2nd Students' International Geological Conference

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April 28 – May 01, 2011
Ratnieki, Latvia

ABSTRACTS

LATVIJAS UNIVERSITĀTE
ANNO 1919 UNIVERSITY OF LATVIA

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The book contains the abstracts of presentations from the International Geological Conference devoted to the regional geology of Europe and related topics – "2nd Students' International Geological Conference" (April 28 – May 01, 2011, Ratnieki, Latvia).
The presentations are devoted to actual problems of recent regional geology and show the opinion expressed by representatives of researchers from number of mining schools, universities and institutes from all around the Europe.

Otrās Starptautiskās ģeoloģijas studentu konferences ziņojumu tēžu krājums satur pārskatus un galvenos zinātniskos rezultātus par kuriem to autori ziņoja konferences laikā Ratniekos (2011. gada 28. aprīlis – 1. maijs). Konferences pamata tematika ir veltīta Eiropas reģionālai ģeoloģijai un ļoti dažādai tās pētījumu tematikai, novitātēm metodiskās pieejās, kā arī atšķirīgiem rezultātu interpretācijas paņēmieniem un pieejām.

Izdevums sagatavots un izdots ar Valsts pētījumu programmas NatRes projekta „Zemes dzīļu resursi, to izpēte un izmantošanas tehnoloģijas" atbalstu.

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Priekšvārds

Visa pasaules attīstība ir pakļauta kādām noteiktām likumsakarībām, dažas no tām ir cikliskas. Dabā šie ritmi un cikli ir labi zināmi, bet tās ir atpazīstamas arī ģeoloģisko pētījumu attīstībā. Tā klasiskam periodam pagājušajā gadsimtā seko maksimālo pētījumu apjoms un tikpat likumsakarīgs ir sekojošais kritums. Ir pagājuši jau vairāk kā 25 gadi un ir pamats gaidīt renesansi – trauksmainu un daudzveidīgu pārmaiņu laiku.

Šajā laikā ir mainījusies ģeoloģijas loma sabiedrībā un nozīme tautsaimniecībā, bijušas vētrainas politiskas reformas un mainījušās ir arī augstskolas un studiju programmas. Tomēr lielākās robežas ir brukušas ne tik daudz priekšstatos par zemes dzīlēm vai politiskajā kartē, cik tās ir pētniecības metodēs un datu interpretācijā. Mūsdienās nav iespējams vairs droši noteikt – vai pētījums ģeoloģijā sniedz lielāko ieguldījumu zemes zinātnēs, vai tas būs atklājums pavisam citām zinātnēm. Tās ir neierobežotas iespējas jauniem pētniekiem.

Tā ir pavisam jauna pētniecības filozofija, kas tiek realizēta zinātņu augstskolās. Latvijas Universitāte tai pievienojas un ir atvērta visām jaunām zinātniskām idejām un ir priecīga, ka var palīdzēt paust jaunu pētnieku idejas, diskutēt par tām un veicināt to attīstību. Tādēļ arī Studentu starptautiskā ģeoloģiskā konference pie mums ir gaidīts notikums.

Nav mazas vai lielas ģeoloģijas, ir tikai dažādi mērogi lielu ideju realizācijai un ļoti atšķirīgi mērogi, kuros mūsu idejas var tikt pierādītas. To uzskatāmi apliecina šis daudzveidīgas pētījumu kopsavilkumu krājums.

V. Segliņš
prof., Dr. ģeol.

Preface

Development of the whole world is undergoing processes that are governed and influenced by certain laws, many of them having a cyclic nature. The rhythm and the cycles are well known in the nature, but they are also recognizable in the course development of geologic research. Thus, the classical period of the last century has been followed by a maximum volume of research and then, consequently, by a descending fall. Twenty-five years have already passed since, and now there are good grounds to expect a new Renaissance – a period of drastic, turbulent and multiple changes.

During the course of time geology science has been changing its role in society and its signifance in economics. The greatest borderlines have collapsed not so much in the very ideas and notions about the entrails of the earth or political maps, rather than in the methodology and interpretation of the data obtained. Nowadays, it is not possible to state certainly if the geological research makes a bigger input into the sphere of natural sciences, or it might be a new discovery for other sciences. It opens unlimited opportunities to the new young researchers and scientists.

This is an absolutely new philosophy of research being applied at scientific universities. Latvia University is joining this approach and is open to all the new scientific ideas, and it is highly pleased to assist the new researchers to express their ideas, discuss them and promote their development. Therefore, the Students International Geological Conference is an event very warmly welcome here, in Latvia.

There is neither a small, nor a big geology, there is only a various scale in carrying out the implementation of our ideas, and a very different scale in which our ideas can be reflected, verified and proved. The above is obviously demonstrated by this compilation of the diverse scientific abstracts.

Valdis Segliņš
Professor, Dr. Geol.

Scientific sessions include: sedimentology; mineralogy and petrography; stratigraphy and palaeontology, quaternary geology and applied geology. Altogether 57 participants from 9 countries – Czech Republic, Denmark, Indonesia, Ireland, Latvia, Poland, Romania, Russia and Ukraine have registered for the Conference, and 42 papers (19 oral and 23 posters) will be presented and discussed.

CONTENTS

Applied Geology

GIS Project "Geological Map M-34-107 (Boryslav)"

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During more than 200 years of the investigations within Boryslav oil and gas region a lot of different geological data were gathered. The high-quality classification and fast access now are actual problems. To our opinion the using of modern GIS technologies considerably helps to solve the tasks mentioned above.

We see twofold aims for solving these problems:

1. to create the geodatabase;
2. to demonstrate the GIS project for the practical purposes in different brunch of Geology.

First the creation of the different digital maps is long and routine stage. The main goal of this process is the digitization of paper maps and the creation of attribute tables of different kind of information. Using software ArcGIS of ESRI we elaborated territory of topography map M-34-107 in scale 1:100 000 to generate the basic electronic map.

This map consists of several shapefiles which represent features from paperprint original. Those include hidrological information, highs, roads and some other items. Next step was creation of digital geological map with generation of geodatabase structure, operational concepts and metadata. Geodatabase is organized into feature datasets that correspond to three necessary elements of geological maps: main map, legend and cross-sections.

Practical using of the above described maps is follows: all information is stored in one place that gives fast access to it, and this information can be used immediate in the field using modern software and equipments (for example ArcPad). In this way gathered and transformed information can be easy communicate and visualize between scientists and public users.

Effects of Hydrological Management in Mires on Water Table Regime

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Mires (raised bogs) are important habitat for different flora and fauna species; they are one of the key elements to maintain biodiversity. Latvia is rich in bogs that cover 10% of the country area, and about 7% are mires. Besides the biodiversity the bogs are source of peat. Hydrological management of mires has begun in the beginning of the 20th century and included digging of ditches to drain water from the bog.

The water table in bogs has been lowered due to the ditches dug in the bogs, and the peat mineralisation and tree growth is facilitated in the dryer areas of the bog thus decreasing biodiversity there. There are several projects carried out to restore the former hydrological conditions in the mires in Latvia. The dams are built on the ditches and water table is raised in the bog.

To study the effects of the hydrological management of mires on water table number of groundwater monitoring wells have been installed in several bogs and water table regime was observed.

Earlier observations (Galeja 2010, Indriksons 2008) showed that amplitude of the water table fluctuation close to the ditch is greater than in the natural bog or the dammed ditch. The water table fluctuations in the natural bog are 15–25 cm per year, but near the ditches the amplitude increases to 50–60 cm per year, and the amplitude decreases again for 15–20 cm after the construction of dams on the ditches.

In the frame of LIFE08 NAT/LV/000449 project The study will be continued in four other bogs – Melna ezera bog, Aizkraukle bog, Aklais bog and Rozu bog, and 60 new wells will be installed to observe groundwater table twice per month in a three year period.

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Tectonic Features of the Bodrak River Basin Geological Structures

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The Crimea Mountains have a distinct tectonic structure and complicated structural forms, within the Crimean peninsula. Folded basement of the Crimea Mountains consists of dislocated flysh formations of the Taurian Series. The platform deposits like molassa, flysh, reef limestones, volcanic-sedimentary geosynclynal deposits and geosynclynal trough formations are located in the limited area, layers are thin and characterized by the special structure and facies.

There are two major still unclear issues regarding the Crimea Mountain tectonic and evolution: 1. unsolved problems of the tectonics and geological evolution which are important for the oil and gas bearing of the Black Sea basin and adjacent territory, and 2. different facts and concepts concerning to the flysch deposits of the Taurian Series.

To solve these uncertanties one of solution is to carry out the detailed geological mapping.

In this paper the field work materials have been used based on carried out detailed geological mapping of a scale 1:5000. In details the Taurian Series deposits outcrops in the middle part of the Bodrak river basin and the Bodrak intrusive complex (J2) have been investigated.

Geological mapping of this scale has been carried out for the first time, the modern tectonophysics methods have been applied. Mapping was accompanied by specific structural studies addressed to: a) plicative and rupture dislocations; b) basic rhythms; c) measurements of different structural and textural bedding elements and d) tension cracks and share fractures paragenesis has been observed.

The following conclusions have been made by comprehensive study of the Taurian Series internal structure in the middle part of the Bodrak river basin: 1. Folded-block structure of the flysch mass with a predominance of monoclinal blocks has been demonstrated. 2. The different ranges folding has been revealed, it depends on the types of the flysch deposits correlation and the layers competence. 3. Near-faulted character of a high range folding located in the two-component flysch has been shown. 4. The absence of a single polarity in the dislocations intensity in the study area has been proved. This intensity varies depending on the basement structure and grows on the boundaries of rigid blocks.

The obtained data concerning to the intrusive bodies of the Bodrak complex consistent with the general submeridian tension-compression with the different range stress-strain states which are typical for this region.

Tectonophysics studies reveal the predominance of a submeridian compression. The results of the detailed mapping demonstrate sequence with a current schemes, but they are more detailed.

This research is the beginning of the detailed study of the Taurian Series structure. Its extension would enable to find out the real mechanisms of structure formation and to research the general geodynamic conditions during folded structure formation of the Crimea Mountains.

Hydrotechnical Management of Soła River Catchment Area

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In the water management of the Vistula River basin the key issue is the management of its Carpathian tributaries. The dam in Porąbka on the Soła River was one of the most important Polish hydrotechnical investments in the interwar period (1919–1939) and the only one successfully finished before the Second World War. One of the main tasks of the dam was the flood protection of the lower part of the river basin.

Geologically, Soła catchment area is located in the external Flysh Carpathians. The characteristic feature of these mountains is the occurrence of flysh nappes which are pulled over the Carpathian foreground. The soil here is heterogeneous and cut with cracks and faults. Consequently this region is threatened with landslides.

The amount of rain water in this region is totally different in spring and winter. During pouring rains water does not sink into the soil but floats on the terrain surface causing the danger of flood. Soła is a very dangerous and changeable river which is not easy to control. Floods appeared in this region very often in the history and caused great damages. The first discussions about the necessity of regulation of this river took place in 1872.

The hydrotechnical development of the Soła River consists of 3 dams and 3 reservoirs in Tresna, Porąbka and Czaniec. In Międzybrodzie Bialskie, inside Żar Mountain there is a huge hydro-electric power station. The Soła cascade provides many advantages such as ecological energy, the reservoir of potable water, partial prevention from floods as well as an attractive place for tourists.

From Photography to Geospatial Model in Geoarchaeological Studies

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Frequent and systematic geological observations, especially of exogenic processes are one of the top study priorities. The available amount of high quality data is quite low and insufficient for modelling and forecasting of these processes. This data is mostly demanded for linking various nature monitoring results and for elaboration of preservation and restoration plans of historical monuments.

As a study object was chosen the Step Pyramid of Djoser in Egypt, the World heritage monument that is currently under continuous restoration. The study was carried out since July 2005 and during numerous field observations this monument was photo documented as far as it was permitted by the Egyptian authorities.

Photo documentation was performed with digital camera SONY DSC-R1 10.3 Mpix with average size of image 4,3 Mb. The images were sorted according to the geographical orientation of the sides of the pyramid. According to our experience it is necessary to select enough images so they would form a mosaic completely covering all facades of the pyramid, moreover, the images forming this mosaic should overlap each other for about 30%. For further processing most appropriate are frontal view photographs taken in direct light. However, slight shadow (side lighting) in the phase of analysing and interpreting the images may be helpful to distinguish comparative depth in the surface of the object allowing to access relief of the surface.

Further all selected images have been adjusted using PTLens 8.7.8 software that corrects lens pincushion/barrel distortion, vignetting, chromatic aberration, and perspective. Such adjustment is necessary so each image would be comparable with other images taken in different conditions or time periods and also forming the mosaic.

All selected and adjusted images have been placed as mosaic onto previously created 3D model of the pyramid using MicroStation V8i software. The placement of the images is carried out using 2D file previously exporting from 3D file particular side (façade) of the pyramid. The image of the whole façade of the pyramid along with detailed images of the façades fragments forming the mosaic were attached to the working 2D file design as raster images. Afterwards raster image warp function was used to adjust the size and shape of a raster image with a combination of move, scale, rotate and skew options to match a raster image to design file elements using several points to match the source and destination points. The adjustment is made by defining points on the image, followed by monument points in the design file. When all façades of the pyramid's 3D model are completely covered by the photo mosaic, the images are merged to form a homogeneous highly detailed covering. Thus a high resolution geospatial model of the pyramid is created and it is applicable for further systematic studies.

For the pyramid the specific information is data about stone material weathering forms and weathering intensity further to be supplemented with the information about quality of the building material and fissures appearing in the structure of the pyramid. This information is very import for elaboration of restoration and conservation projects for this ancient monument.

This system that includes multidisciplinary knowledge (geology, geomatics, material science, history) significantly widens the possibilities to monitor and analyse natural processes by attributing quantitative indices. These are comparatively simple tools and software possible to apply in various geoarchaeological studies and in monitoring observations of exogenic processes.

Tendencies of Sand and Gravel Extraction in the Baltic States and Sweden in 2005–2008

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Sand and gravel belong to most widespread minerals in Latvia, and they are widely used as construction materials. Sand and gravel have been utilised as raw materials for the production of building materials for centuries. The tendencies of the development of the national economy generally reflect changes in the GDP (gross domestic product). Accordingly, in order to characterise how much the quantity of the extracted sand and gravel depends on the GDP, correlation of both indices was conducted, putting forward the hypothesis of the connection of the volume of the extraction of sand and gravel with the general tendencies of the development of the national economy.

The study deals with an analysis of the tendencies in the extraction of sand and gravel and tendencies in the growth of the GDP in Sweden, Estonia, Latvia and Lithuania during 2005–2008, based on the official statistical data, without detailed studies of separate regions and enterprises at this stage. In general, the ratio of the volume of sand and gravel extracted in the Baltic States and the GDP is similar, except Latvia, where the low correlation ratio (R^2 = 0.2976) is due to considerable decline in the extraction volume in 2006 (Figure 1). Making the data correlation without the Latvian indices for 2006 (Latvia), it should be ascertained that, in the Baltic States, a slightly higher rate of the development of the national economy is observed in Estonia (R^2 = 0.7714), while the development indices in Latvia (R^2 = 0.6878) and Lithuania (R^2 = 0.6734) are similar (Figure 1).

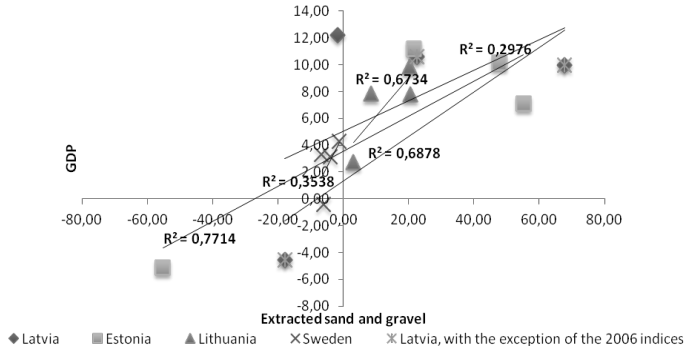

Figure 1. Correlation of the growth of the GDP and extracted sand and gravel (based on the data of worldbank.org, csb.gov.lv, and British Geological Survey).

In Sweden, the average ratio of the quantity of the extracted sand and gravel and the GDP is twice lower than that in the Baltic States (Figure 1); that is explained by the reduction in the quantity of the extracted sand and gravel from year to year, associated with uniform development of construction and well-considered extraction of minerals in that country.

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http://www.csb.gov.lv

Using DRASTIC Method for Groundwater Vulnerability Assessment Step by Step

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The poster shows how to make a map of groundwater vulnerability to contamination, step by step with usage of the DRASTIC method. DRASTIC is an acronym created of the first letters of features used to create the map. There are 7 included features: Depth to the groundwater, Recharge net, Aquifer media, Soil media, Topography, Impact of vadose zone and Conductivity of the aquifer.

At the beginning we need to collect necessary source maps. These maps are: the hydrogeological map, the geological map of area surface, the map of soils and the topography map. The next step is to bind all kinds of each of 7 mentioned features from the map with values from 1 to 10. Low values mean that groundwater are resistant to pollution, high values mean that conditions predefine groundwater as vulnerable to contamination. It is then necessary to set the weights of each of that features. The weight means importance of each feature, and it includes values from 0 to 1, where small values mean less importance and 1 mean the greatest importance. The next step is to digitize collected data. It is necessary to divide the area into squares of equal size. Next we bind those squares with proper values from the prepared maps. Values from maps should be multiplied by "weight" of each map. At the end we sum all calculated values in each square, and we get the value that is called "DRASTIC index". High values of DRASTIC index define area as vulnerable to pollution, and low values mean that area is resistant to pollution.

In most cases this kind of maps are being prepared for big areas, but it can be also made for the smaller ones, for example the area on which it is planned to build an object that is an eventual source of contamination. The DRASTIC method is very simple and effective way of characterizing groundwater vulnerability to contamination.

The poster is created in order to present the DRASTIC method to students and scientific workers who have not known much about this method earlier. Used maps are fictional and prepared only for educational use.

Balanced Cross Section of the Skyba Nappe, Outer Ukrainian Carpathians

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Studied area is located within the Outer Ukrainian Carpathians, one of the oldest petroleum provinces around the world. It is typical accretion wedge forming during Miocene tectonic events. Stratigraphic succession in the studied region include flysch deposits from Upper Cretaceous to 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.

The study was carried out in the frame of Academic Software Initiative (ASI) and this program is launched by Director of Midland Valley Dr. Alan Gibbs.

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 modelling. 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 located 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 studies, the mapping one of the outcrops with several mesostuctures was performed. These structural elements also were restored for the studies of the forming mechanisms. Such multilevel approach provides possibility to get more complete pictures of the structure development.

Organic-Geochemical Implications on Origin and Fate of Organic Matter from Recent Lagoonal Sediments of the Shagany-Alibei-Burnas System, NW Black Sea

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The Shagany-Alibei-Burnas Lagoon (Liman) system, located in the Ukrainian NW part of the Black Sea shelf, was a site of extensive organic-geochemical study over recent lagoonal sediments. The origin and fate of organic matter could be interpreted from diverse organic compounds classes, their distribution and relative quantities. The analytical procedures comprised extraction, derivatisation and gas chromatography-mass spectrometry analysis of investigated material (12–25 cm surface sediment cores). Previously published results (Pilch and Rospondek 2010) implied the two major sources of organic matter: the (cyano) bacterial/algal microorganisms and vascular plants (terrestrial and/or aquatic). This feature is confirmed by positive correlation between fatty acids and *n*-alkanes distribution patterns and corresponds to lithological variations along vertical profiles of sediments. More detailed studies of particular samples revealed the occurrence of specific cyanobacterial biomarker, 7-methylheptadecane, and related compounds from monomethylalkanes (MMA) group. Their occurrence allows to distinguish the cyanobacterial input into sedimentary OM more precisely and emphasizes the important role of cyanobacteria in the primary productivity of lagoonal ecosystem. Subsequent scanning electron microscopy and microprobe of chemical analysis revealed the assemblages of siliceous frustules of various diatoms' species in the sediment, which hasn't been so far considered as important source of OM. In the light of these new data the organic-geochemical characteristics ought to be reinterpreted, e.g. some sterols, previously recognized as deriving from bird faeces, are more likely to originate from this algal group. Special attention is paid to variable preservation potential of considered source-dependent organic compounds. Ultimate molecular composition of OM is modified by microbial and abiogenic degradation as suggested by the occurrence of stanols and various phytadiene isomers, respectively.

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Sediment Classification of Galway Bay

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Much research has been focused on the applicability of using multibeam backscatter data in sediment classification of the seafloor. Sediments, such as silt, sand and gravel are acoustically distinguished by their different roughness and acoustic impedance values. However, the acoustic roughness of the seabed by definition depends on the wavelength of sound being transmitted to it. Therefore, interrogating the seabed type using more than one acoustic frequency can theoretically better distinguish different seabed types than using one frequency alone. This was the basis for an undergraduate study. Additionally, the seabed was classified using two approaches. CARIS software was used to produce mosaics of the varying backscattering strengths of substrates on the seafloor and these were classified using clustering software in ArcMAP. Geocoder is a module in CARIS that extracts modelled sediment properties, such as acoustic impedance and porosity, from analysing angular response curves of the backscatter data. On the basis of inverting these data the backscatter was classified using a data clustering toolbox in MATLAB and the results were displayed using ArcMAP. Classification using both acoustic frequencies resulted in less noisy, more precise classes. Comparison of the two classification approaches found the Geocoder technique to be superior.

Skyba Nappe Flysh Deposits Stress Fields Evolution Assessment

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The research of mesostructures as joints and slickensides are very significant for the stress field evolution in different geological time formations on the territories with complicated tectonic history. Research area is located in the Valley of Rybnytsia River, West Ukraine, Lviv Region. Geological section mainly demonstrates Cretaceous and Palaeogene flysh formations. Data for study was collected to characterize different types of brittle structures, and other study was performed in the valley between Opir and Oriava rivers in 2007 (Bubniak *et al.* 2007), Sukil river – in 2009, and at Bystrytsia Nadvirnianska – in 2010.

The method applied in general is the paleostress analysis (analysis of joints and slickensides) (Gintov 2005). According to method, joints are classified into three groups. The first group – joints are oldest and perpendicular to stratum. They developed after lithification of deposits, but before thrust- and fold formation. These joints are used for paleostress fields of main axes (σ_1, σ_2, σ_3) reconstruction. Possibly, these joints are representing planetary jointing (connected to irregular rotation of Earth). The second group – joints are vertical in modern position of layer. These data are used in the reconstruction of main axes of modern stress fields. The third group – joints are recognize as oblique, and was not studied in details. Slickensides create in the time of the intensive tectonic motions and use for the reconstruction of these fields of that time and (in some case) modern ones with axes (σ_1, σ_2, σ_3). By processing data traditional software was applied: StereoNett (for joints), Win–Tensor (for slickensides) etc. During the study about 1000 different types of joints in 10 places and about 150 slickensides in 7 places was examined. Study demonstrates changes in directions of the regional stress fields during the Paleocene-Oligocene, Miocene and post Miocene time in the study area.

Paleocene-Oligocene. There were four stress fields in this time. The first (σ_1 – 181/01, σ_3 – 272/01, a) and the second (σ_1 – 269/01, σ_3 – 359/01, b) paleostress fields are occur in almost all deposits. They are the oldest fields connected to planetary jointing. The third field (σ_1 – 300/01, σ_3 – 30/01, c) is tension and is connected to creation of Paleogene sedimentation basin. The fourth field (σ_1 – 231/01, σ_3 – 141/01, d) shows the beginning of orogenic process: compression is beginning, but the Oligocene deposits are in horizontal occurrence.

Miocene. At this time Ukrainian Carpathians are under intensive tectonic motions, thrust- and fold formation processes. The first main (about 35 %) field (σ_1 – 220/15, σ_3 – 130/85, e) shows the compression of general Carpathians direction – inversion regime. There were inverse faults on horizontal plane in this field. The second (σ_1 – 226/25, σ_3 – 136/15, f) and the third (σ_1 – 259/20, σ_3 – 169/15, g) fields belong to the slip regime (dextral and sinister faults) These fields demonstrated variable speed of dislocation neighbor blocs and parts of thrust and created synchronous with inverse faults of first field. There were normal and inverse faults (parallel to extending of the Ukrainian Carpathians) in the fourth field (σ_1 – 140/15, σ_3 – 310/80, h).

Post Miocene. There were three fields in this time. The first (σ_1 – 183/13, σ_3 – 093/11, i) and second (σ_1 – 107/11, σ_3 – 197/14, j) show the dextral and sinister faults and created after thrust- and fold formation. The third field (σ_1 – 323/80, σ_3 – 232/05, k) is the youngest one. The last field demonstrates the modern process of destruction of the Ukrainian Carpathians (example, landslides and earthquakes).

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Heavy Metals and Sulphate Mobility in Fresh Water in in Cu-mining District of the Copperbelt Province (Zambia)

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Copperbelt Province occupying an area of 31,328 km2 is a part of one of the greatest sediment-hosted stratiform copper-cobalt provinces in the world. The mineralisation was formed at the end of pan-african orogeny approx. 560–550 Ma ago (Cahen et al. 1984).

The studied area situated in the Kafue river network is covered by several open-mine pits, underground mines, active processing plants and smelters, old tailing impoundments, tailing ponds, and waste heaps often heavily contaminated by heavy metals and sulphate. The reservoirs of local atmosphere, surface water and groundwater, plants, soil and stream sediment contain high amount of aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, nickel, lead, selenium, uranium and zinc. Their concentrations often exceed the standards established by the European Union (Kříbek and Nyambe, 2005). There are several possible routes of pollution input into the environment.

Nevertheless, this study is concentrated on the heavy metals and sulphate distribution in fresh waters. The fresh water contain up to 1,644 ppb of copper, 29,528 ppb of cobalt, 7,836 pb of iron, 17,093 ppb of manganese, 1,776 ppb of nickel, 317 ppb of lead, 3,672 ppm of sulphate, 37.8 ppb of selenium, 1,741 ppb of zinc. The sampling of both contaminated and uncontaminated places took almost six years of monitoring from 2002 till 2008, accompanied by measurements of pH, Eh, temperature and conductivity of fresh water. Sampling was realized by Czech Geological Survey during environmental geochemical mapping in the Copperbelt district. Afterwards, all the data were displayed in distribution diagrams using Surfer® Version 8 and Google™ Earth 6. To model processes causing the mobility and precipitation, Geochemist´s Workbench® version 8 was used.

According to the modeling, sulphates are quite mobile, but their distribution depends also on precipitation which appears from October to April. On the other hand, for instance, copper and cobalt, the greatest pollutants in the district that often migrate together, precipitate at short distances from their sources. Admittedly, cobalt is more mobile than copper.

Very important indicator of chemical conditions as well as of distribution of chemical elements is pH. Extremely low pH down to 2 and low Eh result in mobilization of toxic elements from sediment deposited in bottom sediment.

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Mineralogy and Petrography

Heavy Minerals During Burial Diagenesis, Siri Canyon, Danish North Sea

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Heavy minerals may be selectively concentrated during transport and deposition because of their high density. Selective concentration of heavy minerals in Siri Canyon is thought to take place through a combination of sorting procedures, including settling velocity and differential transport and entrainment. Because of their higher density, minerals tend to be proportionately finer grained than quartz or feldspar grains deposited in the same sediment. Siri canyon in-situ sands are deposited by density flows, and heavy mineral sorting is caused by suspension fall out of heavy minerals. Depositional unites are approximate 10 m thick and the concentration of heavy minerals (as represented by the concentration of Zr) is gradually decreasing upward within each depositional unit. Heavy mineral sorting also occurred in injected sand of Cecilie-2 well. The injected sand is a thin, vertical clastic dike, several meters below the source sandstone. Close to the margin of the dike, thin discontinuous layers of concentrated heavy minerals occur. There is a slight separation between zircon and Ti-rich minerals, many of which have later been altered to TiO_2 and may contain significant internal porosity. The HM laminae may be fully embedded in poikilotopic pyrite, probably as a result of prolific supply of dissolved iron from various Fe-Ti-oxides. Injection of sand into the vertical fractures in chalk resulted in heavy mineral enrichment at the dike margin, and the separation of zircon of Fe-Ti-oxides within lamine follows a vertical trend. Siri Canyon massive sandstone units are characterised by differential sorting of heavy minerals (HM) and, consequently, they were interpreted to be in situ sands. In the present study, we use the distribution and chemical stability of heavy mineral associations. Zircon is the main contributor of Zr and it is very stable during diagenesis, we expect that large variations in the content of Zr reflect a detrital indicator. Other elements may also be carried by zircon and therefore reflect a parallel variation to Zr, or they may be carried by other minerals with hydraulic behavior similar to that of zircon. Some of these minerals are less stable and dissolve during diagenesis. Immobile elements from such minerals will be incorporated in situ diagenetic minerals and will still reflect the overall detrital indication, whereas other mobile elements may sort out and eliminate the detrital indications. Although some TiO2 minerals are very stable (rutile, anatase), others may easily dissolve during diagenesis (ilmenite, magnetite, hematite). In this study, we consider the similar hydraulic behavior variation of Zr and TiO_2 of heavy minerals. However, Ti is rather immobile and will generally re-precipitate “immediately” as leucoxene or anatase. Consequently, the content of TiO_2 can still reflect the overall detrital indication. The selection of elements that correlate with the content of detritus heavy minerals may vary, caused by different solubility of heavy minerals under different conditions, and because of different mobility of elements in different diagenetic environments.

Aragonite Mineralization in Area of Rakhiv-Tysa Fault of the East Carpathians (Transcarpathian Region, Ukraine)

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Processes of formation of mineralization take place in areas of Alpine orogenesis in zone of tectonic active faults, these processes are characteristic for the East Carpathians as well.

Rakhiv-Tysa fault crossing North-west part of Marmarosh crystalline massif and flysch Rakhiv unit, is a fragment of along transcurent Solotvyno – Nadvirna – Dubny fault of the East Carpathians. In zone of this fault a number of mineral water springs was found with high mineralization and very different chemical composition (including deposit of arsenic water with high content of microcomponents of deep origin, "Girska Tysa" is one of it) and point of current mineralization (travertine and different carbonate veins filled joints in the host sandstones) that could indicate on the tectonic activity of this fault.

In the studied mineralization points "Trostyanetsky" and "Stepaniv" one of the most widespread minerals is aragonite. In general, carbonate mineral composition is characteristical for all points of mineralization, and minerals like calcite, aragonite, manganous calcite, siderite, dawsonite, jarosite and realgar, sulphur are common. Samples were studied in laboratory with a help of complex methods: visual microscopy, X-ray analysis, ICP-MS method, electronic microscopy. Inclusions in minerals were investigated by thermobarogeochemistry methods (especially decrepitation, homogenization).

Aragonite at "Stepaniv" – form radiate–fibrous aggregates in the filling of joints in the host rocks. Habit of crystals is prismatic, acute-pyramidal and needle – shaped, size of crystals can attain 6–8 cm. Crystals of aragonite often has zonal structure and it is caused by presence of solid inclusions – crystals of realgar and native sulphur. Changes in the Ba, Fe, Sr content in growth zone of aragonite were distinguished by ICP-MS method. Content of Ba and Fe has been decreased from root part to periphery part along crystals, while Sr content increased.

At "Trostyanetsky" aragonite fill joints in the host rocks also but crystals are intensively fractured, habit of crystals is prismatic, size 2–3 cm. Phase ratio, aggregative state and temperature of homogenizations of fluid inclusions in aragonite were studied. In aragonite crystals at "Trostyanetsky" the primary two–phase (gaseous–liquid) and secondary one–phase (probably, liquid) fluid inclusions and solid protogenetic and syngenetic have been revealed.

Primary inclusions usually occur in growth zones of crystals as a singles large inclusions (50–200 μm) and group or inclusions. The inclusions of irregular shape are elongated, among of them occur flat (Fig. 1a.) as well as volume (Fig. 1b.) ones. In flat inclusions it is rather difficult to observe phase boundary between fluid inclusions and host crystal (Fig.1c.). Phase ratio in the primary inclusions range from 5 to 25% of gaseous phase and from 75 to 95% of liquid one. Temperature of homogenizations of such inclusions is 90–126°C.

Secondary inclusions are in the form of chains of elongated one-phase inclusions that occurs along transverse to the crystal elongation fractures. Size of these inclusions is very small (10–20 μm).

Figure 1. Pictures of different types of primary inclusions.

Results of the fluid inclusions in crystals of aragonite demonstrate that aragonite mineralization was formed from low-temperature hydrothermal solutions that circulated in area of Rakhiv-Tysa trancurent fault of the East Carpathians.

Mineralogy of Clay Gouges from High Tatras, Western Carpathians (Poland)

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The Tatra Mountains are part of Western Inner Carpathians. They consist of two main parts: Mesozoic sedimentary cover and Varscian crystalline core which is composed of various metamorphic rocks and granitoid intrusion. The core is cut by a number of shear zones along some of which the clay gouges have been formed.

The aim of this study was to determine the mineral composition of the clay gouges material and to make an attempt to determine the possible age of their formation. Due to the fact that most of the available clay gouge outcrops are located in difficult mountain terrain only 8 (Wołowa Turnia, Kozia Przełęcz, path to Plecy Mnichowe, path to Żleb Mnichowy from Galeria Cubryńska, upper part of Żleb Mnichowy, Żleb Pod Zadnim Mnichem, Wrota Chałubińskiego, Gładka Przełęcz), relatively easily accessible were sampled. Mineral composition of the bulk clay material and the separated clay-fractions (i.e. < 0.2 μm, < 2 μm, 0.2–2 μm, 2–10 μm) was analyzed using X-ray diffractometry. The Fourier Transform Infrared Spectrometry was used for analysis of the finest (i.e. < 0.2 μm) clay fraction. The sample from Kozia Pass was chosen for radiometric dating using ^{39}Ar-^{40}Ar method.

The composition of the gouges is as follows: quartz, Na-plagioclase, K-feldspar, dioctahedral micas (1M and 2M1 polytypes), dioctahedral smectite and chlorite. The mixed-layered R1 illite/smectite was also found in samples from one site (Żleb pod Zadnim Mnichem). Dioctahedral smectite, 1M polytype of mica and illite/smectite are likely to be formed *in situ* as a result of hydrothermal alteration of feldspars and biotite which took place during the formation of the shear zones. The presence of authigenic 1M dioctahedral mica allowed an attempt to constrain the age of hydrothermal activity which leads to its formation.

Genesis of Siderite Concretions

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The Middle Jurassic near Częstochowa town (Central Poland) begins with sandy deposits representing the Lower Bajocian to lowermost part of the Upper Bajocian (Kopik 1998). They are overlain by an up to 180 m thick, Upper Bajocian to Upper Bathonian sequence, comprising black clays and siltstones with ironstone concretions. These rocks are known as the Ore Bearing Częstochowa Clay Formation, famous due to the wealth of the extraordinarily preserved ammonites that are known since the nineteenth century. The Ore Bearing Częstochowa Clay Formation is currently well exposed in the Częstochowa Region in several clay pits. During a fieldwork in summer 2009 collected siderite concretions come from Gnaszyn, Anna and Leszczyński clay pits.

Siderite concretions are usually oval or spherical bodies within clayey sedimentary rocks. Siderite concretions were formed in the early stages of diagenesis. We can use them as a proxy, reconstructing the environmental conditions and the geochemical conditions of the early stages of diagenesis (Majewski 2000). Siderite concretions contain the structures of different type, both primary ones (e.g. lamination, fossils) and diagenetic ones (e.g. cone-in-cone structure, septarian structure). Septarian concretions very often contain an interesting mineralization. In this type of siderite concretions were found sphalerite, galena, pyrite, calcite, siderite and dickite (or kaolinite). These minerals reflect the geochemical conditions of the later stages of diagenesis.

Factors supporting forming of siderite concretions are:

- fine-grained sedimentary beds (claystone, mudstone, slates),
- accumulation of organic matter within the sediment,
- presence of ions of iron (II) in the sediment,
- pH ranging from 6 to 11,
- oxidizing-reducing potential from -0.4 to 0 V,
- high partial pressure of CO_2
- low concentration of sulphates and sulfides ions,
- presence of the iron reducing bacteria and the methanogenic bacteria,
- isolation from a sea water.

Siderite concretions appear in many geological formations around the World. In Poland we can find siderite concretions in the Krakow – Wielun Upland, in the Carpathian flysch, in the Silesia Upland and in the Zytawa Basin.

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Mineralogy and Geochemistry of the Metal Corrosion Products from the Wieliczka Salt Mine

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Corrosion is the disintegration process of metal under the impact of surrounding environmental conditions. In a salt mine, when the salinity of air and water is very high, the microstructural destruction is very fast and efficient.

The studied metal fragments of pipes and chain (their age is over 100 years old), at different stages of corrosion, were collected underground in the Wieliczka salt mine (average year temperature was about 13–16°C and relative humidity 63–65 %). During macroscopical observations two major layers of corrosion were recognized (external A and internal B), both of them, based mainly on the difference in color, were subdivided into two sublayers. In addition, black blebs, present on the surface of different metal fragments, were studied in details.

SEM-EDS studies showed various morphological forms with different chemical composition of Cl^-. The sublayer A-1 was composed of acinic aggregates of needle-shape goethite crystals and of kidney-focuses of spherical crystals. The sublayer A-2 was mainly composed of intergrown idiomorphic crystals of halite. Finely granular aggregates of magnetite dominate in the sublayer B-1. Goethite and akaganeite form spherical, fibrous and structureless aggregates in the sublayer B-2. All Forms of aggregates seem to depend on the chlorine content, 1–3,5 wt. pt. of Cl^- in the structureless aggregates and 5–10 wt.pt. of Cl^- in the regular ones. In addition in the B-2 sublayer crystals of lepidocrocite form the rosettes focuses. Blebs are built of needle-shape akaganeite crystals, which form fibrous aggregates in the skin and spherical ones in the interior.

XRD and FTIR determinations showed that the studied layers are built of: akaganeite, hematite, goethite, halite, magnetite, and subordinate amounts of lepidocrockite. Where they dominate, the layers reveal specific colors: magnetite – black (B-1), goethite – light brown (A-2) and grey brown (A-1), goethite and lepidocrockite – orange (B-2).

Based on a literature and performed studied a corrosion process of metal fragments was divided into three main stages. In the first stage was created lepidocrockite, which was then transformed into goethihte and akaganeite. Next the layer of akaganeite, which is unstable mineral, transform to more stable form of goethihte or when the environmental is under reduction conditions, to magnetite.

Petrographic Structure of Neoproterozoic Flood Basalts of the Volhyno-Polesie Depression (Volhynia Region, Ukraine)

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During last 20 years, in consequence of geological prospection in Volhyno-Polesie depression region, important information was received, which allow to look at mineralogical and petrographic features of flood basalts from new point of view.

Volhyno-Polesie depression is filled up by Neoproterozoic (the Polesie, the Volhynian and Valdai Series) deposits. The Volhynian Series is divided into (from bottom to top) the Brodovo Beds (aprox. 40 m), the Gorbashi Beds (~ 50 m), the Zabolottya Beds (to 85 m), the Babino Beds (to 200 m) and the Ratno Beds. The Ratno Beds, which is represented by lower Vendian flood basalt are subdivided into the Luchichiv Beds (consist of olivine containing and olivine-free basalts with beds of lava breccias,to 115 m), the Zoriano Beds (to 65 m of siltstones, sandstone, conglomerates with beds of subalkaline basaltic tuffs, trachybasalts, trachytes) and the Iakushevo Beds (high-titanium basalts and ferrobasalts,up to 135 m). All three basaltic flows, according to [1], assigned to Luchichiv Beds.

Three basaltic lava flows were assigned as a consequence of mineralogical and petrographical research of rocks and its postmagmatic alteration of the Ratno Beds basalts. They differ in rockforming minerals proportions, alteration degree, structural and textural features, and also presence of amygdales, veins and vesicles. There are two tuffs beds between basaltic lava flows as well.

The lower basaltic flow has complex composition. There are three types of basalts: aphyric, microporphyritic and amygdaloidal. They all display fine-grained, tholeiitic texture and volcanic glass was completely replaced. The amygdales in amygdaloidal basalts are filled with chlorite, chalcedony and zeolite. The rock display microporphiric texture, where phenocrysts are represented by magnetite and plagioclase.

The middle basaltic flow is zonal and representing amygdaloidal – aphyric – amygdaloidal basalts. All of them display fine-grained, even-grained, allotriomorphic, tholeiitic texture. Volcanic glass is almost completely replaced by palagonite and chlorite. The amygdales are filled with chlorite, zeolite, analcime, quartz.

The upper basaltic flow represented by the least altered aphyric basalts, the texture of basalts is fine-grained, even-grained, intersertal, allotriomorphic, tholeiitic. There is a volcanic glass in basalts, so that initial mineral composition of basalts is preserved. So there was no any influence of basinal fluids.

The crystal-vitric tuffs in the investigating area are highly altered and contain veins, threads and interstices filled with analcime, chlorite, and quartz.

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Quaternary Geology

Inland Dunes at Seda Plain

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The Seda Plain is located in the Northern Vidzeme lowland. It lies between the Vidzeme Upland, Burtnieks drumlin field, Sakala Upland, Aumeisteri and Karula interlobate highs. The highest points (~100 m a.s.l.) and most pronounced topography relates to the inland dunes, while the lowest part is occupied by the valley of the River Gauja (30 m a.s.l.).

Dunes spatial arrangement and morphological measurements were made in GIS environment using 1:10,000 scale topographic map. The inland dunes are common for the most part of the Seda plain. Concentration of the dunes reach up to 42 relief units per square km in the central, northern, and north-eastern part of the Seda plain, but there is no evidence of dunes in the southern part of the Seda plain. Absolute heights of the inland dunes vary from 46 m to 98 m a.s.l. with an average height of 65 m a.s.l. The maximal relative height of some dunes reaches 23 m, but on average it is 4 m. On the basis morphological complexity of dune pattern, simple, compound and comb types of parabolic dunes have been recognized. Simple parabolic dunes are rare, more common are compound and comb parabolic dunes, especially within dune complexes. It is possible to distinguish up to seven dune complexes with different dune patterns.

According to analysis of extend and azimuth of the long axis of dunes the main wind directions were from W to E, NW to SE and WSW to ENE during the phase of the dune stabilization.

In total 11 dune sand samples were collected for OSL (SAR protocol) dating. Samples were processed at the Dating Laboratory of the Finnish Museum of Natural History. Obtained results indicate that inland dunes forming sand were last bleached within timeframe from 6.4 ka to 11.9 ka BP. Most of the samples relate to the Preboreal, Boreal and Atlantic time (Fig.). The inland dunes with a topographically higher location of their base are younger than lower placed ones. It seems that good natural drainage conditions and sufficient amount of dry sand for wind transportation was available in topographically higher areas for longer period than it was in lower parts of Seda plain. Dating results reveal that formation of dune had been started in the Younger Dryas, but the end of dune activity in the Seda plain is related to the Atlantic time.

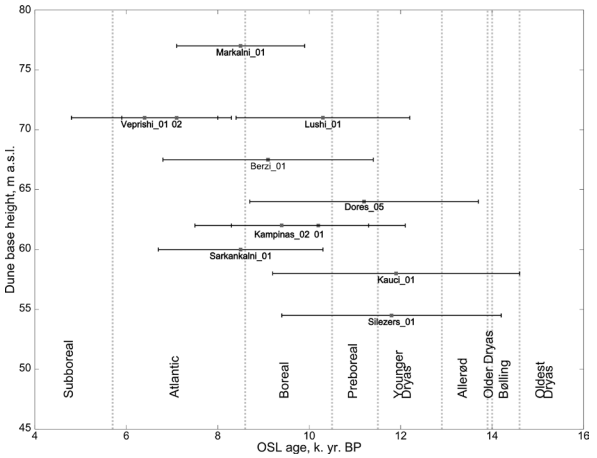

Figure. Age of the dune sand samples and dune base height at sampling sites.

Classification and Internal Structure of Kames Terraces

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The data obtained in the field studies indicate that the morphology and internal structure of kame terraces is much more complicate and different than it has been considered previously (Danilāns 1973; Meirons 1975; Straume 1979).

The results of morphological investigations carried out in the Vidzeme Upland suggest that two morphological types of kame terraces can be recognized in this interlobate area. The segment-type kame terraces stretch for a distance up to some hundred meters along the slopes of the largest composite glaciostructural and plateau-like hills of the central zone. These terraces are 75–125 m wide and up to 15 m high. Each terrace is morphologically expressed as a simple step-like elongated strip with a relatively smooth surface that widens downglacier.

The linear kame terraces are located in lower hypsometric positions. In the central zone of the Vidzeme upland the flights of these type terraces occur on walls of tunnel valleys, indicating periodic reduction of the glacier surface during terrace formation. For example, the kame terrace along Bānūži–Lode tunnel valley is almost 5 km long and 700 m wide. This kame terrace has four levels striking as staircases along the tunnel valley. Headwards of older and upper three levels record erosion by proglacial meltwater. Lower level of the kame terrace passes into kettled surface topography at the distal edge.

The source material of kame terraces forming glaciofluvial sediments are supraglacial debris, as well glacial deposits, particularly basal till of the transgressive stage of the Last glacial maximum, and pre-Quaternary bedrock, that have been eroded upglacier and redeposited downglacier as a result of lateroglacial sedimentation by meltwater streams. Therefore the lithic composition of these deposits differs to a great extent. Granulometrically these deposits correspond to boulder, cobble, pebble, gravel, coarse-grained or medium-grained sand fractions. The kame terrace sediments are characterised by graded cross-bedding, fascicular and cross-bedded textures, flat parallel and circumflex bedding. The bedding character is determined by properties of flows of glacier meltwater – velocity, intensity and saturation with deposit materials and other local circumstances (Āboltiņš and Markots 1998; Meirons 1975). The study results of the internal structure of the kame terraces in the highest central zone of the Vidzeme Upland indicate that the segment type terraces along plateau-like hills consist of the glaciolacustrine deposit of fine-grained sand, silt and clayey material, including even varved clay on the sequence topmost portion.

There are glaciofluvial, glaciolacustrine and complex (glaciofluviolacustrine) kame terraces depending on formation circumstances and internal structure.

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Diversity of Tors in Ridge Zones Near Munchel and Smotrec in the Chornohora Ridge (Ukrainian Carpathians)

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There are many spectacular tors in ridge zones in the Chornohora, especially on the NE side of the main ridge of this range. However they are still poorly studied – they were only mentioned in articles released before the World War II (Ossendowski 1936; Sujkowski 1938; Świderski 1938) and also lately (Liszkowski *et al.* 2003; Kłapyta 2006). Authors tried to make a contribution to further research. The area of interest was part of the Hoverla Unit of the Chornohora Nappe.

Fieldwork was done during autumn 2010 – lithology and morphology of the interesting objects were studied. Three nearby clusters were investigated: the first one near Kiedrowaty, the second one on Stepaniec and the last one near Smotrec. All tors turned out to belong to the chornohora series. Mostly they were massive sandstones and conglomerates, highly resistant to weathering and erosion. Generally the higher the elevation, the more conglomerates appear instead of sandstones. They are all dipping towards SSW, sometimes SSE, at the angles of 20° to 35°. It is worth to mention, that some of them have their own names in the local tradition: 'Doboszowy Sidiec', 'Żaba' and 'Wuchatyj Kamiń'.

Morphology of the tors is a result of several processes taking place in severe climate of alpine zone. Frost action causes both block and granular disintegration and also exfoliation, which can be accelerated by insolation. Granular disintegration is also supported by rain water, which flushes out cement. Grooves, niches and weathering bowls form as a result.

Tors usually took shape of towers or pulpits. Those which are built of beds different in resistance abound in elements of microrelief. Their height ranges from 1,5 m to 13,5 m, usually ca. 2 m. Width ranges from 1,5 m to 38 m and lenght from 1,5 m to17 m; those parameters typically don't exceed 5 m. The size of rock formations is the result of local rock resistance to local rates of denudation.

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Palaeoentomological Research in a Vicinity of the Abavas Rumba Waterfall, Western Latvia

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Although in studies of the Late Glacial and Holocene deposits in Latvia are used different approaches, palaeoentomological method is used rarely. It is possible to determine paleoecological conditions guiding from insect species and specifically living conditions nowadays because the fundamental concept of paleoentomology is that ecological niche preferred by any species has remained a constant throughout recent prehistory (Coope 1986; Morgan, Morgan 1990).

The study area is located 200 m downstream the Abavas Rumba waterfall, on the right bank of the river. In the course of the fieldwork 12 samples were collected and treated (no less than 3–5 kg each). Several thousands of plant, insect, algae and other organic remains were picked out from samples and the analysis of their assemblages has been performed. According to absolute age dating using radiocarbon method deposits began to accumulate already before 10,840±130 (Ri-7A) 14C BP (Zelčs, Markots, 2004), calibrated 12,670–12,800 cal BP.

Amount and variety of insect and plant remains are decreasing in direction from bottom to top of the sections. Most of organic remains occur in clayey and organic sediments layers. Overall degree of preservation of insects is weak. Their remains are damaged and sorted exoskeletons were fragmentary. It succeeds to identify from 80 remains just couple. Most of found insect remains were fragments of heads and legs, however relatively better lasted remains were elytra, thorax and capsules of heads. Significant amount of badly decomposed remains in underneath part of sections could be explained with thesis that remains of insects were washed from river bank already in disintegrated way, because none of the remains were from in water living insects. Commonly exoskeletons of insects are buried by deposits, which comparatively quickly decomposed and frequently most of them disintegrated (Lowe, Walker 1997).

In friable Quaternary sediments are commonly better kept parts of Coleoptera, rarely dipswitches skeleton (Buckland 2007). Considering that remains of insects are less resistant to rework as seeds and drupes, it explains different degree of preservation of various groups of representative trough researched sections.

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Glacial Landforms of the Madliena Tilted Plain, Central Latvian Lowland

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This research focuses on the morphology, spatial distribution and some aspects of the internal composition of the glacial landforms of the NE part of the Central Latvian Lowland, known as the Madliena Tilted Plain.

The elevation data for identification and digitization of the glacial topographic features were derived from the topographical maps of scale 1: 25 000 by using Arc View software. There were mapped 1353 glacial landforms such as drumlins, terminal moraines, recessional moraines, lateral shear moraines, eskers and other forms.

Most of the mapped landforms are of glaciotectonic origin. Their formation is contributed by lateral ice compression along western slope of the Vidzeme Upland and by uneven permeability of bedrock and Pleistocene strata. That cause level variations of pore water what has resulted in spotty bed deformation and basal decoupling. The field observations of sand pits prove that the Late Weichselian Riga (Zemgale) ice lobe flow emerged from a combination and fluctuation in time of subglacial bed deformation and basal sliding.

The greatest part of the Madliena Tilted Plain is occupied by drumlins, what forms the Madliena drumlin field composed of about 900 drumlins covering an area of 1248 km2. The length of the field is 70 km, whereas the width increases from 5 km in N up to 33 km towards S and decreases to 18 km at the distal end. The drumlin field is bordered by the Vidzeme Upland along its eastern side. The northern and southern boundaries of the drumlin field are marked by the Gauja and Daugava River valleys. The western side is transgressively covered by the Linkuva terminal moraine of the Linkuva or North Lithuanian reactivation phase. The landforms situated in the W of Linkuva moraine are recognized as recessional moraines. They are few hundreds to 5 km long and by tens up to one thousand meters wide. The distance between recessional moraines is a few hundreds of meters. It is assumed that the rate of ice retreat was up to a few hundreds of meters in a year.

Drumlins are originated during Middle Lithuanian (local term – Gulbene) deglaciation phase of the Late Weichselian glaciation by the reactivation of the Riga ice lobe. Most drumlins are cored by glaciotectonically dislocated Pleistocene deposits that mainly consist of sand or gravel; the flanks are covered by deformation till.

Most attention in this study was paid to the morphology of the drumlins. A geographic information system (Arc View) was used to collect a range of parameters on drumlins. A mean length of drumlins is found to be 810 m, a mean width is 320 m. A mean elongation ratio is 2.62, varying between 1 and 11.4. Most drumlins are between 200 and 1500 m in a length; between 100 and 600 m in a width; and between 1.5 and 5 times as long as it is wide. The most frequent length is 400 m, width is 200 and elongation ratio is 2.5. The longest drumlin is 5.76 km long, and the widest is 2.04 km wide.

The internal composition of drumlins was studied in the Brenceni sand pit. There were done directional measurements of planar structural elements on the strata compositing the drumlin. The internal composition was tested also by drilling and radiolocation by ground-penetrating radar. The highest part of drumlin is the stoss side; it is mainly composed of fine sand with interlayers of till. This material is squeezed out of glacier bed. The flanks of drumlin are made by thrusts of sand and till. The ice pressure was oriented from inter-drumlin depression during formation of the drumlin core and flanks.

Age and Origin of the Tufa in the Sąspowska Valley

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The distribution and geometry of the tufa and accompanying sediments, in the upper and lower segment of the valley was reconstructed. Five tufa facies were identified.

Tufa deposited in the lower part of the valley represents barrage model. Five tufa barrages were reconstructed. They are built of stromatolitic, oncoidal and phytoclast tufa. Remaining two facies – intraclast and microdetrital tufa – formed the filling of the barrage lakes, mixed and intertwined with associated deposits, such as clay, sand and loess. Those sediments were deposited in a calm environment with high energy periods.

Tufa deposited in the upper part of the stream represents braided fluviatile tufa model. The tufa consists of oncoidal, phytoclast and microdetrital tufa, intertwining with each other. Those deposits, representing both, low and high, energy environments, are built of phytoclast and microdetrital tufa and oncoidal tufa. The latter developed within channels.

Peat deposits were dated by 14C (9240 ± 70 years BP), which points to the Boreal period, but the 3D configuration of the facies reveals that accumulation of tufa in the Sąspowska Valley predated and postdated peat accumulation. Seeds found in the peat suggest that organic matter was deposited in the shallow water environment, not in a typical peat-bog. Identified snail mollusk shells show that the environment prevailing at the beginning of the tufa deposition was mainly woodless grasslands, which were gradually changing into moister environment or even swamp. Next grassland areas, which redeveloped, were slowly changing into moister environment.

Inland Dunes in the Eastern Part of the Central Latvian Lowland

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Inland dunes are widespread phenomenon in the territory of glacial lowlands of central and northern Latvia. These oldest aeolian formations are located far for modern shoreline of the Baltic Sea.

The dunes in the eastern part of the Central Latvian Lowland started forming in the cold and dry climate just after deglaciation of the last Weichselian glaciation. However, during the Late glacial the primary shapes of inland dunes underwent some transformation. As a result of human activity, the most significant local activation of aeolian processes, mainly manifested in a way of dune sand over-blowing, started at the end of the 18th century and continued up until the middle thirties of the 20th century. Currently, nearly all dunes are covered with vegetation and no aeolian processes are taking place. The inland dunes in the study area are spread out unevenly, grouped in dune massifs of differing sizes. Widespread are parabolic dunes that settled on glaciolacustrine, fluvial and deltaic sediments. The maximum recorded parabolic dune length between the extremes of both dune wings ranges is 6 km. The inland parabolic dunes mainly consist of fine-grained to medium-grained sand. A relative relief varies from several metres to 28 m. The typical cross-profile with a steeper and shorter dune slip face is common feature of the parabolic dunes. The radius of the biggest parabolic dunes reaches approximately 1.3–2 km. However, the parabolic dunes with a radius that does not exceed 0.3 km predominate. Certain regularity in parabolic dune horn symmetry can be observed. The parabolic dunes with larger radius have more asymmetrical horns. Therefore, smaller dunes have better dune horn symmetry than bigger ones. This regularity of the dune horns, possibly, can be observed due to the fact that the dunes that are larger for a longer time were subjected to geological influence of wind and as a result greater asymmetry of the horns has been formed. It is possible that smaller dunes were formed and were subjected to aeolian activity for a shorter time. As a result their primary horn symmetry is well preserved. During the dune formation process, the directions of palaeowinds were from W and NW.

Lithological Characteristics of Glaciomarine Sediments in the Forefield of Hornbreen Tidewater Glacier (Brepollen Bay, Hornsund, Spitsbergen)

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The rapid retreat of tidewater glaciers, observed in the subpolar fjords of Svalbard from the beginning of the 20th century, resulted in apparent increase in the sediment accumulation rate and outcropping of glaciomarine sediments in their forefields. Sedimentation in the forefield of tidewater glacier is dominated by formation of submarine moraines and outwash in the grounding line zone, turbidity currents and debris flows, suspension sedimentation from turbid meltwater plumes, iceberg rafting and biogenic sedimentation. The intensity of these processes depends on the proximity to the grounding line zone, the extent of iceberg zone and fjord bathymetry. Grain-size analysis of glaciomarine sediments from the forefield of Hornbreen tidewater glacier, located in Brepollen Bay (Hornsund, Spitsbergen), provided a new data on sediment distribution and transport mechanisms controlling it. Twenty nine surface samples and nine cores of maximum length of 23 cm, collected at distances from 0.5 km to 9 km from the head of the glacier, were analysed. The majority of samples consist of poorly sorted and very poorly sorted mud and sandy mud with grain-size distribution from unimodal (domination of medium silt) to trimodal. The content of sand decreases rapidly from ≈30% to ≈5% with increasing distance from the head of the glacier to the line of 3.5 km. In the more distant part of the bay this decrease is much slower and the average content of sand smaller (≈1%). The content of sand in samples located on the transverse section of Brepollen Bay is ≈2% higher in samples situated closer to the shore than in the central one. No correlation between grain-size distribution and bathymetry has been observed. Psamitic fraction consists mainly of mineral and lithic grains. Skeleton fragments of marine organisms and foraminifera are less numerous.

Sedimentology

Sediment Dynamics in the Kolkasrags Shoal

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The Cape of Kolkasrags is the northern irregularity of the Kurzeme peninsula jutting out from the coast where the Irbe strait meets the Gulf of Riga. The nearshore zone accumulative extension (Kolkasrags shoal) of the Cape of Kolkasrags was formed during the Litorian and Postlitorian sea stages. The Kolkasrags shoal is up to 4–5 km wide, with steep slope to the Gulf of Riga. Wind induced currents are the main mechanism that causes bottom sediment movement in the coastal zone of Irbes strait. The most important is the Eastern Baltic longshore sediment flow caused by prevailing SW and W winds, which is traceable on the upper part of the underwater slope from the Cape of Taran to Cape of Kolkasrags. The Eastern Baltic longshore sediment flow ends in an area surrounding Cape of Kolkasrags where material carried by flow is deposited in the 6 km long shoal.

The research was conducted in the Kolkasrags shoal. For analysis, 416 bottom sediment samples were taken with the Van Veen grab sampler. The sample points covered the study area in a hexagonal grid (intersection point distance – 250 or 500 m) from the swash zone to a depth of about 7 meters. To analyze the change of the granulometric composition of sand, 14 fractions were chosen: >1mm, 1mm–800μm, 800μm–630 μm, 630μm–500μm, 500μm–400μm, 400μm–315μm, 315μm–250μm, 250μm–200μm, 200μm–160μm, 160μm–125μm, 125μm–100μm, 100μm–80μm, 80μm–63μm, 63μm–50μm. Grain size parameters (mean grain size, sorting and skewness) were calculated using logarithmic method of moments. These parameters were used to form eight possible grain size trends – two of these are used to derive a residual pattern: CB+ and FB-. QGIS plug-in GiSedTrend was used to compute vector fields. GiSedTrend plug-in allows us to perform a two-dimensional Grain Size Trend Analysis (GSTA).

The findings in the study area show that average grain size ranges from 2.6 to 3.2, corresponding to fine sand. Typically the location of coarse grain material corresponds with the location of Kolkasrags shoal where the water depth is between 2 to 4 m, as well as near the Gulf of Riga and Irbe Strait coast. Outside this area, where depth is greater finer grained sediment is more common. All sediment samples from the study area show good to very good sorting within limits of 0.2 to 0.4. No distinct sorting patterns were observed in the study area. Typical skewness values of sediment samples from study area are from –2.4 in the Kolkasrags shoal to +5.5 in adjacent areas. Such division is most likely caused by more intense effect of currents, which prevent accumulation of fine grained sediment fractions in the Kolkasrags shoal.

The results obtained from the GSTA show the net sediment transport pathways towards the Cape Kolka shoal from the Irbe Strait (W) and Gulf of Riga (SE). This coincidence is natural – sediments from the W are moved by prevailing SW, W winds, but the sediments from Gulf of Riga side may be moved by ebb currents. Weakest sediment movement trends show up in the central part of Kolkasrags shoal, which can be characterized as a transit and accumulation zone.

Hybrid Sediment Gravity Flow Deposits: a Revision of the Modern Conceptual Models and an Introduction into a Case Study from the Polish Outer Carpathians

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Until quite recently, sediments deposited from turbidity currents were generally classified in terms of sedimentation either from exclusively low-concentration flows or from exclusively high-concentration flows. While the mechanics of these flows are complex itself, during the last years there has been growing evidence that the identification of origin of many of the distal facies in both modern and ancient turbiditic beds requires application of the whole new attempt to the problem of the deposition conditions and flow evolution. Considerable part of sediments of the distal submarine fan reveals features that imply cooperation of at least two processes – progressive aggradation from turbidity currents and en masse freezing of debris flows as well. Therefore many researchers suggest that some of the turbiditic beds, especially the distal ones, may require reinterpretation as they appear to be more commonly associated with the rapid arrest of a debris flow than with the gradual fallout of suspended load from a turbulent particular flow. Such sediments are usually strongly multifractional, characterised by the high mud matrix content with the addition of different amounts of more coarse material and by the common presence of mudclasts. In the Polish terminology they are often referred to as 'skamieniałe błoto', which in literal translation means 'fossilized mud'. Closer description of their origins and processes responsible for their formation is however quite problematic and, depending on the specific author's idea, may include a number of different factors. The main aim of this presentation is to review and to juxtapose main up-to-date conceptual models and theories regarding this topic, from slurry flows and slurry sediments conception, through the idea of hybrid gravity flow sediments and deposition of co-genetic (linked) debrites, to the hypothesis of hyperpycnal flows and syndepositional seismic disturbance. The secondary aim is to introduce the listeners into the specific case study from Polish Outer Carpathians (Magura Beds from the Siary Zone, Magura Nappe) which in the future may become a field example proving one of the mentioned models.

Palaeoenvironmental and Stratigraphic Approach to the Middle-Keuper (the Upper Triassic) Sediments from Southeastern Silesia (Poland)

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Despite the decades of geological studies on the Middle Keuper (Norian) from southern Poland, its stratigraphic scheme, as well as palaeoenvironmental interpretations are still vague. The reasons for that are the paucity of index fossils, considerable facies changes and scarcity of outcrops. Detailed sedimentological analysis with comprehensive multi-stratigraphic approach will provide the base for reconstruction of the Middle-Keuper depositional history in the south-eastern part of the German Basin.

The Middle Keuper consists mainly of variegated mudstones and claystones with minor contribution of sandstones, freshwater limestones and dolomites. Studied sediments represent the fluvial palaeoenvironments situated in southern, marginal part of the Central European Basin and strongly influenced by climate variations.

Detailed sedimentological and palaeomagnetic studies allowed to reconstruct the depositional environments and to create a magnetic polarity scale for the Upper Triassic sediments from Upper Silesia. Three main facies associations have been distinguished: fluvial (braided/meandering rivers environments), alluvial (sheet-flood deposits) and palustrine (represented by freshwater limestones). Within the fluvial facies, "Fossillagerstätten" of dicynodonts and tetrapods occur. Sedimentary features suggest that sedimentation took place under semi-arid climatic regime with temporal flood events.

For palaeomagnetic studies about 100 m long drilling core from Woźniki has been used. It encompasses almost of the entire succession of the Carnian-Norian interval. The succession reveals a continuous transition from marginal marine conditions to terrestrial environments. The development of clastic succession reflects climatic variations. The palaeomagnetic analysis has revealed that a number of zones of normal and reverse magnetic polarity exist, which allowed to correlate them partially with the Geomagnetic Polarity Time Scale (GPTS) and the magnetostratigraphic scale developed for the boreholes from central part of the Central European Basin. It has been shown a good correlation of the time of deposition of Schilfsandstein facies both in Polish and German part of the German Basin and less pronounced correlation between the ages of sedimentation of the Upper Gypsum beds.

Karst Forms in Travertines of Northern Slovakia: Morphology and Development

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In the Northern Slovakia travertines form buildups, mainly large hills (up to a few kilometers of lateral extent), cascades and terraces. Presently their deposition is very limited or does not occur at all. Within some of the inactive buildups particularly Plio-Pleistocene in age several surface and subsurface karst forms has been studied.

Among the surface forms in travertines karrens are predominant. Observed forms are mainly elongated in shape and have up to several decimeters in lateral dimensions and up to 10 cm in depth. They display well developed smooth edges commonly orientated parallel to a slope inclination (between 10 and 90 degrees). Subsurface forms are represented by caverns. They are developed along widened (up to a few decimeters) vertical fissures (due to gravitational and tectonic processes) and along bedding planes of the travertine (due to dissolution of more porous travertine). Caverns reach up to tens of meters in length/depth and a few decimeters in width. Some of them narrow downward. Cavern walls surfaces are commonly irregular and serrated. Part of them have smooth walls and are unroofed, some are partly of fully filled with terra rossa type deposits and/or speleothems. Speleothems are developed as laminated flowstone covers with certain columnar and acicular microfacies, typical of vadose zone speleothems (Wróblewski et al., 2010).

Study demonstrate that mentioned above karst forms are developed after lowering of water table leading to the disconnection of travertine deposition system from the supply of high-mineralized waters. The dominant waters migrating through the travertine and leading to it karstification became meteoric waters. U-series dating of speleothems from Dreveník travertine conducted by Wróblewski et al (2010) confirm that changes in water circulations took place earlier than 226 ka. Recent studies carried out on Sivá brada hill (site of travertine active deposition) by Gradziński et al. (2010) suggest that intensification of the travertine karstification could also be resulted by supersaturation of meteoric waters by endogenic CO_2 in the epikarst zone.

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Localization of Sandy lenses and their Reservoir Qualities in Ancient Deep-Water Systems on Case Study of Achimov Formation, North Part of West Siberian Basin

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Most of simple anticline traps in world petroleum basins have been drilled to present time. As a result exploration is focused on complicated stratigraphic traps. Ancient gravity-driven processes dominated in deep-water slope environment often formed this trap type. The main problem is to predict localization of sandy lenses and their reservoir quality because of the complex structure, defined by their origin. The good example is Achimov Formation in West Siberian basin. More than 100 oil and gas pools have already been discovered in this formation, and further production possibilities of the Achimov formation are huge.

The work is based on results of complex interpretation of seismic and well data using sequence stratigraphy method. There were identified sequences of 4th to 5th order formed during 3–5 My. Four tracts are usually indicated in a sequence: falling stage system tract (FSST), lowstand system tract (LST), transgressive system tract (TST) and highstand system tract (HST). (Catuneanu 2006) The sandy lenses in Achimov Formation were formed during FSST and LST. In this time interval no deposition was present on the shelf, although gravity-driven processes acted on the slope of the relatively deep water depression. Sandy bodies were deposited close to the slope and their spatial distribution depended on sea-bottom relief. During TST and HST clay members were deposited over silty-sandy fans. This sedimentological cycle was repeated again and in such a way prograding fan deposits were formed, causing perfect conditions for formation of sandy reservoirs overlapped by clay seals.

Four main processes are responsible for sediment transport from shelf break to deepwater system: slide, slump, debris flow and turbidity current. Each process has its own physical characteristics and accordingly causes formation of different deposits with different reservoir quality. (Shanmugam 2006).

Lithological evaluation of core data gave reasons to claim that sandy lenses in Achimov Formation were formed mainly due to debris flows, although other three processes had also significant influence. Five main lithotypes were recognized: 1 – massive fine-grained sandstones with floating mudstone clasts; 2 – clayey fine-grained sandstones contorted in different grade, in some cases with sandy or clay injections; 3 – thin parallel-laminated and ripple-laminated silty-shale fine-grained sandstones; 4 – siltstones and mudstones with normal grading; 5 – thin laminated dark-colored bituminous mudstones. First and second types formed in different parts of debris flow. The third type indicated grainflow reworked by bottom currents. The fourth type deposits accumulated after muddy turbidity currents and the fifth type represented hemipelagic claystones.

Thus, localization of sandy lenses and their reservoir quality depend on relative sea level cyclicity, sea bottom relief, sediment supply and type of gravity-driven processes.

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Lithological and Geophysical Investigation of Bajen Reservoirs, Central Part of West Siberian Basin

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Bajen formation is one of the main source rocks in the West Siberian Basin. But nowadays it is of great interest for scientists as an unconventional reservoir. Today more than 70 fields were discovered with accumulation of oil hydrocarbons in the Bajen formation. On the most studied Salym field reservoirs are represented by foliaceous argillites with fractures which formed during the hydrocarbon generation. The main goal of this work was to isolate Bajen reservoirs in the central part of West Siberian Basin and research their features.

Our lithological studies of Bajen reservoirs are based on the core from 2 wells and included rock samples description, a detailed macroscopic description. Microscopic description of rocks in thin sections and scanning electron microscope were carried out for more detailed studies of rock structure and composition. We analyzed geophysical data – well logging in 24 wells – for to determine the intervals flow.

According to detailed core analysis reservoirs of Bajen formation in central part of West Siberian Basin are represented by siliceous and carbonate rocks with rigid framework. Results of petrophysical investigation demonstrate that there are two types of reservoirs. First type is a pore reservoirs are composed of dolomitic siliceous (radiolarite) rocks with porosity is about 16% and secondary limestone with porosity is less than 10%. Secondary type is fracture-cavernous reservoirs, which are represented by shale-siliceous-carbonates rocks. Also well productivity was confirmed by the field geophysical survey data.

At final step we made the model of the reservoir's distribution in Bajen formation, which was based on seismic attributes and results of lithological and geophysical investigation.

Stratigraphy and Palaeontology

Badenian Microborings from Southern Moravia Area and their Value for Paleoecologic Interpretation.

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Miocene (lower Badenian) clays in the eastern Bohemian locality Česká Třebová provided finds of a microboring *Planobola macrogota* (Fig.) which is significant for shallow marine settings (few dozens of metres of depth as the maximum). In comparison, South Moravian localities of the same age and rock composition provided different assemblages of microborings that are significant for depths of hundreds of metres.

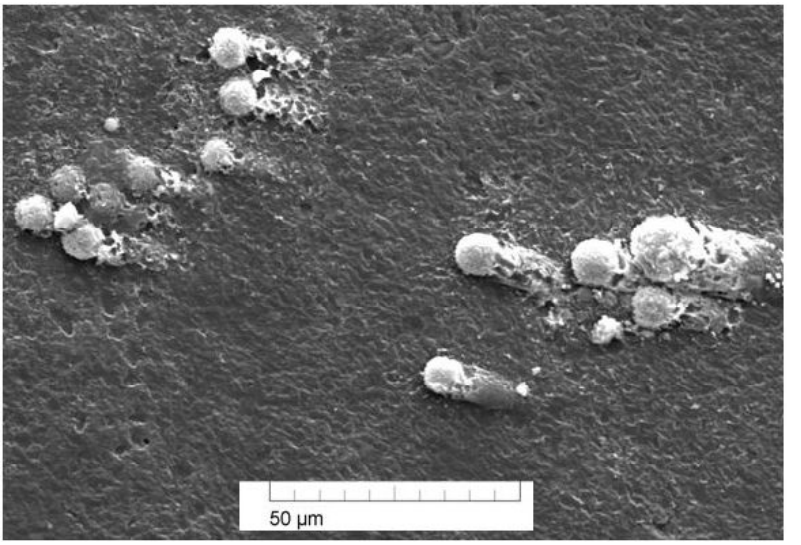

Figure. Microborings *Planobola macrogota* from locality Česká Třebová-cihelna. SEM image, Erlangen University.

New Stratigraphical Data from the Vârciorog Formation, in Fâşca Area, North Western Part of Pădurea Craiului (Apuseni Mountains), Romania

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The area under study is located in the north western part of Pădurea Craiului (Apuseni Mountains), at about half the distance between Vârciorog and Aştileu localities.

The Lower Cretaceous deposits from Pădurea Craiului were subdivided into the following lithostratigraphical units (Bucur & Cociuba, 2001): (1) Blid Formation, (2) Ecleja Formation, (3) Valea Măgurii Formation, and (4) Vârciorog Formation.

The deposits cropping out near Fâşca village consist predominantly of grey, sometimes siltic marls, which locally include massive limestone breccias.

The depositional environment is characterized by carbonate (turbiditic) flows incorporated in the marly sediments, which are coarser proximally (with orbitolinids) and finer distally.

The Lower Cretaceous deposits studied in the outcrops from Fâşca belong to the Vârciorog Formation (Aptian–Albian). Within the carbonate deposits of this formation we have identified the following foraminiferal assemblage: *Mesorbitolina texana* (ROEMER), *Sabaudia minuta* (HOFKER), *Glomospira* sp., *Lenticulina* sp.,*Gaudryna* sp., *Textularia* sp., *Nezzazatinella* sp., *Orbitolinopsis* sp., *Meandrospira*. Additionally fragments of rudists, echinid spines, corals and bindstone with *Bacinella* were evidenced.

The association (particularly *Mesorbitolina texana*) indicates a Late Aptian–Albian age.

The microfacies types identified in this limestone are: fenestral mudstone, fenestral mudstone-wackestone, bioclastic packstone, and peloidal-wackestone-grainstone.

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Carbonate Facies Anlysis by Using Paleontological Data: Rajamandala Formation, Pasir Aseupan, Sukabumi, West Java,

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In study of ancient reefs of Rajamandala Formation in the Pasir Aseupan field, it is essential to integrate both lithological and palaeontological data. This study interpreted the facies or this reef by comparison with modern reefs, fossil reef-builders, standard facies belt, and by use of GPS plotting data. The fossils are represented by molluscs like pelecypod Pectinidae and gastropod Vermentidae sometimes associated with carbonate reef builders like domal coral, head coral, branching coral, platy coral and algae. The mollusc shells and coral fossils give a lot of information showing the depositional mechanism and environment.

Based on correlation of section profil compared with standard facies belt by Wilson (1975), in the Oligocene-Miocene Rajamandala Formation in Pasir Aseupan field 2 repetitive depositional cycles are present. The deposition began from deeper (fore slope) environment to the more shallow environment (organic build-up) marked by layer profile A.4 and changed back to deeper environment (fore slope) and again to the more shallow environment (organic build-up) marked by layer profile C.1 and it was ended in deeper environment.

Campanian–Maastrichtian Deposits of Epeiric Sea of Southern Poland: a Case Study from the Nida Trough

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Nida Trough is a part of the Mid-Polish Trough, one of the major Alpine tectonic elements of extra-Carpathian Poland. The Cretaceous deposits, represented by the Upper Albian – Lower Maastrichtian, unconformably overlie the Jurassic substrate and in the central and southern part of the trough is covered by the Miocene deposits of the Fore-Carpathian Depression. The lithology and stratigraphy was the subject of several papers (Sujkowski 1926 1937, Rutkowski 1960, 1965, Jagt *et al*. 2004) and many others. During Late Cretaceous Nida Trough was covered by the epicontinental sea with domination of carbonate sedimentation. The Cretaceous succession of the Miechów Upland may be divided into two parts: lower part is represented by Albian through Santonian deposits, and upper part comprising Campanian and Lower Maastrichtian deposits, with total thickness estimated about 350 m (Jagt *et al.,* 2004). This study is focused on elucidation of sedimentary succession and inoceramid-based high resolution stratigraphy.

Campanian siliceous limestones (opokas) are well exposed along the western_margin of Nida Trough. Lithological studies in twenty localities revealed the variable composition of the Campanian sediments consisting of mainly siliceous limestones with or without cherts, with marly intercalations and rarely limestones. Two horizons of baculid and inoceramid concentrations were recognized in the Campanian opokas at Rzeżuśnia quarry. During the field works in Jeżówka village hardground surface between the Lower and Upper Campanian was recognized. Hardground developed on the glauconitic limestone conglomerate with echinoids, sponges and microbial mats on the surface. Maastrichtian opokas and sandy limestones were recognized in three outcrops (Pełczyska, Drożejowice and Strzeżów) in the central part of Nida Trough. Two horizons of inoceramid concentrations (mainly *Endocostea typica* and *Cataceramus subcircularis*) were recognized in Drożejowice and Pełczyska.

Diversified lithological and faunal composition including hardgrounds and fossil concentrations imply a great potential of this region as a key area for correlation of the Campanian and Masstrichtian deposits in Poland and Europe. High occurrence of inoceramids outline high biostratigraphical potential this bivalves form Campanian and Maastrichtian sediments.

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Trace Fossils Assemblage in Rhodoliths from the Paleocene Flysch at Brzyska (Istebna Beds, Silesian Nappe, Polish Outer Carpathians)

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Rhodoliths occurring in sandstones and granule to pebble conglomerates outcropped at the Brzyska village (Pogórze Ciężkowickie, S Poland) have been investigated with respect to the character and origin of enclosed borings. The rhodolith-bearing deposits belong to the Istebna Beds (Maastrichtian–Paleocene) constituting the flysch succession of the Silesian Nappe of the Polish Outer Carpathians. Features of the rhodolith–bearing deposits indicate deposition by high-density turbidity currents and debris flows. The rhodoliths are accumulated in few beds (1 to 1.5 m in thickness) appearing to represent the Paleocene part of the succession.

The rhodoliths are one to several centimeters in size and show spheroidal shape with a warty surface and laminar internal structure. They are composed of thin thalli of coralline red algae, mainly of the genera *Lihtotamnion* and *Mesophyllum.* The rhodoliths are characterized by numerous, differently distributed borings. Referring to morphology and size, these borings represent ichnogenera *Trypanites*, *Gastrochaenolites* and *Entobia*. They were produced respectively by polychaetes and/or barnacles, sponges and bivalves.

Borings of the ichnogenus *Trypanites* are characterized by cylindrical, straight and elongate tubes. Their sizes reach 0.3–0.6 mm in diameter and 0.8–1.6 mm in length. They show smooth walls and are filled with calcisparite. These traces fossil are common in the inner and middle part of the rhodoliths. *Gastrochaenolites* borings are characterized by elliptical, elongate single chamber. Their sizes reach 2.5 mm in diameter and 1 mm in length. The infilling sediment (packstone/wackestone-type carbonate) consists of fragments of coralline algae, bryozoans, echinoderms and foraminifera, subordinately quartz grains. Borings of this ichnogenus are very common in the inner and middle part of the rhodoliths. *Entobia* is represented by single or multiple irregular chambers, often connected. The size of single chamber reaches 0.1 mm in diameter and 0.4–1 mm in length. These borings are very common in the middle part and relatively rare in the inner and outer part of the rhodoliths.

The occurrence of rhodoliths mixed with coarse sandy to pebbly siliciclastic material together with rhodolith shape and location of borings indicate origination in shallow water, high energy environments, on a coarse sandy to pebbly siliciclastic substrate. Sedimentary structures of the entire succession enclosing the rhodolith-bearing deposits indicate final redeposition and burial of the deposits in a deep–sea setting.

Microbal Crusts and Micro-Encrusters in the Upper Jurassic Limestones from Bistrița Valley (Buila-Vănturarița massif, South Carpatians, România)

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The Upper Jurassic Stramberk type deposits from the Buila-Vânturarița Massif are mostly composed of massive reef limestone outcropping in large areas on the central and south-western part of this region. Their Kimmeridgian-Tithonian age was established based on the micropaleontological assemblages of calcareous algae and benthic foraminifera. A large part of the reefal limestone is made up of microbial-coral facies associated with a large variety of carbonate crusts. Microbial and encrusting organisms have an important role in generating various types of structures, and they are important elements in the interpretation of the depositional environment. During the Late Jurassic these types of structures have been important components for the stabilization of the reefal frameworks and slope carbonates. The samples collected from Bistrița Valley revealed a large number of encrusting organisms and microbial-type associated structures such as: *Crescentiella, Radiomura, Bacinella,* etc. Together with other identified taxa (e.g. foraminifera, corals, sponges and bryozoans) the microbial-encrusting-type structures indicate a transition from the fore-reef domain to the reef-buildups.

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Geology and Stratigraphy of Gunungpati Region, Pati, Central Java, Indonesia

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The research area is located in the Gunungpanti Region, Pati, Central Java, Indonesia, with geographical position 6°52'30" – 6° 56'30" S and 111° 0'30" – 111° 7'00" E. Research area is represented by landforms such as karst hills and monoclinic hills. The rivers show dendritic distribution pattern and geomorphic intermediate stages.

Geologically the research area is located in Rembang Zone of the Northern East Java basin. The deposits are represented by the Middle Miocene (N11–N12) claystone and sandstone with limestone intercalation unit of the Tawun Formation, Ngrayong Member, which was deposited in transition zone to outer neritic environment. A layered limestone unit of the Bulu Formation of Middle Miocene (N12–N13) was deposited in middle neritic zone. Middle-Late Miocene (N14–N16) claystone unit with limestone intercalation of the Wonocolo Formation was deposited in outer neritic– middle neritic environment. The Late Miocene-Pliocene (N17–N18) Ledok Formation was deposited in outer neritic to upper bathyal environment. Marl unit of the Pliocene Mundu Formation (N18–N20) was deposited in bathyal upper to outer neritic zone. The Pliocene (N21) limestone unit (Mundu Formation, Selorejo Member) was deposited in the outer neritic environment and claystone units of the Lidah Formation Pliocene (N21) was deposited in the inner neritic environment. After the deposition of the youngest unit, the region was affected by the approximately NE – SW directed stress that formed the fold structures. These processes were caused by the Plio-Pleistocene tectonics.

New Geological Data on the Sedimentary Cover in the Pre-Ural Foredeep

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Available geological and geophysical material provides insights into the structure of the upper part of the sedimentary cover. At the same time Pre-Devonian part was drilled only by few wells, studied fragmentary and requires further research. Some researchers believe that the deposits of Riphean and Vendian lay on the Devonian deposits, and the Lower Paleozoic (Ordovician and Silurian) is missing within the Pre-Ural foredeep, appearing only on its eastern margin and in the folded structures of the Urals. These authors (Belokon, Gorbachov, Balashova 2001; Ardasheva, Belyaeva, Valeev 2004; Isherskaya, Romanov 2006) postulate that there are carbonate sequences of the Riphean age. But we think that the Paleozoic deposits are more widespread, and a part of carbonate deposits belongs to the Lower Paleozoic. Resolving this problem has a practical value. Carbonates of the Late Paleozoic age have more perspectives for exploration of hydrocarbons.

Ambiguity in determining the age is explained by many reasons. For example, geological sections have been correlated only by drilling data for a long time. We studied deposits in a depth of 5–8 km and they are penetrated by only few wells.

And now there are some facts about findings of Paleozoic fossils in the rocks, traditionally related to the Precambrian. In particular, there is a report of E.V. Chibrikova (Chibrikova 2006) on findings of the Silurian to Lower Devonian plant microfossils in the rocks of previously supposed Riphean age in wells 6 Akhmerovo and 5 Sheehan.

At the present time seismic investigations are developed extensively. Tracing borders through the entire sedimentary basin have become possible. We have correlated interpretations of regional profiles crossing the south part of Pre-Ural foredeep, and we realized that these interpretations don't suit to each other.

In the southern part of the basin the Pre-Devonian complex of deposits was drilled and his age was proved by findings of fossils (Lower Paleozoic). We have compiled a composite profile, pr. Mednogorsk – pr.40 – pt.37 – pr.7 – pr. South Urals, and traced this complex in a northerly direction, thus we proved that the deposits of the Lower Paleozoic age are more widespread than previously thought.

To clarify the Paleozoic history we built curves of tectonic subsidence by using data of some wells. We made the analysis of facies in these wells. Thus, we can conclude that the majority of Pre-Kungurian sub-salt deposits formed in shallow water zone of outer shelf (depth to 70–100 m). From time to time, terrigenous material was derived from the platform and was deposited here. The deepest, depressional environment existed in Upper Carboniferous and Early Permian time in the central part of the Pre-Ural Trough (depth of the basin from 500 to 2000–3000 m).

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The Morphology of a Late Devonian Placoderm Fish *Bothriolepis Jeremejevi* Rohon from South Timan, Russia

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The first description of *Bothriolepis jeremejevi* Rohon, 1900 was based on fairly incomplete material, compared with current, and accompanied with rather poor quality drawings (Rohon, 1900). Since the first revision of material collected by the "Timan Expedition" led by the T. Chernisov during 1889 and 1890, revisions also were held by V. Gross (1932) and E. Lukševičs (in prep.). After the revision of V. Gross *B. jeremejevi* subsequently was designated as *nomen dubium* (see Gross 1932). Morphological description of *B. jeremejevi* presented in this paper is based mainly on the material collected during the field research in July of 2009 of the joint Russian–Swedish–Latvian expedition.

The redescription is based on more than three hundred disarticulated bones and some partially articulated skeletons. Material represents almost all bones, except orbital bones, rostral (*rostrale*) and pineal (*pineale*) bone. 225 plates were analysed morphometrically in total. Statistical methods were used to compare morphometric indices of fossil remains of *B. jeremejevi* with *B. leptocheira curonica* Gross, 1942 from the lowermost Famennian of Latvia. *B. jeremejevi* was also compared with *B. leptocheira leptocheira* Traquair, 1893 from Scotland. Relative size and proportions of skulls and plates in *B. jeremejevi* and *B. leptocheira* were compared using the Biomorphix software (Novikov *et al*. 2003).

B. jeremejevi with median dorsal armour length 153 mm is a relatively large fish with elongated anterior median dorsal plate (AMD), long and narrow orbital fenestra and slender pectoral fins. Size and position of orbital fenestra is feature of the head shield that is very similar to that in *B. leptocheira leptocheira* and *B. leptocheira curonica*. Relatively broad anterior margin and very short posterior margin is typical for premedian plate. Slightly expressed dorsal median ridge appears only on the posterior median dorsal plate (PMD). This plate is comparatively broad with the breath/length index 91. Pectoral fin six times longer than broader appears long and slender. Ornamentation is fine and basically of reticular type, but in some marginal zones of the head and pectoral fin plates it becomes arranged in ridges. Position of the infraorbital sensory groove, supraorbital sensory line and supraoccipital groove are very similar to that of *B. leptocheira leptocheira* and *B. leptocheira curonica*. In many features *B. jeremejevi* is very similar to *B. leptocheira leptocheira* and *B. leptocheira curonica* nevertheless slight differences exist in proportions of the head shield, AMD plate and position of the ventral lateral ridge on the posterior ventral lateral plate (Stūris, 2010).

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Mineral Composition Characteristics of the Upper Devonian Daugava and Plavinas Formation Dolomites

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Trace fossils are an important object of study of the paleoenvironmental reconstruction and interpretation of ancient basin, helping to discover various aspects of ancient flora and fauna existence. Trace fossils or foot-print fossils are preserved rock structures and components, which offer indirect evidence of the existence of life in the past. Trace fossils are found on top of and inside hard and soft rock, especially limestones, sandstones and dolomites, or between two different rock layers (Bromley, 1996).

Trace fossils studied at Upper Devonian Frana stage sediments reveals changes in foot-print fossil preservation and ichnotaxon diversity among sediments of Daugava and Plavinas formation. Trace fossils are better preserved on those layer surfaces, where the dolomite material contains other mineral admixtures, or have a lower degree of crystallization. To confirm the hypothesis of changes in trace fossil preservation and diversity in relation to the characteristics of dolomite composition, X-ray powder diffraction (XRD) method is used and the mineral composition of samples is quantitatively determined.

It is known that in Daugava formation mainly the dolomites alternating with layers and interlayers of domerites, clay, limestone and rock gypsum are found. By contrast, the carbonate sediments of Plavinas formation mainly consist of dolomites with domerite, seams of limestone, sandstone, aleirite and clays. (Сорокин, 1981).

However, despite the similarities of lithological content of both formations, established in studied geological sections, the inequalities of dolomite mineral composition, as well as macroscopically identifiable differences have been determined. Kalnciems samples are characterized by gray, brittle and thin, a little crumpled strips interchanging with slightly darker strips. Probably the fragility of the material is affected by high illite content of Kalnciems 2 sample.

Low illite content can be explained by the particularity of XRD quantitative analysis, because illite is the only weakly crystalline phase of the examined samples, characterised by low maximums or with the clayey substance content, which may contain not only the clay minerals but also the fine disperse dolomite and quartz. Therefore, in order to determine the true proportion of clayey substance and clay minerals in examined samples, a number of experiments were made, dissolving the samples in hydrochloric acid (20%, 15%, 10%) and glacial acetic acid, and mechanically separating the finer fractions. Despite the fact that Dole and Tūrkalne 2 samples belong to different formations, they are macroscopically difficult to distinguish because they are characterised by cryptocrystalline, resistant, drab coloured dolomite. In both samples of illite the content is within the error below 1%. Dolomite mineral composition analysis confirmed the macroscopic differences between the analyzed dolomite samples.

By developing the methodology of research, further analysis of the mineral composition of the samples will allow better understanding of the regularities and causes of changes in trace fossil preservation and diversity, which is partly related to dolomite formation conditions.

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