

Geology of the Mt Carlton High-Sulfidation (Au-Ag) Epithermal Deposit, NE Queensland, Australia

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The Mt Carlton high-sulfidation (Au-Ag) epithermal deposit is located ca. 150 km south of Townsville, NE Queensland, Australia. Open pit mining commenced in 2013, with total resources of 11.4 Mt at 2.4 g/t Au, 22 g/t Ag, and 0.27% Cu for the V2 orebody and 0.9 Mt at 197 g/t Ag and 0.33% Cu for the A39 orebody (as of December 2013). Additionally, there are several low- and intermediate-sulfidation epithermal prospects (e.g., Boundary, Ortiz) and porphyry-style prospects (e.g., Capsize Creek) in the area. The Mt Carlton deposit is hosted by rocks of the Lizzie Creek Volcanic Group, which were deposited on a granitic basement in a terrestrial setting during early Permian extension in the Bowen Basin. Mineralization is mostly in rhyodacite lavas, volcanoclastics, and tuffaceous sediments. These units occur interlayered between barren andesitic units above and below. Preliminary U-Pb zircon dating yields ages of 287.7 ± 3.7 Ma for the rhyodacite host rocks, and 297.2 ± 4.6 Ma for the granite basement.

The main mineralization at Mt Carlton consists of veins, hydrothermal breccias and disseminations of assemblages dominated by pyrite and enargite. This stage is crosscut by later base metal veins with variable amounts of pyrite, sphalerite, galena and electrum, accompanied by abundant blue-translucent dickite gangue. Pyrite-chalcopyrite veins with quartz-illite halos were found in the basement below the V2 pit.

Hydrothermal alteration has been characterized using SWIR (Short Wavelength Infra-Red) spectroscopy. Advanced argillic (AA) alteration is largely confined to rhyodacite, and is defined by the assemblage of quartz, alunite and pyrite. Alunite in the Mt Carlton lithocap has low-wavelength positions of ~1480 nm absorption peak in SWIR spectra. Values range from 1479 to 1482 nm, and no clear trends can be identified. Euhedral gypsum, coarse alunite veins, and massive barite are found within the AA zones, and could be genetically related. The AA zones transition gradationally into argillic alteration zones characterized by an assemblage of quartz, dickite/kaolinite, and pyrite, and more distal zones with illite/montmorillonite and pyrite. Andesitic rocks dominantly have the argillic alteration, whereas the granitic basement has pervasive illite-chlorite and pyrite alteration. Silicic rocks with hydrothermal breccia occur beneath the V2 pit, which could indicate the main fluid channel.

Many lithological contacts in the volcanic sequence are defined by layer-parallel shear zones. Shear zones in the A39 pit dip at low angles toward the W, and display reverse kinematics (top to the E); shear zones in the V2 pit dip at low angles toward the E, with normal kinematics (top to the E). The shears are part of an anastomosing, low-angle detachment that affected the ore zones, and that probably formed during opening of the Bowen Basin. The low-angle shear zones are crosscut by E-W-trending, high-angle normal faults, with a sinistral strike-slip component. These normal faults were later reactivated, and intruded by basaltic-andesitic dikes. The presence of post-mineralization faults may suggest displacement of deeper high-sulfidation mineralization and potentially underlying porphyry mineralization relative to the currently mined lithocap.