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# Depth to Precambrian basement terranes beneath the Caledonian nappes in Finnmark, northern Norway: a case study

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Rock complexes of Precambrian to early Mid Palaeozoic age dominate the bedrock geology of Finnmark, northern Norway. These can be readily divided into (1) a series of nappes and thrust-sheets that constitute the Caledonide orogen, and (2) a mid-crustal lithospheric basement made up of both granitoid and greenstone complexes that range in age from Neoarchaean to late Palaeoproterozoic. This basement extends into northern Finland and northwestern Russia, forming the northern margin of the Fennoscandian Shield. In several places in the Caledonides the older Precambrian rocks are also found to be incorporated as thrust slices in the Caledonian nappes. Some of the older rock complexes, notably the Palaeoproterozoic Kautokeino Greenstone Belt, also appear in antiformal tectonic windows within the Caledonides.

During the period 2011-2015, new high-resolution aeromagnetic data from the Caledonides and the Archaean-Palaeoproterozoic crystalline basement of Finnmark and North Troms have been acquired from fixed-wing and helicopter-borne surveys conducted as part of NGU's MINN (Mineral Resources in North Norway) programme. The new data have provided spectacular and confirmatory evidence for the continuation of the diverse Precambrian greenstone belts and granulite terranes beneath the magnetically transparent Caledonian nappes.

The main objective of the current study has been to estimate the depths to the main magnetic sources beneath the nappes using 3D Euler and 2D Werner deconvolution methods. The study area comprises both deep and shallow structures. Shallow structures in the region are mainly due to prominent and extensive, ultramafic-mafic complexes, each with associated sets of mafic dykes. Elsewhere, in several thrust sheets, there are significant numbers of mafic dykes with diverse trends and different ages, and locally these reach up to swarm proportions.

In the current study we have specifically targeted the depth-to-basement beneath the nappes and purposely excluded the anomalies deriving from shallow structures such as dykes and faults. The results from both methods (i.e. 2D and 3D) are similar and show an appreciable increase of depth to the Precambrian basement rocks from south to north. In the south, basement rocks are either exposed on the surface southeast of the Caledonian front or reappear in tectonic windows. On the Porsanger Peninsula a prominent magnetic anomaly is inferred to represent an extension of the Repparfjord window. The depth-to-basement beneath nappes close to the Caledonian front is estimated to 500-2000 m whereas in the northern part of the study area the depths reach 3000-4000 m. In some cases, depths are estimated to between 5000 and 6000 m. However, these latter interpretations should be considered with extreme caution as there are not enough clustering solutions for those particular depth estimates. Nevertheless, by employing the 3D Euler and 2D Werner deconvolution methods we are thus able to estimate the approximate thicknesses of the nappes in this northernmost part of the Norwegian Caledonides.