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Delineating the network of brittle structures with geotechnical, structural and reflection seismic data, Kevitsa open pit, Northern Finland

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Abstract

This study aims at developing an internally consistent 3D network of brittle structures for the Kevitsa open pit Ni-Cu sulphide mine hosted by a Palaeoproterozoic mafic-ultramafic layered intrusion. The used approach involves compilation of depth and data-dependent three-dimensional geological sub-models at smaller depths, and their subsequent correlation with rock quality data, and reflection seismic structural models at greater depths. The work aims at bridging the characteristic gaps within and between the used geological-geophysical datasets, caused by the variable scales, coverages and resolutions. The second aim of the work is to provide a tectonic model explaining the generation of the major brittle structures within the area. The used data include digital elevation models, fracture and rock quality data from drill holes and 3D-photogrammetry, and seismic interpretations from previous investigations. The results show that the most distinct fracture zones dip gently towards WNW, steeply towards SE and sub-vertically, with NNW-SSE strikes. The gently WNW-dipping fracture zone shows the largest spatial extent and is clearly recognisable in all the source data sets. A kinematic model containing the gently WNW-dipping structures as major thrust zones, and smaller structures as second order structures is inferred. This work shows how surface and sub-surface data from various sources and depths are successfully integrated into high confidence structural models, which can be used as input data in future slope stability studies of the Kevitsa open pit.

Keywords: fractures, rock mass quality, structural analysis, 3D geologic modelling, reflection seismics

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