



# Cluster of Applied Earth Sciences

Brochure'22



# 33

Members

# 22

SME-s



## Cluster of Applied Earth Sciences



Dr. Ferenc Fedor



[www.capes.hu](http://www.capes.hu)



[info@capes.hu](mailto:info@capes.hu)



+36 30 689 3103



Viola str. 55/1  
Kozármisleny H-7761  
Lot.no: 0222/35  
Kövágószőlős H-7673



Cluster of Applied Earth Sciences



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Institutes & Universities

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Public bodies & Non-profits

### Dear Readers,

Welcome to the information brochure of the **Cluster of Applied Earth Sciences, CAPES!** Our cluster provides access to R&D&I capacity & state-of-the-art expertise in applied geoscience subjects, including hydrocarbon and geothermal research, as well as radioactive waste repository and environmental protection.

The **Cluster of Applied Earth Sciences** is a hub in Central Europe for high tech companies and earth science laboratories offering state of the art services and solutions in:

- Mining, raw material, hydrocarbon exploration,
- Geothermal research,
- Research activity related to radwaste disposal projects,
- Environmental management,
- R&D&I projects.

**CAPES** uniquely delivers integrated expertise based on the knowledge pull of our member companies representing the highest standards of geoscience discipline and well established practice. Our organization is a client oriented and inspiring hub of innovation driven companies, laboratories, universities and R&D&I centers.

The overarching vision of the **Cluster of Applied Earth Sciences** is to provide comprehensive, fast and tailored services to our clients. We are committed to offering our clients quality, the best value on reasonable price.

We are proud that **CAPES** and its members thrive. **CAPES** is also an active partner of the GeoEnergy Europe, a European Union metacluster partnership aiming to contribute to the industrial deployment and market uptake of sustainable geo-energy.

Please use this reference guide to source information on **CAPES** services, start business dialog and achieve success together.

For more details please visit our website: [www.capes.hu](http://www.capes.hu)

Thank you and best wishes for much continued success!

Dr. Ferenc Fedor  
President  
CAPES

### Memberships







### Geo-Energy Europe metacluster - a new, two year cooperation phase has been launched

The second phase of the GEE international cluster collaboration partnership began with the project kick off web meeting on September 18, 2020. The co-operation supported by the EU's COSME program focuses on the exploitation of geothermal energy and on facilitating third market businesses/export activities by the participating European SMEs in this industry.

In the first phase of cooperation, which was successfully completed in the period of 2018 - 2019, we assessed the strengths, export potential and synergies of more than 600 interested companies of the 9 cooperating clusters from 8 EU countries. (Details: [www.geoenergyeurope.com](http://www.geoenergyeurope.com))

The GEE metacluster partnership, which has expanded to include Italian partners, has successfully tendered for the support of the EU COSME program. The main goal of this two year phase is to reach concrete, third market business agreements. Following the Canadian co-operation agreement in the first phase, an MoU was recently reached with our Ethiopian partners on specific co-operation topics with the help of our partner cluster, the Geoscience Ireland. Promising talks are also underway with Kenyan and other international potential stakeholders. Possible areas of cooperation range from training in geothermal areas, exploration, drilling, measurement and laboratory works to equipment delivery.

### GEO-ENERGY EUROPE



[www.geoenergyeurope.com](http://www.geoenergyeurope.com)



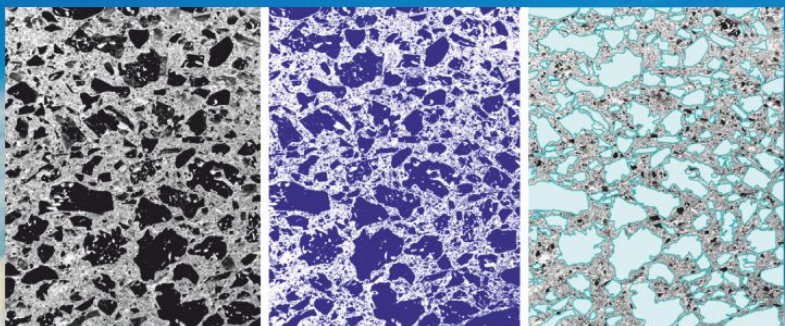
[geo-energy-europe](https://www.linkedin.com/company/geo-energy-europe)

In the second phase of the project, the role of CAPES is two folded: to assist Hungarian SME member companies in their geothermal business endeavors, while at the international level to support cooperation between small and medium-sized companies in 9 member clusters in 8 countries with IT tools. CAPES works on expanding the collaboration toolkit to accelerate the internal exchange of information and creation of synergies in the GEE metacluster. Common goal of the GEE members is to increase the competitive edge of our members on third markets.

Those interested in more details and business relations of the GEE project are kindly requested to contact the management of CAPES.







**Augen Consulting Ltd.** deals with data analysis and complex interpretation of materials of both geological (natural) and artificial origins. The main focus concerns evaluation of chemical and phase analysis data in bulk samples as well as in situ measurement in the  $\mu\text{m}^2$  up to  $\text{cm}^2$  range. As a routine, data of advanced microscopy and image analysis, X-ray diffraction and X-ray fluorescence, Raman spectroscopy, SEM, fluid inclusion microthermometry and organic geochemistry are involved. Complex laboratory data sets are evaluated for numerous reasons, like reservoir characterisation (both porous and fractured), ore body characterisation, solving environmental geological problems, qualification of building materials, archaeological artefacts among many others.

**Augen Consulting Ltd.** undertakes complex investigations in a wide spectrum of problems from sample preparation until data evaluation with international references.

#### Selected projects, references and partners:

- Reuse possibilities of red mud bauxite waste (Tatai Környezetvédelmi Zrt.)
- Inhomogeneity analysis on industrial plastic raw material (IBV Hungária Kft.)
- Physicochemical characterization of artificial sea sediments (Norwegian Institute for Bioeconomy)
- Complex petrography, geochemistry and palaeofluid evolution studies on cores (Mecsekérc Zrt.)
- MOL Nyrt.
- O&G Development Kft.
- TXM Olajkutató és Gázkutató Kft.
- San Leon Services Sp. z o.o.
- Liesa Energy Sp. z o.o.
- Golder Associates (Magyarország) Kft.
- NaWest Koncessziós Kft.

**AUGEN**  
CONSULTING KFT.

**Augen Consulting Ltd.**



**Dr. Félix Schubert**



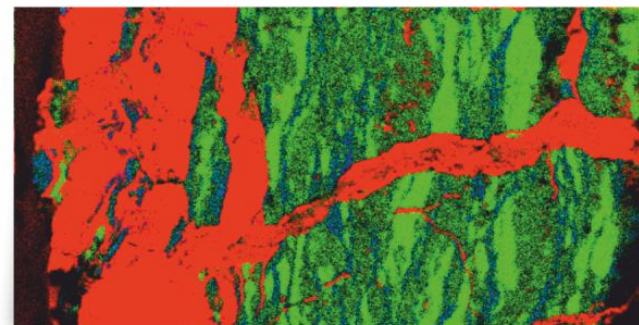
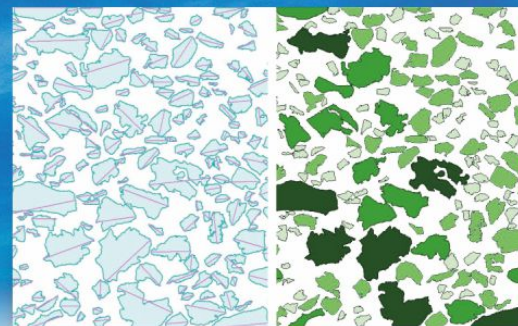
**pacal007@gmail.com**



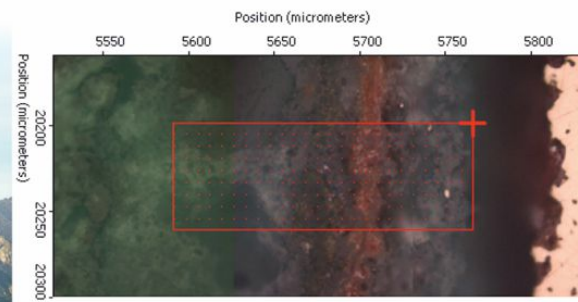
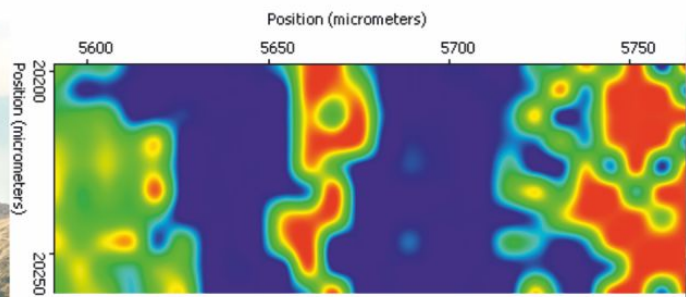
**+36 30 490 3873**



**Alkotmány str. 22.  
Szeged H-6728**



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#### AURORA Energy Kft.

Our Company's main profile includes **consultancy services** in such sectors as **energetics and mining (and in particular oil mining)**, meeting your Company's existing needs and demands at the highest possible standards. We have decades of experiences in energetics and oil mining, and our Company was established with the **key goal to successfully and effectively deploy those experiences based on practical experiences and application, in favour of our clients.**

Relying on our practical experiences, our Company is prepared to take part, besides consultancy, in actual implementation efforts in areas like effective operation, company or asset acquisition or project management and implementation. If our Client requests so, which means that, we are prepared and skilled to find, in close cooperation with you, the successful form of investment and assets in the field of energetics as well as the effective and optimal way of operating the asset(s) (asset management).

Our key objective is to provide you professional services so that, while always achieving greatest success, you can be satisfied with the quality of our services and the value for your money.

The consultants of **Aurora Energy** assume energy management and operational consultancy in all areas of energetics, such as operative organisational review and redesign, executive, crisis and change management and other fields of corporate management (project management, technical and financial planning and control, optimisation of procurement and CAPEX processes).

You can keep on browsing our website as you like, and if you have any question in relation with our services, feel free to turn to us with confidence!

#### SERVICES:

"We know no impossibility, although it may take a while if you expect miracles."

Our mission is to provide You such high quality and comprehensive services that will lead to a lasting long-term cooperation.

You can always turn to us with confidence!

- Energy and mining advising (Consultancy in energetics and mining)
- Operational advising (Effective operational consultancy)
- Asset and company assessment (Consultancy on company and asset assessment / due diligence)
- Enterprise management (Business management consultancy)
- Trainings (Training and development)
- Hydrocarbon Upstream operation (US production and efficient operation)

#### MOST IMPORTANT REFERENCES

- EU-Fire Kft.
- Rikopet Kft.
- MOL Nyrt.
- MFGK Austria GmbH.
- Geomega Kft.
- O&G Development Kft.



#### Aurora Energy Ltd.



Attila Holoda



[www.auroraenergy.hu](http://www.auroraenergy.hu)



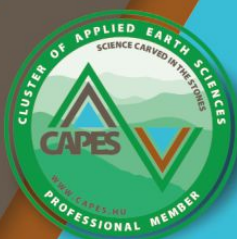
[aurora@auroraenergy.hu](mailto:aurora@auroraenergy.hu)



+36 30 928 7348  
+36 30 915 3770



Ipari park str. 10.  
Budapest H-1044



- OT Industries Zrt.
- KPMG Hungária Kft.
- TXM Olajkutató és Gázkutató Kft.
- Zerlux Kft.
- Magyar Bányászati és Földtani Szolgálat/Geofizika
- Kerui Group
- Magyar Horizont Energia Kft.
- GRID Zrt.
- Gashydrate Kft.
- FMBE Bank Cyprus
- Petrolgeorge Kft.
- Geoinform Kft.
- Dana Gas Plc.
- BTO Management
- Consulting GmbH.
- Bankers Petroleum Plc.
- Geophysik GGD mbH.
- Maximus Kft.
- Kerogoil Zrt.
- Folyópart Kft.

#### MR. ATTILA HOLODA – MANAGING DIRECTOR

Attila Holoda received his Master of Science Degree as a mining engineer from the Faculty of Petroleum Engineering at the Gubkin Russian State University of Oil and Gas in Moscow in 1989. He received his 'MBA in Finance' degree at the Budapest University of Economic Sciences in 2000. Completing the joint course by the Econovum Academy Association of Professors and the Newport University in 2012, he received an 'adult education PhD' degree in the field of Business administration. He started his career as a production engineer in 1989. Till 1999, he occupied a number of managerial positions at the mining plant, between 1999 and 2012, he managed the Domestic Production, Domestic Exploration and Production, and then the Central European and Eurasian Exploration and Production organisations.

In middle of 2012, leaving the MOL Hungarian Oil & Gas Company Plc., he fulfilled for a short period the position of the Deputy Secretary of State in charge of Energy at the Ministry of National Development of Hungary.

Former member in the Board of Directors of MMBF Zrt, the strategic underground gas storage Szőreg-I between 2007 to 2009.

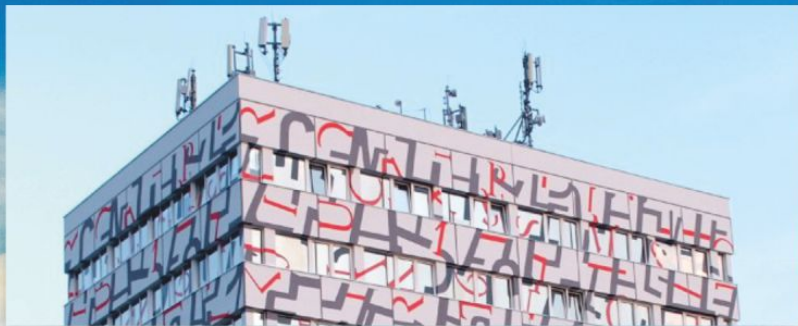
Former member of the Board of Directors of the Croatian national oil and gas company INA d.d. between 2009 to 2011. He was the Chairman of the Supervisory Board of the Hungarian Hydrocarbon Stockpiling Association in 2012.

Member of the Hungarian Mining and Metallurgical Society since 1989, and its Vice President between 2007-2014 as the Chairman of its Crude Oil, Natural Gas and Water Mining Section. Member of the Hungarian Geological Society as the Chairman of its Mineral Geology Section since 2013.

Member of the international Society of Petroleum Engineers (SPE) since 2005.

Chairman of the Hungarian Mining Association between 2009 and 2012.





#### About the Chamber:

The **Chamber of Commerce and Industry of Pécs-Baranya** is a solidary business community, which consists of the best companies in Baranya. It is committed to the development of the county's economy and enterprises. Its goal is the development and well-being of the local society, to help each other not only with expertise, but also with its networks and financial resources.

The Chamber is the engine of the county's economy, the organizer of the business community. Overcoming the challenges can only be achieved in close cooperation with businesses. All elements of the Chamber's strategic matrix serve the businesses, as well as the trained and dedicated staff of its office.

Its core activity is the business development. It is playing a key role in creating a prosperous business environment for its members, thus enabling them to compete effectively in domestic and international markets as well. The aim of the Chamber is to foster the social and economic policy development by providing services for South West Hungarian SMEs. The priority development work of the Chamber is to ensure the cooperation between companies, furthermore establishing and managing clusters.

#### Services:

The Chamber effectively represents the interests of its member companies (e.g. regarding local taxes), supports the management of innovation processes and business development (cluster building, networking), exercises and participates in the control over the creation of rules affecting the economy.

With the support of the constantly expanding Széchenyi Card Program, it helps find solutions to the financing and liquidity problems of SMEs.

It supports the establishment and work of various professional communities and clubs, including the Human Club, Labour Safety Club, Marketing Club, Businesswoman Club, Senior Club, and master clubs by profession (mechanical engineering, construction, automotive and catering).

It supports the establishment and operation of clusters (e.g. South West Hungarian Engineering Cluster and Construction Technology Cluster). It has serious results in the operation and support of clusters in Baranya, e.g. in the field of dual vocational training, dual higher education and development of innovation and business potential of the region. The existence and activity of clusters is a breaking point for the Middle European region, and it is a major possibility to survive. The Chamber of Commerce and Industry of Pécs-Baranya has been a long-term cooperating partner – and also a member since May, 2020 – of the Cluster of Applied Earth Sciences. Moreover, it performs cluster development and supports activities mainly in the fields of mechanical engineering, construction, biotechnology, IT and creative industries.

Clusters, being involved in the European projects of the Chamber, obtain international visibility, training and business opportunities. In the course of common work and the utilization of innovation results, the development of export capacity and joint marketing can be achieved. The Chamber of Commerce and Industry of Pécs-Baranya offers further services in the field of innovation, trade development, external relations, vocational trainings and education. The Chamber is one of the host institutions of the Enterprise Europe Network supported by the European Commission.

The role of the Chamber is decisive in enforcing the purity of business life, in the operation of the Baranya County Conciliation Board.



**PÉCS-BARANYAI  
KERESKEDELMI  
ÉS IPARKAMARA**  
• alapítva 1881 •

**Chamber of Commerce  
and Industry of Pécs-Baranya**



**Szabolcs Rabb**



**www.pecseconomy.eu**



**szzabb@pbkik.hu**



**+36 72 507 148  
+36 20 441 9135**



**Majorossy str. 36.  
Pécs H-7625**



**Chamber of Commerce  
and Industry of  
Pécs-Baranya**



#### Projects:

The Chamber managed and continuously manages successfully several domestic and international projects.

#### Ongoing projects:

##### International projects:

- AMULET (H2020): Advanced Materials and Manufacturing Technologies united for Lightweight
- Better Factory (H2020): Grow your manufacturing business
- Digital Coach (Erasmus+): Learning Factory
- EU4BCC: Sustainable Tourism Development (Hungary and Georgia)
- Enterprise Europe Network (COSME) - Business Support on your Doorstep (since 2008)
- SACHE (Interreg CE): Smart Accelerators of Cultural Heritage Entrepreneurship

#### Closed projects (selection):

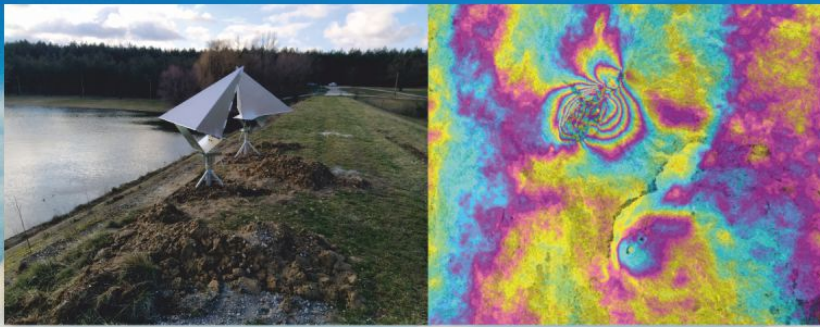
##### Domestic projects:

- GINOP 1.3.2-15-2016-00019: VINE project (Professional support for cluster competitiveness, innovation, internationalization and cooperation)
- Development of "Knowledge Park" on the basis of University of Pécs
- TAMOP 2.3.4-B-13/1: "Learning by working"
- Women's Day 365: Operation of a women's center in Western Baranya
- WorkAND Family: Improving the situation of women in the labour market

#### International projects:

- I-DARE –Development of dual training and introduction of tertiary systems in the field of mechanical engineering and electrical engineering profession
- EN-EFF: New concept training for energy efficiency
- Job Developer: Together against youth unemployment
- SORT: Seniors On Reciprocal Tourism
- Enterprise+: Innovative potential meets experience
- InnoWeit: From innovation to lifelong learning
- FEMME: Fostering the Exchange of practices to Empower Mumpreneurship in Europe
- INKAS Project: Wage value method from the Netherlands
- EVLIA: Making full value of good ideas by leveraging intellectual assets for financing SMEs in SEE
- Cult-CreatE: Cultural and Creative Industries Contribution to Cultural and Creative Tourism in Europe
- REFRESH - Rural Revitalisation For cultural hEritage
- Inno-Hun (H2020): Providing services under Horizon 2020 enhancing the innovation management capacity of Hungarian SMEs within the framework of the Enterprise Europe Network
- Career4.0 (Erasmus+): The impact of digitization on the development of operational competence

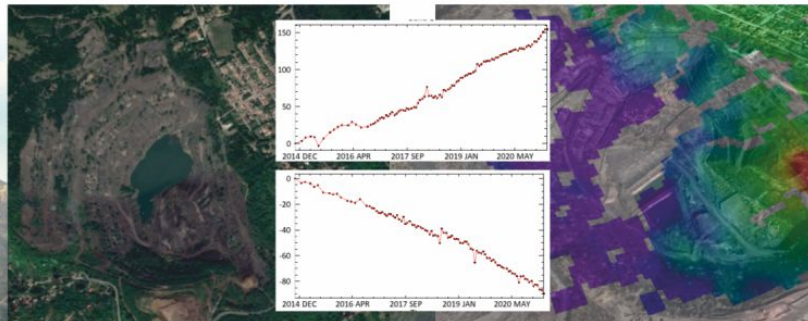




**DATelite Informatics Ltd.** was established in 2017 as an official spin-off company of University of Pécs, Hungary. The company formulation was a result a long research cooperation of senior researchers from various field of STEM and an important international partner of the University, sarmap SA from Switzerland. After several successful research projects on field of remote sensing, image processing and HPC University of Pécs accepted the know-how portfolio of the researchers, and know-how utilization contract was signed between the University and the company. The core members of the company have led various national and international scientific research and development projects for more than two decades.

#### InSAR technology based industrial solutions:

- Critical Infrastructure monitoring,
- Tailing dam monitoring,
- Tunneling monitoring,
- Large area surface deformation monitoring,
- Landslide detection,
- Oil, Gas and Water reservoir management,
- Mining site stability assessment,
- Structural assessment, civil engineering,
- Geohazard detection,
- Geothermal sites stability report



#### Datelite Ltd.



**Dr. Levente Ronczyk**



[www.datelite.hu](http://www.datelite.hu)



[datelite@datelite.hu](mailto:datelite@datelite.hu)



**+36 20 481 1458**



**Fekete str. 22.  
Pécs H-7635**

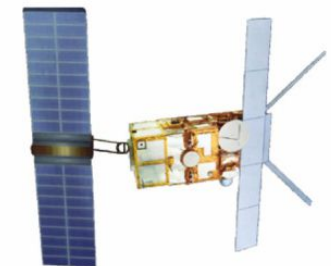
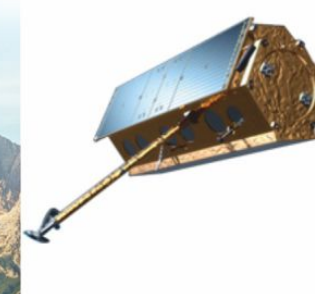
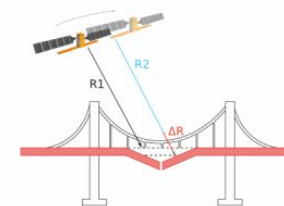
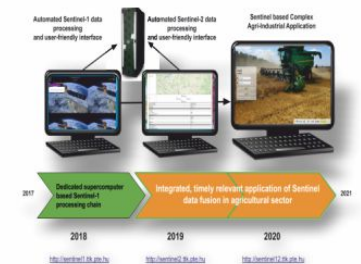


#### Other Capacities:

Land cover and land use change detection,  
GIS-based solutions,  
Complex data structure analysis,  
Customized algorithm development,  
High Performance Computing / Parallel processing  
System development (C/C++/ DevOps),

#### Reference Clients:

ESA-European Space Agency,  
sarmap SA, Switzerland  
Mining and Geological Survey of Hungary,  
University of Debrecen, Hungary  
Envirosense Ltd. Hungary







## FIELDS OF ACTIVITY

- Radiometric survey and monitoring (baseline survey, impact assessment, planning, execution, evaluation, reporting)
- Field Uranium exploration using complex geophysical, geochemical and radiometric methods
- Hydrocarbon exploration using field radiometric (emanation, gamma spectrometric) methods, geochemical sampling and analyses, integrated interpretation of results
- Uranium mine remediation (environmental impact assessment, monitoring, radioprotection, dosimetry)
- High grade education and training in radiological impact assessment, field radiometric methods, monitoring, radioprotection, Uranium mine remediation topics.

## REFERENCES

- Uranium exploration reports carried out in W-Mecsek mountains (Hungary), using and developing complex radiometric methods
- Development and operation of portable radon monitors
- Hydrocarbon exploration reports carried out in South-Transdanubia basin using complex field radiometric and geochemical methods (on behalf of MOL Co.)
- Baseline radiometric survey reports for decommissioning and remediation of abandoned Uranium mining and ore processing sites
- Environmental impact reporting of long-term monitoring system operated in abandoned and remediated Uranium mining area
- Radiological impact assessment for environmental licensing of new Uranium mine
- Professional training in nuclear environment protection specialization in Pécs University and in IAEA training courses.



**Dr. András  
Várhegyi  
Individual  
Consultant**



**Dr. András Várhegyi**



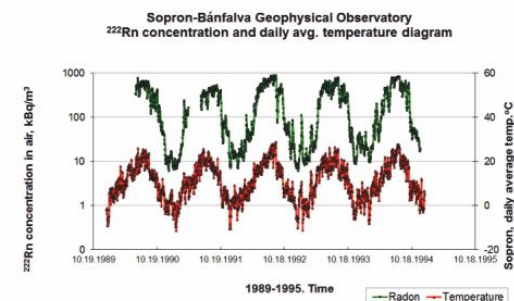
**varhegyi.andras@bvh.hu**



**+36 30 560 6067  
+36 72 252 417**



**Rozmaring str. 17.  
Pécs H-7634**







## ABOUT THE COMPANY

**KVA Consulting Ltd.** is a management consulting firm providing services for companies starting or developing geoscience related businesses in Hungary and abroad.

## DELIVERING THE BEST PERFORMANCE

Having expert knowledge of the Hungarian business environment, investment market and the ability to supply our clients with market intelligence give our clients competitive edge. KVA Consulting Ltd is a member of the Cluster of Applied Earth Sciences (CAPES) and offers the cluster's scientific and entrepreneurial knowledge to its clients. Time to time we team up with international experts to deliver the best performance in special fields too. KVA Consulting Ltd participates in the GeoEnergy Europe metacluster led by Pole Avenia.

## KVA CONSULTING LTD. OFFERS THE FOLLOWING SERVICES:

- Project management consultancy
- Location consultancy
- Trade representation
- Marketing consultancy

## OUR APPROACH

To fulfill our mission we offer trusted sources of information, motivated professional experts, extensive network of business and administrative contacts.



## Dr. Ödön Király Individual Consultant



**Dr. Ödön Király**



[www.capes.hu](http://www.capes.hu)



[kva@capes.hu](mailto:kva@capes.hu)



**+36 20 546 6739**



**Törökvész lejtő 6/h  
Budapest H-1026**



## PARTNERS

**KVA Consulting Ltd** is a founder member of **CAPES (Cluster of Applied Earth Sciences)** and an active team member of **GeoEnergy Europe** project, partnership and metacluster.

## CONTACT US

For more information please contact us.







**Eco-Cortex Ltd** has been working for regional development since 1998. We are not doing scientific work, but we are preparing, for the local university, the Economic Chamber of the county, the local authorities analyses, strategies and development materials which can be directly used for local politics, help developing the region's economy and society, and the preservation and economic exploitation of environmental, cultural values.

We provide development assistance for the business sector through analysis, market research, the generation and development of projects to develop, the preparation of proposals for the expansion of financial resources and Project Management. We are currently developing a virtual incubator to increase the number of corporate relations in business development, especially in the field of innovation and e-commerce, and Economic development impact.

We also play an intermediary role in a number of international relations, primarily in the preparation and implementation of joint tenders and developments. We have a great experience in achieving a network of experts and coordinating its work, achieving professional outcomes reflecting integrated knowledge. This is particularly important for us, as we are able to achieve significant intellectual outputs in a wide range of professional and sectoral spectrum, despite our small numbers (capacity varying between 10-20 persons threw 20 years.). This is the role of our company's professional and business reliability, and the image that we can use to mobilise a wide and highly professional network of experts.

The majority of the company's employees are able to use English as a working language, and some people are high-level in German. International tenders and studies are made in English and the working language is also the English course of implementation.

Our characteristics are summarily: versatility, flexibility, High Professional need, complexity, Strategic system approach

#### CHARACTERISTICS OF THE MOST TYPICAL WORKSPACE

##### Territorial Development, urban development

- Urban development concepts and strategies
- Development of project plans and operational development documents
- Development of project funding proposals, studies and projects to win the European Union and Hungarian national and foreign development Funds
- Project management of projects

##### Business Development, tourism development

- Project generation, project development
- Feasibility Study



#### Eco-Cortex Ltd.



**Dóra Agócs  
Dr. István Göndöcs**



**www.ecocortex.hu**



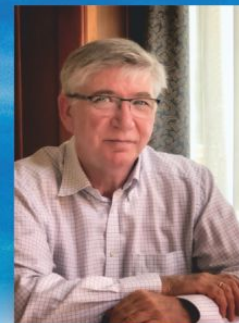
**info@ecocortex.hu**



**+36 72 511 010  
+36 72 511 011**



**Dohány str. 7.  
Pécs H-7624**



- Site development, finding an optimal location for project implementation and infrastructure preparation
- Financing proposals, drawing up loan applications
- Tendering and selection Contractors, suppliers
- Project management
- Partner finding
- Market research, development of marketing strategy
- Electronic Commerce Introduction
- Strategic Consulting

#### Design, manufacture and distribution of creative wooden products "Woodspot":

We intend to increase the merits of the development consultancy activity for SMES by introducing and developing a new product group in the international e-commerce sphere on the European market.

#### CAPACITIES:

Human resources: 10 people, of which tertiary education: 10  
Office: 150m<sup>2</sup>

#### SOME REFERENCES:

- Participation in the elaboration of a regional innovation strategy, developing an Regional education Strategy.
- Development of the Urban strategy papers of PÉCS, Regional Centre European Green Capital Award application.
- European Capital of Culture Award application - strategic base Elaboration (Székesfehérvár).
- Urban rehabilitation applications and project management of developments (Siklós, Villány, Szigetvár, Érd, Sarbogárd, etc.).

#### ECONOMIC DEVELOPMENT

- "REFRESH" – an international Creative Industry Project- Elaboration of a transnational strategy for the participating regions of 5 Countries
- Involvement in the creation of industrial parks, incubators (Siklós, Sarbogárd)
- Development of complex territorial tourism development and Management (Siklós – Mohács)
- Feasibility study of Resort hotel complex and other hotels (Siklós, Szigetvár)
- Wood Development Contest (MOHACS)
- Application and management of agricultural technological developments (Villány, Vajszló)







#### ABOUT THE COMPANY

GEOCHEM Ltd. is an innovation driven company having a high-technology equipped petrophysical laboratory, special knowledge and ideas, significant innovation and development potential.

Main performance of the company is research and development in the fields of geology, like hydrocarbon and raw material exploration, geothermal energy research, radioactive and hazardous waste disposal, water research and environmental protection. Its main objective is to integrate the results of basic research into industrial practice. The company focuses primarily on special instruments and continuous equipment improvements with the complex investigation of very tight and unconsolidated materials. Services are cost effective, internationally competitive and acknowledged Europe wide for their high standards.

#### SERVICES

Our measurement and development services are especially demanded in the fields of geology, but the accumulated knowledge and the organisation's measurement capability, supported by the available instrument park are extending this workfield by material research and analysis, construction industry, archeological geology and automotive industry.

The basis of our services is the well-equipped, one-of-a-kind laboratory in Central-Europe – where we can perform a wide range of measurements and evaluations. Our professional group offers reliable solutions in choosing the right equipment for work, in applying for tenders and managing them (project organization, financial controlling).

#### SOME OF OUR SPECIALITIES

- Development of customized, case-specific solutions.
- SMARTLAB project conception: the SmartLab guarantees time-saving, cost effective solutions for clients by combining on-the-spot measurements made by local technicians in a portable container lab that is placed on the field, ideally anywhere where it is needed and can provide almost immediate detailed analysis via internet connection. The training and service is supported by VR/AR tools.
- Software development for enhanced interpretations (laboratory information management system, acoustic velocity, permeability, grain size analysis, electric properties, etc.).
- The realization of the Smartlab concept is in continuous progress. One of the prototypes, the Smart Reservoir Laboratory SRL-A1000 acoustic instrument is now available on the market, also the SRL-P1000 permeameter has entered the testing phase.

#### EQUIPMENTS & MEASUREMENTS

- Sample preparation: cutting, drilling, end-facing, embedding, cleaning, drying, 3D scanning
- Pore characterization: Hg-porosimetry, gas and vapour physisorption, He-pycnometry
- Routine and advanced rock properties: HPHT acoustic and electric measurements, gas and water permeametry up to pycoDarcy range
- Grain characterization: laser granulometry, particle size and shape analysis, sieving
- Drilling and Stimulation properties: formation damage evaluation, fracture and proppant conductivity, return permeability, mud and gel viscosity



**GEOCHEM**  
Presízely.

**GEOCHEM Ltd.**



**Dr. Ferenc Fedor**



**www.geochem-ltd.eu**



**geochem@geochem-ltd.eu**



**+36 30 689 3103**



**Viola str. 55/1  
Kozármisleny H-7761**

**Lot.no: 0222/35**

**Kövágószőlős H-7673**



**Geochem Geological and  
Environmental Research,  
Consultancy and Service Ltd.**



#### SALES & MAINTENANCE

We are the Hungarian dealer and service partner for Gold App, Winner and Occhio, and we also distribute equipment of our own design. Our portfolio is continuously growing. Actual partners can be found on our website.

**GEOCHEM**



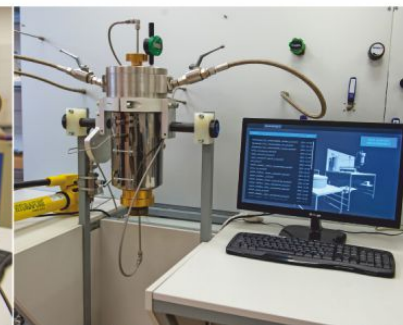
#### R&D ACTIVITY

Our company has participated in many R&D projects as a project manager, partner or subcontractor. The excellence of our colleagues allows us to successfully perform instrument development, method development and related software development tasks related to applied earth sciences.

#### MAIN REFERENCES



**GEOCHEM Nonprofit Ltd.** is a subsidiary of GEOCHEM Ltd., responsible for participating in educational and research projects, and EU projects where the role of knowledge transfer is important and where profitable companies are disadvantaged. RuGeoHeat was such an example, where we collaborated with Croatian and Slovenian partners in the field of shallow geothermal. In the future, the organization will concentrate on postgraduate education in geosciences (preparation and holding of short courses, laboratory exercises).







**GeoEko Ltd.** (together with its legal predecessor) has been doing geological research for more than twenty years. We deal with all areas of classic geological mapping, after the preparation of the research plan, the preparation of the survey, the collection and systematization of archive data, the evaluation of the old maps and aerial images, we perform the field surveying to record their conditions. Rocks are sampled for laboratory testing. In order to clarify the underground spread of the formations and their relation to each other, artificial excavations, shafts, ditches, drills are planned, their materials processed and used to prepare complex documentation for the area.

**The result of the mapping is a geological map of a given scale, documentation containing basic data, and characterization of geological formations occurring in the mapped area.**

In the processing of artificial excavations, the examination of the core material of the deep boreholes has a special place. During the processing of these, GeoEko Ltd. supplements the separation and detailed macroscopic description of each layer with systematic sampling, and prepares documentation of drilling, including the results of the tests performed on the samples.



**GeoEko Ltd.**



**Dr. Géza Chikán**



**@chikangezalehel@gmail.com**



**+36 1 400 1589**



**Gesztenye str. 11. gf.1.  
Budapest H-1164**



**The activities described above were used by the Company and its predecessor (among others) in the following research work:**

- Site research on the disposal of low and intermediate level radioactive waste (Üveghuta)
- Geological survey of the radioactive "cemetery" environment for research purposes (Püspökszilág)
- Geological foundation of high activity radioactive waste disposal research (Boda)
- Geological mapping of the planned nuclear power plant site (Paks)







GEOGOLD KÁRPÁTIA Ltd. provides services in geological, hydrogeological and environmental projects and has gained extensive experience in the field of near-surface geophysical surveys and water research. As the legal successor of GeoGold 2002 LP, founded in 2002, the company started its activities in 2005 with highly experienced geologists and geophysicists.

We have developed excellent relationships with Hungarian universities educating Geological and Geophysical courses; some of their most respected experts are regularly involved in our projects.

**“We are proud to have Dr. Imre Müller as our most experienced member of the team, with his professional knowledge and commitment of science. He has been supporting and helping the long-term plans of GeoGold Kárpátia Ltd.”**

The company name suggests that from the very beginning we have tried to work not only in Hungary but also in the neighbouring countries. We have been involved in the preparation and implementation of a number of EU-funded groundwater research projects. Currently, beyond the borders of the Carpathian Basin with the support of the Hungarian Ministry of Foreign Affairs and Trade, we have been carrying out a drinking water research project in Arusha Region (Northern Tanzania), Italy and in the Balkan Region (Albania, Bosnia and Herzegovina, Serbia, Romania).

In the implementation of water research and engineering related geophysical assignments, we are utilizing the latest technologies and this approach is what distinguishes us from our competitors.

#### Other services

##### Hydrological expertise

- Planning and realization of hydrogeological measurements such as interference assessments, pumping tests
- Preparation of transport and heat transport models for remediation projects and heat pump systems



#### GeoGold Kárpátia Ltd.



**Antal Serfőző**



**www.geogold.eu**



**info@geogold.eu**



**+36 20 940 1923**



**Mátyás Király str. 59**

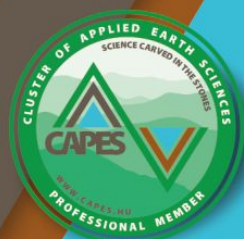
**Kaba H-4183**

**Pongrács str. 9/b**

**Budapest H-1101**



**GeoGold Kárpátia Kft.**



- Identification of polluting sources, water quality investigations
- Long-term (online/offline) monitoring
- Protection plans of vulnerable water resources
- Thermal water exploration
- Tracer tests in fractured karstic areas

#### Licenses of water rights

Designing and permitting of irrigation-, monitoring-, industrial water wells and geothermal heating systems' well

#### Instrument development

Development of geoelectric, electromagnetic instruments and monitoring systems

#### Digitization of logging profiles

Digitization and petrophysical re-evaluation of old paper-based borehole geophysical logs in modern software

#### Dynamic teamwork

Fast positioning/situation awareness and innovative technical solutions of field work and in data processing.

#### Reliability

We offer professionally justified services.

#### Flexible Communication

Building the way of interactive relationship/communication with our clients.

#### Professional skills

Our company has more than 15 years of professional experience







## SHALLOW ENGINEERING GEOPHYSICAL AND UPSTREAM PETROLEUM GEOSERVICES SINCE 1992

**Geomega Ltd** is a Budapest-based geological-geophysical service company, providing wide range of quality services in the field of shallow engineering geophysics as well as of subsurface- and hydrocarbon exploration. The largest value of our company is considered to be the intellectual capital of our highly qualified employees as well as our unmatched geophysical instrumentation.

### UNMATCHED COMBINATION OF GEOPHYSICAL INSTRUMENTS

- Electromagnetic equipments at various frequencies for fast near-surface anomaly detection
- Land and unique submersible GPR technology
- Multielectrode geoelectric instrument for land and shallow fresh water applications
- Magnetic instrument for archeological applications and buried object detection
- Wireless seismic acquisition system
- Proprietary 3-component land-streamer technology for effective seismic acquisition
- P and S-wave mini vibro seismic source
- Ultrahigh resolution single-channel water seismic instrument
- Software solutions for geophysical data inversion, seismic reflection-, refraction- and tomographic as well as state-of-the-art seismic surface wave processing

### FOR MORE THAN 25 YEARS ...

... we have been present in the Hungarian and international geophysical market. During our hundreds of domestic and foreign projects we have solved many geological problems being key to the engineering design.

For example, determination of the tunnel path of Metroline 4 below the River Danube, geological investigations of the Paks Nuclear Power Plant, surveying of shipping routes on major European rivers and investigation of sedimentation of a mine pit in the Dominican Republic.

### WIDE RANGE OF SERVICES, INTEGRATED METHODS

Our main services include the implementation of engineering and shallow geophysical measurements as well as various subsurface geological exploration activities. With the help of our



**Geomega Ltd.**



**Dr. Tamás Tóth**



**www.geomega.hu**



**info@geomega.hu**



**+36 30 931 0272  
+36 1 455 0877**



**Zsil str. 1. 2nd floor  
Budapest H-1094**



**Geomega Ltd**



instrument park we can offer effective solution for many engineering-geophysical and geological problems:

- surveying of pipeline crossings below rivers
- riverbed and wreck surveying
- mud thickness and other riverbed anomalies
- detection of buried objects (i.e. hazardous waste)
- flood protection and embankment surveying
- archeological-geophysical investigations
- agrogeophysical surveyings, water-table detection
- surveying and condition of concrete structures
- geological investigation and interpretation below special constructions (power plants, dams)
- geotechnical surveying
- determination of soil mechanical parameters
- cavity, -drain-, pipeline and cable investigations
- surveying of road condition
- delineation of soil contaminations
- geothermal exploration
- drilling of shallow boreholes
- environmental and geological exploration supporting remediation works
- water reserve exploration

### OUR PHILOSOPHY

... persuade yourself before persuading the Client!







### About the company

GEORT Ltd. gives professional support to designers, contractors and investors to achieve their geothermal goals. We provide planning and design services for buildings that are using geothermal heat pump systems. Our planning is based on our Thermal Response Test (TRT) which we do since the beginning of the shallow geothermal industry in Central Europe. The main aim of our services is to optimize the BHE field, ensuring that we are able to achieve a cost-effective investment with low maintenance costs and long term operational reliability.

### Services

**Thermal Response Test:** Our company carries out the required measurements with the most up-to-date testing device developed by a group of geologists and engineers as a result of 20 years of research. The testing device determines the borehole thermal resistance, the thermal conductivity and the initial temperature of the ground. These key parameters are needed to accurately design a borehole heat exchanger field. We have done near 300 TRTs since 2010 which makes us a leading company in this industry in the Central European region.

**Borehole heat exchanger (BHE) field design:** By using the Earth Energy Designer (EED) software we are able to simulate the behaviour of a given borehole heat exchanger field depending on various input parameters, thus we are able to optimize the BHE field.

**Authorization:** For drilling geothermal probes it is obligatory to obtain the necessary permits from the mining authorities. Since 2010 our company has done the authorization of more than 400 projects.

**Design:** We base our borehole heat exchanger field design on the result of the TRT. If there is no TRT, we collect TRT data from the vicinity of the project from our database. Our planning documentation contains the borehole distribution plan which is harmonized with the landscape architect plans and with the public utility plans. Our planning documentation also contains the technical description and the unpriced budget estimation. To ease the cooperation with other work process and to help the execution we often use 3D planning.



**Geort Ltd.**



**Iván Németh**



**www.geort.hu**



**nemeth@geort.hu**



**+36 30 234 3749  
+36 72 535 282**



**Szépilona u. 4.  
Budapest H-1029**



**GEORT**



### Product

GEORT Mix Premium: GEORT Mix Premium is our high thermal conductivity grouting material. When drilling geothermal probes it is necessary to surround the probes with high thermal conductivity grouting material because like this we can enhance the thermal exchange between the heating-cooling system and the geological surround. Using GEORT Mix Premium as a grouting material is an obvious and easy way to enhance the efficiency of the system.

### References:

Main TRT references:

- MOL, Kopaszi-gát
- ALFA Ha11er residential park
- Waterfront city residential park
- Súlysáp, EBM Papst
- Maklár, Bosch
- Kufstein, Josef Fuchs GmbH
- Belgrád, Rehau Serbia
- Leogang, Sinvelop Erwärmer GmbH

Main design references:

- Soroksár, IKEA
- Testvérhely residential park
- Budaörs, hangár
- Fertő part multifunctional park
- Nagykovácsi family house
- ALFA Ha11er residential park
- Seibersdorf, permanent building
- Balatonföldvár, Mayor's office







## GEOVÍZ – Geothermal and Water well drilling

### About us

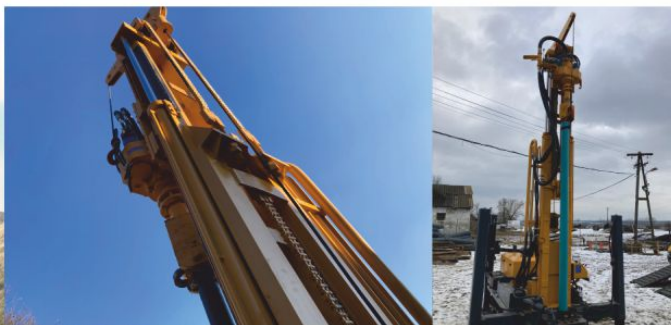
Our company specialized in drilling water wells and shallow geothermal boreholes for ground source heat pumps. We utilize the most up-to-date drilling tools, and techniques to satisfy the customer's needs and to be able to drill in the most versatile geological conditions. The utilization of renewable energy sources is important for us, as well as the management of the fresh water resources in the world of an ever-growing water demand. We have all the necessary qualifications and skills for the drilling, completion and development of water wells. The company's seat is located in the city of Kaposvár, while the company's premise is in the vicinity of Kaposvár, at Somogyjád.

### Working method

To drill our wells and ground source heat pumps we use the best materials available in Hungary, like qualified PVC-U well casing, fine-grained, well-rounded silica packing material and degradable polymer mud additives, which are completely environment friendly. The aim of our work is to create quality products with the best of our knowledge and experience, using the right materials for the job.

### Design of water wells

With the aid of our professional business partner in the field of well design, we can provide you not only the construction, but also the complete process of well design and authorization.



**Geovíz Ltd.**



**Máté Farkas**



**www.geoviz.hu**



**info@geoviz.hu**



**+36 30 458 9053**



**Nyár str. 133  
Kaposvár H-7400**



### Equipment

Our drilling rig is a self-propelled crawler-mounted, hydraulically controlled unit, which is able to drill up to 180 m depth with diameter from 5" (127 mm) to 12" (305 mm). We are working with wide range of drill bits; roller cone bits, polycrystalline diamond bits (PDC), chevron type drag bits and claw bits to ensure the most efficient rate of penetration in the encountered geological formation. Our underreamer tool is actuated by air or mud pressure, and it is able to enlarge the hole below casing by the positive displacement of carbide blades. We use heavy duty drilling equipment, like screw air compressor and triplex piston mud pump for the success of each drilling operation.

### Drillingservices

- industrial water wells
- irrigation well drilling for agricultural purposes
- shallow monitoring wells
- drinking water wells
- hydrogeological wells
- dewatering wells
- boreholes for ground source heat pumps

### Drilling methods

- dry auger drilling
- mud rotary drilling
- air rotary drilling







## Company

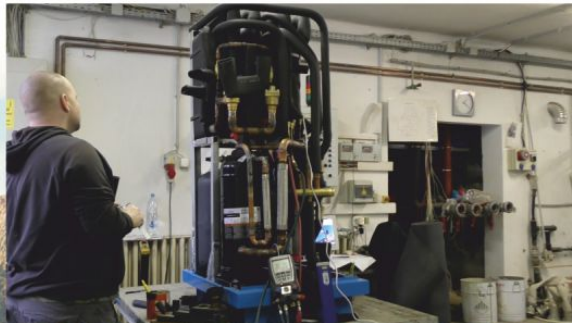
Geowatt has a history of several years. It was founded in 1991 as a family business. The name of the company includes the goal we are actually dealing with. Our main activity between 1991 and 2001 was the trade, construction and design of the assembly, and then in 2001 we believed that the time had come to set a new strategic goal – to realize the utilization of geothermal energy with a heat pump. The fact that there was no precedent in Hungary, and thus no legal regulation, was a serious obstacle.

Within a year, we managed to achieve an amendment to the law, and based on this, in 2002, the Mining Act made it possible to authorize closed probe systems. By 2007, we had designed and installed about 100 heat pump systems. We gained a lot of useful knowledge about both technique and technology.

However, we were not completely satisfied with the results with the efficiency of the systems, which is why we started the theoretical preparation for the development of our own developed heat pump family, with which we can achieve a higher value of SCOP. Our goal is to implement the production of heat pumps in Hungary.

In 2008-2009, the Vaporline heat pump family was developed through a tender. Three-dimensional plans, electrical system plans, and software were developed. The aim of the improvements is to maximize efficiency at a given technical level and at competitive prices. The oscillation of the output heating power at the constant liquid-water temperature level has been eliminated.

– Focus on task-optimized, multifunctional heat pumps that increase the utilization of heat pumps and improve the available SCOP, EER value.



**GEOWATT**

**Geowatt Ltd.**



**Rozália Hoffmann**



**www.geowatt.hu**



**geowatt@geowatt.hu**



**+36 20 454 5607**



**Kén str. 6.  
Budapest H-1097**



Geowatt has been designing and building heat pumps for nearly 20 years, and has been developing and manufacturing heat pumps for the past 10 years. We have gathered a lot of design experience and information, which we try to publish in articles and in various publications. To design a good heat pump system only with a system approach, creating the coherence of the systems

In 2016, for the first time, the Professional Committee awarded the Vaporline® brand (EU trademark) products of Geowatt Kft. In three categories. These three categories, in turn, are the excellent consumer, business, and innovative brand categories. The award was made on the basis of numerical criteria. This result is also confirmed by the results of a national survey conducted by the GfK Market Research Institute. Based on the decision of the Technical Committee, Geowatt Vaporline is considered an excellent TOP brand in Hungarian business.

Our main strength is that we produce and sell our high quality products in a favorable value for money. Our commitment to the environment is demonstrated by the fact that we manufacture heat pumps by protecting the environment and involving renewable energies and environmentally friendly technologies.

## References

<https://geowatt.hu/en/references/institutional-industrial-references/>







## INNOTEQ - THE EXCITEMENT OF DISCOVERY INNOVATIVE - TECHNOLOGY - EXCELLENT - QUALITY

We give you more than just an IT solution!

Our visualization solutions make the discovery of digital collections, museum exhibitions, archive documents and maps a thrilling adventure. With the possibilities of GIS and Augmented Reality new dimensions are opened in content presentation. The company has many years of experience in innovation.

Not only do our customers expect solutions to their problems, but they want to enjoy every moment of their work. Not only do they want to see the final result, but also the way to it. When we start a new task, we always keep this in mind. We are not afraid of new ways either, but we are also trying to find the place of old values as well. We enhance our applications with innovative solutions, a routine solution is never enough. We offer you excitement, the excitement of discovery.

### OUR SOLUTIONS:

#### AUGMENTED REALITY

With our mobile phone and tablet solutions, multimedia and 3D contents are added to real-world objects. (Exhibition guides, textbooks, advertisements, user manuals, etc.)

#### INNOVATIVE MULTIMEDIA SOLUTIONS

Our DiViT System provides a spectacular display of exhibit content on multimedia terminals or mobile devices.



**Innoteq Ltd.**



**Péter Rendes  
László Bíró**



**www.innoteq.hu**



**info@innoteq.hu**



**+36 72 769 102**



**Király str. 66.  
Pécs H-7626**



#### GIS AND 3D DEVELOPMENT

Autodesk, Esri, Mapinfo, MAPserver. We adapt our GIS solutions to the needs of our customers. Our applications open up new possibilities for discovering digital maps. VIRTUAL REALITY

We offer a wide range of spectacular solutions for creating a themed website, presenting collections on the web, and web 2 community solutions.

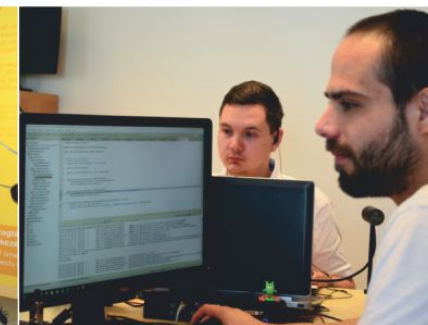
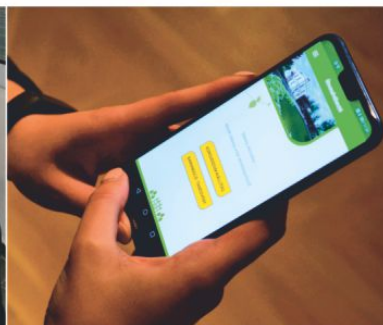
#### MOBILE APPLICATIONS

Pocket our solutions! Take and use our applications optimized for mobile environments anywhere you go!

#### CUSTOM SOFTWARE DEVELOPMENT

Mapping and analyzing business processes, building new systems, optimizing and upgrading existing IT systems to meet the specific needs of our customers.

#### MAIN PARTNERS:







**Karotázs**  
MEASUREMENT  
& INNOVATION

**Karotázs Ltd.**

**Ferenc Henézi**

**www.karotazs.hu**

**posta@karotazs.hu**

**+36 20 937 2905**

**Kővirág str. 39.  
Pécs H-7634**



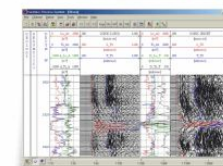
measurement (EIT), impedance spectrum measurement (EIS). With the measurement system it is possible to measure in two points with multiple frequencies or at a constant frequency in many points.

### MEASUREMENT

We undertake to equip our partners with the required equipment on demand, to train the measurements, to service them, to repair them, and to carry out joint research and development on demand.

### INNOVATION RESEARCH DEVELOPEMENT (GINOP PROJECT)

- PCKarotazs (deep drilling-geophysical) surface unit development for different types of measurements, probes, in IP64 design also.
- For measuring electrical impedance (EI, EIT, EIS) in time and frequency range.
- For time-critical and non-time critical measurements, flexible addressable multiplexer enhancements.
- Development of EI spectrum and tomography units in the frequency domain for different types of application development.
- Prototype development for high frequency porosity measurements.
- Marketing activity.



### ABOUT THE COMPANY

During the last 25 years, **KAROTÁZS Ltd.** has achieved an important role in the practice of Hungarian borehole and well-logging metrology. Beside the daily routine work we have developed new measuring equipments and techniques. The R&D activity is a still running program in the life of our Ltd. Our developed products can be purchased from the Ltd. In case of special needs, we undertake them to modify our technologies for able to be applied in solving various problems.

Since the establishment, we have been taking part in several well-logging, geophysical and well testing works, like projekt preparing the disposal of high level radioactive waste at Boda Claystone formation, projects in the disposal of low- and intermediate-level radioactive waste in Bataapáti, works involving mine closure well testing, water and environmental protection measurements in Hungary and in the neighbouring countries.

### SERVICES

- Our field of activity is mainly well-logging, drilling geophysics and well testing.
- Our services: Well-logging for well construction, condition assessments, dynamic well testing
- Borehole logging for mineralogical purposes, geological prospecting, water and environmental protection measurements.

### PRODUCTS

- Complex installation of well-logging equipment!
- Surface Unit: PCKarotazs - Complete well logging data acquisition system.
- PCKarotazs equipment is a universal, PC-based surface recording unit, which was constructed using exclusively own developments. The measuring and processing software is also self-created.
- Karotazs winches: Electric motor driven winch with 300-600-1100-2100 m 3/16" (4.76mm) diameter 4 core armoured cable. Cable speed 0-40m/minute. Winch is supplied with collector, depth decoder for depth measuring and well site wheel too.
- Karotazs probe: Well - logging for well construction, condition assessments, dynamic well testing, Borehole logging for mineralogical purposes, geological prospecting, water research, environmental protection measurements.
- EITS: The potential applications of the system: FFT spectrum measurement, impedance







#### LOGFRAME CONSULTING OFFICE

Project development and project management – from idea to implementation

#### ABOUT US

**Logframe Consulting Office** was founded in 2007. The company has outstanding international experience, its main field of activity is project development and full-scale project management. Our colleagues are all university graduates who have been involved in regional development for two decades, while becoming familiar with both sides of the funding system. This experience is a great advantage when it comes to thinking with the head of the funding authorities and of goals at macro level. In addition, through previous work experience, we have built up a wide network of contacts, both among municipalities and businesses as well as policy makers.

#### PHILOSOPHY

Philosophy of the company is to provide our clients with full-scale services, our activities reach well beyond elaboration of project applications. On one hand we actively contribute to preparation of development programmes and projects, on the other hand we strive to assist our clients in common thinking about project elaboration and elaboration.

Based on our two-decade experience, we can find the appropriate answers to unexpected situations and problems raised during project implementation.

Other main cornerstone of our philosophy is based upon the Logframe matrix indicated in the name of our company: we seek for defining logically structured project elements both in terms of contents and time schedule, and we also put high emphasis on defining project outputs contributing to expected immediate results and long-term impacts. This is very a important aspect for the success of project applications as grantors always search for the fulfilment of their pre-defined objectives in the submitted project proposals – these programme-level objectives should be brought in line with the interests of the applicants.

#### QUALITY MANAGEMENT

**Logframe Consulting Office** has MSZ EN ISO 9001:2009 and MSZ EN ISO 14001:2005 certificates dated from 2013, ensuring the quality-based and environmental-conscious operation.

We pay high emphasis on complying with the rules of sustainable development and environmental protection regulations. Our employees all have strong environmental consciousness contributing to our efficient operation which provides our clients with further advantages.



#### Logframe Ltd.



**György Márton**



**www.logframe.hu**



**logframe@logframe.hu**



**+36 72 998 228  
+36 30 491 8960**



**Anna str. 25. gf.1.  
Pécs H-7621**



**Logframe Consulting  
Office**



#### SERVICES

- Project development: definition and detailing of project elements, elaboration of efficient project management structure, professional cash-flow planning;
- Elaboration of project applications: elaboration of applications for co-financing of the European Union and domestic funding resources, free initial project eligibility check;
- Project management: full-scale project management, administrative and financial assistance of project implementation;
- Project crisis management: making success out of projects in hopeless situation endangered by irregularity procedure;
- Obligatory publicity and communication: carrying out tasks of obligatory publicity and communication according to pre-defined rules;
- Programming: two-decade experience in elaboration of regional development concepts, strategic and operational programmes;
- International project development: professional preparation and implementation of EU co-financed projects based on international cooperation, experience in cross-border and transnational project development and management co-financed by EU Interreg programmes.

#### MAIN REFERENCES

##### Projects:

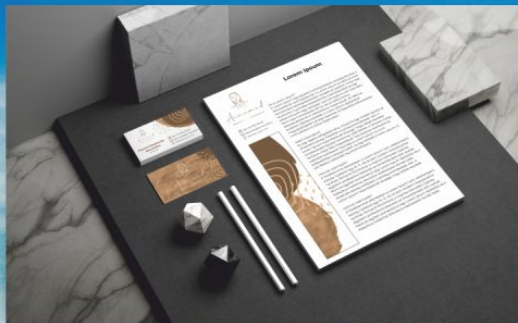
- Development of technology of sustainable and cost-effective thermal water reinjection wells", co-financed by ERDF funds of European Union with a total budget exceeding EUR 8 million, preparation of project proposal in collaboration with project experts, full-scale management of the project;
- Mitigation of structural uncertainty of geological research projects with energy exploitation purpose on the basis of validating geological model of Southern slope of Mecsek hills", co-financed by ERDF funds of European Union with a total budget exceeding EUR 5.5 million, preparation of project proposal in collaboration with project experts, full-scale management of the project;
- Preparation and management of various energy efficient and renewable energy-oriented EU projects in South Transdanubian region of Hungary.

##### Programmes:

- Active participation in conceiving South Transdanubian Operation Programme co-financed by the European Union, elaboration of regional and sub-regional strategic documents;
- Key expert participation in elaboration of Interreg V-A Hungary-Croatia Cooperation Programme.







**Mpix** Photo, Video, Graphics and Wheeled Photography is a young dynamic team based in Pécs who have been involved in Photography, Video and Graphic Materials for many years. Our main goal is to perform all the ordered work in the best and most professional quality and attitude, taking into account the needs of the customer.

#### Our activities:

- Event photography and video recording
- Weddings
- Corporate events
- Music and other festivals
- Model and portfolio photography
- Creating an image, advertising, and promotional videos
- Taking educational and informational photos and videos
- Making drone recordings
- Post-editing of image and moving materials
- Design and editing of publications
- Creating a business image
- Logo, business card design
- Flyer, poster editing
- Design of decorative elements and stickers
- If required, we can also help with printing work.



**MPIX**



**Márton Györfi**



[facebook.com/mpixfotovideografika](https://facebook.com/mpixfotovideografika)



[gyorfimarton77@gmail.com](mailto:gyorfimarton77@gmail.com)



**+36 20 443 0654**



**Perczel M. str 12. 1/3  
Pécs H-7621**



Over the years, we have attended countless events and have had many satisfied customers and many are still returning customers to this day. Our works can be found in various parts and sectors of the country. We have already worked for universities, public institutions, Hungarian and foreign musicians, orchestras, various festivals, restaurants and other service units and many different companies.



Péter Kerekes  
+36308271511  
[info@kerekeshoto.hu](mailto:info@kerekeshoto.hu)  
Peter Baumgartner  
+36307194392  
[info@kerekeshoto.hu](mailto:info@kerekeshoto.hu)  
7625 Pécs, Vincze utca 9/2.







**MS Energy** exists since 2007 and is a dynamically developing innovation company that develops technological innovations primarily in the field of earth sciences. It provides permanent engineering services to hydrocarbon companies in Central and Eastern Europe and plays an active role in professional support for geothermal investments in the region.

The special professional base of the company consists of earth science and energy specialists, as well as reservoir engineers and drilling specialists. The professional activity is complemented by economic and project management competencies related to the projects.

The company has been operating successfully in the hydrocarbon industry since the beginning and is also of a high professional standard as a result of its services related to large geothermal investments.

#### OUR SERVICES:

##### GEOTHERMAL FROMATOZ:

Coordination of the specific fields involved in the utilisation of geothermal energy, designing and implementing systems combining geothermal energy with other renewable energy sources.

##### PROFESSIONAL GEOLOGICAL TASKS:

Performing professional tasks, including modelling, and preparing studies in the fields of geology, hydrogeology and reservoir-geology, preparing documentations be submitted to authorities with applications for authorisations and licences.

##### DEEP DRILLINGS:

Operational tasks involved in designing and implementing deep drilling projects.

##### GEOCHEMICAL ANALYSES:

Organic and inorganic geochemical investigations in connection with O&G and geothermal. Performing complex radioactivity investigations.



### MS Energy Solutions Ltd.



**Mátyás Gáti**



[www.ms-energy.org](http://www.ms-energy.org)  
[www.weheat.systems](http://www.weheat.systems)



[ms@ms-energy.org](mailto:ms@ms-energy.org)



**+36 30 230 8111**



**Petőfi Sándor str. 19.  
Eger H-3300**



**MS Energy Solutions Ltd.**



#### RESERVOIR ENGINEERING TASKS:

Provision of reservoir engineering services for hydrocarbon deposits, inert gas reservoirs and thermal reservoirs alike.

#### WASTE MANAGEMENT:

Disposing of special waste materials produced by implementing deep drilling projects and related activities, in our own depots.

#### MINE SURVEYING, PROPERTY RIGHTS:

Taking care of all administrative procedures relating to geological and energy projects.

**BACKOFFICE:** large-scale scanning, event organisation, PR tasks and the creation of marketing materials.

#### WEHEAT (WELLS FOR HEAT EXCHANGING ADVANCED TECHNOLOGY):

The WeHEAT (Wells For Heat Exchanging Advanced Technology) technology developed by MS Energy Solutions Ltd. is a deep heat producing system that can be implemented in deep wells. Its greatest advantage is that it generates geothermal energy WITHOUT extraction of underground water. It is a fully closed loop system. It allows direct heat use for users living in the vicinity of the well through the geothermal heat recovery. This technology ensures the use of geothermal energy in a cost-effective way, by utilizing not-in-use O&G and geothermal deep drills. The outstanding geothermal potential of the Carpathian-Pannonian region are like a commonplace today. The petrothermal variants of geothermal energy production can be effective similarly to the production and use of thermal energy in this region. With the special well completion of a deep drilling, the geothermal heat will become available in a clean way, and can be transferred to the surface facilities using the appropriate engineering applications. This flexible technology may constitute a heat production system with a capacity of 300 and up to 900 kW, depending on the geological environment, and can be adapted especially effectively to surface heating systems.







## ROCKSTUDY Ltd.: Science of Depth, Depth of Science

„Our working method is to deeply understand the clients' needs and solve their most critical engineering, economic, safety or authorization problems. Our mission is to perform our job on the highest available scientific level applying up-to-date technologies.”

– László Kovács, CEO

ROCKSTUDY Ltd. is specialized in performing laboratory and in situ measurements, design work and providing technical expertise related to geotechnics and rock mechanics. The company was established in 2008 with the aim of performing the geotechnical tasks arising during the construction of National Radioactive Waste Repository (L/ILW, at Bataapáti). ROCKSTUDY Ltd. carried out wide range of laboratory and in situ measurements and monitoring, geotechnical surveying and evaluation tasks at Bataapáti. Utilizing the special knowledge and experiences the scope of services has been expanded: rock mechanical tasks of siting the new Hungarian NPP and HLW repository have also been also successfully fulfilled as well as UCG, geothermal, civil engineering, oil & gas industrial and R&D projects.

ROCKSTUDY Ltd. is committed to using sustainable and environmentally friendly technologies and solutions, doing this in the highest attainable quality level. It is also demonstrated by establishing and implementing the integrated quality and environmental management system in accordance with ISO 9001:2015 and ISO 14001:2015 standards. The economic stability of our firm is proven by Dun&Bradstreet, a leading global Data & Analytics company. This indicates the financial risk of establishing business relations with us is very low.

The number of employees varies between 10 and 15, depending on the ongoing projects. The core group consists of highly educated and trained experts (e.g. mining engineers, civil and geotechnical engineers, environmental protection scientists, physicist, geophysicist, geologists, geographers, GIS specialists and mechanical technicians). The company operates three sites: the head office is located in Pécs (Southwestern part of Hungary), our well-equipped rock mechanical laboratory operates near the city and we have a special R&D site in Budapest.

## Most important references

- Geological research project for the new Hungarian nuclear power plant (Paks II)
- Rock mechanical investigations of the UCG-research project in the Eastern-Mecsek Mts.
- Rock mechanical and geotechnical investigations of NRWR at Bataapáti.



**Rockstudy Ltd.**



**László Kovács**



**www.komero.hu**



**komero@komero.hu**



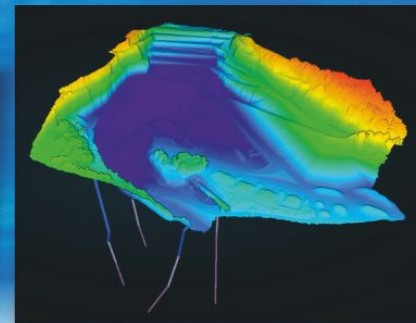
**+36 72 535 358  
+36 72 535 282**



**Esztergár L. str. 19.  
Pécs H-7633**



**rockstudy-ltd**



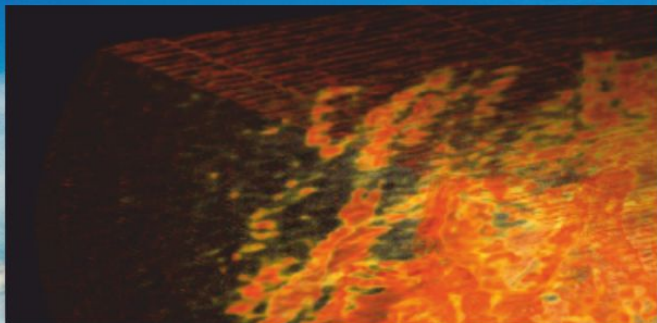
- The characterization project preparing the final disposal of Hungarian HLW and spent fuels.
- Geothermal R&D projects: development of a sustainable reinjection technology of used hot water.
- Rock mechanical investigations and development of methodologies regarding the operation of the former deep uranium and copper mines in Hungary and the possibility of reopening them.
- Inclinator monitoring measurements at the tailings pond of Oroszlány Thermal Power Plant.
- Slope stability analysis at various locations based on our own geological and geotechnical surveys and GIS methods.
- Determination of blasted rock volume based on UAV-survey and GIS methods (Tatabánya).

## Main Services

- In-situ measurements and monitoring (high-precision rock deformation measurements, virgin rock stress measurements - overcoring techniques, measuring both of loads of supporting structures and stress changes caused by tunnelling, complex THM monitoring systems, optical televiwer surveys).
- Geotechnical assessment and classification (geotechnical core logging, geotechnical classification of underground cavities and open-pit walls applying standard empirical methods - e.g.: RMR, SMR, Q, GSI, Rmi-, supporting by the creation of georeferenced photogrammetric 3D models, home-developed Advanced Survey software for the simultaneous geotechnical and geological, tectonical and hydrogeological mapping).
- Rock mechanical laboratory services (sampling, sample preparation, non-destructive tests by DRF method, standard uniaxial and triaxial strength and deformation tests on intact samples, acoustic emission measurements, shear box test, determination of failure envelope applying Multiple Failure State method, short- and long-term rheological tests).
- Consulting and engineering (slope, tunnel and cavern stability analyses, design of underground openings and supporting systems applying rock mechanical and coupled numerical modelling, data-processing, evaluation and integrated interpretation with complex geostatistical methodology, R&D tasks and software development, professional training programmes).
- GIS database building, data processing and developing (field mapping, close-range and UAV photogrammetry, 3D geometry editing, automating workflow and GIS analysis with Python scripts, designing and building spatial databases).
- MaGISter-Mine and MaGISter-Radwaste: GIS-based expert systems with uniquely developed WebGIS applications for helping the design and operation of quarries and radioactive waste disposal facility.







**TOMOGEO Ltd** and Geosoft Partnership Ltd independent private Hungarian companies were founded by Tamás Földes geologist who has 40 years professional experience in the oil and gas business and 20 years experience in development and evaluation of X-ray Computer Tomography measurements on inorganic materials.

#### KEY PERSON:

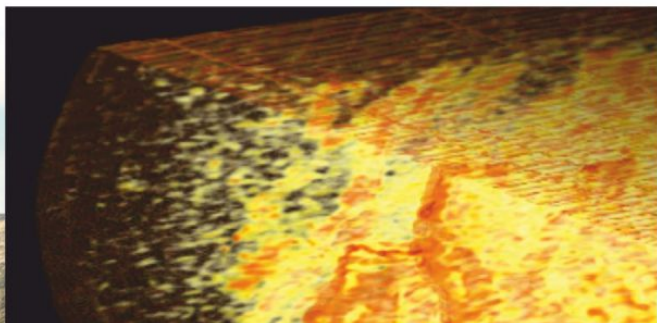
Tamás Földes graduated from the Geological Section of Natural Sciences Branch of Study of the University of Sciences „Eötvös Loránd” in 1979. He has ten years of well site, two years of exploration, four years of geological interpretation of well log analysis and eight years of reservoir modeling and production geologist experience in Hungarian Oil and Gas Company. He worked as a head of department of geological interpretation of well information including interpretations, operations, computing technology and consulting for four years. He was an award winner (co-author) of the Application of Innovation of Hungarian Academy of Sciences for the development of 3D geological visualization software in 1994. He was the winner (co-author) Norman Falcon Award (Best Poster Award of the Petroleum Division of EAGE) in Leipzig, 1998. (Csato, I, and T. Földes, Halo-kinetic structures and hydrocarbon plays – Examples from the Middle East.) He has been working on the 3D reservoir geological modeling, salt modeling, production operation and horizontal well planning of numerous oil and gas fields of Hungarian and foreign areas (Qatar, Yemen, Pakistan, Tunisia). He has an experience in geological modeling of underground gas storage for ten years. He has had a special development and has carried out scientific activity since 1998. It is the integrated interpretation and application of X-ray computer tomography measurement of reservoir geological modeling. He has been invited as a speaker in the several Hungarian universities (University of Sciences „Eötvös Loránd” University of Kaposvár and University of Pécs ) several times. He has published numerous technical papers for several EAGE and AAPG conferences. He is a member of EAGE , Hungarian Geological Society and Hungarian Geophysical Society.

#### MAIN RESEARCH INTERESTS:

Using and evaluation of X-ray computer tomography, positron emission tomography, neutron magnetic resonance measurement in rock and inorganic materials. Characterization of oil and gas fields and modeling of well surroundings and reservoir characterization.

#### PRESENT RESEARCH PROJECT ACTIVITIES:

- Evaluation and characterization of core sample material based on CT measurements by displacement test with reservoir condition.
- Characterization of rock material based on CT and microCT measurements



**TOMOGEO LTD**

**Tomogeo Ltd.**



**Tamás Földes**



**[www.researchgate.net/  
profile/Tamas\\_Foeldes](http://www.researchgate.net/profile/Tamas_Foeldes)**



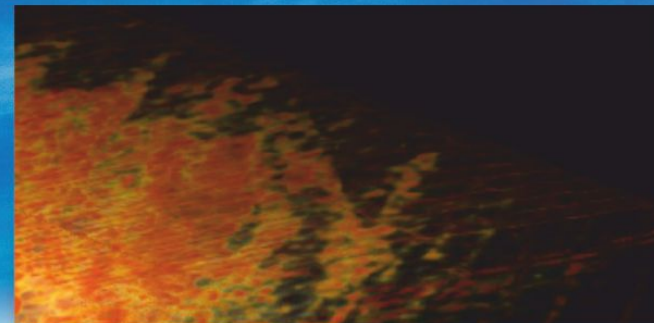
**[t.foldes@t-online.hu](mailto:t.foldes@t-online.hu)**



**+36 30 190 5020**



**Madách u. 26.  
Szolnok H-5000**



- Development of displacement test equipment for microCT measurement with reservoir condition
- Development of PET measurement for reservoir rock evaluation.
- Characterization of wood material based on saturation test during CT measurement
- Determination of concrete parameters based on CT and microCT measurement
- Monitoring of high pressure rotary rubber hose by CT measurement
- Analysis of P-S wavelet and velocity based on displacement test combined CT measurement
- Quality control developments in car business based on X-ray computer tomography measurement
- Quality control developments in concrete material based on X-ray computer tomography measurement

#### REFERENCES:

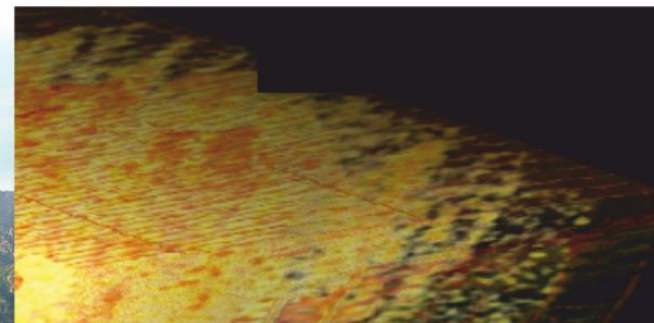
- Main signed contracts (TOMOGEO and Geosoft Companies):
- MOL group: Core analysis by CT measurement contract (8 km measured core since 1999)
- Mecsekerc Hungary Plc Core analysis by CT measurement contract for modeling of nuclear waste deposit
- LMK resources (Halliburton-Landmark Co Islamabad Pakistan) Core analysis by CT measurement contract
- Falcon Oil and Gas (USA) – TXM Ltd Core analysis by CT measurement contract
- Torreador Co Core analysis by CT measurement contract
- Continental Co Monitoring of high pressure rotary rubber hose by CT measurement contract
- Ural and Gas Co (Kazakhstan) Core measurement contract in Uralsk
- RAG Co (Austria) Core measurement contract
- Nuclear power plant projects and contracts in Hungary (Paks I, II)

#### AWARDS AND HONORS:

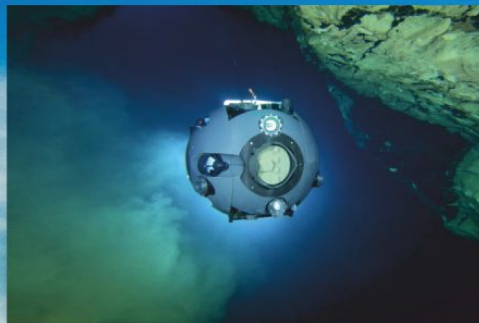
- 1994 Hungarian Association For Innovation Award
- 1997-Oil and Gas Conference for MOL Plc organized. Award
- 1998–EAGE - Best Poster Award European Association of Geoscientists and
- Engineers, 6th Conference and Technical Exhibition, Leipzig, Germany
- 2006 Hungarian Association For Innovation Award

#### HOMEPAGE AND PUBLICATIONS:

[https://www.researchgate.net/profile/Tamas\\_Foeldes](https://www.researchgate.net/profile/Tamas_Foeldes)







**UNEXMIN GeoRobotics Ltd. (UGR)** is a private spin-off company arising from the UNEXMIN H2020 project and that has the IP of the robotic platform there produced. It is our goal to share our unique skills with the industry to solve the complex problems that otherwise go unanswered. UGR have a great passion for innovation and providing solutions for complex tasks.

At UNEXMIN GeoRobotics Ltd., we specialize in applying robotic systems for surveying confined flooded spaces. We are offering robotic exploration in flooded and/or abandoned underground mines, water wells and flooded caves. Our unique robotic solution can explore almost any kind of flooded spaces, meanwhile collect visual and scientific information and create a centimeter precise 3D map about the environment.

UGR has a unique combination of experienced robotics personnel and geoscientific experts. Our experts span a complete range from robot design, maintenance, operations, all the way to geological interpretation & modelling and geotechnical evaluation.

Our team has decades of experience in 3D modeling, in geology, in electronic engineering, in autonomous navigation and in consultancy services relating to reserve evaluation and quarry design for construction raw materials.

UGR is the first company in the world to offer a combination of uniquely developed technologies for surveying flooded environments with a team of experts that know how to evaluate and interpret the results.

#### Former projects, references:

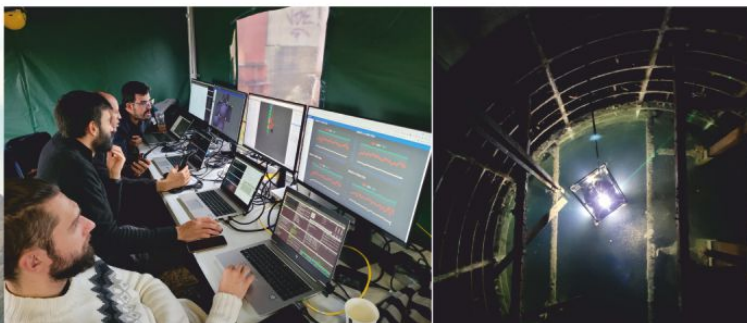
**Molnár János Cave, Budapest:** The UX-1-Neo robot was tested in one of the most complicated underwater passage systems in Europe: The Molnár János Cave in Budapest, the capital of Hungary. This cave is a multilevel maze which means navigation and mapping are extremely difficult.

The known part of the Molnár János Cave is 7 km long but who knows how many meters are hiding below the Buda Hills yet to be discovered. The maze-like structure makes it hard to find the continuations, but the geological information can help us in the search for new passages.

The formation of caves follows the pattern of faults, cracks and fissures in the bedrock. The directions of these features determine the directions of the passages. With the sensors of the robot, we can record the structural geological marks on the cave walls and later the main directions can be calculated giving hints for further explorations.

**Solotvyno salt mine, Ukraine:** The UNEXMIN Georobotics Ltd. explored an abandoned, collapsed and flooded salt mine in Solotvyno, Ukraine. Our robotic solution was able to enter the fully saturated brine and explore the different shafts and tunnels of the mine.

The robot has reached the bottom of the shaft (500 m) and collected visual and 3-dimensional information about the remained structure of the mining shaft and open side tunnels. Continuous water parameter measurements were performed during the dives (pH, O<sub>2</sub> fugacity, temperature, electrical conductivity, pressure) and water samples were collected from different depths.



**UNEXMIN**  
GEOROBOTICS

## UNEXMIN Georobotics Ltd. (UGR)



**Richárd Z. Papp**



[www.unexmin-georobotics.com](http://www.unexmin-georobotics.com)



[info@unexmin-georobotics.com](mailto:info@unexmin-georobotics.com)



**+36 30 842 6668**



**Ráday str. 5 2/3  
Budapest H-1092**



**Csór freshwater well, Hungary:** In June 2021 the UNEXMIN Georobotics Ltd. visited a potable water source in western Hungary – the Csór water well. This was the first commercial mission of the newest robot, the UX-1Neo. The mission was to create a detailed 3D map of the structure of the well, without the need to dewater it or send humans to conduct the survey – which would contaminate the water. The objective was to acquire valuable data that would allow engineers to plan the reconstruction of the well.

The robot was disinfected and launched down the shaft up to a depth of approximately 66 meters. With the help of the sonars, the lasers and the cameras the whole well was explored and a centimetre precise 3D map and a 3D photogrammetric model were created.

**Kaatiala pegmatite mine, Finland:** The Kaatiala mine represented the first real environment trial for the UX-1a robot and the UNEXMIN technology. This site was chosen due to its characteristics: open large lake with mine structures and shallow water – perfect for the first test.

Kaatiala, known for its big pegmatitic deposits, once hosted big mining quartz and feldspar operations in Europe – it all started in 1942. The main rock types of the area are gneisses and mica schists of sedimentic origin, where pegmatitic material has been intruded into the base rock. Feldspar and quartz are the essential minerals with variations of tourmaline, mica, beryl, lepidolite, amongst others.

**Idrija mercury mine, Slovenia:** Idrija mine exploration was held in September 2018. The UX-1 robot was improved from the Kaatiala field trials. The UX-1 robot showed its capabilities: movement, control and 3D mapping to explore shafts and horizontal submerged tunnels. The Idrija mine is now considered as a UNESCO Heritage site – this made it vital that the UNEXMIN technology could work as a non-damaging, non-contact as the mine cannot be damaged in any way.

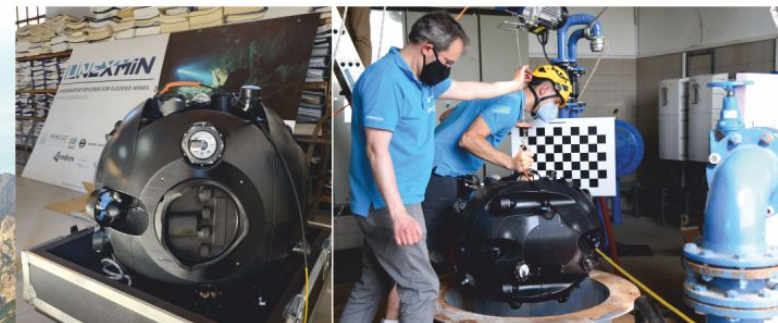
The Idrija mercury mine was explored between 1490 and 1995 for mercury, the mine hosted globally important hydrothermal ore deposits of cinnabar and native mercury, present in sedimentary rocks. In total, around 700km of tunnels were excavated during its lifetime.

**Urgeiriça, Portugal:** During the months of March and April of 2019, the UGR technical teams visited the Urgeiriça uranium mine in Portugal. The maximum depth of the mine is 450m, which allowed the robot and its equipment to be tested in harsh conditions including high pressure and acidic water.

Urgeiriça mine was historically important due to the exploitation of uranium and radium ores between 1913 and 1995.

**Ecton mine, United Kingdom:** The robotic team visited the Ecton Mine, near Manchester, in May 2019. During the mission, a re-survey of the total flooded area of the mine was done. Ecton is now considered as a National Heritage monument and, similar to the Idrija Mine, the technology needed to be non-damaging and non-contact in order to preserve the site.

Ecton was mined for copper but also with important quantities of lead and zinc. The mine was active from 1500BC to 1880AD. The mineralization is hosted in limestones.







BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS  
Faculty of Civil Engineering - founded in 1782

Department of Engineering Geology and Geotechnics  
H-1111 Budapest, Műgyetem rkp.3., HUNGARY

#### DEPARTMENT OF ENGINEERING GEOLOGY AND GEOTECHNICS

Budapest University of Technology and Economics, which was founded in 1782, has been the top higher education institution of Hungary and it has a well-established international reputation. As a member of the oldest faculty of the university the Department of Engineering Geology and Geotechnics has a great past in education, research and testing materials. With the expertise that we gain in the field of engineering geological and geotechnical investigations, design, numerical modelling and research, we are usually requested to accomplish more complex industrial assignments. Our accredited laboratory is working on the fields of Soil and Rock mechanics, which provides a great spectrum of investigations. We actively take part in education (BSc, MSc, and PhD courses in English) and in research, and industrial development. With our background and experiences, we can offer solution for a wide range of geotechnical and engineering geological problems from the material testing till the design of a project. We have broad links and intense research activities at national and international level (radioactive waste disposal, slope stability, natural stone and historic monuments, renders with CO<sub>2</sub> storage potential, etc.)

#### REFERENCES:

- site investigation and design of major construction projects (highways, railways and tunnels)
- geotechnical investigations of Nuclear Power Plant (Paks)
- testing of petrophysical properties of Radioactive Waste Repository (Bátaapáti)
- exploring of the geological conditions and reserve calculations of stone quarries
- qualification of dimensions stones and aggregates
- diagnostics of monuments (House of Parliament, Mathias Church)
- design and stabilisation of subsurface openings
- landslide monitoring and slope stabilisation
- geological hazard assessment



Budapest University  
of Technology and  
Economics



Prof. Ákos Török



[www.gmt.epito.bme.hu](http://www.gmt.epito.bme.hu)



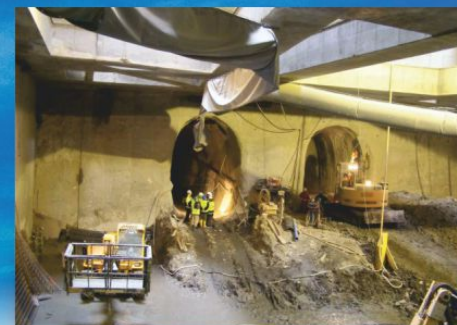
[torokakos@mail.bme.hu](mailto:torokakos@mail.bme.hu)



+36 1 463 2043



Műgyetem rkp. 3.  
Budapest H-1111



#### EXPERIENCES AND FACILITIES

- **engineering geological site and laboratory investigation**
- **geotechnical testing and design**
- **numerical modelling of geotechnical and engineering geological problems** (tunnels, deep foundations, slopes) using FEM codes
- **fully equipped and accredited (EN, ASTM) soil and rock testing laboratory**

#### INTERNATIONAL PROJECTS AND CO-OPERATION WITH MAJOR UNIVERSITIES AND RESEARCH INSTITUTES:

Charles University Prague (CZ), Complutense University (ES), EPFL Lausanne (CH), ETH Zürich (CH), Geosciences University China (CH), Oxford University (UK), Purdue University (USA), Saitama University (JP), San Diego State University (USA), University of Cyprus (CYP), Technical University of Darmstadt (D), Technical University of Graz (A), Université Orleans (FR), University of Ghent (B), University of Göttingen (D), University of Hawaii (USA), University of Maribor (SLO), University of Munich (D), University of Newcastle (AUS), University of Split (CRO), National Technical University of Athens (GR), University of Malta (MT), University of Babes-Bolyai (RO), University of Zagreb (CRO)

#### QUALIFICATIONS FOR TESTING MATERIALS (EN AND ASTM ACCREDITED TEST)

- **in situ and laboratory testing of soils** (classification of soils, compressibility, shrinkage, organic compounds, compactibility, consolidation, triaxial test, shear strength, bulk density, porosity, Atterberg limits, etc.)
- **in situ and laboratory testing of natural stone** (petrographic examination, tensile strength, point load strength, compressive strength, elastic modulus, Poisson ratio, triaxial test, shear test along discontinuities, ultrasonic velocity (Vp, Vs), bulk density, porosity, etc.)
- **durability and non-destructive testing of stones** (surface hardness tests, salt crystallisation, frost resistance, water absorption, slip resistance, abrasion resistance, etc.)
- **testing of aggregates** (determination of particle shape and size distribution, methylene blue test, resistance to freezing and thawing, magnesium sulfate test, Los Angeles, micro-Deval test, etc.)
- **compositional and textural testing of mineral phases and micro-fabric characteristics of stone, mortar and cement** (mineralogical and phase composition testing with XRD, DTA, petrographic microscopy)







The **Department of Geology** is the largest geology department of the country at the prestigious Loránd Eötvös University (ELTE) Science Faculty in Budapest. We participate in training future geologists, earth scientists, geography teachers and environmental scientists at BSc, MSc, PhD levels. We are proud of our diverse profile ranging from classical geology subjects like

- physical geology,
  - geohistory,
  - sedimentology,
  - tectonics,
  - stratigraphy,
  - speleology,
- to a wide range of applied geology subjects in
- hydrogeology
  - oil geology
  - geomathematics
  - modelling.

The **hydrogeology group** focuses on researches related to the understanding of groundwater flow systems of siliciclastic and carbonate areas and contribute to solve water management, geothermal, hydrocarbon and environmental problems.



**Eötvös Loránd University  
Department of Geology**



**Dr. László Imre Fodor**



[www.geology.elte.hu](http://www.geology.elte.hu)



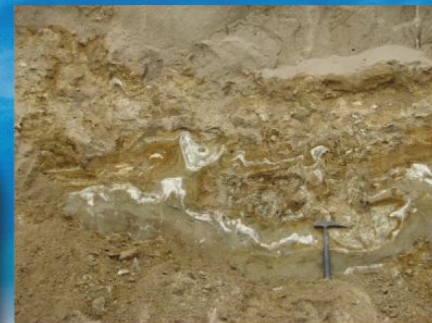
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**+36 1 372 2500**



**Pázmány P. sétány 1/C  
Budapest H-1117**



Our **large laboratories** are ready for analysing water, sediment, soil or solid rock samples. The **microscope laboratory** has both stereo and transmittent light microscopes for research and education.

**Partners** include

- MOL;
- Oil and Gas Development, RAG Oil Company;
- Vermilion Energy, Geogold Kárpátia Kft;
- Smaragd Kft;
- Golder Associates Zrt;
- General Directorate of Water Management;
- Hungarian Natural History Museum, Mining and Geological Survey of Hungary.







### Main fields

The main duty of the institute is to carry out fundamental research for better understanding the formation of materials of the lithosphere and related processes through the study of mineral and rock formation, isotope geochemistry and environmental geochemistry.

The institutes' major activity focus on environmental research with increasing importance, due to recent developments in geochemistry, and the claim to recognize and restore natural environmental conditions, and to improve the quality of life. Within this research field, activities related to the processes in the geospheres and their boundaries are dominant. Primarily, the conditions and changes of the past and recent environment in the Carpathian Basin and its wider environment are studied. Statistical analysis of large databases is also included in the research activities and appear in scientific publications.

In the frame of the wider environmental geochemical research, mineralogical and geochemical properties of soils, geochemistry of surface and groundwater, and the role of microbial processes in mineral formation are studied.

Archeometry is one of the major research activity field of the institute. Coordination of the archeometry sub-project of the Seuso Research Project played a major role in the research related to the study of the cultural heritage.

Due to the formation of the Research Centre for Astronomy and Earth Sciences, interdisciplinary research activities were also continued on the boundary of earth sciences and astronomy. Studies on laboratory astrophysics are carried out through the cooperation of several institutes of the research centre.

### Facilities

#### Stable isotope mass spectrometry

The laboratory was established in 1990. It has three mass spectrometers: a Finnigan MAT delta S isotope ratio mass spectrometer; a Finnigan delta plus XP mass spectrometer equipped with a GASBENCH II unit used for carbonate analyses; a Thermo Finnigan delta V mass spectrometer equipped with TC/EA and elemental analyzer units to measure H-C-N-O isotopes in organic matter and hydrous minerals. H-O isotope compositions of water samples are measured using three laser spectrometers (Los Gatos Instruments), one of them dedicated to fluid inclusion research.

#### Laboratory for mineral and rock analyses

The major profile of the laboratory is the analysis of geological materials for their chemical and



**Institute for Geological and  
Geochemical Research  
Centre for Astronomy  
and Earth Sciences**



**Professor Attila Demény**



**www.geochem.hu**



**demeny@hugeochem**



**+36 1 309 2681  
+36 1 319 3137**



**Budaörsi road 45.  
Budapest H-1112**



phase composition; however, significant experiences are possessed on the analysis of (industrial) ceramics, metals, glasses, and materials of the cultural heritage. Its special areas of analysis are the clay mineral identification and structure analyses, the archeometric analysis, as well as the integrated phase and chemical micro-analysis. A Fourier Transformation Infrared Spectroscope (Bruker Vertex 70) equipped with a Hyperion 2000 IR microscope, a Rigaku DMax RapidII X-Ray micro-diffractometer, two X-Ray diffractometers (Rigaku Miniflex 600 and Philips PW1729), a handheld X-Ray fluorescent spectrometer (Spectro XSort Combi), an electron microprobe (Jeol Superprobe JXA733), an atomic absorption spectrophotometer (Perkin-Elmer AAnalyst 300) and an automatic titrator are operated in the laboratory.

#### Sample preparation laboratory for in-situ produced cosmogenic nuclide

The setup of a sample preparation laboratory for in-situ produced cosmogenic nuclides in our Institute begun in 2013 and has been set for processing quartz-containing sediment and rock samples for the determination of their in-situ produced cosmogenic  $^{10}\text{Be}$  and  $^{26}\text{Al}$  concentrations. Main research topics: exposure age and denudation rate determination of fluvial terraces using  $^{10}\text{Be}$  depth profiles, burial age determination using the  $^{26}\text{Al}/^{10}\text{Be}$  nuclide-pair and  $^{10}\text{Be}$  exposure age determination of glacial landforms.

**References:** Most of the results achieved by the institute appear in publications mainly in leading international journals.

#### Examples from 2019-2020:

Demény A et al. (2019): Middle Bronze Age humidity and temperature variations, and societal changes in East-Central Europe. QUATERNARY INTERNATIONAL 504, 80-95.  
Kern Z et al. (2020): Isotopic 'altitude' and 'continental' effects in modern precipitation across the Adriatic-Pannonian region. WATER 12, 1979.  
Mozgai V et al. (2020): SEM-EDS and  $\mu$ -XRD study of the niello inlays of a unique late Roman silver augur staff (Iltuus) from Brigetio, Pannonia (Hungary). ARCHAEOLOGICAL AND ANTHROPOLOGICAL SCIENCES 11, 1599-1610.  
Ruszkiczay-Rüdiger Zs et al. (2020): Uplift of the Transdanubian Range, Pannonian Basin: How fast and why? GLOBAL AND PLANETARY CHANGE 192, 103263  
Sipos P et al. (2019) Partition of Cd, Cu, Pb and Zn among mineral particles during their sorption in soils. JOURNAL OF SOILS AND SEDIMENTS 19, 1775-1787.  
Újvári G et al. (2019): Clumped isotope paleotemperatures from MIS 5 soil carbonates in southern Hungary. PALAEOGEOGRAPHY, PALAEOCLIMATOLOGY, PALAEOECOLOGY 518, 72-81.







## Social Organization for Radioecological Cleanliness



**Tibor Kovács PhD**



**www.rttisz.hu**



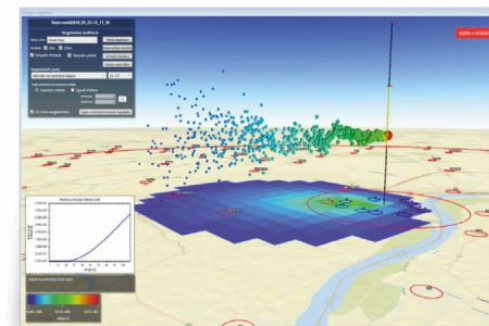
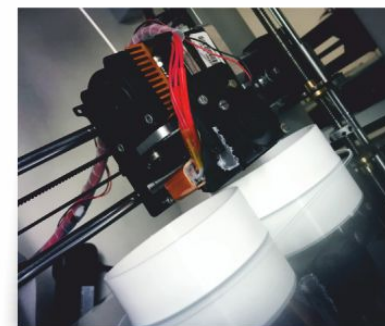
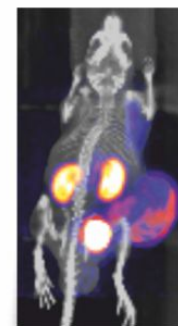
**info@rttsz.hu**



**+36 99 624 922**



**József Attila str. 7/A 2/10  
Veszprém H-8200**



### SORC

The Social Organization for Radioecological Cleanliness (hereinafter referred to as "SORC") was founded in 1993 as an NGO, primarily with the key participants of teachers and students of the Institute of Radiochemistry and Radioecology of the University of Pannonia, with the aim to carry out measurement work concerning radiation protection and other ionizing radiation for the general public. The number of members has significantly increased during the past 10 years, their professional experience have also broadened. During the past 3-4 years the environment protection profile of the Social Organization has basically been broadened due to the young environmental engineer co-workers, expansion has primarily taken effect in the fields of waste management, and renewable energy sources.

Besides the high level professional human resources of the Social Organization, its accumulated experience can also be well utilized in organizing forums for the population, in the management of different projects, and in the dissemination of results. The research strategy is directed towards internationalization, improving human resources and capacity building.

According to the aims the SORC would like to give the public the valuable and reliable information about the hazard on the radiations. The most well-known problems of the nuclear accidents (Chernobyl, Fukushima, etc.) but nowadays the NORM materials are in the focus too.

### Field of activities:

- Survey of radon and environmental radioactivity
- Organizing conferences (Radon forum, TREICEP)
- Model development of migration of radionuclides in the environment
- Research and developments in industrial and medical nuclear imaging field





#### MAIN FIELDS OF ACTIVITY

Research and development activity of the Institute is manifold thanks to the excellent teaching and research staff. Fields of activities associate with topographic mineralogy, mineral resource exploration (ore, industrial and hydrocarbon as well), equipment development for exploration, environmental geochemistry, archeometry, applied mineralogy research. One indicator of excellence is the seven new mineral species discovered under the leadership of specialists of the Institute. In the last years, another important achievement of the Institute was the rare element potential assessment of Hungarian primary and secondary raw materials. Research achievements are supported by the high-quality laboratory facilities.

#### FACILITIES

##### X-ray diffractometry

Crystal structure based mineralogical investigations are carried out on the Bruker D8 Advance powder diffractometer (Cu K $\alpha$  source) with parallel beam produced by Göbel mirror or parafocusing Bragg-Brentano geometry options, in transmission or reflection geometry. In parallel beam geometry samples down to 0.5 mg can be measured for quantitative analysis or crystal structure refinement. In addition, block samples of 10x10x10 cm can be investigated in non-destructive ways. Quantitative calculations are made by Rietveld refinement in TOPAS4 software.

##### Laboratory for mineral and rock analyses

Chemical analysis is performed by X-ray fluorescence spectrometry on Rigaku SuperMini benchtop WDS-XRF system (F to U detection) with Pd source. The instrument operates under vacuum of noble gas flushing environment, with Cereox cemented powder pellet or Li-metaborate fused glass pellets. Analysis from major to trace elements is provided with resolution down to 10 ppm.

##### Optical and electron-optical laboratories

The optical microscopy lab enables magnifications up to 150x for stereo- and up to 500x for polarizing microscopy. Beyond fast and adequate texture and phase characterization, is a basic tool for speeding up electron micro-beam investigations also. The stereomicroscope has motorized focus and in-depth morphology imaging software (Z-stack solution at 0.001 mm lowest step).

Scanning electron microscopy and chemical analysis is resolved on a Jeol JXA 8600 Superprobe with W-filament. The instrument is equipped with state-of-the-art Si-drift EDS detector (C to U detection range) and 5 WDS detectors, with the necessary calibration standards. High precision (1  $\mu$ m resolution) X-ray element mapping is available in both element distribution and quantitative distribution maps.



**Institute of Mineralogy  
and Geology  
University of Miskolc**



**Dr. Ferenc Mádai**



**foldtan.uni-miskolc.hu**



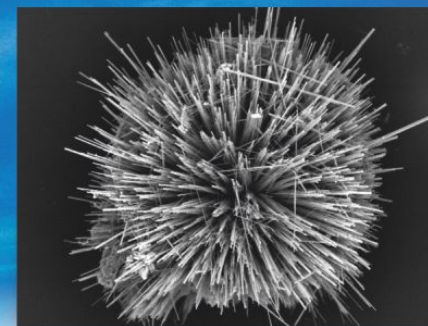
**askmf@uni-miskolc.hu**



**+36 46 565 058**



**Egyetemváros  
Miskolc H-3515**



#### Sample preparation

The Institute is equipped with the full scale of instruments to cover basic and highly specialized geological research. Thin section and polished slabs are produced with the high through put semi-automated Struers RotoPol 35. Loose material, from soils to flotation fractions, is cemented under vacuum with epoxy resins to obtain solid specimens. Powder sample preparation is powered by a Retsch MM 400 tungsten-carbide high frequency vibrating mill, average rock sample is milled from 2 mm to <0,02 mm in 10 minutes. Fine fraction (e.g. clay minerals) separation is helped by Hettich Rotina high speed centrifuge, with the possibility of heavy mineral separation by Na-polytungstate safe and secure method.

#### 3D laboratory

A new, integrated 3D laboratory at the University of Miskolc with cutting edge analytical equipments partly belongs to the Institute. It brings new dimensions in materials testing and R&D, including four equipments: Stresstech XStress Robot for measuring non-destructive residual stress, a Bruker D8 Discover XRD, SAXS, XRR x-ray diffractometer, an Xylon FF35 Computer Tomograph with dual beam and a Thermo Scientific Helios G4 PFIB SEM equipped with a correlative laser ablation tool. This set of instruments allow the 3D investigation of almost any materials in a wide dimension range down to the nanometre scale.

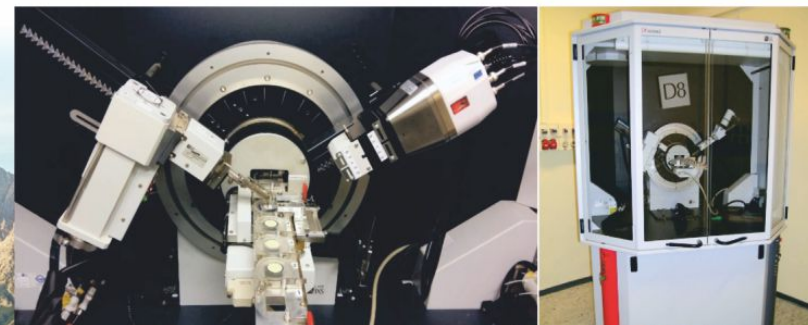
#### REFERENCES:

##### Research and development projects:

- UNEXMIN: a H2020 project led by the University of Miskolc, which develops an autonomous underwater robotic explorer capable to 3D map and deliver geo-scientific information by non-invasive methods from flooded underground mines. (<https://www.unexmin.eu/>)
- REEBAUX: an EIT RawMaterials KAVA project for prospecting of REE recovery from bauxite and bauxite residue in the ESEE region.
- Basic research on critical raw materials in Hungary within international cooperation framework. (TÁMOP-4.2.2.A-11/1/KONV-2012-0005) (<http://kritikuslemek.uni-miskolc.hu/>)
- Sustainable raw-material management network „RING 2017”. (EFOP-3.6.2-16-201700010)
- 3D LAB Infrastructure development for research of special materials. (GINOP-2.3.3-15-2016-00024)

##### R&D for industrial partners:

- Stockwork Ltd. (Romania): Mineralogical investigation of ore samples (2015).
- RAG-Hungary Ltd. (Hungary): Petrographical and sedimentological analysis of the Kiha-003 well (2015).
- Boliden Mineral AB (Sweden): Analysis of ore samples from Aitik North, XRPD phase identification with Rietveld refinement (2017).
- PT J Resources Nusantara (Indonesia): Quantitative mineralogical investigation by Rietveld-refinement on X-ray Powder Diffraction data (2017).







#### CONTINUOUS INNOVATION

As a major factor in world economy and in the energy sector today, the oil and gas industry requires continuous optimization of petroleum exploration, and there is also a constant need for keeping level with the recent methods and developing new, better solutions. The currently achievable technologies gave us the opportunity to be able to interpret new techniques and to improve the older ones to a higher, new level.

As a sustainable and conventional energy source, petroleum itself has always been a key factor in the energy sector, but for the perfect exploitation, our research system requires a thorough and complex research view. In order to make safe, long-lasting and valuable decisions, a very well examined and established base knowledge is undoubtedly needed.

To develop and maintain such a unique and important data, instrument and knowledge base, in order to examine and gather information about the petroleum reservoirs, the Research Institute of Applied Earth Sciences, was founded to become the main support of the Hungarian oil and gas industry.

#### HISTORY AND RECENT GOALS

The Petroleum Industry Research Laboratory of the Hungarian Academy of Sciences was founded in 1957 on the recommendation of Zoltán Gyulai, the first head of the Department of Oil Production of the University of Miskolc and Elemér Szádeczky-Kardoss academic professor. The Memorandum declared that the main objective of the establishment of the Institute was to "fulfill the research needs of the Hungarian oil and gas industry". In the past for approximately sixty years, the Research Institute of Applied Earth Sciences and its predecessors functioned accordingly to the original aims, but the range of research fields have become wider, as we operate successfully by maintaining an innovation system.

#### RESEARCH AREAS

The primary goal of the Institute is to solve tasks in the following areas of sciences:

- general chemistry
- chemical engineering
- reservoir mechanics.

We also develop and improve IOR/EOR (improved oil recovery/enhanced oil recovery) technologies, plan and perform industrial experiments and analyze them afterwards. As well as dealing with production technology and well stimulation of injection and production wells.

#### R&D IN WELL-AND PRODUCTIONS SYSTEMS

We also improve hydraulic profiles, having special experiences in:

- decreasing water influx and coning
- mitigating formation damage
- bottom hole cleaning
- mobilization of the pinched-off oil/gas (residual reserve)



**University of Miskolc  
Research Institute of  
Applied Earth Sciences**



**Dr. Krisztián Baracza**



**www.afki.hu**



**office@afki.hu**



**+36 46 565 255  
+36 46 363 349**



**Egyetemváros  
Miskolc H-3515**



In our Institute there is a complex basic and applied research work on partially depleted (brown) fields in order to improve the recovery factor with the goal-oriented connection of flooding and reservoir conformance control technologies. The primary aim of this complex research is to extend lifetime of oil and gas fields.

#### SPECIAL CORE ANALYSIS (SCAL)

Understanding a reservoir starts collecting and knowing petrophysical properties of rock samples. We also undertake service tasks. These include the determination of petrophysical properties like

- pore structure, pore size distribution (with mercury injection)
- porosity (with helium, brine or petroleum)
- absolute and relative permeability (with helium, brine or petroleum)
- rock compressibility
- capillary pressure and relative permeability

of sandstone and carbonate type reservoir rocks at atmospheric and reservoir conditions. Core preparation and photography also take place here. Determination of complex rheologic and interfacial chemistry properties in multi-phase systems can also be performed.

#### ENHANCED OIL RECOVERY (EOR) TECHNOLOGY

To contribute to the production technology improvement, modeling of displacement processes takes place in our Institute on small (~7 cm) and medium size (~21 cm) core sample assemblies in multi-phase systems at atmospheric and reservoir conditions. This also includes the optimization of the IOR/EOR (improved/enhanced oil recovery) technologies, developing injection protocols and optimized flooding technologies. The recovery factor, the mobility ratio and the alteration of the differential pressure are also investigated in this type of measurements.

#### PLANNING AND IMPLEMENTATION OF RESEARCH DEVICES

Our researchers and technicians can plan and construct special HPHT (high pressure and high temperature) laboratory tools, devices, equipments.

#### RESEARCH AND DEVELOPMENT WORKS

We also deal with R&D works associated with non-conventional hydrocarbons (shale gas, high and low viscosity petroleum stored in extreme low permeability rock, methane stored in coal fields) in the areas mentioned in the previous lines.

- Designing of different laboratory cells for unique requirements
- Complex measurement systems for oil- and gas industry
- Design and implementation of high pressure hydraulic pumps
- Long term laboratory measurements on different fields
- Investigation equipment to understand the water reinjection mechanisms
- Automatic remote monitoring systems for water quality tests







Building on the traditional chemical engineering foundations, our Bio, Environmental and Chemical Engineering Research and Development Center provides industrial and public customers with the most up-to-date engineering scientific results. In the course of our solutions, we combine our wide-ranging experience in bio-, process-, environmental engineering, operations science, radiochemical and chemical engineering with the possibilities provided by our state-of-the-art technology and analytical laboratories. We have extensive experience in Computational Fluid Dynamics (CFD) and data mining technologies in earth sciences. In our work, instead of studying the problems, we research for solutions.

### Radioecology Research Group

The radioecology research group deals with the study of natural radionuclides, especially with the radiological qualification of different environmental matrices, the measurement and modelling the physical-chemical behaviour of radionuclides in them and assessment of the human radiation exposure caused by the inhalation and-/or ingestion of them. Monitoring of major NORM landfills and nuclear facilities and their environmental impact assessment in radiation point of view is launched by our team too.

Besides that, our research area covers the radiological survey of NORM materials, especially focused on the applicability of industrial by-products in the construction industry.



University of Pannonia  
Research Centre for  
Biochemical, Environmental  
and Chemical Engineering



Dr. Endre Domokos



[mk.uni-pannon.hu/  
index.php/rcb-ece](http://mk.uni-pannon.hu/index.php/rcb-ece)



[domokos.endre@uni-pannon.hu](mailto:domokos.endre@uni-pannon.hu)



+36 88 624 298



Egyetem str. 10.  
Veszprém H-8200



### Radiochemistry Research Group

The radiochemistry research group deals with the material sciences related to the operational safety of nuclear facilities e.g. studying of the contamination and corrosion processes of various structural materials. The radioactive waste managements is an integral part of the safe operation, therefore our group deals with the development and optimization of liquid waste processing technologies and the immobilization of waste and the development of appropriate cementation technology too.

### Sustainability Solutions Research Laboratory

The Sustainability Solutions Research Laboratory was established with the aim of identifying and exploring the environmental impacts of anthropogenic activities and their correlations with sustainability. Thus, its main activity is the measurement and evaluation of emissions from industrial installations, the assessment and optimization of life-cycle and circular economy models. In addition to technological solutions, the laboratory aims to develop data-driven models that support decision-making and to actively participate in strategy-making, which contributes to the intensification of achieving sustainable development goals both domestically and internationally.

### References:

Paks és Paks II. (operational safety studies)  
MOL group (environmental geotextiles and other plastic structural materials development)  
MVM group (environmental impact assessment, development of qualification methodology)







## DEPARTMENT OF ENVIRONMENTAL ENGINEERING

### University of Pécs - Faculty of Engineering and Information Technology

The University of Pécs, the oldest university in Hungary, was founded in 1367. Today our university, with its 10 faculties, nearly 20,000 students, 1400 teachers and researchers is one of the largest higher education institutions in Hungary and the centre of knowledge within the Transdanubian region. The Faculty of Engineering and Information Technology, with its 3,000 students and several decades of experience, is one of the most colourful institutions of Hungary's tertiary technical education and one of the prominent centres of the country's engineering life. The 8 basic training programmes cover technical, artistic and information technology related fields of study in the following branches: architecture, civil engineering, environmental engineering, electrical engineering, information technology, mechanical engineering and architectural design.

## RELEVANT STUDY AND RESEARCH OPPORTUNITIES

The topics of applied earth sciences appear in the training and research programs of the Department of Environmental Engineering. Among the trainings, the BSc in Environmental Engineering should be highlighted, aiming at the training of environmental engineers with up-to-date technical, scientific and management knowledge, who are able to prevent, reduce and eliminate environmental harms and damages, to implement near zero-waste and resource-efficient technologies, to use professional databases, design and simulation software, as well as to manage the social transition to the use of renewable resources and the implementation of GHG emission reduction. The major research areas of the Smart City Technologies research group include non-destructive material testing, alternative raw material management, waste management, water management and city management.

Our main research topic is the enhancement of special electrical, non-destructive material testing methods, with special focus on the development of instrumentation, measurement methods and evaluation algorithms. The research focuses primarily on tomography methods, whose applications include geophysical measurements (contaminated soils, landfill exploration, hydrogeology), laboratory tests (e.g. chemical reactor monitoring), and biological and medical applications.

## SERVICES

- Development of tomography instruments and measurement methods, solution of measurement technology related technical problems
- Sample preparation (contaminated industrial soils, sediments, wastewater, sewage sludge, waste, ash, biological samples, unknown materials)
- Analysis of water, soil, sludge and waste



**University of Pécs**  
**Faculty of Engineering and**  
**Information Technology**



**Dr. Zoltán Vizvári**



**www.mik.pte.hu**



**vizvari.zoltan@mik.pte.hu**



**+36 30 380 1223**



**Boszorkány str. 2.**  
**Pécs H-7624**



- Elemental analysis, trace element analysis
- Determination of carbon, hydrogen, sulfur, nitrogen and chlorine content of samples
- Particle size distribution of dusts and soils (0.02 µm to 2,000 µm range)
- Examination of biogas and landfill gases
- Physical and chemical testing of fuels; determination of the heat of combustion of liquid and solid samples
- Quality control of secondary raw materials, biomass and residue derived fuels (calorific value, moisture content, particle size distribution, ash content, etc.)
- Investigation of thermal conversion of solids (inorganic compounds [ceramics, glass-ceramics, cement, composite materials, metals, minerals, nano-products, solid mixtures, melt, gypsum], food [food ingredients, starch, sugars, fats, proteins], organic materials [polymers, drugs, biomass, tires], pesticides, waste, catalysts, adsorbents and raw material samples).

## RELEVANT LABORATORY INFRASTRUCTURE

The Environmental Measurement Technology laboratories are equipped with the following main tools and instruments in addition to basic chemical laboratory equipment: digital balance scales and analytical scales; positive pressure filtration device with membrane filter and compressor; water purifier with UV preparation; ultrasonic cleaner; microwave destruction unit; calcining furnace; lab ovens; automatic titrator; laboratory and in-situ multimeters (pH / temperature / conductivity / dissolved oxygen); COD meter with destruction unit; BOD meter; photometers; UV-VIS spectrophotometers; water analysis rapid tests; TOC meter; portable micro-GC; shaker screen; compact laser particle counter; stereomicroscope with camera; portable multi-gas meter (CH<sub>4</sub>, O<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, CO); cutting mill; ultra-centrifugal mill; AAS device; ICP-OES device; DSC thermal analyzer; bomb calorimeter; C-H-S-N-Cl elemental analyzer; Electrical Impedance Based Material Analysers.

## REFERENCES

- International patent: Borbás Károly, Kiss Tibor, Klincsik Mihály, Kvasznicza Zoltán, Máthé Kálmán, Vér Csaba, Vizvári Zoltán, Odry Péter: PROCESS AND MEASURING SYSTEM FOR DATA ACQUISITION AND PROCESSING IN SOFT - TOMOGRAPHY STUDIES (US 2018 / 0374244 A1; PCT / HU2016 / 050062)
- 2 prototype impedance measurement units (low / high voltage)
- Vizvári Z. – Kiss T. – Máthé K. – Odry P. – Vér Cs. – Divos F.: Multi-Frequency Electrical Impedance Measurement on a Wooden Disc Sample, Acta Silv. Lign. Hung., Vol. 11, Nr. 1 (2015) 67–75.







**The University of Szeged** is one of the leading universities in Hungary. It has twelve faculties among which Faculty of Science and Informatics is the largest and has the highest-level international reputation. In collaboration with the Department of Geology and Palaeontology and Department of Meteorology, our department coordinates education of Earth Sciences at BSc, MSc and PhD levels. The major topics of research activity at the department concern geological interpretation, modelling and estimation of different resources, like fluids (hydrocarbon and geothermal), primary and secondary ores (rare earth element, lithium, scandium, microdiamond, etc.) and soils. In addition, we deal with petrological, structural and hydrodynamic modelling of fractured waste repositories.

The department possesses a well-developed analytical laboratory with rock, soil and fluid sample preparation lab, as well as numerous types of equipment for chemical analysis (XRF, micro-XRF, EDS, LA-ICP-MS), solid-phase analysis (XRD, Raman spectrometer, SEM), fluid analysis (microthermometry, mass spectrometer-based chemostratigraphy) among others.

**The most important partners** of the department in applied mineralogy, geochemistry and geology are the followings: MOL Nyrt., Smaragd-GSH Kft., Envirotis Holding Zrt., Mecsekérc Zrt., Coca-Cola HBC Magyarország Kft., Golder Associates Magyarország Zrt., Contitech Rubber Industrial Kft., Zeolitos SRL, Balla Géza Winery, Árpád Agrár Zrt., Geotermikus Szolgáltató Kft., Móra Ferenc Múzeum.



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



**Prof. Tivadar M. Tóth**



**[www.asvanytan.hu](http://www.asvanytan.hu)**



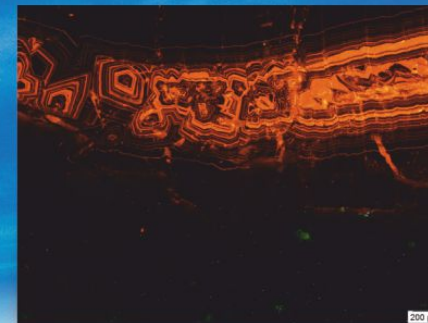
**[asviroda@geo.u-szeged.hu](mailto:asviroda@geo.u-szeged.hu)**



**+36 62 544 058**



**Egyetem str. 2.  
Szeged H-6722**



## Facilities

Hitachi S-4700 FE-SEM Field-Emission Electron Microscope  
L2130 High Performance Liquid Chromatography  
Horiba Jobin Yvon XGT 5000 X-Ray Fluorescence (XRF) system  
Olympus BX-41 Polarizing, epi-fluorescent microscope  
Ocean Optics QE PROVIS-NIR spectrometer  
Rigaku Ultima IV X-ray diffractometer  
THERMO DXR Raman microscope  
Linkam THMSG-600 and MDS-600 heating-freezing stages  
Mass spectrometer-based gas analyser with on-line, low-pressure crashing unit







The Békéscsaba Centre of Vocational Training Vásárhelyi Pál Secondary Technical School, College and Dormitory was founded in 1950. In the first years, experts on waterworks construction were being educated, but nowadays students can choose among all sorts of technological specializations.

One of the most important goals of our school is to provide our students with versatile advanced knowledge applying high-tech. We really want our graduates to make a successful career after the training. These goals of ours are mainly completed as being shown in the statistics and records of the final exams. One of the secrets of our successes is that we don't have a fierce competitor in the educational sector. There is no other school with the same technological specializations within 100 km. We have outstanding programs preparing students for language exams and for the higher education. Some of our specializations are unique, not only on the Great Plain, but in Hungary as well.

These facts and circumstances have also contributed to our students' successful admission to universities, which could not have been made without our staff's conscientious work.



**Békéscsaba Centre of Vocational Training Vásárhelyi Pál Secondary Technical School, College and Dormitory**



**György Schnieder**



**www.vizmu.net**



**vasarhelyi@bsc.hu**



**+36 66 321 145**



**Gyulai rd. 32/1  
Békéscsaba H-5600**



After passing the school-leaving exam, most of our students stay at our school and continue their studies to get the technician qualification. Our popular specializations are the technician of the surface construction and engineering, the technician of the road construction, the technician of geodesy and the geographical information system, the technician of the water management, and the technician of fluid extraction.

We have 600 students currently studying in our 24 classes.





## CAPES goes international with Enterprise Europe Network

**The Enterprise Europe Network helps small and medium-sized businesses, clusters and other actors innovate and grow internationally. The Network's achievements are best shown through the positive results of the many businesses having been helped already. This success story is about how Cluster of Applied Earth Sciences (CAPES) got into an international metacluster with the assistance of Network partner Chamber of Commerce and Industry of Pécs-Baranya.**

### CAPES goes international

The high performance French **POLE AVENIA** cluster started to prepare for a **COSME** Call for proposal "Clusters Go International" in 2017. The topic was 'Support the establishment of **European Strategic Cluster Partnership** - Going International'.

The overall goal was to create a European Strategic Cluster Partnership with a focus on the sustainable use of the **subsurface energy** and to develop a joint internationalisation strategy as well as an implementation roadmap.

**Enterprise Europe Network South West France** provided information, support and assistance to **POLE AVENIA** in the preparation of their proposal. A **partner search** was conducted and a research profile was published on the Enterprise Europe Network's **Partnership Opportunity Database**.

In response to the partner search profile **Cluster of Applied Earth Sciences (CAPES)** – client of Enterprise Europe Network **South West Hungary** – made an expression of interest for joining the project. CAPES has a **deep knowledge and expertise in geothermal energy, environmental engineering, management and renewable energy** thus, it was readily integrated by **POLE AVENIA** in the proposal with the title **GEO-ENERGY Europe**.

The project comprising **Belgian, French, German, Hungarian, Irish, Spanish and Turkish** clusters started in **2018 with a budget of € 267 000** (75% financing rate).

The partnership also **submitted a second proposal** on 30 October, 2019, which (since then) turned out to be a successful application as well.

Check for more: <https://www.geoenergyeurope.com/>

**Enterprise Europe Network**

**The Network** – present in more than 60 countries – **provides support for SMEs, clusters, universities and other actors to build international partnerships.**

### Going international

Competent partners are needed to expand businesses in other countries. The Enterprise Europe Network helps find them. Database of cooperation profiles and matchmaking events assist potential business or technology partners in getting in touch.

Check for more: <http://een.ec.europa.eu>

### Chamber of Commerce and Industry of Pécs-Baranya (CCIPB)

CCIPB – responsible for South West Hungary – is one of the 600 partners of Enterprise Europe Network. The chamber (Est. in 1881) has the ability to help get in contact with innovative SMEs, large companies, research institutions, universities, incubators, innovation agencies, regional development agencies (etc.) at national and international level. In addition CCIPB supports realisation of their goals with advisory services.

Check for more: <http://pecseconomy.eu/>







+36(72)564892



info@capes.hu



www.capes.hu



@capeshu



Cluster of Applied  
Earth Sciences



@capeshu



@clusterearth



Cluster of Applied  
Earth Sciences



Seat:  
H-7761 Kozármisleny  
Viola Str. 55.1. Hungary  
Main Office:  
H-7763 Kővágószőlős  
Lot No.: 0222/35 Hungary