

ASSOCIATION OF HUNGARIAN GEOPHYSICISTS

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INVITATION

to the Meeting of Young Geoscientists

01-02 April 2016

Tiszafüred, Hotel Balneum

www.balneum.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, 1st April onwards

Organisers

MAGYAR GEOFIZIKUSOK EGYESÜLETE
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MEGHÍVÓ

az Ifjú Szakemberek Ankétjára

2016. április 1-2.

Tiszafüred, Hotel Balneum
www.balneum.hu

Tudnivalók:

Szállást és étkezést csak az előzetesen bejelentkezetteknek tudunk biztosítani.

Az ankét programja szabadon látogatható.

A konferencia hivatalos nyelve angol és magyar.

Regisztrálás: 2016. április 1. 9⁰⁰-tól folyamatosan

Rendező Bizottság

PROGRAMME

01. 04. 2016. FRIDAY

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

02. 04. 2016. SATURDAY

9 ⁰⁰ - 10 ³⁵	5 TH SESSION
11 ⁰⁵ - 13 ⁰⁰	6 TH SESSION
13 ¹⁵ - 13 ⁴⁵	PROF. GILBERTO HERNANDEZ-SILVA (MEXICO)
14 ⁰⁰ - 15 ⁰⁰	LUNCH
15 ¹⁵	AWARD GIVING AND CLOSING CEREMONY

FRIDAY

9³⁰ OPENING

9⁴⁰-11¹⁵ 1ST SESSION

9⁴⁰ *Structural modelling of the synrift sub-basins in the western part of the Pannonian-basin*

A **László Bereczki**^{1,2}, Dénes Gärtner³, Gábor Markos², Zoltán Frield⁴, Nándor Szegedi⁵

¹Department of Geophysics and Space Scientist, University of Eötvös Lóránd,

²Department of Geological Research, Geological and Geophysical Institute of Hungary, ³Geo-Log Geophysical and Environmental Ltd., ⁴Institute of Geodesy, Cartography and Remote Sensing, ⁵MOL Group E&P, Operations Geology - Petrophysics

9⁵⁵ *Metamorphic and deformation history of the Mecsekalja Zone around the Szentlőrinc-1 deep well using single quartz fragments of drilling chips*

T **Ágnes Skultéti**

University of Szeged, Department of Mineralogy, Geochemistry and Petrology

10¹⁰ *Evidences of low-grade medium-P regional metamorphism of the pelitic sequence of the borehole Horváthertelend–1 (S Transdanubia) - a microstructural and thermobarometric study*

T **Előd Mészáros**

University of Szeged, Department of Mineralogy, Geochemistry and Petrology

10²⁵ *Middle Jurassic microfaunal studies in the Transdanubian Mountains: a key for understanding the formation of Ammonitico Rosso*

T **Gábor Zsiborás**

Department of Palaeontology, Eötvös Lóránd University

10⁴⁰ *Study of the volcanic facies and the submarine hydrothermal processes of the Jurassic basalt at Szarvaskő (NE Hungary)*

T **Tamás Zagya**¹, Gabriella B. Kiss¹, Federica Zaccarini²

¹Department of Mineralogy, Eötvös Loránd University, ²Department of Applied Geosciences and Geophysics, University of Leoben, Austria

10⁵⁵ DISCUSSION

11¹⁵-11³⁰ COFFEE BREAK

11³⁰-13⁰⁵ 2ND SESSION

11³⁰ *Investigation of the pore pressure - an alternative approach. A case study from South Hungary*

A Zsolt Nagy
MOL Plc.

11⁴⁵ *Determination of pressure dependent elastic moduli based on rock physical model*

T Anett Kiss
Department of Geophysics, University of Miskolc

12⁰⁰ *Impacts of precipitations and solutions on the sustainable operation of a geothermal system*

T Tamás Kerékgyártó, Nóra Edit Gál
Geological and Geophysical Institute of Hungary

12¹⁵ *Distinction of hydrothermal and weathering argillic alteration in Velence Mts.*

T Ivett Kovács, Tibor Németh, Zsolt Benkó, Gabriella B. Kiss
Institute for Geological and Geochemical Research, Hungarian Academy of Sciences

12³⁰ *Calibration of the Fluxnet magnetometer*

A Ádám Domján
MinGeo Ltd.

12⁴⁵ DISCUSSION

13⁰⁵-13¹⁵ COFFEE BREAK

13¹⁵-14⁰⁰ POSTER SESSION – short oral summaries

Observation of the Earth liquid core resonance by extensometers

Dóra Bán, Gyula Mentés

Geodetic and Geophysical Institute, RCAES, HAS

How the midlatitude ionosphere respond to geomagnetic activity in winter at Széchenyi István Geophysical Observatory

Kitti Alexandra Berényi^{1,2}, Árpád Kis¹, Veronika Barta¹

¹Geodetic and Geophysical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of sciences, ²University of West Hungary

Stable isotope analysis of Mihályi-Répcelak area

Dóra Cseresznyés¹, Csilla Király¹, Zsuzsanna Szabó²

¹ELTE TTK Lithosphere Fluid Research Lab, Institute of Geography and Earth Sciences, Eötvös University, ²Geological and Geophysical Institute of Hungary

One-dimensional wave equation with linear variable coefficients

Ádám Domján

Department of Geophysics and Space Science, Eötvös Loránd University

3D modelling of the Quaternary sediments in the southern part of the Great Hungarian Plain

Orsolya Gelencsér

Department of Geophysics and Space Science, Eötvös Loránd University

Numerical water table modelling for different climate windows within in the NAGiS project

Tamás Kerékgyártó, Attila Kovács, Teodóra Szöcs, György Tóth, Annamária Marton, Éva Kun

Geological and Geophysical Institute of Hungary

Phase and particle analysis methods to study composition and potential sources of attic dust samples in Ajka, Hungary

Szylvia Koczur¹, Cintia Kollárik¹, Boglárka Jaloveczki¹, Dóra Zacháry², Péter Völgyesi³

¹ELTE TTK Lithosphere Fluid Research Lab, Institute of Geography and Earth Sciences, Eötvös University, ²Geographical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, ³Nuclear Security Department, Centre for Energy Research, Hungarian Academy of Sciences

Fracture network modeling around the Radioactive Waste Repository in Bábaapáti, based on BN2-1 pre-boring

Krisztina Istovics

University of Szeged, Department of Mineralogy, Geochemistry and Petrology

Coastal effects in East-Borsod Basin presented by high resolution stratigraphic correlation

Tímea Pummer¹, Katalin Sári¹, Erika Buday-Bódi², Titanilla Kertész³

¹Geological and Geophysical Institute of Hungary, ²University of Debrecen, ³Eötvös Loránd University

Developing the concept of “Mineral Deposits of Public Importance”

Katalin Sári, Zoltán Horváth, Csaba Vígh

Geological and Geophysical Institute of Hungary

Unconventional reservoir modelling – using 3D geological models in environmental research

Vera Szabó

Eötvös Loránd University, Department of Geophysics and Space Science

Ground Penetrating Radar developments and investigations

Gábor Taller¹, Zsolt Prónay¹, József Plasztán²

¹Geological and Geophysical Institute of Hungary, ²University of Debrecen

Traces of fluid induced alterations through the example of a Ca-Al-rich inclusion in NWA 2086 CV3 carbonaceous chondrite

Heléna Walter, Krisztián Fintor, Elemér Pál-Molnár

University of Szeged, Faculty of Science and Informatics, Department of Mineralogy, Geochemistry and Petrology

14⁰⁰-15¹⁵ LUNCH BREAK

15¹⁵-16⁵⁰ 3RD SESSION

15¹⁵ *Research of flood protection embankments with geophysical methods*

A **Dániel Péter, András Virók**

Pál Vásárhelyi Secondary Technical School and Student Hostel

15³⁰ *3D photogrammetric reconstruction of the Badenian echinoids*

A **Bálint Polonkai¹, Andrea Raveloson², Ágnes Görög¹, Balázs Székely^{3,4}, Emese Bodor⁵**

¹Department of Palaeontology, Loránd Eötvös University, ²Department of Geophysics and Space Sciences, Loránd Eötvös University, ³Interdisziplinäres Ökologisches Zentrum, TU Bergakademie Freiberg (Germany), ⁴Department of Geodesy and Geoinformation, Vienna University of Technology (Austria), ⁵Geological and Geophysical Collections, Geological and Geophysical Institute of Hungary

15⁴⁵ *Comparison of in-situ electron density measurements with equatorial electron densities obtained by whistler inversion*

T **Lilla Juhász¹, J. Lichtenberger^{1,2}, C. Ferencz¹, M. Clilverd³, C. Rodger⁴, N. Cherneva⁵**

¹Department of Geophysics and Space Sciences, Loránd Eötvös University, ²Geodetic and Geophysical Institute, RCEAS, ³British Antarctic Survey (United Kingdom), ⁴University of Otago (New Zealand), ⁵Institute of Cosmophysical Researches and Radio Wave Propagation (Russia)

16⁰⁰ *The application of polar coordinate transformation on the cinder cones of the San Francisco Volcanic Field*

T **Fanni Vörös¹, Zsófia Koma², Balázs Székely^{2,3,4}**

¹Institute of Geography and Earth Sciences, Loránd Eötvös University, ²Department of Geophysics and Space Science, Loránd Eötvös University, ³Interdisciplinary Ecological Centre, TU Bergakademie Freiberg (Germany), ⁴Department of Geodesy and Geoinformation, Vienna University of Technology (Austria)

16¹⁵ *Importance of geotourism and motivation for participating in geotours*

T **Nikolett Csorvási^{1,2}**

¹Eötvös Loránd University, ²Bolyai College

16³⁰ DISCUSSION

16⁵⁰-17⁰⁵ COFFEE BREAK

17⁰⁵-19⁰⁰ 4TH SESSION

17⁰⁵ *Petrographic features of volcanic clasts at the base of the Upper Eocene succession and of Triassic andesite (Budaörs-1 well) in the Buda Hills*

T Éva Farics¹, Sándor Józsa², János Haas³

¹Eötvös University, Department of Physical and Applied Geology, ²Eötvös University, Department of Petrology and Geochemistry, ³Geological, Geophysical and Space Science Research Group of the Hungarian Academy of Sciences, Eötvös University

17²⁰ *Numerical simulation of the influence of groundwater flow for the performance of borehole heat exchangers*

A Péter Szilágyi, László Merényi

Geological and Geophysical Institute of Hungary

17³⁵ *Fe-Mn-oxide ore indications in the footwall of the Toarcian Úrkút Mn-carbonate ore deposit, Hungary*

T Zsombor Molnár¹, Márta Polgári^{2,3}, Sándor Józsa¹, Tibor Németh², József Fekete², Ildikó Gyollai², Krisztián Fintor⁴, Lóránt Bíró², Máté Szabó², Tamás Vigh⁵

¹Eötvös University, Dept. Petrology and Geochemistry, ²Research Center for Astronomy and Geosciences, Geobiomineralization and Astrobiological Research Group, Institute for Geology and Geochemistry, Hungarian Academy of Sciences, ³Eszterházy Károly College, Dept. of Natural Geography and Geoinformatics, ⁴Szeged University, Department of Mineralogy, Geochemistry and Petrology, ⁵Mangán Ltd.

17⁵⁰ *New mineralogical and geochemical results from the Eplény Manganese Deposit, Hungary*

A Richárd Zoltán Papp, Norbert Zajzon

Institute of Mineralogy and Geology, University of Miskolc

18⁰⁵
A *Heavy metal detection using geoelectric methods in field*
¹**Marcell Szilvási**, ¹Endre Turai, ²Balázs Kovács
¹University of Miskolc, Institute of Geophysics and Geoinformatics;
²University of Miskolc, Institute of Environmental Management

18²⁰
A *Research of the Vízvöröstó (Nagyvázsony, Kab-hill) redclay–bauxitic clay filled dolinas, mapping the bedrock surface. Refine of the archive ELGI (1992) geoelectrical measurements*
István Bóna
Eötvös Loránd University Faculty of Science Department of Geophysics and Space Science

18³⁵ DISCUSSION

19⁰⁰-20⁰⁰ **POSTER SESSION – discussion**

20⁰⁰- DINNER

SATURDAY

9⁰⁰-10³⁵ 5TH SESSION

9⁰⁰ *Applied UV-florescence sounding in environmental remediation*

A Gábor Jeszenői, János Stickel

ELGOSCAR - 2000 Environmental Technology and Water Management Ltd.

9¹⁵ *Effect of particle size on ATR FTIR spectra of common rock-forming minerals*

A Beatrix Udvardi

Geochemical and Laboratory Department, Geological and Geophysical Institute of Hungary

9³⁰ *Titanium, niobium and tantalum minerals in the formations of the Bagolyhegyi Metarhyolite Formation (Bükk Mts.)*

A Péter Gál

University of Miskolc

9⁴⁵ *Diagenesis and burial history of Middle Triassic dolomites in the Szeged Basin, Southeast Hungary*

A István Garaguly

Department of Mineralogy, Geochemistry and Petrology, University of Szeged

10⁰⁰ *Lead isotope study in attic dust samples from Ajka, Hungary*

A Cintia Kollárik¹, Boglárka Jaloveczki¹, Szilvia Koczur¹, Dóra Zacháry², Péter Völgyesi³

¹ELTE TTK Lithosphere Fluid Research Lab, Institute of Geography and Earth Sciences, Eötvös University, ²Geographical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, ³Nuclear Security Department, Centre for Energy Research, Hungarian Academy of Sciences

10¹⁵ DISCUSSION

10³⁵-11⁰⁵ COFFEE BREAK AND CHECK-OUT FROM THE ROOMS

11⁰⁵-13⁰⁰ 6TH SESSION

- 11⁰⁵**
T *Fe-Ti oxide thermometry of the Ciomadul dacites*
Katalin Mészáros¹, Szabolcs Harangi^{1,2}, Réka Lukács², John M. Hora³
¹Department of Petrology and Geochemistry, Eötvös Loránd University, Budapest, ²MTA-ELTE Volcanology Research Group, Budapest, ³Abteilung Geochemie, Geowissenschaftliches Zentrum der Universität Göttingen, Göttingen, Germany
- 11²⁰**
T *The fate of the Dachstein platform at the Triassic-Jurassic boundary in the Transdanubian Range, Hungary: drowning, emergence, acidification crisis, or else?*
Zsófia Kovács¹, József Pálffy^{1,2}
¹Department of Physical and Applied Geology, Eötvös Loránd University, Budapest, ²MTA-MTM-ELTE Research Group for Paleontology, Budapest
- 11³⁵**
T *Geochemical characteristics of two phosphorite occurrences from the Transdanubian Mountain Range (Hungary)*
Zsuzsa Molnár¹, Gabriella B. Kiss¹, Federica Zaccarini², István Dunkl³, István Dódoný¹
¹Department of Mineralogy, Eötvös Loránd University, Budapest, ²Department of Applied Geosciences and Geophysics, University of Leoben, Leoben, Austria, ³Geoscience Center, University of Göttingen, Göttingen, Germany
- 11⁵⁰**
T *Modeling of rock physics parameters vs. depth in order to understand different seismic attributes – theoretical and case study*
Gábor Kocsis
MOL Plc.
- 12⁰⁵**
A *Geological risk assessment of an unconventional gas reservoir – case study of the calcareous marl member of the Endrőd Marl Formation in the Békés Basin*
Jenifer Sarrang
Department of Physical and Applied Geology, Eötvös Loránd University

12²⁰ *Breakpoints in environmental time series - methodological comparison and case studies*

A **Dániel Topál^{1,2}, Zoltán Kern², István Gábor Hatvani²**

¹Eötvös Loránd University, Department of Meteorology, ²Institute for Geological and Geochemical Research, Research Center for Astronomy and Earth Sciences, Hungarian Academy of Sciences

12³⁵ DISCUSSION

13⁰⁰-13¹⁵ COFFEE BREAK

13¹⁵-13⁴⁵ **PROF. GILBERTO HERNANDEZ-SILVA**
An overview on the impact of Hg mining on Terrestrial systems in Southern Sierra Gorda, Querétaro, Mexico
Universidad Nacional Autónoma de México, Centre of Earth Sciences

14⁰⁰-15⁰⁰ LUNCH BREAK

15¹⁵ AWARD GIVING AND CLOSING CEREMONY

ABSTRACTS

Structural modelling of the synrift sub-basins in the western part of the Pannonian-basin

**László Bereczki^{1,2}, Dénes Gärtner³, Gábor Markos², Zoltán Frieled⁴,
Nándor Szegedi⁵**

¹Department of Geophysics and Space Scientist, University of Eötvös Lóránd,

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Recent surface of the Carpathian Basin is formed by fluvial sediments filled plains low hills and Paleozoic and Mesozoic mountains standing out from the Quaternary sediments. The present day's structural view of the basin represents mainly extensional features and renewed shape. The basin's evolution is explained by the thermomechanical model of McKenzie [1, 2]. According to its development, the Pannonian Basin is divided into two main consecutive phases: the tectonically more active synrift, followed by a period of long subsidence and sediment accumulation processes, the thermally controlled postrift phase [3].

The extension and thinning of the lithosphere occurs during 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" which is also associated with the development of metamorphic core complexes in the rim of the area [3]. During the thermal subsidence large amounts of sediment accumulated and deep sub-basins evolved during the Carpathian and Badenian [6, 7]. This type of area were the Dráva-, the Száva-, the Zagyva Basin and the other sub-basins in the vicinity of the Mid-Hungarian Shear Zone as well as each half graben of the Great Hungarian Plain [3].

During this research tectonic elements were examined and analysed in several sub-basins comparingly. The different grabens and half-grabens were illustrated in artificial sections, the sections were edited based on the right paleo-stress field directions from borehole data and 2D seismic surveys. Along the sections a 2D restoration was

performed in order to determine several parameters of the extension related to each other. Furthermore, based on paleontological data and previous publications the relative temporal order was defined.

Information derived from certain basin divisions in an extended, Pannonian Basin scale environment, taking into consideration the age of origin and function of faults made it possible to investigate the development of the extensional parameters of the reconstructed deformational elements. Integrated analysis of these results will help in obtaining more precise knowledge of Pannonian Basin forming geodynamic processes.

- [1] MCKENZIE, D. (1978): Some remarks on the development of sedimentary basins. – *Earth and Planetary Science*
- [2] ROYDEN, L. and HORVÁTH, F. (1988): The Pannonian Basin: A case study in basin evolution. *AAPG Memoir*, 45, 394p.
- [3] HORVÁTH, F. (2007): A Pannon-medence geodinamikája – Eszmetörténeti tanulmány és geofizikai szintézis. – *MTA doktori értekezés*.
- [4] ROYDEN L. and KEEN C. (1980): Rifting processes and thermal evolution of the continental margin of eastern Canada determined from subsidence curves. – *Earth & Planetary Science Letters*, 51, 343-361p.
- [5] SCLATER, J. G., ROYDEN, L., HORVÁTH, F., BURCHFIELD, B. C., SEMKEN, S. and L. STEGENA (1980): The formation of the intra-Carpathian basins as determined from subsidence data. – *Earth & Planetary Scientific Letters*, 51, 139-162p.
- [6] FODOR, L., CSONTOS, L., BADA, G., GYÖRFI, I. and L. BENKOVICS, (1999): Tertiary tectonic evolution of the Pannonian Basin system and neighbouring orogens: a new synthesis of paleostress data. In: Durand et al. (1999) 295-334p.
- [7] HÁMOR, G., POGÁCSÁS, GY. and JÁMBOR, Á. (2001): Paleogeographic/structural evolutionary stages and the related volcanism of the Carpathian-Pannonian region. *Acta. Geol. Hung.*, 44, 193-222p.

***Metamorphic and deformation history of the Mecsekalja Zone
around the Szentlőrinc-1 deep well using single quartz fragments of
drilling chips***

Ágnes Skultéti

University of Szeged, Department of Mineralogy, Geochemistry and Petrology
Theoretical

The Mecsekalja Zone is a 1.5 km wide tectonic belt, an active transcurrent zone since the Permian. It is essential because the recognition of the structures and deformation of the South Transdanubian region. The metamorphic and deformation history of the crystalline basement of the Mecsekalja Zone was known so far

from a few surface-subsurface outcrops. The Szentlőrinc-1 well with its drilling chips brought to the surface from approximately 2 km depth provides an exclusive chance to investigate the shear zone beneath. The aim of this study is the reconstruction of the metamorphic and deformation history of the South Transdanubian part of the Mecsekalja Zone.

The analysis based on, that quartz is a common rock-forming mineral in metamorphic rocks; their metamorphic development, ductile and brittle behaviour determines the chemical composition and rheology of quartz grains. The drilling chips constituted by single mineral and rock pieces, for the most part dominated by single quartz fragments. In the studied drill cuttings, beside the quartz, rock fragments are also present, that consist of muscovite, biotite, K-feldspar and plagioclase. In the analysed well section two different types of gneisses were distinguished. In our previous work the border of these two different rock bodies was marked out by a ductile shear zone, while inside the upper gneiss domain one can localize another ductile shear zone as well.

The titanium content (ICP-MS, MFGI) of the analysed quartz fragments displays that the temperature of the metamorphism in both gneiss types was uniformly 500-575 °C. Microstructure of the analysed quartz fragments suggests the temperature of ductile deformation was below 500 °C, while the temperature of recrystallization by TitaniQ thermometer was 400-475 °C. When comparing the depths and extensions of the deformed horizons of the studied well resulted by petrological and geophysical data, a conspicuous coincidence of ductile and brittle shear zones becomes clear. Our FTIR measurements (MFGI) show that quartz grains of the zones suffered intensive ductile deformation lost a significant part of their OH and H₂O content, so they become partially dehydrated. Thus these sections could favour to the formation of later brittle shear zones.

The coincidence of the border between different gneisses with the depth of the ductile and brittle shear zones allows two different scenarios concerning structural evolution. If the evolved ductile shear zones caused softened regions inside the crystalline mass, it could reactivate later in a brittle way due to a tectonic event independent of the early one. On the other hand, provided that these structures formed

due to the same tectonic event, so ductile and brittle deformation overlaps along the same shear zones, these zones may represent a detachment fault.

Nevertheless based on the TitaniQ thermometer, the formations below and above the shear zone display the same metamorphic temperature (about 500-575 °C). Thus the analysed structural zone displays the border of two rock bodies with the same metamorphic development. The detachment faults usually divide crystalline blocks of significantly different metamorphic evolutions in the footwall and the hanging wall, so the shear zone studied should not be a detachment fault. The coincidence of the ductile and brittle zones along the Szentlőrinc-1 well can be explained instead by the behaviour of quartz. These grains got dehydrated in the central part of the shear zone due to the intensive ductile deformation relative to the nearby formations. Therefore, gneisses inside the shear zone became more rigid ready to deform in a brittle way. There, in the studied section of the Mecsekalja Zone most probably were two independent, single, consecutive deformation events, and the ductile shear zone was reactivated in a brittle way.

As a result of the particular analysis of the quartz chips from the Szentlőrinc-1 deep well our data display good conformance with the results of the earlier analysis provided on surface-subsurface samples from the Mecsekalja Zone. Thus the previous development models of the Mecsekalja Zone can be extended toward SW at least to the Szentlőrinc-1 well.

Evidences of low-grade medium-P regional metamorphism of the pelitic sequence of the borehole Horváthertelend–1 (S Transdanubia) — a microstructural and thermobarometric study

Előd Mészáros

University of Szeged, Department of Mineralogy, Geochemistry and Petrology
Theoretical

In this study the microstructural and thermobarometric examinations of the metapelitic sequence of the borehole Horváthertelend–1 (Hh–1; NW foreland of the Mecsek Mts.) were carried out. The well cut through Cenozoic sediments and sedimentary

rocks across 720 metres. Below the depth 720 m a black slate sequence with metasandstone intercalations was revealed in the thickness of 70 m. The underlying succession of the slate is a dark grey polymictic conglomerate-sandstone rock body. The slate and conglomerate bodies were correlated with the Silurian flysch-like Szalatnak Slate Formation, a unique low-grade metamorphic body among sedimentary formations [1].

In this work the upper slate sequence was studied which consists mainly of black–dark grey, in the lower section pale grey slate with metagreywacke and metasiltstone lenses. The studied rocks contain grain supported, well sorted arkose clasts from millimetre to centimetre scale. The studied slate samples have K-white mica + chlorite + quartz + albite + anatase mineral assemblage. The metagreywacke lenses and laminae are often folded, and a moderately developed continuous foliation together with pressure solution seams are also common. The arkose clasts are strongly flattened and boudinaged. Pre-tectonic quartz veins are systematically folded, dynamically recrystallized (low-T grain boundary migration recrystallization) and apparently thrown by pressure solution.

The full width at half maximum (FWHM) values of the 001 and 002 reflexion peaks of K-white mica and chlorite were measured by XRD in highly oriented $<2\ \mu\text{m}$ grain size fraction of the slate. The low FWHM values (Ms_{001} : $\sim 0.117\ \Delta^\circ 2\theta$, Chl_{002} : $\sim 0.147\ \Delta^\circ 2\theta$) and the large crystallite sizes calculated using the Scherrer-equation (Ms_{001} : $1121 \pm 70\ \text{\AA}$, Chl_{002} : $700 \pm 86\ \text{\AA}$) suggest epizonal metamorphism [2]. The $b_0 = 6d_{(060,331)}$ value of K-white mica was determined in the unoriented $<2\ \mu\text{m}$ grain size fraction. The b_0 value depends on the celadonite substitution in K-white mica. Under constant temperature this substitution is highly sensitive to the pressure in the time of the formation of K-white mica therefore the b_0 is an eligible geobarometer [3]. In the examined samples the average calculated b_0 value $\sim 9,022\ \text{\AA}$ suggests medium P-T gradients during metamorphism.

The rocks contain large amount of autochthonous carbonaceous material (CM) making possible to carry out Raman-spectroscopic thermometry based on the evolution of CM's first order Raman bands. The calculated maximum temperature of the metamorphism has arisen from three different empirical thermometers [4, 5, 6] is $\sim 350\ ^\circ\text{C}$.

The presented observations and data suggest Barrowian type low-

grade (chlorite zone ~350 °C) regional metamorphism and ductile deformation of the metapelitic sequence of the borehole Hh-1.

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Middle Jurassic microfaunal studies in the Transdanubian Mountains: a key for understanding the formation of Ammonitico Rosso

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Theoretical

Red, nodular and marly limestones so called Ammonitico rosso is a widespread, stratigraphically condensed pelagic formation in the Neotethyan Ocean Basin during almost the whole of the Jurassic period. A precise biostratigraphic control is furthermore obtained on the basis of the abundant partly dissolved ammonite fossils which usually occur in this formation. But the base of the food chain, the microfossils were not well-studied yet, especially not from the early Middle Jurassic. Thus the aim of the study was to give paleoecological interpretation based on foraminifers and other microfossils of Nagy-Pisznice and Bakonycsernye from the Transdanubian Mountains.

Foraminifers (Latin meaning hole bearers) are heterotrophic benthic or planktonic unicellular organisms which produce shells

made of calcium carbonate or agglutinated sediment particles. Their diversity and morphological distribution are sensitive paleoecological indicators for the seawater temperature, salinity, oxygen and nutrient concentration, therefore, different marine environments can be characterized by them.

Both studied sequences are about 3 metres thick Ammonitico Rosso (Tölgyhát Limestone Formation). 13 samples from Bakonycsérnye, 6 samples from Nagy-Pisznice were collected and from each one thin section were made for the microfacies studies. To extract the microfossils, each sample was dissolved in glacial acetic acid.

The dominant microfacies is bioclastic wackestone predominated *Bositra* shells. The microfauna consist of foraminifers, calcispheres, juvenile ammonites, ostracods, radiolarians, microgastropods and fragments of echinoderms.

Throughout the Nagy-Pisznice succession, the composition of the foraminiferal fauna is relatively uniform and moderately divers. Most specimens belong to Suborder Lagenina with 60-80% abundance. The Suborder Spirillinina is also frequent with 20-35% abundance.

The taxonomic composition of the foraminiferal fauna of Bakonycsérnye is similar to the aforesaid assemblage, however, the dominance of spirillinids with 70-90% is a radical difference. Planktonic protoglobigerinds occurred only few beds.

The presence of the aragonitic microfossils (juvenile ammonites, epistominids, protoglobigerinids) indicate that the depositional environment was above the ACD. The benthic foraminiferal association, the abundance of the *Globochaete* and *Bositra* suggest outer neritic, upper bathyal zone.

The paleoenvironment can be characterized by aphotic conditions as indicated by the lack of phototropic organisms, scarcity of oxygen recorded by weak bioturbation, and a low sedimentation rate. The presence of dysoxic conditions could be favoured the spread of iron bacterial and fungal biofilms at water–sediment interfaces. They induced the precipitation of iron/manganese oxy-hydroxides causing the red pigmentation of the limestones (Préat et al. 2006). On the bottom, which was covered by microbial and/or fungal mats, numerous epibenthic *Bositra* clams and spirillinids lived.

These successions served the first detailed record about the

composition and ecological features of the Aalenian microfauna of the Neotethyan Basin.

The research was supported by the Hantken Miksa Foundation.

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Study of the volcanic facies and the submarine hydrothermal processes of the Jurassic basalt at Szarvask   (NE Hungary)

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Theoretical

The Jurassic pillow basalt outcrops around the village of Szarvask   form a part of an incomplete ophiolitic sequence. According to the most recent studies, the origin of these magmatic rocks is related to a back-arc-basin or marginal basin opening [1]. Though several studies were carried out about the basalt, the complex volcanic facies analyses of the outcrops within the village of Szarvask   and its close vicinity and the description of the primary submarine hydrothermal processes have not been performed, yet.

Closely packed pillow and pillow fragmented hyaloclastite breccia facies of a submarine basaltic lava flow have been identified. In the pillow fragmented hyaloclastite breccia block, hydrothermal minerals and siliciclastic sediment (unconsolidated at the time of eruption) are filling the space among the breccia clasts. Thus, this locality represents a transition between the pillow fragmented hyaloclastite breccia and the peperitic facies *s.l.*.

Chlorite, pyrite, prehnite and pumpellyite precipitated during the earlier, higher temperature part of the hydrothermal process, while later, at lower temperatures, quartz and calcite formed. Minerals of low-grade metamorphic overprint were also identified.

Chlorite thermometry calculations [2], fluid inclusion microthermometry (on quartz and calcite) and Raman spectroscopy measurements have been performed in order to obtain physical-chemical information about the different steps of the hydrothermal

processes. Based on the composition of chlorite, an average formation temperature of 183°C (st.dev. 7°C) was found. The characteristics of the fluid in the inter-pillow hyaloclastite breccia: Th(LV-L)=145-155°C, salinities ~6-8 NaCl equiv. m% and in the hyaloclastite breccia facies: Th(LV-L)=133-153°C. The results can be compared with data obtained earlier from some other Jurassic basalt blocks, as well as from the nearby Triassic rifting-related submarine basaltic suites.

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Investigation of the pore pressure - an alternative approach A case study from South Hungary

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Applied

The basin scale examination of the pressure conditions is an important issue from many aspects. On one hand the well planning requires the understanding of the pressure regime, on the other hand the abnormal pressure conditions could affect the behavior of the petroleum system.

We are looking for the answer for some critical questions: Can we determine the top of the overpressure zone? Is the overpressure generation related to lithological group(s)? Which mechanisms generated the abnormal pressure conditions? Is it possible to investigate the overpressure in basin scale?

We identified the upper boundary of the abnormal pressure zone based on well logs (DT, RT) [1]. The comparison of the pressure trends with the lithology sensitive logs (GR, SP, RT) proved that the overpressure generation relates to high pelite-content strata. Two sedimentary environment were formed during the Pannonian sedimentation cycle where pelite-rich sediments were deposited: the delta slope and the foreground of the turbidite systems.

As the formation of abnormal pressure regime relates to low permeability sediments the main overpressure generation mechanism might be the non-equilibrium compaction. This theory is confirmed by the log signatures of these sections. Beside the non-equilibrium

compaction at least two other mechanisms could improve the overpressure: clay mineral transformation and post-uplift pressure inheritance.

The basin modeling is an alternative methodology for the pressure regime investigation [2]. In order to test the technique a 3D basin model was built. This approach allowed us to investigate the effect of the lateral transfer and the hydrocarbon generation. Furthermore we gained important information about the timeframe of the overpressure emergence.

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Determination of pressure dependent elastic moduli based on rock physical model

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Theoretical

With the assumption of Hooke body two constants are enough to describe the stress-deformation relationship. In the general form these are the Lamé coefficients (λ , μ), but further elastic moduli can be introduced as well. These parameters are important for engineering designs, such as fracturing planning for hydrocarbon exploitation. This paper includes the investigation of compression (K) and shear moduli ($G=\mu$) beside Young's modulus (E) and the first Lamé parameter (λ). They can be derived if the acoustic longitudinal (P) and shear (S) wave velocities and the density of the medium are known. The pressure dependence of latter is negligible in contrast of the former ones. Therefore one requires accurate velocity data to obtain pressure dependent elastic moduli.

Pressure has great influence beside others on acoustic velocities. Numerous laboratory measurements focus on the investigation of the pressure dependence that of parameters. Several studies found exponential relation. Birch [1] consider this phenomenon as the result of changing pore volume due to varying stress. Walsh and Brace [2] explain the increasing velocity under increasing pressure with the

closure of micro cracks. In the literature empirical relations can be found, authors published the regression parameters for the best fitting functions. Somogyiné Molnár [3] introduced a new rock physical model describing the pressure dependence of longitudinal (P) wave velocity, which provides the physical connection between these quantities. Further investigations [4] [5] demonstrated that the model can be extended for transverse (S) waves.

The developed rock physical model explains the physical relationship between the applied stress and the acoustic P and S wave velocities. It is based on the idea formulated by Birch [1], i.e. the main reason for the increasing velocity under loading is the closure of pores. We assume also linear relationship between the infinitesimal change of the appropriate wave velocity dv (P or S wave) and dV . The differential equations describing these assumptions lead to the model equation

$$v = v_0 + \Delta v_0 (1 - \exp(-\lambda_v \sigma)),$$

where v is the velocity, v_0 is the velocity at zero stress, Δv_0 is the velocity-drop (difference between the velocities measured at maximum and zero stresses). It can be derived, that the parameter λ_v is the logarithmic stress sensitivity of the velocity drop. If P and S wave velocities are measured, data can be processed in joint inversion procedure, since λ_v is a common parameter. After determining the model parameters ($\alpha_0, \Delta\alpha_0, \beta_0, \Delta\beta_0, \lambda_v$) the velocities can be calculated for any pressure.

To prove the applicability of our model and to derive the pressure dependent elastic moduli, we performed velocity measurements on sandstone samples by an automatic 2-channel acoustic test system under uniaxial stresses. The pulse transmission technique was used. In this paper the results of sample A (own measurement) and a Berea sandstone sample chosen from literature [6] are presented. The problem was overdetermined, therefore the Gaussian LSQ Method was used. After determining the model parameters the velocities were calculated by the model equation for the stresses in the region of interest. Based on these velocities the pressure dependent elastic moduli ($K, G=\mu, E, \lambda$) were derived. The accuracy of the inversion estimates and the reliability of the suggested petrophysical model was proved.

The research was supported by the OTKA project No. K 109441.

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Impacts of precipitations and solutions on the sustainable operation of a geothermal system

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Theoretical

Natural conditions in Hungary are favourable for geothermal energy production and utilization. The anomalously high terrestrial heat flow (~ 0.09 W/m²), the high geothermal gradient (~ 0.05 °C/m), and the immense expanses of deep aquifers form an important geothermal resource. There are two types of geothermal reservoir in Hungary. One of them is Mesozoic carbonate formations, the other one is the Pannonian multi-layered sedimentary reservoir; composed of sand, sandstone and shale. Lower Pannonian sediments are typically impermeable; the Upper Pannonian and Quaternary formations contain vast permeable sand and sandstone layers. The Upper Pannonian aquifer is the most important thermal water resource in Hungary.

In the long-term thermal water utilization point of view is important to know the composition and its variation under various pressure and temperature conditions of the produced water. Previous studies [1] indicated that water of some wells more susceptible to precipitation than others; meanwhile there are wells with similar chemical composition of water, where no precipitation

formed during production based on our experiences [2].

It is important to study the gas-water-rock interactions in the wells and in the aquifers that significantly could influence the production rate and the sustainability of operation.

During this research PHREEQC computer program was applied to model gas-water-rock interaction using physical parameters and chemical composition of waters of some production and reinjection thermal well. Results of the first runs confirmed the applicability of this method, details and results of the gradually refined models constantly expanding.

The results of the model aids to maintain the effective operation of geothermal systems.

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Distinction of hydrothermal and weathering argillic alteration in Velence Mts.

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Theoretical

The Velence Mts. are located 50 km west from Budapest. In the present setting, the Velence Mts. can be divided into two parts: the western, larger part consists of Permian granite intrusion, whereas the eastern part is built up by a calc-alkaline andesitic intrusive-volcanic complex of Oligocene age. Triassic and Palaeogene hydrothermal fluid flow resulted in argillic alteration in broad zones of the granite intrusion [1]. The weathering profile can be also characterized by clay minerals and therefore distinguishing of the clay mineral generations of different age and origin is challenging. In the present study the weathering and the hydrothermal clay minerals were studied with several different methods.

Our results show that the main distinctive differences are the structure and composition of smectite. According to the XRPD studies

the hydrothermal smectite is dioctahedral with calcium and/or magnesium in the interlayer space. The basal reflection shifted from 15 to 12.5 Å after potassium saturation, indicating the low-layer charge of the smectite. The Greene-Kelly test indicates that its charge arises from isomorphic substitution in the tetrahedral sheet.

These results show that the hydrothermal smectite is beidellite, while montmorillonite is also present besides beidellite in the weathering zone of the granite. The other main difference is that vermiculite appears besides smectite in the weathering zone. According to these results montmorillonite and vermiculite were produced by weathering processes.

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Calibration of the Fluxset magnetometer

Ádám Domján

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Applied

At MinGeo we are working on an observatory magnetic measurement instrument (called DI Station). This station is going to be more automatic than the absolute magnetometers at the observatories. The main components of the DI Station are a non-magnetic theodolite, a control unit and a 3 component Fluxset vector magnetometer.

One of the essential problems we face is to determine the Fluxset magnetometer calibration parameters and its temperature coefficients. We are also interested about the question that, whether they are time dependent or not.

The Fluxset's magnetic sensor triad have numerous error sources. Among other things the sensors are prone to systematic bias offset error, scale factor error, non-orthogonality error, misalignment error. The sensors are also sensitive for temperature variations. As a consequence, to investigate the behaviour of the sensor triad at extreme temperature conditions we put the Fluxset in a heat chamber, where we were able to control the temperature change as a sinusoidal wave. During the Fluxset's measurements a reference magnetometer

data also were available that time.

The Fluxset recordings were calibrated to this reference magnetometer. The above mentioned error types and the temperature effect were taken into account in the calibration model. From the model and the measurements we constructed a linear inverse problem to determine the calibration parameters and temperature coefficients of the Fluxset magnetometer.

The main aim of this presentation is intended to give the audience an insight of this calibration procedure.

Observation of the Earth liquid core resonance by extensometers

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Poster

The rotation axis of the fluid outer core of the Earth and the axis of the mantle do not coincide in space therefore restoring forces are set up at the core-mantle boundary which try to realign the two axes causing a resonance effect. In celestial reference system it is called the “Free Core Nutation” (FCN), which can be characterized by a period of 432 days while in the Earth reference system it is called the “Nearly Diurnal Free Wobble” (NDFW). Free core nutation of the Earth causes fluid core resonance (FCR) in the diurnal tide band, especially in P1 and K1 waves. Due to its resonance effect this phenomenon can be detected also by quartz tube extensometers suitable for Earth tides recording. The period of the FCN strongly depends on the ellipticity of the core-mantle boundary, and on the electro-magnetic coupling of the core-mantle boundary and anelasticity of the Earth. Therefore the investigation of the FCR effects on Earth tides is an effective tool to gain information about the geodynamics of the Earth’s deep interior. In this study data series measured in several extensometric stations were used to reveal the presence of the FCN resonance on tidal strains. In the Pannonian Basin there are five observatories where extensometric strain measurements were carried out in different lengths of time. Four stations in Hungary: Sopronbánfalva Geodynamical Observatory (2000-2014), Budapest Mátyáshegy Gravity and Geodynamic Observatory (2005-2012), Pécs uranium

mine (1991-1999), Bakonya, near to Pécs (2004-2005) and in Slovakia: Vyhne Earth Tide Observatory (2001-2013). Identical instrumentation in different observatories provides the opportunity to compare measurements with various topography, geology and environmental parameters. The results are also compared to values inferred from extensometric measurements in other stations.

How the midlatitude ionosphere respond to geomagnetic activity in winter at Széchenyi István Geophysical Observatory

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Poster

Geomagnetic storms is the most frequent type of the space weather processes in the solar system. These storms affect the ionospheric regions of the terrestrial upper atmosphere over several storm induced process. The resulting changes and phenomena in the ionospheric plasma layers in summary generally called ionospheric storm. These processes depend on altitude, segment of the day, the geomagnetic latitude and longitude, strength of solar activity and the type of the geomagnetic storm. The differences between ionospheric regions mostly come from the variations of altitude dependent neutral and ionized atmospheric components, and from the physical parameters of solar radiation.

We examined the data of the ground-based radio wave ionosphere sounding instruments of the European ionospheric stations (mainly the data of Nagycenk Geophysical Observatory), called ionosonde, to determine how and what extent a given strength of a geomagnetic disturbance affect the middle latitude ionospheric regions in winter. We chose the storm for the research from November 2012 and March 2015.

As the main result of our research, we can show significant differences between the each ionospheric (F1 and F2) layer parameters on quiet and strong stormy days. We show that the critical frequencies (foF2) increase compared to their quiet day value when the ionospheric storm was positive. On the other hand, when the critical frequencies become lower the geomagnetic storm had negative effect

in the ionosphere. With our analysis, the magnitude of these changes could be determined. Furthermore we demonstrated, how a full strong geomagnetic storm affects the ionospheric foF2 parameter during different storm phases. It has been showed, how a positive or negative ionospheric storm develop during a geomagnetic storm. For a more completed analysis, we showed also the evolution of the F2 layer ionospheric storm effect over foF2 data of a North-South European ionosonde chain on geomagnetic meridian during a full storm duration. With this analysis we determined also, that the data of the ionosonde at Nagycenk Geophysical Observatory are appropriate, it detects mostly regional state of the ionosphere. Also we studied the prominent phenomena (e.g. TIDs- Travelling Ionospheric Disturbances) of the ionosphere in the function of geomagnetic activity. As we compared the daily occurrences of TIDs in the function of the magnitude of geomagnetic storm (magnitude of the Dst- and Ae- indices), we saw significant linear correlation. So we can say that the existence of TIDs in the ionosphere depend on the geomagnetic activity. When a stronger geomagnetic storm starts, we can detect more TID.

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Stable isotope analysis of Mihályi-Répcelak area

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Poster

The Mihályi-Répcelak area, NW-Hungary is well known of its natural CO₂ reservoir. The detailed investigation of natural CO₂ reservoirs can contribute to better understand and assure potential industrial CO₂ reservoir systems and their long-term safety.

The studied reservoir consists of laminated fine grained Middle Miocene (Lower Pannonian) turbidite sandstones. The sediments are

part of a prograding delta sequence that filled the Pannonian Basin during the Middle-Late Miocene.

The isotopic characteristics of the magmatic CO₂, that flooded the sediments in the Pliocene, is assumed to markedly differ from those of sedimentary CO₂, which was present in the pre-flooding stages of diagenesis. Therefore, the flooding imprint is believed to be detectable in the stable isotope composition in carbonates.

The analyzed sample was chosen based on its extremely high dawsonite (NaAlCO₃(OH)₂) content of 16 m/m%. The sample originates from the center of Mihályi area from a depth of ~1220-1460 meters and represents the reservoir rock of the natural CO₂ storage system.

The reservoir rock includes detrital and diagenetic minerals. Detrital minerals are quartz, K-feldspar, albite, mica and dolomite, but this study will focus mainly on the diagenetic minerals i.e., carbonate minerals (siderite, ankerite, dawsonite). Carbonates show variable textural features. Complex zones are found around dolomite clasts made of ankerites with variable Fe-content. Fine grained siderites are present in the cement and the sandstone also contains a considerable amount of dawsonite. Based on the preliminary studies, it seems that the dawsonite formed in a local process.

For stable isotope analysis individual dawsonite, siderite, ankerite and detrital dolomite grains were separated. The minerals were reacted with 100% orthophosphoric acid through different periods of time and analyzed for O, C and H (only dawsonite) isotopes. In this study we present the preliminary results of the stable isotope analysis.

One-dimensional wave equation with linear variable coefficients

Ádám Domján

Department of Geophysics and Space Science, Eötvös Loránd University

Poster

Our field of interest with this poster to demonstrate that how the waves propagate in the non-homogeneous media. The wave propagation in homogeneous media is self-evident, especially when we are restricted the problem to one spatial dimension. However, in non-homogeneous media the problem is not obvious at all.

To investigate the phenomena of the seismic wave propagation in inhomogeneous media we took the simplest case. We are restricted our problem to one spatial dimension, but the density and the Lamé parameters are linear function of that one spatial dimension. Putting these conditions to the seismic wave equation we got a one-dimensional wave equation with linear variable coefficients, which can be solved with applied mathematical methods and techniques.

In this poster, firstly we are going to present how to get the solution of this equation, then we are going to illustrate how the wave propagate in such a media, with that to comparing our result with the d'Alembert solution.

3D modelling of the Quaternary sediments in the southern part of the Great Hungarian Plain

Orsolya Gelencsér

Eötvös Loránd University, Department of Geophysics and Space Science
Poster

The Pannonian Basin is a sedimentary basin in East-Central Europe between the Alps and the Carpathians. This back-arc basin subsided in the Late Miocene. The recent activity has manifested itself in uplift of the western flanks, and continuing subsidence of the central part of the Pannonian basin [1]. The fluvial, -alluvial sediments, deposited in kilometers of thickness, derived from the local mountains. The complete sedimentary sequence of Quaternary can be found in the southern area of the Great Hungarian Plain (GHP). Due to the many boreholes and all sedimentary formations of this area it would be ideal to construct a complex 3D sediment model.

This three-dimensional subsurface model is based on the data of hydrogeological researches: wells and artificial profiles of the GHP edited by the Geological and Geophysical Institute of Hungary. The model is not only a visual aid for researches, but it could also be important for numerical modelling which would come in great use in applied and general earth sciences. Therefore, the proper models, which are loaded with petrophysical parameters, can help petroleum geological and hydrogeological researches and also support researches investigating tracks of paleorivers and make an assumption to evaluate

the discharges of them. Furthermore, the model offers opportunity to compare mountain erosion sediments to the deposit volumes of the GHP. These calculations can give a fresh view for researches on the topic of paleoclimate and paleogeography.

This modelling method can be extended for the complete of GHP, in this way the Quaternary geological history of the greatest region of Hungary could be more understandable.

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***Numerical water table modelling for different climate windows
within in the NAGiS project***

**Tamás Kerékgyártó, Attila Kovács, Teodóra Szöcs, György Tóth,
Annamária Marton, Éva Kun**

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Poster

This poster presents the methodology developed in the NAGiS project for the simulation of the nation-wide groundwater table in Hungary. The primary goal of groundwater modelling accomplished within the frameworks of the NAGiS project was to investigate potential climate impact on shallow groundwater resources. The aim of water table modelling was to develop a toolset which can be used for calculation of the water table for various climate conditions. Climate zones separate geographic areas with different climate characteristics. These zones were analysed separately in the course of hydrological modelling. Out of the internationally accepted biophysical climate classification methods, the Thornthwaite climate classification was chosen for the purpose of the NAGiS project. Climate zones were determined for the 1961–1990, 1981–2010, 2021–2050 and 2071–2100 time periods using average monthly values of climate parameters, based on the ALADIN climate model.

Thanks to the numerical tool, after detailed calibration and validation, quantitative interpretations can be drawn from the results of groundwater models. The presented model outputs are representative of groundwater conditions at regional scale, thus cannot be used directly for local-scale investigations, but the methodology

developed within the NAGiS project can also be applied at local scale. The outcomes of our groundwater models help to identify those regions (aquifers) which are could be potentially the most vulnerable to climate change impacts.

- [1] Attila Kovács, Teodóra Szőcs, György Tóth, Annamária Marton, Éva Kun, Tamás Kerékgyártó: *Predictive water table modelling in the NAGiS project*, MFGI-NAK, 14 August 2015

Phase and particle analysis methods to study composition and potential sources of attic dust samples in Ajka, Hungary

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Poster

Airborne pollutants, deposited in the urban environment, can be efficiently studied by attic dust analysis. The main aim of our study was to determine the mineralogical and phase composition, the grain size and shape of attic dust samples, and then identify potential industrial sources in Ajka city. Ajka have been one of the most polluted industrial cities of Hungary in the past few decades. Attic dust samples were collected in 27 different houses in the city and its vicinity covering 64 km² study area. To represent the long-term industrial pollution, at least 30-40 years old attics without disturbance were used. Good correlations between industrial sources and the spatial distribution of potentially toxic elements were revealed by Völgyesi et al (2014) ^[1]. To corroborate these findings, phase, particle size and shape analyses were carried out by X-ray diffraction (XRD, Philips PW 1730 diffractometer), scanning electron microscope (SEM, AMRAY 1830 I/T6) coupled with energy dispersive spectroscopy (EDS, EDAX PV 9800), laser scattering particle size distribution analyser (Horiba LA-950) and size, shape and chemical analyser instrument (Malvern Morphologi G3-ID).

By the results of the laser scattering particle size distribution analyser the source of the particles can be determined. Normal

distribution of the grain size suggests one major source, whereas multi-modal distribution refers to different sources of the particles, where each peak belongs to an individual source. Particles with a diameter under 50-100 μm can be transported by wind. However, particles $>100\ \mu\text{m}$ are too heavy for this transportation, they most probably formed locally in the attic. The Morphologi G3-ID instrument measures automatically particle size, shape and chemical characters of the particles by counting particles one by one in the sample. A Raman spectrometry can also be carried out on a given particle fraction selected.

According to the XRD and SEM-EDX analyses, the most frequently identified minerals were quartz, calcite, gypsum and Fe-, Al-bearing phases. A high fraction of spherical Al-silicates and Fe-oxides were also distinguished as well as different mixtures of these two phases. A potential source of these particles could have been the coal-fired power plant situated in the city center. Alumina- and Ti-oxides detected could have been derived from the alumina industry operated for decades at the western part of the city.

Based on the results of grain size analysis, there are no sample with normal distribution. Each sample contains minimum 3 peaks (up to 5-6), the biggest one is usually around at 30-70 μm . Most particles are in the 20-200 μm size range and 70 % of the particles are under 100 μm . In a few samples a colloidal size range ($\sim 300\text{-}700\ \text{nm}$) was also observed. Since red mud tailings are located within the city, fine dust, transported by wind from the tailings, can be the source of these colloidal size particles. Using Image Analyser mode on Morphologi instrument, we could identify size and shape of each particle, moreover spherical and non-spherical particles become measurable quantitatively in one sample.

According to our results, the existence of the potential sources, particularly coal-fired power plant and red mud tailing, can be identified.

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Fracture network modeling around the Radioactive Waste Repository in Bábaapáti, based on BN2-1 pre-boring

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Poster

Nowadays one of the most important tasks of environmental geology is to find solution to the safe and permanent storage of emitted radioactive waste of nuclear power plants. In Hungary, the underground repository, which is capable of storing low- and medium level radioactive waste, has been established in Bábaapáti. The construction commenced in 2005 and currently it has been operating with 4 chambers and the related maintenance tunnels since 2012.

Two additional caverns are planned to be built in the territory of National Radioactive Waste Repository in Hungary. From the West Exploring Excavation two horizontal pre-boring, called BN1-1 and BN2-1, was deepened.

The aim of the present study is to characterize the fracture network surrounding the BN2-1 borehole on the basis of measurable geometric parameters (length, aperture, orientation and spatial position) of fractures.

At the first step a 15 megapixel resolution photo documentation of the 142 m long core was made and each single fracture was identified using digital image analysis. Based on the joint pattern the 1D sections of fracture system can be characterized by three methods. Beside fracture density (1/m) log and the series of distances between neighboring joints, the fractal dimension of the pattern can be used as a measure of fracture intensity. During the latter calculation, the core was divided into overlapping intervals of unit length (40 m), and Hurst-exponent (H) was calculated for each section. H values were computed with R/S analysis by Benoit 3.0 software.

Beside fracture density, the fracture length distribution is a fundamental parameter to simulate spatial fracture networks. Fractures can be identified by numerous methods with characteristic sensitivity thresholds so that more sensitive approaches see more single fractures. In the case of the BN2-1, results of digital image analysis of core photos as well as BHTV data are available. Using the fracture density patterns recorded by the two independent methods, parameters of the

fracture length distribution function (E, F of a power law distribution) could be calculated by an adequate mathematical algorithm.

Based on the orientation data measured by the BHTV log, fracture density parameters and the length distribution ten network models with the same probability was generated using an appropriate simulation software (RepSim). As a result, the behavior of the fractured rock mass can be understood through newly calculated parameters, like the spatial position of the communicating joint sub-systems, fractured porosity, fractured permeability tensor and the representative elementary volume.

Coastal effects in East-Borsod Basin presented by high resolution stratigraphic correlation

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Poster

Introduction, aims

Despite its 200 years long exploration history, the Salgótarján Lignite Formation being structurally controlled and overprinted [1] and scarce of biostratigraphic indicators is still subject to revisions (e.g. [2], [3]). At present, while developing the database of perspective coal deposits, the experts of the Geological and Geophysical Institute of Hungary attempt to clarify the regional connections based on high resolution well-to-well correlation and the systematic recording of fossils and quality parameters. In our poster we present observations based on log correlations in East-Borsod Basin which can contribute to the genetic interpretation of stratigraphic key surfaces.

Results and their interpretation

(1) An extensive unconformity related to a sharp-based sand body has been identified below the coal seam III in Edelény region. The rate of denudation can achieve 15 m and affects also the flooding surface used as datum during correlations. This phenomenon indicates a relative sea level fall occurring during the accumulation of the coal-bearing formation. Nevertheless, it makes more difficult to create well log correlation sections north of the Sajó River as a consequence of

the eroded datum. (2) Within the coal-bearing sequence a sharp-based sand body of limited extent has been observed at the base of seam IV in Felsőnyárád region. (3) An unconformity associated with a flooding surface has been detected at the overburden of seam II in Kondó – Kazincbarcika region. The hiatus (20–25 m) increasing westward gradually proves the coast emerging to northwest and the transgression coming from the southeast. (4) Nearshore formations developing simultaneously with this transgression have been identified in Edelény region implying the position of the backstepped shoreline.

Conclusions

(1) The unconformity mapped at the base of BSFR-1 (Basal Surface of Forced Regression) [5] justifies the relative sea level fall along BSFRs assumed earlier and indicates the existence of basin margin in the north. (2) On the basis of the published and here presented BSFRs relative sea level fall occurred at least three occasions during the accumulation of the coal-bearing sequence, before the formations of the seams IV, III and I. Taking into account the eustatic sea level changes [6], these can be most likely interpreted as sedimentary responses to synchronous structural events. (3) The erosion demonstrated at the overburden of seam II indicates southeastward basin direction at the related time in the East-Borsod Basin.

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Developing the concept of “Mineral Deposits of Public Importance”

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Poster

The exploitation of minerals in Europe is indispensable in order to meet the present and future needs of the European society. This means that sufficient access is required to explore and exploit raw materials. At the same time, the mineral supply must be done in a sustainable way while taking into account other land uses such as agriculture, forestry, habitats for fauna and flora, other environmental concerns, priorities for settlements and infrastructure, etc. In response to this challenge MINATURA2020 [1], an EU project was launched in February 2015. The overall objective of this three-year project is to develop a concept and methodology for the definition and subsequent protection of “Mineral Deposits of Public Importance” (MDoPI) in order to ensure their best use in the future. In our poster we present international best practices of safeguarded mineral deposits and outline the development of the MDoPI concept which is still not finished.

Several European countries attempt to protect their mineral deposits and prevent them from sterilization. In Sweden safeguarded occurrences are called “mineral deposits of national interest”. The Swedish Environmental Code determines different “areas of national interest” including “areas that contain deposits of substances or materials of national interest shall be protected against measures that may be prejudicial to their extraction” [2, 3]. In the United Kingdom the protection of mineral resources has been part of the planning process since the 1947 Town and Country Planning Act [4]. According to the National Planning Policy Framework, a “Mineral Safeguarding Area” is defined as “an area designated by Minerals Planning Authorities which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development” [5]. The designation of a Mineral Safeguarding Area does not imply that the mineral will be extracted; however, it preserves the deposit for a potential future development [4, 5].

Before formulating the first definition of MDoPI, the meaning of

its components such as “Mineral”, “Mineral deposit” and “Public importance” has been analysed. This led to a comprehensive but too long definition: “A mineral deposit is of public importance if there is reasonable expectation that its exploitation could provide a significant economic, social, or other benefit to the European Union or the member state or a specific region of the member state in which it is located, provided that there is sufficient geological information to define its extent and that its possible exploitation fulfils sustainability requirements” [6]. This definition constituted a good base for the MDoPI concept, however, it needed modification from several points of view. The definition had to be short, flexible and inclusive in order to be applicable in all EU countries to all types of minerals including mining wastes and other secondary raw materials. Words like “reasonable” and “significant” may lead to confusion and diverse interpretation so these had to be omitted. The new definition meets the requirements listed above: “A mineral deposit is of public importance where information demonstrates that its sustainable exploitation could produce economic, social or other benefits to the EU (or the member states or a specific region/municipality)” [7].

The current definition is generic enough to be a working definition during the project. However, it is still not the final one; it can change as a result of the stakeholder consultations to be held in 16 European countries.

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Unconventional reservoir modelling – using 3D geological models in environmental research

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Poster

Soil and groundwater contamination is a general problem, but each site is unique depends on subsurface conditions (geological, hydrological, etc.) and the type of the contamination, and needs complex knowledge and special techniques to solve the problem. The relative large extension causes difficult understanding of spatial variations in environmental properties. The distribution of contamination related to their solubility. Three main zones are separable in the soil:

- infiltration zone – free phase and vapour phase-,
- zone of fluctuated ground water – free phase and residual phase-,
- saturated zone – dissolved phase contamination

To build up a 3D model from drilling and sampling data is able to show us the required information about spatial distribution of subsurface and contamination properties and support to plan appropriate remediation. The contaminated soil can be interpreted as a kind of near surface reservoir.

The studied test site is a rail industrial area where a large amount, mainly hydrocarbonate contamination filtrated into the soil, and reached the groundwater. Remediation started in 1995 and it still goes on by Elgoscár-2000 Kft. and Biocentrum Kft. This 20 years of work produced uncountable drilling, sampling, and geophysical data. After collecting, and systematizing these data, these were integrated into a 3D geological model, using JewelSuite reservoir modelling program. This program gives possibility to import borehole data, geophysical logs, and also other type of properties, in this case, information about the contamination.

The presented model contains stratigraphy derived from borehole description, and CPT (Cone Penetration Test) measurements, contamination data from FFD (Fuel Florescence Detection), and borehole sampling. The model shows the test site characteristics like typical sediments of the region, and allows to separate the zones where the different type of contamination present.

Ground Penetrating Radar developments and investigations

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Poster

Ground Penetrating Radar is a geophysical method for non-destructive investigation of the subsurface. The scale of the applications vary in very wide range, from locating rebars in concrete to geological purposes as locating caves or other anomalies. Generally the phase information is used for the analysis however the amplitude of the signals can hold valuable information too.

The GPR records usually contain a great amount of background noise, which can make it difficult to perform the amplitude corrections properly. The simplest method to eliminate the background noise is the subtraction of the average signal from all GPR channels still some disturbing residual noise can remain in the profile. The Background Matrix Subtraction [1] is a more sophisticated method, which calculates the noise for every channel individually, and subtracts the noise matrix from the data.

The amplitude of the reflections at an interface is affected by all the materials and layers, which are above it. The idea is to restore the amplitudes along the second or lower layers as they won't be influenced by the upper materials. This method can enhance the data, and can point out anomalies more effectively.

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Traces of fluid induced alterations through the example of a Ca-Al-rich inclusion in NWA 2086 CV3 carbonaceous chondrite

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Poster

Among meteorites, the composition of carbonaceous chondrites resembles the solar nebula material in the highest degree. The most significant of these meteorites are the CV3 (Vigarano-type) chondrites. The most notable components of them are the Ca-Al-rich

inclusions (CAI), which are the oldest solid condensates of the Solar System. These inclusions are built of minerals formed on very high temperatures (over 1000 K), and are exhibiting significant sensitivity to water induced alterations. Hence, they are essential indicators of presence and influences of water in meteorites [1].

Papers about the examination of the Ca-Al-rich inclusions of the NWA 2086 CV3 chondrite are not deeply researched. The investigation of this meteorite may be of great interest, because it contains many Ca-Al-rich. What is more, these inclusions make up the greatest cross-section ever found in this meteorite (3 cm²). The aim of our research is to analyze one of the largest (~7 mm in diameter) Ca-Al-rich inclusions and determine its type, formation and fluid controlled secondary alterations using Raman spectroscopy, scanning electron microscopy and electron microprobe.

The examined inclusion is fine-grained and spinel-rich CAI, its main mineral assemblages are pyroxene phases, diopside ± hedenbergite, and it contains lesser amount of spinel. The inclusion's remarkable feature is a three-zoned structure represented by characteristic mineral assemblages. The inclusion consists of a nepheline-rich core, which has a thin sodalite rim, surrounded by feldspar (anorthite ± dmisteinbergite) and garnet (grossular ± andradite) dominant band. The dominant components of the boundary zone, called outer rim (which is touching the meteorite matrix) are spinel + hibonite assemblages, are surrounded by feldspar-garnet fine grained assemblages too. The spinel phase appears as separate crystals, without hibonite in the core and the inner rim (between the boundary zone and the core). The mineral chemistry analysis has shown that spinels in the outer rim have higher iron content (0.65 – 0.87 apfu), whereas in the core this value is a little less (0.5 – 0.53 apfu). In case of garnets, the grossular dominance is common. In some garnet crystals andradite-rich rims are observed.

The results of our examinations led us to the conclusion, that the primary minerals are spinel ± hibonite ± perovskite, and diopside ± hedenbergite + grossular ± andradite + dmisteinbergite + anorthite + nepheline + sodalite are secondary minerals. The morphology and textural arrangement of the mineral phases suggest that the inclusion evolved from an originally melilite-bearing spinel-rich Ca-Al-rich inclusion, inside the parent body of the meteorite [1]. We may

conclude from a possible evolutionary path of Ca-Al-rich inclusions in the early Solar System. To set up the model we assumed that Ca-Al-rich inclusions' ages were approximately equal to the age of the Solar System. At first, the individual refractory minerals (melilite, spinel, hibonite, perovskite) were incorporated into tiny aggregations. These aggregations may have drifted out towards the outer and colder region(s) of the young Solar System, where ice crystals could have infiltrated. If we assume, that these aggregations later returned to the warmer regions, then the ice started to melt in them. This may have caused the fluid induced alterations of refractory minerals into secondary minerals, such as pyroxenes, feldspars or garnets. This process may be repeated even many times before the aggregation(s) became the part of the meteorite.

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Research of flood protection embankments with geophysical methods

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Applied

In our lecture we present through our practical examples our researches that we have conducted by shallow geophysical methods in flood control facilities and in other areas.

In the 19th century flood control measures, including the construction of protective embankments, were initiated in Hungary. By today, surveying the condition and modernisation of the protective embankments have become actual in a number of places. These examinations and developments are necessary because by the passage of time the condition of the embankments does not ensure sufficient safety against floods to come.

Such change of the conditions is influenced by a number of

things, e.g. the damages caused by floods having subsided, defects that may have been caused by the old technology considered today as outdated, defects having occurred as a result of the consolidation of the supporting shells, etc. We use our researches performed in respect of the flood control facilities for discovering the defects mentioned above, without breaking their structure.

In our presentation we show research results originating from two places, which are the following: embankment section from 7+000 ekm(embankment kilometre) to 8+000 ekm of the right bank and embankment section from 5+500 ekm to 8+000 ekm of the protective embankment of river Berettyó next to the Temesvári Bridge at Szeghalom, embankment section from 65+000 ekm to 67+000 ekm of the right bank embankment section of river Hármas-Körös next to Gyomendrőd.

In the course of our researches we performed geo-electric and seismic measurements and prepared soil sections. We compared our earth section prepared by the help of an earth borer type Edelmann with our geophysical measurements in order to confirm their accuracy and appropriateness. We compared, where we could, our measurement results with earlier measurement results and/or our other own measurements and public utility maps.

Our further researches include researching of position of the utility lines located in the soil with geo-electrical and seismic methods.

Our plans include performing further researches in other areas, like the examination of the subsoil before designing buildings, structures and roads, exploration of barrow pits and the examination of soil pollutions and groundwater flow parameters. Furthermore, our plans also include acquiring greater routine in practical geophysics.

Our objective is to make the science of geophysics more well-known and popular in public life and to highlight its numerous positive and useful usable properties in everyday work.

3D photogrammetric reconstruction of the Badenian echinoids

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Applied

Photogrammetry is in general a useful and well-developed tool to reconstruct 3D surfaces of artefacts. Classification of the fossils is based on the morphology, thus to use this 3D modelling in palaeontology could get new possibilities.

One of the fossil group, where the morphometry is essential for the determination of species – even on higher taxonomical rank – is echinoidea. The skeleton of these fossils is characterized by convex and concave surfaces, which can be measured along linear lines only with low accuracy. In order to test photogrammetry in this study, one of the most common Badenian (Middle Miocene) echinoidea, the *Parascutella gibbercula* DE SERRES, 1829 have been chosen. The studied specimens are coming from the rich echinoid fauna of the Badenian from Budapest (Hungary). Along the road cuts and due to the construction of large buildings from 1960 to 2011, new Badenian outcrops with rich and often well preserved echinoids were found in the different parts of the city (Örs Vezér Square, Gyakorló Street, Rákos and District of Budafok-Tétény). These successions belong to the Upper Badenian Leithakalk Formation Rákos Member, which consists of sandy limestone, calcareous loose sandstone with volcanic clast and/or calcarenite without terrigenous or volcanic clast. The studied specimens are deposited in the collection of Geological and Geophysical Institute of Hungary and in the Paleontological Collection of the Eötvös Loránd University.

Parascutella gibbercula is well known and researched in both morphological and taxonomic aspects. However there are some intraspecific morphological features that show high variability across the specimens: the adapical conical convexity is considerably different between several forms. The petalodium's length/width ratio can also

vary from specimen to specimen. Other morphological characters for example peristomal and periproctal aperture and the food groove can also be different. These differences could be determined by ecological conditions (such as substrate, palaeodepth), or can be related to taxonomical or pathological changes. For an appropriate comparison, quantification of these features is necessary.

In order to evaluate the differences found in *P. gibbercula* specimens various photogrammetric technologies have been used as our preliminary experiments showed that it could be a good tool to get three-dimensional information about the collected fossils.

This contribution discusses which photogrammetric techniques are adequate to study and compare the studied echinoid specimens. Our goal is to review modern techniques and current software solutions to model the fossils and also to study the resulting 3D point cloud. Different methods are evaluated and compared from taking the pictures (with various camera types and different target tables) through data processing, analyzing potential errors, resolution and accuracy for each one of them. Time- and cost-effectiveness of the software packages were also taken into account in order to render the images into 3D model effectively.

Our results show that 3D analysis using photogrammetric method is a good tool to study the collected echinoid specimens showing more information than the classical morphometry studies, especially in the convex part of the studied fossils. Furthermore, the resulting 3D point clouds of different fossils make it possible to compare and maybe even quantify the differences across the species even genera.

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***Comparison of in-situ electron density measurements with
equatorial electron densities obtained by whistler inversion***

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Theoretical

The equatorial electron density obtained from whistler inversion has long been regarded as an effective tool for monitoring the plasmasphere from ground based measurements. However, since these inversion methods are based on various models, it is essential to validate them through comparison with in-situ density measurements. To date, no such comparison was made, mostly because of the lack of suitable in-situ data.

The recent Van Allen Probes experiment provides an excellent base for this comparison, the Probes measure not only the electron density and magnetic field, but all the six electromagnetic wave components that is essential for calibration with whistler-based densities.

Whistlers recorded on the ground are propagated in a duct along a magnetic field line. The ducted propagation was verified first time in the history of whistler research using the six component burst mode measurements on VAP. The wave normal and Poynting vectors were calculated using the Matched Filtering and Parameter Estimation method [2] to check whether the whistler were propagated in a duct. Then a partial-path whistler inversion was applied to the verified whistler to obtain the equatorial electron density.

Our recently developed whistler inversion method [2] includes various models, such as wave propagation, magnetic field, field-aligned density distribution and equatorial electron density models. The latter one is a special one used for multiple-path whistler groups. The comparison of the in-situ densities with the ones obtained through whistler inversion provided a complex validation, not only of the field-aligned density distribution model, but the of other ones as well.

The validation procedure showed that the average difference between the in-situ and whistler based electron densities is smaller than the uncertainty of the in-situ density measurements itself.

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The application of polar coordinate transformation on the cinder cones of the San Francisco Volcanic Field

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Theoretical

Geomorphometric and traditional GIS methods are widely used for studying volcanic forms, e.g. cinder (scoria) cones, which have usually symmetric shapes, but they can be asymmetrical, as well. Their asymmetry may stem of volcanogenic processes or result of erosional processes. Studying asymmetry one can imply to the denudation, denudation rate, and, to some extent, to the age of the volcanic edifice. However, original asymmetries related to formation (e.g. rifting, emplacement on slope, eruption variations etc.) are difficult to separate from erosional features. With the application of polar coordinate transformation (PCT, introduced earlier in volcano-geomorphic studies [1]), we can define new derivatives of the morphometric parameters.

In the study area, the San Francisco Volcanic Field (SFVF), there are roughly 600 cinder cones as well as the central stratovolcano, the San Francisco Mountain. Our goal is the geomorphometric analysis of the cinder cones of the SFVF. SFVF area is well-studied volcanic field with evidence of eastward younging trend of the cinder cones.

Traditional parameter maps (aspect, slope histograms, cone height/width ratio) were PCT-transformed. The results show characteristic separation of the regular cones (the values are more or less constant at given radial distance); some asymmetric cones, however, show sectorial differences or irregular patterns in the

transformed images. As the cones are getting younger in a west-east direction, the PCT images enhance the tendency of the erosion of the edifices: the slope is decreases in context of the age.

As an improvement of the method we plan automatic extraction and classification of the features, in order to group similar scoria cones and relate the age to the destruction of the edifices.

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Importance of geotourism and motivation for participating in geotours

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Theoretical

Geotourism provides the opportunity for tourism regions or villages to promote an identity that is unique to that place. It can create new and exciting tourism experiences, present and protect geoheritage while it is sustainable and economically beneficial to local communities.

Recognition of geotourism can not be dated back to a long time. Geotourism was first defined by Hose in 1995 [1]. In 2000, the European Geoparks Network was founded, while in 2004, the Global Geoparks Network was established. The first book about geotourism was published in 2006 [2] and the first Global Geotourism Conference was held in 2008.

Today, there are 69 geoparks in Europe and 120 in the World besides the countless geosites, geo-trails, visitor centres even outside of geoparks.

Guided geotour is a geotourism service which can focus public attention to local geoheritage and attract new visitors.

The aim of my current research is to understand the different motivations behind tourists undertaking a geotour experience. No literature has been published on this issue yet, even though it is very important for future development strategy.

Quantitative methodology and on-site survey at „Talking Rocks”

geotours were applied, consisting of a self-administered questionnaire. 615 geotour participants took part in the first stage of the research in March, 2015 and 67 in the second stage in October, 2015. More research will be carried out at the V. „Talking Rocks” geotour in March, 2016 with the same method to find out their motivation for participating.

The research was supported by the NTP-EFÖ-P-15 National Talent Program and the fellowships of MOL New Europe Foundation and Development Foundation of Székesfehérvár.

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Petrographic features of volcanic clasts at the base of the Upper Eocene succession and of Triassic andesite (Budaörs-1 well) in the Buda Hills

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Theoretical

In the Buda Hills the unevenly eroded surface of Triassic carbonate rocks is usually overlain by pyroclastite and tuffite layers; these represent the basal part of the Eocene succession. This interval is followed by conglomerate and subordinately sandstone beds which contain clasts of various lithology and size. The dolomite clasts are the most abundant, but in some places the amount of lava rock and tuff clasts are significant, and chert, sandstone and tuffite clasts also occur subordinately.

The main aim of this study is to characterize the volcanic clast-bearing Eocene basal beds of the Buda Hills. The lava rock and tuff clasts are strongly weathered. However, on the basis of textural observations, the determination of the original rock-type was usually possible. Based on microscopic investigations, the following types of volcanic rocks were distinguished: (I) andesite (originally with a

probably porphyric, pilotaxitic texture, and with pseudomorphs after plagioclase and pyroxene); (II) amafitic andesite (with an originally trachytic texture and pseudomorphs after oriented plagioclase); (III) dacite–rhyolite tuff (with juvenile glass shards and pumice; crystals: pseudomorphs after plagioclase, and subordinate quartz, pseudomorphs after pyroxene and biotite); (IV) rhyolite tuff (juvenile pumice and glass shard; crystals: pseudomorphs after feldspar, quartz, and pseudomorphs after a pyroxene, biotite, accessory; lithic fragments: andesite, acidic lava rock, siltstone/sandstone, siltstone and chert); (V) acidic lava rock (consisting of coarse-grained, dark-coloured, spherulitic and fine-grained, light-coloured, alternating bands).

The volcanic clasts are derived from a calc-alkaline intermediate–acidic volcanism. The Triassic andesite (which was penetrated by the Budaörs–1 well) is petrographically (porphyric and pilotaxitic texture with fresh plagioclase (labradorite/andesine) and fresh hypersthene) similar to the andesite clasts found in the “Upper Eocene basal conglomerate”. Consequently, it appears that the investigated Eocene clastic deposits were probably formed via multiple reworking of Triassic volcanites.

Numerical simulation of the influence of groundwater flow for the performance of borehole heat exchangers

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Applied

Improving the efficiency and sustainability of ground source heat pump systems (GSHP) can make the shallow geothermal energy utilization more attractive. If the borehole heat exchanger (BHE) crosses permeable layers, then underground water flow can considerably contribute to the heat transfer, increasing the efficiency of the entire GSHP system. Hence simulation of the BHE systems with groundwater flow is an adequate tool for studying this phenomena and optimizing the shallow geothermal systems. The water flow is typically induced by hydraulic gradient, but in some cases the thermal convection (buoyancy flow) can also occur due to

BHE induced temperature changes. In our study we mainly examined the effect of thermal convection. The thermal convection is less studied phenomena in the literature than the hydraulic gradient induced flow, but it is our belief that it can be a potential factor for the BHE performance improvement, and hence for the GSHP systems optimization.

The evaluation of thermal convection in porous media depends on numerous physical variables, but in our research we have analyzed only four important parameters: the permeability, the porosity, the layer thickness and the temperature disturbance (through the BHE operational parameters). Further factor we have studied is the impact of the advective horizontal fluid flux. By the help of simulation outcomes, we analysed the development of thermal convection and the impact for the BHE power performance.

While the material properties of the underground layers near the BHE is an attribute, a specific characteristic of the given installation sites, the temperature disturbance near BHE depends on the selected BHE type, BHE and grout material, BHE and borehole dimensions and the operations parameter. So these parameters could be optimized in the point of view of the thermal convection. The BHE works in a closed-loop system, without extraction or injection of groundwater, utilising the ground as a heat source or sink. For example, in „heating heat pump mode” the fluid temperature in BHE is lower than the surrounding soil temperature while in „cooling heat pump mode” the fluid temperature is higher. In our three-dimensional models, we have chosen the coaxial type BHE, where the heat carrier working fluid flows down to the bottom in the outer, and flows upward in the inner tube. In the computer models, the inlet temperature of the BHE can be described in different ways. The easiest simulation scenarios use a constant, fixed temperature value. It is also common to use time dependent value, where inlet temperature is a function of either the time (e.g. described by harmonic or rectangular functions) and/or of the actual outlet temperature (constant or time varying heating/cooling rate). In our simulations, we have focused on fixed inlet temperature, but we used other operational modes for better recognition of thermal convection at different transient boundary conditions.

We have made my models in Feflow, which is a widely accepted finite element modelling software for subsurface flow and transport.

In my presentation, I briefly present the results of the several simulation runs and the estimated performance improvement due to convection and advection. I also draw some conclusions about the possible optimization of shallow geothermal systems connected with permeable layers.

***Fe-Mn-oxide ore indications in the footwall of the Toarcian Úrkút
Mn-carbonate ore deposit, Hungary***

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Theoretical

The Fe-Mn-oxide indications at the footwall of the Mn-carbonate ore deposit were studied on 38 samples (Shaft III, deep level) to get information about the early stage of ore formation. Microstructural-textural (optical microscopy, SEM-EDS), mineralogical (XRD- μ XRD) and geochemical (C and O isotopic properties by ICP-MS) were used for characterization of the host marlstone and the ore indication. High resolution *in situ* and bulk organic matter investigations were made for the first time by GC-MS, FTIR-ATR and Raman spectroscopy-7200 spectra).

The Úrkút Manganese Formation is one of the largest manganese deposit in the World, located at the central part of the Transdanubian Range. The deposit is embedded in Mesozoic limestone.

Stromatolite-like, filamentous and coccoid microstructures made of Fe-Mn-oxide (ferrihydrite, goethite, manganite, pyrolusite, hollandite, birnessite, hausmannite) and silica were observed in the micritic marlstone host among common calcite biodebris (microfossils and *Echinozoa* fragments) and rare clasts (quartz, feldspar). The clay (occurring as greenish pathes and showing bioerosional traces), calcite matrix and idiomorphic dolomite are authigenic.

$\delta^{13}\text{C}_{\text{PDB}}$ values of carbonate reflect more intense organic compound contribution toward the mineralized parts (0.64 - -21.35 ‰). Temperature calculation based on $\delta^{18}\text{O}_{\text{SMOW}}$ values of carbonate assuming balanced conditions show elevated temperatures toward the mineralized parts (9.93 – 29.87 ‰).

Sometimes the Mn oxides appear with Fe-oxides in laminated, micro-stromatolite-like structures. In these zones different kind of organic compounds as embedded microlaminae (amid groups, benzol group, PAH) were identified by FTIR, and Raman line profile analyses.

Results show metal-bearing fluid infiltration in the unconsolidated limemarl along the micritic matrix. The host marl can be originated by microbial mediation. The Fe-oxide enrichment was formed via microbial mediation, while Mn-oxide was formed most probably by active surface catalyses. In the sediment/water interface Fe-Mn-oxide stromatolite mounds (chimneys) were created on upward discharge fluid systems of elevated temperature, which needs further investigation.

***New mineralogical and geochemical results from the Eplény
Manganese Deposit, Hungary***

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Applied

The Early Jurassic Toarcian Oceanic Anoxic Event related manganese mineralization was widespread in Europe. In the 20th century there were two, closely located important mining sites in Hungary, the Úrkút and the Eplény Manganese Deposits, where this Jurassic ore was exploited. The underground mine is still operating in Úrkút, but the Eplény mine was closed in 1975 [1].

The Eplény deposit can be divided to Western and Eastern part in virtue of different geological and geochemical conditions. At the Eastern part reworked secondary manganese ore was found, but at the Western part primary and secondary Mn-oxide and in some places Mn-carbonates were found as manganese ore.

Before and during the mining operation 235 boreholes were

drilled at Eplény but after the mine closure, the cores were barely available and were not investigated for decades.

In the summers of 2014 and 2015 we had the opportunity to access some of the old drill cores in the core sample storage of the Úrkút mine (some Eplény drill cores also deposited here), so we selected 24 samples covering all the different parts of the Eplény mining area for detailed investigation.

During our work we determined the main ore minerals (rhodochrosite, kutnohorite, manganite, cryptomelane, todorokite, hollandite pyrolusite, jacobsite) and gangue minerals (clay minerals, quartz, apatite, calcite, pyrite, goethite, jarosite, gypsum). The distribution of these minerals is unequal in the deposit and with further measurements their formational environment can be specified. In the manganese-carbonate containing part of the deposit, significant changes were detected in the mineralogy. Based on the mineralogical composition, the Mn-ore bearing formation was distributed to four parts. The lowest part (1.) contains only cryptomelane, the second part contains cryptomelane, todorokite and/or jacobsite, the third part contains jacobsite and rhodochrosite and the top part (4.) contains kutnohorite and rhodochrosite. Based on the mineralogical information, valence of the manganese is also known. The first layer contains +3 and +4 manganese, the second contains +2, +3 and +4, the third contains +2 and +3 and the uppermost layer contains only +2 valence manganese minerals.

These differences determine a change in the redox condition. The lowest part was in oxidative conditions and the upper parts continuously turned into reductive environment.

The bulk chemical composition (identified with X-ray fluorescence spectroscopy) also follows and reflects this change. In the first and second layers the total amount of barium and strontium reach the 1wt% and the mass of the potassium is near to the 3 wt%, but the amount of the calcium is only 2–4 wt%. The K, Ba and Sr accumulated in the hollandite-structure minerals (e.g. cryptomelane). In the next two layers the total Ba and Sr content are less than 450 ppm and the potassium is only 1.5–1.8 wt%, however the mass of the calcium is 14–17 wt%. The decreasing of the Ba and Sr is caused by the decreasing amount of hollandite-structure minerals and the increasing Ca content could be owe to the appearance of the

kutnohorite, the calcite and the gypsum minerals.

The total rare earth element (measured with ICP-MS) content is less than 100 ppm in every case, and the normalised REE pattern looks almost identical in all the samples. With these data the probability of the changing in the depositional rate of detrital material during the Toarcian Anoxic Event is negligible.

Comparing our results to the composition of the average continental crust [2] positive europium and cerium anomalies were detected in a few samples (even fourfold enrichment) which need further investigations.

Part of the measurements were financed by TÁMOP-4.2.2.A-11/1/KONV -2012-0005 project as a work of Center of Excellence of Sustainable Resource Management, in the framework of the New Széchenyi Plan.

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Heavy metal detection using geoelectric methods in field

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Applied

During the industrial activities a lot of contamination accumulate and it is necessary to store somewhere. These places are specially designed to keep the pollution within the boundaries. However these gates cannot work every time without any malfunctions. In order to avoid some kind of damage, they should be monitored regularly. There were resistivity and induced polarization measurements around one of this type of contaminated site in May 2013 and in August 2013. The Háromkő Geological and Geophysical Prospecting Company was completed the field measurements by the framework of the KÚTFŐ project. There were 24 measuring points at 6 different profiles, thereby we got a sufficiently dense network. This set up was involved by the experts of the University of Miskolc Hydrology and Engineering Department and the Department of Geophysics.

We processed the measured data with TAU-transformation what we received from each monitored station. We have made apparent conductivity and WAV scale maps by points, profiles and different depth level maps. One of the measured points have been on the original polluted area to get a better knowledge about parameters of the source. As we mentioned earlier we had double measured data from two different time, so we had the opportunity to monitor the expansion of the pollution both in time and space. So we can see from the diagrams the spreading characterization, while it moves to the opposite direction from the dam.

Research of the Vízvöröstó (Nagyvázsony, Kab-hill) redclay–bauxitic clay filled dolinas, mapping the bedrock surface. Refine of the archive ELGI (1992) geoelectrical measurements.

Bóna István

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Applied

The topic of my research was geological mapping on the Balaton Highland, accurately in the Vázsony Basin. The aim was to explore the bedrock of the Neogene sediments and basaltes- in this nearly 55 square kilometers area. Data of geoelectrical and magnetic measurement were used during the research. Stratas of eight exploratory boreholes helped us make the evaluation more reliable. There were 101 archive vertical electrical measurements in this area. The re-evaluation of these measurements was carried out and additional geophysical measurements were done; especially vertical electrical soundings and electrical resistivity tomography. During my presentation, the physical background of the used geophysical methods also will be presented. The Neogene deposits show a lower resistivity value, approximately 30-40 Ωm . These deposits display significant resistivity contrast with the quaternary structures above it and the Triassic dolomites under it. The extensive erosion of the Balaton Highland makes this research more complicated. During the research, red clay filled sinkholes and dolomite cones, ridges were evinced. The basaltic structures were explored based on their magnetic properties in order to define the origin and shape of these structures.

My presentation involves the results of the above-mentioned data. Using the results of the research, cross-sections and surface models were created. As a consequence of this research, the geological conditions of this area, with geophysical methods were refined and several tectonic processes were detected.

Applied UV-florescence sounding in environmental remediation

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Applied

Designing and operating an environmental remediation system the knowledge of the geological structure, the location of the pollution is essential.

Classical method of sample drilling must be carried out very carefully during environmental site investigation. Many error can occur that can distorted the results, lead to false implication and the failure of the remediation. The error reduction is a very time-consuming and expensive process. Hence often there isn't any possibility to provide a low risk, detailed site investigation.

According to these there is a huge need of developing new generation site investigation. These methods besides their speed, cheapness and accuracy must provide enough information from each site. These data must be geological, hydrogeological (eg.: engineering geophysical sounding – CPTe) and contamination characterization (eg.: Membrane Interface Probe – MIP, Fuel Fluorescence Detection – FFD).

The FFD and CPTe probes developed by the ELGOSCAR-2000 Ltd. can be considered as a new generation technology. Combined application of the probes makes it possible to study the oily pollution in its medium.

During practical application of the probes the uncertainty and the price of the investigation decreased. With their usage we were able to detect contamination dispersion in different permeability zones. We were able to detect pollution change even from mm to mm what is completely impossible by the classical sampling technology.

As the measured data appears on the computer connected to the

probes the demarcation of the contamination can be done very fast. Before it was only possible after the analytical measurements.

Optimisation and progression of the remediation can be done easily and quickly with the FFD. The application also helps to meet the official and contractual deadlines.

The FFD sounding is not substitute the sampling and analytical measurements, but with comparison their amount can be lowered.

According to the benefits of the application international widespread expected.

Effect of particle size on ATR FTIR spectra of common rock-forming minerals

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Attenuated total reflectance (ATR) is an optical technique that has been used for characterizing a wide range of minerals in oil industrial applications, space and planetary sciences and special mineralogical researches. However, minerals occur in sizes ranging from submicroscopic to coarse, and in characterizing them by their infrared spectrum, it is important to recognize those features of the spectra which are purely a function of particle size. In light of this, six particle-size fractions of minerals (<2, 2–4, 4–8, 8–16, 16–32, 32–63 μm) were prepared in order to demonstrate that ATR FTIR spectra of common rock-forming minerals are, besides other factors (i.e. particle shape, structural changes, band overlaps, multiple scattering) dependant primarily on the particle size.

The results show that the positions of the most intense bands shift to higher wavenumbers when the particle size decreases. This difference in wavenumbers is clearly beyond the analytical uncertainty ($\pm 1 \text{ cm}^{-1}$) in quartz and carbonate powders. Additionally, the coarser the mineral particles is the broader the widths of the infrared bands, regardless the degree of crystallinity and particle shape. As the infrared light samples a different average orientation of the mineral particles, the observed band shifts and band broadenings may not only

be caused by the particle size alone but also by the anisotropy. The intensity and area of infrared bands gradually increases from coarse particles up to 2–4 μm where the absorbance is at maximum. However, if the particle size is very small ($<2\ \mu\text{m}$) in the order of the wavelength and penetration depth of the infrared light, intensity decreases. Therefore, fine particles should be carefully evaluated by ATR FTIR as their real proportion may be underestimated compared to the coarser phases.

Larger band area of water ($3000\text{--}3620\text{cm}^{-1}$) is detected in the powder below 2 μm than in the other particle size fractions due to the higher specific surface of particles. It indicates that the finest particles could have unproportionally more water adsorbed on their larger surface area. Thus, higher wavenumbers of the ATR FTIR spectra are more sensitive to the amount of particles below 2 μm . It is also concluded that at least a proportion of the moisture could be very adhesive to the particles due to the band shift towards lower wavenumbers in the infrared range of $3000\text{--}3620\text{cm}^{-1}$.

Titanium, niobium and tantalum minerals in the formations of the Bagolyhegyi Metarhyolite Formation (Bükk Mts.)

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Applied

Between Miskolc-Diósgyőr and Bükkszentkereszt there is a suite of Triassic age metamorphosed volcanics on the surface, which belong to the Bagolyhegy Metarhyolite Formation. Within the CriticEl research project, from 2013 to 2014 the University of Miskolc carried out a rare earth element exploration in this area, in which I participated.

During 20 field days I collected 41 rock samples in total, 25 of which were later analyzed with wet chemical method. I prepared 6 polished sections for examinations by electron microscope. In the autumn of 2013, a Nb-oxide mineral, columbite-(Fe) was identified by an electron microscope measurement of a rutile grain. It turned out that rutile and ilmenite, accessory minerals of coarse-grained quartz-albite bearing vein rocks found near Bükkszentkereszt have some Nb-

Ta-W-Sn content; also, independent Nb-Ta minerals are associated with these: columbite-(Fe), tantalite-(Fe), fluorcalciomicrolite and a not exactly identified mineral, which is an Y-rich member of the pyrochlore or the aeschynite group. This Nb-Ta-mineralization is unique in Hungary.

Because of the unambiguous differences in the Ti-oxide content I divided the formations into two rock groups: chlorite-rich and chlorite-poor metavolcanics. The latter can be found on the southwestern border of the area only, and it contains the occurrence of the Nb-Ta-bearing Ti-oxide minerals. The ilmenite-rutile mineralization can be found in two further localities only apart from the one I described in the previous paragraph, both on well-defined area. However, none of the rocks samples collected from these localities have Ti-oxide minerals with a Nb-Ta content similar to the one described above.

The trace element chemical examinations attested to an extremely low Nb-Ta content in the complete formation compared to average values of the extrusive magmatic rocks which is typical of calc-alkaline magma.

Diagenesis and burial history of Middle Triassic dolomites in the Szeged Basin, Southeast Hungary

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Significant part of the pre-Cenozoic basement of the Szeged Basin comprises Triassic dolomite rocks. These carbonates are good hydrocarbon reservoirs in numerous cases, and hydrocarbon production is significant in this region of Hungary. Nonetheless, the detailed petrology of the Triassic reservoir rocks has not been investigated for decades.

The aim of this study is to reconstruct the diagenetic and burial history of the studied formations using petrographic observations, fluorescence and cathodoluminescence microscopy, fluid inclusion petrography and microthermometry and stable isotope geochemistry.

The investigations were performed on core samples which were collected from wells in the Szeged Basin.

The aforementioned investigations reveal that the textures of the Triassic dolostones are intensively altered by brittle deformation and cementation events. The original depositional environment can be reconstructed only for the samples exhibit texture preserving dolomitization and low rate of fragmentation.

Four diagenetic domains (eodiagenesis, mesodiagenesis I, telodiagenesis, mesodiagenesis II) could be distinguished based on petrographic observations and stratigraphical position. Most of the examined sediments formed under shallow water marine environment from peritidal to subtidal depositional conditions. During eodiagenesis (approximately from Middle Triassic to Middle Jurassic) the rock bodies were completely dolomitized by both fabric preserving and fabric destructive dolomitization.

The main brecciation events preceded the formation of veins filled by saddle dolomite. Microthermometry analyses performed on saddle dolomite-hosted fluid inclusion assemblages suggest elevated temperature (between 140–210 °C) during the mesodiagenesis I. The $\delta^{18}\text{O}$ data are consistent with precipitation of saddle dolomite at an elevated temperature.

During the Middle Miocene the Triassic beds were located in uplifted position, which marked by abrasional sediments and signs of dedolomization (telodiagenesis).

Formation of fluorescent sparry dolomite generation and bituminous veins seems to be related to the mesodiagenesis II caused by burial after the Middle Miocene.

Remnants of organic matter (hydrocarbon inclusions in saddle dolomite crystals of the mesodiagenesis I and bituminous veins formed during the mesodiagenesis II) suggest multiphase migration events. Recognition of the different hydrocarbon migration phases could provide the basis for the analysis of their relationship with the depositional, diagenetic and tectonic processes, and subsequent stages of basin evolution.

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Lead isotope study in attic dust samples from Ajka, Hungary

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Applied

Lead analysis is especially important in environmental studies because it occurs in all parts of our environment and can be toxic to humans and animals. Lead has been used by humanity since ancient ages. Although its potential danger was quickly recognized, the anthropogenic activities (e.g. coal combustion, traffic, etc.) have generated increasing amount of lead in our urban environment.

Lead isotopes are useful indicators of the origin and pathways of lead in urban samples such as soil and dust. In spite of that Pb-isotope measurements are widely used in environmental studies, it have not used in Hungary yet. Isotope ratios of leaded petrol in the country is also poorly known. Attic dust can preserve potential toxic elements emitted in the past, hence, can be used to identify emission sources.

The study area is Ajka city in Western Hungary, which has been one of the most polluted industrial cities in Hungary in the past. The attic dust samples were collected from 27 different houses in Ajka and its vicinity, which includes industrial areas, urban dwelling locations and background samples. Lead isotopic composition of attic dust samples were measured by ICP-MS in the Laboratory of the Technical University of Freiberg. Local coal samples and samples from the coal waste dump and waste heaps of the local power plant were also analyzed for comparison. The attic study showed higher lead concentrations in the city centre and along major roads in Ajka town, therefore, our major question was to investigate lead sources in the studied samples by using lead isotope ratios. The two uranogenic (²⁰⁶Pb, ²⁰⁷Pb) and the thorogenic (²⁰⁸Pb) stable lead isotopes and their ratios were used. The ²⁰⁶Pb/²⁰⁷Pb ratio shows the greatest variability, whereas the ²⁰⁸Pb/²⁰⁷Pb ratio forms connection between thorium and uranium.

The $^{206}\text{Pb}/^{207}\text{Pb}$ and the $^{208}\text{Pb}/^{207}\text{Pb}$ isotopic ratios vary between 1,15-1,28 and 2,41-2,47, whereas their median values are 1,19 and 2,44. The calculated $^{206}\text{Pb}/^{207}\text{Pb}$ ratios from the attic dust were significantly lower than the values of coal and waste rock samples (avg. 2,28 – coal; 1,83 – waste rock), and as for the other ratio ($^{208}\text{Pb}/^{207}\text{Pb}$) is concerned, the values were higher (avg. 2,32 – coal; 2,39 – waste rock). Thus, the Pb-compound of the attic dust samples is less likely derive from these sources, except for two samples located in the South from the coal-fired power plant. There is a slight difference compared to most of the samples, which is probably due to the mixing of the coal combustion. Besides these two exceptions, others reflect lower $^{206}\text{Pb}/^{207}\text{Pb}$ ratio, their source is likely the lead emitted by the traffic. Compared to the literature, to the Russian data particularly, we can observe highly similar results. The samples show similarity to the Russian leaded gasoline, in which the anti-knock additive derive from the Kazakh Pb-ore.

This method helps to locate the measurements we made on a scale offered by the literature, thus to determine the sources of the pollution. This study opens new fields and opportunities to learn more about the Pb-isotope ratios of Hungarian industrial cities and provides comparison for further studies.

Fe-Ti oxide thermometry of the Ciomadul dacites

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Theoretical

The Csomád (Ciomadul) volcano is the southernmost eruptive center along the Caliman-Gurghiu-Harghita volcanic chain, and is the youngest one in the entire Carpathian-Pannonian region. It is a lava dome volcanic complex comprising two explosive craters and surrounded by older peripheral lava domes. Harangi et al. [1] suggested that a long-lived, low temperature crystal mush bearing magma reservoir could exist beneath the volcano, which was

periodically reactivated by intrusions of basaltic magma, leading to volcanic eruptions.

This work focuses on the compositional characteristics of Fe-Ti oxides (ilmenite, Ti-magnetite) which provides information on the thermal and redox state of the magmatic system. We separated these elements from heavy mineral assemblage (magnetic fractions of 63-250 micrometer crystals). This way we could gain sufficient amount of Fe-Ti-oxides for compositional analysis. Temperature and oxygen fugacity values were calculated after a rigorous equilibrium test.

The calculated temperatures form two populations which have 90-100 °C difference between them: (1) around 620-640 and 660-680 °C, (2) 710-720 and 750-770 °C. Some samples contain only one of these populations, and there is one sample which gives highly different temperatures (800-850°C). The obtained oxygen fugacity values are in a range from 1.1 to 1.8 [$\log_{10}fO_2(\Delta NNO)$] suggesting crystallization from an oxidized environment.

Oxide thermometry allows differentiating temperature ranges representing magmatic crystallization in a low temperature crystal mush, a high temperature magmatic environment, and also cooling stages of the magmatic system. The 710-770 °C is consistent with the crystal mush temperature values obtained from amphibole [2] and titanite (unpublished) thermometry results.

- [1] Harangi, Sz., Novák, A., Kiss, B., Seghedi, I., Lukács, R., Szarka, L., Wesztergom, V., Metwaly, M. & Gribovszki, K. (2015): JVGR, **290**, 82-96
- [2] Kiss, B., Harangi, Sz., Ntaflous, T., Mason, P. R. D. & Pál-Molnár, E. (2014): Contrib Mineral Petrol, **167**, 986

The fate of the Dachstein platform at the Triassic-Jurassic boundary in the Transdanubian Range, Hungary: drowning, emergence, acidification crisis, or else?

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Theoretical

Significant carbon isotope fluctuations are known from the Triassic-Jurassic boundary (TJB) interval. The majority of the available isotopic data originates from open marine settings and

relatively little is known from shallow marine environments, despite the existence of extensive Late Triassic carbonate platforms in the Tethys.

Here we present stable isotopic and carbonate sedimentological data from the Transdanubian Range in Hungary, which cover the termination of Dachstein Limestone and the onset of Hettangian sedimentation following a hiatus. Previously, the TJB in the Transdanubian Range was regarded as a textbook case of a tectonically controlled platform drowning event or, alternatively, cessation of carbonate production due to emergence caused by a significant sea level fall at the TJB. However, recent recognition of global biotic change and environmental perturbations at the TJB call for an assessment of their possible role in the demise of the Dachstein platform.

Oxygen and carbon isotopic composition of bulk carbonates were measured in the Kőris-hegy section (Bakony Mts.), the Tata section (Tata Horst), and the Vöröshíd section (Gerecse Mts.) Other sections, Pisznice and Tölgyhát (Gerecse Mts.), yielded additional sedimentological data.

The surface separating the Dachstein Limestone from the Jurassic limestones carries only minimal relief. Thin section studies reveal small-scale irregularities, stylolites, or a thin clay-rich layer at the TJB. In the first meters of the lowermost Jurassic beds abundant ooids occur, and crinoids become common.

In all studied sections, there is a sudden negative carbon isotope shift at the TJB, followed by a gradual rebound to more positive values. Chemostratigraphy allows correlation with other sections worldwide.

Our results allow a discussion of possible roles of submarine erosion, perhaps partly related to change in carbonate production related to the end-Triassic extinction. These environmental and biotic factors should be considered in explaining the demise of the Dachstein carbonate platform.

Geochemical characteristics of two phosphorite occurrences from the Transdanubian Mountain Range (Hungary)

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Theoretical

The carbonate-dominated Mesozoic sequence of the Transdanubian Mountain Range contains layered phosphorite in Triassic (near Pécsely) and nodular phosphorite in Cretaceous (near Tata) strata. Both phosphorite occurrences may have economic importance due to their trace element content. Uranium enrichment has been already proven in the Triassic phosphorite layers, in contrast, the chemical composition of the Cretaceous formation has not been studied, yet.

The LA-ICP-MS study revealed the U-Pb age of the Triassic phosphorite (237 ± 11 Ma) coincides with the stratigraphic age and indicate negligible post-depositional transformations. The main mineral is carbonate-fluorapatite, however calcite and rarely hematite also occur. According to EPMA analyses, the U enrichment in the phosphorite layer is most likely related to the carbonate-fluorapatite, as it contains 0.023-0.3 mass% U, while no other U-bearing minerals were observed. According to the bulk rock ICP-MS and ICP-OES analyses, a total REE+Y content of 116-158 ppm was detected. The NASC normalised spider diagram of the Triassic phosphorite shows minor depletion and negative Ce and Eu anomalies.

The Cretaceous nodular phosphorite occurs at the basis of the Aptian grey, crinoid-bearing limestone. The structure and texture of the Cretaceous phosphorite strongly differ from the Triassic one, indicating principal differences in their formation. A total REE+Y content of 1055 ppm was detected in this phosphorite and enrichment to the NASC with positive Ce and Eu anomalies are also revealed.

Based on the redox-sensitive proxies, such as Th/U, V/Sc and REEs, both phosphorite occurrences formed in anoxic environment.

Modeling of rock physics parameters vs. depth in order to understand different seismic attributes – theoretical and case study

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Theoretical

Rock physics can be defined as a discipline providing the link between elastic properties of the earth (e.g. acoustic velocities and density) and the intrinsic properties of the rocks such as porosity, permeability, pressure etc. There is also a clear link between the seismic signal and the elastic properties. Bringing together all the available seismic and petrophysical data by building a consistent model the reliability of our final conclusions regarding the traditional seismic interpretation, pre-stack seismic interpretation or prospect generation can be optimized.

The presence of appropriate well log data, moreover the presence of satisfying amount of wells is not always the situation. Reliable empirical and theoretical methods have been presented to model the rock properties in function of depth.

(1) The idea behind this study is to build an initial theoretical 1D earth model (pseudo well) for given rock physics parameters (pseudo logs) and transform them to elastic parameters.

(2) These parameters – following the logic of modeling but being non-exhausting – are the porosity, lithology/mineralogy, density, velocities vs. depth and other properties of the reservoir which are the depth, thickness, hydrocarbon and pressure. Logically perturbing all these parameters a rock physics catalogue is set up resulting in a synthetic seismic response catalogue which can help interpret and evaluate the real seismic events.

(3) In this presented work the following tasks are examined and it is worth emphasizing that, however theoretical and empirical equations are used, these models are able to reflect real geology and depth as a parameter is a key factor during the modeling:

- examining the change of seismic response vs. depth in case of a sandy reservoir for different reservoir conditions
- examining the change of AVO anomaly vs. depth for different reservoir conditions
- examining the effect of overpressure on the seismic responses

***Geological risk assessment of an unconventional gas reservoir –
case study of the calcareous marl member of the Endrőd Marl
Formation in the Békés Basin***

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Applied

This study serves the purpose to demonstrate the geological risk of unconventional shale gas reservoirs through the specific example of the calcareous marl member of the Endrőd Marl Formation in the Békés Basin. As of methodological approach in my research I followed the Common Risk Segment (CRS) Mapping industry practice [1].

The following steps were applied to carry out the geological risk assessment:

- 1) seismic interpretation to identify the formation,
- 2) numerical modeling to estimate the resource volume in which I have chosen to take the generated hydrocarbon volume as a basis of my calculations and I took the following into account: a) volume of potentially migrated hydrocarbon, b) the reservoir mechanism of shale gas, including the volume pertaining to the different phases (adsorbed, dissolved in water, free gas),
- 3) Play-Based Exploration (PBE) methodology. I have concluded that the customization of the existing conventional petroleum play components deemed necessary. Therefore, for the unconventional shale gas play the probability components may include a) hydrocarbon generation, b) development of favorable reservoir parameters, and c) in situ occurrence of hydrocarbons. Exploration maturity is taken into consideration as the fourth separate and independent component. I have constructed their individual risk segment maps and I quantified the geological probability pertaining to each segment.

Finally, the specific play component risk segment maps were used to generate the Common Risk Segment Map which demonstrates the geological probability of having suitable petroleum system mechanism for the occurrence of exploitable unconventional shale gas reservoir how spatially varies.

[1] ROYAL DUTCH SHELL, 2014, *Play Based Exploration: A Guide for AAPG's Imperial Barrel Award Participants*.

Breakpoints in environmental time series
- methodological comparison and case studies -
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Environmental time series often contain breakpoints of different origin, i.e. breakpoints, caused by (i) shifts in trend, (ii) other changes in trend and/or, (iii) changes in variance. Literature regarding breakpoint detection methodology is vast yet we here fill an empty space in applied time series analysis, by comparing different breakpoint detection methods and applying them to real-life time series.

Firstly, artificially generated AR(0) and AR(1) time series were analyzed using three recently developed breakpoint detection methods (modified cross-entropy, kink point detection and a change point model framework) where the artificial time series were modified so that the exact ‘place’ of the breakpoints would be known.

Thus, after having tested the sensitivity of the different breakpoint detection methods with the gained excess knowledge, the techniques were utilized on real-life time series taken from the fields of paleoclimate research and petrology. We showed examples on objectively specifying the change-points in historical temperature proxy (phenology) datasets as well as a data correction method used in petrology on mercury injection capillary pressure curves.