Setting and Petrogenesis of the low Sulfidation Epithermal Gold Mineralization in the Williams Brook area, Tobique-Chaluer Zone, Northern New Brunswick

D. Sánchez-Mora[1], D. Lentz[1], Christopher McFarlane[1], James Walker[2]
[1] University of New Brunswick, Department of Earth Sciences, Fredericton, NB, Canada ;
[2]Geological Surveys Branch, New Brunswick Dept. of Energy and Mines, Bathurst, NB, Canada

Abstract

Low sulfidation epithermal style gold mineralization occurs within Siluro-Devonian bimodal volcanic and sedimentary rocks of the Tobique-Chaleur zone in northern New Brunswick. Geotectonic discrimination diagrams show transitional (calc-alkaline/alkaline to tholeiitic) as well as A-type signatures. Such chemistries indicate a transpressive tectonic setting and suggest that oblique convergence of Gondwana and Laurentia was the driving force for basin formation and coeval magma generation. Lithogeochemical data indicates a bimodal distribution. Variations in Nb/Y vs Zr/TiO_2 show that mafic volcanic samples plot in the andesite/basalt and andesite fields, whereas felsic volcanic samples plot in the rhyolite field. In the study area the gold mineralization is associated with felsic units; flow-layered rhyolite, rhyolite porphyries and polymictic rhyolitic breccias. U-Pb (zircon) dating of felsic volcanic rock from the Williams Brook area yielded an age of 398.7 ± 1.9 Ma and is consistent with assignment of these rocks to the Early Devonian Wapske Formation (Tobique Group).

Two types of mineralization have been recognized in the study area. The first is interpreted to be early and consists of gold and galena with pyrite occurring along muscovite/illite veinlets in weakly altered rhyolite porphyries. The second is a later stage and consists of quartz veins containing minor supergene oxyhydroxides such as jarosite, hypogene sulfides (sphalerite, galena), and native gold. Oxygen isotopes obtained from quartz and muscovite within the mineralized quartz veins yield an approximate deposition temperature of 200°C, and the calculated $\delta^{18}O$ of H_2O (+11.74 ‰) is consistent with magmatic fluids. Sulfur isotope analysis of sphalerite and pyrite return $\delta^{34}S$ values from +1.5 to +7.7‰ with an average of +5.6 ‰. Calculation of $\delta^{34}S$ from the mineralizing fluid (H_2S) for sphalerite and pyrite are +0.45‰ and +1.79‰, respectively, and are also consistent with a primary magmatic sulfur source. The geological setting, mineralization style, and stable isotope data from Williams Brook support the interpretation that the mineralization is a low sulfidation epithermal-style mineralizing system.