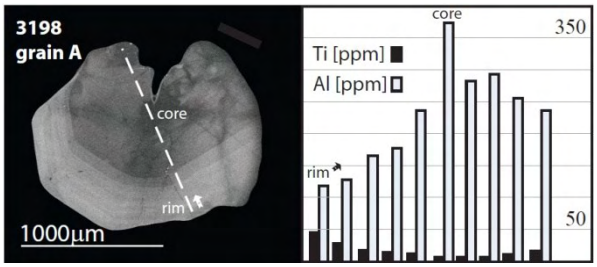

Fig. 1: Quartz grain from Altenberg-Teplice Caldera (TR3). The trace of LA ICP-MS analysis is marked by the interrupted line (to the left). The table of Ti and Al distribution in each measured step (to the right). It is clearly visible that content of Ti (represented by the brighter colour of the luminescence in the image of the grain) increases whereas the content of Al decereases.

Similar observations and results were obtained by Larsen et al. (2009) and Müller et al. (2010). In contrast, no correlation between CL intensity and Al content in quartz, as predicted by Watt et al. (1997), has been found. The Al contents in quartz from some rocks either decrease with the growing CL intensity (always in BR and TR3, occasionally in ZiG) or the element is randomly distributed (always in TR2, occasionally in BiG and ZiG) or its contents increase (some grains in BiG). Both rhyolite and granitic porphyry quartzes exhibit zonal structures regarding to the both elements. The core is rich in Al (200-350 ppm) but poor in Ti (5-30 ppm); the rim is depleted in Al (80-130 ppm) and enriched in Ti (40-100 ppm). Biotie granite (older) is chemically similar to the cores of rhyolite crystals, with contain of Al 100-150 ppm and Ti 15-40 ppm. On the other hand, zinwaldite granite (younger) contains 150-300 ppm of Al and is very poor in Ti (max. 10 ppm).

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POHANSKO – SOUTHERN BAILEY – ENVIRONMENTAL AND SOCIO-ECONOMIC INTERPRETATION

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Great Moravian hill fort Pohansko is situated about 2 km south of Břeclav in the surrounding of floodplain forests between old branches of the river Thaya, about 12 km north of the confluence of the rivers Moravia and Thaya. The location can be divided into a central part and two baileys. From 1958 until today there has been a systematic research under the guidance of the Department of Archaeology and Museology, Faculty of Arts (Vignatiová 1992, Dresler and Macháček 2009).

The location commonly known as Southern Bailey (in older literature referred to as South-western Bailey, too) stretches in the direction of S to SW from the bailey itself. Its shape reminds of an irregular ellipse of dimensions of about 700x350 m, oriented in the direction of WNW-ESE (Přichystalová 2011). The northwest and western edge of the bailey is covered by wind-blown sands, where graves were dug. The central and eastern part consists of gravel and sand sediments (Dresler et al. 2008). The southern bailey was systematically studied in 1960–1962 and 1991–1994, in the years 1975–1979 there was a rescue excavation research carried out (Dresler and Macháček 2009).

The research of the Southern Bailey was focused on archaeolozoological analysis of skeletal material, isotope analysis of carbon and nitrogen and thin section of tooth roots of mammals.

As for its composition, evaluation of the osteological material corresponds to early medieval sites. The fauna is dominated by domestic ox, pig and sheep/goat. Low proportion of hunting fauna shows that it was only a supplementary source of livelihood. The bones of domestic horses do not show marks of cutting the skeleton, which would demonstrate their consumption. The horse was more a status symbol and they were owned by members of the upper classes, or they could possibly be used as draft animals. Similarly, the absence of cutting marks and chopping on the bones of domestic dog point to a role connected with herd protection. Numerous secondary interventions on bones primarily pose traces of bites by dogs.

Animal skeleton material was confronted with types of objects in the Southern Bailey in order to determine the economic model of the early medieval society. In case of two farm objects only (No. 460 and 471) their main use for stabling of large ruminants can be considered.

Isotope analysis of carbon and nitrogen contained in teeth and bones of domestic mammals was chosen in order to carry out a reconstruction of paleoenvironmental conditions in Holocene at the time of and after Great Moravia (locality Kostice - Zadní hrúd – 11th to 13th centuries). The results indicate a drier climate conditions on site Pohansko - Southern Bailey.

The use of thin sections in case of teeth of domestic mammals proves problematic compared to its use in case of wild species. In the fossil specimen of domestic sheep/goat from the locality Kostice - Zadní hrúd more than 25 complete lines were found. The lines form winter and summer increments, although the individual was not older than 3 years according to the abrasion of dental crown. One possible explanation of the higher number of increments might be different living conditions of domestic species compared to their wild relatives. For this reason, attention is directed towards the study of recent material. The question of the methodology and overall suitability of application of tooth thin sections for teeth of domestic animals is being discussed.

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STERZING (RATSCHINGS) MARBLE – USE OF AN IMPORTANT NATURAL STONE FROM PREHISTORIC UNTIL PRESENT TIMES

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Marbles have been a decorative and widely used natural stone material since prehistoric times. In central Europe marbles are – compared to Greece and Asia Minor – rather rare and therefore even more important materials. In South Tyrol / Northern Italy the marbles from Laas and Sterzing are the most important ones. While Laas marble is quite well known due to its use in several important buildings all over the world, the knowledge on Sterzing marble is rather limited.

In the frame of an interdisciplinary project, financed by the Autonomous Province of Bozen / South Tyrol, archaeologists, historians and natural scientists try to shed light on the use and the material technical characteristics of this precious white natural stone.

In the area of South Tyrol several marble objects from prehistoric and Roman times exist. Even though only few of them have already been studied in detail, it is probable that a lot of of them have been made of Sterzing marble.

The oldest finds made from marble in South Tyrol are several menhirs, large upright standing stone blocks from the copper age (3500-2300 BC). From Bronze and Iron Age no marble objects are known. From Roman times milestones, gravestones and votive stones as well as architectural elements from Roman villas and fragments of sculptures exist. It is most likely that the inscription stones as well as architectural elements are out of local or regional material.

Even though we suggest that the material has already been used in prehistoric and Roman times we have no hints that there has been any quarrying of the material. We suggest that boulder material has been used, transported by glaciers and floods from the mountains to the valleys.

Also from historical sources we don't have written evidences for the time when quarrying Sterzing marble started. Due to the fact, that from 15th century AD on the material was used in a lot of profane and sacral buildings we suggest that this is the time when quarrying started. The number of written sources on the use of Sterzing marble is very limited. The importance of the material rose during the 16th century, where Sterzing marble was transported to Innsbruck and Vienna for the use in several buildings of the Habsburgs. But the material was also used for a number of marble gravestones in the area, even though the use decreased during the following decades..

Josef Riehl reactivated the quarries at Sterzing in the end of the 19th century. Today the company "Omya Italia AG" is running a big underground quarry and produces marble-powder for a lot of industrial products.

From a geological point of view Sterzing marble belongs to the so-called "Schneeberger Zug" within the Austroalpine Stubai/Ötztal-crystalline complex and similar marbles are also to find within the Texel Unit from the Pfelders Valley and the Passeier Valley. This marbles are often associated with schists, gneiss and other metamorphic bedrock. The marble is coarse to very coarse grained what might be the reason that the often pure white material has not been used for sculptures, gravestones, etc. in an amount as the much finer grained Laas marble.

Sterzing marble can often hardly be distinguished from the important Alpine marbles from Gummern-Krastal (Carinthia) and Pohorje (Slovenia) due to similar geological formation conditions. With a combination of grain size analysis, stable isotopes of O and C, cathodoluminescence microscopy as well as thin section analysis and in some cases EPR-measurements and trace element analysis we were able to distinguish between these important Alpine quarries for many samples.

FLUID INCLUSIONS AND CHEMICAL COMPOSITION OF ANALCIMES FROM MAGMATIC ROCKS OF TESCHENITE ASSOCIATION (OUTER WESTERN CARPATHIANS, CZECH REPUBLIC)

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The study area is situated within Silesian Unit which is part of the Outer Western Carpathians and it consists mainly of Upper Jurassic-to-Upper Oligocene marine sedimentary rocks (Eliáš 1970). The fold-and-thrust structure of this area was formed by several tectonic events of the Alpine Orogeny in the Mesozoic and Tertiary. The subsidence and spreading during the first tectonic event was accompanied by escape of magma giving rise to the igneous rocks of the teschenite association. These mafic quartz-free alkaline-to-subalkaline submarine Lower Cretaceous (Hauterivian-Barremian) magmatic rocks form hypoabysall sills, submarine extrusions and pillow lavas and are widespread in the area between Hranice in Moravia and Bialsko-Biala in Poland. Along with other types of alteration, the teschenites have been subjected to extensive analcimization (Šmíd 1962).

The experimental studies on formation of interstitial analcime in the Dippin Sill (Henderson and Gibb 1977) showed that it formed by hydrothermal alteration of the felsic components (plagioclase, alkali feldspar, and nepheline) between 380° and 330°C due to the activity of aqueous solutions poor in CO_2.

Wlodyka and Kozlowski (1997) studied fluid inclusions in analcime occurring in amygdules and veins hosted by teschenitic rocks in Poland. The results of their study showed that analcime was formed from low-salinity (4.5 – 0.5 wt. % NaCl equiv.) solution with temperatures of 100° - 320° (amygdules) and 110° - 220°C (veins).

The analcime crystals filling the veins and amygdules in teschenites from three sites in Czech part of the Silesian Unit (názvy lokalit) were subject of our fluid inclusion and electron microprobe analyses. The analcime grains filling up the amygdules have a size up to 3 mm and show a composite structure: a milky white irregularly shaped core up to 1 mm in size is rimmed by clear transparent euhedral crystals. The analcime from veins form euhedral clear transparent crystals or white-pink spherulitic aggregates up to 5 mm.

Chemical composition of analcimes is not close to stoichiometry, with the SiO_2/Al_2O_3 molar ratios from 2.08 to 3.12. The increasing SiO_2/Al_2O_3 molar ratios are consistent with decreasing crystallization temperatures. The microprobe analyses of vein analcime showed higher contents of Si^{4+} and lower contents of Na^+ than showed analcime from amygdules. The vein analcime from Tichá showed uniformly elevated contents of K^+, Ca^{2+}, and Sr^{2+} (0.8, 0.5, 0.15 wt.%, respectively).

All samples of analcime contain abundant primary fluid inclusions, less secondary fluid inclusions. Fluid inclusions are one-phase (L-only) or two-phase (L+V) with essentially constant liquid-vapour ratios (gaseous phase takes cca 10 vol. %). The homogenization temperatures of two-phase inclusions range between 122° - 281°C (analcime from veins) and 219° - 295°C (analcime from amygdules). Inclusions freeze at temperatures - 38° to - 49°C. The last ice melts at temperatures between -0.6° and -3.7°C. The eutectic temperature was not possible to measure due to the small size of the inclusions.

The hydrothermal analcime formed from aqueous fluids causing the pervasive post-magmatic hydrothermal alteration of the host magmatic rocks. The parent fluids were low-salinity (1.1 to 6 wt. % NaCl equiv.) aqueous solutions that were progressively cooled during mineral precipitation. This mineral phase represents a transitional stage of the hydrothermal mineralization between the first and second stage (Dolníček et al. 2010) of hydrothermal activity in the study area.

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RECONSTRUCTION OF ORE FORMING CONDITIONS DURING VARIOUS EVENTS OF DEFORMATION OF GRANITOIDS AT THE ANTEI URANIUM DEPOSIT USING FLUID INCLUSION PLANES

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Cracks in rocks can be considered as Open Cracks (OC: not filled with secondary mineral phases) or Filled Cracks (FC: filled with younger mineral phases and Fluid Inclusions). FC are often partially filled or reopened after a first time of filling. The best records of fluid percolation are paleofluids trapped as fluid inclusions in healed microcracks of the rock-forming minerals (Lespinasse et al. 2005). Usually such fluid inclusions with liquid, vapor and solid phases form differently oriented systems, known as fluid inclusion planes (FIPs). FIPs are result from the healing of former open cracks and appear to be fossilized fluid pathways (Roedder 1984). FIPs are totally sealed and do not present secondary opening.

Microcracks should provide valuable information about the local stress in rocks and can be assumed to be $\sigma_1\sigma_2$ planes (Tuttle 1949). The FIP are mode I cracks that occur in sets with a predominant orientation perpendicular to the least principal compressive stress axis σ_3. These mode I cracks propagate in the direction which favors the maximum decrease in the total energy of the system. They do not disrupt the mechanical continuity of mineral grains and do not exhibit evidence of shear displacement like mode II and III cracks. The FIP are usually observed and characterized in minerals which crack according to the regional stress field, independently of their crystallographic properties, and may easily trap fluids as fluid inclusions when healing. In some minerals (carbonates, feldspars), the fluids are not always preserved due to alteration or dissolution and cracks display more complex patterns resulting from the presence of cleavages, grain boundaries or twin planes. The rate of healing is rapid in quartz (compared to geological times), so it is more informative for studying FIP systems (Lespinasse 1999).

Frequently, FIP form well defined networks which allow the determination of a chronology. After a first generation of FIP, a second crack family can be formed with the trapping of evolving fluid. This second FIP generation commonly cross-cuts the first one. Thus, FIPs provide good records of successive episodes of crack initiation and fluid migration.

FIP generations were studied at the Antei uranium deposit. It is located in Eastern Transbaikalia within the Streltsovskaya caldera, generated in process of late-Mesozoic tectonic and magmatic reactivation of the region. Samples were taken from all fault zones – from the central part (core), the zone of its dynamic effect (failure), and undestroyed wall rock (protolith) at the 9th to 11th mining horizons. Also for microfissural mapping of natural cracks and allocation of FIP systems, samples must be oriented in space. The chronology of FIP generations and their spatial parameters (strike, extension, dip angle) can be established by means of the classical microstructural analysis (Fedorov's stage), or by method of statistical analysis of 2D and 3D digital images of thin sections by means of the special software. Besides, this analysis allows quantifying paleofluid pathway porosity and permeability by the reconstruction of the crack network consisting of cracks described as discs using the geometry of the crack network. For each FIP system, one can determine strike and dip direction, length, aperture, porosity and paleopermeability using microstructural analysis. The data on composition and properties of fluid inclusions trapped in the cracks (temperature, pressure, salinity, phase content) to separate different sets of FIP was find out using microthermometry. So it was shown that orientation of FIPs is defined by reorganization of the local stress field and it is possible to use them as geostructural markers for reconstruction of porosity and paleopermeability of rocks, geometry of fluids migration pathways, reconstruction of fluid migration stages and for studying dynamics of change of PT, physical and chemical conditions at various events of deformation of geological objects.

The carried-out work showed that ore forming process at the Antei uranium deposit took place through four main stages of deformation with differently oriented microcracks which traped fluid inclusions. Temperatures of traped fluids varied from 350°C to 160°C.

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MOLDANUBIAN GRANULITES FROM PLEISTOCENE GRAVEL TERRACES OF PALEO-DANUBE FROM HUNGARY

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The Pleistocene gravel terrace of the Danube has been mined by several gravel pits southeast from Budapest and on the Little Hungarian Plain. Although study of the bench gravel dates back about hundred years, the comprehensive investigations-including petrography of different rocks types - have started only in recent years. The boulder-bearing gravel deposits are very polymict, they contain several well-known lithotypes like andesites, limestones and sandstones that are well known from closely situated outcrops. However the origin of most crystalline rock types (e.g. various types of gneisses, granites, granulites, eclogites and amphibolites) is unclear. In order to identify the possible source area of the pebbles several petrographical and geochemical analysis were carried out and the results were compared with the petrographical and geochemical profile of similar rock types especially from the Alp-Carpathian region and the Bohemian Massif. This study focuses on granulites and granulitic gneisses, provides the petrographic description of main rock types and calculates the pressure-temperature conditions.

Three main types of granulite were distinguished based on petrography. Most of the samples belong to felsic, garnet-kyanite granulites (Type 1) with partly preserved early high P-T mineral assemblage garnet + kyanite + mesoperthitic feldspar + quartz + rutile. Retrogression of the early assemblage led to growth of sillimanite and biotite as well as to the recrystallization of the initial mesoperthite into separate K-feldspar and plagioclase grains. Early relics of mesoperthite are preserved as inclusions within large garnet porphyroclasts, however another garnet variety contains Zn-bearing spinel or ilmenite inclusions and they are rimmed by plagioclase corona. Kyanite is mostly replaced by sillimanite, however metastable kyanite is also preserved but always surrounded by plagioclase or garnet corona which represents a decompressional structure. Microstructure of these rocks shows the development of quartz ribbons and the recrystallization of the original texture into fine-grained mosaic pattern.

Type 2 garnet-orthopyroxene granulite is heavily retrograded, consists of garnet + orthopyroxene + K-feldspar + plagioclase as a primary mineral assemblage with secondary biotite and amphibole.

Type 3 cordierite-biotite-sillimanite gneiss is intensely deformed, consists of pinitized cordierite, biotite, sillimanite, plagioclase, and quartz. Relict garnet and fibroblastic aggregates of sillimanite with biotite in the interior of cordierite grains indicate the production of cordierite by the reaction of $Grt+Bt+Sil+Qtz=Crd+Kfs+H_2O$.

For detailed investigation – including mineral chemistry, bulk chemistry and thermobarometry – representative samples have been chosen from garnet-kyanite granulites.

The thermobarometric calculations of selected samples reflect peak metamorphism under high-temperature and high-pressure granulite-facies conditions which are followed by decompression and cooling. P-T pseudosection and compositional isopleths demonstrate the peak phase assemblage garnet + mesoperthite + kyanite + rutile +quartz + melt is stable over 850°C and 11-14 kbar. Garnet core XCa values and ternary feldspar data yield 17-18 kbar for the peak pressure, while garnet rim compositional isopleths give an intersection at 14 kbar in the field of biotite + garnet + K-feldspar + plagioclase + kyanite + rutile + melt. The graphical analysis of the reintegrated ternary feldspar compositions gives the solvus positions of 900-1000°C.

The preliminary EMPA-based Th-U-Pb dating for monazite revealed Variscan ages (329±17 Ma) for the peak metamorphism of the studied granulite pebbles.

In addition, the investigated granulite samples first were compared to granulite xenoliths of Neogene host basalts from the Pannonian basin, but the comparison yielded quiet different mineral assemblage and metamorphic history, suggesting that the investigated rock types have different source areas. However the nearest occurrences of similar felsic granulites are on the Moldanubian part of the Bohemian Massif. These occurrences are situated closely to the present-day bank of river Danube and they can be regarded as a potential source region of the investigated granulite boulders.

These new findings can also provide relevant data for further studies to understand the paleogeographical environment and sediments transport routes of river Danube during the Pleistocene time.

THE CENOZOIC PALAEOSTRESS FIELDS EVOLUTION OF NORTH-WESTERN PARTS OF THE SKYBA AND BORYSLAV-POKUTTYA NAPPES BY JOINT AND FAULT-SLIP ANALYSES (OUTER EAST UKRAINIAN CARPATHIANS)

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The investigations have been carried out in two frontal tectonic units of the Outer East Ukrainian Carpathians – the Skyba and Boryslav-Pokuttya nappes. A detailed the stress regional fields evolution from the Late Paleogene to the Miocene was determined by analysis of the joint and fault slip orientation data. The orientation data were collected at natural outcrops, located in stream and river beds, quarries.

The chronology of deformation regimes evolution with azimuths orientation of principal palaeostress axes (σ_1, σ_2, σ_3) during the Late Paleogene – Miocene was performed using a complex application of joint and fault-slip analysis. The orientations of compression and tension axes (σ_1, σ_3) show change the regional fields stress state occurring within the Late Paleogene – Miocene deposits in the Skyba and Boryslav-Pokuttya nappes. Palaeostress analysis in this region revealed the existence of eleven different stress fields in the period from the Late Paleogene to the Miocene.

There were four strike-slip stress fields from the Late Oligocene and the Early Miocene. The first and the second are strike-slip palaeostress fields with S–N and W–E compressions. The third field is of NE–SW tension and SE–NW compression. It was the time when the Carpathian Palaeogene sedimentation basin formed. The fourth field with NE–SW minimum horizontal compression shows the beginning of orogenic process.

The Middle and the Late Miocene is characterized by palaeostress field NE–SW direction of the maximum principal compressional stress axis σ_1. At that time the Ukrainian Carpathians suffered the intensive tectonic motions, thrust- and fold formation processes. This fifth inverse field shows the main compression of general Ukrainian Carpathians direction – inversion regime. The sixth field of NE–SW compression belongs to the strike-slip regime. This field demonstrated variable speed of dislocation neighbor blocks and parts of thrust. Dextral and sinistral strike-slip regime was created synchronously with inversion regime of NE–SW compression and provided the rapid advancement of the thrust front. The seventh field is of N–S and NW–SE compression.

The results of the palaeostress analysis show that the latest Late Miocene stress fields (eighth and ninth) are characterized by N–S horizontal compression and N–S tension. The tenth and eleventh fields (of NE–SW and NW–SE tension) demonstrate the neotectonic process of destruction of the Ukrainian Carpathians with the two directions of tension. Stress fields NE–SW and NW–SE tension in the Skyba nappe is fixed by fault-slip analysis, and in the Boryslav-Pokuttya nappe – by joint analysis.

After the main NE–SW compression (after the latest Late Miocene) there was great NE–SW and NW–SE tension in the Boryslav-Pokuttya nappe. This tectonic unit unlike the Skyba nappe became an open system that contributed to the formation of hydrocarbon deposits after the Post-Miocene time.

Availability of the knowledge of the recent tectonic regime of this oil and gas region plays an essential role in the search prediction of hydrocarbon deposits.

MINE WATERS AS ONE OF THE FACTORS OF POLLUTION OF THE ENVIRONMENT IN CHERVONOHRAD MINING INDUSTRIAL AREA

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Ecological conditions in the Western Ukraine and, particularly, in Chervonohrad Mining Industrial Area (CMIA), have deteriorated in recent years. The main ecological problems in this area are the change of natural landscapes, subsidence of the earth surface, water logging of land, formation of anthropogenic landscapes, pollutions of hydrosphere and atmosphere of the area.

One of the main sources of pollution of surface and related groundwaters is the mine water – undergroundwaters penetrating into mine workings duringthe process of exploration and exploitationof the deposits. They account for the major part (74–76%) of waste waters of coal-mining industry of CMIA.

Underground water of coal hydrostratigraphic complex make the greatest influences on the formation of the mine water. The most noticeable is the role of the roadway development. During this work landslip cracks appears. Water, which circulates in this landslip cracks, mixes with water from the mined coal bed and wallrocks are exposed by air oxygen environment and in this metamorphized form goes to rock productions. Mine water is under more active influence of the mine environment. Mine water during the flowing in the used lava scope enriches in coal and rock destruction materials that contain sulfides,with fluids of mineral and mechanic origin and suspended solids.

Based on chemical composition of mine waters of CMIA there have been found peculiarities of the change in their main components (potassium, sodium, calcium, magnesium, chlorine, nitrogen compounds, iron, SO_4^{2-}) in time and those of them have been established that exceed their maximum permissible concentration in potable water. Values of some components of CMIA mine waters show clear spatial variances.

In particular, it has been established, that for the sum $K^+ + Na^+$ its characteristic maximum excess in the water of Lisova mine attains (3220 mg/dm^3) (at maximum permissible concentration Na^+ 200 mg/dm^3). Minimal values of these components are characteristic of the waters of Chervonohradska mine (1315 mg/dm^3) and Vizeyska mine (1258 mg/dm^3). Similar contents of $K^+ + Na^+$ have been noted in the waters of other mines.

Higher levels of the Ca^{2+} compared to the norm have been found in mine waters of four mines only (at maximum permissible concentration Ca^{2+} 200 mg/dm^3); their maximum values have been found in the waters of Lisova mine (432 mg/dm^3) and Vidrodzhennya mine (362 mg/dm^3), while calcium content in the water of Zarichna and Vizeyska mines exceeds only slightly the standard content. This component in waters of other mines, as a rule, has the content that is below the norm.

Mine waters of all the mines are characterized by magnesium content below 150 mg/dm^3, and its maximum content are noted in the water of Lisova mine –125 mg/dm^3.

Chlorine content in mine waters of all CMIA mines exceeds maximum permissible concentration (350 mg/dm^3). Its maximum value has been found in the water of Lisova mine (4420 mg/dm^3), and the lowest chlorine content has been observed in waters of Chervonohradska mine (1358 mg/dm^3).

High levels of the $SO_4^{2-}$are determined in mine waters of Velykomostivska mine – 1894 mg.dm^3 (at maximum permissible concentration 500 mg/dm^3), Lisova – 1354 mg/dm^3, Zarichna mine 1327 mg/dm^3, Mezhyrichanska mine – 1017 mg/dm^3, Vizeyska mine 916 mg/dm^3, Vidrodzhennya mine – 812 mg/dm^3, Nadiya mine – 664 mg/dm^3. At thesame time SO_4^{2-} content in the waters of Stepova and Chervonohradska mines does not exceed the maximum permissible concentration.

A slightly excessive content of Fe^{tot} has been found in the waters of three mines: Nadiya mine 0.42 mg/dm^3 (at maximum permissible concentration 0.3 mg/dm^3), Chervonohradska mine –0.34 mg/dm^3, Lisova mine –0.31 mg/dm^3, while waters of other mines have lower content of iron compared to maximum permissible concentration.

Nitrogen compounds (NH_4^+, NO_3^-, NO_2^-) in the waters of all mines do not exceed maximum permissible concentration.

Hardness of mine waters of most of the CMIA mines exceed values of maximum permissible concentration (7 mg-equiv/dm^3), and their maximum values have been found in Lisova mine (31.9 mg-equiv/dm^3), Vidrodzhennya mine (24.3 mg-equiv/dm^3), Vizeyska mine (19.3 mg-equiv/dm^3), Zarichna mine (17.1 mg-equiv/dm^3), Velykomostivska mine (15.1 mg- equiv/dm^3).

Obtained results of chemical composition of the mine waters show considerable excessive content of $K^+ + Na^+$, Ca^{2+}, $SO4^{2-}$, Cl^- compared to their standard values and it is clear that they are responsible for the most negative effect on the environment.

GEOLOGY AND PETROGRAPHY OF REVAITES

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The contribution deals with theme of revaite, a raw material for chipped industry in prehistoric times.

The authors try to characterized the rock and determine its source.

It has been known that the revaite pebbles are secondarily deposited in fluvial gravels. The raw material was found in a gravel pit at Ostrožská Nová Ves (Mátl 2000), on alluvial terraces near Ostrožská Nová Ves, thence in the sand pit of Hulín and also in the south-west of Kroměříž. A rare finding we have from glacifluvial gravels in Opole-Groszowice in Poland.

The authors also present the qualities of revaites – shape, color, concentric zoning of partially transported fragments and size of pebbles.

The revaites were used for chipped tools in prehistoric times. These artifacts are likely in the wider area of Uherské Hradiště, in the Napajedla Hills and around Kroměřiž. Revaite artifacts have been described at the Paleolithic stations Kvasice and Karolin in the Kroměříž area in the Přerov area (Vokáč et. al. 2001), and at an Aurignacian station Boršice near Buchlovice (Škrdla et. al. 2003).

We have investigated also thin sections of revaites that yielded relics of microfossils (algea diatoms). On the basis of the microfossil findings, the Dynów marlstone and menilite cherts with layers of silicified shale are supposed to be the source rocks for revaites. Using the laser ablation (LA–ICP–MS, carried out by S. Hušková) we have determined chemical composition of revaites and supposed source rocks to deal with the question of revaite origin.

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RECRYSTALIZATION OF SC, Y AND U ENRICHED ZIRCON FROM THE DOLNÍ BORY PEGMATITES, CZECH REPUBLIC

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Zircon is a ubiquitous accessory mineral and principal carrier of Zr and Hf in almost all granitic rocks. It also forms more or less extensive solid solutions with other isostructural minerals (hafnon, thorite, coffinite, xenotime and pretulite). Its ability to incorporate radioactive elements and relative high closure temperature of its isotopic system makes zircon most frequently used mineral for absolute age determination.

The Dolní Bory area belongs to Gföhl unit of Moldanubicum, Bohemian Massif. Gföhl unit underwent granulite facies metamorphism in the root zone of Variscan orogen and subsequent rapid exhumation to shallow levels. Tens of pegmatite dikes up to 30 m thick and 600 m long cuts granulite in NNW-SSE direction. The pegmatites show typical inward zonation: Marginal granitic unit, graphic unit, central blocky unit, irregularly developed albitic unit (± miaroles) and quartz core.

Millimeter-sized intergrowths of zircon and xenotime-(Y) occur together with monazite-(Ce) on fractures in K-feldspar and sekaninaite in blocky zone of the pegmatite dyke no. 4 and they are covered by plates of ilmenite ± biotite. The intergrowths have star-like shape and are composed of central prismatic xenotime-(Y) crystal which is epitactically overgrown by zircon crystals.

Two types of zircon can be distinguished. Zircon I occurs as irregular residual domains mostly in the central parts of the aggregate (fig. 1 left). It is inclusion free and yields low EPMA analytical totals probably due to metamictization and hydratation. Zircon I contains up to 14 mol.% of pretulite ($ScPO_4$) component (≤ 4.82 wt.% Sc_2O_3), up to 18 mol.% of xenotime ($Y,HREEPO_4$) component (≤11.19 wt.% $Y,HREE_2O_3$), and up to 4 mol.% of coffinite ($USiO_4$) component (≤5.09 wt.% UO_2). Microporous recrystalized zircon II occupies preferentially outer parts of the aggregate. The presence of numerous (≈ 5μm large) inclusions of xenotime-(Y) and uraninite but very rare pretulite is typical for zircon II (fig. 1 right); consequently, it is about one order of magnitude depleted in Y, HREE and U (≈1 wt. % $Y,HREE_2O_3$ and ≈ 0.4 wt.% UO_2). On the other hand, majority of the Sc was retained in the zircon II structure as pretulite component (up to 10 mol. % $ScPO_4$). Contrasting ability of zircon structure to retain Y, U and Sc during recrystallization can be explained by their different ionic radius, which is 1.019 Å; 1 Å; 0.87Å and 0.84 Å for Y, U, Sc and Zr (all 8-coordinated), respectively (Shannon 1976).

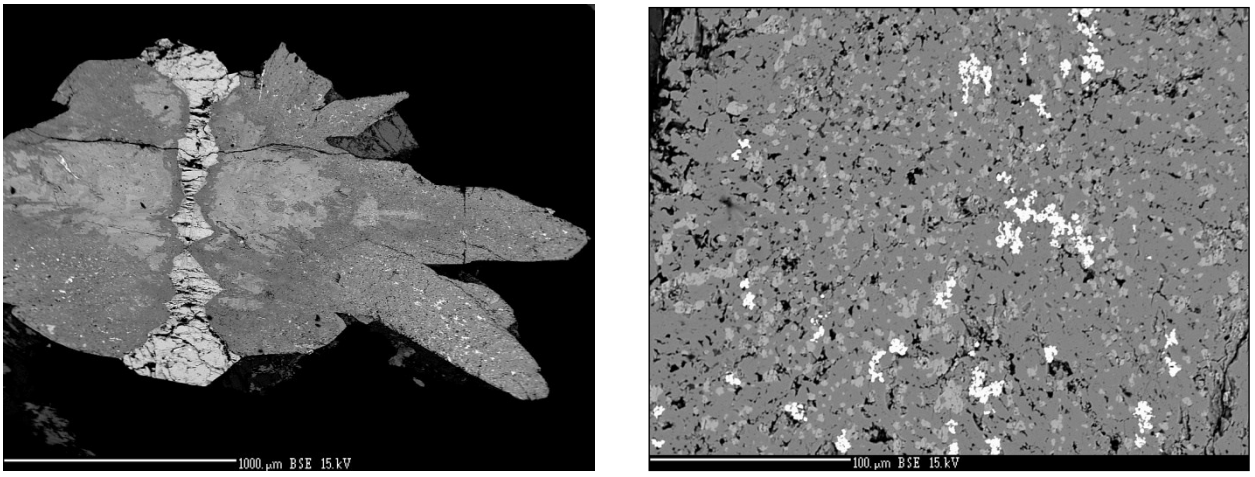

Fig.1: Left: Xenotime-(Y) crystal (bright), domains of zircon I (light gray, in the center) and zircon II with visible bright uraninite inclusions. Right: Recrystallized zircon II (medium gray), uraninite (bright) and xenotime (light gray) inclusions and pores (black). BSE photos R. Škoda.

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ZLATÉ HORY MINE WATER: EVOLUTION AFTER CLOSURE OF THE SITE

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The Jeseníky mountains at the Czech Polish border are a mining area since centuries for copper, lead, zinc, gold… In the Czech republic, the Zlaté Hory mining site closed in the 90's.

The Zlaté Hory mine water, pumped out during the activities and stored in two reservoirs, were put back into the galleries so as to stabilize the underground and to re-create reducing conditions, limiting the ore oxidation and solubilization into the groundwater. An unexpected natural wetland has expanded on the site downhill the mining dump (sludge bed) thanks the water table elevation.

After the end of mining activities, a water quality monitoring was done to characterise the evolution of water quality on the site. The monitoring was done by sampling all across the site: mine water in reservoirs and stream, pore water below the mining dump, ground waters, seepages, pounds, and especially in the wetland.

The wetland was also tested as a remediation area by a monitored seepage.

For this presentation, we will focus on geochemical parameters (Eh-pH, Piper diagrams, SO_4^{2-}-Ca^{2+} and K^+-Na^+ ratios,...) to show the evolution of mine water signature along the flow through the site and the wetland.

The general signature on the area is mine water with more or less impact of shallow fresh groundwater (cf. Piper diagrams). Along the water flow through the site, the evolution is reducing characteristics by decreasing Eh (from 800 to 400 mV) and increasing (neutralising) pH (from 3 to 7-8). The SO_4^{2-}-Ca^{2+} ratio show dilution characteristics whereas the K^+ / Na^+ ratio show retention characteristics especially in the wetland.

The wetland shows increased capacity for the evolution of the mine water geochemical parameters.

OLIVINES OF KLODZKO LAND

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Klodzko Land in West Sudety is situated in north-west edge of Bohemian Massif and it is a part of varicsan orogeny in Central Europe (Żelaźniewicz, 2005).

There are over 100 minerals (Węglorz, 2010), a lot of them are precious and decorative stones. Some of them can be found among effusive rocks. Creating bazaltoids from Lower Silesia is connected with vertical tectonic movements that took place in tertiary. There were corrugations in all Sudecki Massif.

These basaltoids belong to Central Europe petrographical provenience that extends from Moravian Ostrava and Opawski Silesia through Opole Silesia and Sudety with their foothills up to Upper Łużyce and Saksonia. This province is classified to the Atlantic Magma Row. The characteristic feature of this unit is the shortage of silica and diversity of alcali contents. Basalt on Kłodzko Land exists only in one place. Lava from the surroundings of Lądek erupted directly on the gravel terraces of Biała Lądecka river. Bazalts from Lądek region consist a lot of tiny ultramafine enclaves with mostly the composition of lherzolite, sporadically piroxene and mega-crystals of pyroxenes. The main mineral of lerzolites is olivine.

On Klodzko Land olivines can be found relatively rarely, only in 6 places. Featured are only those from olivine gabbros near Nowa Ruda, in village Podzamek famous from garnets, in peridotites from Mąkolno near Złoty Stok and in Złoty Stok in ophicalcite. Moreover that from peridotite from Bielice region has been also featured. Olivines from Nowa Ruda were first described by Rose (1867, vide Lis, Sylwestrzak, 1980). He identified in olivine gabbro the seeds of olivines with the diameter up to 1cm. They are characterized by dark grey to black-green colour. They have usually been intensively transformed. The analysis of optical features was carried in 1934 by Kijak and in 1937 by Schloosmacher. There is also a precious variety of olivines among those that can be found and were featured on Klodzko Land, Sachs (1906). This variety was found on Lądek Zdrój -Lutynia area (Sachs, vide Lis, Sylwestrzak, 1980). The only place of existing basalts on Klodzko Land is the zone of Lądek Zdrój to Lutynia near Lądek Zrój. In basalts; Twierdza Mountains, Modzel Mountains and Grey Stone Mountains the existence of fenocrystals or the concenration of fenocrystals up to a few centimeters from yellow to olive green colour has been proved. There are individuals with the right crystallographic outline (Buch 1977, Kaluza 1818, Fiedler 1863, Lasaulx 1875, Traube 1888, Hintze 1897, vide Lis, Sylwestrzak, 1980. Olivines from Lutynia can be found in so called olivine bombs which are enclaves in basalts. These specimen are usually crystals of irregular olivines. There are also units that are one centimeter long and even longer (Łobos, 2006). The most usual are a few millimeters long crystals, they can be seen in the forms of overgrowth the crystals of olivin with others. They are of green colour. The olivines from the basalt enclaves in Lutynia usually coexist with other minerals. Pyroxenes and spinels belong to this group. Spinels are tiny crystals of strong green colour. There are also magnetites and chromite. Olivines if exists in surface conditions are not resistant, impermanent and they easy undergo serpentinization process. It becomes loose, incoherent, fragile and of turbid colour. It is a rockformative mineral among the basalts, usually unnoticed with a naked eye. Olivine can also be found as huge crystals stucked directly in a rock. Very often these forms are strongly corroded. They are often of elliptic shape with a diameter of several millimeters. They are of dark, dark green and black colours. The external parts of these fenocrystals have the forms of grey border up to several millimeters wide. In a dark green crystal of olivine there are some cracks filled with the same material that surrounds its grains. These fenocrystals are formed in basalt magma, then they undergo the corrosion process as the effect of surrounding magma's interaction. In this process they take a shape of ovals. The further stages are metasomatic processes while there were the biggest changes on the border parts of crystals. These changes are seen as grey, non transparent borders around crystals of olivine and inside it as the cracks filing. Big, transparent crystals of basalt olivines from Lutynia are very rare. The bombs are of different sizes, from 2 – 3 centimeters to over a dozen centimeters.

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STRATIGRAPHY OF THE *ANNULATA* EVENTS IN THE MORAVIAN KARST (FAMENNIAN, CZECH REPUBLIC)

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The *Annulata* events are short-term global episodes in the mid-Famennian Upper *Palmatolepis rugosa trachytera* zone and correspond to the base of „IV Stufe" of the ammonoid zonation. These events are known from Europe, North Africa, Asia, Australia and North America. The *Annulata* events are typically characterized by dark grey to black anoxic or hypoxic sediments, frequently containing stratigraphically significant ammonoids (eg. *Platyclymenia*, *Prionoceras*), orthocone nautiloids, pelecypods (eg. *Guerichia*) or entomozoan ostracods. Event beds might be overlain by fossiliferous layers of „Wagnerbank equivalent" or „*Annulata* limestone" (fig. 1). Based on the most recent schemes of Central European and Moroccan sections, several stratigraphically important conodont taxa reaching the Lower Annulata event disappear below the Upper Annulata event (Hartenfels 2011).

Event beds in the Moravian Karst were previously described from a small pit-quarry near Ochoz u Brna (Rzehak 1910) and from the western Mokrá quarry (Dvořák 1988). Recently, four sections of the markedly condensed Křtiny limestones (Líšeň Formation) were sampled to provide conodont biostatigraphic data around the *Annulata* events. The first studied section is a small pit-quarry near Ochoz u Brna probably corresponding to the locality recorded by Rzehak (1910). A rich conodont association indicating the Lower *Annulata* event was obtained from the event bed but possible condensation of the both *Annulata* events into one interval can not be excluded. Event beds in the vicinity of Hostěnice might correspond to the Upper *Annulata* event which is supported by the stratigraphically uppermost occurence of *Palmatolepis rugosa trachytera* and *Palmatolepis glabra lepta* below these event beds. Event bed from the Mokrá quarry provided also rather poor conodont fauna which include *Palmatolepis glabra lepta* suggesting the Lower *Annulata* event. Studied sections were measured by field gammaspectrometer. Higher values of U and decreasing Th/U ratio corresponding to the event beds probably reflect anoxic conditions.

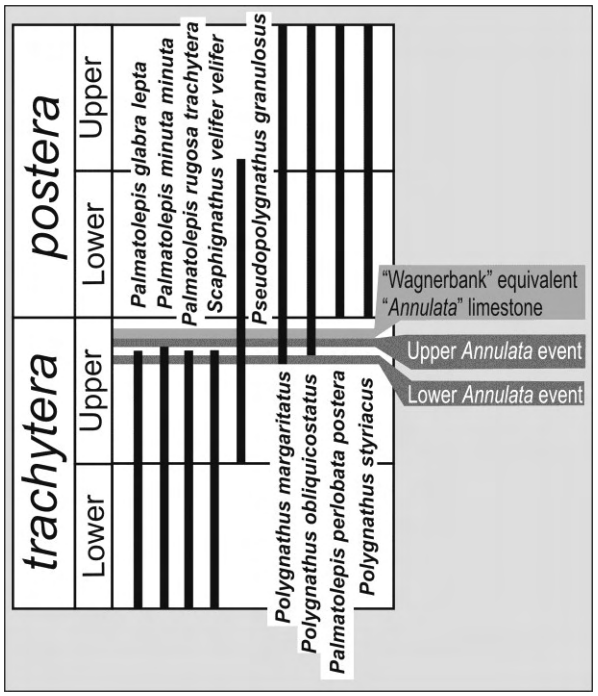

Fig. 1. Stratigraphical ranges of selected conodont taxa around the *Annulata* events within the *Palmatolepis rugosa trachytera* („*trachytera*") and *Palmatolepis perlobata postera* („*postera*") conodont zones (middle Famennian). Modified after Hartenfels (2011).

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NON-DESTRUCITVE LABORATORY ASSAYS OF MAGNETIC SUSCEPTIBILITY AND ITS CORRELATION WITH MEASUREMENT BY PORTABLE KAPPAMETER. A CASE STUDY: STONE RAW MATERIAL, ARTIFACTS

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Magnetic Susceptibility (MS) is physical quality, which we can define as a material's ability to magnetize itself in external magnetic field. Value of MS depends on content of magnetic minerals within the material. We can divide minerals into three groups according to the degree of their influence on MS. Ferromagnetic minerals have the biggest influence (e.g. magnetite, pyrhotine); paramagnetic minerals are next group with less influence (e.g. chlorite, micas, garnets); and minor influence has group of diamagnetic minerals (e.g. calcite, quartz).

There are substantiated advantages (e.g. Bradák et al. 2009, Přichystal 2010) in use of Magnetic Susceptibility measurement in determination of archaeological material such as stone artifacts or stone raw material. Assay of MS could help in determine raw material of artifacts (e.g. weathering patina, macroscopically unknown material) or in correlation of artifacts with natural rock sample (possible source). A portable Kappameter is the most common method of MS assays among archaeologists and petro-archaeologists. Kappameter has a several benefits - smaller, transportable size, non-destructive analysis directly at excavation places, terrain or in a museum's depositories. On the other hand there is a disadvantage – especially a certain inaccuracy in measuring artifacts which are smaller than a head of Kappameter. This problem could solve laboratory technique for measuring MS. Kappabridge MFK1 is capable to assay precise value of the volume magnetic susceptibility even of a very small object such as fragment or flank of artifact. Volume magnetic susceptibility is then with exact data of object's mass and volume recalculated on magnetic susceptibility. It is a non-destructive analysis; the only condition is a size of measuring object. It can't exceed measuring chamber – cylinder shape with 6 cm high and 6 cm in diameter. But as I mention above it is non-transportable laboratory technique so artifacts must be borrowed from depositories and assay in the lab (company AGICO s.r.o.).

Set of artifacts was chosen for this experiment a and possible source rocks of different petrographical type – Culmian sedimentary rocks, volcano-sedimentary rocks, a several types of metamorphic greenschists, serpentines, jadeites, magmatic diorites, diorite porphyrite and neovolcanic basalts. Aim of this experiment is to aplicate laboratory measurement of MS on archaeological materials and correlate it with handheld measurement by Kappameter. You can see results of such comparison on a case study of Culmian siltstones at Fig. 1. (Wertich 2012). The rest of the results will be presented on the poster.

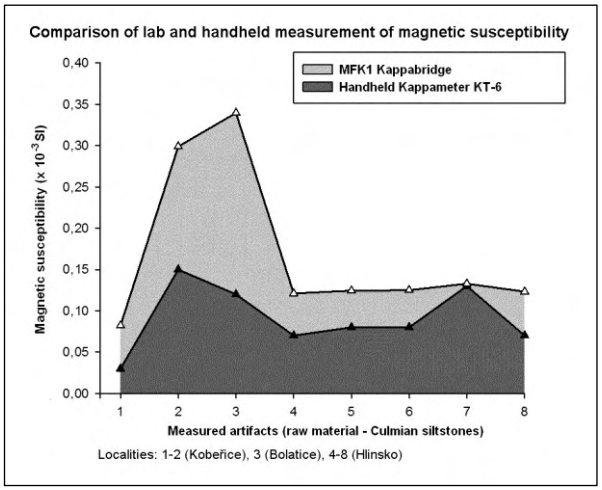

Fig. 1: Measurement of magnetic susceptibility on Culmian siltstones (Wertich 2012)

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SOME FACTORS AFFECTING PRESERVATION OF BONE ARTEFACTS IN LOESS SOILS - A CASE STUDY FROM KICHARY NOWE 2, SE POLAND

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Presented research constitutes a part of author's MA thesis titled *Manufacture, utilization and symbolic meaning of Mierzanowice culture bone personal ornaments in the light of technological and microscopic data*.

One of the problems that arose during the selection of archaeological material for the aforementioned thesis was the state of preservation of bone artefacts. It appeared that a significant amount of them was strongly modified by post-depositional factors caused by specific environment these artefacts were deposited in – the site is located in the region of the Sandomierska Upland which is known for its rich loess soils (Maruszczak 2001). Under macro- and microscopic evaluation two main types of geochemical traces could be identified: limestone crusts (Fig. 1.) and manganese staining (Fig. 2.).

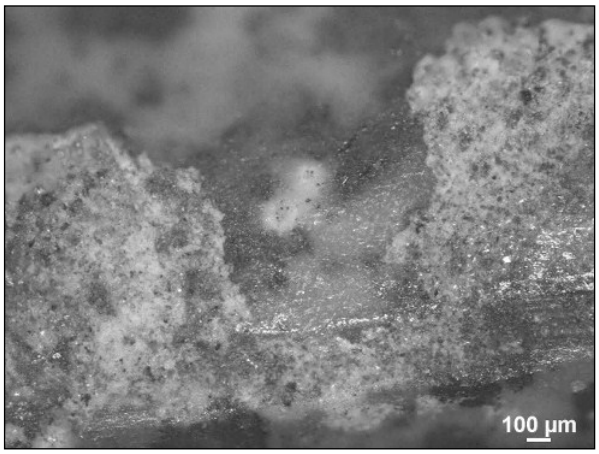

Fig. 1: Limestone crust on a bone bead (optical microscope, magn. 50x), photo: Kinga Winnicka

Analyzed archaeological material consists of bone beads recovered from Bronze Age cemetery – part of a large multicultural site Kichary Nowe 2 located in SE Poland (Kowalewska-Marszałek 2007). The cemetery dates back to ca. 2 000 BC and is attributed to the so-called Mierzanowice culture (Kadrow & Machnik 1997).

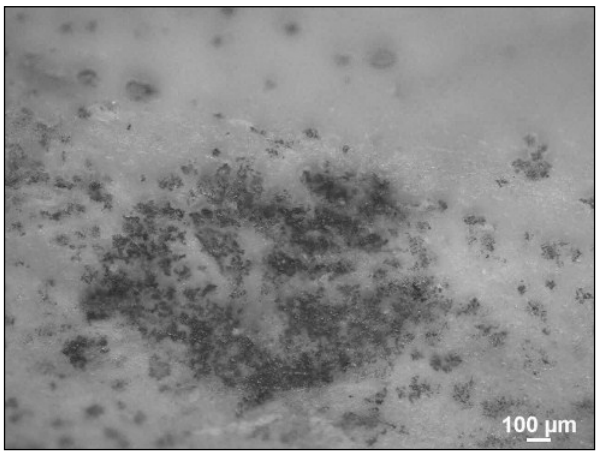

Fig. 2: Manganese staining of a bone artefact (optical microscope, magn. 50x), photo: Kinga Winnicka

Applied method combines microscopic evaluation and taphonomic analysis (Duday et al. 1990). Microscopic observations are being carried out using stereo (magn. 6.3-57x) as well as optical (magn. 50x) microscope. Their aim is to identify and evaluate traces of geochemical modifications connected with long periods of deposition in loess environment. On the other hand, taphonomic analysis takes into consideration factors such as distribution of bone beads in the grave, their relation to each other, presence or absence of other grave goods (especially other bone artefacts and their state of preservation) and anthropological data (ie. post-depositional modifications of human bones). Taken into account are also the properties of the grave infill – changes in the geoarchaeological layers documented during the exploration.

This approach made it possible to hypothesize about 'patches' of different geochemical conditions that affected the archaeological bone material from the site. The results are preliminary but combined with a proper geochemical study they could contribute to a better understanding of archaeological bone preservation in loess conditions.

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SEPARATION BETWEEN INTERMEDIATE AND ADVANCED ARGILLIC-ALTERED ZONES BY USING ASTER DATA IN SWIR AND TIR REGION

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The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) is a research facility instrument launched on NASA's Terra spacecraft in December 1999. Application of ASTER data in shortwave infrared (SWIR) region is highly fast and efficient method to recognize alteration zones as well as to evaluate mining potentialareas. In addition, ASTER data in thermal infrared (TIR) wavelength region has a good potentialfor detecting quartz and silicic alteration. So, it is possible to explore mining potential areas by separation of varied altered zones.

Advanced argillic alteration is commonly found in porphyry systems, inner zones of hydrothermal systems, precious metal-bearing veins, and most typically in the high-sulphur epithermal systems, as well as this type of argillic zone isfollowedby occurrence of quartz. Therefore, separation of intermediate and advanced argillic-altered zones is important subject for mineral exploration. In this study, by using remote sensing data extracted from ASTER images, advanced and intermediate argillic-alteredzones were separated.

In order to detect altered zones, band combination of 468 in RGB were applied in variation of pixel saturations in SWIR region. The result has shown that intermediate and advanced argillic-altered zones were highlighted by light pink color pixels and pink chromaticcolor pixels, respectively.Notably, intensity of pinkish pixels gradually increased with developing of alteration from Intermediate to advanced zones.

Based on ASTER data, spectra of silicic alteration showed that there was an intense absorption in ASTER bands 10 and 12 relative to bands 13 and 14in TIR region. As a result,the best imagewas extracted by using band ratio of 14/10 which highlighted silicic alteration zones in bright pixels whichexactlyoverlaped withadvancedargillic altered zones. In final stage, the field studies, X–ray diffraction analysis (XRD) and thin sections petrography confirmed accuracy of the methods used in this study.

CONTAMINATION MOBILITY IN THE COPPERBELT SURFACE WATERS CONSIDERING TIME EVOLUTION

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The studied area is located in the Zambian part of the Copperbelt, one of the greatest sediment-hosted copper-cobalt provinces in the world. Misra (2000) calculated 150 Mt of copper total resources of the Copperbelt in the Democratic Republic of Congo (DRC) and Zambia, and total reserves of cobalt at least 8 Mt. World-class Cu – Co deposits in the Zambian part, each containing more than 10 Mt, are Konkola – Chlililabombwe, Nchanga, Nkana and Mufulira.

However, local population and the environment suffer from emissions, ore mining, processing and smelting operations. Soil and surface waters of Kafue river network are strongly contaminated by heavy metals (mainly Cu, Co, Ni, Mn, Pb, Mo, Zn) and sulphur. About 500,000 m^3 of industrial water comes into the Kafue River per day resulting in acid mine drainage. AMD conditions result in the oxidation of sulphide minerals forming acidic, sulfate-rich drainage and causing decrease in pH, high specific conductivity, and high concentrations of toxic heavy metals. The acid produces dissolved salts and mobilizes heavy metals. The semiarid climate with three climatic seasons (1. cool and dry season from May to August, 2. hot and dry season from September to November, and 3. warm and wet season from December to April) significantly plays important role in the processes evolution and temporally even more remobilise adsorbed or precipitated heavy metals especially during the wet season.

The data used for this study were taken during environmental-geochemical mapping by Czech Geological Survey in years 2004 – 2008 (e.g. Kříbek and Nyambe 2006). Within the Kafue river flowing in the northeast direction and considering its tributaries, 46 monitoring sites were monitored and measured data then used for modelling distribution and mobility of contaminants and accompanying basic elements in Surfer® Mapping System Ver. 8.00, using UTM coordinates to establish relationships signifying processes that affect mobility of contaminats. Additional geochemical modelling was done in Geochemist´s Workbench® ver. 8.0.8 to define possible involved processes.

pH values are generally mostly neutral to slightly alkaline, reflecting seasonal changes and time scale evolution during four-year monitoring period. In case of Chambishi mine, Chingola mine, and Kitwe industrial area (Nkana mine), low pH values down to 2 cause high concentration of heavy metals in form of dissolved ions in surface water. Electrical conductivity increase corresponds with higher Fe, Cu and SO_4^{2-} concentration.

The distribution of the contamination depends on exposed primary and secondary sources as well as mining sites localised on left tributaries of the Kafue river. The contamination significantly decreases downstream from the source of contamination, indicating relative stabilisation of elements by precipitation or sorption as well as dilution. The dilution process is well demonstrated in case of Kafue river when mixing with its tributaries. In other case, dissolution of gypsum as well as carbonates is a result of AMD conditions. The mobility is different for each element. For instance sulphate anions are relatively mobile, while cobalt and copper disappear relatively quickly from surface water. Concentrations of Ba, Si, and Li are stable.

In neutral to slightly alkaline conditions, heavy metals are eliminated from the solution and their mobility is limited. Acidic conditions provide higher mobility of contaminants by desorption and dissolution of secondary sulphate minerals. Other important factors of possible adding of organic matter especially when a tributary passes settlement or influence of other industrial activities in the Kitwe area change the stability of the surface water and therefore change the way of current running processes.

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Symbols of Paleozoic and Mesosoic Eras
Cambrian (Ȼ), Ordovician (O), Silurian (S), Devonian (D), Carboniferous (C), Permian (P)
Triassic (T), Jurassic (J), Cretaceous (K)

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