Fingerprinting Tools to Distinguish Magnetite Deposit Types

Patrick Krolop[1], Christin Schulz[2], Sabine Gilbricht[2], Thomas Seifert[2]
1. Luossavaara Kiirunavaara AB, Kiruna, Sweden, 2. TU Bergakademie Freiberg, Freiberg, Germany

Magnetite is the prominent ore mineral in several deposit types including iron oxide-apatite (IOA), iron-rich ultramafic pegmatites (IRUPs), magnetite bands in layered intrusions, magnetite-rich carbonatites, magnetite skarns, and banded iron formations (BIFs). Mineral chemical data has commonly been used to utilize discriminating tools (e.g., provenance studies, pathfinder for mineral exploration, and deposit-formation scenarios). In this contribution, we provide both modified existing discrimination diagrams and new tools for separating deposit types by magnetite chemistry. A set of comprehensive EPMA and LA-ICP-MS data of magnetite from several deposits of different genetic types were obtained. Suitable fingerprinting elements are Ti, V, Ni, Cr, Co, Al, Mg, Mn, Si, Ca, Ga, Sn, and Zn. These elements display systematic variation and mostly detectable concentrations in the respective magnetite-bearing samples investigated in this study. Especially Ni vs. Ti+V seems to allow discrimination for all deposit types, with distinct fields when LA-ICP-MS data is used. Since some of the elements (e.g., Cr, Ga, Zn, and Sn) are commonly below the detection limit of the electron microprobe, a thorough textural analysis needs to be conducted to compensate the larger beam diameter of the laser, lowering contamination of the signal by exsolutions and inclusions in some magnetite types.