Economic Geology,
Vol. 96, 2001, pp. 75-89

Timing of Gold and Arsenic Sulfide Mineral Deposition at the Getchell Carlin-Type Gold Deposit, North-Central Nevada

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Abstract

Pregold mineralization at the Getchell Carlin-type gold deposit includes quartz and base metal vein mineralization associated with intrusion of a Cretaceous granodiorite stock. The veins contain minor pyrite and trace chalcopyrite, arsenopyrite, galena, and sphalerite. The pyrite is moderately coarse and, in thin section, has high relief, is well polished, and is fractured and locally cemented by the gold ore assemblage. White micas are associated with veins near the granodiorite intrusion. Gold was not observed or detected by fire assay analyses of samples or electron microprobe analyses of pyrites. Microprobe analyses show that pregold pyrites have near-stoichiometric compositions. Variable, low arsenic is present in pyrite in samples overprinted by gold mineralization. Secondary ion mass spectrometry (SIMS) analyses detected trace gold in the coarse, near-stoichiometric pyrite in overprinted samples. The pregold vein assemblage was fractured and cemented by gold ore-stage mineralization

The gold ore-stage assemblage consists of gold- and arsenic-enriched pyrite and marcasite encompassed by jasperoid and drusy quartz, and local late fluorite, orpiment, and galkhaite. The consistent spatial association of jasperoid and ore pyrite reflects their near-contemporaneous formation. The ore pyrite occurs as either fine, irregularly shaped grains, or rims on earlier, gold-free pyrite. In thin section, the pyrite is visibly distinct and has a low polishing relief and a poor polish. SIMS and electron microprobe analyses show that ore pyrites commonly contain 8 to 11 wt percent arsenic and as much as 2,400 ppm gold. Near the end of the ore stage, fluorite, orpiment, and galkhaite precipitated locally in open space created by faulting or limestone dissolution.

Late ore-stage mineralization consists dominantly of open space-filling realgar and calcite, with minor quartz, stibnite, and framboidal pyrite. Realgar conforms to euhedral crystal faces of ore-stage quartz, fluorite, and galkhaite. Calcite filled most remaining open space and conforms to euhedral crystal faces of quartz, fluorite, and realgar.

Significant textural observations argue against an earlier interpretation that the gold mineralization and arsenic minerals formed as two discrete events separated by 40 m.y. In a few areas where calcite and realgar are in contact with ore-stage quartz containing gold-bearing pyrite, realgar and calcite enclose gold-bearing pyrite grains. Massive realgar and calcite distal from these contacts do not contain the gold-bearing pyrite. The presence of ore pyrite in realgar, calcite, and jasperoid requires close timing of these minerals and shows that there is no major time break separating ore-stage and late ore-stage mineral deposition. Textures indicate, instead, that the ore stage and late ore stage formed as part of a single, evolving hydrothermal system. The consistent successive overgrowth of younger minerals on perfectly preserved euhedral faces of older minerals supports the continuous evolution of the gold ore stage into the late ore stage. These results are consistent with fluid inclusions that indicate that paragenetically successive minerals precipitated from an aqueous ore fluid with consistent salinity and gas contents but at declining temperatures. Results show that, within error, the 34, 39, and 42 Ma ages determined for fluorite and galkhaite at Getchell and adularia at the nearby Twin Creeks mine, respectively, most closely approximate the timing of gold deposition at Getchell.