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Title: A CORDILLERAN PERSPECTIVE ON FLUID SOURCES FOR FE-OXIDE(-CU-AU) (IOCG) SYSTEMS: GEOLOGIC AND ISOTOPIC CONSTRAINTS FROM THE COPIAPO AREA, CHILE

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Abstract: Understanding the genesis of IOCG deposits and their analogy, if any, to porphyry Cu systems remains unsettled. Most workers advocate a required role for magma-sourced fluids, whereas some advocate a key role for external brines (Barton & Johnson, 1996, Geology). Because the geologically youthful American Cordillera hosts both Cu-Au mineralized and "barren" Fe-oxide systems plus premier porphyry Cu provinces, this region allows an unparalleled perspective on the characteristics and origin of IOCG mineralization. Key issues include the diverse relationships to magmatism and tectonism, the voluminous and distinctive styles of hydrothermal alteration, and the extensive but non-unique geochemical and petrological data. We address these themes by focusing on new geological and geochemical results near Copiapo, Chile and their Cordilleran context.

The composite, Early Cretaceous Copiapo batholith and its aureole host many IOCG deposits including those of Candelaria and the Punta del Cobre district. Regionally, IOCG and porphyry-type systems occur widely with the broadly coeval Chilean Coastal Batholith. Building on earlier work, new geologic mapping (>125 km2) in the Copiapo area has focused on the time-space development of hydrothermal alteration and its relationship to a complex igneous history. Spatial distributions and crosscutting relationships demonstrate that each phase of the batholith generated its own hydrothermal system with voluminous sodic-calcic (NaCa) associations and variable, but widely

recognized K-silicate suites. Both types systematically vary in intensity and mineralogy with the composition of generative intrusions and with host rocks. NaCa is most intense with dioritic rocks and zones inward from sources beyond intrusive margins. Consistent with petrologic predictions, intrusion-hosted K-silicate styles vary: one group (K-Ca) relates to upflow (cooling) of NaCa fluids; a rarer, feeble porphyry-like suite (K-Si) relates to cooling of magmatic fluids from the more felsic plutons. Analogous relationships can be inferred in many Cordilleran IOCG districts.

Most Copiapo (and other) isotopic results fail to discriminate clearly among material sources, however new Sr isotope data on altered rocks combined with published data on fresh rocks and nearby sediment-hosted deposits show that Sr in IOCG mineralization, NaCa alteration, and IOCG-related K-alteration is 30 to >90% non-igneous in origin thus requiring major influx of brines from outside the batholith. Although our results imply that Copiapo batholith IOCG ores (and others) were dominated by non-magmatic fluids, these systems are complex and the source and concentration mechanism of metals remain to be firmly established. As in other areas (e.g., Yerington, NV), detailed mapping combined with careful geochemistry is required to constrain the evolution and roles of magmatic and non-magmatic components in igneous-related hydrothermal systems. We thank Phelps Dodge for support.