



Integration of 2D and 3D reflection seismic data with deep boreholes in the Kevitsa Ni-Cu-PGE deposit, northern Finland

Emilia Koivisto (1), Alireza Malehmir (2), Teemu Voipio (3), and Chris Wijns (3)

(1) University of Helsinki, Helsinki, Finland (emilia.koivisto@helsinki.fi), (2) Uppsala University, Uppsala, Sweden (alireza.malehmir@geo.uu.se), (3) First Quantum Minerals Ltd., Finland/Australia (teemu.voipio@fqml.com; chris.wijns@fqml.com)

Kevitsa is a large disseminated sulphide Ni-Cu-PGE deposit hosted by the Kevitsa mafic-ultramafic intrusion in northern Finland and dated as about 2.06 Ga old. The Geological Survey of Finland first discovered the Kevitsa deposit in 1987. Open pit mining by Kevitsa Mining Oy/First Quantum Minerals Ltd. commenced in June 2012. The final pit depth is planned to be 550-600 m. The estimated ore reserves of the Kevitsa intrusion are about 240 million tonnes (using a nickel cut-off grade of 0.1%). The expected life-of-mine is 20-30 years. More than 400 hundred holes have been drilled in the Kevitsa area, but most are concentrated close to the known deposit and do not provide a comprehensive understanding of the extent of the intrusion. The basal contact of the intrusion is penetrated by only about 30 drill holes, most of which are shallow. A better knowledge of the geometry of the intrusion would provide a framework for near-mine and deep exploration in the area. An exact knowledge on the basal contact of the intrusion would also provide an exploration target for the contact-type mineralization that is often more massive and richer in Ni-Cu.

In December 2007, a series of 2D reflection seismic profiles was acquired in the Kevitsa area. It consisted of four connected survey lines between 6 and 11 km long. In 2010, the initial positive results of the 2D seismic survey led Kevitsa Mining Oy/First Quantum Minerals Ltd. to initiate a 3D reflection seismic survey. The 3D seismic survey is limited to the closer vicinity of the known deposit, while the 2D seismic survey was designed to provide a more regional view of the Kevitsa intrusive complex. The main aims of the 2D and 3D seismic surveys were to delineate the shape and extent of the ore-bearing Kevitsa intrusion and the geometry of some of the host rock and surrounding units, and extract information about the larger-scale structures and structures important for mine-planning purposes. The 2D and 3D seismic data were used to create a 3D lithological and structural model for the architecture of the whole complex. The information on the extent of the ore-bearing Kevitsa intrusion can be used for more effective exploration in the area. The base of the intrusion is particularly clear in the northern and eastern sectors. Toward the east, the base is mostly defined by disruption of the reflectors internal to the intrusion. The 2D seismic data, which extend beyond the 3D seismic study, reveal that the prominent reflectors at the base of the intrusion continue deeper toward the south-southwest. This has been interpreted as a previously unknown southern continuation of the intrusion. Furthermore, the data reveal strong reflectors at the base of the intrusion that have been penetrated by two deep drill holes in the area. These drill holes reveal contact-type mineralization at the onset of the reflectors. Thus, the seismic data can be directly used for exploration of the contact-type mineralization.