GAS FLUX, GAS FRACTIONATION, AND TECTONIC STRUCTURE IN THE WESTERN PART OF THE EGER RIFT

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In the western part of the Eger Rift, more than 70 mineral springs and mofettes (dry gas escapes) were investigated for gas flux, gas composition and isotope ratios of helium, carbon and nitrogen. The control of the tectonic structure on the regional gas flux and gas composition pattern were shown in detail.

Four main gas escape centres were detected with gas fluxes of > 150 m^3/h. Composition and isotopic pattern of the gases released at both the two northern and the southern rift faults are very similar indicating a common origin (magma body). Therefore, as a consequence of the y-shape of these faults, the gas flux might split below about 15 km and a CO_2-free zone is formed between the faults. We found the Eger Rift to be offset by younger NNW–SSE trending faults and to narrow down to the west.

The gases of the escape centres are very CO_2-rich (> 99 vol. %) and have isotopically heavy CO_2 with $\delta^{13}C$ values from -1.8 ‰ to -3.9 ‰ and with $^3He/^4He$ ratios of R/R_a up to 5, some of the highest mantle-derived helium proportions found in Europe. These findings indicate a magmatic origin of the CO_2-rich gases. In local gas escape centres such as the Cheb basin and Mariánské Lazně, the carbon mass balance is dominated by the flux of released gas, whereas with distance from these centres HCO_3^- and, to a minor extent, dissolved CO_2, start to play an important role. As a consequence, $\delta^{13}C$ values of CO_2 in the gas phase decrease and N_2 contents increase. Despite the fact that an admixture of biogenic and/or carbonatic CO_2 may somewhat influence the isotopic composition of the CO_2 gases, the predominance of fractionation due to HCO_3^- formation can be demonstrated. The most representative $\delta^{13}C$ values for the deep-seated CO_2 can probably be derived from the high-flux gas exhalations in mofettes in the range of -2.5 ‰ to -2.9 ‰, remarkably higher than the commonly accepted upper mantle value of about -7 ‰. If fractionation of the CO_2 gas occurs during the passage through the crust, it must be below the depth of splitting of the main rift faults. It is therefore justified to assume a carbonatitic magma body, with our data and the $\delta^{13}C$ value of -3 ‰ for the carbonatite of Roztoky in the eastern part of the Eger Rift. On the basis of gas flow balance we assume that at least a proportion of nitrogen is mantle derived. Unfortunately, any effect on the isotopic composition of N_2 is covered by the large scatter caused mainly by low-level atmospheric contamination. In any case, a correlation between the mantle-derived ^3He flux and the N_2 flux was found.

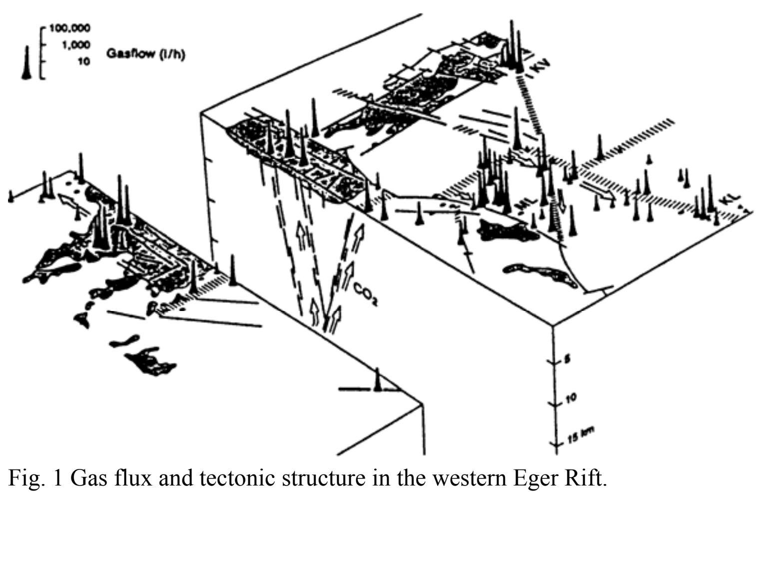

Fig. 1 Gas flux and tectonic structure in the western Eger Rift.