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Geochemistry, Mineralogy, and Reconnaissance Cathodoluminescence Study of Gold Vein Samples, Eastern Interior Alaska

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A series of gold occurrences, including the active Pogo mine, are located along a broadly east-southeast-trending region in eastern interior Alaska that stretches from the Shaw Creek fault in the west to Black Mountain in the east. Auriferous veins in the occurrences can be hosted in either metamorphic or mid-Cretaceous plutonic rocks. Vein thickness ranges from meter-scale (e.g., Liese veins at Pogo) to cm-scale sheeted veins. The total contained sulfide in veins is generally several percent and ore minerals are commonly very fine grained (<10-100s of microns).

Geochemical analyses of select vein samples from surface and drill cores indicate that a few prospects hosted partially or entirely in ortho- and paragneiss have strong correlations among Au, Bi, and Te. These prospects include the Pogo mine (Bi commonly exceeding ~100 to >1000 ppm; Te mostly >0.5 to 200 ppm; Au ranging to 100+ ppm) and the Boundary and Gray Lead prospects near/at Black Mountain. Despite significant arsenic in these samples, there is no strong As:Au correlation. Other prospects hosted in mid-Cretaceous granitoids include prospects just north of Gray Lead at Black Mountain. These prospects generally have no detectable Te and lower Bi (<100 ppm). In the limited sample suite, no correlation between Au and other elements exists, except in the West Pogo prospect, where enriched Bi and Te, and Sb-Au correlations are reported.

We selected mineralized vein samples from the greater Pogo system, Gray Lead (geochemically similar to Pogo), and Blue Lead (Sb-As-rich prospect) to examine mineralogy and quartz textures using cathodoluminescence (CL). Scanning electron microscope-energy dispersive spectroscopy analysis confirms the presence of Bi-bearing phases in the Pogo and Gray Lead samples. Pogo exhibited Bi-Pb-Sb sulfosalts, Bi-tellurides, chalcopyrite, pyrite, galena. Hill 4021 (on the Pogo property) exhibited arsenopyrite, loellingite, Bi-tellurides, electrum and complex intergrowths of Au- and Bi-bearing minerals. Gray Lead exhibited arsenopyrite, Bi-Te- and Bi-Sb sulfosalts, and Pb-Sb-Ag-Bi sulfosalt, and Blue Lead displayed arsenopyrite, electrum, stibnite, and unknown Sb-Pb-Ag-sulfosalt. Gold occurs as electrum, alone or intergrown with Bi-bearing minerals associated with quartz grain boundaries and cracks, or, rarely, as inclusions in clusters of euhedral arsenopyrite that may be rimmed by Bi-Te sulfides (including at Blue Lead).

We examined CL spectral intensities at the ~ 2.7-2.8 eV position, previously interpreted to reflect variations in Ti concentration. Despite complexity, intensities tend to vary from higher intensities in the interiors of quartz crystals and decreasing outward. Arsenopyrite, Bi-Te-bearing minerals, and gold occur within microveinlets of lowest intensity quartz that clearly crosscuts the older quartz, as well as along grain boundaries. Stibnite is paragenetically youngest at Blue Lead, filling voids and partially corroded earlier quartz generations. Preliminary microprobe analyses of quartz with different spectral intensities hint at the sulfide-related quartz having lower Ti concentrations, consistent with lower temperatures of formation during late quartz (and Au) deposition. Our preliminary observations in CL suggest that, despite variations in ore mineralogy empirically related to host-rock type, similar relative timing and processes were responsible for gold deposition within these widely spaced prospects and perhaps others in the region.