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Abstract

Iron oxide-copper-gold (IOCG) deposits define a group of diverse, epigenetic Cu-Au deposits to which several economically important deposits belong. Their typical characteristics are: (1) Fe-Cu-Au-Co-U-REE-Ba-F element association, (2) high Fe-S ratio manifested by magnetite- and/or hematite-rich host rocks of the ores, (3) extensive, commonly spatially and temporally zoned Na-Ca-K-Fe metasomatism in and around the deposits, (4) highly saline aqueous \pm carbonic fluids related to alteration and mineralisation, and (5) spatial correlation with crustal-scale fault and shear zones. Host rock sequence, fO_2 , and depth as well as temperature of the mineralisation events vary extensively between the known deposits causing considerable diversity in their characteristics.

The purpose of this work is to evaluate the IOCG potential of northern Finland. This is done by studying five iron oxide-rich deposits from two different regions: (1) Raajärvi and Puro magnetite deposits in the Misi region located in the easternmost part of the Peräpohja schist belt, and (2) Hannukainen, Kuervitikko and Cu-Rautuvaara Fe-Cu-Au deposits in the Kolari region located in the western part of the Central Lapland greenstone belt. The study covers alteration, mineralogy, geochemistry, fluid inclusion characteristics, and geochronology. The data achieved are further compared to the existing data on the IOCG deposits elsewhere and to genetic models that have been proposed for IOCG deposits.

In both Kolari and Misi regions, the geological features of the deposits are comparable to the IOCG deposits elsewhere and consistent with proposed magmatic source models. The Kolari deposits also contain Cu and Au in grades typical for IOCG deposits and thus they best fit to the IOCG category. Although at least Cu was mobile during the mineralisation and alteration events related to magnetite deposits in the Misi region, only anomalous values of Cu and Au have been detected. However, the alteration style, fluid inclusion composition, O- and C-isotope characteristics, and the proposed genetic model of the magnetite deposits at Misi are consistent with what has been described with IOCG deposits. Therefore, the magnetite deposits in the Misi region are considered to be representatives of IOCG deposits barren with respect to Cu and Au.

According to the data presented, northern Finland is a IOCG potential region. The most prospective district for IOCG is the western part of the Central Lapland greenstone belt, the area adjacent to the major Kolari shear zone system. Based on the age data on the studied deposits, favourable time periods for IOCG mineralisation in northern Finland were 2.44 – 2.05 Ga and 1.83 – 1.77 Ga. These periods represent the crustal-scale rifting stage that predates the 1.92 – 1.77 Ga Svecofennian orogenic events, and the D₃-stage thrusting event(s) of the Svecofennian orogeny post-dating the peak of regional metamorphism, respectively. The most prospective locations for IOCG deposits in northern Fennoscandia are old cratonic margins and intracratonic regions with abundant rift-related magmatism and extensive, metal-depleting sodic alteration.

Keywords: *IOCG deposits, Skarn deposits, Iron deposits, Copper deposits, Gold deposits, Hydrothermal alteration, Palaeoproterozoic, Peräpohja Schist Belt, Central Lapland Greenstone Belt, Misi, Kolari, Finland, Geochemistry, Fluid inclusions, U-Pb age, O-isotopes, C-isotopes, SIMS, PIXE*

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