

2D and 3D Resistivity Models From Magnetotelluric Measurements North East of Kiruna, Sweden

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In the frame of Barents mapping project the Geological Survey of Sweden (SGU) carried out magnetotelluric (MT) measurements at two areas in northern Norrbotten during summer of 2014. The survey objective was to model the variation of electrical resistivity of the upper crustal structures. The upper crust around Kiruna is largely composed of various supracrustal units dominated by metabasalts, felsic metavolcanic and clastic metasedimentary rocks. These rocks rest on an Archean metagranitoid complex. All of these units have been intruded by plutonic rocks, and to variable degrees are folded, sheared and metamorphosed, during the Svecokarelian orogeny.

The collected MT signals cover a wide frequency band from 10^{-2} to 300 Hz. 2D and 3D modeling of the collected data imaged the variation of electrical resistivity down to a depth of about 30 km. The resistivity models resolved three distinct highly resistive structures that most probably represent crystalline rocks such as granitic and gabbroic intrusions and volcanic units. The resistive features at some places reach a depth of about 20 km. The resistivity models also show low resistivity zones at various depths and locations almost in the entire study area. An extremely low resistivity feature is resolved about 10 km west of Vittangi village with known graphite mineralization. The low resistivity feature deeps towards the WSW.

The 2D resistivity model along the profile in the second area shows a highly conductive feature (~ 1 ohmm) that reaches depths greater than 5 km. The anomaly can be caused by either the graphite layer within the metasedimentary rocks crossed by the profile or highly conductive zones of sulfide mineralizations reported in the other parts of the area. SGU has recently funded airborne VTEM (Versatile time domain electromagnetic) measurements. The VTEM data close to this zone have detected elongated very low resistivity anomalies. The resistivity model from 1D inversion of the VTEM data along part of a flight line close to the MT line shows considerable correlation with the 2D MT resistivity model.