Snowfield: A gold-rich porphyry Cu deposit in NW British Columbia

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An important question in understanding the genesis of porphyry-type deposits is, ‘why are some systems unusually enriched in gold?’ A review of the literature suggests that Snowfield in northwestern British Columbia it is one of the most gold-rich porphyries in the world (134.7 Mt at 1.01g/t and 0.06% Cu), with unusually high gold/copper ratios. Therefore, it provides an excellent opportunity to address the issue of porphyry gold enrichment. In addition, the extensive quartz-sericite-pyrite alteration assemblage observed at Snowfield cannot be satisfactorily explained by a classic telescoping porphyry model. Rather, the alteration distribution may reflect a more complex hydrothermal evolution. The aim of the research is to gain a better understanding of the nature of the hydrothermal fluids and the physiochemical conditions related to the gold mineralisation and alteration at Snowfield. Some initial results include detailed petrography and SEM imaging that display important mineral relationships and textures, as well as preliminary alteration mapping data using a field portable spectrometer. Native gold (containing ~5-15% Ag) is observed as inclusions in chalcopyrite hosted by pyrite, along quartz-quartz contacts, along pyrite-pyrite grain boundaries, and in association with chalcopyrite-sphalerite-tennantite. Chalcopyrite commonly occurs with pyrrhotite as inclusions in pyrite, and locally the pyrrhotite is intergrown with the chalcopyrite. These textures suggest that the chalcopyrite and pyrrhotite predate the pyrite and the pyrrhotite ‘veined’ the chalcopyrite. They also suggest that that gold mineralisation was long lived beginning before pyrite crystallization and continuing after. The occurrence of the chalcopyrite-pyrrhotite inclusions indicate that conditions of gold mineralisation were initially reducing and subsequently become more oxidizing. A near infrared and short wave infrared spectroscopic (NIR and SWIR) survey was conducted on selected drill core and surface samples using a field portable spectrometer. Based on these initial spectroscopic results, abundant pyrophyllite was identified on the northern edge of the deposit, representing the advanced argillic alteration zone of the porphyry system. The research will continue with more electron microprobe analysis to identify textural relationships, and zoning within minerals. X-ray diffraction will be used to validate field spectrometer mineral identification and examine mineral crystallinity. Fluid inclusion microthermometry and LA-ICP-MS will be used to constrain physiochemical conditions. Multielement geochemistry will be analyzed to identity host rock types and trends related to mineralisation and alteration. The overarching objectives are to use all of this information to determine why Snowfield is unusually rich in gold, validate new field strategies for both spatially and chemically mapping alteration, and develop tools for vectoring to mineralisation in future exploration.