Geophysical Research Abstracts, Vol. 7, 00290, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00290

Seismic reflection imaging and modeling to delineate structures hosting VMS deposits in the Skellefte Ore District, northern Sweden

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Over 85 Volcanogenic Massive Sulphide (VMS) occurrences are known in the Skellefte Ore District. In the western part of the area, the most important metallogenic zone in Northern Sweden, several world class mines, e.g., the Kristineberg VMS mine (20.1mt, Cu-Zn-Pb-Ag-Au), are situated. It is the most important mining district in Sweden today. Although several studies have been conducted in the region, the contact relationships between the ore bearing rocks of the Skellefte group and the surrounding rocks are poorly known at depth. To delineate the structural geologic framework at depth with the purpose of obtaining high resolution images of the upper 12 km of crust, new seismic reflection data were acquired in the Kristineberg area along two approximately 25 km long parallel profiles (Profile 1 and Profile 5) in late August and early September 2003. These profiles complement other research objectives in the area that include determining the relationship between the various rocks hosting ore bodies, understanding the structural geology at depth by incorporating other geophysical and geological information publicly available and constructing a pilot 3-D geologic model of the area. Development of a detailed 3-D geological model of the region will allow the contact relationships between the ore bearing volcanic formations and the surrounding rocks to be understood. Although the structural geology is very complex, stacked sections of the seismic data show numerous reflections that can be correlated with surface geology. Results along Profile 1, which passes over the Kristineberg mine, show the mine to be located in a major synform extending down to about 2-2.5 km. Stacked sections from Profile 5 show the post-orogenic Revsund granite as a tabular body and clear images of ultramafic rocks. Seismic modeling in 3-D of traveltimes to

reflections in the stacked sections and shot gathers along the crooked line geometry provides strike and dip estimates of major reflectors. Projection of these orientations onto the total field aeromagnetic map shows good correlation with surface features allowing an integrated interpretation of possible faults and magnetic bodies. This project demonstrates the potential of the seismic reflection method for mineral exploration in complex areas.