Integrated Geodynamic Stations in Central Europe

ISTVÁN JÁNOS KOVÁCS1, CSABA SZABO2, ALEXANDRU SZAKÁCS3, MR. THOMAS PIETER LANGE4, ÁKOS KÓVÁGÓ4, ORSOLYA GELENCSE6, ÁGNES GÁL6, MÁRTA BERKESI7, NORA LIPTAI8, LEVENTE PATKO4, LÁSZLÓ PALCSU8, ISTVÁN BOZSO8, SZILVESZTER GERGELY9, BÁLINT SÜLE10, ATTILA NOVÁK4 AND VIKTOR WESZTERGOM4

1MTA FI Lendület Pannon Litho2oscope Research Group, Institute of Earth Physics and Space Science
2Institute of Earth Physics and Space Science and Lithosphere Fluid Research Lab
3Lithosphere Fluid Research Lab, Eötvös Loránd University
4Institute of Earth Physics and Space Science
5O&GD Central Ltd.
6Babeș-Bolyai University
7MTA FI Lendület FluidsByDepth Research Group
8Isotope Climatology and Environmental Research Centre, Institute for Nuclear Research
9Department of Applied Biotechnology and Food Science, Budapest University of Technology and Economics
10MTA FI Lendület Pannon Litho2oscope Research Group

Presenting Author: steve.rooman@gmail.com

Novel results in geochemistry suggest that the solidifying melt content of the cooling, partially molten asthenosphere and metasomatic alterations in thinned continental lithospheric mantle, such as in the Pannonian Basin, could be a source of volatiles, especially CO₂. This is because CO₂ cannot be incorporated into the minerals that crystallise as the asthenosphere cools, so it becomes enriched in CO₂ fluids. The flow of these fluids towards the surface is also strongly influenced by the stresses building up in the lithosphere. We propose that there are also signs that the combined observation of CO₂-rich surface emanations and earthquakes may provide an opportunity to identify anomalies that may precede earthquakes. The research is based on the Dutch-Hungarian-Romanian Topo-Transylvania cooperation and targets to deepen the understanding of the complex geological processes in the Carpathian bend. The Carpathian bend is one of the tectonically most dynamic areas in Europe and includes the highly earthquake-prone Vrancea zone. A prototype of the Integrated Geodynamic Station was built in Hungary, in the Balaton Highlands, where a suitable location to achieve the technical objectives was found in Badacsonytördemic. By simultaneously monitoring seismic activity, the flux of volatiles from the Earth’s interior, meteorological parameters and the electromagnetic properties of the subsurface, this internationally unique station can play a key role in fingerprinting signals that precede earthquakes and better understanding the global carbon cycle. The integrated geodynamic station analyses the composition of gases (CO₂, C₆H₆, S and N components) at the surface and below the subsurface continuously and accurately using an infrared spectrometer. The most important goal is to identify precursors prior to earthquakes in the time series of gas compositions, conductivities of the Earth’s lithosphere and seismic events. Recently second such a station was installed in Covasna (Romania) of the Carpathian Bend area close to the Vrancea zone. We will present some preliminary data from both of these stations having a great potentials to identify earthquake precursors.