



# *Workshop on the Danube Region Geothermal Concept (DanReGeotherm)*

*Budapest, 28 November 2013  
Geological and Geophysical Institute of Hungary*

## **Country update: ROMANIA**

Anca-Marina Vîjdea

Project manager

Geological Institute of Romania (IGR)

With contributions from Marcel Rosca, Codruta Bendea

University of Oradea

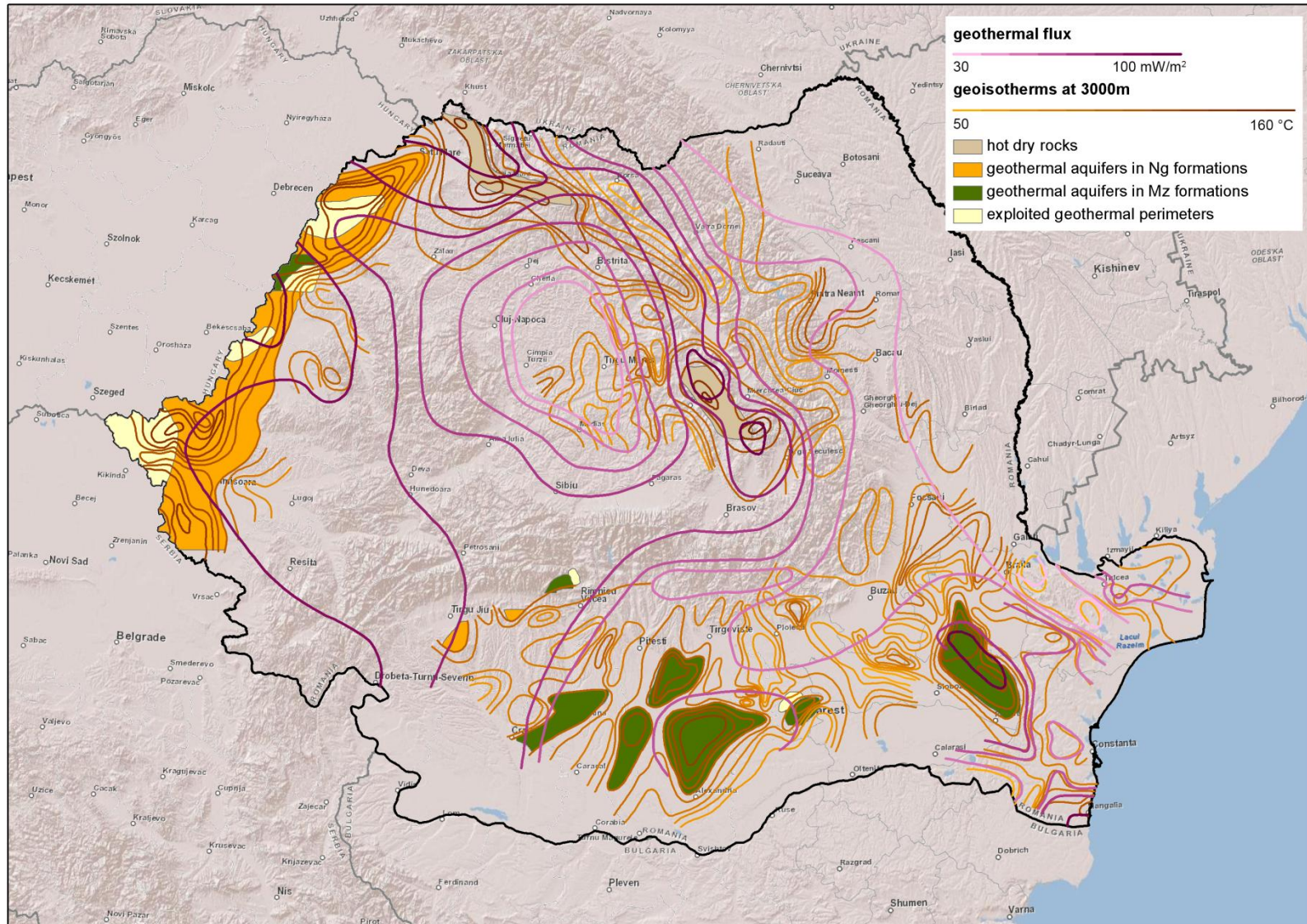
# Main deep geothermal reservoirs

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- The sole surface manifestation are hot springs
- The geothermal resources in Romania are of low enthalpy, with temperatures 40 – 120°C
- Located at depth of 1 – 3 km
- Most of the temperature data and the geothermal aquifers were determined by measurements in wells drilled for oil and gas exploration, as well as in structural wells and wells made especially for geothermal exploration in the period 1970 – 1990.
- Located mainly in the sedimentation basins and the fracture zones



# Geothermal map of Romania



Published by IGR in the Geological Atlas 1:000.000 (Veliciu et al., 1985)

# Aquifers in the Pannonian Plain

Parameter	Unit	Pannonian (West plain)	Oradea	Bors	Beius	Ciumeghiu
Type		Multilayered, confined, located in the sandstones at the basement of Upper Pannonian, artesian and pumping	In Triassic limestones and dolomites, hydrodynamically linked with Felix reservoir (Cretaceous limestones), artesian	Fissured Triassic carbonate formations, tectonic closed aquifer, artesian	Triassic limestones and dolomites, artesian	Gritstones (Lower Pannonian), artesian
Area	km <sup>2</sup>	2500	75	12	47	5
Depth	m	800–2400	2200–3200	2500	1870–2370	2200
Well head temperature	° C	60–90	80–110	120	84	105
Total dissolved salts	g/l	2.0–7.0	0.8	1.4	0.5	5–6

# Aquifers in the Getic Unit and Moesian Platform

Parameter	Unit	Olt Valley (Cozia-Calimanesti)	Noth Bucharest (Otopeni)
Type		In fissured Sennonian siltstones, artesian	In fissured Cretaceous limestones and dolomites, needs pumping
Area	km <sup>2</sup>	28	300
Depth	m	2100–2400	1900–2600
Well head temperature	° C	70–95	58–84
Total dissolved salts	g/l	13	2.2



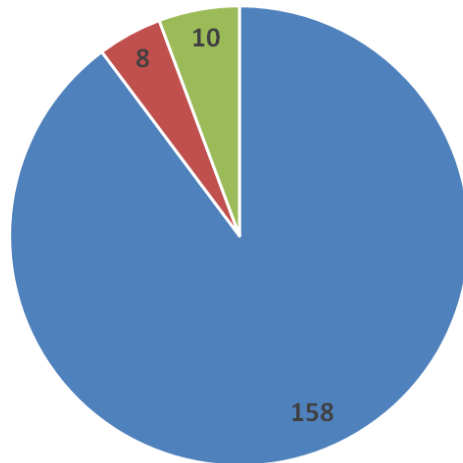
# Main types of current utilization of geothermal energy

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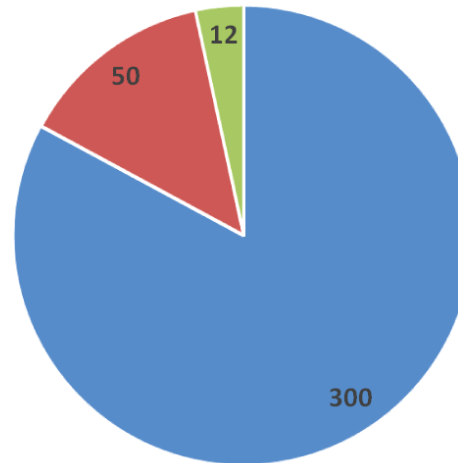
- Total thermal capacity of existing wells (around 250 wells) : 480 MWt (for a reference temperature of 25°C).
- Used capacity: 180 MWt (from around 80 wells). Temperature range of hot water produced: 40–115°C. Annual energy use for 2012: 360GWh.
- Direct heating and use of warm water is the main use.
- Electricity production: first pilot geothermal power plant (in Oradea, Iosia Nord district): 0.05MW<sub>e</sub> total installed capacity, 0.025 GWh<sub>e</sub>/yr production in 2012.
- Balneology: 64.68 MWt and 489.16 TJ/yr (around 40 wells in 16 spas, with a capacity of over 850000 people/year):

# Distribution of geothermal use in 2012

Capacity (MW<sub>th</sub>)



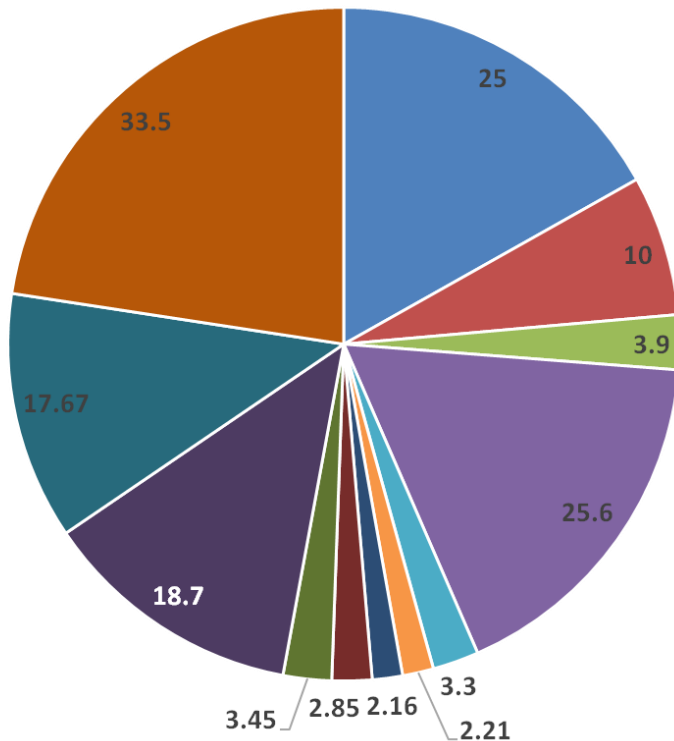
Production (GWh<sub>th</sub>/yr)



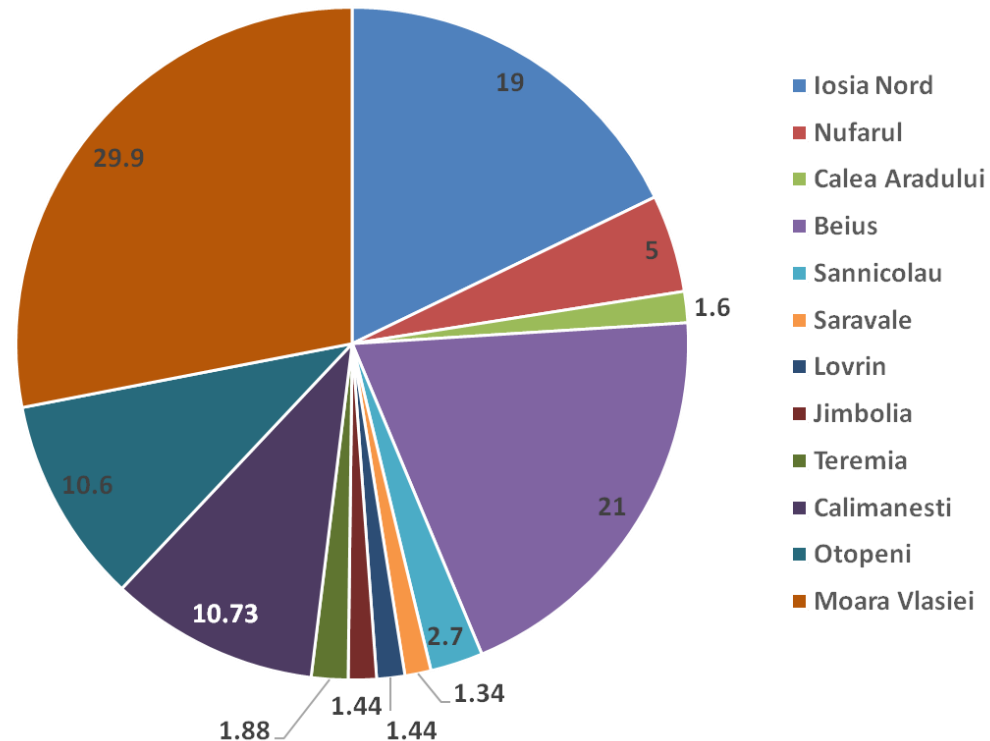
- Geothermal district heating plants
- Geothermal heat in agriculture and industry
- Geothermal heat in balneology and other

# Distribution of district heat plants in 2012

2012 geothermal heat production (GWh<sub>th</sub>/yr)



Installed geothermal capacity (MW<sub>th</sub>)





# Data policy

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- ▶ In Romania the geothermal data is not hosted in a single organisation. There are several organisations which produce and manage the data.
- ▶ Well data collected by various institutions should be delivered to the National Agency for Mineral Resources. Requests for consultation of these data should be approved by NAMR.
- ▶ Some of the data is published, but the majority not.
- ▶ For some of the published data (e.g. maps) there is a small fee.
- ▶ Some data of interest for the geothermal field can be produced by interpreting, processing and extracting the requested information by a GIS spatial analysis of multiple layers (e.g. basin boundaries, granitic outlines etc.)

# Scientific and technical data

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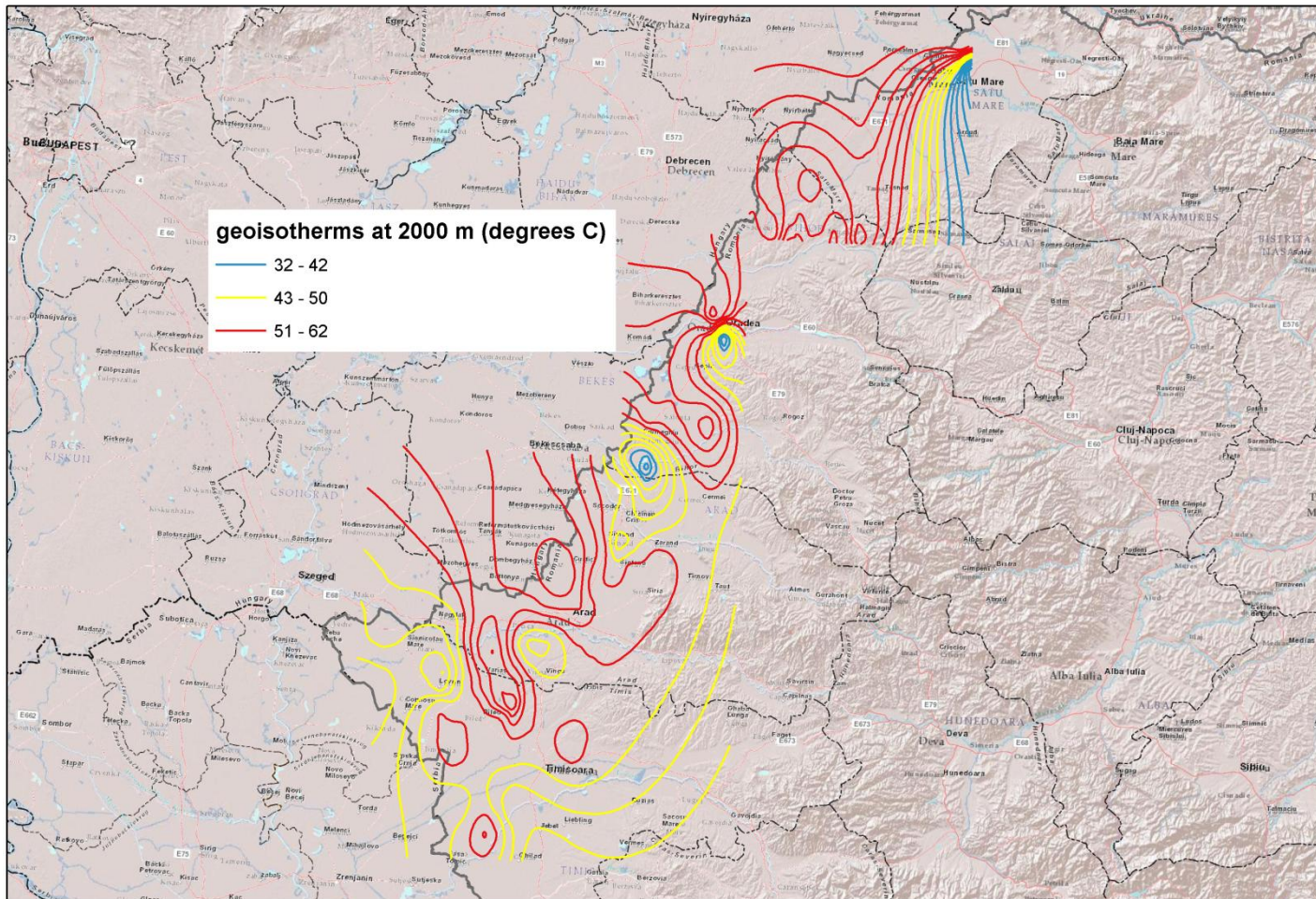
## ► Temperature data in oil and gas boreholes:

- National Agency for Mineral Resources
- OMV – Petrom – Institute of Technological Research and Design Câmpina
- FORADEX S.A.
- TRANSGEX S.A.
- Geological Institute of Romania (IGR)

## ► Temperature maps at various depths:

- Geological Institute of Romania (IGR)
  - – published maps in paper format, digital format (on IGR web application of geophysical data <http://harti.igr.ro/geofizica>)
  - – gradients, more detailed scale maps in internal reports of IGR

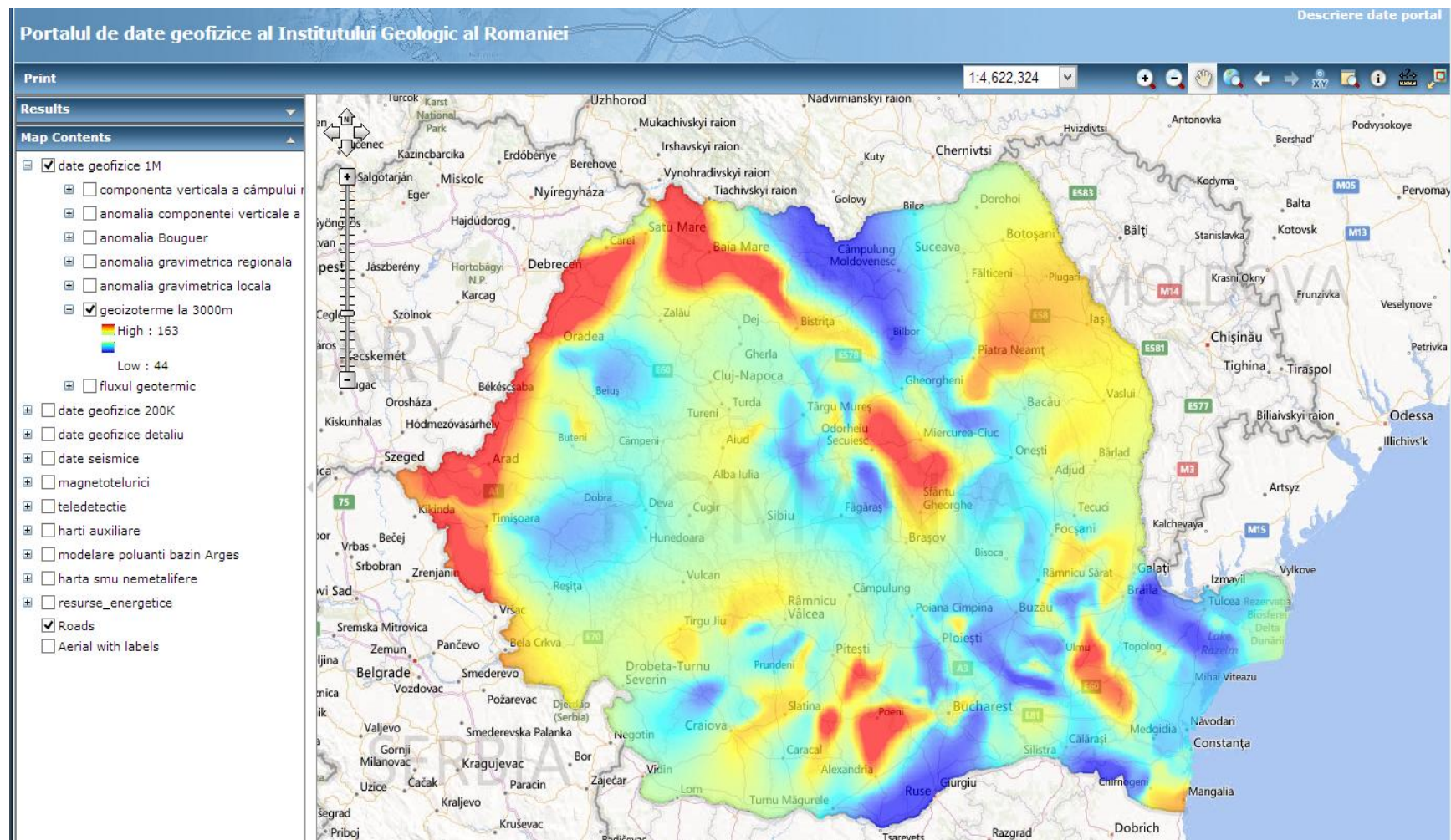
# Temperature at 2000 m



IGR maps at 200:000 scale (Veliciu, 2002)



# Temperature map at 3000 m





# Scientific and technical data

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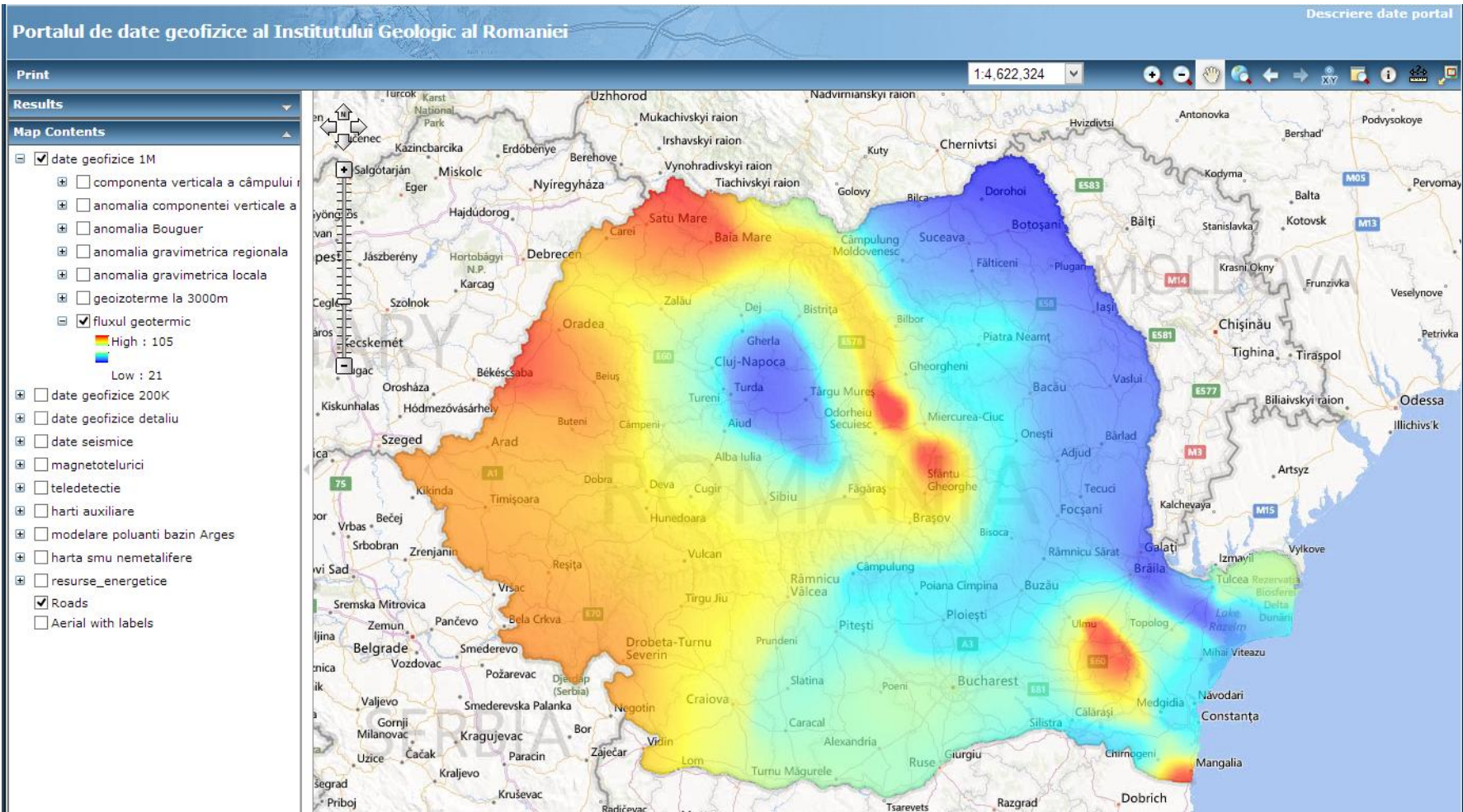
## ► Surface heat flow measurements and map

- Geological Institute of Romania (IGR)

- published maps in paper format, digital format (on IGR portal of geophysical data)
- More detailed scale in internal reports

- OMV – Petrom – Institute of Technological Research and Design Câmpina

# Geothermal flux 3000m



# Scientific and technical data

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- ▶ **Thermal spring analysis**
  - Geological Institute of Romania (IGR)
    - published map in paper format 1:1.000.000 with accompanying text book
    - Internal reports
  - literature
  
- ▶ **Reservoir information (pressure, production level depth, flow range, fluid characteristics etc.)**
  - TRANSGEX S.A.
  - OMV – Petrom
  - Geological Institute of Romania (IGR)
  
- ▶ **Published temperature model interpretation (regional heat flow etc.)**
  - Geological Institute of Romania (IGR) – publications and internal reports
  - Literature

# Scientific and technical data

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- ▶ Basin layout and sediment–basement interface depth
- ▶ Outlines of granitic formations
- ▶ Fault mapping, Tertiary and Quaternary fault systems
- ▶ Information regarding geographical restricted areas for geothermal (mining and oil exploration, CCS, nuclear storage, spas, natural parks, density population, interference with drinking water systems)
  - These data can be obtained by IGR by interpreting, processing and extracting the required information from own and publicly available thematic layers in a GIS environment.



# Scientific and technical data

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- ▶ Geothermal and oil&gas masterlogs, including lithostratigraphy, wells technical aspects, geophysics logs
  - National Agency for Mineral Resources
  - OMV–Petrom Institute of Technological Research and Design Câmpina (ICPT)
  - FORADEX S.A.
  - TRANSGEX S.A.
  - Geological Institute of Romania (IGR)
- ▶ Geophysical surveys (e.g. seismic cross-sections, MT surveys, geoelectrical survey)
  - National Agency for Mineral Resources
  - OMV–Petrom Institute of Technological Research and Design Câmpina (ICPT)
  - Geological Institute of Romania (IGR)

# Scientific and technical data

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- ▶ Recorded Seismicity
  - National Institute for Earth Physics (INFP)
- ▶ Porosity – Permeability measurements, porosity/depth relationship
  - OMV–Petrom
  - TRANSGEX S.A.
  - Geological Institute of Romania (IGR)
- ▶ Monitoring network data
  - FORADEX S.A.
  - TRANGEX S.A.

# INSPIRE in the geothermal field in ROMANIA

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- ▶ National Agency for Mineral Resources (NAMR) is responsible with the implementation of themes **mineral resources** and **energy resources**.
- ▶ NAMR collaborates with the Geological Institute of Romania (IGR) for transposing the INSPIRE Data Specifications for these theme. An example is the EuroGeosource project, where mineral and energy resource data (but not geothermal) are made available as web services.
- ▶ IGR is responsible with the “**geology**” theme.

# EuroGeoSource portal

 **EuroGeoSource**  
Oil - Gas - Minerals

Help | Metadata | Contact info | Homepage

Search on the Map  search English

Data sources

search for commodities; eg.  search

- ▶ Background Map
- ▶ Southern Permian Basin Atlas
- ▶ European data
- ▼ EuroGeoSource services
  - ☐ AM.ManagementRestrictionOrReg
  - ☐ AM.ManagementRestrictionOrReg
  - ☐ ER.EnergyProducingCountry
  - ☒ ER.NonRenewableEnergyResource
  - ☐ MR.Mine
  - ☐ MR.MineralOccurrence
  - ☐ MR.MineralOccurrence\_Points
  - ☐ MR.MineralProducingCountry
- ▶ Country specific data
- ▶ Administrative Units

Add WMS capabilities url  add WMS

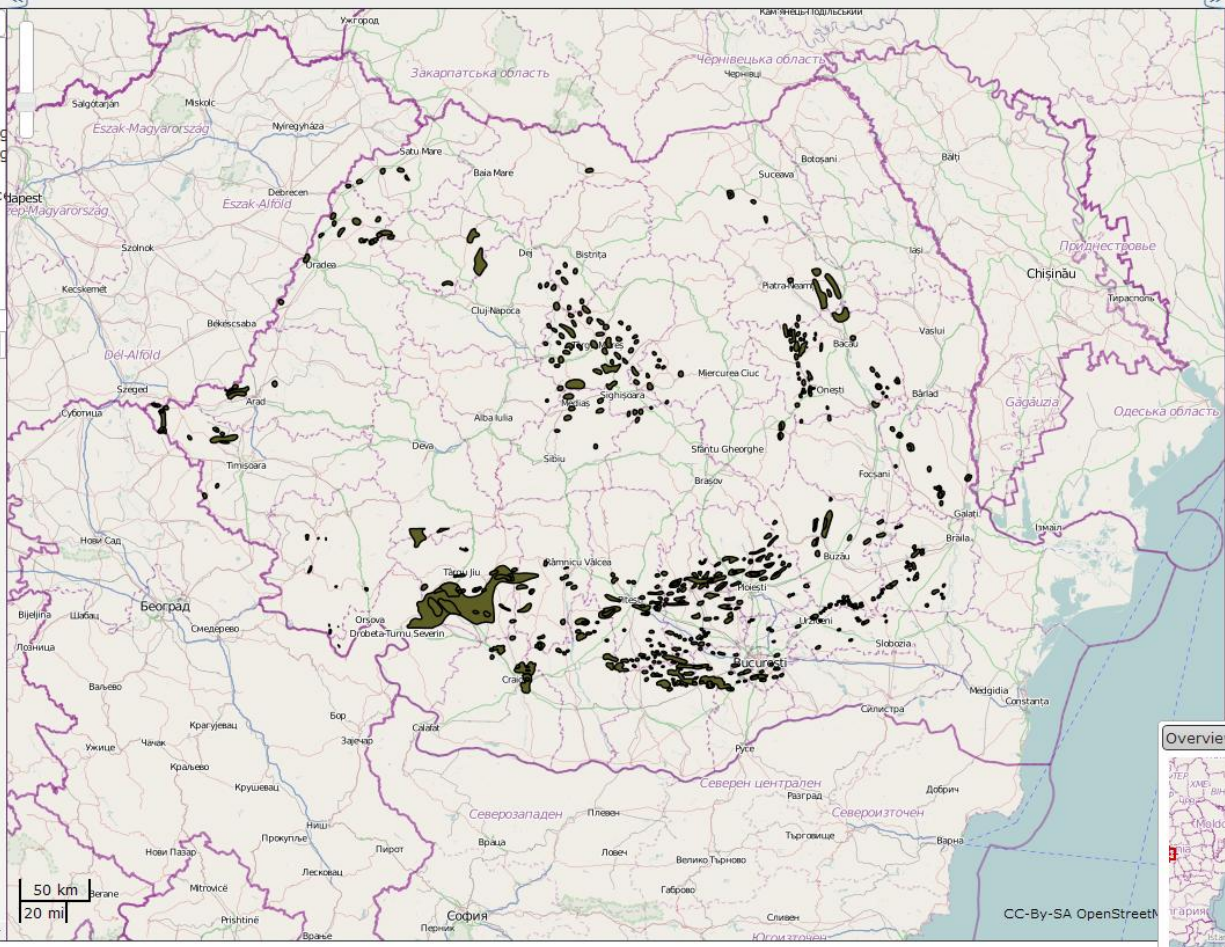
Map data

- ▼ ER.NonRenewableEnergyResource
- ▼ OpenStreetMap

CC-BY-SA OpenStreetMap

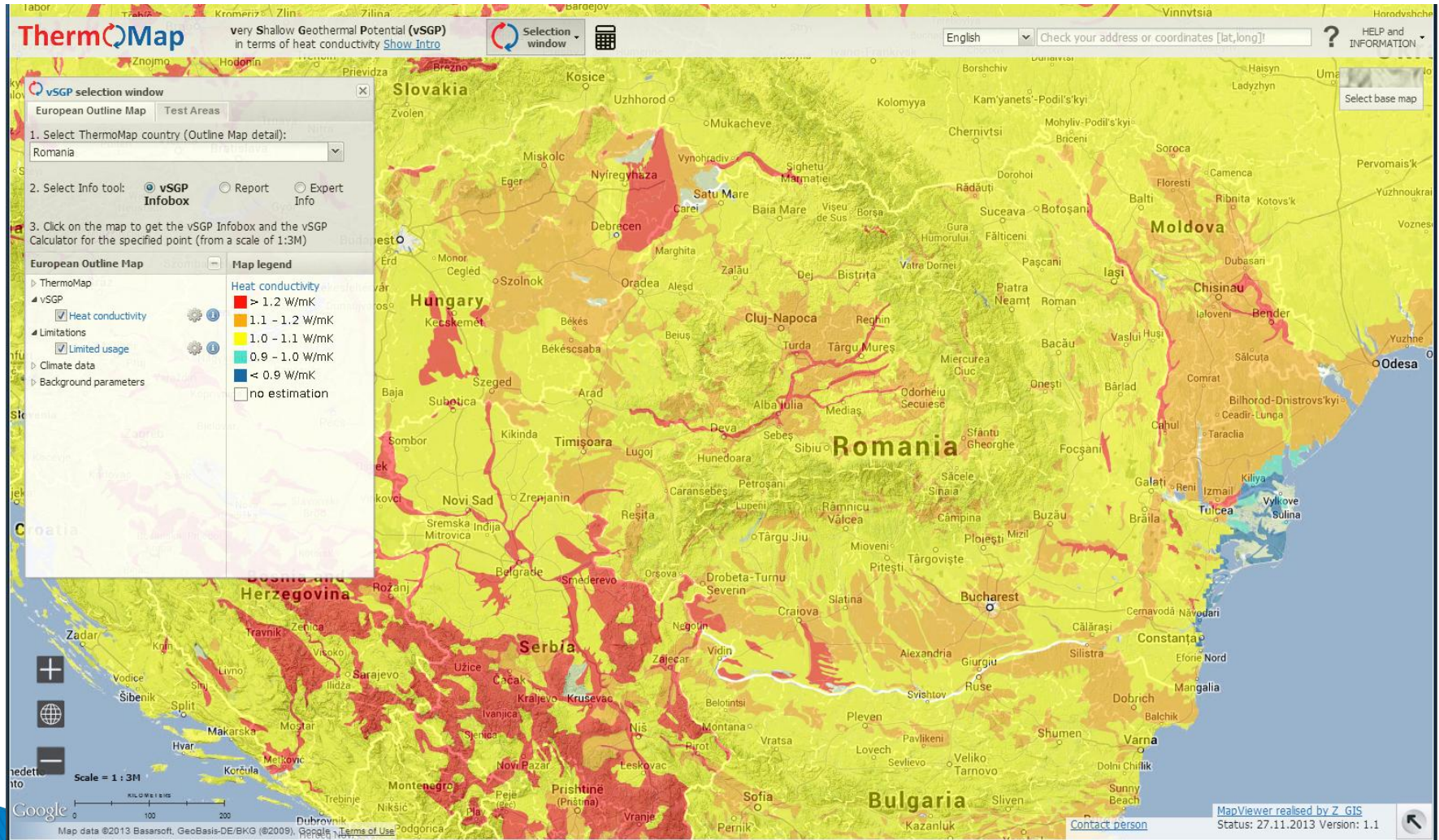
Overview map

position: 25.71045, 46.74866



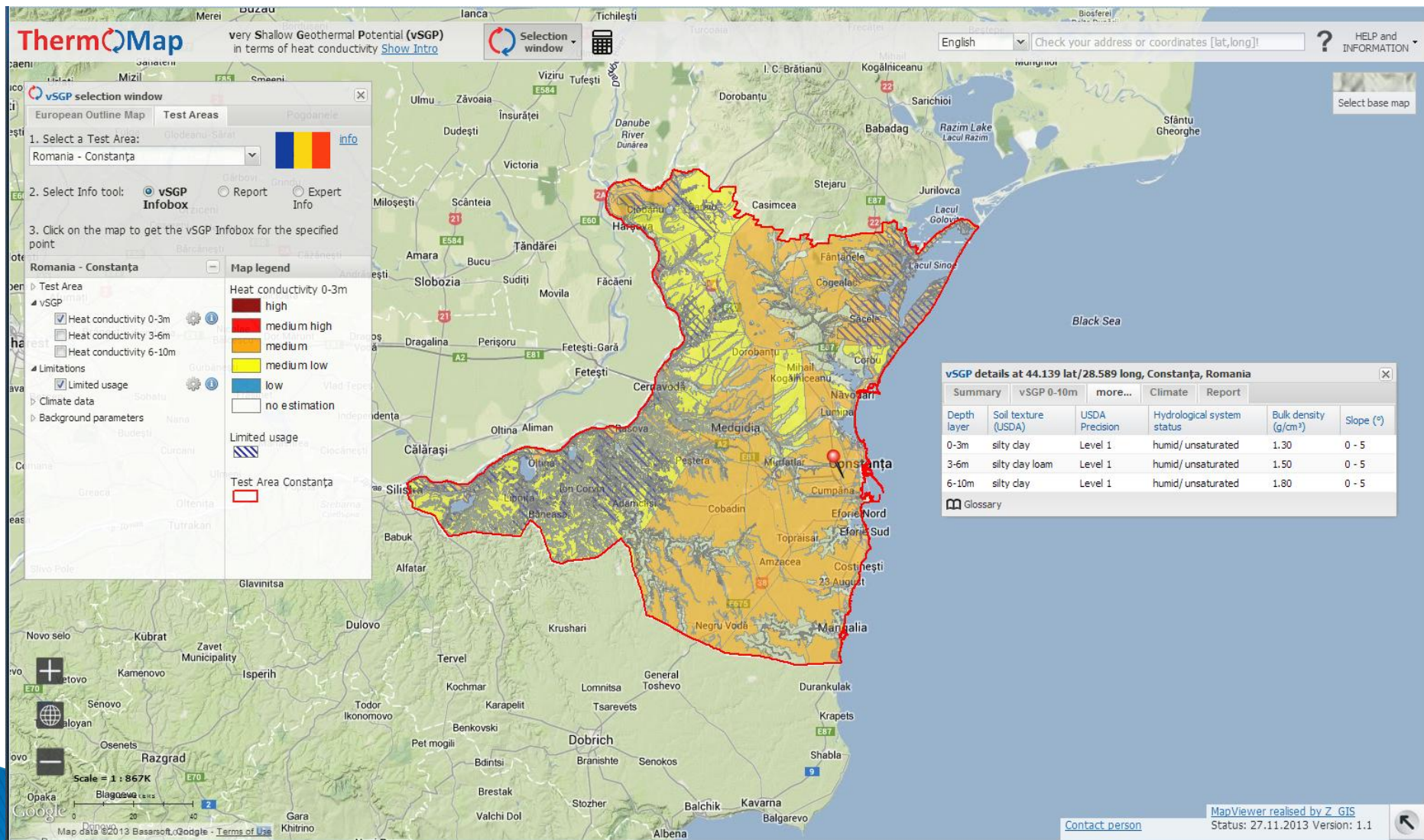


# ThermoMap map viewer for heat conductivity in the first 10 m





# ThermoMap test areas – detailed data



# Main stakeholders of geothermal projects

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National Agency for Mineral Resources – governmental authority responsible with licensing for geothermal operations

National Authority for Energy Reglementations (ANRE)

Geological Institute of Romania

University of Oradea

Romanian Geothermal Association

TRANGEX S.A.

FORADEX S.A.

GEOEXCHANGE