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A geophysical model of lower crustal structure of the Palaezoic crustal root (Bohemian Massif): implications for modern collisional orogens

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A new model of the structure and composition of Variscan crust is proposed based on 3D gravity modelling, geological data, seismic refraction (CEL09) and reflection (9HR) sections. The Bohemian Massif crust is characterized by succession of positive and negative anomalies of about 60 – 80 km wavelength for nearly constant Moho depths. The southwestern part of the Bohemian Massif displays a large negative Bouguer anomaly corresponding to high grade rocks (granulites, migmatites) of the Palaeozoic crustal root represented by the Moldanubian domain. Adjacent Neo-Proterozoic Brunia microcontinent displays important gravity high corresponding to mafic and intermediate medium grade metamorphic and magmatic rocks. However, the strong gradient marking deep crustal boundary between the root domain and the Brunia microcontinent is located 50 to 70 km westwards from the surface boundary between these units suggesting that in this area the high density basement rocks are covered by thin sheet of low density granulites and migmatites. NW from the Moldanubain domain occurs an important gravity high corresponding to the Neo-Proterozoic basement of the Teplá-Barrandian Unit limited in the north by southeast dipping reflectors of the Teplá suture which is characterized by high density eclogites and ultramafics. The footwall of the suture corresponds to low density felsic crust of the Saxothuringian basement. The reflection and refraction seismics and gravity modelling suggest a complex lithological structure of the Moldanubian domain marked by low density 5 – 10 km thick lower crustal layer located above MOHO, 5 – 10 km thick heavy mafic layer, 10 km thick mid-crustal layer of intermediate density and locally developed 2 – 5 km thick low density layer at the surface. The low density lower crust correlates well with low P velocities in the range 6.0-6.4 km-sec in the CEL09 section. This complex geophysical structure and surface geology are interpreted as a result of partial overturn of low density lower crust and high and intermediate density crust in the area of central root. The crustal structure in the east is interpreted as a result of viscous extrusion of low density orogenic lower crust over the high density Brunia continent. Comparison of these data with geophysical profiling of the Andean and the Tibetan plateaus suggests that modern orogenic systems reveal comparable but thicker deep crustal pattern. Based on these similarities we propose that the Variscan root represents a deep crustal section of above mentioned plateaus which may have develop by the same orogenic process.