

Trace element variation associated with varying degrees of deformation in sulphides from IOCG deposits in Mount Isa, Queensland Australia

ELIZABETH DE LAS MERCEDES MARINO MOREJON¹,
IOAN SANISLAV¹, MR. AVISH KUMAR¹, MELANIE
FINCH², RHIANNON JONES³, ALKIS KONTONIKAS-
CHAROS³ AND GABRIEL CELLIER¹

¹James Cook University

²University of Melbourne

³Geological Survey of Queensland

The Mount Isa inlier, in Queensland, Australia, hosts world-class Iron Oxide Copper Gold deposits with more than 20 deposits. This region was exposed to multiple deformation events, including the Barramundi Orogeny at 1.9 Ga, the Wonga Orogeny at 1.7 Ga, and the Isan Orogeny at ~ 1.6 Ga [1]. The IOCG deposits in this region are located in shear zones, regional folds and brittle damage zones. This provides a wide range of structures where effects of deformation can be recognised in the sulfide mineralogy. Therefore, in this research we investigated the effects of deformation on sulfide mineral chemistry. Samples were collected from deposits located in ductile deformation, and also from those deposits situated in brittle zones. These samples were mounted and studied under reflected light microscope for microstructures, Electron Probe Microanalysis for major element distribution, and Laser Ablation Mass Spectrometry for trace element. The sulfide trace element results indicated systematic trends in Co, Ni, As, Zn, Ag, Sn, and Ba. Undeformed pyrite samples shows high Co (35760 ppm) and Ni (8506 ppm) concentrations in the absence of pyrrhotite. Additionally, pyrite under slight deformation in brittle setting shows enrichment for Co, Ni and As. Under weak deformation regime, the pyrrhotite shows similar geochemical affinity to pyrite with Co, Ni, and As enrichment. Chalcopyrite has high Zn, Ag, Co, Sn concentration in brittle setting. In ductile setting, pyrite shows enrichment for Co, Ni, Ba, and As, while chalcopyrite is enriched in Zn, Ag, and In. These findings suggest that deformation plays a role in the redistribution of trace elements within pyrite, chalcopyrite, and pyrrhotite. Our data suggests that deformation processes influence the trace element distribution on pyrite, chalcopyrite and pyrrhotite. Therefore, these trends observed in sulfides could be used to vector towards deformation environment. Since deformation environment is positively associated with ore grades in a mineral deposit, these trends can be indirectly used as a vector towards mineralization.

[1] Case, G. *et al.* Delineating the structural controls on the genesis of iron oxide-Cu-Au deposits through implicit modelling: A case study from the E1 Group, Cloncurry District, Australia. *Geol Soc Spec Publ*, (2018).