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The Cheb Basin (Czech Republic) as a potential natural analogue site for geological carbon sequestration - past, current and planned activities

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General difficulties for evaluating methods for the detection and monitoring of CO_2 spreading and degassing to the atmosphere induced by CO_2 sequestration are the time scale of transport processes and the desired situation of a non-release of sequestered CO_2 at the subsurface. The Cheb Basin (western Eger rift / Czech Republic) provide excellent opportunities for further direct investigations of transport processes along migration paths caused by cap rock failures and the development and validation of adequate monitoring tools.

The Eger rift belongs to the European Cenozoic rift system and represents an approximately 50 km wide and 300 km long ENE-WSW striking continental rift that formed during the Upper Cretaceous-Tertiary transition. This rift zone is one of the most active seismic regions in Central Europe. There are a lot of gas emanations (cold vents) with high CO_2 contents (> 99 vol% CO_2). The CO_2-fluxes vary in a wide range between smaller than 1 up to 4000 L/h per vent.

Comprehensive studies of CO_2-rich fluids have been started 20 years ago and have included two detailed chemical and isotope monitoring studies lasting for several years. These studies result in the identification of the fluid component sources. The CO_2 stems from the lithospheric mantle - a deeper source area as in the case of CO_2 sequestration. A distinct relationship was found between the steadily magmatic CO_2-degassing and the recurrence of swarm earthquakes in the Nový Kostel focal zone close to the Cheb basin. Such areas with permanent CO_2 fluxes from a well-known characterized deep source are especially suitable to study and test methods and method combinations for CO_2 degassing monitoring.

Several past and ongoing geophysical investigations concerning the geodynamical activity and the structural settings have been carried out to characterize the active fault systems. The lateral distribution of swarm seismicity is limited to a small number of focal zones, which have been periodically reactivated during the last years. The migration of fluids, uprising in permeable channels, is assumed to be the trigger of these earthquake swarms. Tectonic setting and sedimentary layers in the area have a great influence on the degassing situation of CO_2 at the surface. Due to their permeability, faults act as preferential pathways for the upward migration and deep gases can escape to the atmosphere. Furthermore, regional patterns of diffuse CO_2 emissions have been intensely studied to obtain insights into spatial and temporal variations in soil gas fluxes and concentrations.