

Geology of the Ivanhoe Hg-Au District, Northern Nevada: Influence of Miocene Volcanism, Lakes, and Active Faulting on Epithermal Mineralization

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Abstract

The mercury-gold deposits of the Ivanhoe mining district in northern Nevada formed when middle Miocene rhyolitic volcanism and high-angle faulting disrupted a shallow lacustrine environment. Sinter and replacement mercury deposits formed at and near the paleosurface, and disseminated gold deposits and high-grade gold-silver veins formed beneath the hot spring deposits. The lacustrine environment provided abundant meteoric water; the rhyolites heated the water; and the faults, flow units, and lakebeds provided fluid pathways for the hydrothermal fluids.

A shallow lake began to develop in the Ivanhoe area about 16.5 Ma. The lake progressively expanded and covered the entire area with fine-grained lacustrine sediments. Lacustrine sedimentation continued to at least 14.4 Ma, and periodic fluctuations in the size and extent of the lake may have been responses to both climate and nearby volcanism. The eruption of rhyolite and andesite flows and domes periodically disrupted the lacustrine environment and produced interfingering flows and lake sediments. The major pulse of rhyolitic volcanism took place between 15.16 ± 0.05 and 14.92 ± 0.05 Ma. High-angle faulting began in the basement about 15.2 Ma, penetrated to and disrupted the paleosurface after 15.10 ± 0.06 Ma, and largely ceased by 14.92 ± 0.05 Ma. Ground motion related to both faulting and volcanism created debris flows and soft-sediment deformation in the lakebeds.

Mercury-gold mineralization was coeval with rhyolite volcanism and high-angle faulting, and it took place about 15.2 to 14.9 Ma. At and near the paleosurface, hydrothermal fluids migrated through tuffaceous sediments above relatively impermeable volcanic and Paleozoic units, creating chalcedonic, cinnabar-bearing replacement bodies and sinters. Disseminated gold was deposited in sedimentary and volcanic rocks beneath the mercury deposits, although the hydrologic path between the two ore types is unclear. Higher-grade gold-silver deposits formed in massive rhyolites and Paleozoic quartzites at deeper levels, and these mineralized zones possibly represent the feeder zones for the higher-level deposits. Fluctuations in the ground-water table locally produced hydrothermal oxidation of the near-surface mercury and disseminated gold deposits. The locus of mineralization shifted with time, moving south and east from its inception point in the west-central part of the district. Thus, although mineralization in the district took place during a span of 300,000 years, the duration of mineralization at any one place probably was much shorter.

The low-sulfidation deposits of the Ivanhoe district formed at the same time and under similar conditions as those in the nearby Midas district, 15 km to the northwest, which includes the large, high-grade Ken Snyder gold-silver epithermal vein deposit. The exposures in the Ivanhoe district are interpreted to represent the near-surface example of the paleosurface that originally was present above the Midas mineralizing system. The resulting combined Ivanhoe-Midas model provides an exploration guide for epithermal deposits in similar geologic environments in northern Nevada.

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