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3D modeling of the bedrock surrounding the Lampinsaari and Kuuhkamo Zn-Cu deposits in the Vihanti area, Finland

Eevaliisa Laine (1), Jouni Luukas (2), Aimo Ruotsalainen (2), Ilkka Suppala (1), Jukka Kousa (2), and Raimo Lahtinen (1)

(1) Geological Survey of Finland, Espoo, Finland (eevaliisa.laine@gtk.fi), (2) Geological Survey of Finland, Kuopio, Finland (jukka.kousa@gtk.fi)

The Vihanti area is situated in Western Finland on the coastal plane of the Gulf of Bothnia. The terraine is an old peneplane covered with swamps and ridges, with only few outcrops available. The bedrock of the Vihanti area is composed of Palaeoproterozoic supracrustal and intrusive rocks. Geological map of the Vihanti area has been drawn using, in addition to the few unevenly distributed outcrops, boulder observations, basal till samples, geophysical data and drilling. The Lampinsaari Zn deposit was discovered by the Geological Survey of Finland (GTK) in 1946 and it was mined from 1954 to 1992 by the Outokumpu Company. The Kuuhkamo Zn deposit was found by the Outokumpu Company who investigated it in years 1985-1989. The Zn mineralizations are associated with altered felsic to intermediate volcanic and calc silicate rocks. The Vihanti area has been later studied in several projects by GTK. The present study is part of the Work Package 2 of the EU-funded FP7 project "ProMine". This workpackage will develop geomodels which will use geodata and information bases to model and visualise the key spatial, geological, geophysical, geochemical and financial parameters of resources in 3D and 4D developed on common 3D GIS platforms. The aim of this study is to create a 3D model of the bedrock in the Vihanti area as a part of the regional 3D model of the Pyhäsalmi-Vihanti area. Important data sources include the HIRE-project data (High Resolution Reflection Seismics for Ore Exploration 2007-2010 at GTK), gravity data and low-altitude aeromagnetic and aeroelectromagnetic (AEM) data. The resulted 3D model covers an area of 30 x 18 km with a depth of 5 km. The geological units were continued downwards by using previous geological interpretations and geophysical models. For example, the depths of the gabbroic bodies have been interpreted from combined seismic and gravity data. Regional gravity high is interpreted to be due to denser granulite facies rocks below the depth of 3 km. The 3D model was further improved by using HIRE seismic sections, 2.5D/3D magnetic inversions and interpretation of AEM data with simple conductive structures. The final 3D model shows that the domes, composed of volcanic rocks, resulted by the interference of two separate deformation phases. The 3D mapping of the volcanic units and related structures is essential because felsic to intermediate volcanic rocks and their metamorphosed alteration products, cordierite sillimanite gneisses, are an important marker horizon for ore formation in the area.

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