ASSOCIATION OF HUNGARIAN GEOPHYSICISTS
H-1145 Budapest, Columbus utca 17-23.
Phone/Fax: +3612019815

HUNGARIAN GEOLOGICAL SOCIETY
H-1015 Budapest, Csalogány utca 12.
Phone/Fax: +3612019129

INVITATION

to the Meeting of Young Geoscientists

31 March – 01 April 2017

Kaposvár, Hotel Kapos
www.kaposhotel.hu

Useful information:

Accommodation and meals are available only for pre-registered participants.
The talks are open and public.
Official languages of the conference are English and Hungarian.

Registration desk open: from 9:00 am, 31st March onwards

Organisers

MAGYAR GEOFIZIKUSOK EGYESÜLETE
1145 Budapest, Columbus utca 17-23.
Telefon/Fax: 201-9815

MAGYARHONI FÖLDTANI TÁRSULAT
1015 Budapest II., Csalogány utca 12.
Telefon/Fax: 201-9129

MEGHÍVÓ

az Ifjú Szakemberek Ankétjára

2017. március 31. - április 1.

Kaposvár, Kapos Hotel
www.kaposhotel.hu

Tudnivalók:

Szállást és étkezést csak előzetesen bejelentkezetteknek tudunk biztosítani.
Az ankét programja szabadon látogatható.
A konferencia hivatalos nyelve angol és magyar.

Regisztrálás: 2017. március 31. 9^{00}-tól folyamatosan

Rendező Bizottság

PROGRAMME

31. 03. 2017. FRIDAY

9^{30}- 9^{40}	OPENING
9^{40}-11^{15}	1ST SESSION
11^{30}-13^{05}	2ND SESSION
13^{15}-14^{00}	POSTER SESSION – SHORT ORAL SUMMARIES
14^{00}-15^{15}	LUNCH
15^{15}-16^{50}	3RD SESSION
17^{05}-19^{00}	4TH SESSION
19^{00}-20^{00}	POSTER SESSION – DISCUSSION
20^{00}	DINNER

01. 04. 2017. SATURDAY

9^{00}-11^{00}	5TH SESSION
11^{30}-13^{30}	6TH SESSION
13^{30}-15^{00}	LUNCH
15^{15}	AWARD GIVING AND CLOSING CEREMONY

FRIDAY

9^{30} OPENING

9^{40}-11^{15} 1ST SESSION

9^{40} *'Water' in the fire - determining magmatic water content with micro-FTIR spectrometry*

A **Zsófia Pálos**
Eötvös Loránd University, Faculty of Science, Institute of Geography and Earth Sciences

9^{55} *Geophysical measurement in the practice*

A **Dániel Péter**[1], **András Virók**[2]
[1]University of Miskolc, [2]Pál Vásárhelyi Secondary Technical School and Student Hostel

10^{10} *Continental red clays on carbonate substrate - the complex story of the Late Cenozoic Vöröstó Formation (Southern Bakony Mts., Hungary)*

T **Péter Kelemen,** István Dunkl, Gábor Csillag, Andrea Mindszenty, Hilmar von Eynatten and Sándor Józsa
Deparment of Petrology and Geochemistry, Eötvös Loránd University

10^{25} *Tectonostratigraphic evolution of the Danube Basin: inferences from gravity, magnetic and seismic data*

T **Zsófia Zalai**
Dept. of Geophysics and Space Science, Eötvös Loránd University

10^{40} *Coal dust recovery in Vietnam (Hon Gai Peninsula, Quang Ninh)*

T **Balazs Ivanics**, Felix Bilek, Antje Ulbricht
Dresdner Grundwasserforschungszentrum e.V.

10^{55} DISCUSSION

11^{15}-11^{30} BREAK

11^{30}-13^{05} 2ND SESSION

11^{30} *Rock Physics Study – Focus to reservoir separation and wedge modelling*

A **Dávid Holló**
MOL, Group E&P Development Geoscience

11^{45} *Hypocenter relocation of the 22 April 2013, ML=4.8 Tenk, Hungary earthquake aftershocks using Waveform cross-correlation and Double-difference methods*

A **Barbara Czecze**[1], István Bondár[2], Bálint Süle[2]
[1]Eötvös Loránd University, Department of Geophysics and Space Science, [2]Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences

12^{00} *Outcome of well logging works related to the future Northern section of the M0 beltway*

A **Dénes Gärtner**, Bernadett Faluvégi, Gábor Szongoth
Geo-Log Environmental & Geophysical Ltd.

12^{15} *Can we measure how interesting rocks are? Methodology of geotourism potential measurement*

A **Nikolett Csorvási**
Eötvös Loránd University

12^{30} *Quartzite xenoliths from the basanite quarry of Bulhary (Bolgárom)*

T **Thomas Pieter Lange**, Tamás Sági, Sándor Józsa
Department of Petrology and Geochemistry, Institute of Geography and Earth Sciences University of Eötvös Loránd

12^{45} DISCUSSION

13^{05}-13^{15} BREAK

13^{15}-14^{00} POSTER SESSION – short oral summaries

Practical application of VES measurements in Schlumberger array and multielectrode resistivity profiling in pole-pole array for tunnel designing confirmed by boreholes

Anna Begidsán, Zsuzsanna Borsósné Egger, András Kovács
KBFI-Triász Ltd.

Structural modelling of the synrift sub-basins in the Pannonian Basin

László Bereczki[1,2], Gábor Markos[2], Dénes Gärtner[3], Zoltán Frield[1,4], Balázs Musitz[2], Gyula Maros[2]
[1]Department of Geophysics and Space Science, Eötvös University, [2]Department of Geological Research, Geological and Geophysical Institute of Hungary, [3]Geo-Log Geophysical and Environmental Ltd., [4]Institute of Geodesy, Cartography and Remote Sensing

3D geological and structural modelling of the Danube Basin based on 2D seismic surveys and borehole data

István Bóna
Department of Geophysics and Space Scientist, University of Eötvös Lóránd

Lithology and fludium content determination using a robust cluster analysis method - application to well logs measured from an oil exploration well

Bence Ádám Braun
Department of Geophysics, University of Miskolc

Absolute magnetic measurement with FluxSet digital D/I station

Ádám Domján[1], László Hegymegi[1], Csaba Hegymegi[1], János Szöllősy[2]
[1]MinGeo Ltd., [2]Individual contractor

Why suitable the „susceptibility termination surfaces" for stratigraphic investigation of fluvial freshwater reservoirs?

Tímea Fogarassy-Pummer[1], Enikő Faragó[2]
[1]Geological and Geophysical Institute of Hungary, [2]University of Debrecen

New data of the origin of the P-Mn-U-Be-HREE-enrichment in phosphatite, near Bükkszentkereszt, NE Hungary

Péter Gál[1], Márta Polgári[2,3], Sándor Józsa[1], Lóránt Bíró[4], Ildikó Gyollai[2], Krisztián Fintor[5]

[1]Eötvös Loránd University, Department of Petrology and Geochemistry, [2]Research Center for Astronomy and Geosciences, Geobiomineralization and Astrobiological Research Group, Institute for Geology and Geochemistry, Hungarian Academy of Sciences, [3]Eszterházy Károly University, Department of Natural Geography and Geoinformatics, [4]Eötvös Loránd University, Department of Physical and Applied Geology [5]Szeged University, Department of Mineralogy, Geochemistry and Petrology

Clay mineral assamblages in the Praid salt rocks: an X-ray powder diffraction study

Orsolya Gelencsér

Department of Mineralogy, Eötvös Loránd University

Structural and textural evicences of magma mingling and mixing in diorites of the Ditrău Alkaline Massif (Romania)

Adrián Heincz

University of Szeged

Receiver functon analysis using AlpArray stations in Hungary

Kalmár Dániel[1], Süle Bálint[2], and Bondár István[2]

[1]Department of Geophysics and Space Science, Eötvös Loránd University, [2]Research Center for Astronomy and Earth Sciences, Hungarian Academy of Sciences

New testing program to measure acoustic velocities under triaxial loading

Anett Kiss

Department of Geophysics, University of Miskolc

Trace-element distributions of corundum from heavy mineral deposit at Kikeri-tó based on LA-ICP-MS studies

Ákos Kővágó[1], Sándor Józsa[1], Edit Király[2]

[1]Department of Petrology and Geochemistry Eötvös Loránd University, [2]Geological and Geophysical Institute of Hungary

Geophysical Investigations on Reactivated Karst Springs in Tata – A Case Study

Dorottya Polgár, Erika Hegymegi

Geological and Geophysical Institute of Hungary

14^{00}-15^{15} LUNCH BREAK

15^{15}-16^{50} 3RD SESSION

15^{15} *The Pannonian mollusc fauna of the Transylvanian Basin*

T **Dániel Botka[1],** Imre Magyar[2,3]

[1]Department of Palaeontology, Eötvös Loránd University, [2]MOL Hungarian Oil and Gas Plc., [3]MTA–MTM–ELTE Research Group for Paleontology

15^{30} *Tectonic investigations in the area of Balatonkenese and Balatonakarattya based on ultra-high resolution seismic data*

A **Benjamin Jakab**

Department of Geophysics and Space Science, Eötvös Loránd University

15^{45} *Salt effects on thermal regime and maturity in 2D basin models A case study from North Kazakhstan*

A **Zsolt Nagy**

MOL Plc.

16^{00} *Significance of Jurassic early deformation structures in the SW-Bükk Mts.*

T **Éva Oravecz,** Szilvia Deák-Kövér, László Fodor

Eötvös Loránd University, MTA-ELTE Geological, Geophysical and Space Sciences Research Group

16^{15} *Nothia ex gr. excelsa (Grzybowski, 1898), 'flysch-type' agglutinated foraminifera from the Karpatian (Early-Miocene) of Hungary*

A **Eszter Balassi,** Ágnes Görög, Tamás Váczi

Eötvös Loránd University

16^{30} DISCUSSION

16^{50}-17^{05} BREAK

17^{05}-19^{00} 4TH SESSION

17^{05} *Geological and hydrogeological evaluation of the preliminary work of remediation of waste dump in Nyíregyháza-Borbánya, Hungary*

A **Rita Kapiller**, Balázs Benei
BIOCENTRUM Environment Protection and Water Management Ltd.

17^{20} *Geologic Structure of the Keta Basin, South-Eastern Ghana, From Geophysical Datasets.*

A **Nuamah Daniel Oduro Boatey**
Department of Geophysics, University of Miskolc

17^{35} *Inversion of Cocurrent Electrical Measurements Based on Initial Models Given by Recursive Way*

T **Viktória Pap**
ELTE TTK Department of Geophysics and Space Science

17^{50} *Re-evaluation of the Sirok-1 borehole based on the available samples: mineralogical, petrological features and some curiosities related to history of science*

T **Tibor Zádeczki,** Gabriella B. Kiss, Sándor Józsa
Eötvös Loránd University, Faculty of Science, Department of Mineralogy, Department of Petrology and Geochemistry

18^{05} *Shale volume estimation by factor analysis using a global optimization approach*

A **Armand Abordán**
Department of Geophysics, University of Miskolc

18^{20} *On the possible source locations of HP-metaophiolitic polished stone artefacts*

A **Benjámin Váczi[1],** György Szakmány[1], Zsolt Kasztovszky[2] Zsolt Bendő[1], Elisabetta Starnini[3]
[1]Department of Petrology and Geochemistry, Eötvös Loránd University, [2]MTA EK Nuclear Analysis and Radiography Department, [3]School of Humanistic Sciences, Department of Historical Studies, University of Torino, Italy

18^{35} DISCUSSION

19^{00}-20^{00} POSTER SESSION – discussion

20^{00}- DINNER

SATURDAY

9^{00}-11^{00} 5^{TH} SESSION

9^{00} *Numerical investigation of a borehole heat exchanger in synthetic and real geological situation*

T **Zsóka Kiss, Márk Szijártó**
Eötvös Loránd University, Department of Geophysics and Space Science

9^{15} *Thermal spring related hydrochemical and precipitation changes along a canalized water outflow in the tunnel of Gellért Hill, Budapest*

A **Petra Bodor,** Judit Mádl-Szőnyi
Erzsébet and József Tóth Endowed Hydrogeology Chair, Department of Physical and Applied Geology, Eötvös Loránd University

9^{30} *Analysis of recent stress field in the Pannonian Basin using focal mechanism solutions*

T **Lili Czirok**
University of Sopron, Roth Gyula Doctoral School of Forestry and Wildlife Management Sciences

9^{45} *Anatomy of silicified woods from the upper Permian of the Mecsek Mts.*

T **Lóránd Mihály**[1]**,** Emese Réka Bodor[1,2], Miklós Kázmér[1]
[1]Eötvös Loránd University, Department of Palaeontology, [2]Geological and Geophysical Institute of Hungary

10^{00} *Regional Tectonic Evolution Of The Derecske Trough, Hungary*

A **Attila Várkonyi,** Jan Witte
O&GD Central Ltd., Budapest, Hungary, Falcon Geoconsulting, Hameln, Germany

10^{15} *Building a Magnetic Surveying System for Unmanned Aerial Vehicles*

A **Ádám Domján**
MinGeo Ltd.

10^{30} DISCUSSION

11^{00}-11^{30} BREAK AND CHECK-OUT FROM THE ROOMS

11^{30}-13^{30} 6TH SESSION

11^{30} *Non-destructive test methods in determining the physical properties of rocks – the use and reliability of Schmidt hammer and the Duroskop*

A **Erzsébet Jámbor**
Eötvös Loránd University

11^{45} *Numerical Modelling of Seasonal Borehole Thermal Energy Storage Systems*

A **Gergő András Hutka, János Mihályka**
Eötvös Loránd University, Faculty of Science, Department of Geophysics and Space Science

12^{00} *Analysis of volatile compounds of drill cuttings using mass spectrometry*

A **Sándor Körmös,** Nóra Czirbus, Félix Schubert
Department of Mineralogy, Geochemistry and Petrology, University of Szeged

12^{15} *Comparative U-Pb geochronology on zircon crystals from Mórágy, Hungary*

T **Annamária Kis**[1], Tamás G. Weiszburg[1], István Dunkl[2], Friedrich Koller[3], Tamás Váczi[1], György Buda[1]
[1]Department of Mineralogy, Eötvös Loránd University, [2]Sedimentology and Environmental Geology, Geoscience Center, University of Göttingen, Germany, [3]Department of Lithospheric Research, University of Vienna, Austria

12[30] *Underwater cave exploration using [222]Radon as natural tracer*

A **Katalin Csondor[1],** Anita Erőss[1], Ákos Horváth[2], Dénes Szieberth[3]

[1]Department of Physical and Applied Geology, Eötvös Loránd University, [2]Department of Atomic Physics, Eötvös Loránd University, [3]Department of Inorganis and Analitycal Chemistry, Budapest University of Technology and Economics

12[45] *From Russia with love – On production since 1947*

A **István Nemes**

MOL Group

13[00] DISCUSSION

13[30]-15[00] LUNCH BREAK

15[15] AWARD GIVING AND CLOSING CEREMONY

ABSTRACTS

1ST SESSION

'Water' in the fire - determining magmatic water content with micro-FTIR spectrometry

Zsófia Pálos
Eötvös Loránd University (ELTE), Faculty of Science,
Institute of Geography and Earth Sciences
Applied

This conference presentation presents a new state-of-the-art method for constraining pre-eruptive magmatic water contents of Börzsöny Mountains' different volcanostratigraphic units. Using micro-FTIR spectrometry of the plagioclase phenocrysts of 5 representative samples from Börzsöny, the OH^- content of the phenocrysts has been measured. The plagioclase OH^- content was measured to be between 25 ppm and 546 ppm. I calculated the pre-eruptive magmatic water content using the partition coefficient between the melt and the plagioclase of [1]. Magmatic water contents turned out to be from 0.3 wt% to 6.28 wt%. Results are in satisfying agreement with previously published magmatic water contents of andesitic-dacitic volcanoes [2], [3]. The work presented here has promising implications for future studies of volcanology and micro-FTIR spectroscopy and may get us to fully comprehend the Western Carpathian volcanic-geodynamic systems and eruptive styles of volcanoes.

[1] Hamada, M., Ushioda, M., Fujii, T., & Takahashi, E. (2013). Hydrogen concentration in plagioclase as a hygrometer of arc basaltic melts: Approaches from melt inclusion analyses and hydrous melting experiments. *Earth and Planetary Science Letters*, **365**, 253–262. http://doi.org/10.1016/j.epsl.2013.01.026

[2] Johnson, E. A. (2005). Magmatic water contents recorded by hydroxyl concentrations in plagioclase phenocrysts from Mount St. Helens, 1980-1981. In *Goldschmidt Conference Abstracts 2005* (Vol. **A743**).

[3] Okumura, S. (2011). The H_2O content of andesitic magmas from three volcanoes in Japan, inferred from the infrared analysis of clinopyroxene. *European Journal of Mineralogy*, **23** (August), 771–778. http://doi.org/10.1127/0935-1221/2011/0023-2141

Geophysical measurement in the practice

Dániel Péter[1], András Virók[2]

[1]University of Miskolc

[2]Pál Vásárhelyi Secondary Technical School and Student Hostel

Applied

During our researches we studied the properties of the subsoil by means of shallow-depth geoelectrical measurements and shallow-depth seismic measurements. We carried out our research on numerous areas to be able to acquire information from as many areas as possible in the interest of better evaluation of the measurement results. The purpose of our measurements was to get so high-level experience in condition assessment before subsoil investigations and technical operations as well as in disaster management and environmental research operations that geophysical measurements can be introduced as an investigation method for such operations. Our secondary purpose was to make the said research methods more well-known and accessible.

In our presentation we will demonstrate the actual state of our researches through practical examples (reflecting our present knowledge and information). The presentation will refer to the actual state analysis we carried out on flood control dams, the investigation of material quality, the mapping of public utility networks, the location of borrow pits, the testing of humus soil, the determination of the parameters of groundwater flow and further researches and research opportunities.

Our researches started with the actual state analysis of the flood protection dams along the left and right banks of the River Berettyó at Szeghalom. We performed measurements on dam sections that had been modernised in three different periods (1970, 1990 and 2015), where the dam section restored in 2015was re-built with drain pipe technology.

In the summer of 2015, we started our measurements for the actual state analysis of the flood protection dam along the right bank of the River Hármas-Körös near Gyomaendrőd as well. On this dam section, several blows and leakages have been recorded in recent years. The Water Management Directorate for the Körös Region (KÖRKÖVIZIG) authorised us to survey the dam section between the

dam section kilometres 65+000 and 67+000 on the right bank of the River Hármas-Körös.

In 2016 we started our measurements for mapping the public utility networks, and by now we are able to detect any pipe with a diameter exceeding 15 cm. One advantage of this work that we can map the public utility networks of a given area where there is no registered map on public utility lines, while it is another advantage that we can determine the location of eventual pipe breaks and water leakages.

In 2016 we started further researches in the fields of material quality investigation, location of borrowing-pits and investigation of humus soil and determination of the parameters of groundwater flow. In the framework of material quality investigation we examine the soil of a given area for the purpose of creating borrowing-pits. We carried out measurements in the area of the designated borrowing-pit of particulate materials for the foreground load of flood inlet structures in Gyula. As for the investigation of humus soil, we surveyed an area of 900 m^2 on an arable land belonging to a sand quarry in Gyula to determine the amount of humus that must be extracted to be able to start mining operations. At the Nagykunság Main-Channel XIV. in Murony, we carried out measurements (at middle water level and in the irrigation season) to determine the parameters of ground-water flow. We carry out further researches for archaeological purposes as well.

Continental red clays on carbonate substrate - the complex story of the Late Cenozoic Vöröstó Formation (Southern Bakony Mts., Hungary)

Péter Kelemen, István Dunkl, Gábor Csillag, Andrea Mindszenty, Hilmar von Eynatten, Sándor Józsa
Deparment of Petrology and Geochemistry, Eötvös Loránd University
Theoretical

The Vöröstó Formation, a red clay mixed with bauxite pebbles covers locally the karstified surface of Triassic carbonates in the Southern Bakony Mountains, Hungary. This continental assemblage was deposited in an extremely long-lasting apparent stratigraphic gap.

Sequences covering Vöröstó Formation are dated mid-Miocene to Quaternary.

Pebbles, rock fragments and the clay matrix were studied by sediment petrographic methods, XRD, SEM, and whole-rock geochemistry. Further, heavy mineral assemblages and the zircon single-grain U-Pb age distributions from both the bauxite pebbles and the red clayey matrix were analysed separately.

The coarse fraction of the Vöröstó Formation consists of well-rounded, mostly oolithic, hard bauxite-pebbles, likewise hard, angular to subangular ferricrete fragments and dolomite clasts embedded in a clay-mineral rich matrix (kaolinite, illite, smectite) mixed with silt to fine-sand sized quartz grains and very rare altered feldspar grains. The heavy mineral suite of the pebbles and the matrix are markedly different. The matrix contains a variegated heavy mineral assemblage with staurolite, garnet, pyroxene, ilmenite and epidote being present beside the dominant ultrastable heavy minerals zircon, rutile and tourmaline. The zircon U-Pb age spectra are composed of distinct components reflecting Ordovician, Variscan, Paleogene (40 to 27 Ma) and Middle Miocene (18 to 10 Ma) ages. In contrary, the bauxite pebbles are rather poor in heavy minerals, and only contain the ultrastable species. The U-Pb age spectra of bauxite pebbles contain the same pre-Mesozoic age components, additional Triassic ages, while the Cenozoic ages are missing.

Based on their lithology, micromorphology, heavy mineral assemblage and the lack of young zircon ages the hard bauxite pebbles are considered to have been eroded from some of the older Cretaceous bauxite deposits of the Bakony Mts. A probably significant part of the matrix is derived by re-deposition and break down of debris from the Paleogene bauxite deposits, as they contain variegated extraclasts and characteristic, euhedral, volcanogenic zircons with Paleogene U-Pb ages. The presence of partly decomposed feldspar grains and the wide age range of Miocene zircons indicate that the continental red clay landscape in the Bakony accumulated air-born ashes during the entire period of the Carpathian-Pannonian Neogene volcanic activity.

Tectonostratigraphic evolution of the Danube Basin: inferences from gravity, magnetic and seismic data

Zsófia Zalai
Dept. of Geophysics and Space Science, Eötvös Loránd University
Theoretical

The 220-290 km of Miocene extension observed in the Pannonian basin system of Central Europe was driven by the rapid roll-back of the Carpathian slab. Basin formation was coupled with the extrusion of the Eastern Alps with large amounts of translation and vertical axis rotations. In the hanging wall of low-angle normal faults and detachments few kilometers thick syn-rift sediments deposited during the Early to Middle Miocene (Karpatian, Badenian and Sarmatian). A spectacular unconformity is present at the basin margins, and passes to a correlative conformity towards the basin center. It is overlain by the gently folded thick Pannonian to Quaternary sedimentary deposits.

A novel tectonostratigraphic interpretation was carried out in the Csapod and Győr-Kenyeri sub-basins using a dense network of reflection seismic data supported by gravity and magnetic anomaly maps. Incorporating new biostratigraphical data from deep wells the spatial and temporal patterns of Miocene deformation was analysed. 3D geological model was constructed using the gravity and magnetic forward modelling software (IGMAS+, e.g., Götze & Lahmeyer, 1988) based on the potential field anomalies. Dz magnetic anomalies imply the location of buried volcanic bodies while the gravity anomalies indicate the buried basement highs.

Our seismic interpretation revealed that asymmetric extension (Tari et al. 1992) was diachronous in the basin system. Oldest half-grabens closer to the basin margins were characterized by Karpatian (ca. 17.2-16.3 Ma) extension with limited amount of Badenian post-kinematic sedimentation. Toward the basin centre, in the Csapod Through the culmination of extension is Badenian (16-13 Ma) in age. Further to the deepest depocenters, in the Győr-Kenyeri depression, half-graben formation was still active during late the Badenian - Sarmatian (14-11.6 Ma). Uplift and extensional exhumation of the footwalls of the half-grabens are shown by the interpretation of depth-converted seismic data. Our estimations on this uplift of this footwall uplift is in the order of a few hundreds of meters, up to 1 km, based on

the lateral correlation of the seismic profiles. The depth of the Neogene basement and crustal thickness were refined by seismic interpretation coupled with gravity and magnetic forward modelling.

This project was supported through the ÚNKP-16-2 New National Excellence Program of the Ministry of Human Capacities.

[1] Götze, H.-J., Lahmeyer, B. (1988): Application in three-dimensional interactive modelling in gravity and magnetics – *Geophysics* **58** p. 1096-1108

[2] Tari, G., Horváth, F., Rumpler, J. (1992): Styles of extension in the Pannonian Basin – *Tectonophysics* **208**. p. 203-219

Coal dust recovery in Vietnam (Hon Gai Peninsula, Quang Ninh)

Balazs Ivanics, Felix Bilek, Antje Ulbricht
Dresdner Grundwasserforschungszentrum e.V.

Theoretical

DBU Deutsche Bundesstiftung Umwelt
DGFZ e.V.
GEFÖRDERT VOM Bundesministerium für Bildung und Forschung

Currently there is no integrated resource recycling or water reuse management for the mining areas of North Vietnam. It is necessary to develop a concept for the environmental protection, such as the recovery of coal dust from streams. The study belongs to the project "WaterMiner – Spatial-temporal adjusted recirculation and reutilization of mining impacted waters, exemplary for an urban affected mining area". The project is sponsored by the German Federal Ministry of Education and Research.

The study area is the Hon Gai Peninsula in the province of Quang Ninh, Vietnam. It is characterized by competing land uses in a limited area. The challenges and conflicting priorities in the water sector that are present in the Ha Long Bay coal mining, urban habitat and tourism areas are contrary to a sustainable urban and regional development.

The main focus of the study is to understand the separation of dense siliceous matter and coal dust particles suspended in the river water to determine a coal dust recovery method and test the method with a pilot plant on laboratory scale.

The method for the separation is hydro classing, whereby the sand and coal dust are separated by their density. The fast sinking particles are removed basally and the slow sinking particles are drawn off with

the main volume stream at the top. A mixture of sand and coal particle is placed in a tank, from where it is pumped into the first sedimentation basin, where the separation of the particles takes place. Only the lighter particles will be moved with the water flow into the second sedimentation basin.

Because it is infeasible to transport large quantities of coal dust from Vietnam to Germany to test this methodology, it is required to produce coal dust in Dresden, Germany with similar chemical and physical properties to the solids contained in the Vietnamese pit waters. The tested sediment mixture consists of coal dust and sand.

The inflow of water enriched with sediment is supplied with a pump. The pump has been chosen with regard to the desired flow rate and supply height to transport coarser particles up to 2 mm in diameter. During the tests the conveyance of different grain size ranges were tested individually in order to determine the pumping capacity of the pumps. The flow rate, the amount of mixed sediment and the amount of water pumped were taken into consideration.

In order to separate the coal-sand mixture by its density, the sinking speed of the particles was determined as well as their sedimentation distance in a flow field. The sinking speed (v_s) for granular, settable substances was calculated according to Stokes and Hazen using formula (1):

$$v_s = \frac{d^2 \times g \times (p_p - p_f)}{18 \times \eta} \qquad (1)$$

d: grain diameter, g: gravitational acceleration = 9.81 m/s², p_p: grain density, p_f: density of the fluid (water) = 0.9982 g/cm³ (at 20°C) and η: dynamic viscosity of the fluid (water) 0.1414 m²/s (at 20°C).

The residence time of the individual particles was calculated according to their density and grain size for basin depths of 100 cm, 150 cm and 200 cm in a settling basin not influenced by a flow field. The required residence time in a settling basin results from equation (2):

$$Residence\ time\ (s) = \frac{Basin\ depth\ (m)}{Sinking\ speed\ (m/s)} \qquad (2)$$

Based on these calculations the plant will be dimensioned, constructed and tested. The following tasks are planned for the future to optimize this method: tests with further coal types, adjustment and reduction of pumping capacity, construction of the system and optimization of settling properties.

2ND SESSION

Rock Physics Study – Focus to reservoir separation and wedge modelling

Dávid Holló
MOL, Group E&P Development Geoscience
Applied

Day by day in the HC exploration and production world, we have new professional and managerial needs. 30 years ago the pre-stack seismic data, logging while drilling (LWD), describe the uncertainty of a surface and generate realizations of a horizon by velocities were rare needs, because of the technical background. Nowadays we have chance to build static and dynamic reservoir models by million points and calculate production profiles with the application of these results. The technical development allows completing the whole process in higher resolution with more details. Based on the geophysicist point of view, from the seismic interpretation's structural and stratigraphic modelling scale we focus directly to the reservoir's scale. The rock physics studies helps us to find those seismic attributes that have correlation with the reservoir parameters and decide which is the maximum resolution that we can use to support the static reservoir model building. Before the beginning of the static modelling, we have to be familiar with the local rock properties and the "behavior" of the rocks inside and outside of the reservoirs. Traditional rock physics workflows work only in sand-shale environment.

The workflow of a rock physics study starts with to collect and QC of all available seismic data, well logs, VSP-s, processing velocities etc. After the well-tie section, we analyze and quantify

depth trends to decide the velocity prediction opportunity by depth. The next step is the cross-plot analysis to separate zones based on the rock physic parameters, e.g. reservoirs to non-reservoirs, limestones to dolomites, high porosity parts to low ones etc. To the separation, we have to calculate Acoustic Impedance (AI), Gradient Impedance (GI), Vp-Vs ratio, Lambda-Rho (LR) and Mhu-Rho (MR) rock physic parameter logs by the P-wave velocity (Vp), S-wave velocity (Vs) and Density well logs. The application of cross-plots allows the separation by AI – GI, AI – Vp/Vs, LR-MR, AI – Porosity cross-plots.

Elastic Impedance (EI) analysis and Extended Elastic Impedance (EEI) analysis follows the separation of reservoirs. The EI and EEI analysis allow the fluid and lithology discrimination, and help to decide the usefulness of AI, EI, EEI seismic inversions. Last step is the tuning analysis, or a wedge modeling to investigate the effect of the variations of the reservoir thickness changes to seismic amplitudes and define the minimum reservoir thickness that can be seen on seismic. The method is to create pseudo wells (that not drilled) with own Vp and Density logs. Modify the thickness of the target zone and generate synthetic traces (seismograms) by a wavelet, the thickness modified Vp and the thickness modified Density logs. Define the minimum visible reservoir thickness by synthetic wedges.

The study focuses to the cross-plot analysis and to the wedge modelling. The presentation includes industrial examples from a limestone-dolomite and a sandstone-clay/shale environment.

Hypocenter relocation of the 22 April 2013, M_L=4.8 Tenk, Hungary earthquake aftershocks using Waveform cross-correlation and Double-difference methods

Barbara Czecze[1], István Bondár[2], Bálint Süle[2]

[1]Eötvös Loránd University, Department of Geophysics and Space Science,
[2]Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences

Applied

In Hungary, County of Heves, near the village of Tenk, an earthquake with the local magnitude of 4.8 occurred on 22 April 2013. The mainshock after two minor fore-shocks (M_L=3.6, 2.5) was followed by 27 aftershocks with 0.7-2.9 magnitudes.

Accurate seismic event location is necessary to understand tectonic processes. The location errors can be significantly reduced using multiple-event location methods. We applied the Double-difference method to relocate the mentioned events in order to provide accurate hypocenter parameters instead of the routinely determined hypocenters.

The routinely picked arrival times in the Hungarian Earthquake Bulletin were manually repicked to increase the consistency and accuracy of the P and S arrivals, then We added more travel time data to the new dataset. Waveform cross-correlation was used to obtain differential times. We used the extended ISC location algorithm, iLoc to determine the absolute single event locations for the Tenk aftershock sequence. We applied the Double-difference algorithm on the new locations with different datasets to investigate the influence of repicked P and S arrival times, initial hypocenters and different velocity models on the relocation process.

The results improved with in every step, compared to the original, routinely determined locations. The results show that the multiple event location procedure significantly enhances the picture of seismicity even in this earthquake sequence.

Outcome of well logging works related to the future Northern section of the M0 beltway

Dénes Gärtner, Bernadett Faluvégi, Gábor Szongoth
Geo-Log Environmental & Geophysical Ltd.
Applied

Tunneling has been found necessary in the construction of the northern section of the M0 beltway connecting main roads nr. 10 and 11. Two tunnels were planned, tunnel „A” is going to run 2020 m long between Budakalász and Békásmegyer, tunnel „B” is planned 3190 m long amongst Pilisborosjenő and Üröm. 27 (11+16) boreholes of various depth (35-90 m) were drilled within the confines of the required licensing process. Well logging works have been carried out in all boreholes except 3 (3 borehole pairs were close to each other, therefore logging was performed only in one of the couples). General logging program contained resistivity, spontaneous potential, gamma

ray, neutron porosity, density, full wave sonic, caliper, magnetic susceptibility and borehole televiewer (acoustic or optical) logging, although depending on borehole conditions – most improtantly the presence or lack of water in the borehole – not all measurements were possible to execute in every cases.

After quality control, depth validation and application of the required corrections and calculations combined results were presented as a composite log. Stratigraphic column primarily was designed based on logs and a priori information about the geology of the area (geologic maps, stratigraphic column of nearby wells, drilling reports), then was corrected and refined later when core descriptions became available. Televiewer images were used to investigate the incidence and distribution of fractured, weakened zones in each borehole.

After data processing and evaluation cross-sections were constructed based on the final stratigraphic coloumn of the boreholes, site elevations above sea level taken into account. All but one boreholes along proposed tunnel „A" (section „A") terminated in the lower oligocene Kiscell Clay Formation below 5-20 m of quaternary sediments. The westernmost borehole of this cross-section reached the underlying Buda Marl, therefore a fault was interpreted east from this borehole.

Succession along tunnel „B" (section „B") show a more diverse lithology. Generally quaternary sediments were deposited on the Kiscell Clay, several boreoles also penetrated the clay and reached the underlying Hárshegy Sandstone Formation. Progressing E-NE from borehole nr. 827 Kiscell Clay gradually thins out. In borehole nr. 822 the clay is completely missing, quaternary sediments directly overlay the Hárshegy Sandstone. East from here all boreholes reached the Kiscell Clay in a thickness of 30-60 m. The phenomenon was interpreted as a horst (borehole nr. 822) and an additional normal fault westwards. Borehole nr. 814 was drilled above the uplifted triassic basement high of the Kő-hill; it reached the triassic Hauptdolomite right below the Kiscell Clay at a depth of 37 m from the surface. Another fault is interpreted NE from the southernmost borehole.

Fractured zones and fracture directions derived from image logs were also investigated. Fracture (plane) correlation gave poor results, only one shared population was detectable in 3 nearby boreholes. One

possible explanation of the poor correlation might lie within the size difference of faults interpreted on the cross section (~100-1000 m in length) and joints detected on televiewer image (~0,1-1 m in length).

Results of surface geophysical measurements (VLF, Slingram, multielectrode, and refraction seismic measurements). correlate well with the cross-sections.

Can we measure how interesting rocks are? Methodology of geotourism potential measurement

Nikolett Csorvási
Eötvös Loránd University
Applied

Geotourism is growing around the world through the growth of geoparks as well as independently. It presents and protects geoheritage while it is sustainable and economically beneficial to local communities.

To help stakeholders invest into this relatively new tourism sector, we should be able to provide data about geotourism potential of an area. The aims of my research were to find the proper methodology to measure geotourism potential and apply it to sample areas in Fejér county, Hungary.

After looking over the references on the topic, I selected those methods which measure the touristic value of a geotope (not the scientific or educational value) and their indicators are well defined. Ten methods were tested to six geotopes with six different profiles in Fejér county. Results given by the tests were compared and the most suitable method was selected [2] and used at larger areas. The Velence Hills and the Eastern Bakony were evaluated in Fejér county so far.

To select the geotopes for which the method was applied, I followed the same work flow than Reynard et al. [1]. First, I collected and studied the earth scientific references of the selected areas. Then, I did systematic field work in both areas. I visited all the sites which have been mentioned in the references, signed at the geological map or seemed hopeful geotope according to the 1:10 000 and 1:40 000 topographic map or Google Map. I walked along all the walk routes as well.

After the field work I set up the preliminary geotope list about the Velence Hills and Eastern Bakony. These geotopes were evaluated by the method of Vujičić et al. [2].

To visualize the results, geotourism potential maps were made.

The research was supported by the NTP-NFTÖ-16-0817 National Talent Program.

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Quartzite xenoliths from the basanite quarry of Bulhary (Bolgárom)

Thomas Pieter Lange, Tamás Sági, Sándor Józsa

Department of Petrology and Geochemistry, Institute of Geography and Earth Sciences, University of Eötvös Loránd

Theoretical

In the last few decades a lot of publications were concerned with the xenolith bearing basalts-basanites of the Nógrád-Gömör Volcanic Field (e.g. [1],[2]). One of them is the basanite quarry near the village Bulhary (Bolgárom), where the bazanite contains greyish white coloured quartzite xenoliths, which have an – unique thick – light green coloured contact aureola, which can be seen macroscopically. A few microscopic (4 times enlarged, PPL) maps were made from a polished thin section. In the most wide part of the contact aureola, 6 contact zones between the basalt and quartzite xenolith can be distinguished: (1) basalt, (2) metasomatic basalt, (3) leucite rich zone, (4) clinopyroxene zone, (5) pyroxene-feldspar zone and (6) quartzite. With petrography and mineral composition we could determine a mineral and contact zone formation sequence. Besides we could also estimate a direction of the element migration (between the basaltic melt and the xenolith), which had a huge influence on the composition of the contact zones itself. The fourth (clinopyroxene) zone played a considerable role in this process, because it devides the whole contact aureola to a silica untersaturated (on the basalt side) and a

supersaturated (on the xenolith side) zone. Based on the more or less intact core of the xenolith and any available geological data about the underlying sedimentary, igneous and metamorphic formations the assumed place of origin of the xenolith was assigned.

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POSTER SESSION

Practical application of VES measurements in Schlumberger array and multielectrode resistivity profiling in pole-pole array for tunnel designing confirmed by boreholes

Anna Begidsán, Zsuzsanna Borsósné Egger, András Kovács
KBFI-Triász Ltd.

Poster

Interpreting the inversion models of the VES curves and multielectrode profiles in some geological situations could be inaccurate. We face such an uncertainty when the resistivity values of the layers are in an ascending order from the surface to the deeper layers. In case of three layers in interest we have a $\rho_1<\rho_2<\rho_3$ layered structure. If the second layer (ρ_2) is thin that cannot be detected with the help of surface resistivity measurements because of the effect of the third layer (ρ_3) [1]. Using different electrode arrays simultaneously might be a key to overcome this situation. In this paper we present some results of the VES (Schlumberger array) and multielectrode (pole-pole array) measurements and a comparison between these two different resistivity imaging methods confirmed by boreholes.

VES measurements in Schlumberger array and multielectrode profiling in pole-pole array were carried out for mapping the geological structures along a designed tunnel and its region. The VES curves were processed with 1D and the multielectrode profiles with 2D inversion methods. The inversion models were compared with the

results of the core drillings and the well loggings on the same site. These results show a good agreement with our calculated resistivity values. In order to recognize the changing in geological structure, multielectrode profiling was carried out in some part of the survey site between the VES points. One of these sites consists clay (ρ_1), clay marl (ρ_2) and sandstone (ρ_3) layers, so this structure satisfies the requirements of the $\rho_1<\rho_2<\rho_3$ structure. To analyse the effect of the third layer (ρ_3) the VES measurements (Schlumberger array) were compared with the multielectrode measurement (pole-pole array) along the same profile.

The depth of the investigation of the VES (Schlumberger array) measurements reached the third (ρ_3) layer but the bound between the first (ρ_1) and the second (ρ_2) layers could not be detected. If the depth of the investigation was reduced above the third (ρ_3) layer, the inversion results were uncertain because of the effect of the third (ρ_3) layer.

The depth of investigation of the multielectrode (pole-pole) profile just reached the third (ρ_3) layer but only the first (ρ_1) and the second (ρ_2) layers could be observed. In this case the measurement was not affected by the third (ρ_3) layer.

Based on the VES measurements in Schlumberger array the clay marl (ρ_2) – sandstone (ρ_3) boundary and based on the multielectrode profiling in pole-pole array the clay (ρ_1) – clay marl (ρ_2) boundary could be identified. That effect can be caused by the difference between the sensitivity of the pole-pole and the Schlumberger arrays [2].

The inversion models of the VES and multielectrode measurements show good agreement with the results of the core drillings and the well loggings. Comparing the VES (Schlumberger array) measurements with a multielectrode (pole-pole array) profile resulted in a more accurate interpretation of the $\rho_1<\rho_2<\rho_3$ layered structure because of the difference between the sensitivities of the two arrays.

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Structural modelling of the synrift sub-basins in the Pannonian Basin

László Bereczki[1,2], Gábor Markos[2], Dénes Gärtner[3], Zoltán Frield[1,4], Balázs Musitz[2]Gyula Maros[2]

[1]Department of Geophysics and Space Science, Eötvös University Budapest, [2]Department of Geological Research, Geological and Geophysical Institute of Hungary, [3]Geo-Log Geophysical and Environmental Ltd., [4]Institute of Geodesy, Cartography and Remote Sensing

Poster

Formation of the recent surface of the Pannonian Basin is dominated by fluvial processes filling up the basin and forming alluvial plains and gentle hilly areas between theoutcrops of the underlying Paleozoic and Mesozoic blocks. Present day structural pattern of the basin represents mainly extensional features and rejuvenated shape. Basin evolution is explained by the thermomechanical model of McKenzie [1, 2]. Development of the Pannonian Basin can be divided into two main consecutive phases: the tectonically more active synrift, and the following thermally controlled postrift phase of long subsidence and sediment accumulation. [3]. The extension and thinning of the lithosphere occured during the initial part of the synrift phase. Isostatic compensation due to the thinning of low density crust is the reason for both simultaneous and subsequent subsidence [4, 5]. The basin-forming extension is called “wide rift extensional system” which is also associated with the development of metamorphic core complexes in the rim of the area [3]. During the final stage the thermal subsidence, large amounts of sediment accumulated in the evolved deep sub-basins during the Carpathian and Badenian [6, 7]. Drava-, Sava Basin, Zagyva Trough and other sub-basins along the Mid-Hungarian Zone as well as each half graben of the Great Hungarian Plain were partially or fully filled suring this stage [3].

The aim of this study is to point out the difference between the main synrift tectonic elements of sub-basins on Tisza and ALCAPA megaunits. Some of the grabens and half-grabens were illustrated in artificial cross-sections. These sections were prepared using the right paleo-stress field directions from borehole data and 2D seismic surveys. 2D restoration was performed along the sections in order to

determine several parameters of the extension related to each other. Furthermore, extension parameters of the main synrift tectonic features (metamorphic core complexes, low angle listric normal faults and transfer fault system) were compared to each other, and these were compared in the northern and southern megaunit of Pannonian Basin (ALCAPA and Tisza). The synrift tectonic elements were categorized based on the streching parameters. The area of the metamorphic core complexes suffered the most extension, more than 25%. The second deformation type was the area of the low angle listric normal faults, with a 15-20% amount of extension. Finally, the lowest amount of streching was detected in the transfer fault zone, muchless than 15%. Information derived from certain basin divisions in an extended, Pannonian Basin scale environment with an average stretching of approximately 1.5 [8], we can concluded the value of the upper crust and the difference of the basin range extension. Integrated analysis of these results lead to understanding the forming geodynamic processes of Pannonian Basin.

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3D geological and structural modelling of the Danube Basin based on 2D seismic surveys and borehole data

István Bóna
Department of Geophysics and Space Scientist, University of Eötvös Lóránd
Poster

The Danube Basin was formed by extension, however the recent surface was the result of the fluvial sediments. The extension and thinning of the litosphere begins during the synrift phase of the Pannonian Basin [1, 2]. This thinning caused the isostatic subsidence of the region. The tectonically active synrift phase was followed by the less active postrift phase, with the previously mentioned subsidence, and accumulation of the sediments up to the Badenian [3].

This study aims to examine and analyze sub-basins in the Danube Basin. 2D seismic surveys andborehole data were used to interpret several geological structures for example faults, grabens, half-grabens. Furthermore, based on these interpretations, 2D restorations were prepared in order to determine several parameters of the extension. Relative temporal order of the deformation elements was defined based on previous publications, what allows to compare the different tectonics phases from the early Miocene to the recent active phase.

These outcomes made it possible to compare the age, origin and function of the faults with the other part of the Pannonian Basin. Integrating these results to the Pannonian Basin scale environment may help to understand the whole geodynamical process of the Pannonian Basin.

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Lithology and fludium content determination using a robust cluster analysis method - application to well logs measured from an oil exploration well

Bence Ádám Braun
Department of Geophysics, University of Miskolc
Poster

The determination of hydrocarbon, freshwater, ore, coal as an underground rawmaterials by well-log sections are generating the base of a successfull geological exploration. The exact place and lithological division of this materials in the layersequences is the greatest task for well-logging methods.

In my presentation I will show up a new-type, robustificated clusteranalysis and it had been applied via oil-exploration well-logs, where the modification factor was the Most Frequent Value-method (Steiner-weights). The most important task of clusteranalysis is to classify the data by a given common property. This classifing method is made by a well-defined metrics, also by a distance-function.

The final task of my thesiswork was to create a non-hierarchical, geostatistic-based dataprocessing method. The base of applied method was the geostatistical-preferred „classic" euclidean distances-type clusteranalysis, that is modified by the theory of Most Frequent Value-method (Steiner-weigths). In the presentation a 6 dimensional dataset was classified: spontaneous potential, natural gamma-ray, 10 and 40 cm resistivity, bulk density and neutron porosity.

By the received results can state, the method is well-applicable for determination of different rawmaterials quality and for exact determination of layerdepths. It was made by numerical calculation way, in MatLab programming environment, thus the excavated rock's quality-knowledge for defining of lithology are secondary. In this way it can determine the layers' depth and thickness more easily / more efficient in a given geological media and it has more precise results for deposit evaluation. Besides this, it has other advantages: high noise and outliers rejection capability.

Absolute magnetic measurement with FluxSet digital D/I station

Ádám Domján[1], László Hegymegi[1], Csaba Hegymegi[1],
János Szöllősy[2]
[1]MinGeo Ltd.
[2]Individual contractor
Poster

Geomagnetic observatories use classical theodolites equipped with single axis flux-gate magnetometers to determine absolute values of declination and inclination angles. This instrument and the measurement method is very reliable but needs a lot of handwork and experience. The authors developed and built a non-magnetic theodolite which gives all measurement data in digital form. Use of this instrument significantly decreases possibility of observation errors and minimizes handwork. The new instrument is presented in this paper together with first measurement results in comparison to the classical one.

Why suitable the „susceptibility termination surfaces" for stratigraphic investigation of fluvial freshwater reservoirs?

Tímea Fogarassy-Pummer[1], Enikő Faragó[2]
[1]Geological and Geophysical Institute of Hungary, [2]University of Debrecen
Poster

According to recent conclusions (Püspöki et al. 2016) a Quaternary fluvial MS record can be controlled by the climatic changes due to the changing delivery and preservation of magnetic minerals. Cold-and-dry climate can ensure the releasing of magnetic minerals by frost shattering, while the early postglacial periods can lead to the transportation of these minerals into the alluvial plains thanks to the increasing discharge of rivers. However, with further warming the weathering-sensitive magnetic minerals soon disappear from the soils of the catchment area and thus from the fluvial load. As a result, early postglacial warmings are expressed by the occurrences of fluvial MS maxima ("magnetic episodes"), while the fluvial deposits of interglacials are characterized by low MS values.

Due to the relatively fast (10^2–10^3 years) phase transformations, the high magnetic content of the early postglacial fluvial load abruptly

decreases, thus producing low MS of the subsequent interglacial alluvial accumulations regionally, both in channel and overbank sandy facies. This relatively short, sharp change in mineralogical composition can be traced in the magnetic susceptibility records, providing a sensitive marker and correlative surface (susceptibility termination surfaces – STSs) in the fluvial sedimentary record. Therefore STS can be considered as a promising tool for stratigraphic investigation of fluvial freshwater reservoirs.

Now, as a first test, we present log correlations in the close surroundings of magnetically investigated fully cored boreholes of the Körös Basin (Nádor et al. 2003) interpreting the data from the hydrogeological wells of the enclosing local water reservoirs. We present sections at Dévaványa, Vésztő, Szarvas and Komádi.

As a result we can conclude that considering the lithological appearance of the STSs i.e. their occurrence at the boundary of sand below and clay on the top we can calculate with the minimal rate of erosion in the investigated fluvial sequence along the STSs. This gives a potential at least in short distances, for the reliable mapping of STSs in hydrogeological wells where magnetic susceptibility was not recorded and one is forced to work only with lithological and wireline log data.

These results can modify the domestic hydrogeological practice adapting the mapping of STSs in stratigraphic interpretations, using adequate complex data bases (lithology and logs), and suggesting the completion of the in-situ logging sets by magnetic probes.

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New data of the origin of the P-Mn-U-Be-HREE-enrichment in phosphatite, near Bükkszentkereszt, NE Hungary

Péter Gál[1], Márta Polgári[2,3], Sándor Józsa[1], Lóránt Bíró[4], Ildikó Gyollai[2], Krisztián Fintor[5]

[1]Eötvös Loránd University, Department of Petrology and Geochemistry, [2]Research center for Astronomy and Geosciences, Geobiomineralization and Astrobiological Research Group, Institute for Geology and Geochemistry, Hungarian Academy of Sciences, [3]Eszterházy Károly University, Department of Natural Geography and Geoinformatics, [4]Eötvös Loránd University, Department of Physical and Applied Geology [5]Szeged University, Department of Mineralogy, Geochemistry and Petrology

Poster

A positive uranium anomaly was detected near to Bükkszentkereszt, in the Bükk Mts. in 1971 as part of the uranium-research programme in Northern Hungary. Strongly deformated phosphatite layers occur in the locality in the microbrecciated crack zones of the weathered metarhyolite tuff of the Bagolyhegy Metarhyolite Formation, of Triassic age (Ladinian-Carnian). These layers were also found in the nearby deepened shafts and shallow drillings, it figured out that the ore bodies form irregular run out lenses in variable tickness [1].

The phosphatite bodies form inhomogenous bands, their color is light cream and brownish, depending on the amount of Mn-oxides. The ore is massive, especially fine-grained. The Be and U content of the phosphatite is around 0.1 % (max. value), furthermore it has a significant HREE content and the chalcophile elements show also enrichment (particularly Zn and As). The ore was not mined, because its parameters did not reach economic level [1].

It is supposed that the fluids discharging on the cataclastic crack zones of the metarhyolite tuff generated the phosphatite [1]. The origin of the hydrothermal fluids can be the result of the heat effect of the alpine regional epimetamorphism and the submarine exhalations after the subsidence of the area. The Si-P-Mn-U-Be-HREE-containing fluids, having a high Ca-content probably soluted from limestones while moving on the crack zones, dissolved the silicate rocks with the metasomatism of apatite-Mn-oxides. U-Pb isotope dating (ICP-MS) showed 49-29 Ma for the U-enrichment. Fission track age data of the apatite formation, supported this time interwall giving 47.7 Ma. The

enrichment of the U was probably a long process, the samples having higher U-content have younger ages [1].

In the frame of the CriticEl research project at Miskolc University (2014), surface occurence of the phosphatite was reexplored in order to reinvestigate the geochemistry and mineralogy of the ore body. With SEM-EDXS and XRD investigations the mineral composition was determined, the cream-colored bands are made up by mostly quartz and some fluorapatite, while the dark bands are significantly enriched in fluorapatite with some quartz and a strongly variable Mn-oxide content. High resolution ICP-AES, ICP-MS, LA-ICP-MS and WDXS technology were used for the phosphatite and different rocks of the Bagolyhegy Formation, adding new data to the known main and trace element compositions and distribution. The apatite contains the U-Be-HREE in inhomogenous dispersion, but the Be is enriched mostly in Mn-oxides [2].

I participated also in the research project, I made mapping and sample collecting field trips. New Investigations was made on two self-collected phosphatite sample in the ELTE, Department of Petrology and Geochemistry, and in the Institute for Geology and Geochemistry, Hungarian Academy of Sciences. Preliminary observations showed thin, Mn-oxide and Fe-oxide-hidroxide bands, stromatolite-like, filamentous and coccoid-like microstructures, which contain ferrihydrite and pyrite, and also variable embedded organic compounds based on in situ FTIR- and Raman-spectroscopy. These structures can be interpreted as series of Fe-rich biomats. According to POLGÁRI (2016) [3] the Bükkszentkereszt occurrence is a mineralized microbially mediated deposit, and the recent results may support this scenario based on the mineralized microbially produced structures. Also the P, Mn, U, Be, (As, Zn) are bioessential elements. Recent analogies and experiments prove that the microbial colonies represent metabolic-processes which are accompanied by the enrichment of some elements. The complex activity of the colonies can create ore deposits in geological times [3]. The role of the microbial mediation needs further investigations, but the recent results sign a new way in the investigation of the origin of the P-Mn-U-Be-HREE-enrichment.

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Clay mineral assamblages in the Praid salt rocks: an X-ray powder diffraction study

Orsolya Gelencsér
Department of Mineralogy, Eötvös Loránd University
Poster

The Transylvanian Basin (TB) developed between the East Carpathians, South Carpathians and the Apuseni Mountains in a back-arc type tectonic setting. TB has some specific characteristics compared to other basins in the Carpathian-Pannon region. It is subsided simultaneously during the Mid- and Late Miocene and one of the characteristic features of the basin fill is the presence of Middle Miocene evaporites, represented by shallow-water gypsum and salt as a result of the Badenian salinity crisis. Praid is situated at the Eastern Diapir Belt of the TB. The aim of the study is to determine the origin of the clay minerals in the salt.

The samples from Praid were collected from different places of the mining area. X-ray powder diffraction measurements were performed on natural samples at Department of Mineralogy of Eötvös University using a Siemens D5000 diffractometer. Based on the preliminary studies the most abundant evaporitic minerals are halite and anhydrite. Subordinate amount of gypsum is associated with halite and anhydrite. It is noteworthy to mention that potassium and magnesium salts are absent. Beside these salt minerals, quartz, feldspar, carbonates (calcite and dolomite) and phyllosilicates (clay minerals) are present. Based on the bulk rock analysis the samples contain illite/muscovite, chlorite and mixed-layer illite-smectite as clay minerals. Some samples contain dark-color interbedded strata which contain clay minerals, mainly illite and chlorite. Further detailed investigation of the clay mineralogy in the < 2μm fraction is

in progress, and the results will be presented at the conference. The knowledge of the clay mineral assemblage helps us to reconstruct the paleoenvironment where these salt deposits was formed.

Structural and textural evicences of magma mingling and mixing in diorites of the Ditrău Alkaline Massif (Romania)

Adrián Heincz
University of Szeged
Poster

The Ditrău Alkaline Massif (DAM) is part of the S and SW Giurgeu Mountains (Eastern Carpathians, Romania). Structurally, the DAM is the part of Alpine Bucovinian Nappe System having direct contact with four Pre–Alpine litogroups. A wide variety of igneous rocks were described in the DAM form ultramafic cumulates (hornblendites) to differentiated granitoids (for examples: gabbros, diorites, monzonites, syenites, nepheline syenites). These rocks were cut through by numerous dykes of lamphrophyres, tinguaites and ijolites [1].

Near the confluence of the Pietrăriei de Sus-creek and the Jolotca-creek an artificial excavation located. The excavation reveals a main section of the diorite rocks of the DAM. In the diorite wall-rock mafic and ultramafic enclaves can be identified with high diversity of geometry and texture.

On the 60 m^2 section of the diorite rounded or elongated, dark grey mafic enclaves with size of few centimetres or diametres can be seen in a highly oriented grey more felsic host rock. These enclaves are surrounded by a more mafic mantle (chill margin) than the internal part of the enclaves. Beside mafic enclaves, felsic aggregates, and dark grey, in some case black, mafic bands (schlieren) appears in subordinate amounts. On the upper and the lower section of the wall, the mafic enclaves are significantly enriched, but on the middle part of section the enclaves “float” in the host rock. Beside the host rock grey, medium-grained, oriented diorite, other types of structures are distinguishable on mineralogical and textural basis.

All of the structural types and the host rock have holocrystalline, phanerocrystalline, hypidiomorfic-granular texture. The studied rocks

contain amphibole, pyroxene, biotite and plagioclase, occasionally K-feldspar and calcite with different amounts. The accessory minerals are titanite, magnetite and apatite. Four rock type can be separated based on the modal analysis: hololeucocratic diorite (felsic inclusion), mesocratic diorite (grey, medium-grained, oriented texture structure; grey, coarse-grained, oriented texture structure, fine-grained mafic enclave; feldspar-aggregated enclave), melanocratic diorite (dark grey, feldspar-aggregated rock; dark grey, feldspar-aggregated mafic enclave) and pyroxene-hornblendite (ultramafic enclave). The rock forming minerals show many microtextural marks. The plagioclase shows multiply overgrowth, resorbed crystals, altered core with unaltered margin, different inclusions-bearing types (inclusion-free, resorbed core with inclusion-rich margin and inclusion-rich crystal with thin inclusion-free margin) textures which refer to the interaction of different magmas. Rarely amphibole-mantled pyroxene appears in the chill margin. In some cases, the plagioclase contains needle-like apatite crystals, showing rapid cooling.

In the studied outcrop, the lenticular shape of the enclaves with more mafic mantle, their oriented appearance and the presence of schlieren structures suggests the mingling of magmas with different composition and physical properties and the chill margin show the effect of quench process [2]. The microtextural features of enclaves (zonation in crystals, resorbed crystals, different inclusions-bearing plagioclases, amphibole-mantled pyroxene, needle-like apatite crystals) suggest local disequilibrium between the mafic magma and the more felsic host magma due to mixing processes [3] [4].

In the studied outcrop, the structural and textural features show the sign of mingling process. The microtextures of rock-forming minerals suggest the presence of mixing process. However for the confirmation of the presence of mixing process, further geochemical examinations are needed.

This study could be useful to understand the structure and processes of the magma chamber of the Ditrău Alkaline Massif.

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Receiver functon analysis using AlpArray stations in Hungary

Kalmár Dániel[1], Süle Bálint[2], and Bondár István[2]
[1]Department of Geophysics and Space Science,Eötvös Loránd University,
[2]Research Center for Astronomy and Earth Sciences, Hungarian Academy of Sciences
Poster

The AlpArray temporary seismic network, together with the permanent stations of the Hungarian National Seismological Network provides an unprecedented density and resolution to study the Eastern Alps - Pannonian basin transition zone. Previous receiver functions studies .(Hetényi et al., 2007, 2015) in the region used a much smaller station density and shorter time period than the present paper. In the analysis we used data from 48 permanent and temporary AlpArray stations in Hungary and neighbouring countries. We present our methodology (P-wave receiver function analysis and H-K grid search method), the pitfalls in processing, and finally our result, the detailed Moho map of the region.

New testing program to measure acoustic velocities under triaxial loading

Anett Kiss
Department of Geophysics, University of Miskolc
Poster

Acoustic waves are often in focus of geophysical investigations. They are used for reflection seismic measurements to determine large scale geological structures, for refraction seismic which operates in the near surface region, for acoustic well logging to complete seismic measurements (calculation of acoustic impedance log and synthetic seismograms, improvement of seismic velocity model) and obtain

information about porosity along the borehole. These methods provide in situ information. After determining the wave travel times, the length of propagation path (depth) can be calculated if the velocity is known, or vice versa. But how can we determine the velocities?

One possibility is to measure the longitudinal (P) and transverse (S) velocities in laboratory, where all the conditions (pressure, displacement, temperature, etc.) can be monitored and controlled and use them as an estimate for field applications. At the rock physical laboratory of the University of Miskolc, a complex loading and ultrasonic measuring system is available. In previous years acoustic velocity data measured under uniaxial pressure were determined and processed with the developed rock physical models. Now a new measuring program is written using the Freely Programmable Interface of the software DION7 developed by walter+bai ag, which gives the opportunity to apply triaxial pressure conditions to the samples. The measuring system consists of five major units: triaxial cell, load frame (Servo1), pressure generator (Servo2), 2-channel acoustic device to measure P and S wave velocities as well as the controllers and computers to control the whole system. The controlled parameters of Servo 1 are the Load and Stroke (path of the pressure plate), for Servo2 they are the Pressure and the Volume (in the piston). The advantage of the system is, that beside these four physical parameters, user-defined virtual channels can be introduced as well. For example such a virtual channel can be the axial pressure calculated from the actual value of the Load and the sample diameter. It is not only defined, but it can be controlled as well. Another useful feature is, that parameters of one Servo can be exported and imported into another Servo and controlled there. It makes the programming easier and the programs shorter and clearer.

Adjusting the parameters, now the cylindrical samples (diameter 35 mm) can be loaded similarly to in-situ conditions. The loading frame provides the axial loading of the sample up to 300 kN, the confining pressure can be increased up to 80 MPa using the pressure generator. In this newly developed program the pressures are increased hydrostatically stepwise with a ramp function having a loading rate of 0.05 MPa/s between each step. (Of course if it is required $\sigma_1 \neq \sigma_2 = \sigma_3$ pressure system can be built up as well.) Reaching the desired pressure step 340 s waiting time is embedded for the

relaxation of the sample. Before increasing the pressure to its next value the longitudinal and transverse velocities are measured using 256-fold stacking. The sum up of the individual signals is necessary to supress the random noises and make the useful signal and so the first wave arrivals more visible. Using manual acoustic measurements the first arrivals of the waves can be picked in real time on the screen, or in automatic mode the wave signals are saved, which can be evaluated later in different seismic programs, for example in Reflex. From the travel times and the sample length the P and S wave velocities are calculated in the measured pressures interval.

The research was supported through the ÚNKP-16-3 New National Excellence Program of the Ministry of Human Capacities.

Trace-element distributions of corundum from heavy mineral deposit at Kikeri-tó based on LA-ICP-MS studies

Ákos Kővágó[1], Sándor Józsa[1], Edit Király[2]
[1]Department of Petrology and Geochemistry Eötvös Loránd University,
[2]Geological and Geophysical Institute of Hungary

Poster

In the outcrop of Kikeri-tó (Kikeri lake, Bakony Mts.) Pannonian shallow marine siliciclastic sediments are exposed. It is located in an abandoned sand quarry between Várpalota and Öskü 2 km to South-West from Várpalota. This 5 m thick sequence is composed by altering layers of sand and gravel. On the top of the outcrop, there is a layer of well sorted and cross bedded sand which contains a nearly one-centimetre-thick heavy mineral placer [1] with nice variable transparent mineral fraction included corundum.

In the past there was some heavy mineral analysis (Oláh, Katona and Szilágyi) of the deposit but these results are unpublished. Our goal is to find the source of corundum and the adjacent heavy mineral assemblage. We analysed the heavy minerals of the placer in the grain size of 63–125 μm and 125–250 μm. Heavy minerals were sorted out by sodium polytungstate.

We analysed the trace elements of corundum to determine its geochemical fingerprint, the size of the analysed grains of corundum is between 250–500 μm. LA-ICP-MS analysis was applied for trace element determinations at the laboratory of MFGI. The results suggest

metamorphic origin of corundum and of larger part of heavy mineral assemblage as well.

However for finding the source rock we need further investigations of primary corundum deposits on the possible source areas, for example Börzsöny Mts., Soproni Mts. and Velencei Mts.

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Geophysical Investigations on Reactivated Karst Springs in Tata – A Case Study

Dorottya Polgár, Erika Hegymegi
Geological and Geophysical Institute of Hungary
Poster

Reactivation of karst springs after the termination of mining and dewatering operations causes environmental risks and issues in the surrounding towns of the former mining area that is connected to the Transdanubian karst aquifer.

The (re)appearance of springs in built-in areas can be hazardous and thus the geological, hydrogeological conditions must be updated for geotechnical, architectural development, sustainability management and adaptation. In this case study the investigation of the appearance of a spring in a basement of a 5-storey house in Tata will be shown.

GPR and geoelectric measurements were performed around the building to obtain information on the local geological conditions and the potential groundwater flow directions. Shallow drilling datasets were used to validate the geophysical results.

As a result it was possible to locate an area characterized with relatively high electrical resistivity values compared to its environment that can be identified as a permeable layer with relatively lower clay content as the possible flow direction for the groundwater flow and as a source of the spring appeared in the basement of the building. The identification of this possible groundwater flow direction can enhance and support the further engineering planning and the renovation of the (sub)structure of the building.

3RD SESSION

The Pannonian mollusc fauna of the Transylvanian Basin

Dániel Botka[1], Imre Magyar[2,3]
[1]Department of Palaeontology, Eötvös Loránd University, [2]MOL Hungarian Oil and Gas Plc., [3]MTA–MTM–ELTE Research Group for Paleontology
Theoretical

During the Late Miocene, an enormous and long-lived lake – Lake Pannon – with rich endemic fauna covered most of the Carpathian Basin [3]. For a while, the water mass of the Transylvanian Basin was connected to Lake Pannon through the Sălaj area and/or the Mureş Valley.

Today, the Pannonian sediments occur in a more or less contiguous area in the central, southwestern and eastern part of the basin. After their deposition, exhumation and erosion started due to tectonic inversion, therefore the average thickness of the Pannonian sequence is only 300 m [1]. The estimated age of these sediments is between 11.6 and 9.5 Ma [4].

In the lack of a detailed and comprehensive treatise on the Pannonian fossils of the area, the accurate biostratigraphic resolution of this ca. 2 Ma has not been developed so far [2]. The widely outcropping Early Pannonian deposits offer an excellent opportunity for a modern investigation of the fauna and for exploring the changes that occurred at the beginning of the Pannonian. The rocks of similar age and their fauna are deeply buried in the Pannonian Basin and are mostly known from boreholes [5].

Taxonomic determination and revision of Pannonian brackish-water gastropods and bivalves were carried out from 63 localities. The material came from our own collection (12 localities) and from collections of the Geological and Geophysical Institute of Hungary (47 localities), the Hungarian Natural History Museum, Budapest (6 localities), and the Palaeontological Collection of the Department of Palaeontology of the Eötvös Loránd University (2 localities). Altogether 2592 specimens were determined, representing 18 genera

and 51 species. There are 77 mollusc taxa in the material, including 3 probably new species.

On the basis of faunal composition and sedimentological characteristics of the localities, shallow-water (littoral) and deep-water (sublittoral and profundal) associations were separated. The shallow-water outcrops are mainly on the basin-margin, while the deep-water ones are rather located in the central part of the basin. We hypothesize that 9.5-9 million years ago the Transylvanian Basin became isolated from the Pannonian Basin, as suggested by the appearance of new endemic taxa, and evolved as an independent lake.

Authigenic $^{10}Be/^{9}Be$ isotopic dating method was applied on 7 samples from 4 localities. The tentative results were combined with the biostratigraphic data, thus in case of the deep-water sediments, 2 biozones and 4 subzones („*Lymnocardium*" *praeponticum* – *Gyraulus vrapceanus* assemblage zone and *Congeria banatica* assemblage zone with *Radix croatica*, *Velutinopsis velutina*, *Undulotheca nobilis* and *U. rotundata* lineage subzones) were established.

The research was funded by the Hungarian National Research, Development and Innovation Office (NKFIH – 116618).

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Tectonic investigations in the area of Balatonkenese and Balatonakarattya based on ultra-high resolution seismic data

Benjamin Jakab
Department of Geophysics and Space Science, Eötvös Loránd University
Applied

Lake Balaton has been the target of structural geology research in the last few decades that resulted in a large database of 2D ultra-high resolution seismo-acoustic profiles. Using this dataset, a fault zone has been mapped in Late Miocene (Pannonian) strata below the lake and was interpreted as a sinistral shear zone sub-parallel with the lake's longitudinal axis [1,2,3]. Observed fault pattern suggests that this shear zone continues to the East with transition into known structures of Balatonfő Line.

In 2014 and 2016 new reflection seismic surveys with average profile density between 100-500 metres were performed close to the shore of Balatonkenese and Balatonakarattya to reveal the relation between faults below the lake and structures onshore. This dataset allows the detailed mapping of nearshore neotectonic features (faults and folds) and their intersections with the shoreline.

As a result of seismic interpretation faults were detected with a maximum dip separation of 5-10 metres, 1-2 metres in average and orientation of SW-NE, sub-parallel to the lake's longitudinal axis. Horizon mapping in the Pannonian strata has revealed several folds with SW-NE and W-E orientations, average wavelength of 700-1000 metres and amplitude of 2-10 metres. In some cases, the axis of synform and antiform features are parallel to faults suggesting that these folds are fault related.

New observations are compatible with the current tectonic model and the mapped folds and faults are proximate continuation of the known structures. In the light of the new results, 5 locations have been identified between Balatonfűzfő and Balatonakarattya where the fault-zone cross the shoreline.

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Salt effects on thermal regime and maturity in 2D basin models A case study from North Kazakhstan

Zsolt Nagy
MOL Plc.
Applied

Maturity and migration models were created along a few 2D seismic sections in North Kazakhstan in order to support the exploration activity. There are several salt domes in this area that could have affected the proved Paleozoic pre-salt hydrocarbon systems [1].

Seismic horizons and faults were correlated by the exploration team and were imported as basic input parameters. Identification of the petroleum system elements were based on Rock-Eval, petrophysical and well test data. PetroMod 2D software package was used in the simulation process that is able to handle salt bodies [2]. Unique lithologies were integrated into the model that are consistent with geological data and boundary condition maps were created using the calibrated 1D models.

Basin models relay on simplification in salt related workflows. Volume of salt body remains unchanged during the different time steps, so the models don’t deal with external salt masses originated from neighboring areas [2]. Salt thickness maps were generated for every time steps in the modeling workflow. Recent salt thickness maps were used as starting point of the model building process. The salt movement caused displacement of the post-salt sediments. Therefore, it was necessary to construct thickness maps of the overlaying layers as well as salt thickness map.

The simulation results proved that there are two independent hydrodynamic systems which have no effect on each other. The stratigraphic column is divided into a pre- and a post-salt part by the salt layer. There are no identified source rocks in the post-salt

sediments. However, hydrocarbon generation, migration and accumulation take place below the thick salt layer.

The thermal conductivity of mixed salt layers are two or three times higher than in case of evaporite-free sediments. This high heat conductivity was taken into consideration, and the models shows that the elevated conductivity has impact on the spreading of the heat. These effects have a dual role:

- cooling effect on the pre-salt sediments due to high vertical extension and conductivity of salt,
- and the rapidly transported heat results positive thermal anomaly in the post-salt strata next to the domes.

The simulated subsurface thermal regime clearly reflects this dual thermal anomaly: thermal isoclines are pulled up between domes while the same isoclines are pushed down below diapirs. The maximum magnitude of the pull-up was encountered 900-1000 m while the push-down effect was few hundred meters.

Very similar anomalies were identified in the depth of the maturity zones, but the differences are smaller than in the case of temperature. Salt windows caused 500-700 m shift in the top of the main hydrocarbon zones.

As a conclusion, basin modeling is possible between salt domes but it could involve some unexpected challenges. However, simulation can be more valuable than evaporite-free areas because the few point data can’t represent the deeper part of the salt basin. Above all a few hundred meters shift in the hydrocarbon zones could bears economic impact also due to the appearance of lighter hydrocarbons.

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Significance of Jurassic early deformation structures in the SW-Bükk Mts.

Éva Oravecz, Szilvia Deák-Kövér, László Fodor
Eötvös Loránd University, MTA-ELTE Geological, Geophysical and Space Sciences Research Group
Theoretical

Field work in the quarry of Bükkzsérc and at the Patkó Cliffs (SW of Bükk Mts) revealed several types of early, soft-sediment deformation structures in the Jurassic Bükkzsérc Limestone which was deposited in a subduction-related basin of the Neotethys ocean and now appears as olistoliths in the accretionary Mónosbél Complex. These structures include small syn-sedimentary normal faults, ductile shear surfaces and slump folds, both of which were not recognized by previous structural geological and sedimentological studies (e.g. [1]), although these structures have direct implications for the poorly known early deformation history of the Mónosbél Complex and possibly of the Bükk para-autochtonous unit.

The aim of our study was to estimate the Jurassic paleo-stress field for the Mónosbél Complex of the Bükk Mts. by measuring syn-sedimentary faults, and to estimate the paleoslope direction from the slump fold geometries.

In case of the normal faults, the key observations in our interpretation were that the faults are rather characterized by rounded, curved shapes, and that they don't have discrete fault planes. This can be explained by syn-sedimentary deformation in case of which the deformation in soft sediments is limited, while the diagenetic processes may have further effects on fault geometries as well.

Data were rotated back to its paleoposition by the average paleomagnetic data attributed for the Bükk Mts. (e.g. [2]). Based on the back-rotated small-scale deformation structures we estimated a NE-SW extension as the Jurassic paleostress field, while the results of the slump fold analysis showed a SW paleoslope direction. Although these extensional directions match the previous broad estimations, we need to take into account that the olistolith itself could have had further rotation, so in order to finalize our estimations, additional measurements in other olistoliths and direct paleomagnetic data from the Bükkzsérc olistolith are still needed.

The research was supported by the research found NKFIH OTKA 113013 and the ÚNKP-16-1 New National Excellence Program of the Ministry of Human Capacities.

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Nothia ex gr. excelsa (Grzybowski, 1898), 'flysch-type' agglutinated foraminifera from the Karpatian (Early-Miocene) of Hungary

Eszter Balassi, Ágnes Görög, Tamás Váczi
Eötvös Loránd University
Applied

Nothia ex gr. *excelsa* [1] branched, agglutinated, tubular foraminifera is documented for the first time from the Karpatian (latest Burdigalian, 15.97‑17.10 Ma) molasse sediments of the Paratethys. Because of the tectonically disturbed incomplete successions, the foraminifera record of the Karpatian is relatively poor and void, therefore every new information is especially valuable.

In more detail, samples were collected from the vicinity of Acsa village, Cserhát Hills from the succession of an abandoned gravel pit, where the Garáb Schlier concordantly overlies the Egyházasgerge Sand. The studied pit had a higly diverse microfauna, Altogether more than 1500 tests were picked and classified into 48 taxa, notedly 44 species of 37 genera belonging to 28 families. More than 500 *Nothia* ex gr. *excelsa* specimens were analysed for this study.

Uniquely well-preserved specimens were present in both formations, allowing the analyses of the macro- and microstructure of the test using reflected and polarized light microscopes, SEM and Raman spectroscopy. The mineralogical components of the agglutinated grains, the appearance of the protruded aperture with a scalloped-edge, the microstructure of the bilamellar wall, the presence of the calcareous microgranular cement could all be described in detail. Systematic description was given based on isolated specimens and on oblique and horizontal thin sections made from them.

The specimens of *N.* ex gr. *excelsa* are generally straight tubes but dichotomously branching forms are also abundant. Based on autecology, the test morphology and the associated fauna indicate that *Nothia* ex gr. *excelsa* was a surface-dwelling detritivore with a seasonal-phytophagous mode of life. Lying on the surface is an unusal mode of life, as tube-shaped foraminifera are, in general, erected.

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4TH SESSION

Geological and hydrogeological evaluation of the preliminary work of remediation of waste dump in Nyíregyháza-Borbánya, Hungary

Rita Kapiller, Balázs Benei
BIOCENTRUM Environment Protection and Water Management Ltd.
Applied

TPH, BTEX and toxic heavy metal pollution were detected in the early 2000's at the eastern side of Nyíregyháza-Borbánya, Hungary. The area once was a lake which was started to fill up with communal and industrial waste from the 1960's till the middle of 1980's. The environmental site assessment and the technological intervention were financed by the Environment and Energy Operational Programme funded by European Union and Hungarian Government. The technological intervention was set by BIOCENTRUM Environmental Protection and Water Management Ltd. between 2014 and 2016.

Several detailed investigations were set off to reveal the geological and hydrological settings of the area. Multiple methodologies were used during the investigations such as geophysical cone penetration test (GCPT), vertical electrical sounding (VES) and in situ hydraulic conductivity (K) measurements. The geological settings of the landfill showed a varied picture according to the geophysical and hydrologic measurements. Fine grained beds with low K value, coarse grained beds with high K value and transitory beds appeared as well. The beds located directly below the waste dump were medium grained sands with high K value and continuously

alternated into a fine grained clay bed, and then coarse grained sand beds were underlying the clay with persistent transition and high K value as well. The clay bed regard as an aquitard separated two different aquifer layers: unconfined groundwater could be found above and confined groundwater beneath the clay bed.

The following methods has been used during the technological intervention: 1) construction of a watertight barrier at the south side of the northern area; 2) translocation of the garbage, waste; 3) clearing the groundwater with pump-and-treat method; 4) fitoremediation on the mixture of soil and waste.

Within the intervention, the soil, unconfined groundwater and deeper, confined groundwater were tested for the following components: TPH, benzene, ethyl-benzene, xylenes, nickel, zinc, arsenic and boron. The arsenic and boron were the two main pollutants in the area. The distribution in time and space of the general water chemistry parameters and the conductivity show us the decrease of the pollutants` concentration. In 2016, at the end of the technological intervention the concentrations of all pollutant components were under the „D" threshold limit and the samples from different plants contained larger amounts of boron, copper and arsenic, nickel than before. Taking one thing with another the remediation achieved its goal.

Several geological and hydrogeological questions incurred during the preliminary work of the above demonstrated investigation and we used different methods for the interpretation. We investigated and determined the connection between the two different aquifers, the distribution of the pollutants and of high conductivity water evaluating data of GPCT, VES and pumping tests.

This presentation tries to reveal that although the intervention is over, the huge amount of residual data can help us to understand the geological and hydrogeological settings of the area.

Geologic Structure of the Keta Basin, South-Eastern Ghana, From Geophysical Datasets.

Nuamah Daniel Oduro Boatey
Department of Geophysics, University of Miskolc
Applied

Seismic, magnetic and gravity geophysical methods have been applied to the Keta basin to delineate tectonic structures, lithologic boundaries (contacts) and estimate depth to the basement. Four processing methods namely the edge detection techniques, located 3D Euler deconvolution, 2D inverse modeling and fault interpretations were applied to the acquired data sets. Three edge detection methods (horizontal, tilt and 1st vertical derivatives) were applied to the magnetic data to delineate basement lineaments which were further interpreted as faults and lithologic contacts from a produced structural map of the study area. The general trends of the mapped faults were northeast-southwest, east-west and northwest-southeast.

Several basement faults were mapped with two of them considered as major fault since they run through the entire basin forming two fault systems. These were inferred to correlate with the Fenyi-Yakoe and Adina fault-systems established by Akpati [1]. Depth to magnetic source estimated from located 3D euler deconvolution showed non-uniform depth across the basin with deeper depths occurring to the south and east (> 2000 m) whilst shallower depth occupies the north and south-west (< 1500 m) of the study area. 2D inverse modeling of gravity data revealed depth and width of approximately 3.5 km and 10.7 km respectively for the Keta lagoon trough located at the eastern-most part of the basin. Fault interpretation from 2D seismic sections indicated that the onshore sedimentary succession may be characterized by both normal and reverse faulting whilst the offshore is dominated by step-like normal faulting. The mapped faults mostly dipped north/north-west in direction and appeared to be more intense along the narrow shelf than the offshore area. In terms of geometry, the Keta basin was inferred as a conical southward sloping opened basin controlled by basement flexures and fault systems.

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Inversion of Cocurrent Electrical Measurements Based on Initial Models Given by Recursive Way

Viktoria Pap
ELTE TTK Department of Geophysics and Space Science
Theoretical

From the statistical point of view the inversion is the proper approach to evaluate geophysical data. The calculated statistical characteristics of fitted parameters reflect the information gain and uncertainties. The VES data inversion is based on direct problem related to the horizontally layered media. In multilayered case the coefficient function of solution can be expressed by recursion which makes harder the calculation of statistics (Jacobian and Hessian). Perhaps because of these difficulties, the most often used inversion softwares (GEOTOMO softwares) don't calculate parameter covariance matrix, just the residual which is not enough to judge of parameter uncertainty and parameter equivalences.

During my research the VES inversion was extended to the multilayered case. The developed software (numerical integration of Bessel-Fourier integrals) has been tested by simulated date in the first stage and real data in the second phase.

In order to handle this problem the aim of the study is to expand the traditional inverse methods in multi-layered case, moreover to determine the results (electrical resistivity) and the necessary statistical elements (covariance matrice of the parameters and estimated measurements) in the form of parametervector.

During the research I used the program MathCad to execute the inversion of two-and three-layered models from the determinaton of unknown parameters to the analysis of measured data. Hereafter I would like to offer a method to solve inverse problems given by recurrence way, where - according to the traditional two-and three-layered case - I found out the covariance matrice of the parameters and estimated measurements, with the help of that I would like to present the equivalence reflecting also in the statistics.

To sup up, the research with appropriate statistical analysis and numerical calculations in recurrance way provides numerous possibilities to the detailed examination of inverse results in multi-

layered case. The methods can be used in several fields of geophysics, for instance in the research of archeology and raw materials.

Re-evaluation of the Sirok-1 borehole based on the available samples: mineralogical, petrological features and some curiosities related to history of science

Tibor Zádeczki, Gabriella B. Kiss, Sándor Józsa
Eötvös Loránd University, Faculty of Science, Department of Mineralogy, Department of Petrology and Geochemistry
Theoretical

The Darnó Mountain is located in NE Hungary, forming a part of the Bükk Unit, within the ALCAPA Megaunit. Igneous and sedimentary rocks related to Triassic magmatism, representing the early rifting stage of the Neotethys, are found in this unit, which can be correlated to the Dinarides as well (Kovács et al. 2008, 2010; Kiss et al. 2008, 2010, 2012).

The latest detailed review of the submarine igneous rocks was performed by Kiss et al. (2010). In this work several surface outcrops and a few boreholes were studied. However, the Sirok-1 borehole was not involved, because its samples disappeared. Only a few samples are available from previous sampling, therefore the present work aimed to describe the available material and place the results within the frames of the modern research.

With macroscopic and polarization microscopic study, two types of basalt were distinguished. Both are characterised by the typical features of the closely packed pillow facies.

Type A has spherulitic and variolitic texture. The rock-forming minerals are pyroxene and plagioclase appearing in larger size than in type B basalt. Pseudomorphs after olivine and spinel are also found as well as chlorite and calcite appearing in veins formed by hidrothermal circulation. In contrast, type B basalt has variolitic texture and the rock-forming pyroxene and plagioclase appear in smaller size. Pseudomorphs after olivine and spinel cannot be found, but chlorite and calcite also appear in the veins together with some clay minerals. The SEM-EDS study revealed that the plagioclase is commonly albitic, while the pyroxene is diopsidic in composition. Discrimination

factors calculated based on the chemical composition of pyroxene suggest withinplate basalt origin. The results show significant similarities with the ones described by Kiss et al. (2010), therefore we may assume that the formation of this basalt is also related to the rifting of the Neotethys.

Basic characteristics of some other rock types (limestone, andesite) along the section of the borehole were also described, moreover the origin of two unsure samples was clarified as well. Therefore the present work can serve as basic documentation of the remaining samples of the Sirok-1 borehole and can be used as further reference also.

Shale volume estimation by factor analysis using a global optimization approach

Armand Abordán
Department of Geophysics, University of Miskolc
Applied

Factor analysis of well logging data is applied to calculate shale volume in hydrocarbon formations. A global optimization approach is developed to improve the fit between the observed and theoretical data calculated by the factor model. Shale volume is directly calculated from the factor scores by a nonlinear relationship, which is consistent in the studied area in Alaska, USA.

The results of the factor analysis of well logs are compared and verified by independent estimates of deterministic modelling. The suggested method is tested in three different shaly-sand formations in the North Aleutian Basin (Alaska) and the comparative study shows that the presented nonlinear relationship between the factor scores and shale volume is applicable with the same constants in all three formations.

The suggested global optimization approach to factor analysis provides an independent in-situ estimate to shale content along the borehole, which can be effectively used to further improve the geological model of the hydrocarbon structure in the investigated area.

On the possible source locations of HP-metaophiolitic polished stone artefacts

Benjámin Váczi[1], György Szakmány[1], Zsolt Kasztovszky[2], Zsolt Bendő[1], Elisabetta Starnini[3]

[1]Department of Petrology and Geochemistry, Eötvös Loránd University, [2]MTA EK Nuclear Analysis and Radiography Department, [3]School of Humanistic Sciences, Department of Historical Studies, University of Torino, Italy Applied

In NW-Italy most of the Neolithic polished stone artefacts (axes, adzes, chisels) are manufactured from high pressure and low temperature metaophiolites – greenstones – but we can find them in minor quantity in other collections everywhere in Europe also [1, 2, 3]. In the last 10 years in Hungary 25 prehistoric polished stone tools were identified during the re-examination of the Museum historical collections [4]. The specialty of these artefacts is in their really uncommon raw material for East Europe. There are only few outcrops in whole Europe where we can find LT-HP metaophiolites in primary form: Monviso, Western Alps (near Torino)[5] and Syros and Tinos, Greece [6]. Na-pyroxenites, eclogites and their retrograde metamorphic derivates appear also in the Oligocene conglomerate on the northern side of Voltri [7] and in the alluvium of river Po, Curone and Staffora. The researchers agree in: the raw material of these artefacts originated from the W-Alps and the N-Apennines, but the precise source location is not specified so far. The aim of this research is to find significant difference between the potential source locations.

The main rock forming minerals of Na-pyroxenites and eclogites are Na-rich monoclinic pyroxenes (jadeite-omphacite), the eclogites also contain a great quantity of garnets. By the chemical composition of them D'Amico created 9 main groups: jadeitites, Fe-jadeitites, omphacitites, Fe-omphacitites, mixed jade, Fe-mixed jade, Mg-eclogite, intermediate eclogite and Fe-eclogite [3]. This type of classification simplifies the comparison between the stone artefacts and raw materials, but gives no information about the precise geological source location, because all these types of rocks appear in the studied locations mentioned above. Therefore, we think that the accessory minerals are the best tools to prove that there is significant difference between the different source locations, and that they can be

used as markers to trace the provenance of prehistoric artefacts. My preliminary researches proved that the main Ti-, and Fe-bearing mineral is ilmenite in the Monviso area and rutile appears in minor quantity. The greenstones from Curone and Po river sediments contain rutile as a Ti-mineral and pyrite as Fe-mineral. There is remarkable difference between the localities about the REE-minerals. Monviso and Po alluvium samples contain often allanite, furthermore monacite and xenotime also appear. In Curone samples the REE-minerals almost absent and the rocks from this site are characterized by strong retrograde alteration compared to samples from the W-Alpine localities.

Our work was financially supported by OTKA K100385 research project (supervisor: Zsolt Kasztovszky).

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SATURDAY

5TH SESSION

Numerical investigation of a borehole heat exchanger in synthetic and real geological situation

Zsóka Kiss, Márk Szijártó
Eötvös Loránd University, Department of Geophysics and Space Science
Theoretical

Three-dimensional finite element numerical calculation has been carried out to investigate the operation and the environmental effect of a U-shaped borehole heat exchanger in stationary cases.

A comprehensive parametric test has been applied for a stationary, homogeneous, isotropic medium to reveal the influence of the rock's petrophysical, hydrogeological properties, and the technological parameters of the heat exchanger. It was established that the existence of the groundwater flow is fundamental both for thermal energy extraction and thermal heat storage. Groundwater flow enhances the efficiency of the heat exchange (plus 31% heat extraction for the base model), however, obviously, for the latter case the effectiveness of the heat recovery reduces. The outlet temperature and power were studied depending jointly on the depth of the heat exchanger, the flow velocity in the tube and the inlet temperature (over 400 model runs). For lower tube velocities the heat exchanger takes the temperature from the rock independently of the depth of the exchanger, additionally at the lowest inlet temperatures the water is cooling in the upward side of the tube. In case of higher tube velocities the system is also insensitive to the depth of the sonde because of the reduced heat exchange. The optimization of the operation of the borehole heat exchanger can be achieved only for given geological situation and project requirements.

The operation of the system with fixed geometry was studied in a stratified, inhomogeneous geological environment, too. It was demonstrated that the specific heat power for unit depth of the heat exchanger grows significantly in permeable layers, especially with intensive groundwater flow, however its value depends on the

parameters. The presence of the negative heat anomaly induced by the heat exchanger disappears on the upstream side of the groundwater flow in the permeable layer, while expands significantly on the downstream side. Numerical shallow geothermal model of Ibrány (Betegellátó) and Zalaegerszeg (Infocentrum) was built up based on real borehole geophysical measurements. The general conclusions obtained from the synthetic model are valid in this case too, but the power output from numerical calculations underestimates the value from engineering routine. The discrepancy between the numerical solution and practice might be caused by the transient operation of the heat exchanger and the not U-shaped tube.

Thermal spring related hydrochemical and precipitation changes along a canalized water outflow in the tunnel of Gellért Hill, Budapest

Petra Bodor, Judit Mádl-Szőnyi
Erzsébet and József Tóth Endowed Hydrogeology Chair, Department of Physical and Applied Geology, Eötvös Loránd University
Applied

The canal in the tunnel of Gellért Hill provides a unique opportunity for studying the physicochemical parameters of the discharging thermal water in a controlled environment. The observations of the variation of the parameters along the flow path is significant to better understand the influencing factors of the formation of red (biofilms) and white precipitates (mainly carbonates) in this environment.

The aim of our study was to evaluate the changes of the physicochemical parameters along the flow path. Those parameters were measured which can influence the formation of the precipitates and those which also can be affected by the precipitates: temperature, specific electric conductivity, pH, dissolved oxygen content, redox potential, concentration of major ions, dissolved carbon dioxide content, concentration of radium-226, uranium-234+238 and radon-222. The parameters were measured twice and the results were also evaluated with PHREEQC by reactive transport modelling.

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Anatomy of silicified woods from the upper Permian of the Mecsek Mts.

Lóránd Mihály[1], Emese Réka Bodor[1,2], Miklós Kázmér[1]
[1]Eötvös Loránd University, Department of Palaeontology
[2]Geological and Geophysical Institute of Hungary
Theoretical

Since the end of the 19th century plant macrofossils were collected from the Upper Permian beds of the Mecsek Mountains, mainly from the Kővágószőlős Formation. The sediment of this formation is predominantly fluvial, but it contains also lacustrine, marsh, dead channel and alluvial fan facies [1, 2]. The formation has four members. The lower three correspond to the Upper Permian based on palynomorphs and the uppermost indicates the Lower Triassic [2, 3].

These plant macrofossils were stored in the Hungarian Natural History Museum and in the Geological and Geophysical Institute of Hungary. Silicified woods were collected by many researchers (SZABÓ, VADÁSZ, REMÉNYI, JANTSKY, FÜLÖP) and were determined by TUZSON [4], SIMONCSICS [5] and GREGUSS [6] in the past centuries. Two type of morphospecies were defined as *Platyspiroxylon heteroparenchymatosum* GREGUSS and *Baieroxylon implexum* GREGUSS [6], these has been used as reference for a long time in the literature [7, 8, 9, 10].

The specimens of these collections have been examined only by morphological aspects. Nowadays, statistical methods also became more useful in wood anatomy in addition to morphological descriptions: the correlation matrix (with Euclidean distances), the Principal Component Analysis (PCA) and the Non-metric Multidimensional Scaling (NMDS) were used, however a small specimen number was taken into consideration. Using the correlation matrix on the measured parameters, we managed to evaluate the radial pattern and differentiate the reaction wood from normal ontogenetic progression. The NMDS opened new perspectives in the examination of fossil wood anatomy, because it simplifies the complicated relationship between these measured histological characters and gives quantifiable results. Using this method we can determine the parts of the wood (branch, trunk, root) which are present in the silicified wood fragment. This has taxonomical importance, because in the beginning

of wood anatomy research these parts of the wood were classified into different taxa. With the statistical methods mentioned above, results have been demonstrated that all of the measured and examined specimens have to be referred as *Agathoxylon* HARTIG.

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Regional Tectonic Evolution Of The Derecske Trough, Hungary

Attila Várkonyi, Jan Witte

O&GD Central Ltd., Budapest, Hungary,

Falcon Geoconsulting, Hameln, Germany

Applied

The main focus of this study is the structural evolution of the Derecske Trough (= DT), one of the deepest Neogene depressions in the Pannonian-basin system. Located in the eastern part of the Great Hungarian Plain, the DT is interpreted as an asymmetric, left-lateral pull-apart basin that subsided heavily during Pannonian and throughout Pliocene times. Seismic and well data indicate that the DT

contains at least 6km of Neogene sediments. The northwestern basin shoulder is controlled by the SW-NE trending Derecske Fault Zone, a complex, steeply SE-dipping array of negative flower structures, affecting the entire stratigraphic succession, even exhibiting neotectonic activity. The DT has been a focus of hydrocarbon exploration for decades and is covered by about half a dozen 3D seismic volumes (vintages 1993 to 2004, total ~1500km^2) and ~2000 linear km of 2D seismic (ranging from 1950s to late 1980s). About 100 exploration wells have been drilled in the area since the 1950s. The present day DT is the result of numerous tectonic increments, such as (a) Alpine thrusting, (b) the syn-rift basin initiation, (c) Late Miocene (Sarmatian) – Early Pannonian inversion, (d) post-rift subsidence and (e) neotectonic movements. We present new structural observations regarding the timing and deformation style in the DT, based on the following data: The individual 3D seismic volumes covering the study area were merged, newly reprocessed (2017) and depth converted. Detailed structural mapping of 4 key horizons was conducted and tied with about ~35 key wells. An approximately 65km long seismic transect was extracted from the 3D volume and incrementally restored to key stages of the basin evolution. Together with digital terrain data and surface geology the subsurface data was integrated into a three-dimensional basin model. The excellent data quality enabled us to map the stratigraphic units (including reservoirs, source rocks and seals), unconformities, detailed structural elements, grabens, sub-basins with a high degree of confidence throughout most of the basin. The seismic and well data indicate that the oldest detectable structures are remnants of possibly Cretaceous-Paleogene thrust sheets, broken-up by subsequent tectonics. Isochron mapping and associated fault patterns reveal that the pre-Pannonian Miocene succession consists of at least two major units, separated by a major unconformity. We identify an Early Miocene (Karpatian) and a Middle Miocene (Badenian) sequence across the investigated area. Syn-rift deformation resulted in a series of half-grabens controlled by listric faults exhuming Alpine thrust sheets (possible core complexes), some of them buried deeply, others covered by thin Upper Pannonian strata. Dramatic subsidence occurred during the post-rift phase, as shown by anomalies on Pannonian isochron maps. Our interpretations reveal that the syn-rift depocentres do not spatially correlate with the

post-rift ones. Deepening of the sensu stricto DT caused more flexural (ductile) deformation of the overlying sediments along the southeastern basin boundary, while the northwestern basin shoulder was affected by more brittle deformation (wrench-related faulting). Data from other southeast Hungarian sub-basins (e.g. Békés Basin) indicates that the tectonic increments did not occur at the same time regionally. We suggest, therefore, that the deformation migrated spatially as well as temporally. A number of questions remain open and need additional investigation: How can different Early and Middle Miocene thicknesses on both sides of the Derecske Fault Zone be explained? Can the lateral tectonic movements be quantified? What is the effect of the underlying Alpine thrust sheets on the petroleum systems? What is the impact of these observations on hydrocarbon exploration?

Analysis of recent stress field in the Pannonian Basin using focal mechanism solutions

Lili Czirok
University of Sopron, Roth Gyula Doctoral School of Forestry and Wildlife Management Sciences
Theoretical

In my research, I carried out stress inversions to characterise the variations of the recent stress field and determine the dominant tectonic regimes in the Pannonian Basin. My studies focused on Hungary and the peripheral regions, I had 160 focal mechanism solutions (FMS) in total for my estimations. I utilized a linear, iterative inversion method to determine the tectonic stress that is best fitting to the input data. I used the program "STRESSINVERSE" in MATLAB environment.

The resulting stress tensor includes the orientations of the principal stress axes (σ_1, σ_2 and σ_3) and the shape ratio (R) that describes the relationship of the principal stress axes. These data typify the direction of maximum horizontal compression (S_{hmax}, azimuth of σ_1-axes) - that equals to the orientation of the stress field - and the typical tectonic regime (plunges of σ_1-, σ_2- and σ_3-axes) in the study area.

Because of the orientations of stress-trajectories and distribution of epicenters, I had to generate more subareas and I calculated the results of these regions. In general, my results are similar to the previously published studies, but there were some differences due to the inaccuracy or amount of the used FMS's or the tectonic background.

Building a Magnetic Surveying System for Unmanned Aerial Vehicles

Ádám Domján
MinGeo Ltd.
Applied

One of the major goals at MinGeo to develop such a FluxSet vector magnetometer device with included software, which can be mounted to any Unmanned Aerial Vehicles, also known as UAVs or drones to create magnetic survey maps. Among other things this magnetic surveying system could be utilized for geophysical prospecting, archaeology, mining exploration, and directional boring.

Many of the individual technologies of this project have been developed. At MinGeo we have implemented a low-weight, low power consumption 3 component vector magnetometer namely as FluxSet, which measures 0.1 nT resolution. In the market there are also available accurate attitude and positioning determination systems, long-flight endurance drones and flight controller software. The core innovation of the magnetic survey project is the integration of these different technologies. At MinGeo we are working on to brought together in this way.

This paper is intended to give the audience an insight the difficulties that we are faced with. There will be exhibited the results of our test measurements as well as the problems, which pop up during the development. Hardware and software implementation problem issues will be discussed in detail.

6TH SESSION

Non-destructive test methods in determining the physical properties of rocks – the use and reliability of Schmidt hammer and the Duroskop

Erzsébet Jámbor
Eötvös Loránd University
Applied

At heritage sites or at bridges, physical properties of the stones needs to be observed or measured without destroying the surface of the buildings. Compressive strength test requires core specimens, but in many cases samples cannot be taken from the building material because of heritage protection or safety reasons.

The Schmidt hammer is a non-destructive test method frequently used to assess the surface hardness and estimate the compressive strength of the rock material. The Schmidt hammer is widely used for estimating the surface hardness of concrete; however, its use for rock material has only spread in the last few decades. The hammer consists of a spring-loaded piston, which is released when the plunger is pressed against the surface. The rebound of the piston determines the *R* rebound value, which can be related to compressive strength. The Schmidt hammer ensures a non-destructive testing of surface hardness, however, the impact of the piston might cause microcracking, grain crushing and collapse of pores in friable, porous and weathered rocks. The Duroskop is also a non-destructive method suitable for weak rocks.

To compare the reliability of above mentioned methods, measurements were made on two types of rock with Schmidt hammer and Duroskop, and the results were analysed by basic data analysis and multivariate methods. Granite and marble samples were measured with both methods. On each measuring point twenty impacts with Duroskop and thirty impacts with Schmidt hammer were obtained. There are significant differences in the results, based on the sensibility of the Schmidt hammer and the Duroskop, on surface roughness, the locality of the measuring points on the rock surface and the destructive effect of repeated impact on each point.

Numerical Modelling of Seasonal Borehole Thermal Energy Storage Systems

Gergő András Hutka, János Mihályka
Eötvös Loránd University, Faculty of Science, Department of Geophysics and Space Science
Applied

Nowadays, in attempt to satisfy the heat demand of our society, several forms of renewable energy sources are under constant development. Although solar energy represents an excellent example, it has a major disadvantage: while the heat demand throughout the year is greatest in winter, the production of solar energy has its maximum during summer. As a consequence, on days having the maximum heat demand - especially in the winter period - solar energy cannot provide sufficient amount of heat. Thermal energy storages can offer an effective solution to this problem.

The aim of our study was to examine the application of medium-deep borehole thermal energy storage systems for thermal energy storage. The operation of borehole thermal energy storage system has two specific phases: in the charging or storage phase taking place during summertime, the warm fluid produced by solar energy is circulated through the borehole heat exchangers, where the fluid can transfer its energy to the colder surrounding rocks and sediments having large heat storage capacity. The other phase is the extraction period, in which significant (but not the whole) amount of energy stored in the sediments and rocks can be retrieved by circulating a colder fluid in the borehole heat exchangers.

There are several parameters that can influence the operation of this kind of energy storage system, such as the geometrical parameters of the boreholes (for example the length of the boreholes, or the distance between the boreholes), the linking type of the boreholes (parallel or serial), or the physical parameters of the surrounding rock (e.g. heat conductivity). In our study, we carried out a finite element numerical model of a borehole thermal energy storage system including 19 borehole heat exchangers. Finally, we studied the response of the system, while changing the parameters mentioned above at simple charging/extraction working phases.

Analysis of volatile compounds of drill cuttings using mass spectrometry

Sándor Körmös, Nóra Czirbus, Félix Schubert
Department of Mineralogy, Geochemistry and Petrology, University of Szeged
Applied

The drill cores may provide essential information on many geological research areas, although, the process of cutting drill cores is not part of any general drilling program, even at high crude oil price. Nonetheless, the drill cuttings are produced and expected during drilling operation, but their applicability in geological research is limited relative to drill cores.

Rock samples containing micron-sized fluid inclusions may provide valuable information about the ancient fluid system, such as temperature, pressure or composition. Considering the composition of the fluid inclusions, they usually contain aqueous fluids, however, may contain hydrogen, carbon-dioxide, hydrogen-sulphur, sulphur-dioxide, methane or higher hydrocarbons [1]. The chemical composition of fluid inclusions can be studied by non-destructive analytical methods as microthermometry, fluorescence spectroscopy, Raman and Fourier-transformed infrared spectroscopy or nuclear magnetic resonance [2]. Applying destructive analytical methods, the rock samples containing the fluid inclusions should be first prepared, and then the inclusion fluids released for extensive compositional data. The liberated volatiles can be analysed by gas chromatography, mass spectrometry and their linked procedures [2].

The mass spectrometric method is used in the oil and geothermal industry for exploration purposes. The technology can provide stratigraphic information on a lithological column due to the difference in chemical composition of fluid inclusions [3]. In this study a unique instrument, so-called gas analyser was used, that is located at Department of Mineralogy, Geochemistry and Petrology, University of Szeged. During the analyses, the rock samples were crushed in vacuum chamber at pressure of 10^{-5} mbar and at temperature of 100 °C. Thereafter, the evacuated volatiles were analysed by mass spectrometry.

The device is being under development, accordingly it is necessary to set up its own measuring protocol, that is why we have

performed crushing and cleaning tests. The crushing tests were implemented to determine the amount of sample and the number of hits for the crushers. Owning the results of crushing tests we could specify the optimal crushing process and amount of samples for a representative and reproducible procedure. The cleaning tests were performed for eliminating the contamination adsorbed on the surface of samples. As a result, we have established the optimal sample preparation and measuring process for the gas analyser. The applicability of the designed measuring procedure was checked on drill cuttings originating from two wells of the Hungarian Paleogene Basin.

During the evaluation of mass spectrometric data, we have considered organic and inorganic molecule ions and fragments [3]. Based on the results we have successfully identified the barren and the producing wells. We assume the presence of decane, cyclooctane and polycyclic hydrocarbons – containing maximum 12 carbon atoms – in the fluid inclusions of the digested drill cuttings. Furthermore, we have determined the paleo-fluid system, the paleo-oil-water, the paleo-oil-gas contact and the presumable extent of vertical migration. We have verified the results of mass spectrometric data by UV-fluorescence spectroscopy performed on thin sections, prepared from drill cuttings originated from the paleo-oil-water leg.

Using the mass spectrometric measuring protocol above, we could conclude the variance of the chemical composition in the fluid inclusions over lithological columns. Moreover, we could get valuable stratigraphic information regarding to the paleo-fluid system. The gas analyser could facilitate the understanding of many exploration areas because the sampling or the storage of samples does not modify the content of fluid inclusions. Therefore, drill cuttings – independently of the drilling time of the well – could provide relatively quick and additional information about the paleo-fluid system of the research area, even at local or meso-scale.

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Comparative U-Pb geochronology on zircon crystals from Mórágy, Hungary

Annamária Kis[1], Tamás G. Weiszburg[1], István Dunkl[2], Friedrich Koller[3], Tamás Váczi[1], György Buda[1]

[1]Department of Mineralogy, Eötvös Loránd University, Budapest, Hungary, [2]Sedimentology and Environmental Geology, Geoscience Center, University of Göttingen, Germany, [3]Department of Lithospheric Research, University of Vienna, Austria

Theoretical

Based on LA-ICP-MS study of about 100 carefully selected zircon crystals we refined the genetic picture of the Mórágy granitoid, Hungary, which allows a better paleotectonic reconstruction of the Variscan plutonic rocks across Europe.

The origin (restitic or in situ unmixing) of mafic enclaves in Variscan granitoids of the Mórágy Subunit, Hungary has been debated widely, based mainly on petrological and geochemical constraints [1] [2]. Comparative age determination provides independent arguments to that debate, but previous geochronological interpretations [3] [4] left open basic questions, mainly because of the ambiguity caused by the uncontrolled heterogeneity of the studied zircon crystals.

In the current work we focus on the identification and clarification of geological processes based on their preserved traces in zircons texture from all the three rock types (the host granitoid rock, mafic enclaves, hybrid rock) of the Mórágy granitoid pluton.

Zircon ($Zr[SiO_4]$, tetragonal), the most suitable mineral for U-Pb, and Th-Pb dating, was separated for age determination. Having regard to inhomogeneous textural patterns (e.g. zonation) and variable structural state (level of metamictisation) of zircon, the following inevitable preparatory steps were applied on the separated crystals before starting dating:

The *structural state* (well crystallized, intermediate, metamict) of zircon zones was determined by Raman spectroscopy, as the degree of radiation damage is reflected in the value of the full width at half maximum (FWHM) of specific Raman bands. Accordingly, the metamict zones could be excluded from the measurement, thus overprinted age data (potential Pb loss) would not disturb the U-Pb age determination.

The areas of the *primary textures* (growth and sector zoning) and *secondary texture* (convolute zoning) in zircon crystals were identified by comparative observation of the SEM-CL and SEM-BSE contrasts. The primary textures represent the effect of the main magmatic event and the secondary texture reflects the imprint of any post-magmatic event.

Based on these preliminary textural features and structural state determinations we defined the spot positions and spot sizes for the LA-ICP-MS measurement.

LA-ICP-MS (point)analysis of 263 spots was performed on these fully mapped zircons, out of which 173 were concordant. These concordant data, interpreted here, represent 99 spots from the host granitoid rock, 35 from the hybrid rock and 39 from the mafic enclave.

The results indicate the same crystallization age of the mafic enclave and that of the host rock. We can conclude that the genetics of these granitoid rocks is in situ unmixing.

Additionally, zircon crystals show bimodal age distribution (335.6 ± 0.74 Ma and 345.9 ± 0.95 Ma), independently from the rock types, zircon morphology and texture. These age data are conform with our previous zircon texture and zircon inclusion observations, suggesting continuous crystallization of the granitoid pluton in a long time interval, that gave chance for the formation of hybrid magma during the intrusions of the mafic "enclave" into the host granitoid.

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Underwater cave exploration using ^{222}Radon as natural tracer

Katalin Csondor[1], Anita Erőss[1], Ákos Horváth[2], Dénes Szieberth[3]
[1]Department of Physical and Applied Geology, Eötvös Loránd University, [2]Department of Atomic Physics, Eötvös Loránd University, [3]Department of Inorganis and Analitycal Chemistry, Budapest University of Technology and Economics
Applied

The Molnár János cave is one of the largest hypogenic caves of the Buda Thermal Karst (Budapest, Hungary) and mainly characterized by water-filled passages. The major outflow point of the waters of the cave system is the Boltív spring, which feeds the artificial Malom Lake. Previous radon measurements in the cave system and in the spring established the highest radon concentration (71 BqL-1) in the springwater. According to previous studies, the origin of radon was identified as iron-hydroxide containing biofilms, which form where there is mixing of cold and thermal waters, and these biofilms efficiently adsorb radium from the thermal water component. Since mixing of waters is responsible for the formation of the cave as well, these iron-hydroxide containing biofilms and the consequent high radon concentrations mark the active cave forming zones. Based on previous radon measurements, it is supposed that the active mixing and cave forming zone has to be close to the spring, since the highest radon concentration was measured there. Therefore radon mapping was carried out with the help of divers in order to get a spatial distribution of radon in the cave passages closest to the spring. Field parameters of the samples (pH, temperature, specific electric conductivity) and the radon activity concentration in addition to some water chemistry parameters (chloride and sulfate concentration) were determined.Based on our measurements, the highest radon activity concentration (84 BqL-1) was found in the springwater. Based on the distribution of radon activity concentrations, direct connection was established between the spring and the deepest point of the cave (István-room), which was verified by an artificial tracer. However, the distribution of radon in the cave passages shows lower concentrations (18-46 BqL-1) compared to the spring, therefore an additional deep inflow from hitherto unknown cave passages is assumed, from which waters with high radon content arrive to the spring. These passages are

assumed to be in the active cave formation zone. This study proved that radon activity concentration distribution is a useful tool in underwater cave exploration.

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From Russia with love – On production since 1947

István Nemes
MOL Group
Applied

According to the global oil market changes one of the company's reactions was to take more ownerships of its assets by reviewing them one-by-one in-house to cross-check historical values and possible third-party numbers, and map associated risks. In line with the strategy one of the greatest challenges was to set up a comprehensive in-house database on one of MOL's largest assets in Russia. Historically the modelling, dynamic simulation and forecasting, field development optimization was planned by local, authenticated institutes and service companies – according to the Russian Federation's law – and MOL provided supervision and took part in the decision-making process. The changes provided the opportunity as well as challenge to start an in-house subsurface project aiming to gain a well-established, up-to-date knowledge on the asset and become a more integrated party, as MOL HQ, in the daily life of the field.

The field was already discovered and put on production in 1947, but based on its initial in-place volumes and comparison to average Russian hydrocarbon field sizes it was peripheral, so its development progressed at a very confined pace. This explains how and why it is reaching the plateau production only this year and still has low recovery and room for investment in re-development, and is still a significant member in MOL's portfolio.

The interdisciplinary team faced/is facing several unexpected challenges, problems and pitfalls while building the database, quality-checking and interpreting the data with a starting vintage of 1947. To overcome these problems new approaches, "unorthodox" methods

were needed while maintain the overall goal to arrive to a reliable output set of volumes, production forecasts, well placement and development concept. The presentation would like to highlight some of the focal points during the workflow from the start until the finalization of a reference case static model from a practical point of view, rather introducing the big frame than getting lost in the details, but highlighting the most interesting (sometimes surprising) aspects.

The structure of presentation aims to follow the workflow used in the last 1.5 years, by this giving an overview of the subsurface tasks necessary to build a robust base of optimized work and future investments.

Also giving an outlook on the afterlife and use of the data and model to increase profitability of the field and to highlight remaining risks and uncertainties, and how those shall be mitigated.