The Cloncurry District Mineral System; An IOCG Exploration Perspective

Richard Lilly,[1*] David Holwell,[2] Benjamin Francis,[2] Megan Williams,[2] Lisa Craddock,[2] George Case,[3] and Mikaella Rough[4]

[1]A.W.E.S.O.M.E.S. Research Unit, Department of Earth Sciences, University of Adelaide, South Australia, Australia
[2]Department of Geology, University of Leicester, Leicester, LE1 7RH, UK
[3]EGRU (Economic Geology Research Centre), College of Science, Technology and Engineering, James Cook University, Townsville, Queensland, Australia
[4]Mount Isa Mines, Mount Isa, Queensland, Australia

* E-mail, richard.lilly@adelaide.edu.au

The Cloncurry district of North West Queensland is one of the most metalliferously endowed examples of Proterozoic crust in the World and is host to many economically viable mineral deposits, including Ernest Henry, the E1 Group, and Great Australia. Many of the deposits can be classified within the iron oxide copper-gold (IOCG) category with broad genetic and geochemical similarities. However, due to large variation in fluid sources, fluid compositions, magmatic influences, structural controls, host rock lithologies and fluid-rock interaction, each deposit and prospect has its unique set of characteristics. Because of the inherent variation between the deposits, each example has different geophysical and geochemical signatures and each new discovery adds further complexities to any generalized geological model.

Exploration in the region presents a number of challenges, including a wide range of economic and associated elements to target (including Cu, Au, Zn, Pb, Ag, Mo, U, REE), highly variable deposit styles in a range of host lithologies, poorly constrained structural controls and a complex district alteration history result in some of the most metasomatized rocks on the planet. Previous literature defines broad genetic similarities and key styles (such as Ernest Henry IOCG or Cannington BHT), which have been used as representative deposit models for exploration. However, awareness of a range of newly defined styles such as Lorena (Au-As-Co-Bi) and Great Australia/Taipan (Western Cloncurry dolerite-hosted Cu-Au carbonate) may offer an opportunity to the explorer as possible “end-member” styles.

Recent industry-led research projects have resulted in advances in geochemical and geological understanding of these deposits, leading to the improvement of exploration methods by direct application of research findings. Integration of research findings with active exploration data has also enabled numerous volcanic events to be discriminated that record the magmatic evolution of the Eastern Succession. Future studies may be able to use this work to vector to prospective volcanic units and to establish potential “end-members” for the Cloncurry district mineral system. These applications include identification of trace element vectors to mineralization, spatial and temporal evolution of mineralizing fluids, and geological constraints on the distribution of different fluid stages, with direct exploration implications.