

Free gases as tracers for mantle-related geodynamic processes in the European Cenozoic rift system

K. BRÄUER¹, H.KÄMPF², S. NIEDERMANN² AND G. STRAUCH¹

¹UFZ Centre for Environmental Research Leipzig-Halle,
Department Hydrogeology, Germany ;
karin.braeuer@ufz.de, gerhard.strauch@ufz.de

²GeoForschungsZentrum Potsdam, Department Chemistry of
the Earth, Germany; kaempfe@gfz-potsdam.de, nied@gfz-potsdam.de

We have studied the isotope signature of CO₂-rich free gases escaping at the surface in three regions of western and central Europe which are volcanically inactive at present: Massif Central (France), Eifel (Germany) and NW Bohemia (Czech Republic). These areas belong to the European Cenozoic rift system and are characterised by the occurrence of Quaternary volcanoes as well as swarm earthquakes. The Massif Central is marked by the most intense Quaternary volcanism, whereas in NW Bohemia only two small Quaternary volcanoes are known but the strongest seismicity is presently registered there.

The results of the isotope geochemical study of free gas exhalations in the western Eger rift (Czech-German border region; 102 locations), the East Eifel, (20 locations) and the Mont Dore region (Massif Central; 11 locations) indicate a sub-continental mantle origin of the gases.

Long-time series of isotope studies (He, CO₂) are being carried out at locations within the degassing centres Cheb basin and Mariánské Lázně (CR), at the Laacher See mofette and a borehole in Wehr (D) as well as at the mineral spring Ste-Anne (F). The highest ³He/⁴He ratios in free gas exhalations (~6 Ra) are presently found at mofettes in the eastern part of the Cheb basin. These values are in the same range as those determined in mantle xenoliths from the Quaternary volcano Železná Hůrka located at the southwest boundary of the Eger rift.

Since 1992 a clear increase of the mantle-derived helium fraction was observed at the Cheb basin locations, whereas in the degassing centre Mariánské Lázně it has remained nearly the same [1]. The increasing ³He/⁴He ratios beneath the Cheb basin may be an indication of recent magma intrusions. The Cheb basin is close to the epicentral area of Nový Kostel that is known for the occurrence of swarm earthquakes with magnitudes up to M_L = 4.6, whereas the seismicity in the surroundings of Mariánské Lázně is weak. The recent ³He/⁴He data from locations within the Cheb basin indicate that the active magmatic process beneath the Cheb basin is continuing at present.

References

[1] Bräuer, K., Kämpf, H., Niedermann, S., Strauch, G. (2005). GRL, **32**, L08303, doi:10.1029/2004GL022205