Genesis and Mineralization of the Shotgun (Mose) Deposit, SW Alaska

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The Shotgun deposit, one of the larger recent gold discoveries in Alaska, consists of quartz stockwork Au-Cu-As mineralization in a Late Cretaceous rhyolite (granite porphyry) stock. The deposit is located approximately 160 km north of Dillingham, SW Alaska, south of the Donlin Creek and Vinasale Mountain Au prospects, and west of the Sleitat Sn-Ag deposit. NovaGold Resources, Inc. calculated an inferred resource of 980,000 oz. Au using a 0.016 opt cut-off for the deposit, with initial metallurgical tests indicating >90% Au recoverable by cyanide leaching. The preliminary work reported here shows that the Shotgun deposit is a Au-Cu-As porphyry.

Utilizing the $^{40}Ar/^{39}Ar$ dating method, four primary biotites from the rhyolite exhibit a mean plateau age of 69.7 +/- 0.3 Ma. Although this is the same age as other Au systems in SW Alaska, the Shotgun deposit is unique in mineralization and alteration characteristics. Within the rhyolite, the deposit has zones of high density stockwork quartz veining and hydrothermal brecciation. Overall, the Shotgun deposit has many similarities to a Cu-Mo porphyry deposit. However, the potassic alteration typically associated with these porphyries is nearly absent. Instead, the predominant alteration assemblage is albite-sericite-quartz, +/- carbonate. Localized feldspar alteration to garnet is similar to that observed in high Si porphyry Mo deposits; such as the Climax-type Henderson deposit. The ore mineralization of the Shotgun deposit includes primary Au°, Bi°, Bi-Te, arsenopyrite, chalcopyrite, loellingite, pyrrhotite, pyrite, scheelite, sphalerite, and supergene covellite, chalcocite, Cu°, and marcasite.

Geothermometry of quartz veins with various combinations of arsenopyrite, chalcopyrite, loellingite, pyrrhotite, and pyrite yield deposition temperatures of >450 °C. Coexisting vapor-rich and aqueous saline-rich fluid inclusions in quartz veins suggest aqueous immiscibility, or 'boiling'. Fluid inclusion microthermometry indicates an H_2O-CO_2-CH_4 rich vapor phase, salinities >40 weight percent NaCl equivalent, and homogenization (not trapping) temperatures of 214 to >600° C. Three quartz-albite-sericite samples yield $\delta^{18}O$ values of +16.4 to +17.0‰ (quartz) and δD values of -105 to -108‰ (sericite). Calculated values for H_2O in equillibrium at 350° C (approximate temperature of sericitic alteration) are roughly 10‰ $\delta^{18}O$ and -80‰ δD, which are consistent with formation from magmatic fluids. When combined with the geochronology and isotopic data, the evidence for high temperature and saline fluids indicates a direct relationship between early mineralization and magmatism.

The Shotgun Deposit is the only known true Au-Cu-As porphyry-style system in Alaska, and the only large intrusive-hosted deposit in SW Alaska with mostly non-refractory Au. Furthermore, the ore mineralogy of Au-Bi-Te, loellingite-pyrrhotite-arsenopyrite, and presence of CH_4 indicate an oxidation state far below that of a typical porphyry Cu deposit. In comparison to Donlin Creek, which contains gold in solid solution in arsenopyrite, the abundance of Au° at the Shotgun deposit is presumably due to the high temperature of formation. The low oxidation state assemblage and oxygen-hydrogen isotopic data signifies that the system was not overwhelmed by later meteoric fluids. The unanswered questions are why did the Shotgun porphyry form, and where are more located? As the questions are related, a characterization of the Shotgun deposit will improve our understanding of SW Alaska's potential for Au deposits.

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