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Geochemistry of pyrite and whole rock samples from the Getchell Carlin–type gold deposit, Humboldt County, Nevada

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1. Introduction

Carlin-type gold deposits were not recognized as a new major type of gold deposit until the 1960's. he Getchell deposit, which is now known to be a Carlin-type gold deposit, was discovered in 1934 oralemon, 1951). This deposit is located in north central Nevada (Fig. 1).

Much is known about the physical characteristics of Carlin-type gold deposits (Cline et al., 2005). Ar nusual characteristic of these deposits is that free gold is generally not present. Instead, gold occurs as sub- icrometer particles in the mineral pyrite or marcasite. The marcasite and pyrite that are gold bearing ommonly occur as rims on gold-free pyrite or marcasite cores. These rims typically contain, in addition to old, elevated arsenic, antimony, thallium, mercury, and copper.

We have samples of ore from the Getchell deposit that contain metals that are not typically present in ese deposits. For example, silver, which is typically very minor, is as abundant as gold. It is currently nclear if this silver is in the pyrite rims with the gold and other hydrothermally transported metals, or if the lver is in other minerals in the rock. If this is the case, this would indicate another source for the silver.

In this study we are conducting petrographic examinations and chemical analyses of pyrites to quantif old and other metals. First we used the microscope to look at polished thin sections of the samples. Pyrite ystals were identified that had visible rims giving us a location to analyze for gold and other trace metals. econd, we are using an electron microprobe to quantitatively determine elements and their abundances in yrite and marcasite cores and rims.

We expect to see a suite of elements typical of the Carlin-type systems, such as: Au, Sb, Hg, As, Cu, nd Tl in the pyrites. Our study is determining the chemistry of four types of pyrite that have been identified, locate gold, silver, and other trace metals. Our analyses will indicate whether or not silver occurs with the her Carlin metals, or if it is alternatively present in other minerals in the rock.

2. Field Area

Looking south along the main pit at Getchell

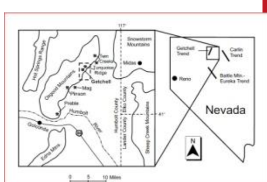
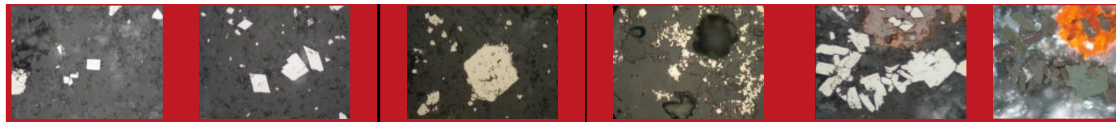


Figure 1. Location map (modified from Cline, 2001).

3. Hypothesis

In this study, we expect:
1) we will find gold in the pyrite rims
2) silver will be with gold, in the pyrite rims



Type 1
Euhedral faces, shiny, cubic

Type 2
Euhedral to subhedral faces, diamond shaped

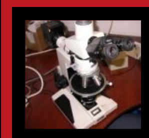
Type 3
Subhedral to anhedral faces, porous, narrow rims

Type 4
Euhedral to anhedral faces, typical ore-stage rims

Type 5
Marcasite, differentiated by birefringence

Figure 2

4. Methods

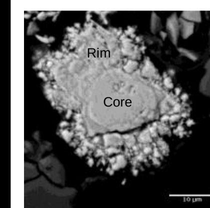


1. Ore microscopy:

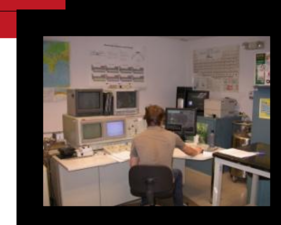
- A Nikon OPTIPHOT-POL microscope was used to view thin sections of rock. Reflected light was used to examine opaque minerals.

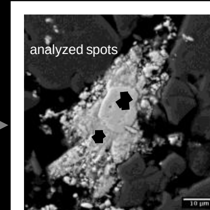
2. Electron Microprobe (chemical analysis):

- The sections were taken to the Electron Microanalysis and Imaging Laboratory to analyze 2-5 micron spots to determine the chemistry of the pyrite cores and their rims.



5. Results

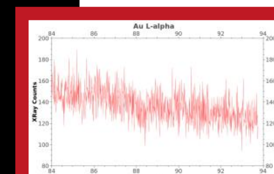




Viewing the samples through the microscope revealed there were five generations of pyrite, which are shown in Figure 2. Several crystals from each type of pyrite were observed and their locations were noted. We selected crystals that are characteristic of Carlin-gold deposits for analysis. The samples were then carbon coated and taken to the EMiL lab to analyze using the probe.

We are reporting our first chemical analyses that were performed on the sample that contained anomalously high silver. The results are as follows.

No.	As	S	Fe	Total	Zn	Hg	Au	Pb	Tl				
1: Core	0.12	52.37	45.18	97.70	0.0048	0.0781	0.0000	0.1656	0.0346	0.0451	0.8401	0.1045	0.0000
2: Rim	2.32	47.21	42.65	92.25	0.0309	0.0824	0.0000	0.1012	0.0728	0.0000	0.7122	0.2630	0.0127
3: Rim	1.61	47.98	43.13	92.75	0.0643	0.0690	0.0000	0.0834	0.1617	0.0447	0.7946	0.2159	0.0125
4: Core	0.43	52.03	45.04	97.52	0.0029	0.0953	0.0000	0.1508	0.0182	0.0036	0.7705	0.1707	0.0073
5: Rim	2.25	47.40	41.69	91.40	0.1794	0.0737	0.0000	0.0688	0.1348	0.0124	0.6409	0.3113	0.0160
6: Rim	1.59	49.15	42.94	93.72	0.0879	0.0696	0.0000	0.1033	0.1538	0.0014	0.7325	0.2153	0.0037



6. Conclusions and Future work

The minerals pyrite and marcasite are chemically made up of 46.6 weight percent iron and 53.4 weight percent sulfur. Ideal, stoichiometric pyrite and marcasite will have these concentrations and chemical analyses should total 100 weight percent. In our results, the cores are close to this ideal composition and analyses total 97.5 to 97.7 weight percent. Analyses show that the rims contain less iron and sulfur, implying that other elements substituted for iron and sulfur. Although this is what is expected for these samples, the elements that the analyses have identified as substituting for iron and sulfur are not what we expected. First, gold was not detected in the analyses, which is unusual for this deposit, and indicates that the rims we analyzed are not typical ore-stage rims. Second, silver was not as high as expected and the low abundance of silver in the rims cannot account for the high silver in these rocks. These results indicate that other minerals in the sample must contain the gold and these, or other minerals, may contain significant silver as well. Also the analytical totals determined for the rims are 91.4 to 93.7 weight percent, indicating that there are other elements present in the rims, that were not included in our analyses.

Future work will include analyzing more grains from this and other samples to quantify gold, silver, and other potential metals. In addition, we will reanalyze these crystals to quantify other elements that were not included in our original analyses. Our results will help us understand the geologic processes responsible for the formation of these unusual gold- and trace element-rich pyrite rims that comprise an important source of gold and other metals.

7. References

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