Strontium and stable C and O isotopic composition of carbonates in the Ernest Henry deposit, Queensland, Australia: implications for genesis and exploration*

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The Ernest Henry IOCG (iron-oxide copper gold) deposit is hosted within Paleoproterozoic meta-sedimentary and meta-igneous rocks of the eastern succession of the Mt Isa inlier. The mineralization is mostly breccia-hosted, with K-feldspar altered clasts cemented by biotite-carbonate-magnetite-sulfides. The breccias grade out to crackle breccias and then veins, with the breccia/crackle breccia contact typically demarcating economic mineralization. The origin of brecciation and mineralization remains controversial, but numerous elemental enrichments suggest multiple fluids with a mixed origin including magmatic and/or saline metamorphic fluids. Foremost among the proposed mechanism for IOCG formation at Ernest Henry is that CO_2 release directly from enriched mantle, or indirectly from mafic magmas, played an important role in breccia formation and in scavenging ore components from local wallrocks, particularly mafic rocks. This hypothesis is mainly based on the regional interpretation of stable C and O isotopes from carbonates within the eastern succession of the Mt Isa inlier, including limited samples from Ernest Henry.

Here, the hypothesis linking CO_2 release, brecciation and mineralization, is examined using Sr isotopes and more detailed C-O analyses combined with examination of zonation patterns. This new sample set has representative spatial coverage of the ore deposit and the surrounding host rocks. This was achieved by taking samples in a long section from rich ores to peripheral weak mineralization, extending into distal hanging walls and footwalls. This data set also includes samples taken from two deep holes recently drilled 1-2 km from the orebody along strike to the SE, and samples from exploration prospects 1-3 km away from the orebody to the NW and at lower stratigraphic positions. Strontium isotopes and C-O isotopes analyses are ongoing at JCU. Preliminary results will increase understanding of the breccia formation and the mineralization process, and establish if an alteration footprint zonation pattern is present. This pattern will directly assist with current near-mine and regional exploration rational.