

Structural, Mineralogical, and Geochemical Studies of the Paleoproterozoic Omai Gold Deposit, Guyana

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Abstract

The granitoid- and greenstone-hosted Omai gold deposit is located in the Paleoproterozoic Barama-Mazaruni greenstone belt, Guiana Shield. At regional scale, the emplacement of the deposit was controlled by the Makapa-Kuribrong crustal shear zone. At local scale, the gold-bearing quartz veins are associated mainly with a quartz monzodioritic intrusion (Omai stock, Fennell pit) and subvolcanic quartz-feldspar porphyry and rhyolite dikes, and subordinately, with intermediate volcanic flows and metasedimentary rocks (Wenot pit). Six gold-bearing undeformed subhorizontal and subvertical vein sets can be distinguished in the two ore zones. On the basis of their internal structures and textures, the veins can be classified as crack and seal, laminated, breccia, and open-space-filling veins. The geometrical and textural relationships between the vein sets suggest that they are broadly contemporaneous. The formation of most veins can be summarized by two filling stages and a late fracture-filling stage related to a protracted hydrothermal process. Although the metallic minerals represent less than 1 percent of the vein volume, their mineralogy is complex and consists of various sulfides, together with tungstates, native elements, tellurides, and sulfosalts. The metallic paragenesis is defined by the Au-Ag-Te-W-Bi-Pb-Zn-Cu-Hg-Mo assemblage. The nonopaque gangue includes mainly quartz and subordinately carbonates, albite, sericite, chlorite, tourmaline, rutile, and epidote.

Wall rocks of gold-bearing veins are affected by synmineralization alteration. The dominant alteration assemblages include carbonates, sericite, silica, chlorite, albite, epidote, argillic minerals, pyrite, and pyrrhotite. There is an obvious association between the alteration assemblages, the vein internal textures, and the chemical nature of the host rocks.

Vein-forming scheelite has $^{87}\text{Sr}/^{86}\text{Sr}$ ratios between 0.7019 and 0.7021 and $\delta^{18}\text{O}$ values between 3.8 and 4.3 per mil, which suggest both consistent temperature and isotopic composition of the hydrothermal solutions during its deposition. Oxygen isotopes measured in vein quartz vary between 13.2 and 14 per mil, similar to the $\delta^{18}\text{O}$ values of carbonates (avg 13.8‰ for calcite and 14.4‰ for ankerite). The carbon isotopes of carbonates range between 1.7 and 4.7 per mil. The $\delta^{18}\text{O}$ values of the mineralizing fluids vary between +5.6 and -2.7 per mil and the δD values between -52 and +18 per mil. The isotopic composition of the hydrothermal fluids plots outside both magmatic and metamorphic water boxes, therefore suggesting a significant component of surface-derived water.

The Omai deposit is late orogenic and its emplacement was controlled by the last brittle to brittle-ductile stages of the Trans-Amazonian orogeny. It can be considered as a Paleoproterozoic equivalent of the Archean epizonal orogenic deposits described in the Yilgarn (Wiluna, Racetrack) and Zimbabwe (Shamwa, Commoner) cratons.