The Distribution of Co and Ni in Sulfide and Arsenide Minerals at the Eloise ISCG Deposit,

Queensland

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Iron-Sulfide Copper Gold (ISCG) deposits host economic concentrations of Cu, Au and Fe and may also contain significant amounts critical metals such as Ni, Co and REE's. This project investigates the mineralogy and geochemical distribution of Co and Ni in sulfide and arsenide minerals at the Eloise deposit, Queensland, Australia. While previous studies have reported the presence of Co and Ni minerals at Eloise, a comprehensive review of the Co-Ni mineralogy and distribution patterns is missing. Therefore, we aim to enhance our understanding of critical metal distribution within ores and provide insights into ore-forming processes and deposit genesis.

We combined textural and geochemical techniques to track Co and Ni distribution at Eloise. Chemical compositions were determined using electron probe microanalysis (EPMA) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). The EPMA was also used for mapping element distribution patterns and to identify micro-inclusions rich in Co and Ni. The EPMA results show that Co and Ni have an affinity for pyrrhotite over chalcopyrite when only these two phases are present in the ore assemblage. However, in pyrite-rich ore assemblage Co and Ni are preferentially enriched in pyrite followed by pyrrhotite. The EPMA mapping highlights that Co and Ni are concentrated as micro-particles (<10 μm) along grain boundaries and fractures in samples collected from ductile zones of the deposit. The mineral formulas of these micro-particles were estimated by stoichiometry applied to the EPMA data and which revealed compositions similar to glaucodot (Co-rich) and mackinawite (Fe-Ni-rich). Additionally, pyrite grains display compositional variation with cobalt enriched towards grain margin while nickel towards the core. Generally, at the Eloise deposit, pyrite grains from the brittle deformation exhibit low Co and Ni concentrations compared to samples from ductile zones.