

## Haile Gold Mine: A Neoproterozoic Low-Sulfidation Au-Ag-Te Epithermal System

**Samuel Oxhorn**, Samuel Reid, Michael Garlick, Ashton Vonnahme

<sup>1</sup>OceanaGold, Kershaw, United States

Haile Gold Mine is located within the Carolina Terrane of the southeastern United States and is hosted by ca. 550 Ma calc-alkaline volcanic and volcanosedimentary rocks of the Persimmon Fork Formation. Re–Os dating of molybdenite from key deposits (e.g., Haile and Ridgeway) indicates that gold mineralization was broadly coeval with host magmatism, placing ore formation within a Neoproterozoic magmatic–hydrothermal framework developed during arc magmatism and subsequent extensional reorganization of the terrane. The deposit has historically been interpreted within both magmatic–hydrothermal (epithermal) and orogenic frameworks.

Recent drilling has identified low-sulfidation epithermal textures in drill core, including ginguero banding, crustiform–colloform quartz–adularia veins, cockade breccias, comb quartz, and quartz–adularia pseudomorphs after lattice-bladed calcite. Petrography of vein and breccia samples further documents mineral replacement and multi-stage vein development, supporting a low-sulfidation epithermal interpretation.

Gold mineralization is concentrated along the hanging wall–footwall metavolcanic–metasedimentary contact but is not restricted to this interface. A rhyolitic intrusive complex of domes, cryptodomes, sills, and dikes occurs along the contact and at deeper structural levels within the volcanic–volcaniclastic succession. Higher-grade zones are increasingly recognized within and along the margins of these intrusions, particularly at intrusive–country rock contacts where permeability contrasts localized hydrothermal fluid flow, indicating that felsic magmatism exploited and enhanced pre-existing structural permeability, establishing vertical pathways for hydrothermal fluids and focusing mineralization within a low-sulfidation environment.

Historically, exploration focused on shallower zones along the stratigraphic contact characterized by sericite–silicification alteration and pyrite-dominant sulfide mineralization with subordinate pyrrhotite. Integration of four-acid whole-rock geochemistry, pXRF, SWIR spectroscopy, petrography, and systematic vein-texture logging has identified deeper feeder zones defined by pervasive wall-rock adularia–silicification and Au–Ag telluride mineralization with elevated Mo–Te signatures.

Although the deposit has undergone structural modification, recognition of this preserved epithermal domain at depth expands the search space and highlights exploration potential at Haile and across the Carolina Terrane.