

Geochemical and Mineralogical Signatures of the Rocklands Cu-Au-(Co) Deposit, Northwest Queensland, Australia

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The Rocklands Cu-Au-(Co) deposit is one of numerous mineralogically and geochemically diverse IOCG deposits in the Mount Isa Province of Northwest Queensland, Australia. Rocklands consists of multiple structurally controlled ore bodies, including Las Minerale and Rocklands South, hosted within Proterozoic metasedimentary and volcanic rocks. The deposit contains a supergene enrichment blanket and hypogene mineralisation with dominantly sodic and calcic-ferric alteration.

The Geological Survey of Queensland (GSQ) characterised seven drillholes from Rocklands using a range of hyperspectral, geochemical, and microanalytical techniques. Continuous hyperspectral and XRF core scanning with systematic whole rock multi-element geochemistry data provided an effective method to classify alteration and lithology variations throughout the deposit. Selective samples were analysed using Bruker Tornado μ XRF imaging and SEM-TIMA to resolve detailed paragenetic relationships and fine-scale mineral associations. Based on Tornado and SEM-TIMA imaging, multiple sulfides and Fe oxides were selected for Fe and Cu isotope analyses, as part of a systematic GSQ program of geochemical and isotopic fingerprinting of IOCG deposits in the Cloncurry district.

Hyperspectral and microanalytical analyses revealed the occurrence of distinct alteration zones of dominant albite, actinolite, carbonate and, locally, K-feldspar. Comparison between whole rock multi-element geochemistry data and microanalytical analysis of selective samples highlighted a decoupling between the association of Cu and Co. Detailed SEM-TIMA analysis enabled us to investigate the distribution of Cu and Co and to recognise the occurrences of Cu and Co-bearing mineral phases. Cobalt-bearing phases included carrollite, linnaeite, and pyrite (in the lattice and within Co mineral inclusions), which were typically associated with chalcocite, bornite, and chalcopyrite.

The detailed characterisation of the Rocklands Cu-Au-(Co) deposit provides new insights into the nature of Co and Cu mineralisation and offers a framework for enhancing the understanding of mineralogical and geochemical signatures and the critical element deportment within IOCG deposits of the Mount Isa Province.