Characterization and Paleotectonic Setting of Mesoproterozoic Iron Oxide Deposits of the St. Francois Mountains, Missouri, USA

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ABSTRACT

The Mesoproterozoic St. Francois Mountains (SFM) of southeast Missouri, USA contain examples of both iron oxide-apatite (IOA) and iron oxide-copper-gold±cobalt (IOCG) deposits and yield clues as to processes controlling metal endowment in iron oxide systems. The 1.48 to 1.44 Ga igneous rocks of the SFM formed along the Paleoproterozoic margin of Laurentia as juvenile additions to the crust. The region is dominated by granitoid intrusions (~60%) emplaced into compositionally similar volcanic rocks (~30%), which host all known deposits. Two distinct paleotectonic regimes have been hypothesized for these rocks: (1) anorogenic intraplate or (2) orogenic arc- to back-arc settings. Unlike the younger examples of dominantly andesite-hosted IOA/IOCG systems that formed along ocean-continental collisional volcanic arc margins, the SFM volcanic rocks are dominated by high-silica rhyolite flows and ignimbrites (~80%) with lesser amounts of basalt to basaltic andesite (~20%). Trace element compositions for these felsic rocks approximate those of both volcanic arc and intraplate granites. Nb and Ta depletions in all rock suites are characteristic of rocks of arc origins. Previous stable isotopic studies indicate that the IOA systems formed from magmatically-derived hydrothermal fluids, whereas IOCGs require infusion of modified meteoric fluids that interacted with the igneous host terrane and/or volcanic lakes. Major, trace element, and radiogenic isotope data imply either magma genesis within juvenile continental crust in an arc setting that transitioned to an extensional regime, or as mantle-derived partial melts that interacted with the juvenile crust. The SFM was a highly active igneous province with magmatism, seemingly mediated by mafic underplating of the crust and subsequent partial melting of the juvenile crust over a period of 40

m.y. Ore-forming systems contemporaneously ascended through the crust and emplaced in shallow (<2 km) near-surface settings.