

Tl Isotope Implications for the Metalliferous Source of Carlin-type Deposits in northern Nevada

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The Carlin-type deposits of northern Nevada comprise a world-class accumulation of Au deposits with a characteristic geochemical signature of elevated Tl, As, Hg, and Sb. Three possible sources of Au in Carlin-type systems have been described: (1) leaching of Au from Paleozoic sedimentary rocks +/- Mesozoic intrusive rocks by circulating meteoric fluids; (2) mobilization of Au by deeper metamorphic fluids that have resulted from dewatering of deeply-buried Proterozoic sedimentary and Archean basement rocks; and (3) magmatic fluids associated with extension-related Eocene magmatism, possibly with a mantle component. Traditional geochemical and isotopic tracers have yielded ambiguous results, however, and the metal source remains enigmatic.

Because there is a strong correlation between Tl and Au in these deposits, Tl may be utilized as a proxy for the origin of Au. This study describes the first-ever Tl isotope data collected for ore- and late- stage mineralization at a Carlin-type deposit as well as for a suite of potential source rocks. Although not pointing to an unequivocal origin for the Tl (and by proxy Au), the Tl isotope data clearly rule out early Paleozoic passive margin rocks as metal sources. In addition, comparison of ore- to late- stage minerals suggests a shift in Tl isotope compositions that are consistent with evolution of the fluid from magmatic/metamorphic-dominated to meteoric-dominated through time.