The North Amethyst vein system is a precious and base metal-rich epithermal deposit located in the Creede mining district of the central San Juan Mountains in southwest Colorado. The vein deposits of the district are located along north-northwest trending normal faults that cut across rhyolitic to dacitic ash flow sheets that were deposited between 28.3 and 26.7 Ma ago as products of recurrent caldera eruptions. The intermediate-sulfidation epithermal vein deposits are thought to be genetically linked to a concealed pluton emplaced below the northern part of the district. The North Amethyst deposit is located at the intersection of the northern extension of the N-NW trending Amethyst fault and the E-W trending Equity reverse fault, above the inferred pluton. The ore zones of the deposit comprise crustiform and colloform banded veins and breccias. The veins are relatively narrow, but extend over large vertical distances.

Preliminary investigations show that the ore and gangue mineralogy of the veins change with depth. Veins in the Equity reverse fault at elevations of 3215 to 3420 meters are crustiform banded and contain high gold grades. The Equity veins have an Au/Ag ratio of approximately 1:100 and are dominated by a gangue of quartz, carbonate minerals, and some K-feldspar. The mid-level veins in the Amethyst normal fault at elevations of 3010 to 3185 m contain high gold grades and are crustiform and colloform banded. The veins have a Au/Ag ratio of 1:100, but are dominated by manganese-rich carbonate and silicate gangue minerals, including rhodochrosite and rhodonite. The high- to mid-level veins contain similar ore mineralogy; fine-grained base metal sulfides as well as Au and Ag sulfosalts. The deepest level veins at elevations of 2690 to 2828 m occur at the intersection of the Amethyst and Equity faults. The ore occurs as crustiform and colloform banded veins and breccias. The Au grades are typically lower and the Au/Ag ratio is around 1:10. The gangue is composed of quartz, hematite, chlorite, Mn-carbonate, Mn-silicates, and K-feldspar.

Analytical research on vein samples includes petrographic investigations, optical cathodoluminescence investigations, and scanning electron microscopy to characterize the ore and gangue mineralogy and establish the paragenesis. In addition, fluid inclusion analysis will be applied to reconstruct the physicochemical conditions of ore formation and to interpret the evolution of the hydrothermal fluids from the lower to the upper levels of the North Amethyst vein deposit. These detailed studies will provide new critical constraints on the reasons for the gold enrichment in the northern part of the Creede district and the origin and evolution of fluids of intermediate-sulfidation states.