

Mineral Chemistry of Iron Oxides in the Leveäniemi Iron Ore Deposit in Northern Sweden.

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ABSTRACT

The Paleoproterozoic Leveäniemi iron oxide apatite (IOA) deposit of the so-called Kiruna type is currently mined by Luossavaara-Kiirunavaara AB (publ.), commonly known as LKAB. The mineralogy of iron oxides, i.e. magnetite, hematite, maghemite, and goethite is more complicated compared to the neighbouring and more famous IOA deposits of Kiirunavaara and Malmberget. Furthermore, the mineral chemistry of the iron oxides in the Leveäniemi deposit is also slightly different. Especially, the information about the deportment of titanium and vanadium in iron oxides and distribution in the deposit is essential since they can have an impact in the steel making process.

For this study 50 samples were selected from exploration drill cores and investigated by optical microscopy, FE-SEM-EDS and EPMA at LKAB and the Geological Survey of Finland. Investigations revealed that magnetite is the predominant iron oxide mineral with secondary hematite being the second most abundant mineral. Primary hematite, maghemite, and goethite seem to be less abundant. It should be noted, however, that this investigation focused on magnetite which currently is the only mineral with economic value.

Vanadium occurs as a substitution element in the crystal lattice of iron oxide minerals in the Leveäniemi deposit and not as discrete stoichiometric vanadium minerals. In the investigated samples vanadium concentration in magnetite ranges from 0.12 to 0.32 wt% V₂O₃ with higher concentration in the southern part of the deposit. Contrary, titanium does not substitute for iron in the crystal lattice of magnetite or secondary hematite (less than 0.018 wt% TiO₂). It either occurs as tiny inclusions of titanium oxide minerals or as exsolution lamellae of ilmenite in magnetite. The spatial distribution for titanium in the deposit, however, remains unknown. Furthermore, results of this study indicate that alteration of primary magnetite to secondary hematite has had no significant effect on the trace element chemistry of these minerals in the Leveäniemi deposit.

Key words: LKAB, Kiruna-type, Iron ore, Magnetite, Hematite, Maghemite