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Project proposal for evaluating alunite resources of the Bovard(Rand, Copper mountain) mining district, Mineral County, Nevada

To include an MS thesis by Stephen Weaver, Geology Dept.,MSM

Introduction

The Bovard mining district is on the eastern flank of the central part of the Gabbs Valley Range, Mineral County, Nevada, about 12 miles south of Rawhide and 12 miles northeast of Hawthorne. The location is 4 miles south of the mouth of Nugent wash, and accessable by good, graded gravel roads to the range front, and then poorly maintained and rough jeep trails into the district itself.

The district is underlain principally by ash flow tuffs of late Oligocene to early Miocene age, originally assigned to the Hartford Hill Rhyolite, But now being subdivided into several formations(Ekren and others, in press; Bingler, in press), and andesites of Nugent Wash and Mt. Ferguson of Miocene age(Ekren and others, in press). Also present are mafic lavas of late Miocene(?) to Pleistocene age. The area is structurally complex, with dominantly northwest to west-northwest trending high angle faults, down to the north being the major structural features. In the western part of the district ,faults which appear to be anti-thetic, have their up-thrown sides to the south, raising later Tertiary or Quaternary gravels exposed in the large flat area in the interior of the range to the southwest relative to the younger mafic lavas. Figure 1 shows reconnaissance mapping carried out by Silberman in 1970 in the area.

Quartz veins containing Au, Ag, and some Cu cut rhyolite ash flow tuffs in the eastern part of the area, and cut similar rocks and intermediate volcanic rocks in the western part. The Golden Pen mine and the Lone Star group of claims are developed along the Golden Pen vein, which is emplaced along a northwestward trending fault that offsets the ash flow tuff sequence(figure 1). The vein is 3 to 8 feet thick, and consists of broken and brecciated quartz cemented by sheets and pods of fine grained alunite. Veinlets of alunite extend out into the wall rocks, and alunite appears to be a primary replacement mineral in the wall rocks for some distance out from the vein, the exact extent of this replacement being yet uncertain. Prospect pits, and small addits show that the vein outcrops for at least one mile along strike. Northwest of the Golden Pen mine, the fault bends, or splits and continues across the range with a more westerly trend (figure 1). Numerous prospects adits, and shafts including those of of the Rand and Nevada Rand mines are developed along the trend of this fault in ash flow tuffs and intermediate lavas.On dumps of the shafts in this part of the district are numerous specimens of quartz with chalcopyrite, and heavy Mn oxide staining. Ross(1961) reports ceragerite, argentite, and electrum in these veins, and a total production of about $360,000 from the district.

Alteration in the vicinity of the Golden Pen and Lone Star claims is of the advanced argillic type(Meyer and Hemley, 1967) with veins of alunite and quartz, and quartz, alunite, limonite, and kaolinite(?) replacing the wall rock minerals. A single specimen from the Golden Pen mine , in a cross cut going southwest from the vein indicates considerable alunite in the altered ash flow tuff host rock approximately 100 feet from the contact with the vein. Alteration in the vicinity of the Rand and Nevada Rand mines appears to be of the sericitic or phyllic variety.

We propose to do an integrated geologic mapping, geochemical, petrological, and isotopic study of this area with a variety of objectives:

(1) Evaluate the extent of alunite replacement of the wall rocks and development of alunite veins in the wall rocks outward from the Golden Pem vein. A determination of the alunite resources in the Bovard district is considered important from overall considerations of the U.S. aluminum resonrce and demand situation (see section om economic considerations).

(2) Determine the nature of the strüctural and lithologic controls of mineralization in both the Rand and Golden Pen areas of the mining district. The alteration appears to differ in these two areas, and the extent and controls of these alteration types will be studied. At present , it is not known what if any relationships exists between alteration types in the district. Samples of intermediate lavas from both areas appear to show propylitic alteration. Geometric relations between these alteration types will be determined.

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(3) Determine the types and amount of offset along the the faults in the district. The district lies along the Walker Lane, and the type, rate and nature of deformation in this area will provide additional information om the tectonics of this zone.

(4) Determine the ages of faulting, and the ages of alteration-mineralization in the district. To determine the ages of faulting, dating of the volcanic units must be accomplished. This will allow calculation of the rates of deformation.

To accomplish the above objectives, detailed mapping of the area of figure 1 will be done by Weaver. This will provide information for objectives

2 and 3. Detailed petrographic ~~examination~~ examination of thin sections from the alteration zones will be made by Weaver for objectives 1 and 2. K-Ar age determinations on the volcanic units , and on the alteration and vein minerals will be done by M.L. Silberman and C.L. Connor of the U.S.G.S. which will aid in accomplishing objectives 3 and 4. Underground access in the district is good. The Golden Pen mine has several levels(250') open, with several hundred to perhaps a thousand or more workings available for mapping. This will establish vertical and lateral control on the extent of alunite development in the area(see later section on economic significance). The The final report will be a collaborative effort between Weaver and Slemmons(?) and Silberman and Connor in which Weaver will be responsible for producing a map of 1:24,000 Of the area of figure 1, a detailed study of the alteration petrography, a map of alteration zones at 1:24,000 and a discussion of alteration zones and their controls. This should constitute a very solid MS thesis. Additional data to be included in an extended version of this report will be the nature, and rate of faulting, and ages of volcanic units and mineralization. An attempt will be made to determine the amount of alunite reserves and resources of the district, along with a discussion of feasibility of recovery.

Economic Significance

The major economic significance of alunite is that it could be a major source of aluminum. The other major components,sulphur and potassium,are also marketable commodities. At the present time, the USSR is the only country producing significant amounts of aluminum from alunite ore(Minerals Yearbook v. 3,1974). The mining of alunite in the U.S. has primarily been primarily restricted to the Marysville, Utah area. During WW I, when German imports were cut off, alunite was mined to produce potash. This accounted for 4-7% of the U.S. production of potash at that time(Callaghan, 1938). Production stopped when imports resumed in 1920. Alunite was again mined at Marysville during WW II, when it was recognized as a significant source of alumina. A process was developed to recover alumina and potassium sulphate from alunite(Fleischer,1944) and a plant was built in Salt Lake City to process Marysville ore. About 37,000 tons were mined for testing purpouses(Parker,1964). After the war interest again declined and currently only small amounts of alunite are mined for use in fertilizer.

With the increased demand for aluminum in the future and decreasing supplies of bauxite,domestic reserves are approximately 40 million tons and we import 87% of bauxite used to manufacture aluminum(Patterson&Dyni, 1973), alunite must again be considered as an important source of alumina. Experimental facilities for alunite processing are currently being planned for construction in Boulder City, NEvada(Minerals Yearbook v.1,1974).

If alunite does become an important source of aluminum, the Golden Pen area could become a significant alunite producer. The following general calculation provides a very rough approximation of the amount of alunite in the area:

> If the vein containing the alunite is 1 mile long(the vein system is actually 5 miles long,Schrader,1936) and there is 20% alunite (visual estimates suggest this is a minimum figure) in the wall rocks up to 30 meters on either side of the vein,extending for a depth of 300 feet:

5280ft * 30.48cm/ft =160934.4 cm
300ft * 30.48Cm/ft =9144.0 cm
60m= 6000 cm

total volume of vein system is:
8.8295049×10^{12} cm^3

20% of 8.8295049×10^{12} cm^3= $1,765901 \times 10^{12}$ cm^3

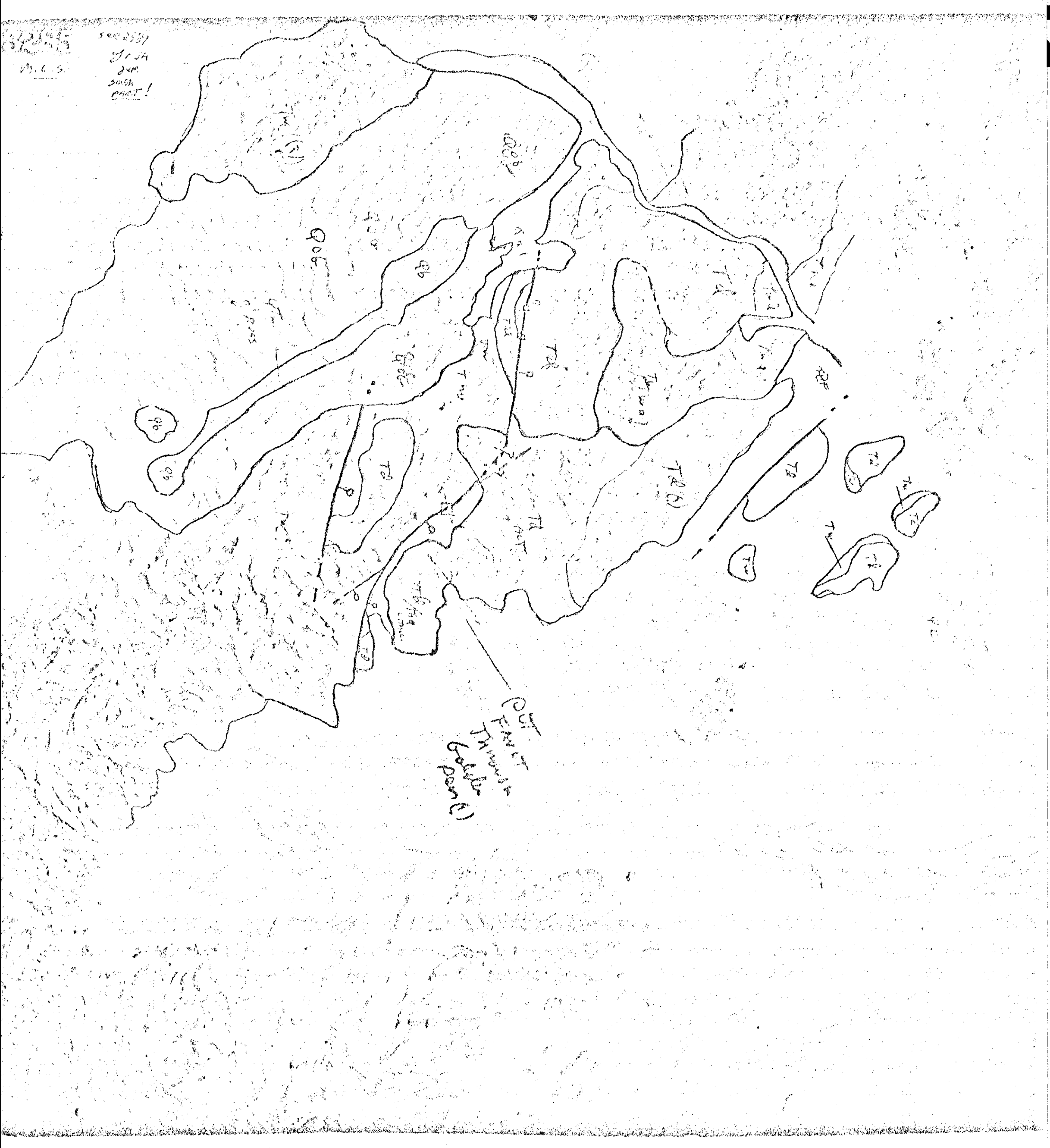
alunite has a density of $2.822 g/cm^3$

$$(1.765901 \times 10^{12} cm^3)(2.822 g/cm^3) = 4.9833726 \times 10^{12}\ g$$

$$(4.9833726 \times 10^{12}\ g)(1 \times 10^{-6}\ \text{metric tons/g}) = 4.9833726 \times 10^{6}\ \text{metric toms}$$

This figure of about 5 million metric tons is most likely a minimum value because the vein as observed in the Golden Pen mine was at least 50% alunite. Obviosly a significant amount of alunite could be present in the area. Because the vein dips tp the northeast in the direction of the slope of the hill, open pit mining could most easily be used to extract the alunite ore.

The above calculations have been made using very limited facts and assumptions. It is the hope of this study to more accurately determine the amounts of alunite reserves and resources in the Golden Pen area.



CUT FAULT Through Cobble Pan(?)