Magnetization of lower crustal rocks - potential sources of long wavelength anomalies

Geertje ter Maat\textsuperscript{1}, Suzanne McEnroe\textsuperscript{1}, Nathan Church\textsuperscript{1}, and Hirokuni Oda\textsuperscript{2}

\textsuperscript{1}Norwegian University of Science and Technology, IGP, Trondheim, Norway (geertje.termaat@ntnu.no)
\textsuperscript{2}Geological Survey of Japan, National Institute of Advance Industrial Science and Technology (AIST)

The occurrence and nature of primary magnetic phases in ultramafic rocks is a subject of debate. Studies of ultramafic rocks originating in the deep crust commonly report secondary magnetic phases due to later metamorphism, serpentinization, or alteration as sources for long-wavelength anomalies. To assess the potential magnetic contribution from primary magnetic minerals occurring ‘in situ’ in deep-seated ultramafic rocks, the stability of these phases at lower crustal pressure and temperature conditions must be addressed. However, to study the magnetization of deep-crustal rocks, we are limited to exposures of unaltered uplifted rocks. Studying the petrophysical and rock magnetic properties of these ultramafic rocks can aid in predicting magnetic behavior deeper in the crust.

Here, we present the results of a petrophysical and rock magnetic study on the ultramafic rocks of the Reinfjord Ultramafic Complex (RUC). These rocks are part of the Seiland Igneous Province, a magmatic plumbing system that formed in the deep crust (25-35 km depth). The dunites and wehrlites are minimally serpentinized, which indicates that the magnetic oxides in these rocks may be representative of those at depth. The primary magnetic carriers in these rocks were characterized using optical and electron microscopy, hysteresis and FORC measurements, backfield unmixing curves, and scanning magnetic microscopy. The primary magnetic carriers in the RUC are Cr-magnetite blebs exsolved from Al-chromite, and exsolved magnetite lamellae within clinopyroxene. The magnetic carriers have a range of domain states from SD to MD.

The ultramafic rocks from the RUC are remarkably pristine and therefore provide insight into the magnetization of the lower crust. Due to the presence of SD magnetic carriers, these rocks may hold a stable remanence at lower crustal conditions and therefore be a potential source for long-wavelength anomalies.