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Iron Oxide-Copper-Gold Deposits: A One-Size-Fits All Genetic Model Does Not Work

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There are enough similarities among iron oxide-copper-gold (IOCG) deposits globally that they would seem to fit a single genetic model. However, genetic models in the literature often take twists and turns to invoke processes for which there may or may not be evidence in the rocks. IOCG deposits are iron and copper rich, sulfur poor, and most contain gold, but some do not. IOCG deposits in many districts are spatially and temporally associated with igneous rocks, but not always. IOCG deposits are sometimes hosted in igneous rocks, but not always. IOCG deposits formed in orogenic and post-orogenic settings, and back-arc extension seems to have been particularly important for some districts. Drill core reveal that IOCG mineralization in some deposits transitions with depth to iron-rich, sulfur-copper-gold-poor mineralization. Stable copper, hydrogen, iron, oxygen, and sulfur isotopes fingerprint a magmatic source for the ore fluids in some deposits, but seawater-derived brines in others. Regional sodic-calcic alteration is observed in some districts, but not all. Petrographic observations of drill core indicate that some IOCG deposits, but not all, record multiple episodes of fluid infiltration with hematite followed by magnetite followed by copper-iron-sulfide in some deposits. Some deposits contain mushketovite, which is best explained by the reduction of primary specular hematite and requires at least two generations of fluid. The trace element composition magnetite, which modally dominates IOCG deposits, sometimes varies systematically with depth, and petrographic observations of magnetite textures reveal multiple episodes of hydrothermal dissolution and reprecipitation. In this presentation, I will review the characteristics of IOCG deposits from different districts and tectonic settings and try to frame a genetic model that can be adapted to explain their formation globally.