Multi-level gas monitoring of a mofette to reveal mantel fluid movements

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Mofettes are gas emission sites where CO_2 ascends through conduits from as deep as the mantle. They provide natural windows to magmatic processes at depth. The primary objective of our research on mofettes is to clarify physical links between fluid properties,their pathways and the relation to swarm earthquakes. State-of-the-art fluid monitoring techniques allow for a high temporal resolution compared to the low-resolution discrete sampling approach used in the last decades. Gas and isotope compositions will be continuously analyzed *in-situ* at different depth levels (30 m, 100 m, 300 m) reached by a number of existing and planned drill holes. A unique approach will allow for ascending mantle fluids to be tracked vertically in a set of drillings from a depth of a few hundred metres to the surface. This setup can provide hints on the origin of temporal variations related to the opening of fault-valves, admixture of crustal fluids to a background mantle-flow or the release of hydrogen during fault rupturing. Gas migration velocities can thus be measured directly (from the arrival times of anomalies at different depth levels). In addition, potential admixtures of mantle fluids with crustal or meteoric fluids during the ascent to the Earth's surface can be quantified. In order to test the hypothesis that sites located on different faults react differently, we will repeatedly collect gas samples for noble gas isotope analyses from key sites in specific tectonic structures. These will be combined with stable isotope measurements of dissolved inorganic and organic carbon species to outline CO_2-H_2O interactions. The sampling will cover background and event-driven periods, with the latter triggered by earthquakes or fluid anomalies.

The Hartoušov mofette with a daily CO_2 flux of up to 97 t has been chosen as a key site in the frame of the ICDP project: "Drilling the Eger Rift: Magmatic fluids driving the earthquake swarms and the deep biosphere." It is located in the Cheb Basin, which terminates the Eger Rift to the West and is known for recurring earthquake swarms. Detailed fluid measurements before, during and after drilling of a 300 m deep well will be carried out to investigate possible influences of drilling activities on the local and regional fluid regime. Wells F1 (30 m) and F2 (108 m) already exist, F3 (target depth 300 m) will be drilled in August 2019.