COMBINED GAS-GEOCHEMICAL AND GEOPHYSICAL STUDIES ON THE VOGTLAND/NW-BOHEMIA NONVOLCANIC EARTHQUAKE SWARM AREA, CENTRAL EUROPE

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The flow rates of gas emanations, their composition, as well as the isotope (C, He) ratios of CO_2 and He of 102 mineral springs and mofettes in the western Eger (Ohře) rift and its surroundings have been determined. The studies have resulted in the identification of three gas escape centers, which may be distinguished based on their CO_2 fluxes: (1) Františkovy Lázně/Cheb basin ($\approx$ 90 m^3 h^{-1}), (2) Márianské Lázně up to Konstantinovy Lázně ($\approx$ 156 m^3 h^{-1}) and Karlovy Vary ($\approx$ 356 m^3 h^{-1}). The gas of all gas escape centers consists of nearly pure CO_2 with δ^{13}C values between -2 and -4‰ and contains a high percentage of upper mantle derived helium (R/R_a between $\approx$ 2.4 and $\approx$ 6). High resolution monitoring studies at the Bublak mofette have resulted in the estimation of a CO_2 transport velocity of about 400 m/day for the upper crust (Bräuer et al. 2003, *JGR* 108, 2070). The combination of high gas flux and the high transport velocity connected with the ^{3}He/^{4}He ratio of about 6 R_a indicates that the Bublak gas directly images the degassing magma reservoir in the upper mantle beneath the Cheb basin. The positions of the escape centers at the surface point to the location of the covered magmatic source. This was the main motivation for us to start a local-scale geophysical mapping of the Moho discontinuity and the subcrustal mantle.

The receiver function method (here: P-to-S conversions at seismic discontinuities) is a relatively new tool to map seismic discontinuities in subcrustal depths. It is based on three-component recording of teleseismic events. The processed receiver functions provide images of the crust and upper mantle similar to steep angle reflection images. We analyzed teleseismic data from 55 broadband and 17 short-period seismological stations. At almost all stations we observed strong conversions with positive polarity near 3.6 seconds Ps delay time. These conversions stem from the Moho discontinuity. The Moho depth increases from NW (31km) to SE (38 km). Beneath the Cheb Basin the Moho seems to dome up to at least 27 to 28 km. Clear converted phases with Ps delay times of about 6 seconds (50 to 60 km depth) are observed at 8 stations also in the Cheb Basin area. The Moho updoming and the “6 s phase” are present directly beneath the CO_2 degassing escape centers at the surface. So we propose that CO_2 degasses from presently active magma/fluid reservoirs within a highly metasomatic mantle between 27 and about 60 km and migrates vertically through the lithosphere using deep-reaching faults.