Stable isotope and LA-ICP-MS microanalytical evidence for a hydrothermal origin of Paleoproterozoic Fe oxide-apatite deposits, western Norrbotten County, Sweden

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LA-ICP-MS data show that magnetite in Fe oxide-apatite (IOA) deposits (e.g., Kiruna, Pattok) have low Ti, Mg, Al, V, Ni, Co, LREE, Sc and Cr, and are similar to magnetite in the El Laco Fe deposits, Chile, and hydrothermal deposits elsewhere. Low Ti, Co, Ni, Cu and Zn in these magnetites is dissimilar to typical magmatic varieties in mafic intrusive rocks and carbonatites, and also indicates that the IOA deposits are unlikely to represent the products of high Fe melts separated from magmas of similar composition to the deposit's host rocks. The low V, Ti, Mg, Al and Ni content of magnetite and the occurrence of earlier Na-Ca alteration around most of the ore bodies probably indicates a hydrothermal, rather than orthomagmatic process for IOA formation. Calculated $\delta^{18}O_{H2O}$ for ore fluids (+7.2 to +12.9 ‰) are consistent with a significant igneous component to these systems. We favor the formation of IOA deposits via a single geological process largely involving the exsolution of hot magmatic fluids (cf. Mark & Foster 2000), where additional components may have been sourced by metal scavenging associated with hydrothermal Na-Ca alteration of the host rock package (cf. Mark et al. 2004).

References

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