Economic Geology
Vol. 96, 2001, pp. 1073-1088

Geology and Host-Rock Alteration of the Henty and Mount Julia Gold Deposits, Western Tasmania

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Abstract

The Mount Julia-Henty gold deposits are a series of small tonnage (<500,000 t) high-grade (10–30 g/t Au) sheetlike lenses hosted in an extensive package (>20 Mt) of quartz-sericite altered volcanics. The alteration system is hosted in Cambrian submarine volcaniclastic and hyaloclastic dacites associated with interbedded carbonates and calcareous volcaniclastic sandstones located at the Mount Read Volcanics Tyndall Group-Central Volcanic Complex boundary.

The alteration zone forms a subvertically dipping tabular sheet over 3 km in length and between 10 and 100 m in width. Although this zone is broadly strata bound in the north, it crosscuts stratigraphy and is hosted 50 to 300 m deeper to the south, well below the Central Volcanic Complex-Tyndall Group contact.

The alteration zone is bound updip by the South Henty fault and downdip by abruptly decreasing alteration intensity. Mineralization is confined to lenses within the subvertically dipping alteration zone. The alteration zone is strongly deformed due to reactivation of the South Henty fault. The sericitic alteration assemblage is strongly foliated and mylonitized and the orebody is now located on the steeply west dipping, overturned limb of a broad, shallowly south plunging syncline.

Alteration is distinctly asymmetric and can be subdivided into three categories: (1) footwall alteration, (2) alteration associated with mineralization (A zone), and (3) hanging-wall alteration. Alteration in the southern area (Mt. Julia) is similar to the north (Zone 96) but has a much lower sulfide content. Footwall alteration consists of intensely sericite ± pyrite ± carbonate altered schistose rhyolitic and dacitic volcanics. The main mineralized zone (A zone) is also zoned from intensely leached, massive quartz alteration, to quartz-sericite alteration, to an outer quartz-sericite-pyrite-chlorite alteration. Minor massive pyrite and massive sulfide lenses are located at the top of the A zone. Hanging-wall alteration consists of chlorite-albite-quartz alteration in andesitic volcaniclastic rocks and albite-quartz alteration of rhyolitic volcaniclastic rocks and lavas.

Bedded carbonates and calcareous volcaniclastic rocks are mainly associated with the upper parts of the A zone alteration zone but are also found toward the footwall and well up into the overlying sequences.

The footwall and A zone alteration zones are intensely Na_2O depleted and K_2O enriched due to feldspar destruction and sericitization. The hanging-wall alteration is strongly Na_2O enriched due to intense albitization. Aluminum and K_2O have been strongly depleted from the massive quartz alteration within the A zone, suggesting leaching by highly acidic fluids.

Mineralization consists of pyrite and chalcopyrite with lesser galena and sphalerite and with minor gold, electrum, galenobismuth, and native bismuth. Gold, copper, and bismuth are mainly confined to the massive quartz and quartz-sericite alteration zones, whereas the outer quartz-sericite-chlorite alteration halo is dominated by pyrite. Metal zonation extends from a gold-silver-rich core associated with copper, lead, and bismuth, to a proximal halo of copper, lead, and bismuth, and then to a distal halo of zinc.

Modeling of oxygen and carbon stable isotopes suggests that the carbonates formed from an early phase of basin-wide magmatic CO_2 devolatilization that commenced early in the hydrothermal event and continued for a long time period. The carbonates precipitated due to mixing of small amounts of magmatic CO_2-rich fluid with seawater at and below the seawater interface. An alternative model suggests that the observed carbon and oxygen stable isotope signature results from fluid-rock interaction between a preexisting carbonate and a later hydrothermal fluid.

The Au-Cu-Bi-Ag association and alteration zonation suggests that the Henty-Mount Julia system formed from an evolving submarine Cambrian hydrothermal system, with some low-sulfidation epithermal characteristics. Phase separation of magmatic volatiles from metalliferous magmatic brines formed the alteration halo first, followed by the mineralizing event. Deposition occurred through mixing of the magmatic fluid with bicarbonate/H_2S-rich seawater circulating through the unconsolidated Lynchford Member and Central Volcanic Complex volcanics. Mineral deposition was less efficient at Mount Julia where the magmatic volatile phase was dominant and the late, reduced seawater influx less focused, resulting in discontinuous, lower grade mineralization and extensive areas of barren massive quartz and

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quartz-sericite alteration. The metal zonation is a result of both sulfur availability and decreasing temperature.

The Henty-Mount Julia alteration system possibly represents a gold-rich end member of a large, regional, submarine magmatic copper-gold hydrothermal event. This mineralizing event is probably responsible for most of the deposits found on the southeastern side of the Henty fault, including the Mount Lyell deposits.