Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11353

Fingerprinting placer gold alloy from the Yukon-Tanana uplands of eastern Alaska: Integrating trace element and Pb isotopic chemistry of gold

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Placer gold deposits are an important source of gold production in Alaska (~350,000 ounces from 2014- 2020 (Twelker et al., 2022)). However, the lode origin of many of these placer deposits is not completely understood. The ability to link placer gold to a specific type of source deposit would have significant implications for regional exploration, but recent research has shown that the most widely applied approach to studying alloy major element composition (via Electron Microprobe Analysis) is generally not capable of generating diagnostic compositional signatures for gold formed in specific deposit types (Chapman et al., 2021). Characterization of the suite of mineral inclusions within gold particles has proved far more useful in this regard (Chapman et al., 2021), but in some cases the scarcity of inclusions is problematic. The low limits of detection afforded by laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) can provide additional sources of compositional and isotopic information. Integration of these data with those defining inclusion suites could provide an effective approach to differentiate between gold from different mineralization styles (e.g., orogenic vs. intrusion-related) (Chapman et al., 2021).

This study presents new trace elemental and Pb isotopic compositions measured via LA-ICP-MS to better understand the link between placer gold deposits and their lode sources in the Yukon-Tanana uplands of eastern Alaska. Pb isotopic results indicate significant differences in placer gold derived from different streams and a wide range of Pb isotopic compositions are seen: $^{206}Pb/^{204}Pb$ 17.5 to 19.7 indicating both high and low μ Pb sources for the gold mineralization. Trace elements in gold alloy show systematic differences between different streams, and likely lode sources, for some elements like Cu and Sb.

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