

### **What Controls High-Grade Carlin-Type Gold Deposits?: Structural and Geochemical Factors from the Leeville Underground Complex, North Carlin Trend, Nevada, USA**

**Koray Tasbicen**<sup>1</sup>, Elizabeth Holley<sup>1</sup>, Kendle Fraley<sup>2</sup>, Elizabeth D. Stock<sup>3</sup>, Joseph Becker<sup>2</sup>

<sup>1</sup>Colorado School Of Mines, Golden, United States, <sup>2</sup>Nevada Gold Mines, Elko, United States, <sup>3</sup>Barrick Gold Inc., Toronto, Canada

The Leeville Underground Complex (LUC) hosts high-grade Carlin-type gold deposits (CTGDs), each reflecting different physical and chemical controls over time and space. The primary host rock, the Wispy unit (WS) of the Devonian Popovich Formation (Dp), is highly porous, permeable, and enriched in reactive iron. Other Siluro-Devonian sedimentary rocks either lack geochemical reactivity or porosity; therefore, they require additional ground preparation factors for Eocene Carlin-type gold mineralization.

The West Leeville (WL) and turf deposits are hosted in the Dp-WS, with stratabound mineralization gently deepening northward. At WL, a NE-plunging anticline thickens the Dp-WS, cut by NW-trending strike-slip faults that accommodate dike swarms of various ages (Jurassic–Eocene). In southern WL, gold mineralization follows the thickened WS unit along a NE trend, while in northern WL, it transitions to a NNW trend, obliquely cutting the anticline. At the inflection zone, mineralization is vertical and deep, following a NW-trending dike swarm.

At western turf, the Silurian Roberts Mountain Formation (Srm) hosts vertical and locally brecciated gold mineralization. The ore body geometry is controlled by an NNE-plunging anticline and a NW-trending vertical dike swarm cutting its core. Additionally, a major pre-Eocene metasomatic fluid-flow event reduces the volume of rocks that could potentially be mineralized. Hence, the intersection of structures and the metasomatic event creates high-grade zones that are narrow and vertical.

This study documents structural and geochemical controls on the Eocene Carlin-type gold mineralization at the LUC. These controls can be used as vectors supporting the brownfield and greenfield exploration of CTGDs. Deposit- to district-scale structures and geochemical proxies can also guide operational mine planning and production decisions. Understanding the cumulative factors in the CTGDs would improve the genetic model, iteratively comparing the factors with other deposit types with similar geological controls.