DOI: 10.3190/jgeosci.270

Appendix D

D1 Support by gravity modeling

It is desirable to support the reliability of detected velocity features by independent geophysical methods. They are, of course, assumed to reach a comparable resolution of investigated features. The known results of gravity modeling will be compared because of their sensitivity to the density and/or P-wave velocity changes.

1.1. S04 and CEL09 profiles

The NW part of the S04 profile (Fig. 11 in main text) shows structure elements developed in the collision zone of the Saxothuringian and Teplá–Barrandian units. At km 50–150 along profile, the DRTG resolved several close minor HV and LV anomalies. Because of their relatively small lateral sizes, these velocity anomalies are at the edge of resolution achieved.

Sedlák et al. (2009) performed gravity modeling to support the geothermal drilling near Litoměřice (see the Lt-1 well in Fig. 1 near the 100 km tick on the S04 scale). They studied the gravity response of igneous rocks in the SE Saxony and NW Bohemia. Previously, Sedlák et al. (2007) derived a 2-D density model down to 12 km depth. Their density profile, passing the Lt-1 position, parallels the S04 line ~15 km north-east. Both the NW–SE trending profiles seem to encounter the same geological structures bound to the SXT–TBU collision zone. The high and low-density alternations inferred by gravity modeling are in a close conformity with the minor HV and LV isolated anomalies revealed by the DRTG. Later, Novotný et al. (2010, fig. 8) performed gravity modeling along the NW part of the S04 profile using the DRTG velocities. The inferred density model confirmed the fine blocky structure which Sedlák et al. (2007) found along the collateral density profile earlier.

Confirmation of the CEL09 velocity model is based on the geophysical results in the West Bohemia surveyed by the pilot deep reflection 9HR profile. Both profiles are nearly collateral and almost perpendicularly pass the Saxothuringian and TBU structures (Novotný 2012, fig. 2). Among more studies devoted to gravity modeling in the West Bohemia (Hofmann et al. 2003; Blecha et al. 2009; Guy et al. 2011), only Švancara and Chlupáčová (1997, plate 8) used the 9HR reflection data to constrain the density interfaces in their 2-D density model. In this way, they modeled the interface between the light granitoids of the Karlovy Vary (or Eibenstock–Nejdek) Pluton and high-density mafic rocks in its basement. Their density model along the 9HR profile was compared with the CEL09 velocity section considering the divergence of both lines (see fig. 4 in Novotný 2012). Comparison proved that the modeled density interface corresponds to the 6100 m/s velocity contour and both consistently delimit the mafic basement in a length of 50 km including details of 5–10 km sizes.

1.2. S02 and *S03 profiles*

Chopin et al. (2012) studied the structure and formation of the Moldanubian mantled gneiss Orlica–Śnieżnik Dome (OSD) in the easternmost European Variscides. Their thorough study also presented results of gravity modeling along two parallel 2-D profiles passing the Sudetes region between the Krkonoše (Karkonosze) Massif and Orlica–Sněžník (Śnieżnik) Dome. They transversally intersect both S02 and S03 profiles (Fig. 1). The density distributions inferred from the Bouguer anomalies along these profiles can be compared with the transverse S02 and S03 velocity sections. Figure D1 (bottom) presents the density distribution derived by Chopin et al. (2012, fig. 12c) along the southwestern CH1 profile.

The S02 line intersects the density profiles at 59 and 69 km within a gravity high (Figs D1 and 10). Both density sections comprise here a high-density layer of 2.90 g/cm^3

(interpreted as amphibolites) down to ~5 km. Deeper, there are two layers with a substantially lower density 2.67 and 2.69 g/cm^3 (gneisses) that wedge SE out at the depths of 24 and 19 km (Fig. D1). In the transverse S02 velocity section, the amphibolites layer corresponds to the shallow HV body (6300 m/s) intersected at its NNE margin. The gneiss thickness modeled beneath has its counterparts in the gradient-free layer (6000 m/s) with the adjacent LV diapiric body (5900 m/s) reaching 20 km depth. A principal agreement of the density/velocity encountered bodies is obvious. Both geophysical models predicted an inverse sequence of layering caused by emplacement of a mafic body reaching the depths of ~7 km and a steep increase of P-wave velocities/densities beneath ~15 km depth.

The S03 line crosses both density profiles at 135 and 145 km within the gravity low due to the low-density gneisses of the OSD (Figs 9 and D1). Chopin et al. (2012) modeled the OSD minimum (~ –50 mGal) by outcropping the gneiss body with 2.67 g.cm^{-3} density reaching down 24 km depth. Its image on the transverse S03 velocity section shows a narrow, almost vertically dipping LVZ with a central minimum of ~6000 m/s at 7–12 km depths. As the velocity contours indicate in Fig. 9, the diapiric LV body likely continues beneath the 15 km depth.

The lateral range of the 6000 m/s loop coincides with the western (Orlica) branch of the OSD outcropping at 120–148 km (Fig. 1). Except a week HV intercalation at ~5 km depths (Fig. 9), with 6050–6100 m/s velocities, both geophysical sections image the same, almost homogeneous gneiss complex reaching more than the 15 km depth.

References

BLECHA V, ŠTEMPROK M, FISCHER T (2009) Geological interpretation of gravity profiles through the Karlovy Vary granite massif (Czech Republic). Stud Geophys Geod 53: 295–314

CHOPIN F, SCHULMANN K, SKRZYPEK E, LEHMANN J, DUJARDIN JR, MARTELAT JE, LEXA O, CORSINI M, EDEL JB, ŠTÍPSKÁ P, PITRA P (2012) Crustal influx, indentation, ductile thinning and gravity redistribution in a continental wedge: Building a Moldanubian mantled gneiss dome with underthrust Saxothuringian material (European Variscan belt). Tectonics 31, doi: 10.1029/2011TC002951

GUY A, EDEL JB, SCHULMANN K, TOMEK Č, LEXA O (2011) A geophysical model of the Variscan orogenic root (Bohemian Massif): implications for modern collisional orogens. Lithos 124: 144–157

HOFMANN Y, JAHR T, JENTZSCH G (2003) Three-dimensional gravimetric modeling to detect the deep structure of the region Vogtland/NW-Bohemia. J Geodyn 35: 209–220

NOVOTNÝ M, SKÁCELOVÁ Z, MLČOCH B (2010) Crustal structures beneath the Saxonian Granulite Massif, the České středohoří and the Doupovské hory Mts. based on the depth-recursive tomography. J Geosci 55: 81–94

NOVOTNÝ M (2012) Depth-Recursive Tomography of the Bohemian Massif at the CEL09 Transect – Part B: interpretation. Surv Geophys 33: 243–273

SEDLÁK J, GNOJEK I, ZABADAL S (2007) Zhodnocení anomálií gravitačního a magnetického pole v okolí vrtu PVGT Lt-1. Unpublished Manuscript, Geomedia Ltd., Prague, Miligal Ltd., Brno

SEDLÁK J, GNOJEK I, ZABADAL S, SCHEIBE R, ZABADAL S (2009) Gravity response of igneous rocks in the northwestern part of the Bohemian Massif. J Geosci 54: 325–342

ŠVANCARA J, CHLUPÁČOVÁ M (1997) Density model of geological structure along the profile 9HR. In: VRÁNA S, ŠTĚDRÁ V (eds) Geological Model of Western Bohemia Related to the KTB Borehole in Germany. Sbol Geol Věd, Geol 47: 32–36

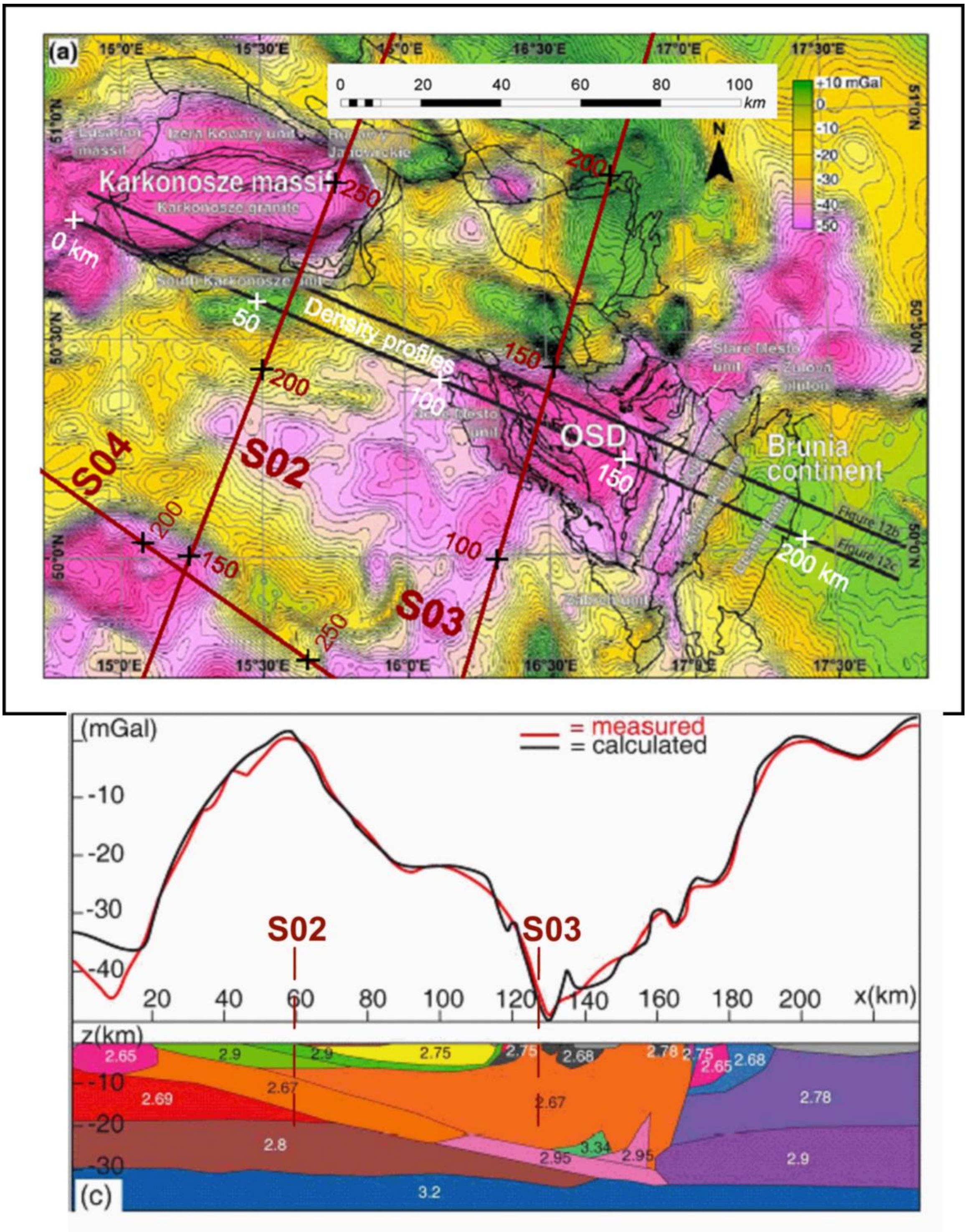

Fig. D1 The Bouguer anomaly map of the Sudetes with two density profiles after Chopin et al. (2012). The inferred densities (g/cm^3) modeled along the southwestern density profile CH1.