TRACE ELEMENT SIGNATURE OF PYRITE FROM THE LOS COLORADOS IRON OXIDE-APATITE (IOA) DEPOSIT, CHILE: A MISSING LINK BETWEEN ANDEAN IOA AND IRON OXIDE COPPER-GOLD SYSTEMS?

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Resumen

Although studies have proposed that iron oxide-apatite (IOA) deposits may represent the deeper roots of some Andean iron oxide copper-gold (IOCG) systems, their genetic links remain obscure and controversial. A key question when considering an integrated genetic model is whether a magmatic-hydrothermal fluid that precipitates massive magnetite will continue transporting significant amounts of dissolved Fe, Cu, and Au after IOA precipitation. Here we provide new geochemical data for accessory pyrite from the Los Colorados IOA deposit in the Chilean iron belt that confirm the role of this sulfide as a relevant repository for economic metals in IOA deposits. Pyrite occurs at Los Colorados as disseminated grains and as veinlets associated with magnetite and actinolite that postdate the main igneous magnetite stage. Electron probe microanalysis (EPMA) data for pyrite show anomalously high Co and Ni concentrations (up similar to 3.9 and similar to 1.5 wt %, respectively) and relatively high As contents (100s of ppm to a maximum of similar to 2,000 ppm). When combined with results from secondary ion mass spectrometry (SIMS) spot analyses, pyrite data show significant amounts of Cu that range from sub-ppm values (similar to 100 ppb) up to 1,000s of ppm, plus nonnegligiblc concentrations of Zn, Ph, Cd, Sb, Se, and Te (up to 100 ppm). The highest contents of Cu measured (wt % level) most likely record the presence of Cu-bearing submicron-sized mineral inclusions. Contents of Au and Ag are up to 1 and 10 ppm, respectively, with maximum concentrations that can rise up to 800 ppm Au and 300 ppm Ag due to the presence of submicron-sized inclusions. The high Co/Ni ratios of pyrite from Los Colorados are consistent with a magmatic-hydrothermal origin associated with a greater mafic affinity, compared to pyrite from porphyry Cu deposits. Furthermore, the geochemical signature of Los Colorados pyrite shares important similarities of composition and microtexture with the few published data for pyrite from IOCG deposits (e.g., Ernest Henry, Australia, and Manto Verde, Chile). These findings,

combined with recent geochemical and isotopic studies that support an igneous origin for the dike-shaped magnetite orebodies at Los Colorados, point to a magmatic source of mafic to intermediate composition for the contained metals, and support the hypothesis that IOA systems can source Fe-Cu-Au-rich fluids. Based on experimental studies, these IOA-derived fluids may continue transporting significant amounts of metals to from IOCG mineralization at shallower levels in the crust.

Palabras clave

KeyWords Plus:LACO MAGNETITE DEPOSIT; FIELD EVIDENCE BEARING; NORTHERN CHILE; HYDROTHERMAL SOLUTIONS; METAL NANOPARTICLES; INVISIBLE GOLD; ORE GENESIS; KIRUNA-TYPE; ORIGIN; MINERALIZATION

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