

Combined 3D inversion of MT and CSEM-data from Malmberget northern Sweden.

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SUMMARY

During 2020-2022 both MT and CSEM surveys have been conducted around Malmberget in northern Sweden. Malmberget is the location of one of Europe's largest underground iron mines with iron oxide-apatite ore and mafic-intermediate metavolcanic host rock. In the area two different CSEM surveys were conducted, one in the summer of 2021 with a 4km long grounded dipole source and 150 measurements with 250m spacing in a 3x4km² rectangle, and another one done in the winter-spring of 2022 with a 1x1km² loop source with 100 measurements with 250m spacing in a 2x2 km² area. In the 2021 summer survey all five field components were measured (Ex,Ey,Hx,Hy,Hz) but in the 2022 winter-spring survey only the magnetic fields (Hx,Hy,Hz) were acquired due to weather limitations. The Magnetotelluric survey spans the whole area and consists of roughly 130 1km spaced measurements in a 10x15km² rectangle. These measurements were done in the summers of 2020,2021 and some during the winter-spring of 2022. CSEM surveys were processed to estimate univariate transfer functions between field components and current recording in frequency range 8 – 3000Hz. This approximates to a depth of investigation of about one to two km. The data are jointly inverted using the MR3Dmod code and the results compared to single inversions and a 3D geological model. The surveys were conducted in cooperation between Loussavaara-Kiirunavaara Aktiebolag (LKAB) and Luleå university of technology (LTU) and are part of two different projects. One focusing on Common Earth modelling (CEM) on deposit scale and the other being (D-Rex) which focuses on connections between regional and deposit scale exploration.

Keywords: Magnetotellurics, Controlled source electromagnetics, Combined inversion, 3D inversion, multiresolution grid
