Narrative Notes for Epithermal Au Ag Mnzn of Summit Mine, NM by J.L. White

1) The Summit mine is located in Southwest New Mexico 4 1/2 miles from the Arizona state line.

2) The Summit mine occurs within the Steeple Rock Mining District, one of several epithermal precious metal districts located in the late Eocene to early Oligocene volcanic terrain of SW New Mexico and SE Arizona. Other significant epithermal districts in this region include Black Range, Mogollon, Ash Peak and Pearce. The volcanic host rocks are dominated by a thick sequence of intermediate composition flow and volcaniclastic rocks, locally intruded by felsic dikes, and overlain by rhyolitic ash flow tuffs. Several large calderas of late Oligocene age have been identified in this terrain, and a genetic relationship has been suggested between the calderas and epithermal mineralization. However, of the districts shown here, only Mogollon is proximally located on a caldera margin. The age of mineralization at Steeple Rock estimated by Virginia McLemore is early Miocene, about 20 to 18 mya.

3) This generalized map of the Steeple Rock district shows an intermediate sequence of volcanic and volcaniclastic rocks, intruded by irregular rhyolite dikes, overlain by rhyolitic ash flow tuffs, and then cut by northwest-trending faults. Portions of this fault system localize epithermal precious metal-bearing quartz veins shown in red. The Summit vein occurs along a northwest-trending zone of faulting and mineralization that roughly defines the northeast margin of the district.

Producing mines of note are shown by the black squares, and total district production to date is estimated at 500,000 tons averaging 10 grams of gold and 250 grams of silver per tonne. (Summit production: 200,000 tonnes @ 3 gm Au and 160 gm Ag).

4) Here is a typical outcrop of the intermediate volcanic rocks. You can see here two separate flow units of relatively unaltered fragmental andesite porphyry.

5) Here we see andesite cut by one of the rhyolite dikes.

6) Scattered throughout the district are areas of alteration manifested by white clays, silica, alunite and very fine disseminated pyrite; referred to by others as "acid sulfate" alteration. It occurs in irregular zones that cover from tens of meters to over 2 kilometers in aerial extent, and is layered, apparently following favorable stratigraphic horizons. The typical layered sequence grades from massive white chert, down through progressively less quartz and more of a variable combination of alunite, kaolinite, pyrophyllite and pyrite. Below this the rocks grade into andesite partially altered by chlorite with local quartz-calcite-chlorite-pyrite veinlets. The alteration is not mineralized, and a conclusive direct relationship to mineralization has not been established.

7) Shown here is a plan view of the Summit vein. The vein strikes north 35 west to north 80 west, and dips about 75 degrees to the northeast. Note the Summit vein has a significant bend centrally located in the structure. At the bend, the quartz vein narrows on the surface to about 10 meters, and moving laterally along the vein in both directions the width of quartz veining increases to between 20 to 30 meters. Massive calcite veining is present on the surface in the footwall of the main Summit structure. Continuing in both directions the quartz vein grades into a quartz stringer zone that further grades outward and basically disappears into broad irregular zones of "acid-sulfate" alteration. Patches of this alteration also occur 100 to 300 meters perpendicular from the main vein structure. Smaller discontinuous narrow quartz veins occur subparallel to the main vein in both the hanging wall and the footwall. These smaller veins are locally mineralized. Note also the presence of rhyolite dikes located southeast of the main vein.

If we look at a cross section of the main structure .....

8) we can see the vein does have some variation in dip with depth. Gold-silver mineralization occurs in narrow zones within the wider quartz structure. Provided here are representative assays of intercepts at different depths showing the total horizontal vein thickness, the thickness of the mineralized interval within the vein, and the grade of gold and silver in grams per tonne. The mineralization tends to favor the footwall side of the structure, but does occur in the central and hangingwall portions of the vein as well. Note that at the vertical kink in the vein the mineralization is relatively wide, but lower grade, while above and below that point the mineralization is significantly higher grade. About 95% of the mineralization occurs in a band about 300 meters, or 1000', vertically between elevations of 5800 and 4800 feet (1760 and 1460 meters). Note also the massive carbonate veining at the surface occurs primarily above the band of mineralization, and does not continue with depth.

9) Here we are standing on the edge of the southerly altered zone looking northwest up along the strike of the Summit vein.

10) Here we see in the road cut a broad zone of clay alteration on strike with the vein. The quartz veining ends roughly where the altered zone opens up.

If we go about halfway up the hill ....

11) we see in the foreground the light gray to the left is massive calcite, and the rest is quartz and silicified andesite breccia.

12) Here we see a typical vein outcrop of colloform banded quartz in a quartz vein breccia.

Models for epithermal precious metal veins typically call for near surface boiling. One texture cited as evidence for boiling is bladed calcite. .....

13) Here we see bladed calcite textures.

14) Here are a couple more examples of calcite blading. These textures are common in the vein outcrops above the ore horizon.

15) This underground exposure shows a relatively high grade mineralized face. The Summit mineralization is commonly seen as irregular black bands and patches within quartz. The gangue is about 88% silica, with several percent calcite and clay-chlorite-silica altered wall rock fragments. The ore minerals are primarily pyrite with argentite and electrum. Total sulfide content of the ore is less than one percent.

16) This sample illustrates the basic paragenetic sequence of the vein mineralization at the Summit. From the red stained altered wall rock fragment on the upper right, there are successive bands of calcite plus quartz, fine grained to amorphous silica, and then a heavy dark band of mineralization. The mineralization has two phases, the first and most abundant phase is seen here as a black aphanitic band. The second is coarser sulfides, mostly pyrite with argentite, electrum, and local chalcopyrite. This second phase is preceded and followed by fine crystalline quartz. This is followed by a coarser crystalline amethyst phase with no apparent associated sulfides. These are all cut by later barren quartz veinlets, that are all cut by late stage calcite-siderite veinlets.

Note the heavy dark band cuts across the preceding bands. This suggests the mineralizing phase was initiated by a significant fracturing event. Other exposures and samples show cross cutting relationships that indicate fracturing and faulting of the vein structure occurred several times throughout the vein deposition, before, during and after mineralization.

17) Looking at the vein in longitudinal projection we see here the vein surface profile, the location of the bend in the vein, as well as underground mine workings and drill hole intercepts.

18) Here we see a contour delineating drill hole intercepts that contain mineable widths of mineralization greater than 3.2 grams per tonne equivalent gold. Note that the mineralization roughly is symmetrically centered on the bend in the vein.

19) Within this contoured area is a lower core of higher grade mineralization centered on the bend in the vein. The average of mineralized intercepts within the contour not including the high grade core is about 3.6 meters of 7 grams per tonne equivalent gold. The higher grade core averages about 4 meters of 13 grams per tonne of equivalent gold.

Samples were collected and analyzed for trace elements from several levels in the mine workings as well as from locations on the surface.

20) From the trace element work, the ratio of copper to arsenic was found to have a clear trend to increase with depth.

This trend combined with other observations provide a preliminary framework for further exploration in the district ...

21) Here is a summary of some of our salient observations.

- On the surface we see evidence for boiling above the mineralized zone such as bladed calcite
- A lower higher grade core of mineralization is present centered on the prominent bend
- Mineralization above this core is distributed upward and laterally again roughly symmetrically away from the bend
- Roughly 95% of the precious metal mineralization occurs within a band measured 300 meters or 1000' vertically between 4800' and 5800' elevation
- Marginally along strike from the vein, as well as perpendicular from the vein, barren clay silica pyrite alteration extends outward along select horizons
- and finally Cu/As ratios and carbonate content vary with elevation

These items suggest a model of formation, ...

22) that may have practical application for future work.

23) Thank you Dr. Eric Cheney

References:

Virginia McLemore PhD dissertation Univ of Texas at El Paso Geology and geochemistry of the mineralization and alteration in the Steeple Rock district

SEDAR Santa Fe Gold Corporation September 2014 Technical Report Preliminary Economic Assessment Summit Gold Silver Project