

Gold-Bearing Breccias of the Rain Mine, Carlin Trend, Nevada

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Abstract

The Rain mine includes two mined-out open pits that contained 36.4 t (1.17 Moz) gold, averaging 1.8 g/t gold, and underground reserves, including underground production, estimated at 4.9 t (157,000 oz) gold averaging 7.7 g/t. Rain orebodies are localized in a breccia complex within the hanging wall of the Rain fault and hosted within the Mississippian Webb Formation immediately overlying the contact with the Devonian Devils Gate Limestone.

The ore host includes four texturally and genetically distinct breccia types: (1) crackle breccia; (2) hydrothermal breccia; (3) tuffisite with accretionary lapilli; and (4) collapse breccia. Crackle breccia forms a capping over multistage hydrothermal breccias that are cut by tabular- to pipe-shaped tuffisite dikes, with some containing accretionary lapilli. Pre- and synore hydrothermal breccias formed during at least three episodes of convective fluidization, followed by quartz-sulfidebarite cementation. High-grade gold was deposited as a late phase along the upper portion of the hydrothermal breccia mass and extended into the crackle breccia zone. Collapse breccias occur along the floor of the composite breccia mass and have irregular upper and lower contacts. The lower contact occurs on a dissolution boundary with the Devils Gate Limestone.

Matrix-supported, heterolithic, hydrothermal breccias at Rain consist of sedimentary rock fragments composed of sandstone, siltstone, mudstone, limestone, and conglomerate. Some fragments contain as much as 8 percent introduced biotite in veinlets and/or fragment matrix replacements. The veinlets consist of euhedral quartz, biotite, sphalerite, and pyrite. Barite constitutes as much as 60 percent of the hydrothermal breccias in the form of fragments and as a cement to the breccias. Quartz replacement of fragments and as a breccia cement is pervasive. The total sulfide content in unoxidized ores is less than 5 volume percent.

The Rain orebody resulted from five interpreted stages of development: (1) structural preparation along the rightlateral oblique Rain fault system and conjugate left-lateral oblique northeast-striking faults; (2) multiple episodes of hydrothermal breccia formation, with high-grade gold deposition immediately following the last brecciation event; (3) late channelized and fluidized rock fragments and fine clays forming tuffisite bodies with accretionary lapilli; (4) postmineral extensional reactivation of structures; and (5) collapse brecciation resulting from postore supergene acidic fluid ponding on and dissolving the upper Devils Gate Limestone.

The age of the Rain orebody is poorly constrained. It is older than 22 Ma supergene alunite, but no maximum age constraints other than the Mississippian host rock are known.