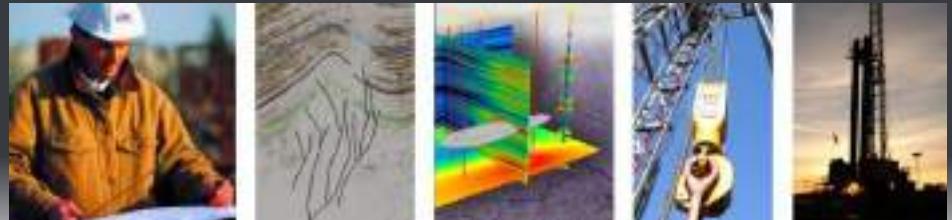




from Ideas to Implementation



# GEOMEGA

GEOLOGICAL EXPLORATION AND  
ENVIRONMENTAL RESEARCH SERVICES



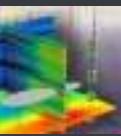
[info@geomega.hu](mailto:info@geomega.hu)



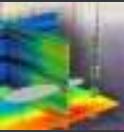
[www.geomega.hu](http://www.geomega.hu)



[/GeomegaLtdBudapest](#)



# ENGINEERING GEOPHYSICS



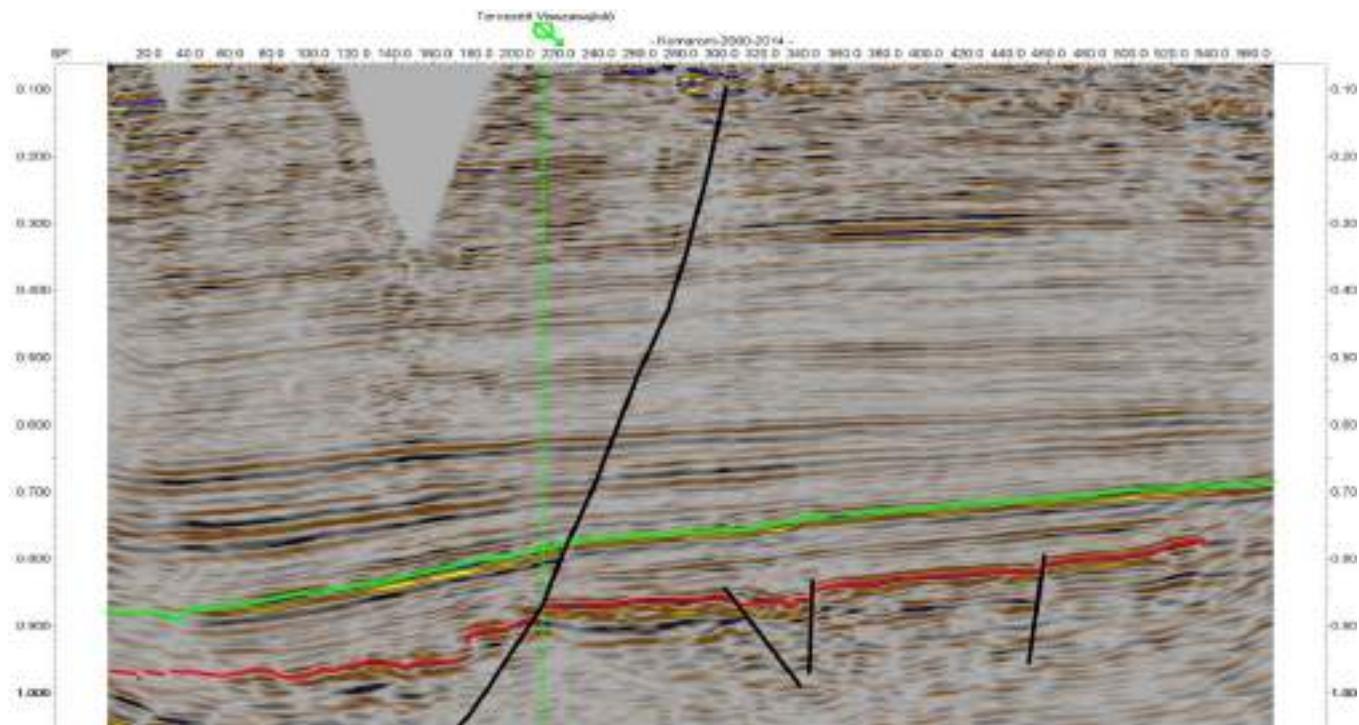
## Field recording:

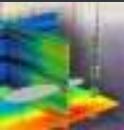
- vibroseis and explosive sources
- P and S wave sources for engineering surveys
- 900 channel wireless recording system



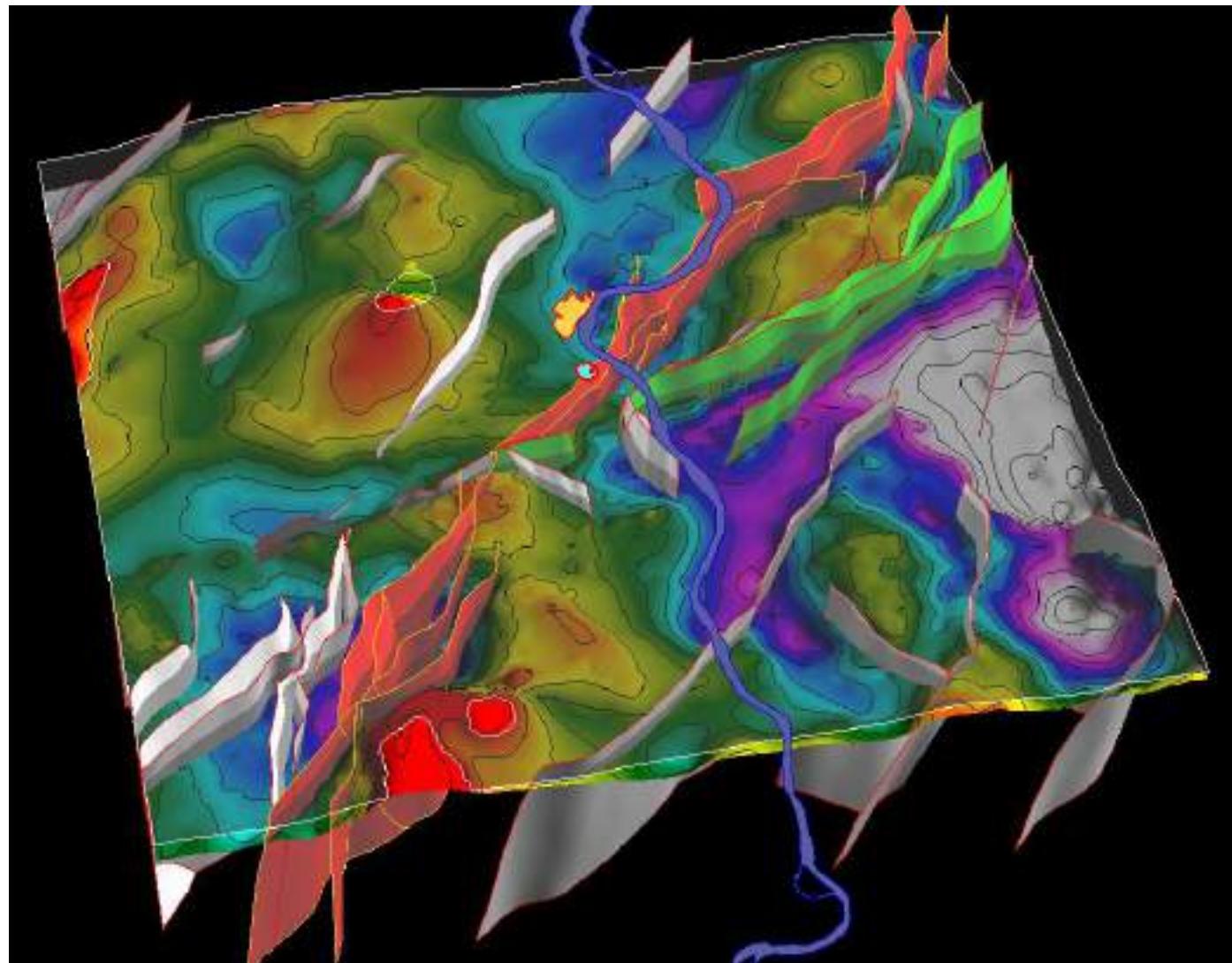
## Reflexion seismic profiles:

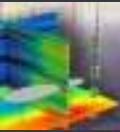
- structural,
- geothermal,
- hydrocarbon and
- engineering investigations



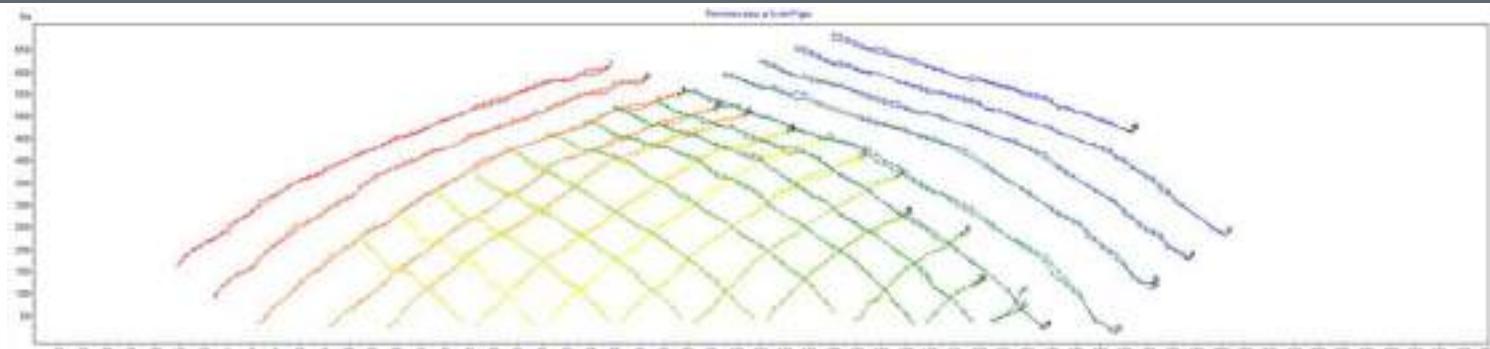


## Structural and stratigraphic studies:



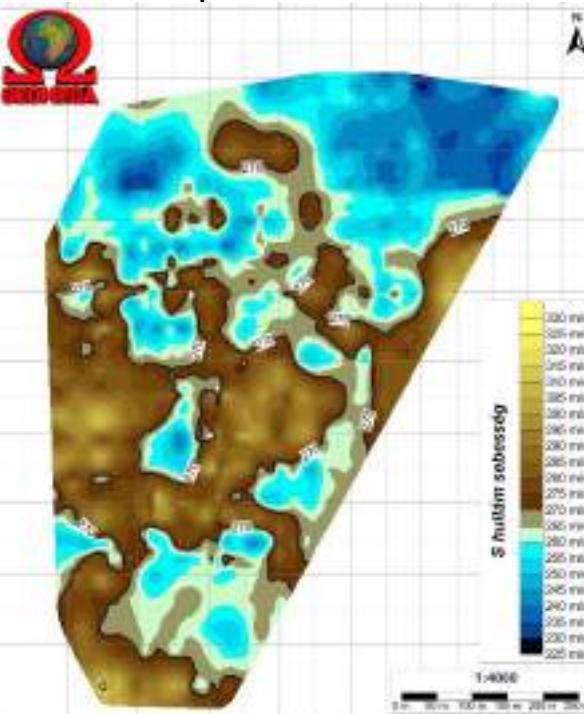


## Tomographic evaluation:

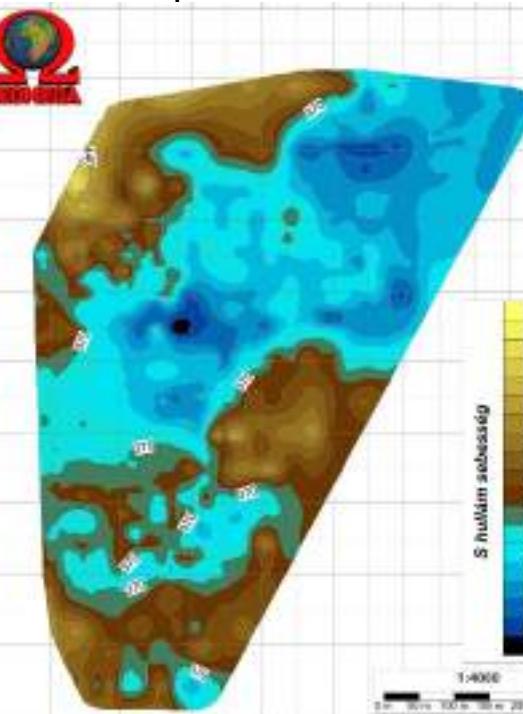


Soil physical properties (e.g. Young modulus, shear modulus) mapped from P and S wave seismic

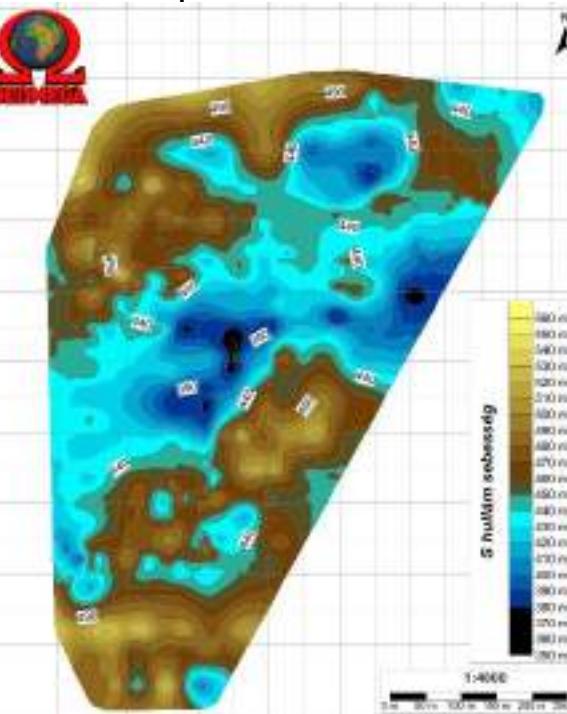
Depth slice 85 m asl

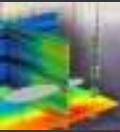


Depth slice 70 m asl



Depth slice 60 m asl

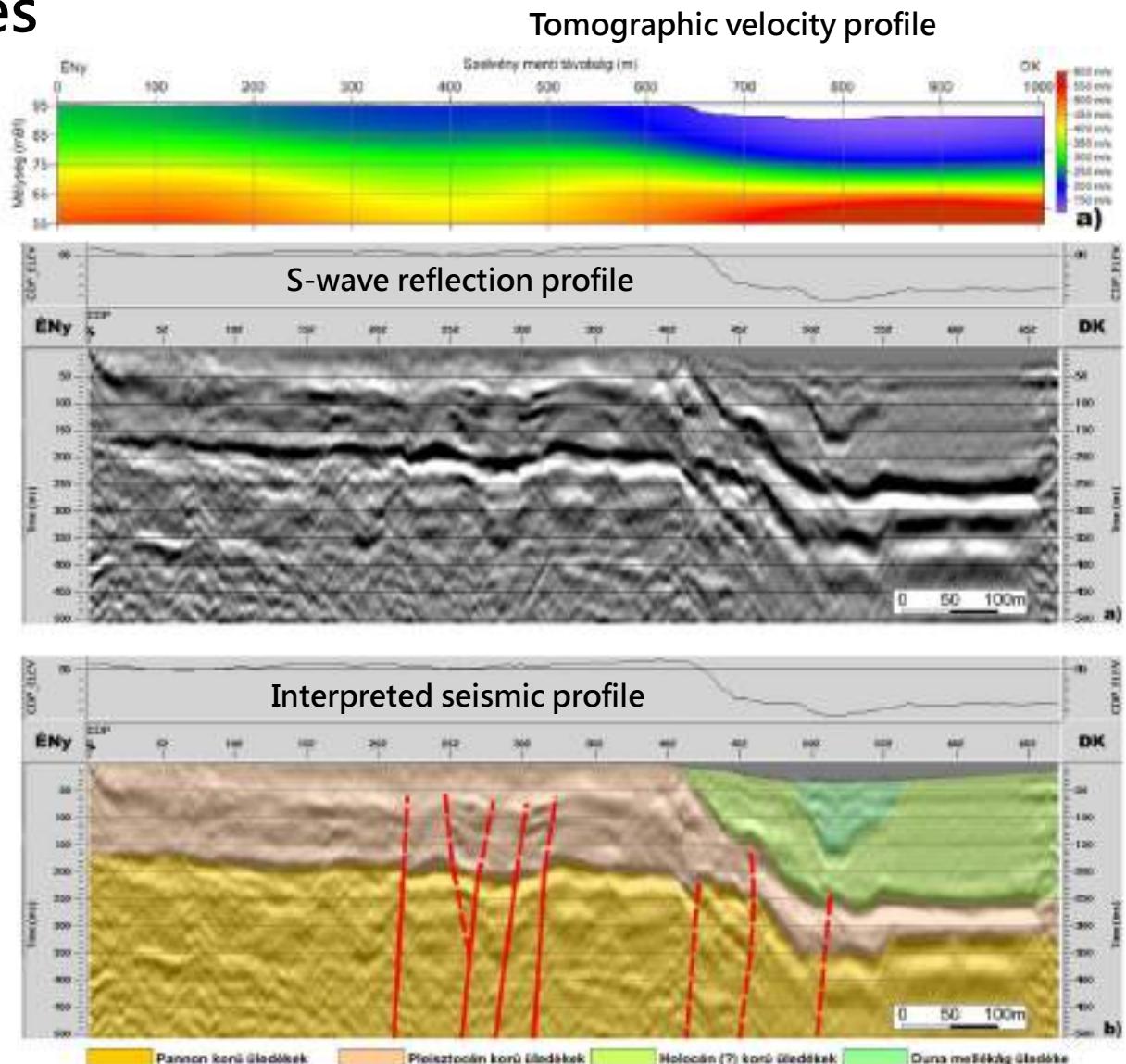


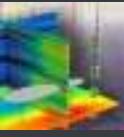


## S wave seismic profiles



Interpreted trenching result  
along the seismic profile





- Spontaneous potential (SP) survey  
Detecting stray currents and corrosion effects



- ARES-G multielectrode system  
*Vertical Electric Sounding (VES)*

1D subsurface model, determining depth and thickness of layer boundaries

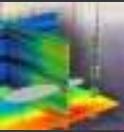
*Multielectrode tomography (MUEL)*



2D/3D surveys, several tens of m penetration

Cavity detection, ground water investigations, mapping of permeable and impermeable layers, investigation of road, dam structures, pollution detection and monitoring

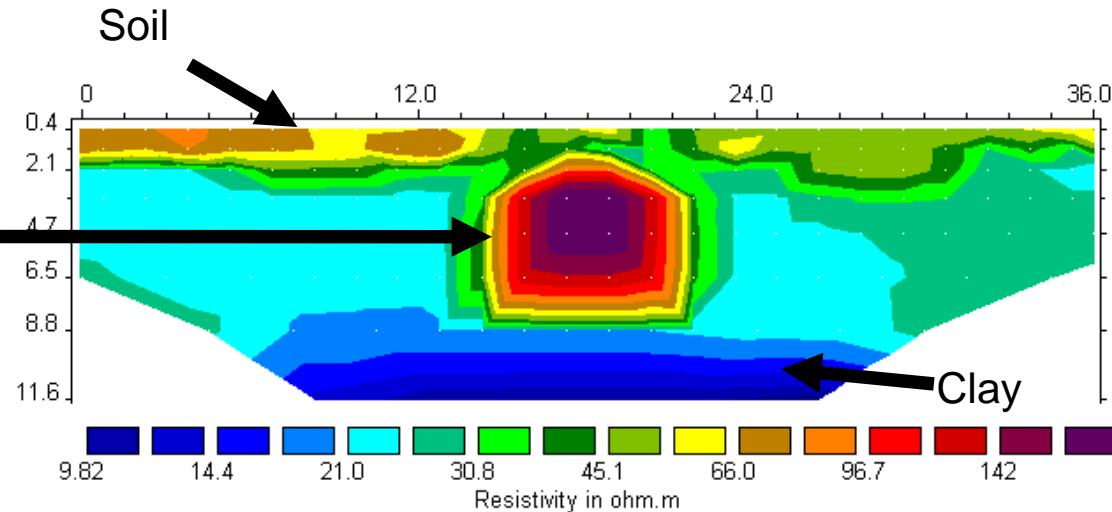




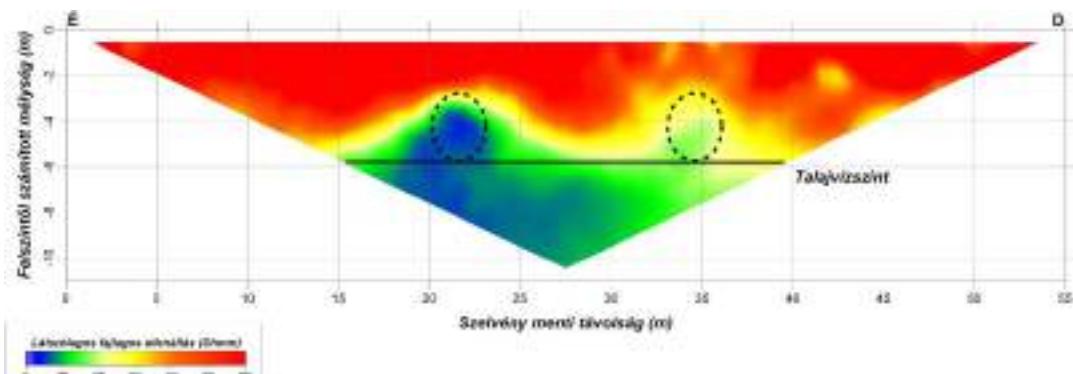
## MUEL – *Cavity and pipeline detection*

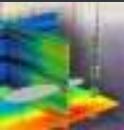
- Large electrical resistivity contrast

Tunnel  
3.4 m high  
5.1 m wide



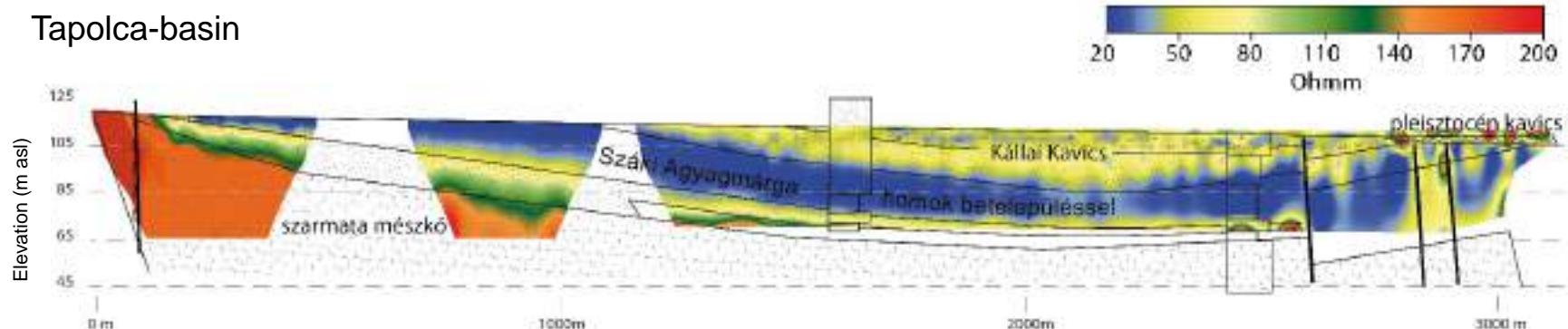
Water pipes buried 3.5 m deep



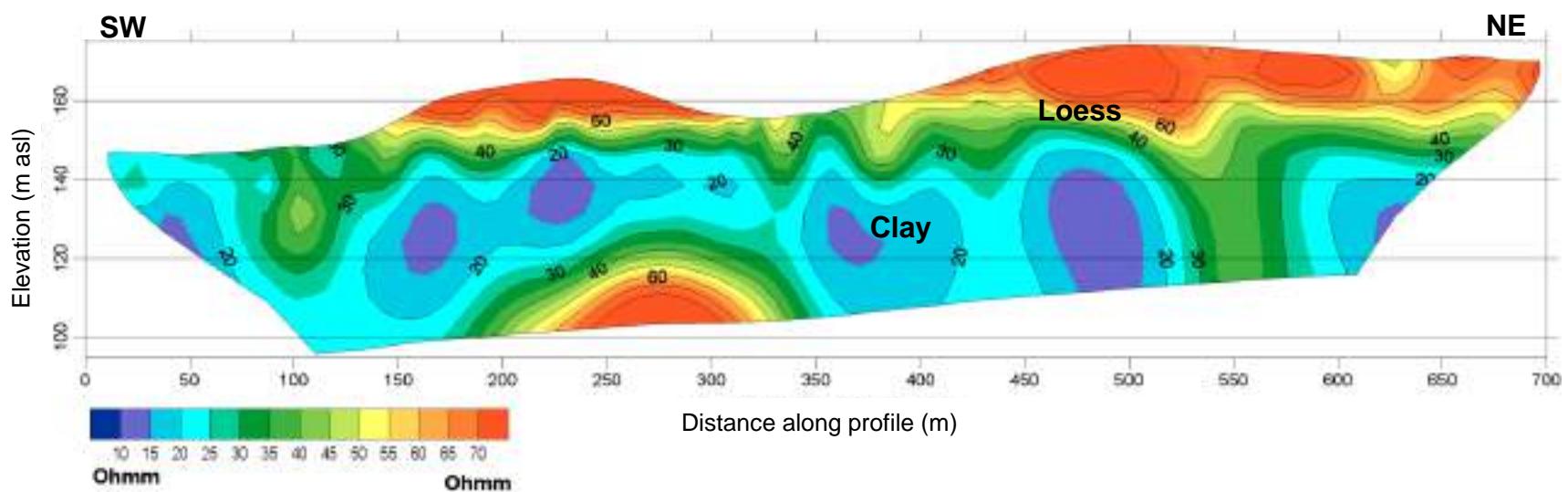


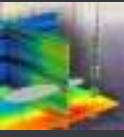
## MUEL – *Geological survey*

- Tapolca-basin



- Mende area (Pest county)





### EM38B: ElectroMagnetic profiler

- Depth of penetration: max 1.5 m
- Rapid surveying, mapping

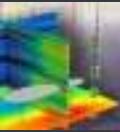


### Geometrics G-858G: Magnetometer

- Sensitivity: 0.01nT (appr. 0.2 ppm)
- Gradient survey
- Rapid surveying, mapping

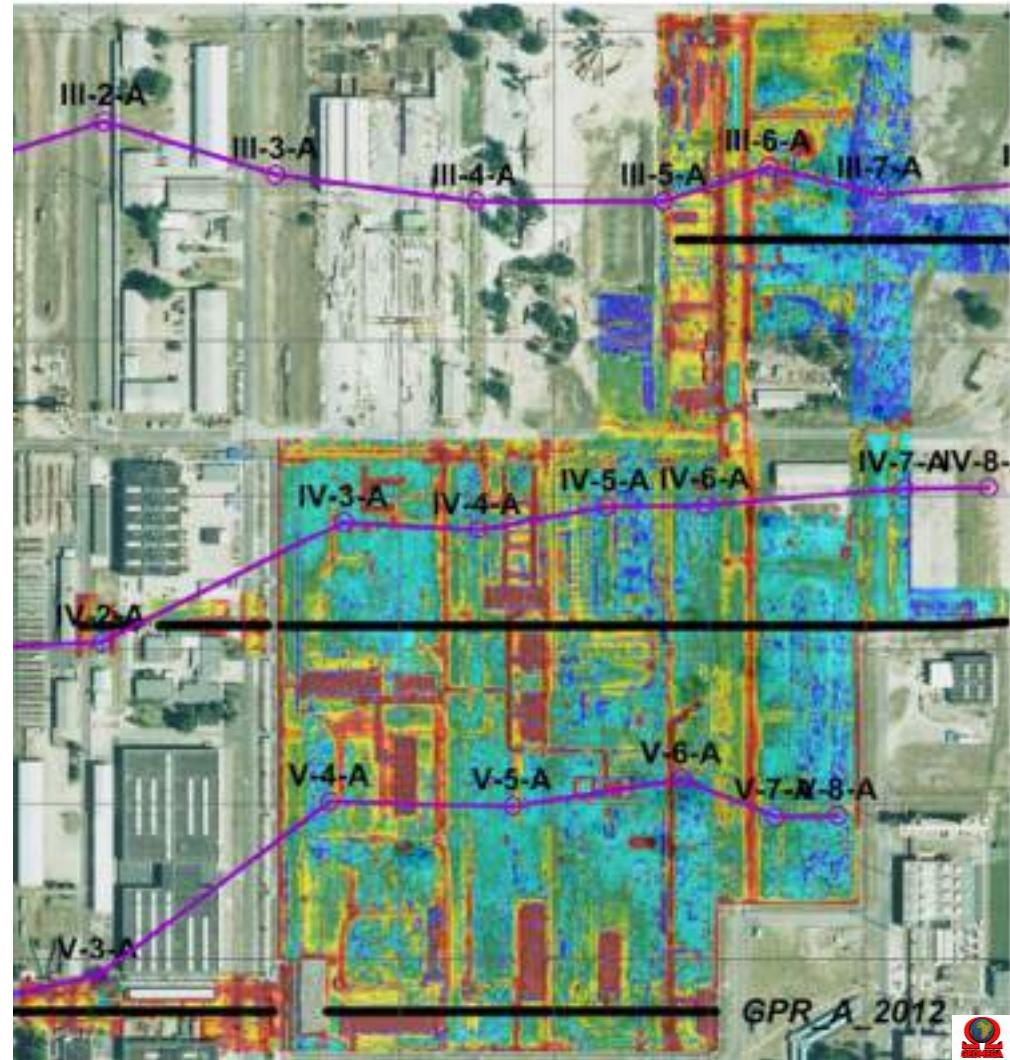
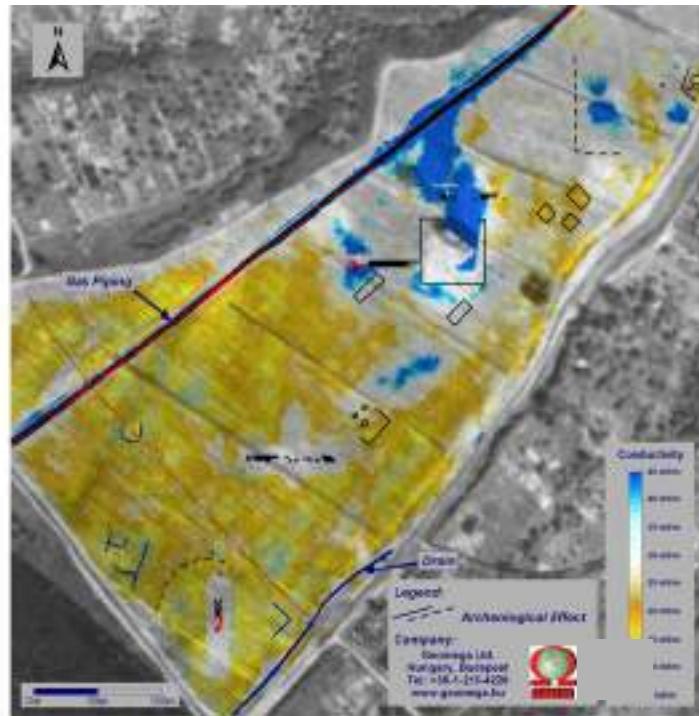


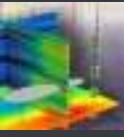
Application: archaeological surveys, detecting pipelines, cables, buried objects.



## Electromagnetic mapping:

- Pipelines
- Cables
- Archaeological objects
- Subsurface anomalies

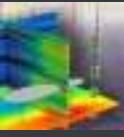




## Magnetic mapping:



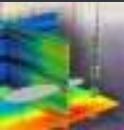
- Pipelines
- Cables
- Archaeological objects
- Subsurface anomalies



## GPR systems:

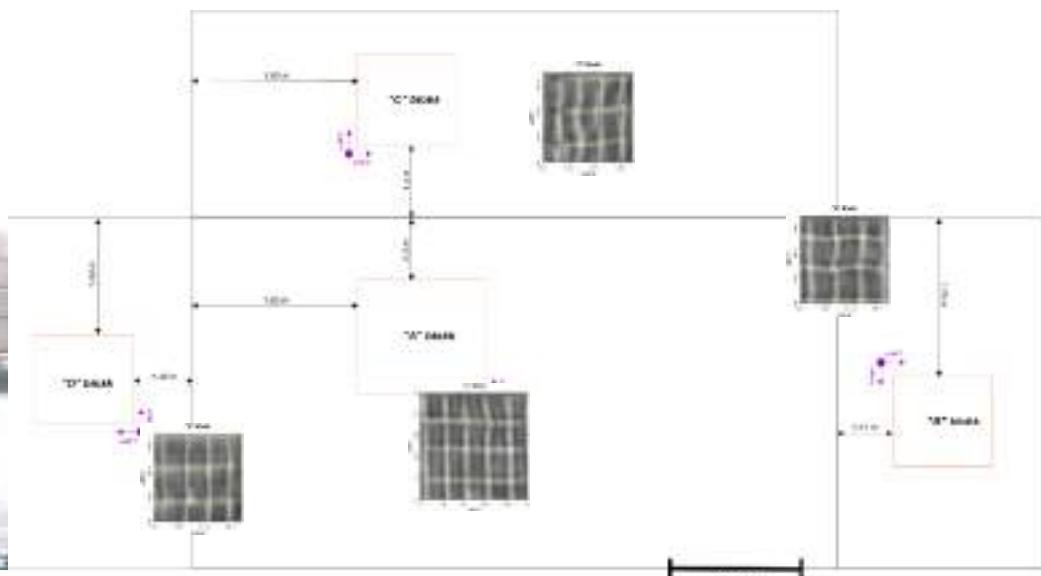
- Low (25MHz-100MHz), medium (250MHz-800MHz) and high (900MHz-2GHz) frequency antennas
- Typical penetration depth is in the few metres range, depending on antenna frequencies and subsurface properties
- On-land and off-shore applications also using submersible underwater antenna
- Wide range of applications: engineering geophysics, archaeological surveys, pipelines, utilities, buried objects, cavity detection, road and bridge structures



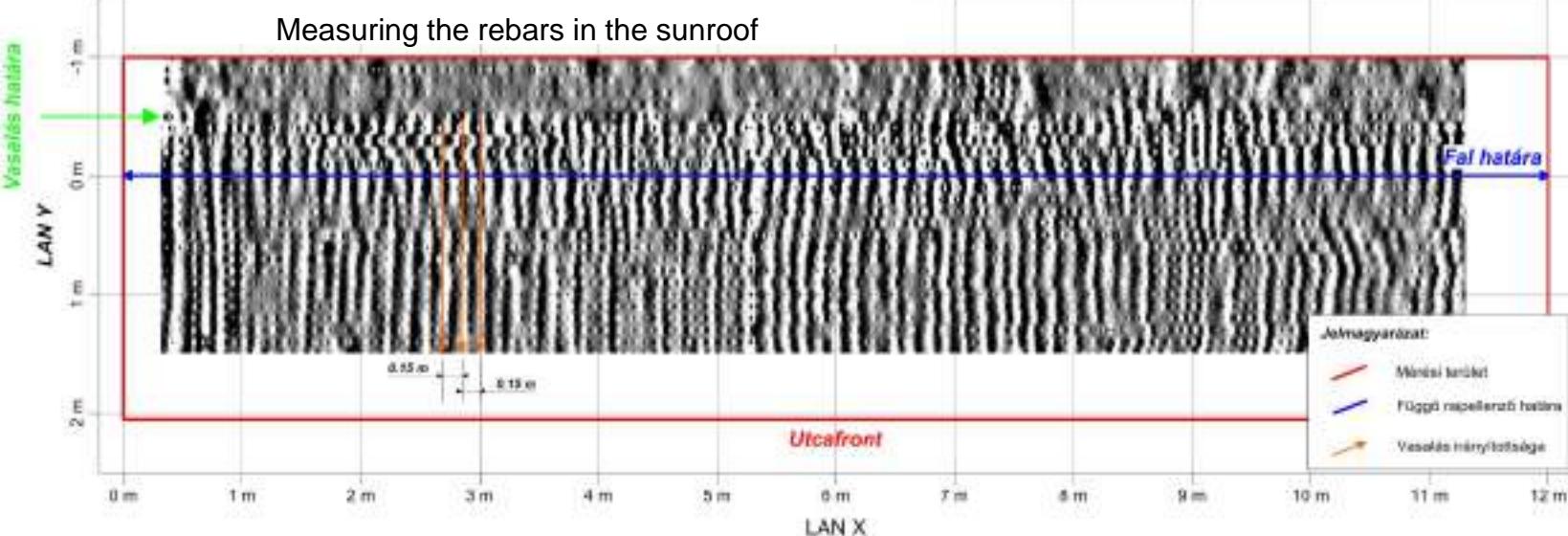


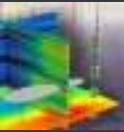
## Concrete structures:

Rebars,  
Detachment surfaces,  
Cavity detection



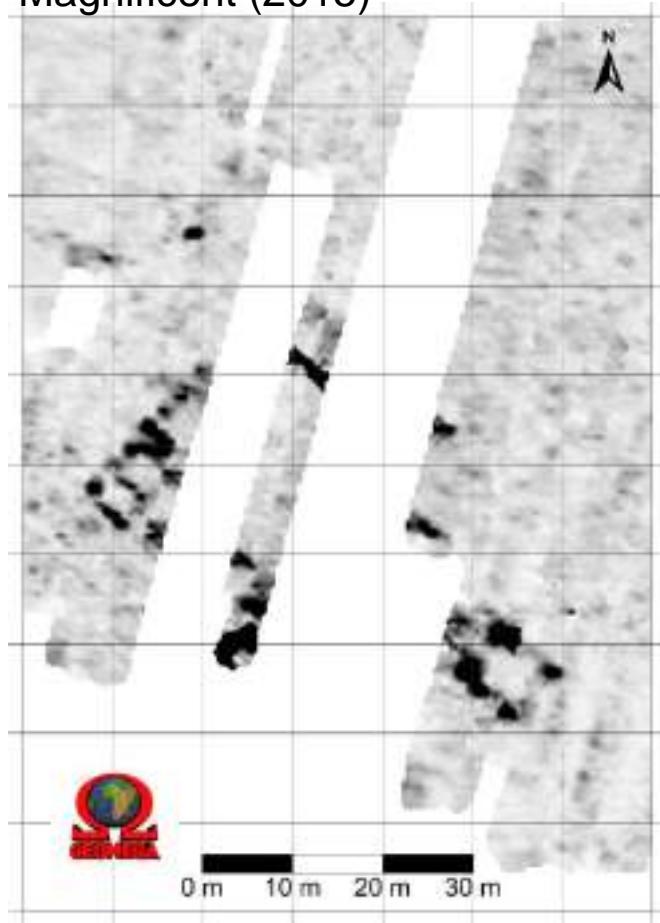
Measuring the rebars in the sunroof





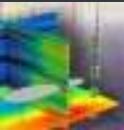
## Archaeological surveys and utility mapping:

Szigetvár, Tomb of Suleiman the Magnificent (2015)

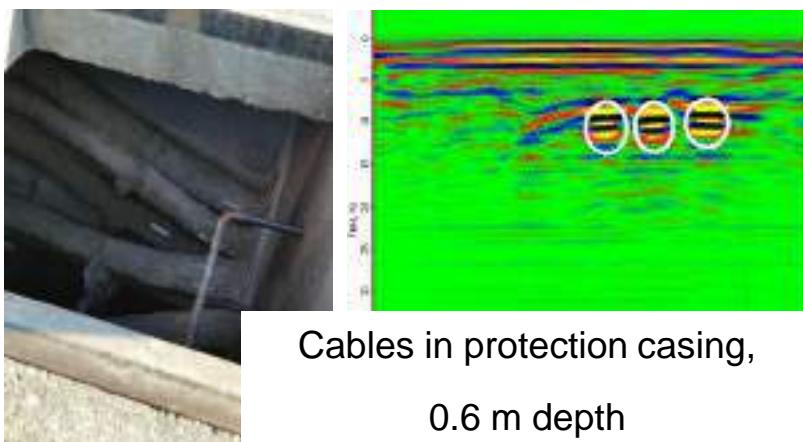
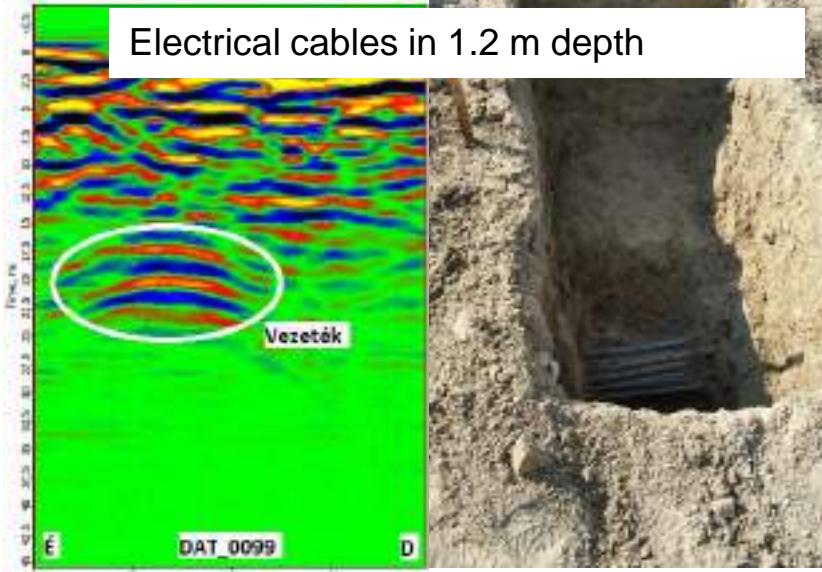


Győr, Dunakapu square

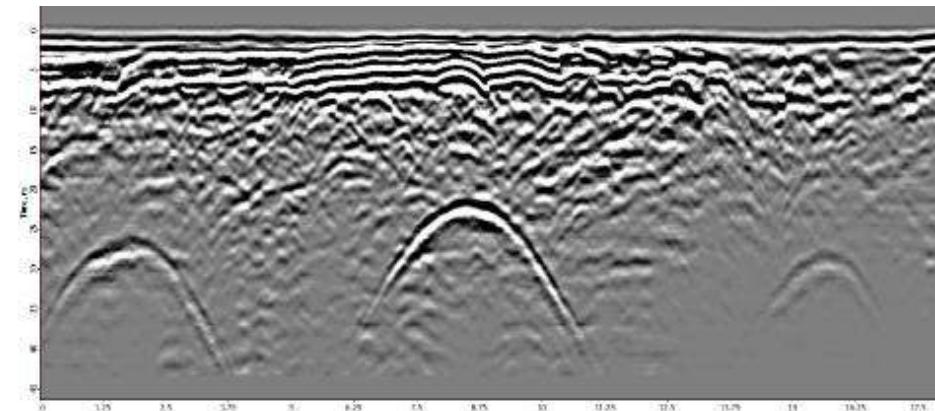




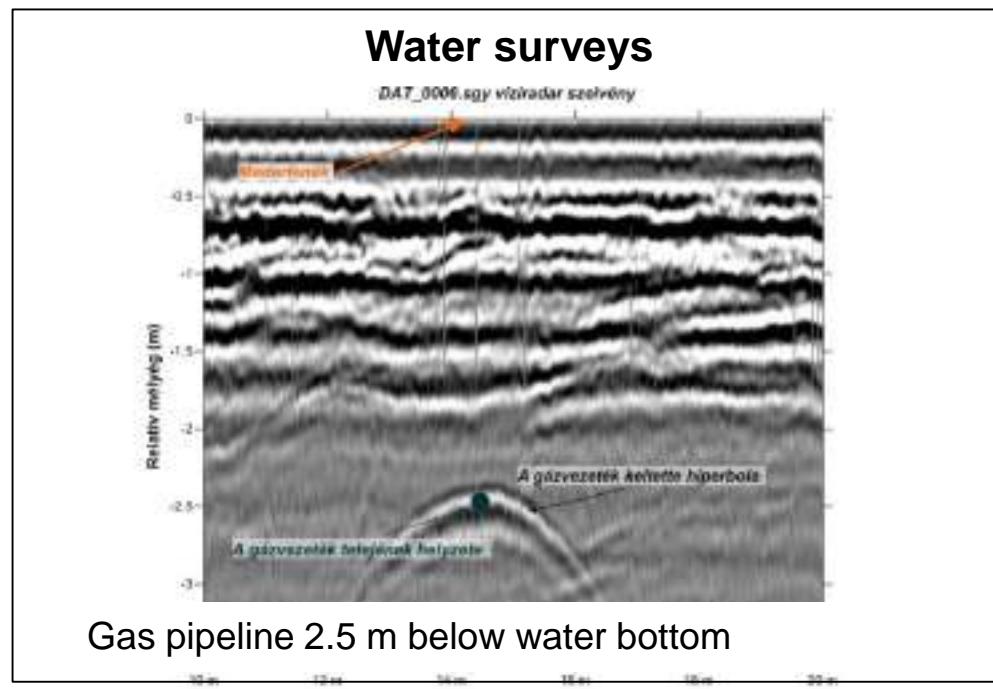
## Cable and pipeline detection:

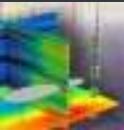


Reinforced concrete pipes in 1.5 - 2 m depth

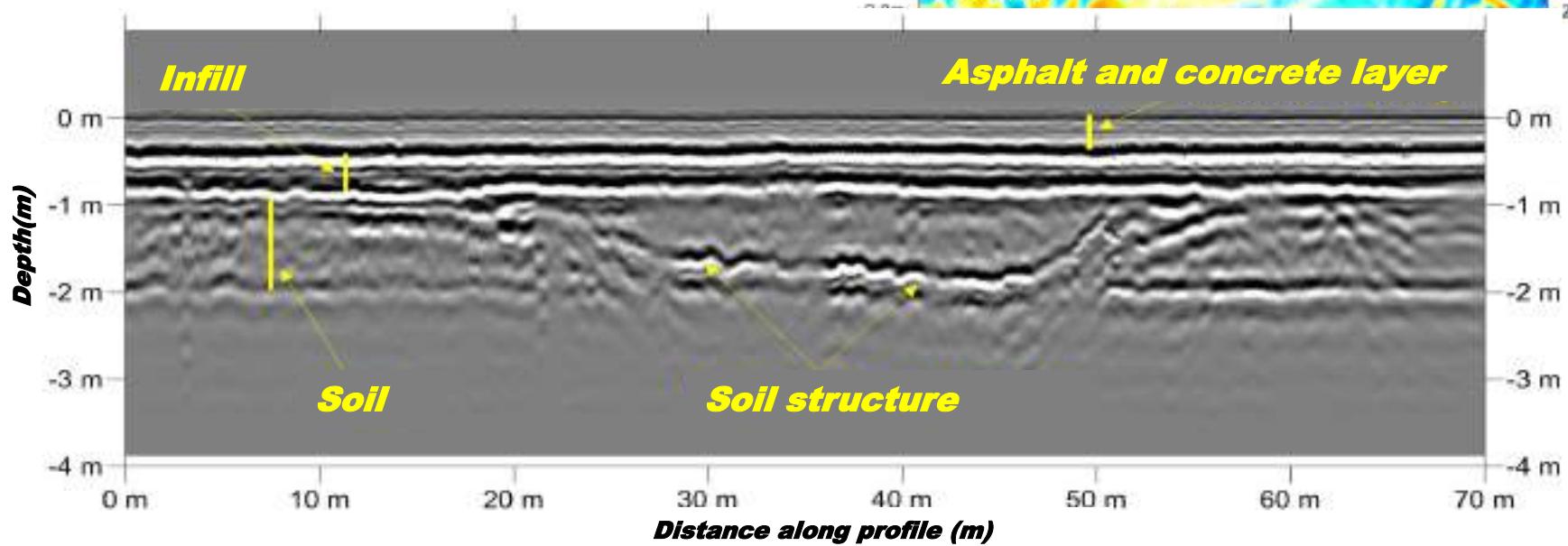
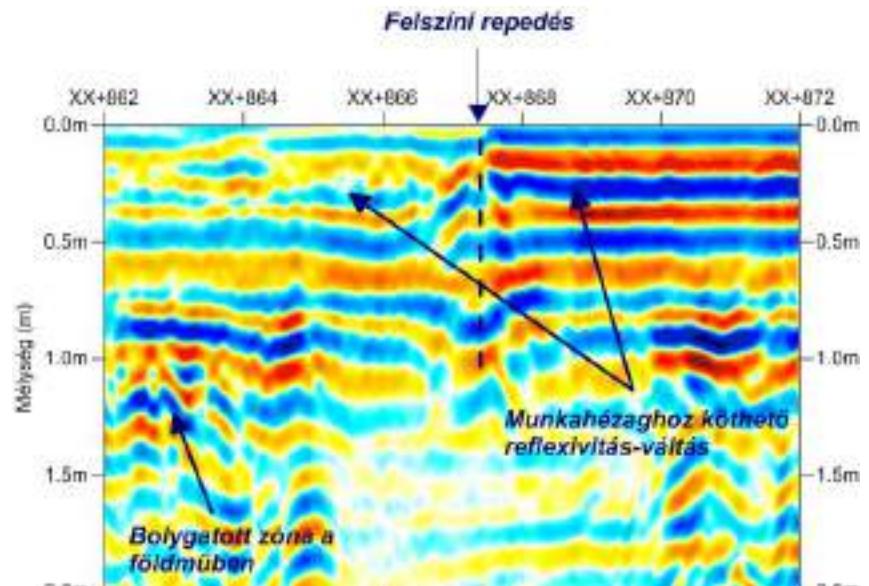


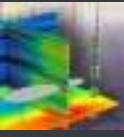
## Water surveys





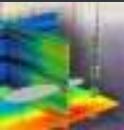
## Road structures:





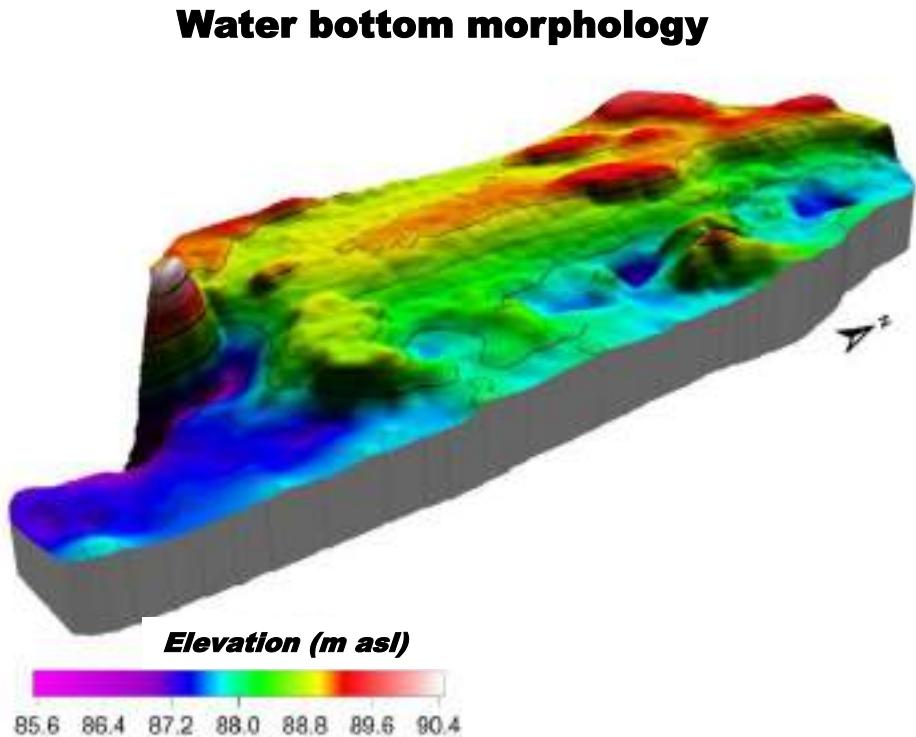
## Cavity detection (Esztergom Prímás-island):



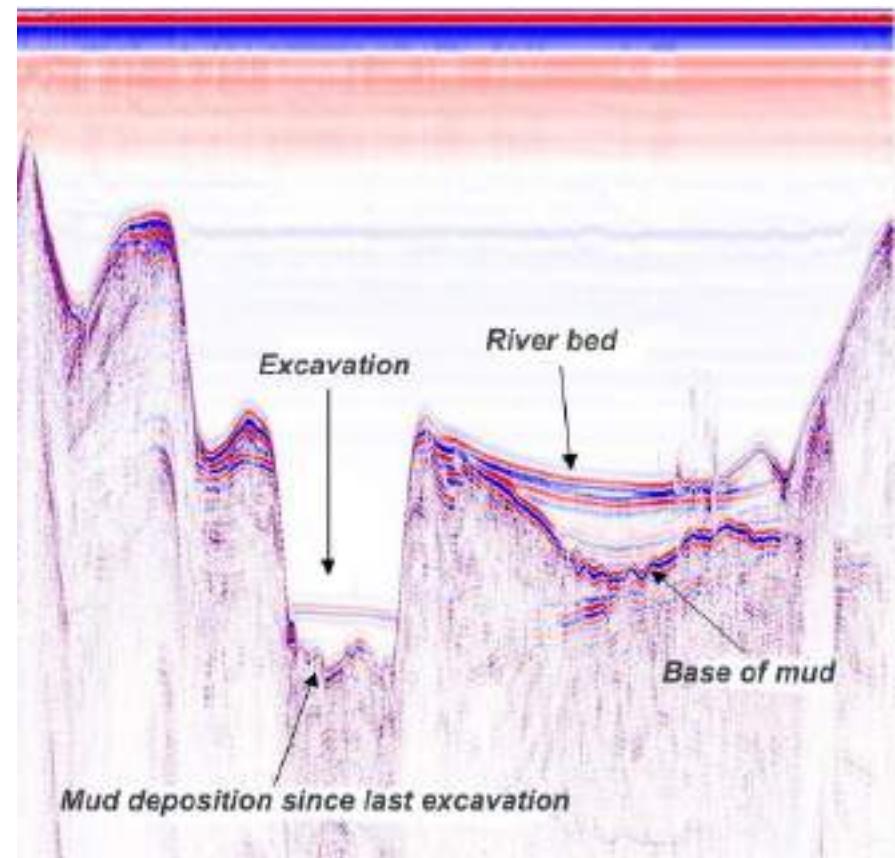


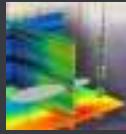
## Archaeological surveys

Roman age stone structure reinforced with wooden logs in river Danube at Dunaújváros (2016)

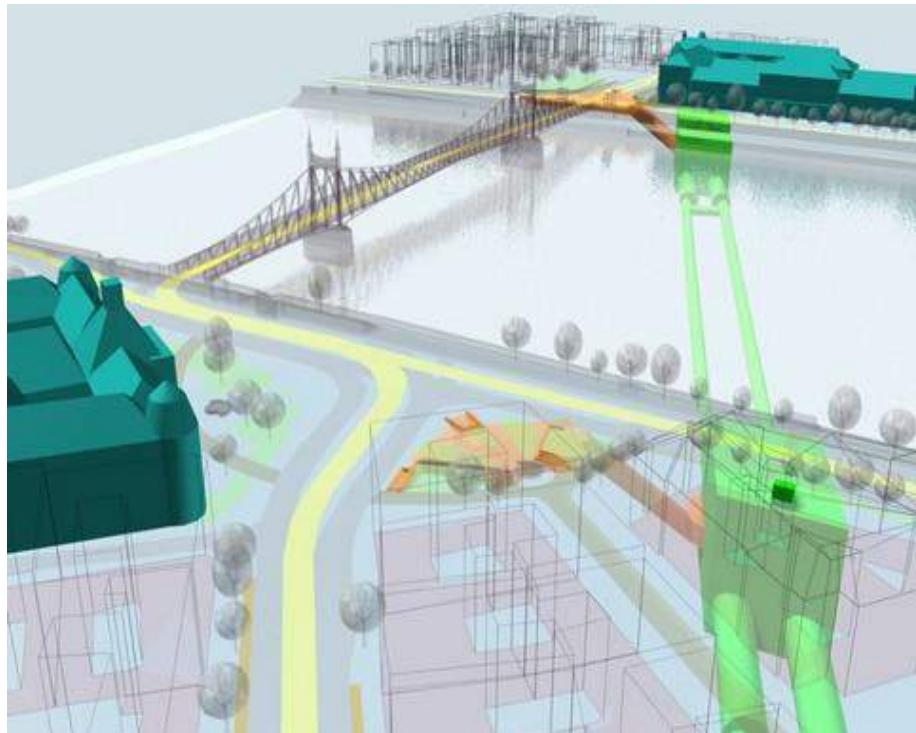


## River and lake bottom, sub-bottom profiling



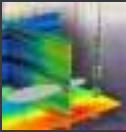


**Engineering Support for  
Metro-4 tunneling work  
under river Danube**



**Planned Tunnel Location  
under River Danube**

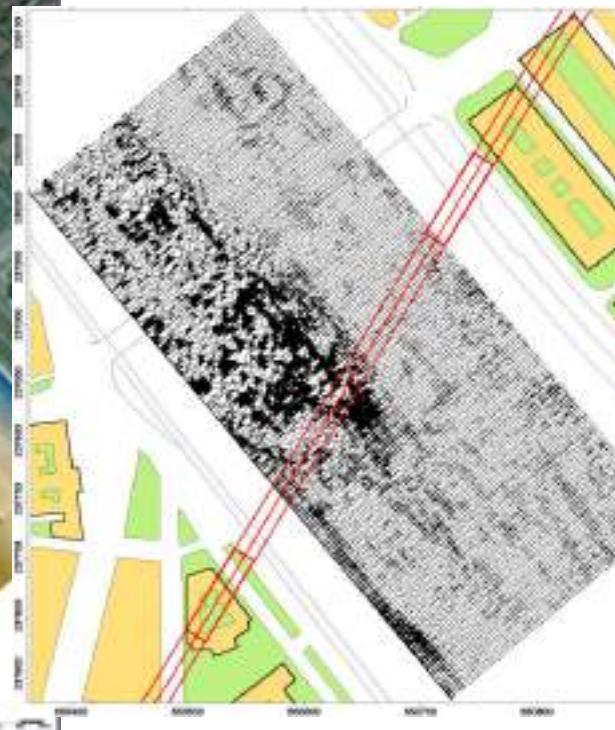




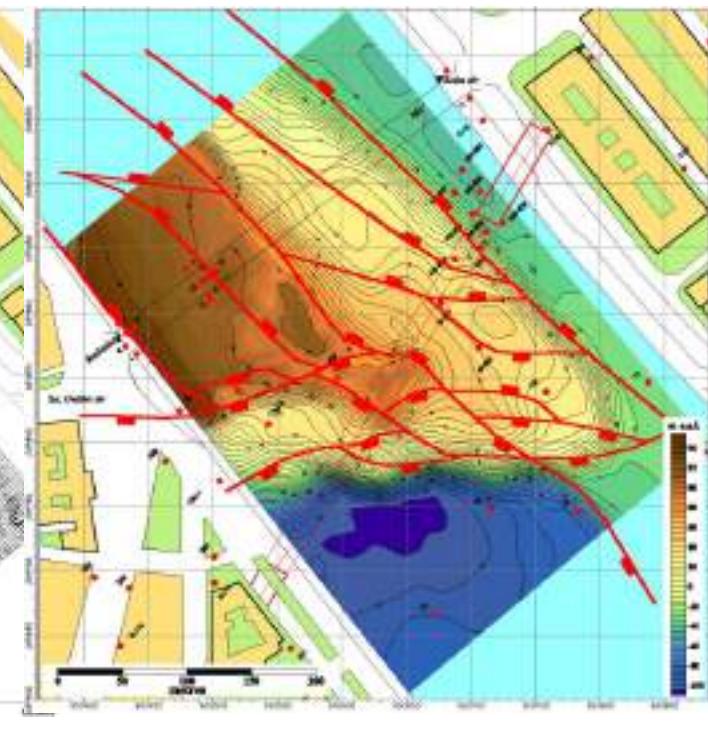
## Engineering Support for Metro-4 tunneling work under river Danube



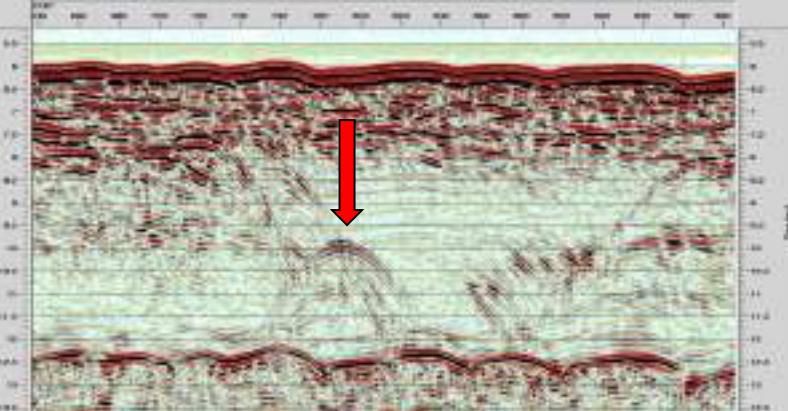
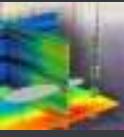
River bed morphology



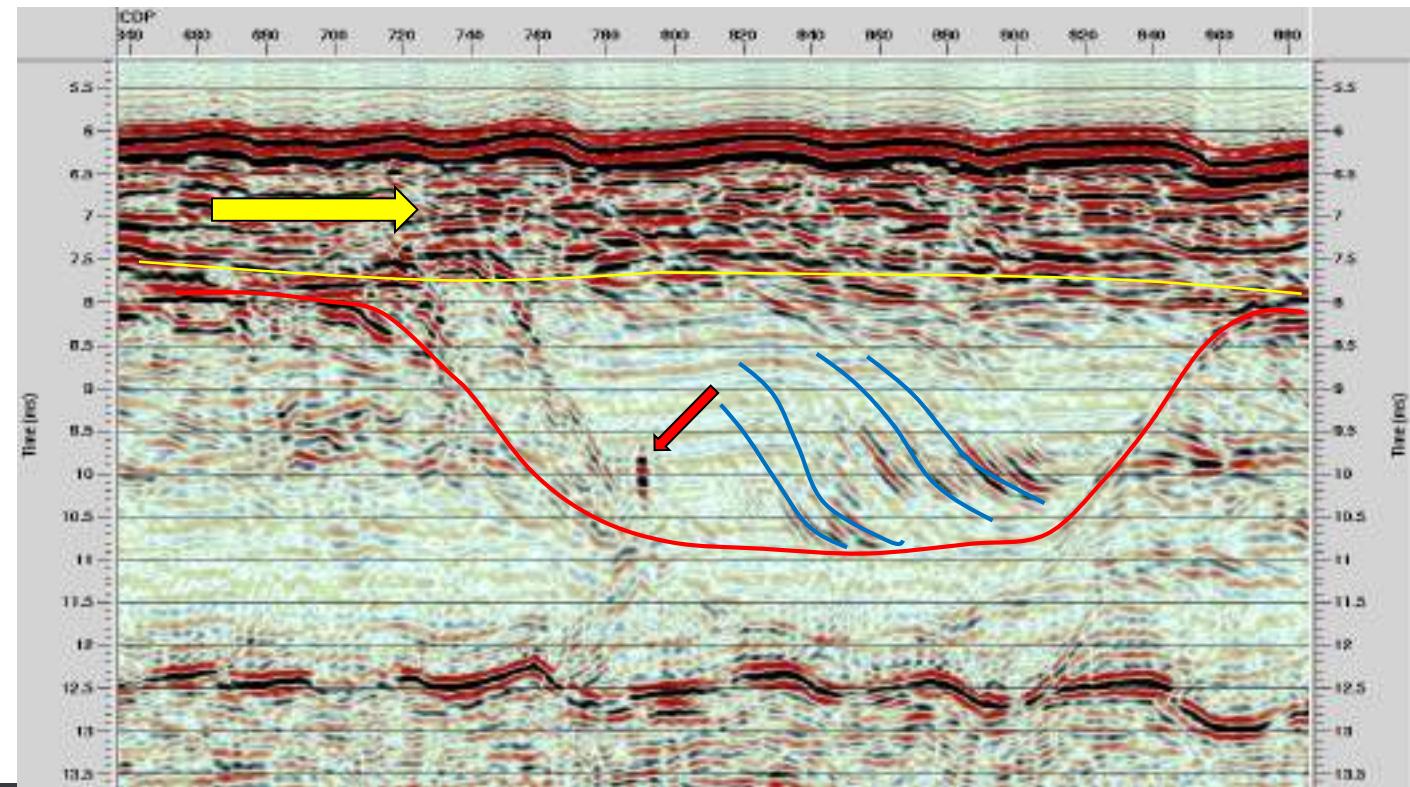
Depth-slice of the 3D seismic data-cube at the depth level of the planned M-4 tunnel

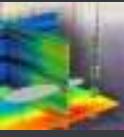


Top of carst and tectonic lines

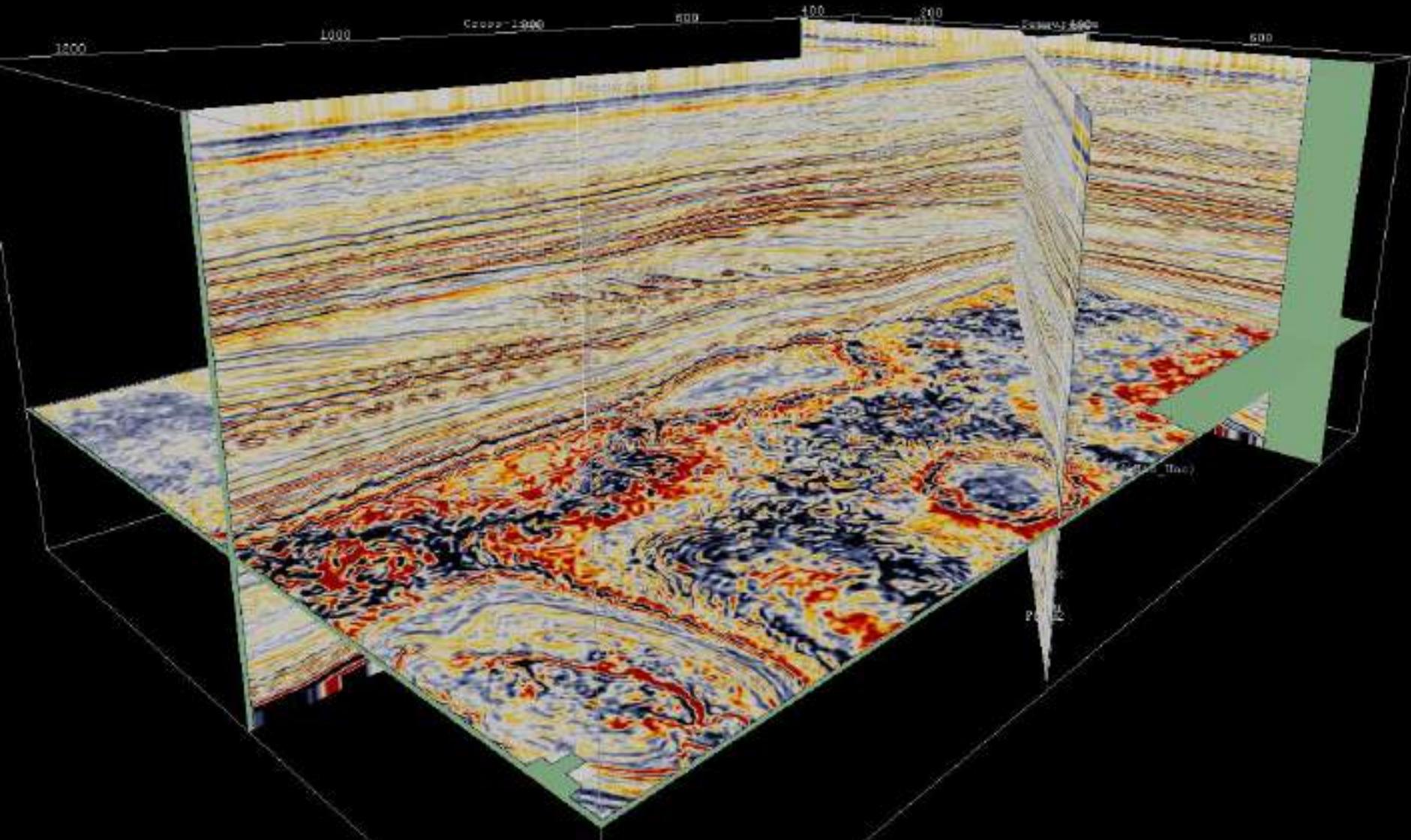


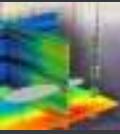
## Gas and Oil Pipeline Detection under River Tisza



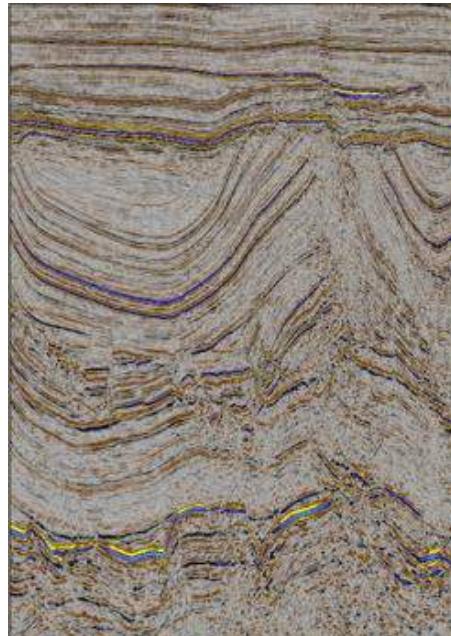


# Hydrocarbon and Geothermal Exploration

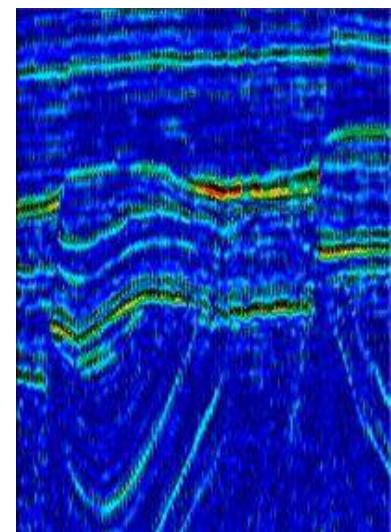


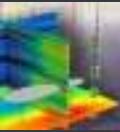


**Seismic design and processing:** Planning, field supervising and processing of 2D and 3D seismic data including state-of-art oil industry solutions (2D-3D stack, post-stack migration, PSTM, PSDM, CDP gathers, AVO)

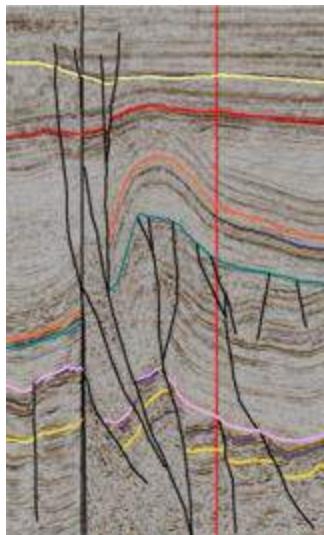


- Flexible, integrated solutions
- Experience in various geological settings all around Europe
- Geologically consistent velocity modelling and workflows
- Preservation of seismic amplitudes
- Borehole-calibrated parametrisation
- State-of-the-art PSTM-PSDM processing
- AVO pre-processing and analysis
- Extensive list of references
- Key softwares: ProMAX 2D/3D,  
Tsunami PSDM  
Hampson&Russell

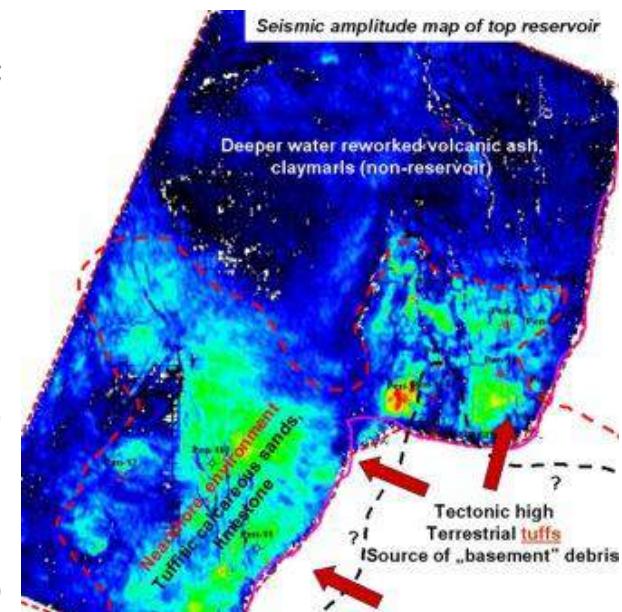
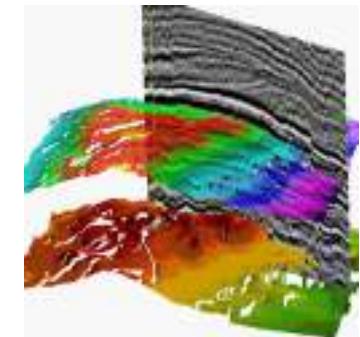


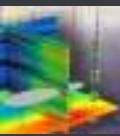


**Regional exploration:** Comprehensive, basin-scale geological/tectonic mapping and interpretation, basin analysis, tectonic and sedimentological modelling, play fairway- and hydrocarbon system analysis, hydrocarbon and geothermal prospecting based on integrated seismic-, borehole- and geophysical databases



- Basin-scale interpretation of 2D and 3D seismic data
- Interpretation of gravity, magnetic and electromagnetic survey data
- Integration of all available geological/geophysical data and borehole information
- Quality-controlled, integrated tectonic and subsurface map constructions based on multivariate geostatistical methods
- Tectonic and basin modelling, map and evolutional reconstructions

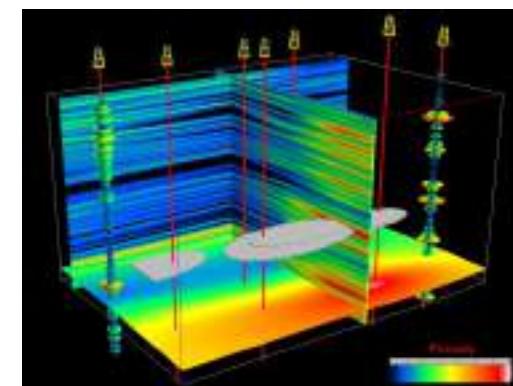
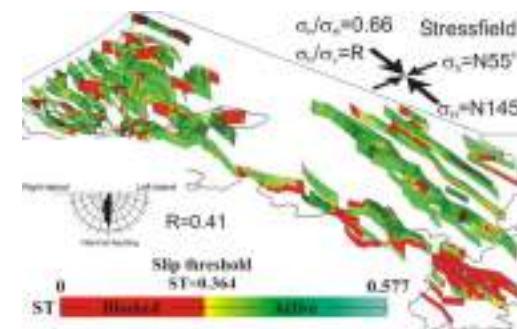
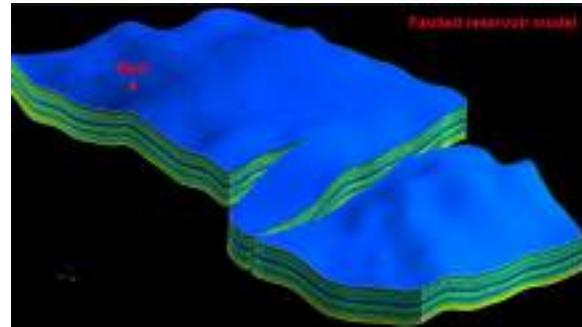


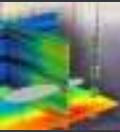


## 3D numerical geological and reservoir modelling:

Construction of geologically consistent, petrophysically fully parameterised 3D digital earth models for reservoir engineering-, hydrogeological-, geothermal- and mining computations

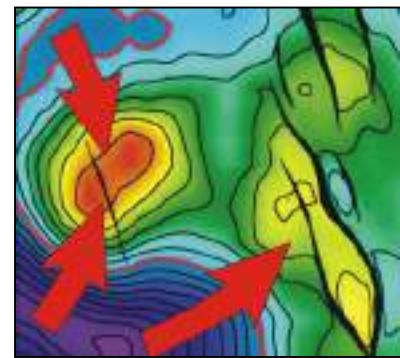
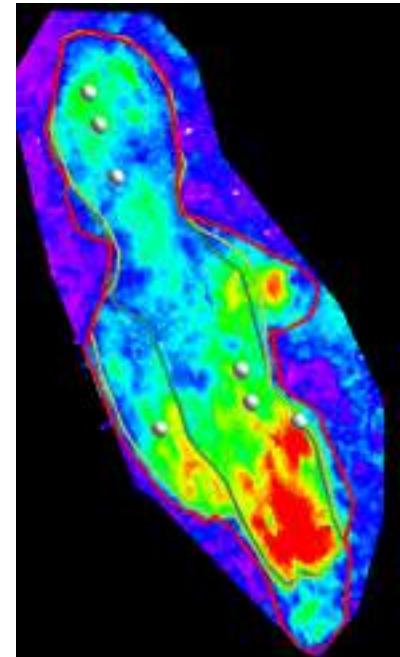
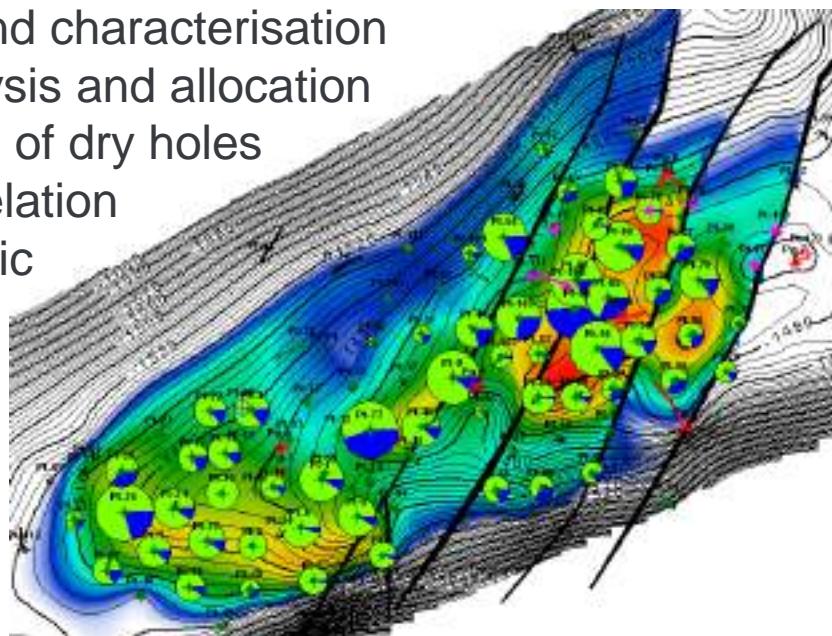
- Integration of borehole geophysical-, seismic- and core data
- Fault reactivation modelling
- 3D fault and tectonic models
  - Realistic faulted horizons
  - Structurally consistent fault systems and fault hierarchy
  - Quality controlled, crossover-free horizon systems
- Multi-parameter 3D earth and engineering models
  - Stratigraphically consistent grid cells (SGRID)
  - State-of-art parameter interpolation techniques
  - Industry standard formats for geothermal-, reservoir geological-, hydrogeological and geo-engineering numerical applications

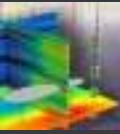




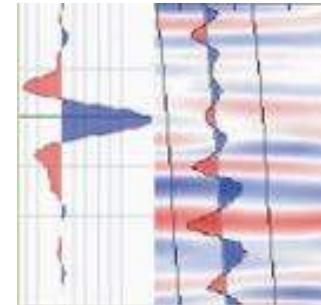
**Hydrocarbon field and prospect analysis:** Comprehensive evaluation of hydrocarbon fields and prospects based on advanced seismic,- geological- and petrophysical interpretations, petroleum geological risk assessment, probabilistic reserve and volumetric calculations, prospect ranking

- Integration of borehole geophysical-, seismic-, and core data
- Reservoir mapping and characterisation
- Production data analysis and allocation
- Post-mortem analysis of dry holes
- Geophysical log correlation
- Monte Carlo volumetric modelling (1D, 2D)
- Comprehensive re-evaluation of hydrocarbon fields
- Geological assessment of hydrocarbon projects

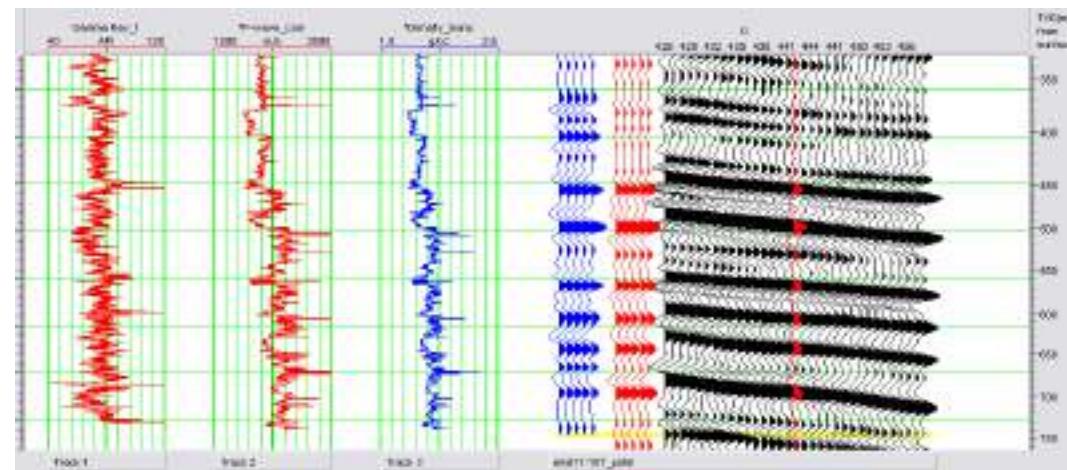
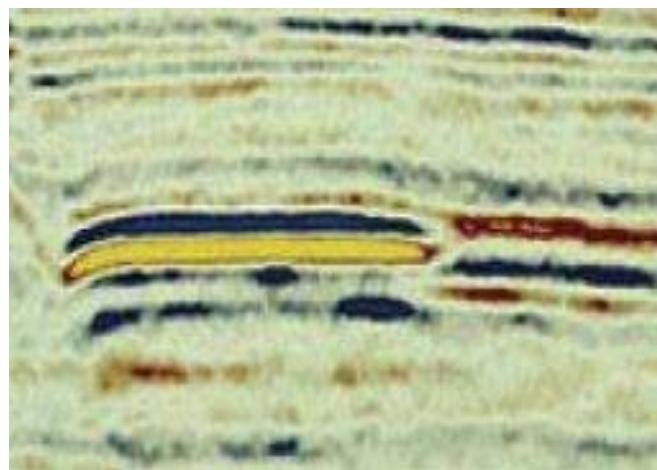


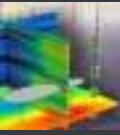


**Quantitative seismic services:** Calibration of seismic data, pore content characterisation, AVO analysis, Fluid Replacement Modelling, seismic inversion, forward seismic modelling, depth conversion, geostatistical reservoir mapping

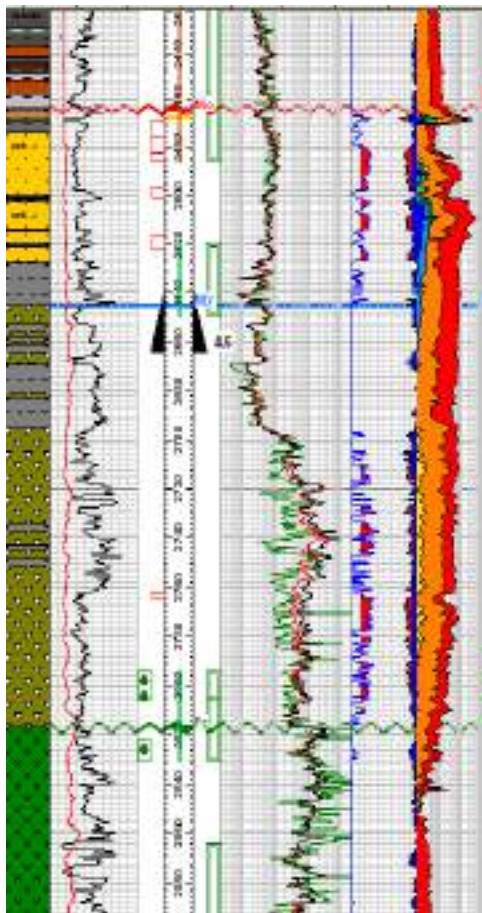


- Matching of borehole and seismic data by synthetic seismograms
- Prospect characterisation and derisking using advanced AVO seismic analysis
- Preparation of petrophysical inputs for 3D Earth models by seismic inversion
- Transformation of any data between seismic time and depth domain
- State-of-the-art software packages

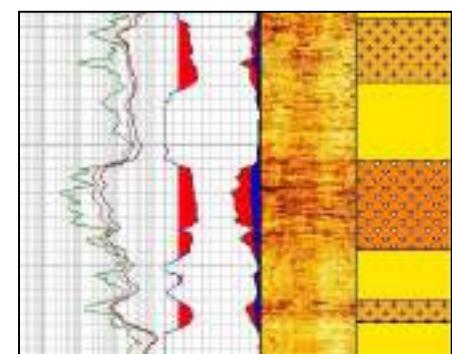
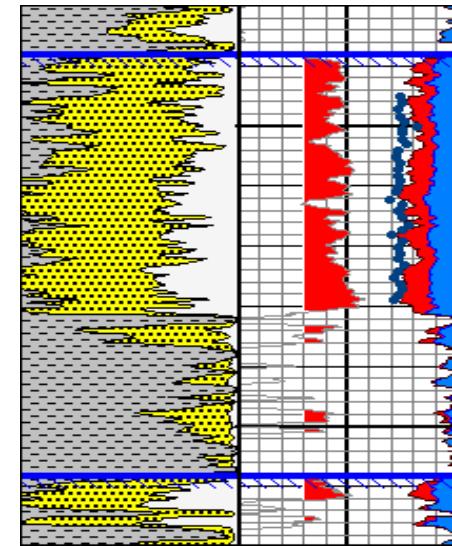


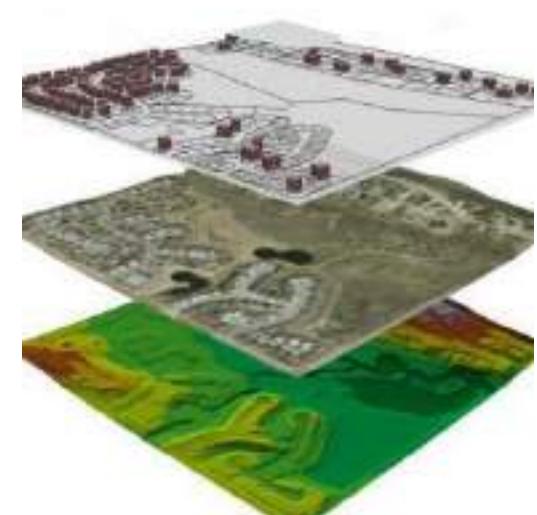
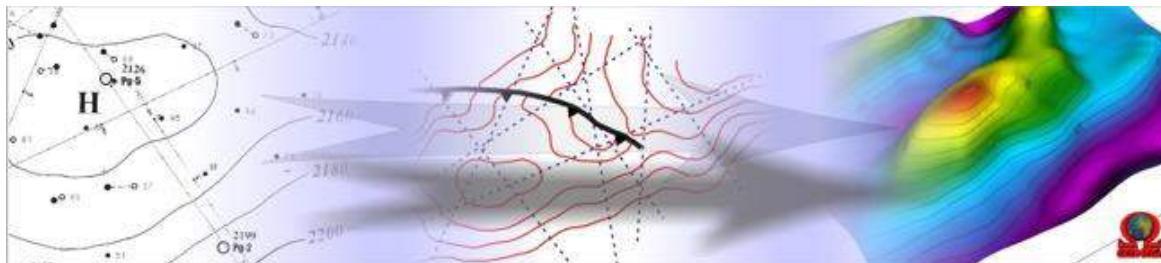
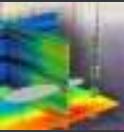


**Petrophysical evaluation:** Calibration and quality-controlled evaluation of borehole geophysical logs, quantitative determination of the petrophysical parameters (clay volume, effective porosity, water saturation) of the reservoir



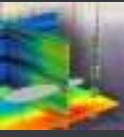
- Hydrocarbon reservoir and aquifer characterisation using industry standard modern as well as all type of vintage logs
- Identification and characterisation of fractured reservoirs and aquifers using state-of-art image logs (CBIL, FMI)
- Optimisation of required log suite
- Perforation characterisation and interpretation of production logs including spinner and noise logs
- Integration of all available core, well test and mudlog data
- Conventional and unconventional rock types (tight sand, volcanites)





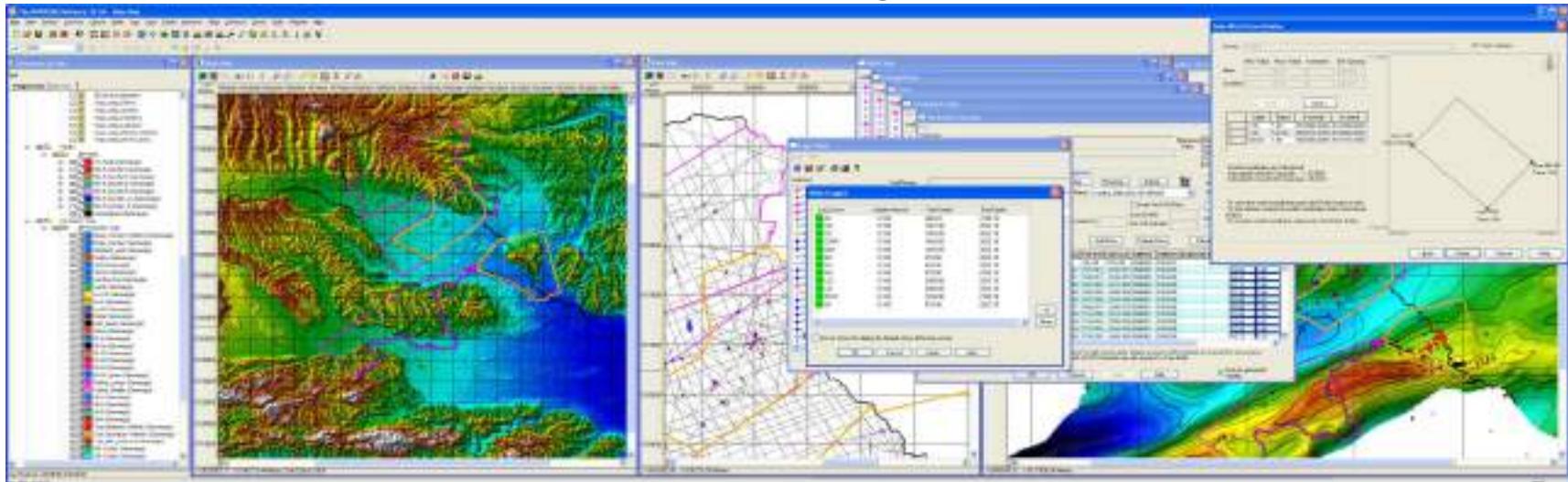
**Well log and map digitisation:** Size independent scanning, georeferencing, and vectorization of geological/geophysical maps, borehole geophysical logs and geological sections

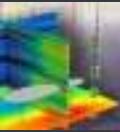
- Map digitisations
  - Digitisation of vintage geological/geophysical data from any media
  - Image transformations and georeferenced vectorisation
  - Outputs compatible with any GIS system
- Well log digitisations
  - Market leading software solutions
  - Flexible handling of paper/scanning distortions
  - Neural network-based automatic tracking of continuous or dashed curves
  - Linear, multi-linear, logarithmic and back-up scale handling
  - Industry standard LAS, LIS output formats



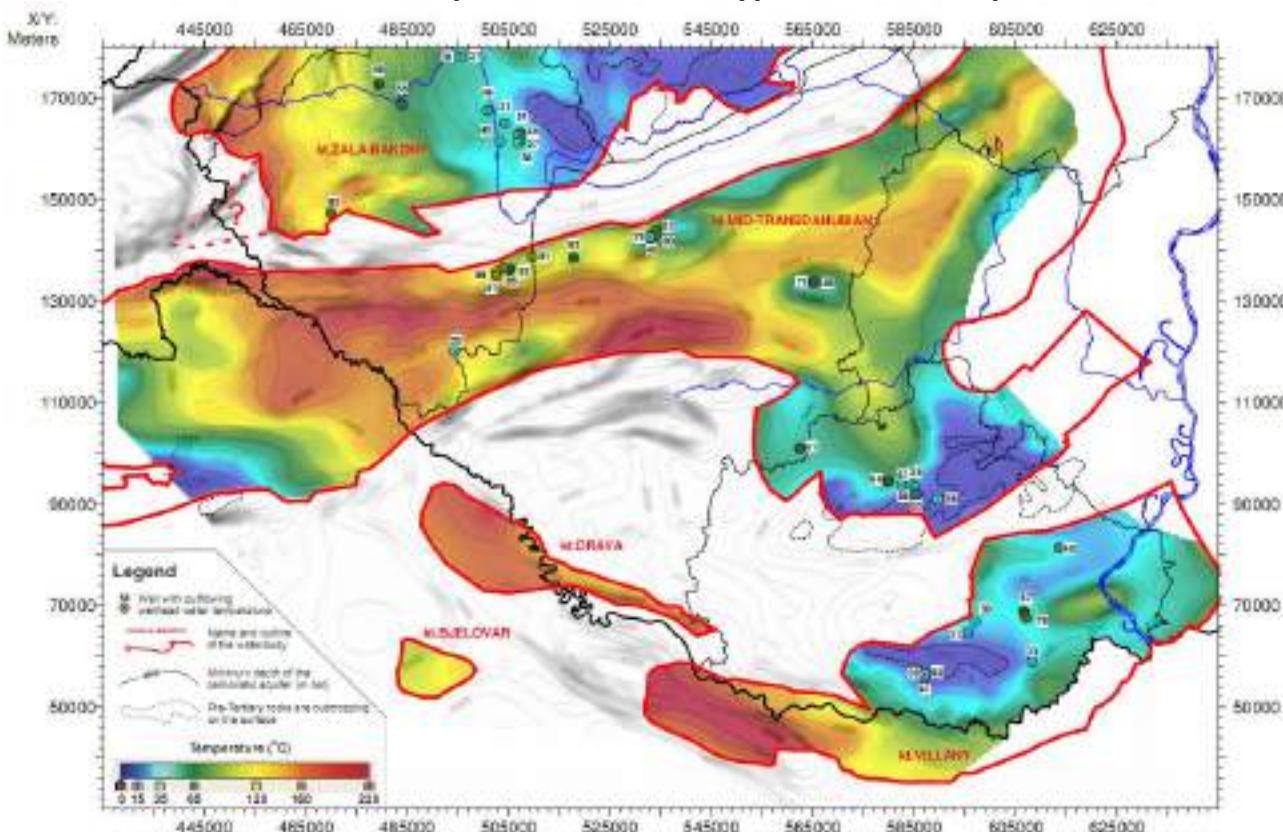
**Data Services:** Capturing and management of essential geological-geophysical, borehole and production data, data conversion, building of digital geological-geophysical exploration projects, dataroom and eRoom services

- Data capture and management
- Rigorous quality control
- Grid and coordinate transformations, SEGY and well log merging
- Integrated project building for trouble-free interpretations
  - Seismic mistie analysis
  - Comprehensive geological-, geophysical- and borehole databases
- Virtual dataroom services for Clients using our dedicated servers

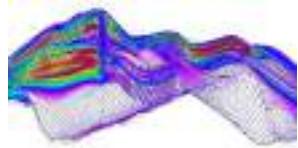
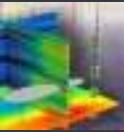




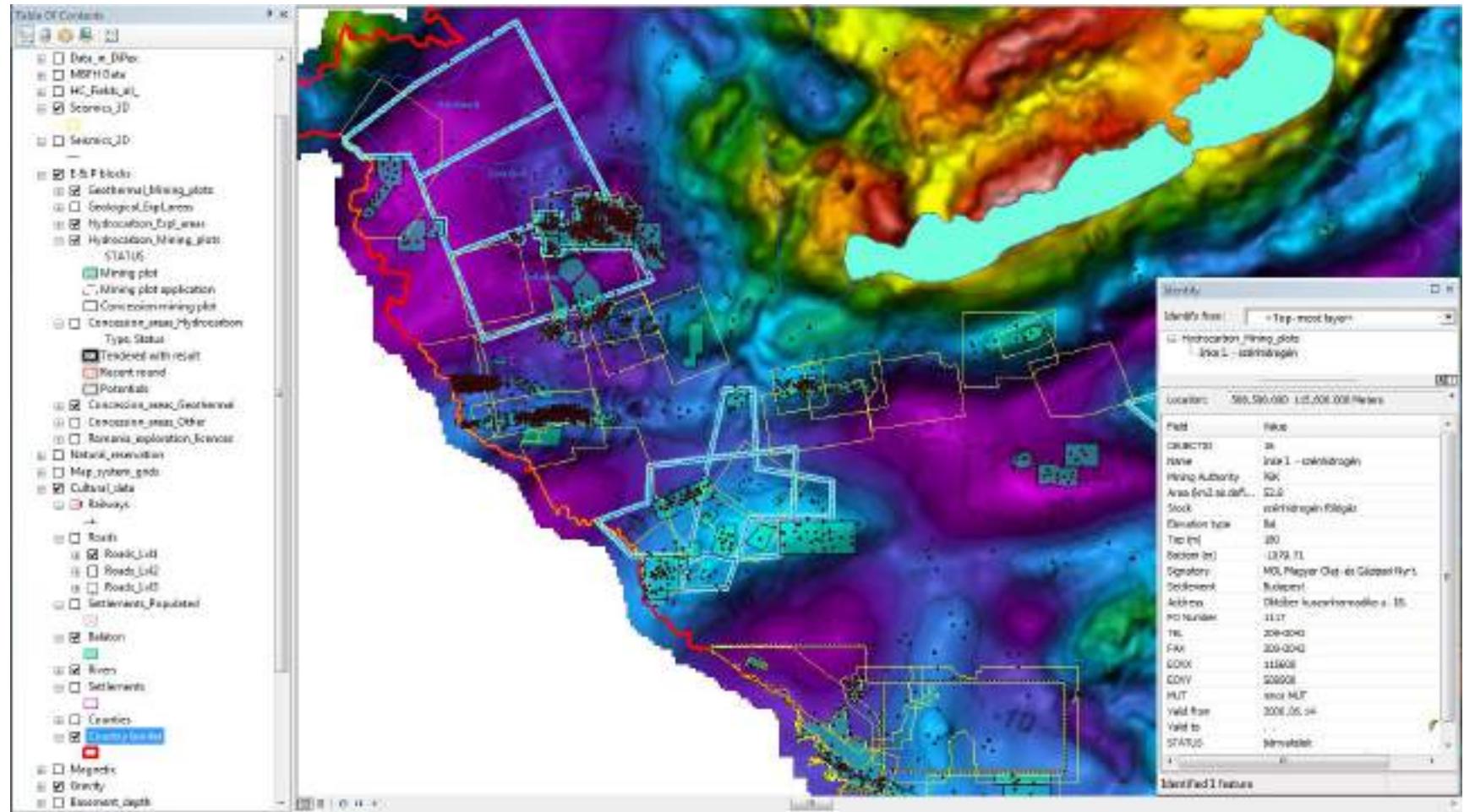
**Geothermal exploration:** Geological-geophysical evaluation of geothermal energy projects, thermotectonic characterisation of geothermal aquifers, thermal modelling, geothermal prospecting, construction of subsurface temperature and gradient maps

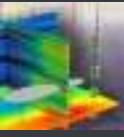


Development and maintenance of the geothermal database of the Pannonian Basin  
 Thermal and maturity modelling  
 Identification of thermal aquifers  
 Comprehensive geothermal prospectivity analysis  
 Geological evaluation and risk assessment of geothermal projects

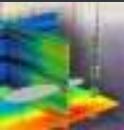


## A geological-geophysical data inventory and management tool





- A versatile and adaptive tool for data inventory and exploration management
- An integrated GEO-database developed by geoscientists for geoscientists
- Arc-GIS based database structure applicable for any exploration area worldwide
- Old analog / paper based data turned into a modern digital database
- Continuous development of the database structure for more than 10 years
- Most complete digital geo-database available for our Clients in Hungary
- Knowledge / license transfer to any country is an open possibility



## A multi-layer, interconnected digital ArcGIS graphical database and underlying thematic directory structure

### ArcGIS layers and connected databases

- Exploration objects: 2D/3D seismic surveys, boreholes geophysical surveys, etc
- G&G maps: geological, depth and historical maps
- Thematic: HC field & reservoir data, mining data, water reserve etc
- Exploration legal data: exploration and concession licences, mining plots
- Environmental data: nature reserve, national parks
- Cultural data: roads, rivers, topography, satellite

### Borehole database example

└ Nykščíny Nydb-1
└_01_Well_aliases
└_02_Logs_All
└_03_Logs_GeoL.curves
└_04_Sтратиграфия
└_05_Core_list
└_06_Test_results
└_07_Mud_samples
└_08_Geochem_samples
└_09_Petro_samples
└_10_Well_structure
└_11_Perforations
└_12_Wells_Water_data
└_13_Well_data_info



query and selection

### Thematic directory structure for raw data

#### 2D/3D seismic

- field data
- reports
- segy files
- velocity cubes



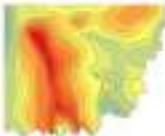
#### borehole data

- final reports
- core data
- deviation
- fluid analysis
- logs, etc



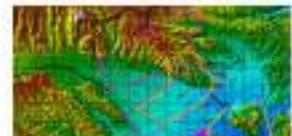
#### G&G maps

- raster maps
- vector maps
- grids
- regional maps
- historical data



#### thematic layers

- HC field data
- water reserve
- mining data
- etc



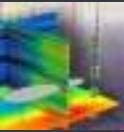
#### environmental etc

- nature reserves
- cultural data
- topography
- satellite imagery
- etc

### Well data structure example

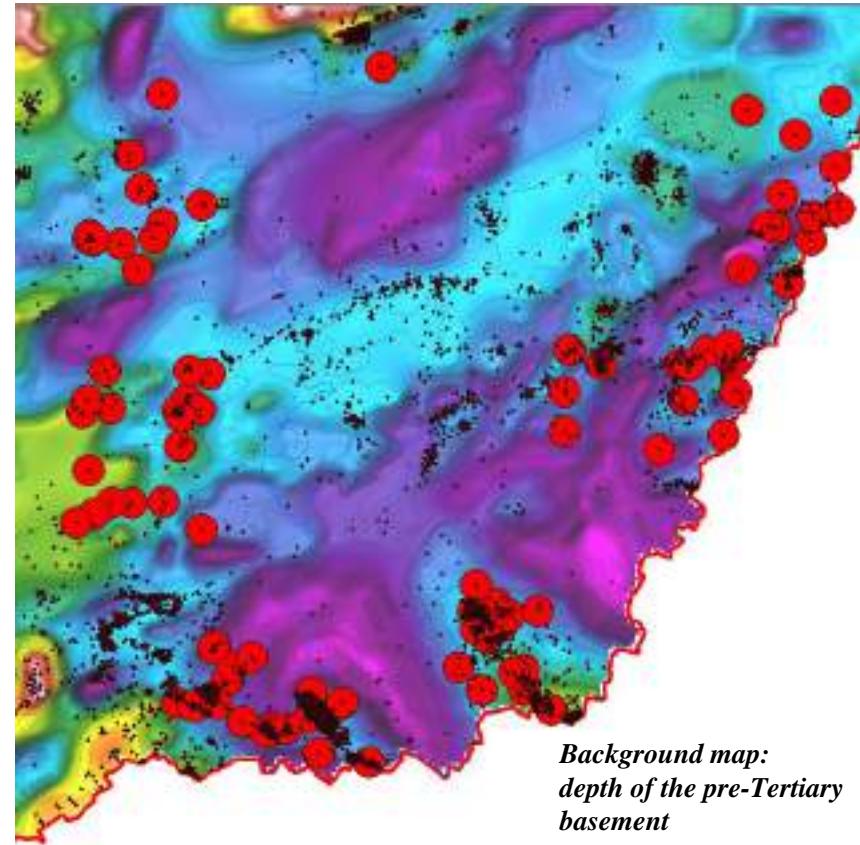
Name	Ext	Size
...		<DIR>
[#Wellbook]		<DIR>
[#Composite_log]		<DIR>
[#Core_data]		<DIR>
[#CPI]		<DIR>
[#Daily_reports]		<DIR>
[#Deviation]		<DIR>
[#Final_report]		<DIR>
[#Logs]		<DIR>
[#Mudlog]		<DIR>
[#Tests]		<DIR>
[#VSP_Checkshot]		<DIR>

Flexible and user-friendly query and selective raw data export to any interpretation tools (IHS Kingdom, Petrel etc)

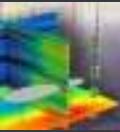


## Benefits

- Geoscientific thinking behind the data structure
- Information about both existing and available exploration data
- Complex queries and export (i.e. all boreholes which has GR logs in the Miocene)
- Database structure compatible with industry leading interpretation tools
- Data display and single-click data reach
- Adaptable to any exploration company or country
  - Our hungarian database contains information over 190000 wells, 6500 2D seismic and 98 3D seismic surveys

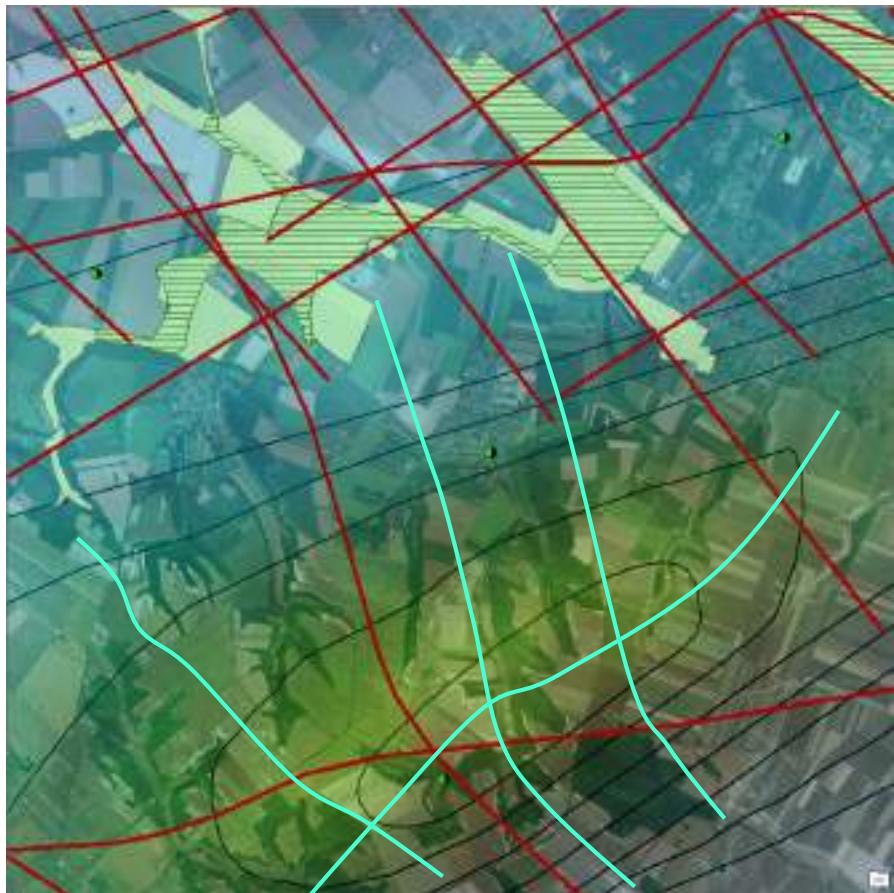


*Example: all HC wells from SE Hungary, which were drilled deeper than 300m (boreholes with digitally available time-depth data are highlighted)*

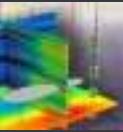


## Benefits

- Easy integration of all necessary topographical and subsurface geological maps to design exploration activities
- High resolution topographical imagery together with up-to-date environmental GIS objects help to design the precise location of any exploration object (well or survey) with minimal environmental and social impact



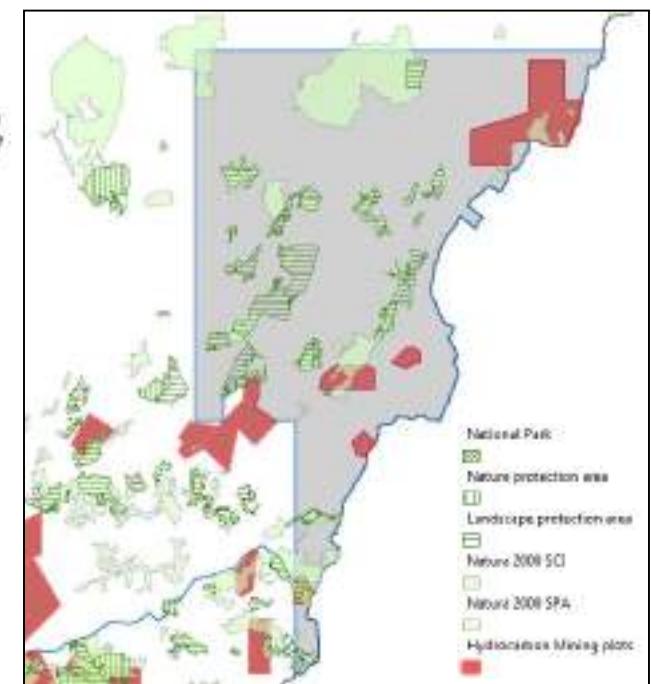
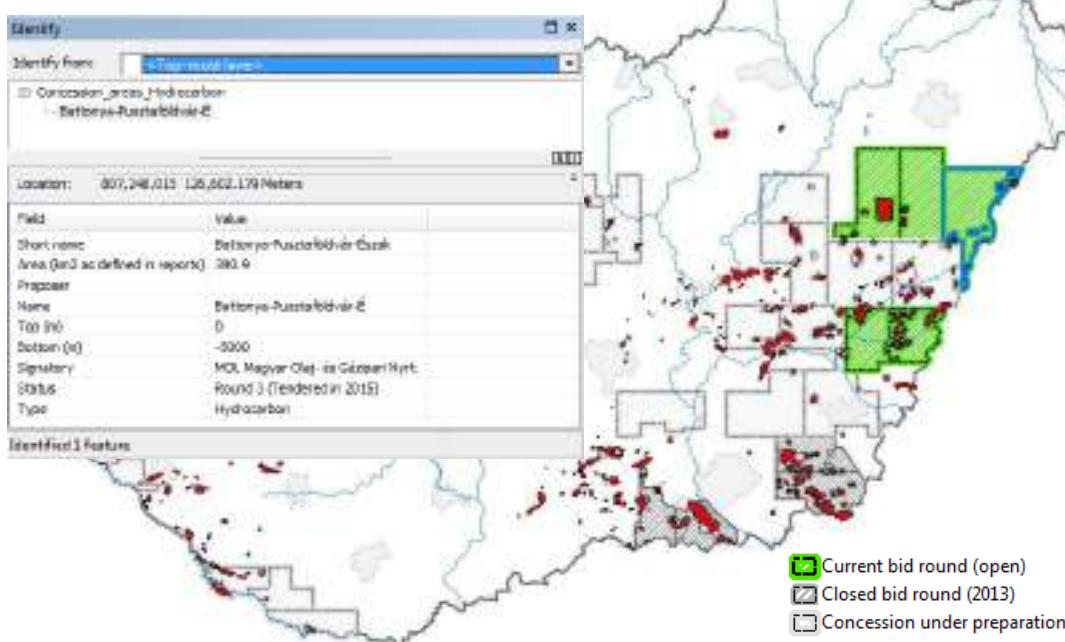
*Example: infill 2D seismic trajectory design (cyan lines) avoiding protected and habited areas, and keeping acquisition costs down by running on cultivated farmlands instead of forests (contours and background color shading: subsurface structural map)*

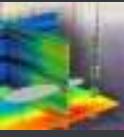


## Benefits

- Very helpful for exploration companies and government institutions
- Putting upcoming or existing exploration and concession blocks into geological perspective
- Easy overview about geological data availability within a given block/area
- Not only for the HC industry

### *Concession block details*



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1095 Budapest

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7673 Kővágószőlős

Hungary

**Baranya County Branch Office:****Tel:** +36-1-215-4226**Mobile:** +36-30-9310-272**Fax:** +36-1-455-0877**E-mail:** [info@geomega.hu](mailto:info@geomega.hu)**Web:** [www.geomega.hu](http://www.geomega.hu)**Facebook:** /GeomegaLtdBudapest