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INVITATION

to the **51th** Meeting of Young Geoscientists

10-11 September 2021

Zalakaros, Hunguest Hotel Freya

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, 10th September onwards

Organisers

MAGYAR GEOFIZIKUSOK EGYESÜLETE
1145 Budapest, Columbus utca 17-23.
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MAGYARHONI FÖLDTANI TÁRSULAT
1015 Budapest II., Csalogány utca 12.
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MEGHÍVÓ

az **51.** Ifjú Szakemberek Ankétjára

2021. szeptember 10-11.

Zalakaros, Hunguest Hotel Freya

Tudnivalók:

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

Regisztrálás: 2021. Szeptember 10. 9^{00}-tól folyamatosan

Rendező Bizottság

PROGRAMME

10. 09. 2021. FRIDAY

9^{30}- 9^{40}	OPENING
9^{40}-11^{30}	1^{ST} SESSION
11^{30}-13^{10}	2^{ND} SESSION
13^{10}-13^{20}	POSTER SESSION – SHORT ORAL SUMMARIES
13^{20}-14^{25}	LUNCH
14^{25}-16^{20}	3^{RD} SESSION
16^{20}-18^{00}	4^{TH} SESSION
18^{00}-18^{40}	POSTER SESSION – DISCUSSION
19^{00}	DINNER

11. 09. 2021. SATURDAY

- 10^{00}	CHECK-OUT FROM THE ROOMS *Please leave your room after breakfast, until 10 o'clock. The baggages can be stored in a luggage room.*
8^{30}- 9^{20}	BREAKFAST
9^{30}-11^{25}	5^{ST} SESSION
11^{25}-13^{05}	6^{TH} SESSION
13^{05}-14^{15}	LUNCH
14^{30}	AWARD GIVING AND CLOSING CEREMONY

FRIDAY

9^{30} OPENING

9^{40}-11^{30} 1ST SESSION

9^{40} *Quantitative characterisation of the variability in sedimentary architecture of Gilbert-type deltas*

T **Soma Budai**, Luca Colombera, Nigel P. Mountney, William D. McCaffrey

University of Leeds, Fluvial, Eolian & Shallow-Marine Research Group, School of Earth & Environment, Leeds, United Kingdom

9^{55} *A study on Uzboi Vallis and Nirgal Vallis (Mars)*

T **András Szilágyi-Sándor**, Balázs Székely

Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary

10^{10} *Monte Carlo modelling of a nuclear borehole geophysics method: the carbon-oxygen measurement*

T **József Gábor Szűcs**

Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary

10^{25} *The origin of the Late Neolithic red sandstone ground stone tools from the tell site of Hódmezővásárhely-Gorzsa (Tisza culture)*

T **Dóra Georgina Miklós**[1], Sándor Józsa[1], György Szakmány[1], Katalin Gméling[2], Ferenc Horváth[3], Starnini Elisabetta[4]

[1]Eötvös Loránd University, Department of Petrology and Geochemistry, Budapest, Hungary [2]Hungarian Academy of Sciences, KFKI, Nuclear Analysis and Radiography Department Centre for Energy Research [3]Móra Ferenc Museum, Szeged [4]University of Pisa, Department of Civilizations and Forms of Knowledge, Pisa, Italy

10^{40} *Spectral Decomposition for Thin Reservoir Hydrocarbon Detection - Ngrayong Formation, East Java Basin Study Case*

A **Agra Adipta**[1], Riky Hendrawan[2]

[1]University of Miskolc, Miskolc, Hungary [2]Pertamina Hulu Energy, Indonesia

10^{55} DISCUSSION

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

11^{30}-13^{10} 2ND SESSION

11^{30} *Opening 2nd session*

11^{35} *Soil property, terrain and land-use based soil hydrological model development and GIS modeling supporting decision making and sustainable use of soil resources in Tunisia*

A **Mohamed Rajhi**
University of Miskolc, Miskolc, Hungary

11^{50} *Statistical methods applied for palaeontological samples: a case study on the Pannonian (late Miocene) mollusc fauna of the Transylvanian and Șimleu basins, Romania*

T **Dániel Botka[1,2]**, Bence Szabó[3], István Róbert Bartha[4], Emőke Tóth[1], Imre Magyar[3,5]
[1]Eötvös Loránd University, Department of Palaeontology, Budapest, Hungary [2]Laboratories MOL, MOL Hungarian Oil and Gas Plc., Budapest, Hungary [3]Hungarian Academy of Sciences - Hungarian Natural History Museum - Eötvös Loránd University, Research Group for Paleontology, Budapest, Hungary [4]Eötvös Loránd University, Department of Geology, Budapest, Hungary [5]MOL Hungarian Oil and Gas Plc., Budapest, Hungary

12^{05} *Complex evolution of double coronas from Oldoinyo Lengai ijolite*

T **Noémi Halász[1]**, Tivadar M. Tóth[1], Márta Berkesi[2], Tibor Guzmics[2]
[1]University of Szeged, Szeged, Hungary [2]Eötvös Loránd University, Budapest, Hungary

12^{20} *Structural evolution of the Nekézseny Fault – a displaced segment of the Dinaric-ALCAPA contact zone in NE Hungary (Bükk and Uppony Hills)*

T **Éva Oravecz[1,2]**, Dorina Juhász[1,2], Zsolt Benkó[3], Szilvia Kövér[1,2], Tibor Németh[1], Benjamin Scherman[1,2], László Fodor[1,2]
[1]Eötvös Loránd University, Budapest, Hungary [2]Hungarian Academy of Sciences - Eötvös Loránd University, Geological, Geophysical and Space Science Research Group, Budapest, Hungary, [3]Hungarian Academy of Sciences, Institute for Nuclear Research, Debrecen, Hungary

12^{35} *Modeling of ERT method and ERT method errors to estimate the condition of flood protection embankments*

A **András Virók[1,2]**, Tamás Lukács[2]

[1]Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary [2]Mining and Geological Survey of Hungary, Budapest, Hungary

12^{50} DISCUSSION

13^{10}-13^{20} POSTER SESSION – short oral summaries

13^{10} *Opening Poster session*

13^{12} *Analysing the effect of small, local earthquakes on GNSS kinematic coordinates aided seismic and tiltmeter time-series*

P **Csilla Szárnya**, István Bozsó, Eszter Szűcs, Viktor Wesztergom

Eötvös Loránd Research Network, Institute of Earth Physics and Space Science, Budapest, Hungary

13^{16} *How many types of volcanic rocks and phases are there? New results of the Permian felsic volcanism in the eastern Pannonian Basin (Békés–Codru Unit)*

P **Máté Szemerédi[1,2]**, Andrea Varga[2], Réka Lukács[1,2], István Dunkl[3], János Szepesi[1,4], Elemér Pál-Molnár[1,2]

[1]Hungarian Academy of Sciences - Eötvös Loránd University, Volcanology Research Group, Budapest, Hungary [2]University of Szeged, Department of Mineralogy, Geochemistry and Petrology, 'Vulcano' Petrology and Geochemistry Research Group, Szeged, Hungary [3]University of Göttingen Geoscience Center, Department of Sedimentology & Environmental Geology, Göttingen, Germany [4]Hungarian Academy of Sciences, Isotope Climatology and Environmental Research Centre, Institute of Nuclear Research, Debrecen, Hungary

13^{20}-14^{25} LUNCH BREAK

14^{25}-16^{20} 3RD SESSION

14^{25} *Opening 3rd session*

14^{30} *The 154 ka Kis-Haram lava dome, Ciomadul volcano: an erupted crystal mush*

T **Emese Pánczél[1]**, Maurizio Petrelli[2], Réka Lukács[3], Szabolcs Harangi[1,3]

[1]Eötvös Loránd University, Department of Petrology and Geochemistry, Institute of Geography and Earth Sciences, Budapest, Hungary [2]Università degli Studi di Perugia, Department of Physics and Geology, Perugia, Italy [3]Hungarian Academy of Sciences - Eötvös Loránd University, Volcanology Research Group, Budapest, Hungary

14[45] *Regoinal-scale hydrogeological and local-scale geochemical investigation of natural radioactivity of groundwater-derived drinking water*

A **Petra Baják[1]**, Katalin Csondor[1], Daniele Pedretti[2], Muhammad Muniruzzaman[3], Bálint Izsák[4], Márta Vargha[4], Ákos Horváth[5], Tamás Pándics[4], Anita Erőss[1]

[1]Eötvös Loránd University, Department of Geology, Budapest, Hungary [2]University of Milan, Department of Earth Sciences "Ardito Desio", Milan, Italy [3]Geological Survey of Finland, Water Management Solutions, Espoo, Finland [4]National Public Health Center, Budapest, Hungary [5]Eötvös Loránd University, Department of Atomic Physics, Budapest, Hungary

15[00] *The position and relationship of the basement units below the Danube Basin based on seismic interpretation*

T **Kitti Váradi**

Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary

15[15] *Pannonian (late Miocene) mollusc fauna of the Şimleu Basin (Romania)*

T **Dániel Botka[1]**, Bence Szabó[2], István Róbert Bartha[3], Imre Magyar[2,4]

[1]Eötvös Loránd University, Department of Palaeontology, Budapest Hungary [2]Hungarian Academy of Sciences - Hungarian Natural History Museum - Eötvös Loránd University, Research Group for Paleontology, Budapest, Hungary [3]Eötvös Loránd University, Department of Geology, Budapest, Hungary [4]MOL Plc., Budapest, Hungary

15[30] *Borehole Geophysical Inversion Using Levenberg-Marquardt and Singular Value Decomposition Schemes for Petrophysical Parameters Estimation*

A **Moataz Mohamed Gomaa Abdelrahman**

University of Miskolc, Institute of Geophysics and Geoinformatics, Miskolc, Hungary.

15^{45} DISCUSSION

16^{05}-16^{20} BREAK

16^{20}-18^{00} 4TH SESSION

16^{20} *Opening 4th session*

16^{25} *Structural evolution and petrography of um nar area, Eastern Desert, Egypt*

T **Mohamed Abdelhadi Badawi**
University of Miskolc, Institute of Mineralogy and Geology, Miskolc, Hungary.

16^{40} *Forced or normal regression signals in a lacustrine basin? Insights from 3D stratigraphic forward modelling*

T **Ádám Kovács**[1], Attila Balázs[2], Orsolya Sztanó[1], Marko Spelić[3]
[1]Eötvös Loránd University, Department of Geology, Budapest Hungary [2]ETH Zurich, Department of Earth Sciences, Zurich, Switzerland [3]Croatian Geological Survey, Zagreb, Croatia

16^{55} *Approach to understand and avoid injection related problems in geothermal systems*

T **Markó Ábel**[1], Judit Mádl-Szőnyi[2], Maren Brehme[3]
[1]Eötvös Loránd University, Department of Geology Budapest, Hungary [2]Eötvös Loránd University, Department of Geology, Budapest, Hungary [3]Delft University of Technology, Department of Geoscience and Engineering, Delft, The Netherlands

17^{10} *Two-phased folding in the Nagyvisnyó area, NW Bükk Mts.*

T **Dorina Juhász**, Éva Oravecz, László Fodor
Eötvös Loránd University, Department of Geology Budapest, Hungary

17^{25} *Thermogravimetry and Raman spectroscopy analysis of graphite from Szendrőlád (Szendrő Mts., NE-Hungary)*

T **Lívia Leskóné Majoros**[1], Krisztián Fintor[2], Tamás Koós[3], Sándor Szakáll[1], Ferenc Kristály[1]
[1]University of Miskolc, Institute of Mineralogy and Geology, Miskolc, Hungary [2]University of Szeged, Department of Mineralogy, Geochemistry and Petrology, Szeged, Hungary [3]University of Miskolc, Institute of Energy and Quality, Miskolc, Hungary

17^{40} DISCUSSION

18^{00}-18^{40} POSTER SESSION – discussion

19^{00} DINNER

SATURDAY

CHECK-OUT FROM THE ROOMS

PLEASE LEAVE YOUR ROOM AFTER BREAKFAST, UNTIL 10 O'CLOCK.

9^{30}-11^{25} 5^{TH} SESSION

9^{30} *Opening 5th session*

9^{35} *The environmental history of a Transylvanian sphagnum peat bog at the end of the Quaternary: Anthropogenic effects and global aridification events*

T **Tamás Zsolt Vári**, Pál Sümegi, Tünde Törőcsik, Balázs Pál Sümegi

University of Szeged, Department of Geology and Paleontology, Szeged, Hungary

9^{50} *Characterization of global lightning activity via the inversion of Schumann resonance measurements*

T **Tamás Bozóki[1,2]**, Ernő Prácser[1], Gabriella Sátori[1], József Bór[1], Péter Steinbach[3,4]

[1]Eötvös Loránd Research Network, Institute of Earth Physics and Space Science, Sopron, Hungary [2]University of Szeged, Doctoral School of Environmental Sciences, Szeged, Hungary [3]Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary [4]Eötvös Loránd Research Network – Eötvös Loránd Universty, Research Group for Geology, Geophysics and Space Science, Budapest, Hungary

10^{05} *Unconventional Hydrocarbon research in the Battonya region*

A **Máté Barnabás Borsányi**

Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary

10^{20} *An assessment of mass movements of steep slopes on the Danube Bend based on UAV and other imagery*

T **Gábor Rozman**[1], Ekaterina Bitiukova[2], Balázs Székely[3]

[1]Hungarian State Railways co. Ltd, Budapest, Hungary [2]Eötvös Loránd University, Centre of Environmental Science, Budapest, Hungary [3]Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary

10^{35} *Peralkaline rhyolite formation at Oldoinyo Lengai: a case study*

T **Emanuel Andrade Albuquerque Mororó**, Márta Berkesi, Tibor Guzmics

Eötvös Loránd University, Lithosphere Fluid Research Lab, Budapest, Hungary

10^{50} DISCUSSION

11^{10}-11^{25} BREAK

11^{25}-13^{05} 6TH SESSION

11^{25} *Opening 6th session*

11^{30} *Transition from platform to basin: mapping observations at the surroundings of the Krvavica mountain*

T **Benjámin Scherman**[1,2], László Fodor[2], Szilvia Kövér[1,2] Boštjan Rožič[3], Ágnes Görög[4,5]

[1]Eötvös Loránd University, Department of Physical and Applied Geology, Budapest, Hungary [2]Hungarian Academy of Sciences - Eötvös Loránd University, Geological, Geophysical and Space Science Research Group, Budapest, Hungary [3]University of Ljubljana, Faculty of Natural Scineces and Engineering, Department of Geology, Ljubljana, Slovenia [4]Eötvös Loránd University, Department of Paleontology, Budapest, Hungary [5]Hungarian Academy of Sciences - Eötvös Loránd University, Geological, Geophysical and Space Science Research Group, Budapest, Hungary

11^{45} *Investigation of hydraulically conductive faults using equivalent porous medium (EPM) approach*

T **Bence Egey**

Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary

12^{00} *Results of new geochemistrical and geochronological investigations of the Triassic metavolcanics of the Bükk Mountains*

T **Péter Gál**[1], Norbert Németh[2], Réka Lukács[3], Sándor Józsa[1], István Dunkl[4], Szilvia Kövér[5], Szabolcs Harangi[1,3]

[1]Eötvös Loránd University, Department of Petrology and Geochemistry, Budapest, Hungary [2]University of Miskolc, Institute of Mineralogy and Geology, Miskolc, Hungary [3]Hungarian Academy of Sciences - Eötvös Loránd University, Volcanology Research Group, Budapest, Hungary [4]University of Göttingen, Department of Sedimentology & Environmental Geology, Göttingen, Germany [5]Eötvös Loránd University, Department of Physical and Applied Geology, Budapest, Hungary

12^{15} *Estimation possibilities of lithosphere-asthenosphere boundary depth using magnetotelluric data in the Pannonian Basin*

T **Tibor Rubóczki**[1,2,3]

[1]Eötvös Loránd Research Network Institute of Earth Physics and Space Science, Sopron, Hungary [2]Eötvös Loránd University, Department of Geophysics and Space Science, Faculty of Science, Budapest, Hungary [3]Hungarian Academy of Sciences, EK Lendület Pannon LitH2Oscope Research Group

12^{30} *Numerical modeling of soil contaminant transport using the finite element method*

T **Márk Szijártó**[1,2]

[1]Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary [2]ELGOSCAR-2000 Environmental Technologies and Water Management Ltd, Budapest, Hungary

12^{45} DISCUSSION

13^{05}-14^{15} LUNCH BREAK

14^{30} AWARD GIVING AND CLOSING CEREMONY

ABSTRACTS

1ST SESSION

Quantitative characterisation of the variability in sedimentary architecture of Gilbert-type deltas

Soma Budai, Luca Colombera, Nigel P. Mountney, William D. McCaffrey
University of Leeds, Fluvial, Eolian & Shallow-Marine Research Group, School of Earth & Environment, Leeds, United Kingdom
Theoretical

Gilbert-type deltas are steep faced deltas characterised by distinct tripartite internal architecture (topset, foreset, bottomset). They are common in a variety of tectonically active settings, including extensional, compressional, and transtensional basins, as well as in physiographic settings where accommodation is not primarily created by tectonics, such as incised valleys, fjords, and proglacial lakes. Such deltas form important nodes in sediment-delivery pathways linking continental hinterlands to subaqueous lacustrine and marine depocentres.

The aim of this study is to provide new quantitative facies models for Gilbert-type deltas based on the integration of sedimentological data from many known examples. Specific objectives are: (i) to characterise quantitatively the variability of the architecture and facies of such deltas at multiple scales of observation; and (ii) to relate the observed differences to the possible controls exerted by allogenic and autogenic factors.

This is achieved by using a database-driven approach to synthesize sedimentological data derived from 18 literature sources on 61 Gilbert-type deltas of different ages and from different basinal settings. Qualitative and quantitative data on these sedimentary units (facies, architectural elements, basinal properties) were stored in a relational database (SMAKS).

The analysed data revealed high variability in the geometry and facies of Gilbert-type deltas. The thickness of the examined deltas ranges from 2 up to 150 metres with up to 70% difference between the thickest and thinnest deltas within one depositional system. Given their facies variability the deltas were classified into gravel and sand-dominated types, based on differences in the gravel fraction of distinct elements, even though, notably, topsets of sand-dominated deltas are still predominantly gravelly in nature. These two groups are characterised by different relations when comparing the fraction of gravelly facies of subsequent elements or facies properties vs. element dimensions. For example, contrasting relationships were observed between foreset thickness and gravel fraction of gravel (inverse relation) and sand-dominated deltas (direct relation).

Facies properties of distinct elements, such as the gravel fraction, the relative proportion of sediment linked to debris flows vs turbidity currents, and vertical lithological trends (e.g. coarsening- vs fining-upward profile) can vary significantly in space within short distances (50-75 m). These may indicate variations in allogenic (e.g. climate, base level changes etc.) and autogenic (e.g. avulsion processes) factors controlling sediment influx and dispersal, and in the predominance of different depositional processes trough delta progradation.

A study on Uzboi Vallis and Nirgal Vallis (Mars)

András Szilágyi-Sándor, Balázs Székely
Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary
Theoretical

The fluid-modified surfaces of Mars provide evidence of the surface processes of the celestial body's past. Throughout the history of Mars, the climate has enabled the presence of liquid water several times (perhaps periodically). Watercourses and mega-river systems have ruled the surface; their tracks are still recognizable in many places. Valleys have been able to form several processes. Outcomes of several types of surface development are more or less preserved. Sensing these, we can deduce the processes that took place. A large

proportion of the valleys were formed by surface or groundwater seepage. But there are some that were not.

The Argyre Crater (which was once a Mediterranean-Sea-sized lake) served as the source of such a huge river system: the Uzboi–Ladon–Morava River System (ULM), during the late Noachian. ULM is therefore fundamentally different from most of the valleys and channels of Mars as it is not an amphitheatre-headed valley and its source is connected to a large crater.

In this study sections of ULM were studied using data from different probes. HiRISE (30 cm or 1 ft/px) photos and HiRISE-stereopair-based DEMs were used together with Mars Odyssey THEMIS-IR Day Global Mosaic v12 (100 m) and the Mars Global Surveyor's Mars Orbiter Laser Altimeter (MOLA) data. A comparison is presented of Uzboi Vallis and its tributary, Nirgal Vallis. In addition to creating traditional elevation profiles, we used the swath profile analysis method. The swath analysis is fundamentally different from elevation profiles that enhance the specific Martian conditions (impact cratering, complete absence of the –at least spectacularly influential– biosphere, less gravity). In addition to the swath analysis completely covering the two studied areas, several regions of the catchment were specifically analyzed. According to the data obtained, the Uzboi Vallis is at least partly a half-graben of tectonic origin. Based on these observations, in the northeastern part, half-graben structures are hypothesized.

The method of swath profile analysis, previously not applied to Martian data, proved to be useful and provided interpretable data for the surface of a planet other than Earth both in the large scale MOLA and in the very detailed HiRISE-based DEMs.

To prove the style and extent of the tectonic deformation HiRISE photos' higher resolution and their more accurate topographic model were used for the in-depth understanding of this mega river system.

Monte Carlo modelling of a nuclear borehole geophysics method: the carbon-oxygen measurement

József Gábor Szűcs
Eötvös Loránd University, Department of Geophysics and Space Science, Budapest, Hungary
Theoretical

Carbon-oxygen (C/O) logging is a relatively new nuclear borehole geophysics method, used for the determination of hydrocarbon saturation. I carried out the Monte Carlo modelling of the said measurement in MCNP environment.

Unlike other methods (e.g. electrical resistivity logging) C/O logging can be used in oil filled and/or closed boreholes, and it is also independent of water salinity. The physical phenomenon behind the measurement is a time-dependent, coupled, neutron-photon transport process. The tool detects the gamma photons emitted by atoms, which are excited by colliding (inelasticly scattering) high energy neutrons from a 14 MeV, pulsed, neutron source (neutron generator). These photons have a characteristic energy corresponding to the excited atoms which emits them. This is why the gamma detection happens energy sensitively, using 2 or 3 scintillation detectors. Part of the measured photon energy spectrum (which falls into the inelastic scattering time window) is used for acquiring a carbon-oxygen ratio, which can be utilized to estimate oil saturation, or even oil hold up in the borehole, with appropriate interpretation charts.

I chose the MCNP(4c) code as my tool for this study, which models particle trajectories using the Markov Chain Monte-Carlo method, i.e. by randomly sampling probability distributions, generated using data libraries containing full and differential reaction cross sections. By summing these particle trajectories, the model result converges stochastically to a consistent result.

In my work, I investigate the effects of the following factors on the C/O ratio: detector placement, carbonates (carbon in rock matrix), borehole fluid, formation fluid, and the shielding effect of the borehole casing.

The origin of the Late Neolithic red sandstone ground stone tools from the tell site of Hódmezővásárhely-Gorzsa (Tisza culture)

Dóra Georgina Miklós[1], Sándor Józsa[1], György Szakmány[1], Katalin Gméling[2], Ferenc Horváth[3], Starnini Elisabetta[4]

[1]Eötvös Loránd University, Department of Petrology and Geochemistry, Budapest, Hungary [2]Hungarian Academy of Sciences, KFKI, Nuclear Analysis and Radiography Department Centre for Energy Research [3]Móra Ferenc Museum, Szeged, Hungary [4]University of Pisa, Department of Civilizations and Forms of Knowledge, Pisa, Italy

Theoretical

Sandstones has been used for ground stone tools (e.g. grinding stones, mill stones) or making of molds frequently throughout human history, but so far, their archeometric processing has not been completed. In the Carpathian-Pannonian Region sandstone is a very widespread rock type and it's got a very diverse composition. The stone tools represent significant volume and generally have little exhibition value; therefore, it is possible to apply destructive analyses. The aim of this work is to present ground stone tools made of red sandstones and their possible raw materials as well using petrologic, geochemical and micromineralogical investigations.

The settlement of Hódmezővásárhely-Gorzsa is situated 25 km northeast of Szeged. Active excavations were made between 1978 and 1996 in this area by Ferenc Horváth. 1061 archeological finds were listed quarter of which were polished stone tools, three quarters were ground stone tools. On the base of preliminary classification six different types were described (e.g. red, grey, white meta, etc.) (Szakmány et al. 2010). Recently we distinguished three red sandstone types on the base of petrographic features, of which two (red-1 and red-2 types) were known from earlier publications (Szakmány et al. 2008, 2010, Piros 2010). With the help of our detailed examinations, a new red sandstone type was determined (red-3).

Type red-1 is purple − gray-purple, poorly sorted, large-coarse grained sandstone. It contains large quantities of quartz and volcanic rock fragments. They also contain generally lesser amounts (5-15%) of feldspar. Samples with >15% feldspar we distinguished as subtype. The *type red-2* is a red – pale red, well sorted, fine-medium grained sandstone. It contains quartz, few (3-5%) feldspar, quartzite and

metasedimentary rock fragments. The newly described *type red-3* is a purple, well sorted, ripe sandstone with a fine-medium to large-coarse graine size. It contains mostly quartz, feldspar (10-15%), lesser amount of quartzite and volcanic rock fragments.

According to the previously works (e.g. Piros 2010) the raw material of the tools of type red-1 is similar to the rocks of Triassic Jakabhegy Sandstone Formation (Mecsek Mts.). While that of the type red-2 could derived both from the Papuk Mts. (Permotriassic series), from the Miocene siliciclastic series from Western Mecsek Mts. (Szászvár Formation), from the Pleistocene terraces of the Danube (Pestvidék Pebble Formation), from the Krassó-Szörény Mountains and also from the western part of the Gyalui Mountains.

During our work we focused on the type red-3. We analysed red sandstones as possible raw materials from four different fromations: 1) the pebbles from the recent debris of Maros-valley, 2) the pebbles from Miocene siliciclastic sediments in Western Mecsek Mts. (Szászvár Formation), 3) the pebbles from Pleistocene terraces of the Danube in Dunavarsány and 4) the rocks of Permotriassic series from the Papuk Mountain. The petrological and the chemical (neutronactivation analyses, NAA) data possible support the Maros origin of the type red-3.

In the future our study will be completed with heavy mineral analyses (HMA), these minerals are very sensitive to the environment that's why they are very useful for identification the provenance and the potential source rocks. HMA allows for us to distinguish the different types of raw materials, for example we can specify the red-I, red-II and red-III sandstone pebbles within the Miocene conglomerate series (Szászvár Formation).

PIROS L. 2010: Homokkő nyersanyagú kőeszközök, szerszámkövek archeometriai vizsgálata Gorzsa (DK–Magyarország). — Diplomamunka, Eötvös Loránd Tudományegyetem, Kőzettan-Geokémiai Tanszék, 89 p.

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Spectral Decomposition for Thin Reservoir Hydrocarbon Detection - Ngrayong Formation, East Java Basin Study Case

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Applied

The appearance of direct hydrocarbon indicator (DHI) enables to highlight potential hydrocarbon prone areas, yet overoptimistic interpretation might lead to certain drawbacks due to seismic signal ambiguity. Spectral decomposition is a robust technique to emphasize certain potential areas and resolve the seismic interpretation pitfalls. The area of study was constrained by the wireline-logging findings and well-test data to describe the effective thickness of productive reservoir zones to justify the actual presence of hydrocarbons. Amplitude spectra analysis yielded low-frequency amplitude anomalies are associated with the presence of hydrocarbon (15 – 30 Hz). The frequency spectra analysis is targeted to the prior identified hydrocarbon-prone frequencies resulting a distinctive direct hydrocarbon indicator ranging between 18.3 – 37.0 Hz. This technique was applied to "Tiong" area, Ngrayong Formation, East Java basin, and has been deemed as an effective method to identify the hydrocarbon distribution and give a greater understanding of seismic signal features in a relatively thin bed reservoir.

2ND SESSION

Soil property, terrain and land-use based soil hydrological model development and GIS modeling supporting decision making and sustainable use of soil resources in Tunisia

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Applied

Today, the world faces many challenges, such as food security, scarcity of water resources, climate change, degradation and contamination of soils by salts. The social-economic reality of farmers

in the study areas is very critical, because agriculture is the only means of survival, also the soil degradation and the uncontrollable variation in soil moisture threatens the lives of the inhabitants of these regions and the disruption of the demographic, economic and environmental ecosystem. There is a crucial need for an in-depth study of the characteristics of the soil and of the variation in soil moisture in order to set up a monitoring system to aid in decision-making.

The aim of the study is to support decision making and local regulations to optimize the land use structure by providing accurate soil moisture data and soil moisture regime estimations over the area using scientific information and innovative methods.

The study area is located in Northern part of Tunisia, in the Kariouan region, where the dominating land use is small scale farming. In the first part of the study we will collect the available spatial databases for the physical geographical description of the study area, including terrain, geology, soil and land use. Based on the available datasets, a theoretical model of the soil horizonation and their hydraulic properties will be developed and incorporated into a terrain driven soil redistribution model over the landscape. Different digital terrain modeling tools and indices will be applied together with Sentinel-1 and Sentinel-2 data top build remote sensing based estimation procedures, which can be used to describe the current moisture content and estimate the trends. Different hydrological models describing the soil dependent infiltration rates and the water retaining capacities of the different horizon will be combined to develop a model to calculate the plant available moisture content and pair the results with the actual land uses to forecast the temporal changes trends. Locally deployed multi-depth, low cost soil moisture sensor sets will be applied to calibrate the estimation approaches and develop microwave satellite remote sensing data based (Sentinel-1) methodology to refine, update the models and provide reliable data for decision making. This work will require strong image processing toolsets to prepare the input variables and develop statistical, geostatistical methods for the quantitative estimations and machine learning tools for classifying the different soil hydrological systems. The SARScape toolset of the ENVI software will be applied to process and classify the image and these images will be used for the

regression - kriging procedure to estimate the soil moisture content of the different layers.

The results of this study is to develop a soil hydrological model that is capable of describing the horizontal and vertical availability and redistribution of soil moisture in time and adjust the land use variability and the type and intensity of different land uses to the moisture regime of the soils.

Statistical methods applied for palaeontological samples: a case study on the Pannonian (late Miocene) mollusc fauna of the Transylvanian and Şimleu basins, Romania

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Theoretical

More than 900 mollusc species were described from the late Miocene sediments of Lake Pannon providing one of the most diverse lacustrine faunas of Earth's history. During the last 150 years, a large amount of data was accumulated on the occurrence and distribution of these species [1]. A comprehensive revision and statistical evaluation of the Pannonian mollusc fauna, however, has not been attempted.

This gap can be filled by the application of statistical methods, which are elegant tools for analysing palaeontological data [2]. In this study, revised Pannonian mollusc fauna of the Transylvanian and Şimleu basins, with 84 species collected from 44 localities, were analysed by sample-based rarefaction, non-metric multidimensional scaling, cluster, and network analytical methods to demonstrate how these tools can be used for refining and displaying palaeoenvironmental and biostratigraphic data.

Our first preliminary results indicate that faunas of different biozones and environmental conditions could be distinguished and

show how species network builds up. This work can be upgraded with data of other fossil groups or from other sub-basins. The aim of future studies is to create a modern numeric summary on the unique Lake Pannon fauna.

This study was funded by the Hungarian National Research, Development and Innovation Office NKFIH 116618 project and ÚNKP-19-3 New National Excellence Program of the Ministry of Human Capacities.

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Complex evolution of double coronas from Oldoinyo Lengai ijolite

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Theoretical

Oldoinyo Lengai (OL) lies in the Tanzanian volcanic province, where the lithosphere is highly heterogeneous structurally and lithologically [1] [2]. Such circumstances cause the presence of extremely complex rocks with complex evolution. The most common plutonic rocks in OL are ijolites, which occur as xenolith in pyroclastic rocks in this study [1] [3] [4] [5] [6].

In general, OL ijolites in many cases contain special double corona features [1] [4] [7] [8] (DCs) and were studied in detail in our xenolith sample, as well. The DCs are built by an olivine grain as a core and are surrounded by an inner clinopyroxene- and an outer mica-corona. The olivine is up to 2 mm large xenocryst with corroded rim, characterized by homogenous major element composition (mg#=79–83). The surrounding clinopyroxene-corona has different zones, causing chemical diversity varying from diopside (light green, mg#=85–88) to aegirine-augite (dark green, mg#=59–62). The mica-corona (mg#=79–83) consisting of phlogopites. Additionally, the DCs

(both coronas) contain melt inclusions and mineral inclusions of magnetite, perovskite, and symplectic textured opaque grains consist of ilmenite, pure diopside, titanite, and zirconolite.

Widely accepted model for clinopyroxene corona formation is a reaction between the olivine xenocryst and the ijolitic melt [1] [4] [7] [8], as olivine cannot be in equilibrium with evolved Si-enriched melts and forms diopside at the reaction front. However, in the studied sample the composition of corona and matrix clinopyroxenes is identical and have similar zoning patterns, reflecting compositional changes of the melt during clinopyroxene crystallization. In contrast to the popular model, we suggest that clinopyroxene used olivine as a nucleus during crystallization [9] and, is not a product of olivine-melt reaction. The presence of melt inclusions supports this idea. The outer mica-corona is usually explained by metasomatic overprint (fenitization) [1] [4] [7] [8]. In our samples, the composition of corona- and matrix-phlogopite shows strikingly similar composition. Moreover, they both contain primary melt inclusions, suggesting that the corona mica has been crystallized from a mafic silicate melt. We suggest that the olivine-clinopyroxene core surrounded by mica flakes can be a product of crystal accumulation. Phlogopite, nepheline, and clinopyroxene in the ijolite matrix are oriented in the same direction, indicating a magma moving during crystallization, i.e., olivine and clinopyroxene grains could roll and collect mica crystal fragments around.

We have found evidence for solid-state reactions in the DCs. During the corona crystallization, titanite of the matrix and olivine reacted to form diopside and ilmenite as follows:

$FeMgSiO_4$ (olivine) + $CaTiOSiO_5$ (titanite) = $FeTiO_3$ (ilmenite) + $CaMgSi_2O_6$ (diopside) (+zirconolite). Minor zirconolite is considered to be formed by using Zr-content of the titanite.

We state that in contrast to the traditionally accepted hypothesis, the DCs of the OL ijolite could not form only due to crystal-melt reactions. We rather propose that nucleation, crystal accumulation, and subsolidus reactions were the governing processes.

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Structural evolution of the Nekézseny Fault – a displaced segment of the Dinaric-ALCAPA contact zone in NE Hungary (Bükk and Uppony Hills)

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Theoretical

The Bükk and Uppony Hills (NE Hungary) are two adjacent structural units with correlations to the Northern Dinarides and Inner Western Carpathians (ALCAPA), respectively. These two units are separated by the Nekézseny Fault, which may therefore be considered as a presently displaced segment of the Dinaric-ALCAPA contact zone [1]. Along this contact zone, the Bükk-type Permo-Mesozoic formations are thrust over the Paleozoic and Senonian formations of the Uppony Unit [2]. Despite of the Nekézseny Fault being a terrain boundary, its structural evolution has not been studied in details. Preliminary structural data suggested multiple faulting events between the latest Senonian and early Miocene [3], however, the initial age of the contact zone has remained uncertain.

In this study a detailed structural analysis was carried out in order to understand the deformation geometry, kinematics and the timing of movements along the Nekézseny Fault. Our preliminary results show that the Nekézseny Fault developed in response to NW-SE shortening. Low-angle fractures within individual pebbles suggest an early (latest Cretaceous or early Paleogene) age for the NW-SE shortening, as pebble fracturing is limited to the early stage of diagenesis and requires soft or semi-consolidated fine-grained matrix. K/Ar dating of fault gauge samples, collected directly from the Nekézseny Shear Zone also confirmed tectonic activity during the latest Cretaceous (~70 Ma).

The top-to-the-NW emplacement of the Bükk over the Uppony Unit was accompanied by the folding of the Senonian conglomerate in the footwall, where a large, almost isoclinal recumbent fold developed due to the estimated several km of displacement along the main contact zone. Despite of the similarity in the shortening directions, the top-to-the-NW shortening certainly post-dates the penetrative S-SE-vergent contractional structures present throughout the Bükk Hills, that are related to the latest Jurassic to Early Cretaceous nappe stacking and subsequent shortening [4]. Microtectonic analysis of the Nekézseny Fault Zone proved that the main contact zone is a strongly distorted cataclastite zone, which suggests a late-stage low-temperature deformation. Similarly younger semi-ductile or low-temperature contractional structures (e.g. kink folds) were recognized in several parts of the Bükk Unit, all of which were dated tentatively to the late Cretaceous [5,6,7]. Our observations indicate that the top-to-the-NW displacement was much more extensive than previously thought and incorporated large part of the Bükk Unit. This shows that the top-to-the-NW displacement represents an important deformation phase, which should be integrated into the Mesozoic structural evolution of the Alpine-Dinaric area.

This study was supported by the research funds NKFIH OTKA 113013 and 134873, the ÚNKP-17-2 and ÚNKP-20-3 New National Excellence Program of the Ministry of Human Capacities.

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Modeling of ERT method and ERT method errors to estimate the condition of flood protection embankments

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Applied

The safe drainage of floods is provided with flood protection embankments in Hungary, most of were built in the 19th and 20th centuries. Due to changes in nature, many of the available data are no longer up to date and do not provide enough information for various interventions. There is a need to continue the reviewing the condition of the embankments to find out which section requires more precaution or technical intervention.

The study of flood defense embankments has become more efficient with the development of technical tools based on geophysical methods. Their advantage is that we can collect information about the geological parameters of the subsoil without destruction with surface measurements.

The topic of my dissertation is the investigation of the right-hand embankment of Kettős-Körös based on the distribution of specific electrical resistance values from multielectrode measurements. During my instrumental measurements, I used the electrical resistivity tomography. I surveyed the topographic conditions with RTK GPS to produce a topographic model where the geophysical results are also

can be shown. The geophysical results were analyzed using modeling software. The modeling was able to find out the errors of the instrumental measurements, the inversion errors and the errors due to the geological situation, thus getting closer to the formation of the image of the real geological situation.

Supported by the ÚNKP-20-1 New National Excellence Program of the Ministry for Innovation and Technology from the source of the National Research, Development and Innovation Fund.

POSTER SESSION

Analysing the effect of small, local earthquakes on GNSS kinematic coordinates aided seismic and tiltmeter time-series

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Poster

The processing of the GNSS (*Global Navigation Satellite System*) datasets can be useful in solving various forms of geophysical and space geodetic problems. Due to its high temporal and adaptable spatial resolution, along with its high precision, GNSS data is still often used as a standalone measurement or as an accompanying method. Its many eligible applications include the estimation of tropospheric parameters, or monitoring and measuring deformations and movements in the Earth's crust.

The Bernese *GNSS Software* is a high performance, high accuracy, and highly flexible GPS (and GLONASS) processing software package, considered to be the most precise software for processing GNSS data. The *Bernese GNSS Software* version 5.2 allows the estimation of the so-called kinematic coordinates. Kinematic positioning is a satellite navigation technique used to enhance the precision of position data derived from GNSS. The kinematic coordinates are the epoch wise coordinates of the receiver,

obtained by determining the coordinate-differences between the moving satellite and the reference receiver station. In the GNSS analysis, kinematic positions are the parameters with the lowest redundancy. From about six to ten observations at a given epoch, three coordinate parameters are estimated in addition to the parameters valid for several epochs (e.g. ambiguity or troposphere parameters).

Crustal deformations, earthquakes, etc. are often found as discontinuities or outliers in the time series of processed GNSS data. In kinematic coordinates, strong or local earthquakes can cause a seemingly few 10 mm displacement during epochs affected by the direct seismic waves.

In the spring of 2021 two weak earthquakes occurred near Wiener-Neustadt (Bécsújhely). The first one on March 30th 2021, at 18:25 local time and its estimated magnitude was about 4,2. The second one occurred on April 20th, 2021 at 0:57 local time with magnitude of 4,3.

In the analysis of these earthquake events beyond GNSS kinematic coordinates the following datasets were also taken into consideration: displacements estimated from InSAR processing of Sentinel-1 Synthetic Aperture images, data from the local permanent seismic stations, and the tiltmeter time-series recorded at the Conrad Observatory.

How many types of volcanic rocks and phases are there? New results of the Permian felsic volcanism in the eastern Pannonian Basin (Békés–Codru Unit

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Poster

Permian felsic volcanic rocks were drilled by petroleum exploration wells in SE Hungary (eastern Pannonian Basin, Tisza Mega-unit, Békés–Codru Unit) during the second half of the twentieth century. They were considered to be dominantly lavas (the so-called ‘Battonya quartz-porphyry’) and were genetically connected to the underlying ‘Battonya granite’ [1, 2, 3]. New petrographic observations, however, pointed out that the presumed lavas are relatively crystal-poor (8–20 vol%) rhyolitic ignimbrites near Battonya and resedimented pyroclastic or volcanogenic sedimentary rocks in the Tótkomlós and Biharugra areas, respectively. The studied ignimbrites are usually massive, matrix-supported, altered fiamme-bearing lapilli tuffs with eutaxitic texture as a result of welding processes. Some samples lack vitroclastic matrix and show low crystal breakage, but consist of oriented, devitrified fiammes, too. Textural features suggest that the latter are high-grade rheomorphic ignimbrites.

Zircon U–Pb geochronology of these rocks revealed two or three distinct volcanic episodes in SE Hungary. (i) Spherulitic, vitrophyric lava-like ash tuff in the Tótkomlós-I borehole might be the oldest volcanic product in the eastern Pannonian Basin (268 Ma). Similar zircon U–Pb ages were obtained from felsic volcanites in southern Transdanubia and the Apuseni Mts (Tisza Mega-unit, Romania). (ii) Eutaxitic, welded ignimbrites and rheoignimbrites of the Battonya area are the products of a Guadalupian (266–264 Ma) volcanism, while (iii) volcanoclastic rocks e.g., in the Tótkomlós-K-3 borehole are somewhat younger (260–259 Ma).

At local to subregional scale, felsic volcanic rocks in SE Hungary belong to the Permian volcanic system of the Tisza Mega-unit (including similar rocks in southern Transdanubia and the Apuseni Mts); however, they are relatively crystal-poor (8–20 vol%) rhyolitic ignimbrites, in contrast to the dominantly crystal-rich (40–45 vol%) rhyodacitic-dacitic pyroclastites of the Tisza Mega-unit. Additionally, some geochemical and geochronological differences between them were also observed [4]. Therefore, the studied rocks might represent the most evolved, rhyolitic melt of a large-volume felsic volcanic system.

Based on this study, the following delusions [2, 3] were uncovered in the regional geology of SE Hungary: Permian felsic volcanic rocks in the eastern Pannonian Basin are pyroclastic rocks or volcanic

sediments, while lavas are present in very subordinate amount or do not occur at all. Additionally, the studied samples do not show any evident correlations with neither the Permian felsic ignimbrites in the Finiş Nappe (Apuseni Mts), as it was supposed so far [5], nor the similar rocks in any nappe of the Codru Nappe System. Moreover, no relevant plutonic-volcanic connection was found between the studied samples and the underlying 'Battonya granite' as the latter proved to be an older (Mississippian, ~ 356 Ma) igneous body. Permian volcanic rocks in the study area do not represent a single event (as a regional marker horizon) but can belong to at least two or three distinct volcanic phases.

The research was supported by the National Research, Development and Innovation Fund project K 131690.

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3RD SESSION

The 154 ka Kis-Haram lava dome, Ciomadul volcano: an erupted crystal mush

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Theoretical

Long-dormant volcanoes (quiescence time is several 100's to 10's thousand years between eruptions) pose a particular hazard, since the long repose time decreases the awareness and there is mostly a lack of monitoring. The Haramul Mic, a ~0.15 km3 volume, crystal-rich, homogeneous, high-K dacite lava dome is part of the Ciomadul Volcanic Complex in eastern-central Europe (Romania) and serves as an excellent example of such volcanoes. The Haramul Mic lava dome is the earliest product of the Young Ciomadul Eruption Period (YCEP), when the activity recrudesced in the area after about 200.000 years quiescence time. Eruption age of the dome determined by (U-Th)/He dating on zircon gave 154 +/- 16 ka that is in agreement with the youngest zircon U-Th outer rim date (142 +18/-16 ka). The apparently continuous crystallization of zircon between the eruption age and the 306 +/- 37 ka oldest zircon core date records a long-living magmatic plumbing system.

The Haramul Mic lava dome rock has 35-40% average crystal content and consists of plagioclase, amphibole, biotite and accessory zircon, apatite, titanite and Fe-Ti oxides. The groundmass is mainly built up by perlitic glass with some microlites and sheared vesicles. The dacite contains sparse mafic enclaves with K-rich, shoshonitic bulk composition, mainly composed of plagioclase and biotite. Felsic crystal clots are more common and they comprise plagioclase, amphibole, biotite and interstitial vesicular glass.

Trace element content of the mineral phases and the groundmass glass was determined by LA-ICP-MS. All of the studied phases show homogeneous trace element compositions and along with the textural characteristics these imply general equilibrium state in the magma storage system before the eruption. Amphibole-plagioclase geothermometer and geobarometer calculations result in 700-800 oC crystallization temperature and 200-300 MPa crystallization pressure.

In order to reveal the magma chamber processes that triggered the eruption and formed the Haramul Mic lava dome after long quiescence time, it is necessary to understand better the behaviour of trace elements as the most sensitive indicators of magma reservoir mechanisms. We determined mineral-liquid trace element partition coefficients and evaluated the result in the context of crystal lattice strain model. They show many similarities with those proposed for the Fish Canyon Tuff dacite except for Li and Sc. The anomalous behaviour of Sc is clearly expressed by the elevated concentration in the glass phase and many times, there are some zonation in Sc from crystal core to rim. This could be explained either by inherently higher Sc content of the melt reflecting the nature of the primary magmas or by partial remelting of biotite just before the eruption. Significant positive anomaly of Li content can be observed in biotite crystals of the mafic enclave compared with the dacitic host rock. Li content of plagioclase varies between 15-30 ppm with slight rimward depletion.

Eruption initiation cannot be explained by physical mixing of mafic recharge magma, but rather by volatile transfer or second boiling. The water-rich nature of the melt is reflected by the abundant vesicles in the glassy groundmass. Furthermore, the amphibole phenocrysts have sharp margin without resorption rim, which suggest hydrous melt phase and relatively fast magma ascent.

This research belongs to the NKFIH-OTKA K135179 project and was supported by the ÚNKP-19-1 New National Excellence Program of the Ministry for Innovation and Technology.

Regoinal-scale hydrogeological and local-scale geochemical investigation of natural radioactivity of groundwater-derived drinking water

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Applied

During the interaction with its environment groundwater can mobilize, transport and accumulate radioactive elements which are omnipresent in different amount in the rocks. The most important contributors to the natural radioactivity of groundwater are the ^{40}K, ^{234}U, ^{235}U, ^{238}U, ^{228}Ra, ^{226}Ra and ^{222}Rn isotopes. The characteristic geochemical properties of uranium, radium and radon isotopes make them efficient natural tracers during the investigation of groundwater flow systems. Uranium is mobile under oxidising conditions, though the presence of dissolved organic matter, carbonates and phosphates can enhance its mobility. Radium is soluble under reducing conditions, especially in the presence of dissolved carbonates, sulphates and chlorides. Radon is a noble gas easily soluble and transportable by groundwater, however its occurrence determined by the distribution of its mother element, the radium, due to its short half-life. The geochemical environment (i.e. pH, redox potential, TDS) varies along the systematically organized groundwater flow paths (from local to regional flow systems) and with regard to the change of regime characteristics (recharge or discharge areas). Therefore, with the help of hydrogeology, those areas can be delineated, where high radionuclide concentrations can be expected in the groundwater.

As groundwater is an important freshwater resource and the excess of radionuclides may pose a health risk for water consumers, this knowledge can facilitate safe drinking water management. During quality monitoring measurements, high gross alpha activity was measured in several water wells in the vicinity of the granitic outcrop

of the Velence Hills. This study aimed to understand the cause of this elevated radioactivity in drinking water with using a complex hydrogeological and geochemical approach, involving nuclide-specific measurements. Uniquely in Hungary, alpha spectrometry applied on Nucfilm discs was used to measure the $^{234}U+^{238}U$ (3−753 mBq L^{-1}) and ^{226}Ra (<5–695 mBq L^{-1}) activity. ^{222}Rn activity (<5–314 Bq L^{-1}) was determined by TriCarb 1000 TR liquid scintillation detection. Pressure-elevation profiles and tomographic potential maps were compiled and thorough hydrochemical analysis were made to investigate the properties of groundwater flow system in the study area. The measured activity values correlated well with the results of the hydraulic evaluation and it was revealed that the oxidising characteristic of the predominant recharge areas and local flow systems are favourable for uranium mobilization in the regional-scale. The effect of changing redox conditions on uranium mobility in groundwater was further investigated in the local scale by PHREEQC geochemical modeling.

To conclude, groundwater flow systems beside aquifer geology have to be taken into consideration if dealing with the excess of radionuclides in groundwater-derived drinking water. The joint application of nuclide-specific measurements and hydrogeological approach can facilitate safe water management.

This study was supported by the ÚNKP-17-4-III-ELTE-73 New National Excellence Program of the Ministry of Human Capacities and by project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 810980. The modeling results here presented have been developed in the frame of the MIUR Project "Dipartimenti di Eccellenza 2017—Le Geoscienze per la società: risorse e loro evoluzione".

The position and relationship of the basement units below the Danube Basin based on seismic interpretation

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Theoretical

The structural correlation of the Alps and the Carpathians below the basin fill of the Danube Basin has been the subject of debate in

recent decades. In this time, several works have been produced that have attempted to correlate the structural elements of the two orogenic zones and the geological formations of Austria, Slovakia, and Hungary. Nevertheless, a comprehensive, exhaustive correlation may only be achieved in the TRANSENERGY project [1].

In this study seismic interpretation of 163 seismic sections from Slovakia and Hungary was carried out with the help of well information. The aim of the study was to investigate the positions of the basement units and their contact with each other, in addition, if possible, to separate different nappes within the units. The results of the interpretation were compared with already published interpretations and Pre-Cenozoic basement maps. As a result of the research, a new, simplified basement map was created based on my seismic interpretation and different basement maps.

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Pannonian (late Miocene) mollusc fauna of the Şimleu Basin (Romania)

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Theoretical

The Şimleu Basin (SB) is located in the northwestern part of Romania, in the junction zone of the Apuseni Mountains and the Great Hungarian Plain. It is a small satellite basin of the Pannonian Basin (PB) proper and contains old Pannonian sediments of a less than 1.0 Ma time span. Outcrops representing different lacustrine environments offer an insight into its late Miocene evolutionary history.

Lake Pannon brackish-water fauna of this small subbasin is poorly studied and the age of these sediments was a matter of debate for a

long time [1, 2, 3, 4], although some papers were published mainly on the mollusc and vertebrate fauna of the Derşida locality [5, 6].
In this study, the mollusc fauna of 11 localities (Bilghez, Cehei, Derna, Derşida, Ip, Nuşfalău, Porţ, Sălăjeni, Șimleu Silvaniei, Vârșolț, and Zăuan) were investigated, which consist of more than 50 mollusc taxa. Bulk of the material was newly collected, but archive collection of the Paleontology-Stratigraphy Museum of the Babeş-Bolyai University, Cluj-Napoca was also revised. Data matrix of molluscs was analysed by sample-based rarefaction, non-metric multidimensional scaling, cluster, and network analytical methods to demonstrate how these tools can be used for refining and displaying palaeoenvironmental and biostratigraphic data.
Littoral, sublittoral, profundal, and freshwater depositional environments were separated based on the sedimentological observations and collected fauna. Deep-water mollusc fauna of the SB is very similar to that of the Transylvanian Basin, while the littoral and sublittoral faunal elements suggest a younger age, with characteristic specimens of Congeria pancici, Lymnocardium conjungens, and small- and large-sized melanopsids.
The oldest biozones of Lake Pannon have not been proven from the SB so far. Based on the common occurrence of some characteristic molluscs, the upper part of the Lymnocardium conjungens littoral mollusc biozone was identified, suggesting that infilling of this small adjacent subbasin of the PB happened during an 1.0 Ma time period, roughly from 10.6 to 9.6 Ma.

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Borehole Geophysical Inversion Using Levenberg-Marquardt and Singular Value Decomposition Schemes for Petrophysical Parameters Estimation

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Applied

Borehole geophysical inversion was carried out using Levenberg-Marquardt (LM) and Singular Value Decomposition (SVD) techniques for the determination of petrophysical parameters. In this research, synthetic data with 5% Gaussian noise contamination, and field data were used to compare the results from the two inversion methods. The borehole geophysics inversion concept is an overdetermined inverse problem since the number of the data estimated at local depth is higher than the number of unknowns. MATLAB software has been developed to solve the overdetermined inversion problem. The estimated petrophysical parameters from both inversion methods had been compared one another in terms of robustness to noise, rock interface differentiation, different fluid prediction, and the accuracy of the estimated parameters. In the case of the noisy data, both methods show a good fitting between the observed and calculated data with relatively high fitting in terms of the LM-based inversion method, furthermore, the results of the SVD-based inversion show lower sensitivity to the noise effect. SVD-based inversion results are more accurate than the LM-based inversion result in the case of field data, besides that, the MATLAB code shows higher stability in the case of the SVD-based inversion. The LM-based inversion is faster than the SVD-based inversion because of the inner iterative loop of the eigenvalue selection for determining the best damping factor. This inner loop exhibits the local inversion the capability to overcome the problem of overestimated or

underestimated parameters by considering the sensitivity of the Jacobian Matrix. The inversion results showed that both methods can be used for the petrophysical data estimation and borehole log data interpretation.

4TH SESSION

Structural evolution and petrography of um nar area, Eastern Desert, Egypt

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Theoretical

The Um Nar shear zone (UNZ) is a spectacular shear zone, extending in the NE-SW direction, deforming the Neoproterozoic arc terrains of the Eastern Desert of Egypt. It strikes parallel to the regional trend of the Najd Fault System (NFS) deforming the Arabian-Nubian Shield crosscutting the ENE –WSW trending the Mubarak – Barramiya (MBB) highly deformed belt. The UNZ therefore appears to be a structural feature that was formed after the MBB. Three main tectono-stratigraphic rock units form the geological terrain of the UNZ including a) Metavolcano-sedimentary Association, b) Gneissic and Mylonitic rocks and c) Syn- to post-tectonic intrusives of calc-alkaline granitoids. The metavolcano-sedimentary rock association is thrust over the gneissic rocks which are derived from igneous protolith of granodioritic to dioritic composition. The structural evolution of the region is interpreted to be characterized by several major northwest directed transport thrusts in the MBB. The belt was subsequently affected by sinistral shear in the northwest–southeast trending UNZ that is correlated well with the formation of the Najd Fault System. These two main tectonic events are linked with specific types of magmatic intrusions of calc-alkaline granitoids. Field observations and petrographic investigations of mylonitic and gneissic rocks in the UNZ region were performed; thirty-five rock samples were collected

and examined petrographically for identification of mineral composition and tracing of shear sense indicators. The metavolcano-sedimentary association consists mainly of low-grade metavolcanics of andesitic composition. These metavolcanics are dark green fine grained rocks, microscopically exhibit plagioclase phenocrysts embedded in a fine-grained matrix of plagioclase, hornblende, quartz, epidote, iron oxides and ±calcite. The gneissic rocks are greyish coarse grained foliated rocks that essentially include plagioclase, quartz, hornblende, mica, chlorite, epidote, iron oxides and ±calcite. Shear sense indicators from monoclinic asymmetries of rotated fabrics cored with felsic porphyroclasts (e.g. quartz and plagioclase) and mica fish reveal sinistral motion of the UNZ. En-echelon, right-stepping, arrays of extensional rhyolitic dykes and a strike-slip fault in the UNZ suggest that this shear zone underwent brittle to semi-ductile dextral displacements on the NNW-SSE direction, crosscutting the earlier sinistral fabrics.

Forced or normal regression signals in a lacustrine basin? Insights from 3D stratigraphic forward modelling

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Theoretical

The overall architecture of a sedimentary basin is driven by a complex interplay between subsidence, water-level variations, and sediment influx rates. Several studies have been carried out in continental margin settings to analyse the effect of these forcing factors. However, in deep lacustrine settings, where temporally and laterally variable subsidence and uplift rates occur along with different climatic controls, and multiple sediment sources much less is known. Moreover, their distinct effects are usually overwritten by post-sedimentary processes. Our main aim is to describe and discuss the influence of these internal and external forcing factors and demonstrate their sedimentary response, particularly the related unconformities and clinoform geometries in deep lacustrine settings.

For this purpose, the DionisosFlow stratigraphic modelling software was used to carry out 3D numerical simulations. A series of numerical models were constrained and calibrated by observations from the southwestern margin of the Pannonian Basin of Central Europe. The results have implications on the local tectono-stratigraphic evolution. Our modelling infers that paleo-water depth could have been much larger than previously anticipated, reached more than 1000 m in the deepest part of the basin. Furthermore, we show that post-depositional processes, such as compaction and subsidence could create apparently descending shelf-edge trajectories and onlap surfaces, that are often misinterpreted as proofs of base-level drops. Therefore, we strengthen the argument that without restoring the original offlap geometry base-level drops higher than the seismic resolution cannot be identified and specifically did not occur in the area during the late Miocene. Modelling also infers that autoretreat and autocyclic variations are more effective at low sediment supply and higher amplitude lake-level variations. At locations of high sediment supply normal regression is continued, while between sediment entry points transgression occurs, highlighting that lateral variation needs to be considered during interpretation. Our numerical model is applicable to similar lacustrine sedimentary basins, but also provides insights to high-supply siliciclastic dominated marine shelf-margin systems.

ÁK acknowledges financial support from NFKIH 134873.

Approach to understand and avoid injection related problems in geothermal systems

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Theoretical

This study proposes a workflow to examine potential reasons for low injectivity which is a major issue related to utilization of thermal waters. In order to completely understand and avoid the geothermal reinjection problems, potential problem sources acting on different

scales should be taken into consideration. Thus, in our workflow, possible problem sources are considered after categorized into 1) effect of regional hydraulics (potential presence of overpressure and upward flow) 2) inadequate reservoir performance (low extension and low permeability) and 3) local clogging processes (fines migration, mineral precipitation, microbial activity). Hydraulic conditions are characterized by defining the pressure regime and the direction of vertical driving forces. The reservoir properties are given by determining the grain size and the length of the screened sections, as well as the permeability and the transmissivity of the reservoir and the capacity of the injector. Physical, chemical and biological processes are investigated by specifying the rock properties, clay content; by analysing the type, probability and amount of the scaling; and by evaluating the possibility of biofilm formation.

The workflow was tested on a geothermal site (Mezőberény, SE Hungary, installed in 2012) that had to even be stopped because of the unsuccessful reinjection. The potential reasons were investigated by processing the available dataset (geological, geophysical, geochemical and hydraulic), by modelling (hydrogeochemical, numerical), and by comparing the results to other operating geothermal systems. Based on the results, in the Mezőberény case injectivity decline is a consequence of several separate problems and their interaction: Reservoir properties are insufficient due to low permeability and transmissivity of the reservoir and the limited vertical and horizontal extension of the sandstone bodies. The active vertical length of the screened sections is reduced by inactive segments with lower grain size. Precipitation of carbonates, iron and manganese minerals is expected based on the hydrogeochemical modelling and the solid phase analysis. Microbial products are created due to the particularly high organic content of the produced thermal water that provides organic nutrition. Formation of bioprecipitation and biofouling is also possible. Injection problems due to hydraulic effects are not expected since the pressure regime is hydrostatic and ascending flow was not detected in the close surrounding of Mezőberény. Consequently, reservoir properties determine a low injectivity, which is further decreased to a critical level by the clogging processes.

The proposed workflow can contribute to the detailed reservoir and geothermal system analysis which is essential for a sustainable geothermal use

Two-phased folding in the Nagyvisnyó area, NW Bükk Mts.

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Theoretical

Although, the geological evolution of Hungary is quiet well known, there are still a lot of unknown and not well understood geological features in the Bükk Hills. In the past decades, the Hungarian geologists gave more attention to its lithological and structural evolution but many questions remained unanswered.

Hence, I carried out some research in the surroundings of Nagyvisnyó which is located in the NW-Bükk Mts. (NE Hungary). In this study, I focused on the observation of the outcrop-scale structural features and I attempted the interpretation of their development. I did field measurements in different outcrops where I observed several types of faults and folds. After the comparison of my results to previous studies, I could restore the structural evolution for this area. Six different deformation phases were separated, in which there are even two different sets of folds, which may be attribute for the major deformation event of the Bükk related to the Cretaceous nappe stacking and subsequent thrusting and folding. Moreover, the N-S striking folds have not discovered/observed at all in this area before.

By restoring the local deformation history in the Nagyvisnyó area, we are able to better understand the structural evolution of the Northern Bükk Hills and its connection to the Uppony Hills.

Thermogravimetry and Raman spectroscopy analysis of graphite from Szendrőlád (Szendrő Mts., NE-Hungary)

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Theoretical

Due to its ever-growing role, graphite, the hexagonal polymorphic form of carbon, has become a versatile used non-metallic raw material of nowadays [1]. Moreover, it is also included on the list of Critical Raw Materials for the European Union [2]. It is used mainly in the automobile industry, metal extractive industry, at steelmaking and in the high-tech industry [3].

In our study, drill core samples were examined in detail from 278-295 m depth from the Szendrőlád-6 borehole (Szendrő Mts, NE-Hungary). The graphite bearing rocks were black phyllites (Szendrőlád Limestone Formation, middle-late Devonian, shelf-basin facies) [4]. The samples were investigated with polarizing petrographic and ore microscopy, scanning electron microscopy with energy dispersive spectrometry (SEM-EDS), X-ray powder diffraction (XRD), X-ray fluorescence spectrometry (XRF), Raman spectroscopy and differential thermal analysis (DTA) in order to characterise graphite and get more information about the formation conditions.

According to our results, the matrix of the samples contains mainly V-bearing muscovite, quartz and calcite. The 20-50 μm sized graphite flakes, rarely with low S content, are often arranged in >300 μm aggregates. Beside graphite, the presence of a graphitized material is also indicated by Raman measurements, which does not reach the graphite crystallinity grade. On the XRD diffractograms, due to the heavy peak overlapping with quartz peaks, graphite cannot be directly identified. However, by Rietveld refinement, its peaks are observed on the difference curve, allowing direct quantification. The minerals defined by Rietveld refinement, are also detected on the simultaneous TG-DTA curves, including graphite, as well.

In the samples, there are a lot of accessory minerals: e.g. pyrite, chalcopyrite, sphalerite and TiO_2 (anatase and rutile, both with Nb and V content). Moreover, REE-carbonates (bastnäsite-parisite mixed phases) and Pb-sulphosalts are also detected.

Based on our results, the graphite is epigenetic, and its quantity is 1.5-3 weight%, calculated by Rietveld refinement. During the geological evolution, the Szendrő Mts. went through on very low – lower middle grade of metamorphism [4], thus the graphite was formed by the regional metamorphism of the organic matter rich shales. The observed low S content of the samples refers to organic matter derived origin of graphite. By the formula of Beyssac et al. [5], the formation temperature of graphite can be estimated using Raman spectroscopy results. According to our calculations, the formation may occurred at ~410°C (±30°C), but this formula does not take into account any existing strain. Graphite was certainly formed in the shear zones, due to the marks of shearing deformations observed in the metamorphic textures.

The research was carried out at the University of Miskolc both as part of the „More efficient exploitation and use of subsurface resources" project implemented in the framework of the Thematic Excellence Program funded by the Ministry of Innovation and Technology of Hungary (Grant Contract reg. nr.: NKFIH-846-8/2019) and the project titled as „Developments aimed at increasing social benefits deriving from more efficient exploitation and utilization of domestic subsurface natural resources" supported by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund in line with the Grant Contract issued by the National Research, Development and Innovation Office (Grant Contract reg. nr.: TKP-17-1/PALY-2020).

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SATURDAY

5TH SESSION

The environmental history of a Transylvanian sphagnum peat bog at the end of the Quaternary: Anthropogenic effects and global aridification events

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Theoretical

The wetlands, peatlands, mires and bogs not only carry information about their environment but also reveal geological and cultural history facts after their formation. The sphagnum peat bog in Magyarbagó carries important historical and paleoclimatic information from the past 8600 years, which is why the most important goal of the study is to get to know the formation and transformation of the layers developed at the end of the Quarternary. The accumulation of the peat bog depends on both the climatic effects and the human activity nearby. Disturbing the forest vegetation fundamentally influences humidity and the amount and type of sediment entering the catchment basin by erosion. The peat bog is formed on a carbonate bedrock in a closed forest with a hilly position and a valley within it.

We used a Russian peat corer to extract 8.6 meters of core from the middle of the bog. The field stratigraphy description was made with the help of the Munsell colour chart and the Troels-Smith classification. The analyses used were the loss on ignition method (LOI), magnetic susceptibility analysis (MS), grain size analysis, and water-soluble geochemical analysis (Ca-Mg-Na-K-Fe). We based the dating on (AMS) radiocarbon method. The result of the excellent environmental condition is that it has a high average organic matter content and the bog is regenerated after every erosion event. In the Bronze Age and the Árpád period, during the rainy and cold periods,

the water level of the bog increased significantly and two water layers formed in the section. The 8.2 and 4.2 kiloyear aridification events and their effects are also clearly visible in the profile.

Characterization of global lightning activity via the inversion of Schumann resonance measurements

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Theoretical

Detailed investigation of lightning climatology on global scales is currently hindered by the incomplete and spatially uneven detection efficiency of ground-based lightning detection networks and by the restricted spatio-temporal coverage of satellite observations. Currently available technology does not allow the detailed quantitative evaluation of lightning activity on continental scales on time scales ranging from the diurnal to the interannual.

Our group proposes a cost-effective technique to infer the distribution and intensity of global lightning activity based on the inversion of Schumann resonance (SR) measurements. Due to the extremely weak attenuation of lightning-radiated electromagnetic (EM) waves in the SR-band (~3-50 Hz) all lightning strokes contribute to the globally detectable EM field which makes SR measurements very much suitable for climatology-related investigations. This approach gives the intensity of lightning activity in terms of an absolute physical quantity: the charge moment change (CMC), not biased by chosen event selection criteria as in case of traditional statistics based on the number density of strokes or flashes. Here we describe our inversion algorithm and present CMC-based lightning distributions from a few selected days.

Unconventional Hydrocarbon research in the Battonya region

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Applied

The steadily increasing world population paired with the climbing standards of living across the globe results in a year by year increase of the global energy demand. The resulting changes in the energy market make it possible to harness the previously unprofitable hydrocarbon accumulations.

This study focuses on the accumulations of the Endrőd Formation in the Battonya region.The calculated volume of the formation was based on the interpretations made on three 3D and roughly fifty 2D seismic surveys along with several wells. Using previously measured TOC and HI values [1] combined with the calculated volume from my own interpretations the amount of generated hydrocarbons was determined with Monte Carlo simulations. One, where the whole formation, and another where only a member, the Tótkomlós Calcareous Marl was viewed as a hydrocarbon source.

The results include young structures, faults, and slides in the Pannonian strata. The Monte Carlo simulations show a possibility for large amounts of unconventional hydrocarbon deposits. However, most of that is trapped in the deep basins and troughs where the current techniques of fracturing and production make it difficult or in some cases impossible to recover.

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An assessment of mass movements of steep slopes on the Danube Bend based on UAV and other imagery

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Theoretical

The Danube Bend is one of the scientific hotspots as well as one of the most popular places for tourists in the Northern Hungary. Different natural and anthropogenic factors contribute to development of spectacular and dynamic landscapes. The interaction between the uplift and the incision of the largest river in the Central Europe has created the steep slopes on both banks that are in critical and subcritical state in terms of mass movements. The recent landslide events have paralyzed both the road and railway traffic for a considerable time. Thus, the research of (in)equilibrium of slopes is an important issue for the study area.

Unmanned aerial vehicles (UAV) were applied to obtain data about geomorphological characteristics and slope structure of the Szent Mihály Hill, located on the left bank of the Danube river; a digital surface model with a horizontal accuracy of better than 3 cm and a vertical accuracy of about 1 cm were created to evaluate the slope structure.

A better true reconstruction of the study area was represented on the orthophoto mosaic, that allows to roughly estimate a possible mass displacement. For the roughly evaluation, the visible rock outcrops were calculated with the certain assumptions. The volume of possible mass movements was calculated for each identified flatiron on the Szent Mihály Hill. To improve the mass estimation, the reconstruction of the slopes is recommended because it allows to evaluate the difference in height, and in its turn, the displaced mass of materials. Such modelling can be used for the further calculation and projection of engineering constructions, considering approximate mass of displaced material.

Although blur effect was mentioned on the orthophoto mosaic, the results indicate that tested techniques might be a valuable alternative to LiDAR survey. The extraction of vegetation points from the Point Cloud was obtainable in Agisoft PhotoScan, by that a digital terrain model was created to estimate the slope surface.

Based on GIS analysis, the combination of UAV output and Earth Observation data were used for mapping to identify topographical features contributing mass movements as well as to understand the connection between natural and anthropogenic factors on the susceptibility of the study area. High-resolution satellite images, an orthophoto mosaic and a digital surface model are

important output data to investigate mass movement and can be significant input data for extraction of detailed layers for mapping causal factors such as a slope angle, an aspect and a land cover. Based on in-situ observation and a GIS-based statistical analysis, the mapping of mass movements finding was possible and could be used for the risk management of hazards in the future, e.g. the traffic safety and the maintenance and safekeeping of roads and railway tracks.

The Danube Bend itself is a natural laboratory for rock uplift and the river incision even if there are some hazardous consequences, e.g. mass movements, thus, a holistic approach from the geodynamics to the practical consequences and mitigation underlies this research.

Peralkaline rhyolite formation at Oldoinyo Lengai: a case study

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Theoretical

Peralkaline silicate rocks [i.e., molar $(Na_2O + K_2O)/Al_2O_3 > 1$] commonly occur in rift zones and are associated to bimodal flood basalts. The greatest density of peralkaline silicate volcanism on Earth is found on the East African Rift System (EARS), where peralkaline trachytes and rhyolites dominate the basalt-peralkaline silicate complexes. The three most widely discussed models proposed to explain the formation of peralkaline rhyolites are: 1/ fractional crystallization of a basaltic-basanitic magma [1]; 2/ partial melting of underplated basalts forming peralkaline trachytes, followed by fractional crystallization [1]; 3/ partial melting of continental crust, followed by fractional crystallization [1]. Assimilation of crustal rocks by the basaltic parent magmas has been involved in all three models. However, direct evidence of peralkaline rhyolitic eruptions has never been recorded [2]. The elusive nature of these eruptions led us to study peralkaline rhyolitic matrix-glass, melt inclusions and minerals from Oldoinyo Lengai (OL), where alkaline silica-undersaturated magmatism currently takes place.

The studied rock is contained within a partially resorbed vesicular, hypocrystalline, porphyritic, crustal metamorphic xenolith,

consisting of two distinct parts: non-igneous quartz-feldspar relict crystals and a glass-clinopyroxene-feldspar-titanite igneous matrix (groundmass). SEM-EDS measurements performed on clinopyroxene (n=30), feldspar (n=30), glass (n=15) and secondary quartz hosted melt inclusions (n=6) showed that: 1/ relict crystals and groundmass crystals have distinct composition and thus are not cogenetic; 2/ matrix-glass is of peralkaline rhyolitic composition and is higher in SiO_2 compared to the trachytic glass-phase in secondary quartz-hosted melt inclusions; 3/ clinopyroxene is aegirine-rich and its crystallization is one of the main factors affecting the remaining melt peralkalinity; 4/ the studied xenolith interacted with both fluid and melt from OL magmatism. Using the composition of the studied matrix-glass, we considered quartz-feldspar assimilation (glass gain) and clinopyroxene-feldspar-titanite fractionation (glass loss) and, calculated a composition for "original" peralkaline phonolite melt that was existed just before its interaction with the metamorphic xenolith. The calculated melt is compositionally similar to phonolites occurring at Oldoinyo Lengai. We suggest that the formation of peralkaline rhyolites does not strictly requires a "classic" crystal fractionation from a basaltic-basanitic parent melt, such as olivine-clinopyroxene-plagioclase-oxide fractionation with variable degrees of crustal contamination. Our result rather suggest that peralkaline rhyolites can be formed from peralkaline phonolite melts by assimilation of quartz+plagioclase-feldspar and crystallization of alkali-feldspar+aegirine-rich-clinopyroxene+titanite.

This study was financially supported by project NRDIO (National Research, Development, and Innovation Office of Hungary) K-119535.

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6TH SESSION

Transition from platform to basin: mapping observations at the surroundings of the Krvavica mountain

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Theoretical

The Krvavica Mountain is situated on the northern limb of the Trojane Anticline as part of the Sava folds region in Middle Slovenia. This Cenozoic fold belt is situated in the transition zone of the Alps and Dinarides, south from the Periadriatic Fault (Placer 1999) This area was part of the Adriatic margin of the Neotethys in the Middle-Late Triassic). (Schmid et al. 2008). During this time and later on reoccurring rifting phases created the Slovenian basin, which continued to subside until the Late Cretaceous. The extensional phase was followed by contraction in the Paleogene and Neogene during the Dinaric and Alpine phase. This deformation placed the study area within the Alpine retro-wedge system. These major tectonic events are responsible for the complex deformation of the area (Rožič et al. 2014).

Previous mapping and cross section evaluation showed that this part of the Trojane Anticline is really complex and needs to be studied in detail. One major goal is to detect the original Triassic to Jurassic paleogeographic boundaries which are located within the strongly deformed fold belt. The goal is to understand the original paleogeographic relationships between the basin and platform developments. The thorough study of the area near the Krvavica Mountain resulted in a number of fault-slip measurements, outcrop dip

data and other field observations where rock samples were taken. From these samples thin sections give a preliminary understanding of the Mesozoic sequence.

Along a S to N section three formations can be traced: Triassic siliciclastic basin sediments (shale, sandstone), Triassic platform carbonates and Cretaceous carbonates. These formations are repeated at least two times by a major thrust. The thrust was associated with tilting, and probably pre-dated by early deformations, including normal faulting. The two Triassic facies have an intricate relationship. Previous study of the area suggested that these facies were separated by range-parallel and range-perpendicular late faults and excluded any intercalations. However, our observations clearly show that the platform and basinal formations are repeated in the dip direction. Map geometry strongly suggests that the two formations are interfingering. Carbonate bodies might be considered as prograding wedges pinching out in the dip direction. In this interpretation, the platform-basin margin is located near the Krvavica Mt., which was folded and imbricated during the Cenozoic.

A better understanding of the passive margin evolution may help our correlation with units that were displaced by the Periadriatic–Balaton Fault system. These data are necessary to the construction of a detailed N-S cross section through the junction of the Southern Alps and Dinarides and to correlate the evolution of the units that were displaced by the Periadriatic Line.

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Investigation of hydraulically conductive faults using equivalent porous medium (EPM) approach

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Theoretical

Two-dimensional numerical modelling has been carried out to reveal the role of faults and fractured zones in homogenous groundwater flow system. The equivalent porous medium (EPM) approach is widely used to consider the effect of hydraulically conductive faults. In this study, a systematic parameter test was accomplished to investigate the validity of the EPM approach.

Effects of the physical properties of faults (e.g. length, permeability, thickness, dip angle) were examined in two-dimensional finite element simulations. In addition, some theoretical fault systems and a strike-slip fault system with Riedel shear mechanism were set in the model. Effective permeability of the system ($k_{eff}=k_f/k$) was calculated using the permeability of the fault and the surrounding porous medium in order to elucidate the effect of the tested parameters. Based on the numerical results, it was established that the basin-scale subsurface fluid flow depends on the parameter set of the porous medium and the structural elements in different degree. Significant changes appear in the vicinity of faults, while the modification in the effective permeability (k_{eff}) did not exceed 20%, which seems a marginal effect compared to the variability of the matrix permeability by many orders of magnitude. In conclusion, the EPM approach is a suitable method to consider the effect of hydraulically conductive faults in regional-scale groundwater flow systems.

This research is a part of a project that has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 810980.

Results of new geochemistrical and geochronological investigations of the Triassic metavolcanics of the Bükk Mountains

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Theoretical

The Bükk Mountains exposes mostly the Carboniferous-Jurassic sequences of the Bükk Paraautochtonous of the Bükk Unit. In the east, W(NW)-E(SE) fault zones and thrusts divide this to further structural units comprising various stratigraphy.

There are several volcanic bodies associated with Triassic sedimentary rocks, often of uncertain stratigraphic position, which were mapped in four different formations (1). The most widespread Szentistvánhegy Metaandesite (SMA) is known to be a calc-alkaline series from basaltic to rhyolitic composition, well constrained by underlying Anisian and overlying Lower Ladinian carbonates occuring in both the northeastern and southeastern units. In the central unit Carnian cherty limestones contain small alkaline basaltic intercalations, mapped as Szinva Metabasalt (SMB). Small coarse grained basalt bodies embedded into metapelites were mapped as Létrás Metabasalt (LMB).

In the northeastern unit a large metavolcanic body occurs between Miskolc and Bükkszentkereszt, surrounded by limestones and metapelites with assumed Ladinian-Carnian ages, the S and SW contacts are steep fault zones. It was mapped as Bagolyhegy Metarhyolite (BMR) (1); however, it consists of two different volcanic units. The larger contains a rock series from basaltic andesite to dacite (Bükkszentlászló Block, BLB). The other unit contains metarhyolite only (BMR sensu stricto) and occurs along the southwestern edge of the area, overlying the previous one.

We studied samples from type localities of the above described formations and small metavolcanic bodies with uncertain

stratigraphical position from all structural units where such rocks occur as part of Triassic sequences.

There are many published assays on major elements from the Triassic metavolcanics, but interpretation of these is limited due to regional metamorphism and other metasomatic alterations. Based on new trace element analyses, we have found that the BLB and the SMA represent the same calc-alkaline series. The BMR s.s. has also calc-alkaline composition, but it seems to be strongly differentiated or altered with unique characteristics: strong depletion in REEs and in some other trace elements. The SMB and LMB samples show an alkaline character with low grade of differentiation.

We made U-Pb dating on zircons from rhyolitic-andesitic rock varieties with LA-ICP-MS method. The zircons of the BLB and the SMA have a range of ages of 238–241 Ma. The zircons of the BMR s.s. have extremely high U-content. The measured range of ages is wide, most belong to the 243–250 Ma interval, but in some samples a significant amount of measured ages falls between 250–320 Ma.

Our results show that the BLB represent the same horizon as the SMA, which belongs to the „pietra verde" horizon widespread in the Alpine-Dinaric system. The older (mostly Early Triassic) ages of the BMR s.s. are unknown in the same system, but the dated zircons seem to be of metasomatic origin. SMB and LMB and basaltic SMA-type rocks are not usable for zircon dating but several trace element composition helped us to group them.

Acknowledgement: The work of P. Gál was supported by the ÚNKP-19-3 New National Excellence Program of the Ministry for Innovation and Technology.
The work of N. Németh was carried out within the framework of the „Improved exploitation and utilisation of subsurface natural resources" (TUDFO/51757-1/2019-ITM) Thematic Excellence Program of the University of Miskolc, financed by the National Research, Development and Innovation Office of Hungary.

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Estimation possibilities of lithosphere-asthenosphere boundary depth using magnetotelluric data in the Pannonian Basin

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Theoretical

The magnetotelluric (MT) research method offer a unique opportunity to determine the subsurface resistivity structure over several orders of magnitude. Even in difficult measuring conditions. In this way, we can map the near-surface, but even deep depth geological structure and the possible phase boundary transitions along with the depth profile where the conductivity as a petrophysical parameter changes. In this work I use broadband and long-period (10^{3}-10^{-5} Hz) MT measurements to estimate the range of the lithosphere-asthenosphere boundary (LAB) depth at some places in the Pannonian Basin.

When the apparent resistivity values reached the LAB we usually observe a significant resistivity decrease. This boundary transition zone causes that resistivity contrast. The typical resistivity values of the electrical conductive asthenosphere are in the range of 1-25 Ωm, where the lithospheric mantle represents a relatively resistive layer (a few hundred to 1000 Ωm) beneath a typically conductive lower crust. However, the accurate detection of this boundary encounters a number of difficulties. For example, the noisy electromagnetic time series often causes a deadband over a magnitude around 1 Hz in the frequency domain. The complex near-surface geology can distort the apparent resistivity values on the soundings, but tectonic boundaries, faults and shearing zones can also give a significant distortion effect. Furthermore, in the lower crust, some layers can become well conductive (1-10 Ωm) with adequate water, graphite, metal, sulfide content, thus exerting a shielding effect on the underlying layers. Also, large rock bodies can cause macro-level anisotropy or even the crystal structure of the homogeneous rocks can determine directions for conducting electrical charges, thereby inducing micro scale anisotropy. All these effects were investigated both in the synthetic

models I made and in the field surveys performed in the Pannonian Basin and I tried to estimate a depth range for the LAB boundary. During interpretation, I considered the geomagnetic induction vectors and the tensor invariants what shows the geoelectric strike directions and the dimension of the subsurface structure. Finally, after improving the MT response function with tensor decomposition and rotation, I selected the estimated depth range for the LAB boundary based on the inversion results. Taking into account the phenomenon of equivalence during the inversion, and then I discuss the possible pitfalls of interpreting the obtained results.

Broadband and long-period magnetotelluric measurements may give an estimate of the lithosphere and the upper mantle structure and the processes taking place in them. However, the MT measurement data are influenced by a number of conditions, so their accurate estimation can only be obtained by considering these main factors. Since a LAB depth study is currently underway in the Pannonian Basin with the participation of MT measurements, I consider it important to draw attention to the major conditions limiting the MT method in a deep depth investigation.

Numerical modeling of soil contaminant transport using the finite element method

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Theoretical

The numerical analysis of the combined effect of recharge-controlled groundwater motion and mass transport is relevant for understanding the physical and chemical processes in both basin and local-scale flow systems. Focusing on local-scale studies (~100 m), one of the most serious problems is liquid contamination from industrial activities, which after a certain time can be transported through the partially saturated medium into the near-surface aquifers. Although this process is irreversible, the environmental footprint can be reduced through planned remediation. The main purpose of this

study was to investigate numerically the contamination transport at the boundary of unsaturated and saturated zones before and after remediation process.

Two- and three-dimensional finite element models were set up in agreement with an area under remediation operated by ELGOSCAR-2000 Ltd in Northeast Hungary. First, based on the data from pumping tests (e.g. porosity, hydraulic conductivity, position of water table), the estimated recharge rate ($R \leq 150$ mm/yr) and the geological features of the region, an intermediate-scale (~1 km) model was carried out to determine the initial and the boundary conditions of the remediation model. Second, mass transport was investigated from the beginning of contaminant infiltration in different time intervals. Third, several scenarios were tested using monitoring data in order to schedule the remediation process in the study area. It was established that (1) the surface infiltration does not increase the spread of the contamination due to the position of the water table (~8 m); (2) the contamination is transferred through the partially saturated layer mainly by gravity force; (3) the effects of advection, dispersion and diffusion are facilitated by saturation. Although the remediation can intensify the contamination transport in the partially saturated zone, the procedure prevents the further leakage outside the study area.

This research is a part of a project that has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 810980. The research was prepared with the professional support of the Doctoral Student Scholarship Program of the Co-operative Doctoral Program of the Ministry of Innovation and Technology financed from the National Research, Development and Innovation Fund. This research was carried out in cooperation with ELGOSCAR-2000 Environmental Technologies and Water Management Ltd.