

Magnetite-apatite deposit from Sri Lanka: Implications on Kiruna-type mineralization associated with ultramafic intrusion and mantle metasomatism

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ABSTRACT

Kiruna-type iron oxide–apatite associations occur in a variety of rock types and their origin has remained controversial. Most of the Kiruna-type deposits are associated with intermediate to felsic rocks, and in rare cases with ultramafic rocks. Here we investigate the Seruwila iron oxide–apatite deposit at the contact between the Highland and Vijayan complexes that has been defined as the “eastern suture” in Sri Lanka, which formed during the late Neoproterozoic assembly of the Gondwana supercontinent. The ore deposit is hosted in an ultramafic intrusion and comprises massive and disseminated mineralization. The ore-bearing rocks are mainly composed of low-Ti magnetite and chlor-fluorapatite. Our petrological and geochemical studies suggest a magmatic–hydrothermal model for the mineralization wherein: (1) the Cl-rich magmatic–hydrothermal fluid scavenged iron and P from the ultramafic magma, transported iron to shallower levels in the crust and deposited along the suture zone to form the massive type magnetite and apatite; and (2) the cooling of the hydrothermal fluids resulted in the growth of disseminated magnetite and the precipitation of sulfide minerals, followed by a calcic metasomatism (scapolitization and actinolitization). This model is in conformity with the genetic relation between Kiruna-type deposits and iron oxide–copper–gold (IOCG) deposits. We also report LA-ICP-MS zircon U–Pb ages from the host ultramafic intrusion suggesting its emplacement at ca. 530 Ma, which is younger than the regional high-grade metamorphism associated with the collisional assembly of the crustal blocks in Sri Lanka at ca. 540 Ma. By analogy with the common occurrence of Kiruna-type deposits in extensional tectonic settings, and the geochemical features of the studied rocks including low silica, high Mg, Fe, Ca with high field strength elements (HFSEs such as Nb, Ta, Zr, Hf, Ti) depletion and strong LREE and F enrichment, we theorize that the ultramafic magmatism occurred in a post-collisional extensional setting derived from a volatile- and LREE-rich metasomatized lithospheric mantle.

Keywords: Kiruna-type, IOA deposits, magnetite, apatite, ultramafic intrusion, Sri Lanka; From Magmas to Ore Deposits