Characteristics and Ore Genesis of the Clifton Porphyry Copper-gold Prospect, Northern Luzon, Philippines

*Avriel Venis Literal Cirineo[1], Akira Imai[1], Ryohei Takahashi[1], Redempta P. Baluda[2], Victor B. Maglambayan[2], Jocelyn B. Galapon[2], Roy Ronald C. Luis[2]

1. Akita University, 2. Philex Mining Corporation

The Clifton prospect is one of the priority prospects identified by the renewed exploration campaign of Philex Mining Corporation (PMC), the mining company that has been operating the Sto. Tomas II orebody, an auriferous porphyry copper deposit located in the southern tip of the Baguio District since 1957. Mineralization in Clifton is porphyry copper type associated with a quartz diorite complex emplaced along a ENE-WSW structure. In this study, we investigated the intrusive rocks from the viewpoints of cross-cut relations, alteration and associated vein types, mineral paragenetic sequence, fluid inclusions and sulfur isotopes to reveal the condition of mineralization.

Corelogging and petrographic analyses recognized at least intrusive rocks intruding through the basement consisting of volcanic rocks of the Pugo Formation (PMV): (1) the Early Andesite Porphyry (EAP), (2) the Intra-mineral Diorite Porphyry (IMD), and (3) the Late Andesite Porphyry (LAP). The intrusive rocks have similar mineralogical compositions, and are distinguished via texture of the groundmass, degree of alteration and density of veinlets. The emplacement of the multiple intrusive rocks introduced several alteration types: (1) K-silicate alteration is well-developed in the EAP and its contacts with the PMV. It is characterized by pervasive hydrothermal biotitization, and is accompanied by abundant chalcopyrite, bornite and magnetite with ilmenite-hematite and sphene as disseminated grains. Associated wavy quartz veinlets cross-cut the host rocks. (2) Quartz-dominated K-silicate alteration, occurring within the “Stockwork Zone” (“SQZ”), introduced addition of silica accompanied by chalcopyrite-pyrite-magnetite-hematite with rare gold. It is accompanied by sheeted quartz, quartz-magnetite, and chalcopyrite-rich quartz veinlets. (3) Chlorite-sericite overprint accompanied by chalcopyrite-pyrite affects the bottom portion of the “SQZ”, and cross-cuts the earlier quartz veinlets. Chalcopyrite grains appear to be rimmed by an unidentified silver-bearing mineral. Lastly, (4) propylitic alteration, characterized by chlorite-actinolite, in the IMD and LAP.

A direct correlation of copper and gold concentration is evident in the early stage biotite-dominated K-silicate alteration. Higher concentrations of copper in the quartz-dominated K-silicate alteration are associated with the later chalcopyrite-rich mineralization. Higher silver contents correspond to the higher silver content of the electrum, Ag/(Au+Ag) = c.a. 46.7 atomic% was measured in a minute gold globule found in the later chalcopyrite-rich mineralization.

Abundance ratios of vapor-rich fluid inclusions to polyphase hypersaline fluid inclusions vary from 18% to 47% and from 95% to 287%, for the veins related to the “SQZ” and the later quartz veins at the shallower parts, respectively. The significant increase in the vapor to brine ratio at the shallower depth compared to the deeper portions indicates the transport of vapor in the shallower part.

Formation depth of Clifton is shallow, estimated to be 2.2 km, 58MPa at 650˚C, 58 MPa during the earliest stage, and uplifted to 1.5 km, 38.5MPa at 525˚C, during the chalcopyrite-rich stage, based on fluid inclusion microthermometry.

Sulfur isotope analyses measured +1.0 to +6.0 $\delta^{34}S_{CDT}$ (‰) indicating that the source of sulfur is enriched in ^{34}S similar to the other hydrothermal ore deposits in the western Luzon arc.

Keywords: Clifton prospect, Baguio District, porphyry copper-gold mineralization

©2017. Japan Geoscience Union. All Right Reserved.

©2017. Japan Geoscience Union. All Right Reserved.