

Petrographic Characteristics of Low-sulfidation Epithermal Deposits in the Manhattan District, Nevada

Easton Maxey¹, Thomas Monecke¹, T. James Reynolds^{1,2}, Ben Frieman¹, Harrison Pokrandt³

¹Center to Advance the Science of Exploration to Reclamation in Mining, Colorado School of Mines, Golden, USA, ²FLUID INC., Denver, USA, ³Scorpio Gold Corporation, Vancouver, Canada

The Manhattan district in south-central Nevada encompasses several low-sulfidation epithermal deposits that are hosted by Paleozoic metasedimentary rocks. Discovered in the 1860s, mining initially focused on high-grade ore shoots developed along extensional structures crosscutting limestone beds. Recent exploration has identified several distinct ore zones that can be mined in open pit, with ongoing exploration having defined an inferred mineral resource of ~18.3 million metric tonnes grading 1.26 g/t Au. Previous studies on low-sulfidation epithermal deposits have primarily focused on deposits hosted by volcanic successions. Systematic geochemical and mineralogical gradients around high-grade veins can be used to vector towards ore in these deposits. The present study aims to establish how exploration strategies may need to be changed to account for the fact that the host rocks have different rheological and compositional characteristics.

Petrographic evidence, including the occurrence of mosaic, flamboyant, and prismatic quartz, suggests that vein quartz at Manhattan formed through maturation of an originally noncrystalline silica precursor. It is hypothesized that silica supersaturation resulting in the deposition of the noncrystalline silica was achieved during flashing of the hydrothermal fluids. The vein mineralogy, including the occurrence of euhedral adularia and bladed calcite, provides additional evidence for fluid flashing. The occurrence of high-grade ore zones within limestone suggests that rock tensile strength may have been a key control on fracture development, with abundant fractures and small veins developing in this rock type. Veins contain abundant pyrrhotite, suggesting that wall-rock buffering of the mineralizing fluids resulted in lower sulfidation states than typically observed in low-sulfidation epithermal deposits. The results of the study provide new insights into the processes of epithermal mineral deposition in metasedimentary rocks and may be used to refine existing exploration models.