



The effect of swarm seismicity on fluid transport – a natural long-distance gas tracer experiment using stable isotopes

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The spatial and temporary long-distance effect of swarm quake events onto the hydrodynamic and hydrochemistry in seismo-tectonic regions is one of the aim of our complex isotope and gasgeochemical investigations in the Eger rift and was verified for mineral springs in Vogtland (Germany) and NW-Bohemia (Czech Republic) (Bräuer et al., 2003, Weise et al., 2001). In the light of these results the gas monitoring carried out at the 453m level of the Schönbrunn fluorite mine have to be evaluated as an example of a boundary location of the western Eger rift affected by swarm earth quakes.

The hydrothermal system of Schönbrunn, Vogtland, is located at the north-western rim of the seismically active western Eger rift area, coinciding with a currently active CO₂ mantle degassing field at Bublak characterised by He isotope signatures $>5 R_a$ (Bräuer et al., 2003). Its lower R/R_a of 0.7 is obviously due to mixing of He from both a deep-seated magmatic and a crustal source. The area is not far from the swarm seismic zone of Novy Kostel, connected with the NNW-SSE striking fault, and belongs to the Marianske Lazne fault system.

We used a multidimensional isotope gasgeochemical and hydrochemical methodology to study this very sensitive versus seismic disturbances system. For this aim, gas and water samples were taken in the fluorite mine Schönbrunn in a depth of 453 m between April 1994 and August 1996. The monitoring period has included the strong earthquake swarm period lasting from December 4/5, 1994.

The results indicate a release of gas components stored in the rock near the sampling

location by stress/strain field changes during and after seismic events. Therefore, we can assume a long-distance connection between the hydrothermal system and the degassing centre of the western Eger rift fed by magmatic CO₂ and mantle derived He. From the variations of the gas isotope tracers the transport velocity and the spatial distribution of the magmatic gases (CO₂ and He) and their crustal components can be evaluated along the large degassing province of the western Eger rift.

Bräuer, K., Kämpf, H., Strauch, G. and Weise, S.M. (2003) Isotopic evidence (³He/⁴He; ¹³C_{CO2}) of fluid-triggered intraplate seismicity. *J. Geophys. Res.* 108, B2, 2070, doi:10.1029/2002JB002077.

Weise, S.M., Bräuer, K., Kämpf, H., Strauch, G. and Koch, U. (2001) Transport of mantle volatiles through the crust traced by seismically released fluids: a natural experiment in the earthquake swarm area Vogtland/NW Bohemia, Central Europe. *Tectonophysics* 336, 137-150.