3D imaging of the subsurface electrical resistivity structure in West Bohemia/Upper Palatinate covering mofettes and Quaternary volcanic structures by using Magnetotellurics

A. Platz[1], U. Weckmann[1,2], J. Pek[3], S. Kováčiková[3], R. Klanica[3], J. Mair[1], B. Aleid[1,2]
[1]Helmholtz-Zentrum Potsdam, Deutsches GeoForschungsZentrum, Potsdam, Germany, aplatz@gfz-potsdam.de
[2]University of Potsdam, Institute of Geoscienes, Potsdam, Germany
[3]Institute of Geophysics of the Czech Academy of Sciences, Prague, Czech Republic

SUMMARY

The region of West Bohemia and Upper Palatinate belongs to the West Bohemian Massif. The study area is situated at the junction of three different Variscan tectonic units and hosts the ENE-WSW trending Ohře Rift as well as many different fault systems. The entire region is characterized by ongoing magmatic processes in the intracontinental lithospheric mantle expressed by a series of phenomena, including e.g. the occurrence of repeated earthquake swarms and massive degassing of mantle derived CO_2 in form of mineral springs and mofettes. Ongoing active tectonics is mainly manifested by Cenozoic volcanism represented by different Quaternary volcanic structures. All these phenomena make the Ohře Rift a unique target area for European intra-continental geoscientific research. With magnetotelluric (MT) measurements we image the subsurface distribution of the electrical resistivity and map possible fluid pathways. 2D inversion results by Muñoz et al. (2018) reveal a conductive channel in the vicinity of the earthquake swarm region that extends from the lower crust to the surface forming a pathway for fluids into the region of the mofettes. A second conductive channel is present in the south of their model; however, their 2D inversions allow ambiguous interpretations of this feature. Therefore, we conducted a large 3D MT field experiment extending the study area towards the south. The 3D inversion result matches well with the known geology imaging different fluid/magma reservoirs at crust-mantle depth and mapping possible fluid pathways from the reservoirs to the surface feeding known mofettes and spas. A comparison of 3D and 2D inversion results suggests that the 2D inversion results are considerably characterized by 3D and off-profile structures.

Keywords: Magnetotellurics, Ohře Rift, Conductive channel, Fluid/magma reservoir, Earthquake swarm