Issue N° 25 The Newsletter of the ENeRG Network May 2012

GEO ENeRGY

Transenergy: transboundary geothermal energy resources of Slovenia, Austria, Hungary and Slovakia

The project „TRANSENERGY – Transboundary Geothermal Energy Resources of Slovenia, Austria, Hungary and Slovakia" is implemented through the Central European Program and co-financed by ERDF. It's aim is to provide a user friendly, web-based decision supporting tool which transfers expert know-how of sustainable utilization of geothermal resources in the western part of the Pannonian basin.

TRANSENERGY addresses the key problem of using geothermal energy resources shared by different countries. The main carrying medium of geothermal energy is thermal groundwater. Regional flow paths are strongly linked to geological structures that do not stop at state borders. Therefore only a transboundary approach and the establishment of a joint, multi-national management system may handle the assessment of geothermal potentials and give guidelines for a balanced fluid/heat production to avoid possible negative impacts (depletion, or overexploitation) in the neighboring countries.

Targeted stakeholders are primarily authorities, present and future users and investors, who will get a regional evaluation of geothermal resources in the project area. Assessment will be done by various geological, hydrogeological and geothermal models at a regional scale and on five selected cross-border pilot areas with different geothermal settings, where existing utilization problems have been identified.

MAIN OUTPUTS:

- multilingual interactive geothermal web-portal containing databases linked to thematic maps, cross sections and models
- geological, hydrogeological and geother-mal models for the regional and pilot areas
- scenario models showing estimates on the potential and vulnerability of the cross-border geothermal systems for different extractions of thermal water/heat
- database of current geothermal energy users and production parameters, visualized on transboundary utilization maps
- database of authorities dealing with management and licensing of trans-boundary geothermal reservoirs
- summary of actual legal and funding framework at the participating countries
- strategy paper evaluating existing exploitation, future possibilities and recommendations for a sustainable and efficient geothermal energy production at the project area

The results of the TRANSENERGY project achieved so far are associated with the overview of utilization of thermal groundwater in the project area, including a database of authorities dealing with geothermal energy utilization, a database of current users and utilization parameters from 172 users which are visualized on 12 utilization maps and a summary report discussing the various utilization aspects, waste water treatment, monitoring practices, exploited geothermal aquifers and their further potentials. A great variety of geological, hydrogeological and geothermal data to be used for modeling have been collected and uploaded into a harmonized, multilingual database, containing data from more than 2500 boreholes from the 4 countries. Additional investigations (hydrogeochemical analyses, temperature logging, petrophysical measurements) were carried out from areas with poor data coverage and these will also be incorporated into the final expert database, a part of which will be available to the public in 2012. Geological, hydrogeological and geothermal modelling is ongoing on a supra-regional scale covering the entire project area. The geological model shows the spatial distribution of the most important hydrostratigraphic units, while maps of temperature distribution at various depths characterize the thermal field. This serves a basis for more detailed modelling to be carried out on selected cross-border pilot areas in 2012 and 2013.

Results can be downloaded from the project website (http://transenergy-eu.geologie.ac. at), which provides further information and PR material about ongoing activities.

Annamária Nádor
(project leader)
Hungarian Geological and Geophysical Institute

nador.annamaria@mfgi.hu

Fig.1 Transenergy project area. Within the investigated region (red line) the project focuses on some representative pilot-areas along the borders (thermal karst of Komarno-Sturovo area (HU-SK), Pannonian Central Depression of the Danube basin (A-SK-HU), Lutzmannsburg – Zsira area (A-HU), Vienna basin (SK-A) and Bad Radkersburg – Hodoš area (A-SLO-HU)

Recent results on mineral carbonatization in Slovakia

The methodology of mineral carbonation has progressed in Slovakia during last four years. We prefer to use the term „carbonatization“, because the process results in the fomation of carbonates. Different materials for binding CO_2, including rocks and various wastes, were tested. Waste material was represented by fly ash and slags from the energy and heat production industry, as well as an asbestos cement known as eternit. The main requirement for a successful reaction with CO_2 is the presence of Ca and Mg cations in appropriate compounds of reacting samples. The rate of CO_2 reaction with the Ca and Mg components is strongly affected by the prior activation of the tested material. Mechanical, thermal and chemical activation techniques or combination of these methods were applied.

Ultramafic rocks of the serpentinite group (containing 35-40% MgO), mainly represented in East Slovakia, have been used for mineral carbonatization. The optimum laboratory conditions were found at a temperature of 22^oC, a pressure of 6 MPa and a stirrer rotation of 300 rpm. After reaction of the material in the high-pressure reactor and filtration of the suspension, two carbonate minerals were formed. Nesquehonite crystallized at 50^oC with a purity of 94-98%. Hydromagnesite crystallised later at 200^oC with a purity of 91-98 % (Fig. 5). The best reaction results were found with samples from the Hodkovce village (Slovakia). The hydromagnesite with a weight yield of 17-22% was formed during a one hour reaction after mechanical-thermal pre-treatment. During the formation of the carbonate product, containing predominantly hydromagnesite at the above-stated conditions, a total of 2.9-3.3 tonnes of serpentinite rock bound one tonne of CO_2.

Fine-grained fly ash, the product of black (hard) coal burning, was also tested. Prior to artificial carbonatization, 98% of the fly ash had a grain-size <0.2 mm. The fly ash contained 98.3% of the amorphous material, carbon and minor content of apatite and anhydrite. The input fine grained material contained 1.6% CaO and 0.6% MgO. A new calcite-aragonite product was produced after one hour reaction at 22^oC, 5 MPa and the stirrer rotation 300 rpm. This reaction time and conditions were used for all the experiments performed below. The calcite-aragonite had a crystalline structure and had a weight yield of 0.9% with 44 % of $CaCO_3$ (19 % CO_2 was bound in newly formed carbonate).

Slag, a by-product of cauldron burning of the black coal, represented by glassy material, was milled before carbonatization. The slag contained 99.7% of amorphous silicate material. The input material contained 2.4% CaO and 1.2% MgO. A new crystallized calcite-aragonite had a weight yield of 0.54% with 34 % $CaCO_3$ (15 % CO2 was bound in newly formed carbonate).

During carbonatization of milled asbestos cement (eternit), the input fibroidal material contained 35% CaO and 5% MgO. As a result, 19% of CaO was bound into $CaCO_3$ including 16% of CaO in larnite (free for reaction), while MgO was bound into fibroidal chrysotile. After the crystallization the new calcite-aragonite product had a weight yield 2.3 % with 66 % of $CaCO_3$ (29 % CO_2 is bound in this carbonate).

Carbonatization of eternit was also made with prior mechanical-thermal reactivation. The input material contained 48 % CaO and 7 % MgO. After carbonatization 18 % of CaO was bound in $CaCO_3$ and 30 % of CaO was bound in bredigite. MgO was bound in mechanically-thermally activated chrysotile. A new crystallized calcite-aragonite product had weight yield of 6% with a content of 14% of newly formed calcite-aragonite and 68 % hydromagnesite. Laboratory experiments have demonstrated that, at the above stated reaction conditions one tonne of CO_2 was bound to 28.8 tonnes of mechanically-thermally modified eternit. The poorer results from using eternit for CO_2 sequestration compared to ultramafic rocks were caused by the primary bounds of CaO in the eternit calcite structure. The methodology of artificial carbonatization can significantly contribute to decreasing waste in dumps and can help neutralise the waste’s alkalinity. In addition, this technique contributes towards the permanent removal of CO_2 from the atmosphere.

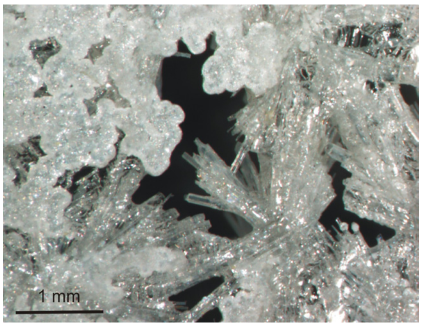

Fig. 5 Nesquehonite (needles on the lower right side) and hydromagnesite (spherical shape; the left upper saide) represent carbonates produced after the reaction of CO_2 with ultramafic rocks

ŠTÁTNY GEOLOGICKÝ ÚSTAV DIONÝZA ŠTÚRA
MENTE ET MALLEO

Lubomir Tucek, Ludovit Kucharic, Martin Radvanec, Zoltan Nemeth, Katarina Cechovska, Jan Derco, Pavel Stastny & Pavol Nejedlik

The ENeRG Network – Country Representatives

ALBANIA
Prof Adil Neziraj
Albanian Geological Survey
aneziraj@gsa.gov.al

AUSTRIA
Prof Karl Millahn
University of Leoben
karl.millahn@mu-leoben.at

BOSNIA AND HERZEGOVINA
Prof Edin Delic
University of Tuzla
edin.delic@untz.ba

BULGARIA
Prof Georgi V. Georgiev
Sofia University
gigeor@abv.bg

CROATIA
Prof Bruno Saftic
University of Zagreb
bruno.saftic@rgn.hr

CZECH REPUBLIC
Dr Vit Hladik
Czech Geological Survey (CGS)
vit.hladik@geology.cz

DENMARK
Niels Poulsen
Geological Survey of Denmark and Greenland (GEUS)
nep@geus.dk

ESTONIA
Dr Alla Shogenova
Institute of Geology,
Tallinn University of Technology
alla@gi.ee

FINLAND
Jarmo Kallio
Geological Survey of Finland
jarmo.kallio@gtk.fi

FRANCE
Dr Isabelle Czernichowski-Lauriol
BRGM
i.czernichowski@brgm.fr

GREECE
Dr Apostolos Arvanitis
Institute of Geology & Mineral Exploration (IGME)
arvanitis@igme.gr

HUNGARY
Dr Endre Hegedüs
Eötvös Lorand Geophysical Institute (ELGI)
hegedus@elgi.hu

ITALY
Ing Sergio Persoglia
National Institute of Oceanography and Experimental Geophysics (OGS)
spersoglia@ogs.trieste.it

LATVIA
Dr Viktor Lisin
Interseis
interseis@inbox.lv

LITHUANIA
Dr Saulius Sliaupa
Institute of Geology and Geography
sliaupa@geo.lt

FYROM (MACEDONIA)
Dr Gavril Mirakovski
University in Skopje
mirak@pluto.iziis.ukim.edu.mk

MOLDOVA
Dr Oleg Bogdevich
Institute of Geology and Seismology
bogdevicholeg@yahoo.com

MONTENEGRO
Ing Vladan Dubljevic
Geological Survey of Montenegro
vladan.dubljevic@gov.me

THE NETHERLANDS
Chris te Ströet
Netherlands Institute of Applied Geoscience TNO – National Geological Survey
chris.testroet@tno.nl

NORWAY
Dimitrios Hatzignatiou
International Research Institute of Stavanger (IRIS)
Dimitrios.Hatzignatiou@iris.no

POLAND
Dr Adam Wojcicki
Polish Geological Institute
awojci@pgi.gov.pl

PORTUGAL
Virgilio Cabrita da Silva
Ministry of Economical Activities and Innovation – Directorate General for Energy and Geology
virgilio.cabritadasilva@dgge.pt

ROMANIA
Dr Constantin S. Sava
National Institute for Marine Geology and Geoecology – GeoEcoMar
savac@geoecomar.ro

RUSSIA
Alexander Ilinsky
VNIGRI
alex.ilinsky@bk.ru

SERBIA
Dr Snezana Komatina-Petrovic
Union University Belgrade
unabojan@eunet.rs

SLOVAKIA
Dr Ludovit Kucharic
Dionyz Stur State Geological Institute
ludovit.kucharic@geology.sk

SLOVENIA
Marjeta Car
GEOINŽENIRING d.o.o.
m.car@geo-inz.si

SPAIN
Roberto Martinez Orio
Geological and Mining Institute of Spain (IGME)
ro.martinez@igme.es

TURKEY
Prof Ender Okandan
Middle East Technical University
Petroleum Research Center
okandan@metu.edu.tr

UK – Scotland
Prof Patrick Corbett
Heriot-Watt University
P.W.M.Corbett@hw.ac.uk