The Co-Ni signature of sulfide minerals from the Mantoverde IOCG deposit, northern Chile

CINTHIA JOHANSSON[1*], FERNANDO BARRA[1], MARTIN REICH[1], ARTUR P. DEDITIUS[2], ADAM C. SIMON[3], PAULA ROJAS [1]

[1] Department of Geology and Andean Geothermal Center of Excellence (CEGA) of Universidad de Chile, Plaza Ercilla 803, Santiago, Chile.
*cjohansson@ing.uchile.cl
[2] School of Engineering and Information Technology, Murdoch University, Murdoch, 6150WA, Australia.
[3] Department. of Earth and Environmental Sciences, University of Michigan, Ann Arbor, USA.

Iron Oxide Copper Gold (IOCG) deposits are an important source of Cu and other elements such as Au, Ag, REE, U, P and Co. Although these deposits are economically important, their modes of origin remain controversial and two main genetic models have been proposed. The first model invokes basinal brines, whereas the second invokes a magmatic-hydrothermal origin for the mineralizing fluids. Recently, evidence for a genetic connection between Kiruna type-IOA and IOCG deposits has been presented, where IOA deposits represent the deep Fe-P-rich, Cu-(Ag) barren root of an IOCG deposit [1].

In this study, we focus on the mineral chemistry of sulfides from the Mantoverde IOCG deposit, located in the northern section of the Chilean Iron Belt (CIB). Our purpose is to characterize pyrite and chalcopyrite samples retrieved from drill cores, and compare their chemistry with sulfides from IOA deposits from the Chilean Iron Belt.

WDS-EMPA mapping revealed multiple stages of pyrite mineralization displayed by distinct chemical zoning of Ni and Co. In some grains Co and Ni are geochemically coupled, while in others Co and Ni zoning form alternate sequence.

Based on Co/Ni ratios, three groups of pyrite are recognized, i.e., Co/Ni <1, Co/Ni ratios between 1-20, and Co/Ni>90, respectively. Pyrite grains from the upper sections of the deposit have Co/Ni<1, whereas pyrite with Co/Ni>90 correspond to samples from the deeper sections of the deposit. Chalcopyrite is chemically homogeneous and does not incorporate Ni or Co in amounts detectable by EMPA.

The high Co/Ni ratios of pyrite from Mantoverde deposit are consistent with a magmatic-hydrothermal origin associated with a mafic source. Furthermore, the geochemical characteristics of Mantoverde pyrite are similar to pyrite from Los Colorados and El Romeral IOA deposits in northern Chile, suggesting a genetic link between IOA and IOCGs.

[1] Knipping *et al*. (2015) *Geology* **43**, 591-594.