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3D gravity modelling of the Scandinavian Caledonides in the vicinity of COSC-1 drill site constrained by petrophysical data from the drill core

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The Scandinavian Caledonides have long been recognised to have been part of a Paleozoic mountain belt of Alpine-Himalayan dimensions. Today, the remnants of the Scandinavian Caledonides extend laterally over ca. 1500 km and show east-vergent thrusting and emplacement of allochthons in Norway and western Sweden. The middle allochton (Seve nappe complex), characterized by an inverted metamorphic gradient and partially molten parts that were involved in ductile extrusion, provides opportunities to investigate deep mountain building processes currently occurring in the Himalaya-Tibet orogen. Moreover the recent discovery of a subduction related ultra-high pressure terrane in the upper part of the middle allochton raises more questions about the process of emplacement of this continental slice during orogeny (Majka et al., 2014). Investigating crustal structure in the vicinity of the COSC-1 area is of key importance in understanding the extrusion process. In this study, we use a combination of new and pre-existing terrestrial gravity data to image the high-density middle allochton and its structural relation to the underlying units. Compared to previous work (Hedin et al., 2013), we use free-air anomaly data instead of the Bouguer anomalies (and the standard correction of 2670 kg/m3) because the near surface-density distribution has a significant influence on the gravity signal in this area of high relief. The topography and its density variations are thus incorporated in the 3D gravity model of the area. We also take advantage of the density measurements from both the 2.5 km recovered core material and borehole logging to calibrate the upper part of our model, as well as new seismic data to better constrain the location and shape of the main tectonic limits. Our constrained 3D gravity modelling thus improves the structural image of the western Jämtland area, especially the high-density anisotropic middle allochton that is underlain by the by lower density lower allochton.