A mineralogical, geochemical, and geochronological study of Marathon Gold Corporation's Valentine Lake Gold Camp, central Dunnage Zone, Newfoundland, Canada

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Marathon Gold Corporation's Valentine Lake Gold Camp is located in the Exploits Subzone of the Dunnage Terrane of the Newfoundland Appalachians, approximately 20 km east of the main Iapetan suture - the Red Indian Line (RIL). The property contains numerous auriferous zones within a northeast-southwest trending mineralized corridor. Epigenetic gold mineralization is largely hosted within Neoproterozoic (ca. 563 Ma) trondhjemite, but also within quartz monzonite and rhyolite porphyry that are geochemically distinct from the trondhjemite and likely represent a separate arc magmatic event. Gold mineralization occurs primarily within quartz–tourmaline–pyrite ± apatite (QTP) veins, vein stockworks, and adjacent selvedges observed throughout the camp. Minor gold mineralization also occurs within vein networks and late en echelon tension gashes containing varying amounts of carbonate, quartz, tourmaline, pyrite, muscovite, chlorite and rutile, which dominate the Sprite and Victory Gold Deposits – as well as in base-metal-rich quartz veins present in parts of the J. Frank Zone. All vein networks are close to a 30 km long regionally extensive, brittle-ductile shear zone, which defines the eastern contact of the Victoria Lake Intrusive Suite (VLIS) with a Silurian fault-scarp sequence, the Rogerson Lake Conglomerate (RLC). A suite of heterogeneously deformed basaltic and gabbroic dykes, variably transposed toward the penetrative regional foliation, also traverse the property. Detailed ore petrography has identified pre-native gold precious-metal–telluride and post-native gold base-metal–telluride assemblages in all QTP vein networks. Locally, a base-metal assemblage, associated with silicification and pyrite recrystallization, may be consanguineous with a second generation of native gold mineralization. Preliminary trace element microanalyses of native gold also strongly indicate the presence of multiple gold generations, as shown by Te, Ag, Pb, and Bi contents. Sulphur isotopic microanalyses of pyrite collected from each type of silicate vein assemblage display consistent changes in isotopic composition from a corroded core to a recrystallized rim. Together, the sulphur isotopic analyses of pyrite, chalcopyrite, and galena cover a range of negative $\delta^{34}S$ values, likely indicative of a reduced sedimentary sulphur source. Overall, ore petrography, U–Pb geochronology, trace-element analysis of native gold, and sulphur isotopic microanalysis of pyrite are being combined to constrain the timing and nature of gold mineralization at Valentine Lake, and to recognize any correlation between mineralization and distinct events during the Salinic and/or Acadian orogenies.

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