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Compositional Characterization of Placer and Lode Gold Grains from Eastern Interior Alaska, USA

Erin E. Marsh¹, Robert J. Chapman², Renee Pillers¹, Heather Lowers¹, Ryan D. Taylor¹

1. U.S. Geological Survey, Denver, CO, USA, 2. University of Leeds, Leeds, United Kingdom

The geology of eastern interior Alaska, from east to west, consist of the intersection and juxtaposition of two tectonic assemblages: the arc and basinal assemblages of the allochthonous Yukon-Tanana terrane and the parautochthonous continental margin Yukon-Tanana Upland (YTU). The YTU is bordered to the northwest by tectonically interleaved rock formations of the Livengood Assemblage. The region hosts various reduced intrusion-related and orogenic gold deposits and occurrences, (i.e., Fort Knox, Golden Summit, and Pogo).

Compositional characterization of placer gold and placer-lode gold pairings from across interior Alaska is based largely on the elemental signatures of opaque mineral inclusions revealed in polished section. The inclusion suites reflect the mineralogy coeval with gold precipitation in lode occurrences and correlate with the tectonic setting of the locality. Mineral inclusions in gold from arc and basinal assemblages have Ag-Te +/- Bi, Pb, and Sb signatures, which transition to Pb-As-Sb-dominated inclusion suites in gold from the parautochthonous continental margin. Gold from the ultramafic rocks of the Livengood Assemblage yields a Pb-As-Ni-Co-Cu signature. The observed differences suggest interaction between ore fluid and host lithologies, culminating in strong partitioning of minor elements to the mineral inclusions. In equivalent studies of placer gold in the neighboring Yukon Territory, samples with an Ag-Te mineral inclusion signature are postulated to be associated with epizonal lode deposits, whereas those with a Pb-Sb-As signature are related to orogenic gold deposits. The alloy compositions of gold from throughout the region do not provide robust discriminants, except for elevated Hg (to >3 wt%) in gold from the Livengood and 40 Mile Districts. The approach sheds light on the influences of the host terrain on the mineralogy of gold in orogenic belts and permits characterization on that basis.