Structure of the crust and upper mantle in the Vienna Basin region

Michael Behm (1,2) & Götz Bokelmann (1)

(1) University of Vienna, Department of Meteorology and Geophysics
(2) currently at Colorado School of Mines, Center for Wave Phenomena

universität wien

Within the last decade, several geophysical experiments targeted the Eastern Alps and their surroundings to the neighbouring tectonic provinces. The main results of these investigations are large-scale seismic images of the crust and upper mantle. Although the size of the Vienna Basin (VB) region is comparably small with respect to the resolution of these models, we find several interesting features in this specific area.

The lower crust is characterized by high P-wave velocities (6.8 - 7.2 km/s) (**Fig.3**) . The amplitude and wavelength of a significant positive gravity anomaly (**Fig. 4**) indicates high densities in the lower crust. The crust-mantle boundary (Moho, **Fig. 5**) below the VB appears more diffuse, which suggests a gradual increase from crustal velocities to upper mantle velocities. Strong lower crustal reflectivity is also apparent in the region, and masks reflections from the Moho (**Fig. 10**).Comparable observations in the Danish-Norwegian Basin are explained by mafic intrusions from the mantle, and we speculate that similar processes also took place in the VB region. A subhorizontal reflector is found in the uppermost mantle in a depth of about 55 km (**Fig. 6**). Those features stretch also into the Little Hungarian Plain and into the margin of the Bohemian Massif. Although weakly constrained, the dip of the Lithosphere-Asthenosphere boundary (LAB, **Fig, 7**) correlates with the strike direction of the VB. Deep features obtained from teleseismic inversion (**Figs. 8, 11**) possibly represent remnants from old geodynamic processes related to the collision and subduction during initial stages of alpine and carpathian orogenesis. Nevertheless, it is interesting to note that the VB is situated inbetween parts of the mantle with significant different seismic velocities.

The spatial coincidence of these features is thought-provoking. So far, the majority of the evolutionary models for the VB do not take lower crustal and mantle features into detailed consideration. The extent of the deep structures suggests a common large-scale geodynamic framework for the evolution of the VB and surrounding basin systems (e.g., Little Hungarian Plain). The presented geophysical data aim to contribute to this discussion, and serve as a basis for future experiments and studies (e.g. deep seismic reflection profiling, receiver function analysis).

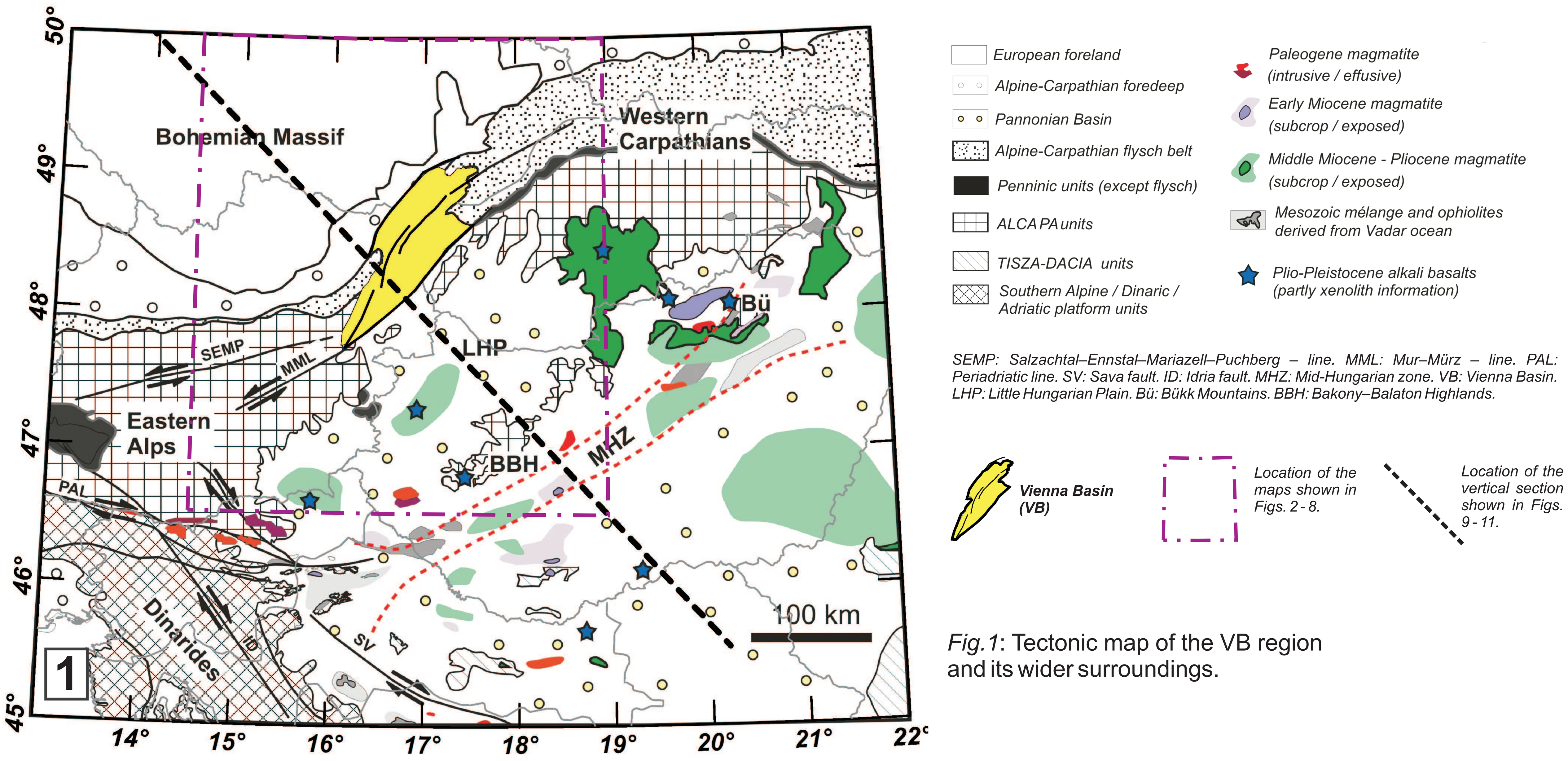


Fig.1: Tectonic map of the VB region and its wider surroundings.

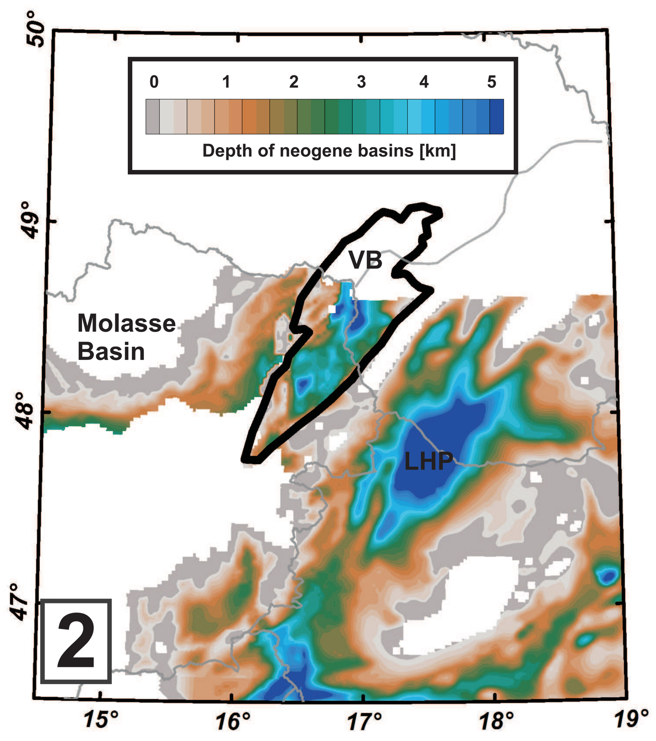


Fig. 2: Thickness of neogene basin fillings. Note the peculiar location of the VB inbetween the Molasse Basin and the Little Hungarian Plain (LHP). Data from the northern VB have not been integrated yet.

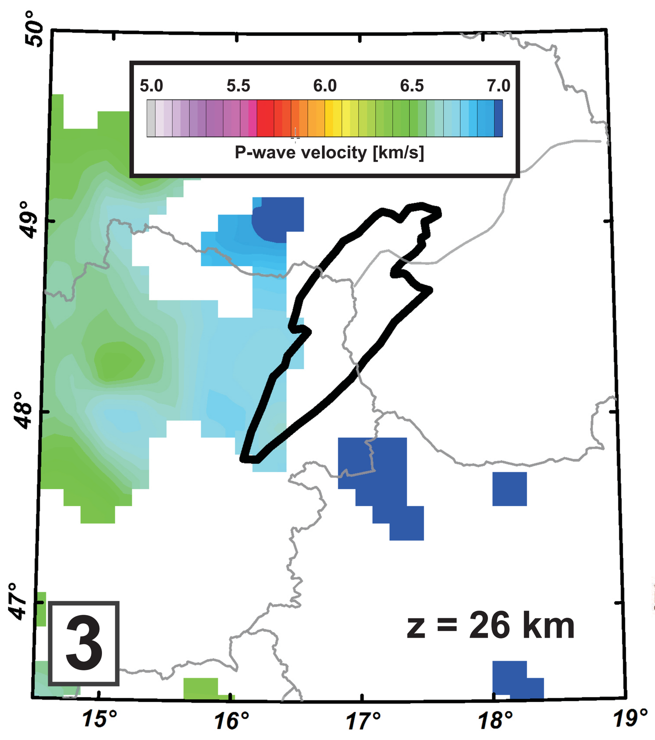


Fig. 3: Crustal P-wave velocities at a depth of 26 km. Note the increase of the velocities towards the VB.

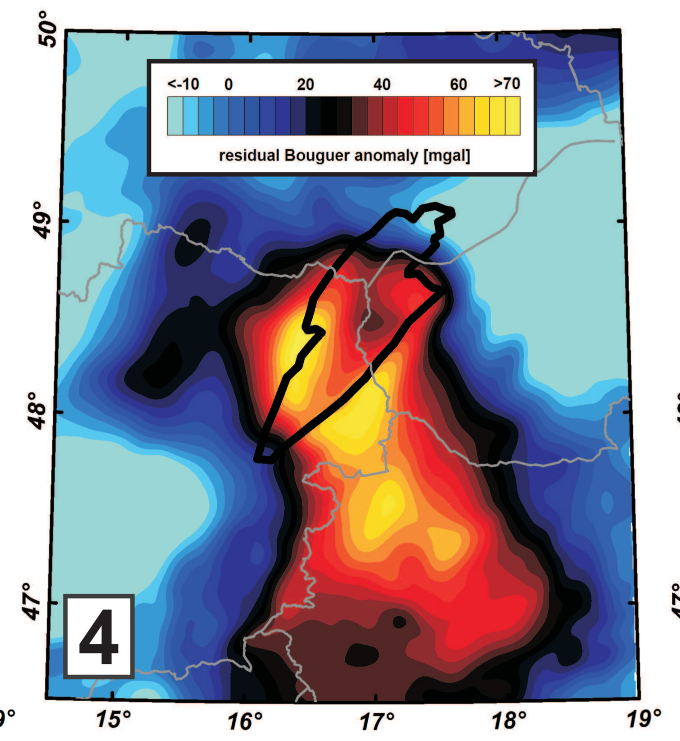


Fig. 4: Residual Bouguer anomaly after the subtraction of upper crustal and upper mantle effects. This residual most likely represents increased densities in the lower crust.

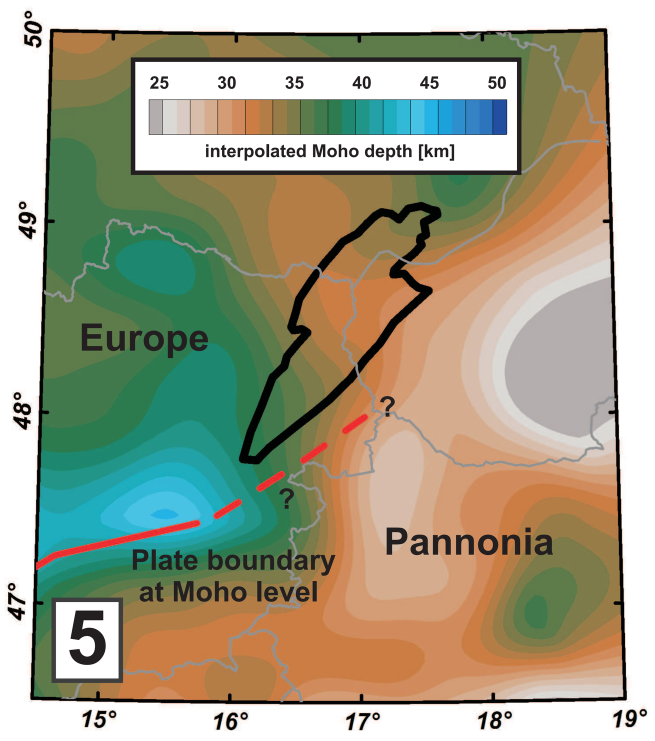


Fig. 5: Moho depth map of the region after interpolation to full coverage. Below the VB, the data are poorly constrained. Note the boundary between the European and the Pannonian Moho.

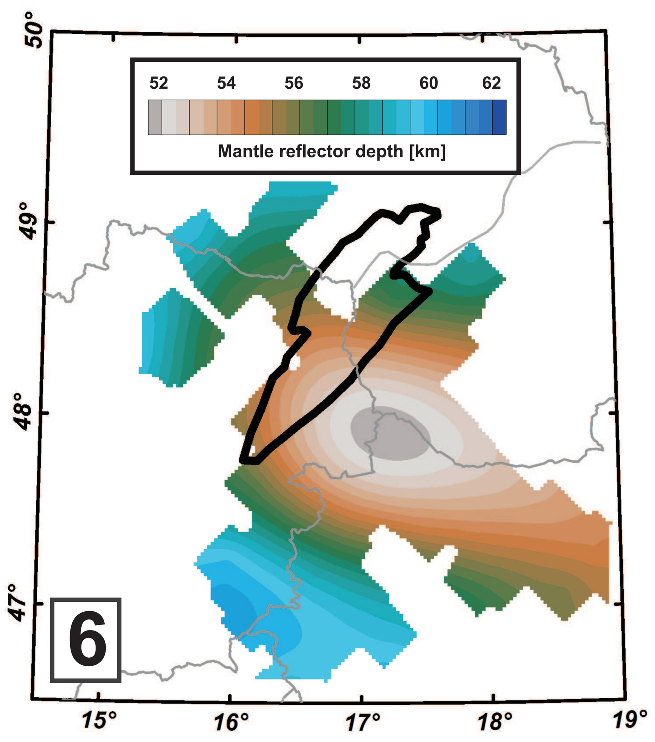


Fig. 6: Depth of a pronounced seismic discontinuity in the upper mantle, which possibly represents a vertical change in anisotropy.

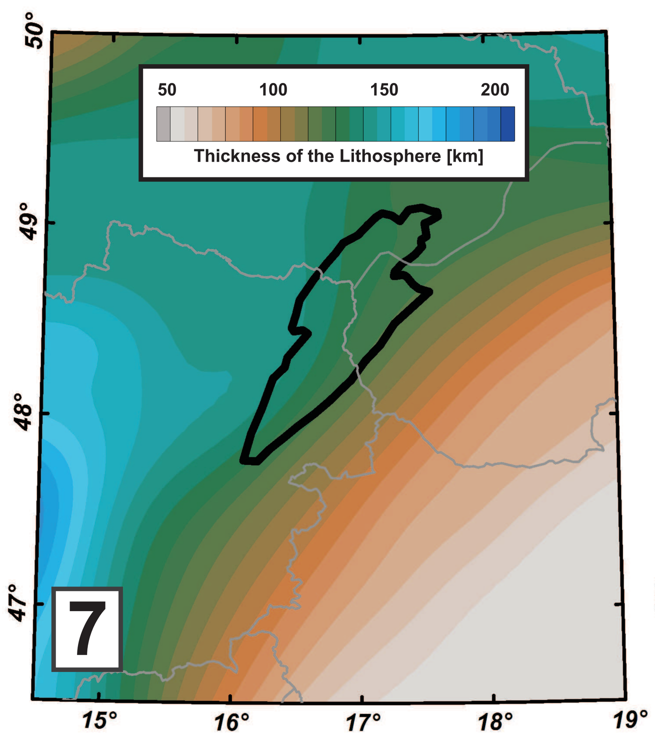


Fig. 7: Estimated depth of the Lithosphere-Asthenosphere boundary (LAB), primarily based on heatflow and magnetotelluric data.

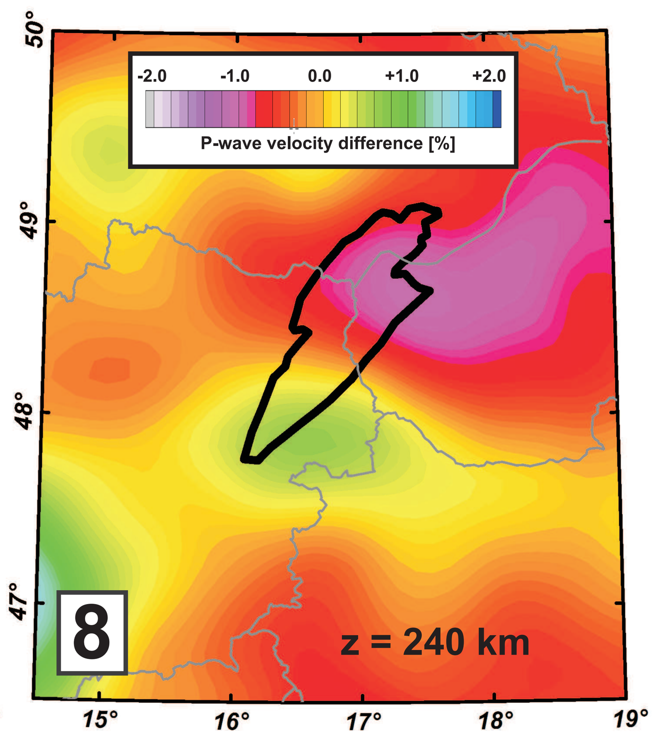
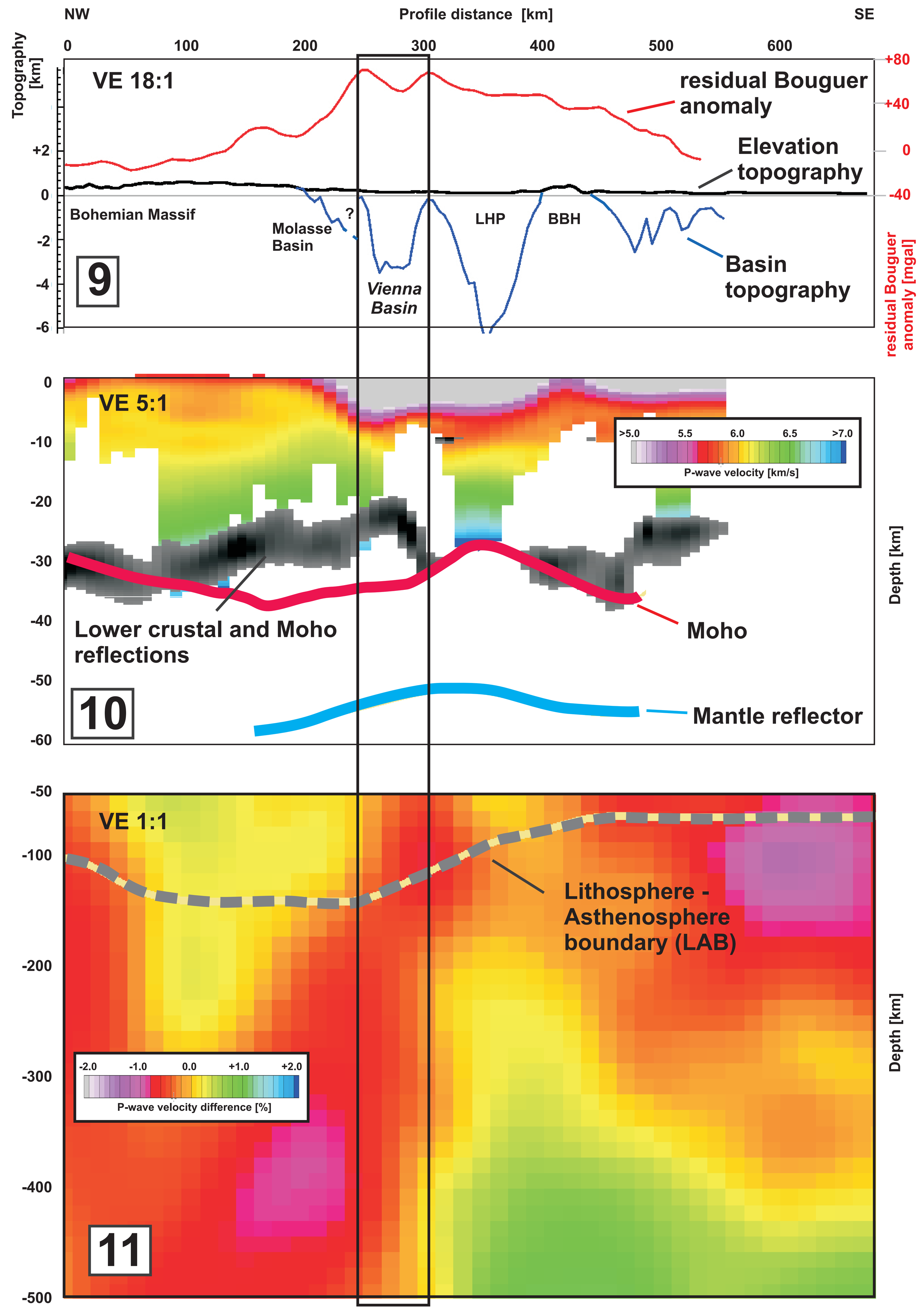


Fig. 8: P-wave velocity differences to the global AK135 reference model at a depth of 240 km. The differences represent an average of three different teleseismic models.



Synthesis of all data along a 680 km long vertical section. *Fig. 9*: residual Bouguer anomaly, elevation & basin topography. *Fig.10*: Crustal and uppermost mantle velocities and discontinuities. *Fig.11*: Mantle velocity differences to the AK135 reference model.

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