

### **IOCG, ISCG and Genetically Affiliated Deposits in the Cloncurry District, Queensland, Australia: Diverse Products of One Mineral System**

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The Cloncurry district in the eastern Mount Isa Province hosts over 50 Cu±Au±Co±REE Proterozoic mineral deposits commonly classified as Iron Oxide Copper-Gold (IOCG) or Iron Sulfide Copper-Gold (ISCG) deposits. The deposits have diverse mineralogical and geochemical signatures, with major implications for mineral exploration. Over the past decade, the Geological Survey of Queensland (GSQ), in collaboration with CSIRO and multiple other research and industry partners, have undertaken a program of systematic characterisation of these deposits, focusing on their mineralisation and alteration signatures, and distal footprints. The program covered the 15 largest deposits in the district (including Ernest Henry, SWAN, Osborne, Eloise, Jericho, Little Eva, Mt Dore, E1, Rocklands and Kalman) and numerous smaller deposits. Consistent data acquisition included continuous drill core scanning (HyLogger, Minalyzer), comprehensive multi-element geochemistry (68 elements), micro-XRF scanning (Maia Mapper, Bruker Tornado), BSE-EDS mineralogy (TESCAN TIMA), mineral chemistry (chalcopyrite, pyrite, magnetite, apatite, garnet) – including isotope geochemistry (Cu, Zn, Fe, Nd, S, C and O and geochronology of ore and alteration minerals – U-Pb, Re-Os, Ar-Ar, Rb-Sr). This data coverage, variety and consistency enable an objective district-scale metallogenic assessment of the Cloncurry district.

Copper-dominant deposits in the district have a common Cu-Au-Ag-S-Te-Se ore geochemistry, but there are several distinct geochemical signatures within the group. Ernest Henry and E1 have significantly enriched Te-Cu-Re-As-Au-Mo-Se-Bi-Co-W-Sb-Ag-Ba-F and proximal K-feldspar-magnetite alteration, whereas the other deposits have different (generally much simpler) geochemical signatures and predominantly Na-Ca-Fe, Fe-Ca and K-Ca proximal alteration. In addition to common magnetite-dominant IOCGs (K-feldspar-magnetite breccias, actinolite-carbonate-magnetite veins, 'IOCG Cu-REE skarns' – each with distinct ore geochemistry) and pyrrhotite-dominant ISCG vein deposits, the district also hosts genetically affiliated low-iron alkali-calcic Mo-Re±Cu, Fe, U, REE and Au deposits. The extreme metallogenic diversity in the Cloncurry district is the product of a long-lived (~100 Ma) Metasomatic Iron Alkali-Calcic (MIAC) mineral system.