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Seismic indications for asthenospheric updoming beneath the western Bohemian Massif

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BOHEMA (BOhemian Massif Anisotropy and HEterogeneity) is a passive seismic experiment in the western part of the Bohemian Massif which is carried out in an international effort by various institutions in the Czech Republic, France and Germany. Its scientific aim is to use all available techniques such as high-resolution tomography, receiver function analysis and 3D anisotropy studies to image the crust and upper mantle to depths of about 250 km. The investigation of crustal and upper mantle xenoliths will add petrological information. Between the end of 2001 until the end of 2003, 84 temporary seismic stations were deployed by French, Czech and German institutions in addition to about 60 stations of already existing permanent Czech and German seismic networks in the area. The temporary stations were operating for at least half a year up to one and a half years. The network was heterogeneous with broad band stations, medium and short period stations. It covered a territory approximately 270 km long and 150 km wide, centered on the crossing area of the Eger Rift and the Marianske Lazne fault.

Here we want to present results from the Ps receiver function analysis of BOHEMA data, which was carried out at GFZ Potsdam, Germany. With this method it is possible to map seismic discontinuities in the Earth's crust and upper mantle by measuring delay times of P-to-S converted phases. By analysis of more than 8500 P-receiver functions we obtained detailed images of the Earth's crust and uppermost mantle beneath the swarm earthquake and CO_2 degassing area in the Western Bohemian Massif. The resulting Moho depth map shows crustal thicknesses of 27-31 km in the Saxothuringian, 30-33 km in the Tepla-Barrandian and 35-40 km in the Moldanubian block. At the intersection of Regensburg-Leipzig-Rostock zone and Eger Rift, crustal thickness decreases to 26 km from approx. 31 km in the surroundings. In this area of Moho updoming, CO_2 mantle degassing and earthquake swarm activity, we observe

an additional positive phase at about 6 s delay time and a strong negative phase at 7 to 8 s. With the P-receiver function technique alone it is not clear whether these phases are direct conversions from a structure in the uppermost mantle or multiple phases from a structure in the middle crust. The phases can be modeled by a velocity increase at 50 km and a velocity decrease at 65 km depth. The velocity decrease, observed over an area of 5300 km^2, possibly gives evidence for local thinning of the lithosphere or a confined body of partial melt beneath the investigation area, which might be the reason for high CO_2 mantle fluid flow and earthquake swarm activity in this nonvolcanic, intracontinental rift area.