The Allard stock is an ~67 Ma syenite intrusion in the La Plata mining district that lies at the southwestern end of the Colorado Mineral Belt, located approximately 20 km from Durango, Colorado. The La Plata district consists of Mesozoic sedimentary strata domed by intrusion of Cretaceous laccoliths and stocks of a mostly alkaline composition, and thus the general geology is similar to the nearby Henry, La Sal, and Abajo laccolithic mountains. The Allard stock appears to have been intruded late in the magmatic history of the La Platas, and hosts porphyry copper-style mineralization and alteration containing the minerals chalcopyrite, pyrite, bornite, covellite, and magnetite in late-stage hydrothermal veinlets that crosscut the intrusion. Previous research has documented anomalous concentrations of precious and noble metals (Au, Ag, PGEs), Bi, and Te in the mineralization from Allard. Electron microprobe analyses conducted in this study indicate that PGEs occur in four phases: 1) the Pd>Pt-Bi-telluride merenskite; 2) the Pt>Pd-Bi-telluride moncheite; 3) a Pd-Ag telluride sopcheite (Ag₄Pd₃Te₄); and 4) a previously unrecognized (?) mineral with the approximate formula PdTe₂. Epithermal and limestone replacement deposits of Ag-Au also occur in the district, and they contain abundant Au-Ag telluride minerals with minor amounts of PGEs (80 ppb in only a single fire assay analysis). The enrichment of the Allard stock in Au, Ag, Te, etc., led to the previous suggestion that a genetic connection exists between the porphyry and epithermal mineralization in the district. The present study was conducted to test that hypothesis.

Due to the ~1 km of topographic relief, the transition between porphyry and epithermal styles of mineralization is well exposed and amenable to sampling in the La Plata district. Copper mineralization at the Allard stock can be found in old mine workings and outcrops at the Allard Tunnel (adit) and the Copper Hill “glory hole,” <1 km to the east. Samples from both the Allard Tunnel and Copper Hill were analyzed in this study. Sulfur isotope values for the Allard stock range from -7.8 to +1‰ 34S(VCDT), indicating a magmatic source with perhaps a minor 32S-enriched component of contamination derived from the country rocks. Copper isotope values for the Allard stock range from +0.965 to +2.700‰ 65Cu, with some of the data overlapping previously measured values for hypogene minerals in typical porphyry copper deposits. Lead isotope data on Allard stock sulfides also suggests a magmatic source for lead. Because of their close spatial association, hydrothermal fluids that mineralized the Allard stock porphyry are likely coeval or analogous to fluids that formed the Au-Ag-tellurides in the epithermal deposits and perhaps even the skarn deposits. Anomalous precious metals, Bi, and Te in the Allard stock and the Au-Ag telluride mineralization in the epithermal ores further eludes to the presence of a geochemical connection between mineralization in both porphyry and epithermal regimes.