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Re-Os Lens on the Enigmatic Pogo Au District, Tintina Au Province, Alaska

DOUGLAS C KREINER[1], **HOLLY STEIN**[2], AARON ZIMMERMAN[3], SIRI L. SIMONSEN[4], ØYVIND HAMMER[5], JUSTIN K.L. KIMBALL[6], JUDITH HANNAH[3] AND BRUNO REYNARD[7]

[1]USGS Alaska Science Center
[2]AIRIE Program, Fort Collins, Colorado, and University of Oslo, Norway
[3]AIRIE Program
[4]University of Oslo
[5]Natural History Museum, University of Oslo
[6]Museum of Cultural History, University of Oslo
[7]CNRS

Models for low-sulfide, quartz vein hosted Au deposits are many and highly variable, whether the discussion be on relationship to magma composition, fluid source, or Au source(s) and transport. The well-endowed Tintina Au Province, spanning interior Alaska and the Yukon is exemplary, containing numerous diverse gold deposits that prove difficult to relate to one another. Pogo lacks obvious temporally related intrusion(s) for a potential Au source, even as the metamorphosed (pre-120 Ma) Devonian-Mississippian basement is filled with Cretaceous intrusions emplaced continuously from ~115-90 Ma across the region. Pogo is defined by gently northwest-dipping sheeted quartz-dominant lodes exhibiting variable pre- and post-mineralization fault-related deformation. Gold-bearing quartz lodes exhibit overprinting relations including quartz textures that present as multiple ghost breccias with multiple annealing events.

Magmatism in the immediate region is restricted to ~114-112 Ma altered and mineralized peraluminous granites, the ~107 Ma Goodpaster batholith >5 km away, and ~98-93 Ma monzodiorite plutons cutting mineralization. Re-Os geochronology on Au-associated sulfides (pyrrhotite and arsenopyrite) in some Pogo deposits suggest pyrrhotite may be slightly older (~112-110 Ma). The majority of arsenopyrite (interestingly, two varieties, one with and the other without common Os) provides Re-Os ages of ~106-105 Ma.

Here we address an unexpected age of ~142 Ma, determined for a highly unusual vein type at Pogo. Non-planar, hairline to 3-mm auriferous sulfide veinlets with tight squiggle-like morphologies, prominently crisscross an undefined, but seemingly early quartz generation. The mineralogy of these veins is pyrrhotite and arsenopyrite, with disseminated Au, and Bi_2Te_3. Both SEM and CT imaging support emplacement of the auriferous sulfide veinlets during a catastrophic event that appears to have produced nearly simultaneous sulfide-Au-Bi-Te and local quartz melt. Rounded sulfide-Au- Bi_2Te_3 melt-like blobs are suspended in quartz together with mostly rounded quartz grains containing the same sulfide-Au-Bi-Te mineralogy as the vein. Melting, freezing and brecciation may define a nearly instantaneous geologic time span.

Significantly, initial $^{187}Os/^{188}Os$ ratios for key isochrons are chondritic. We are presently investigating quartz and Pogo's non-magnetic pyrrhotite using Raman spectroscopy, in the context of a possible impact origin for early Pogo mineralization.

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