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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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Introduction

The Getchell deposit, which is now known to be a Carlin-type gold deposit, was discovered in 1934 (Joralemon, 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). An unusual characteristic of these deposits is that free gold is generally not present. Instead, gold occurs as submicroscopic particles in the mineral pyrite or marcasite. The marcasite and pyrite that are gold bearing commonly occur as rims on gold-free pyrite or marcasite cores. These rims typically contain, in addition to gold, 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 ore deposits. For example, silver, which is typically very minor, is as abundant as gold. It is currently unclear if this silver is in the pyrite rims with the gold and other hydrothermally transported metals, or if the silver 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 quantify potential metals. In addition, we will reanalyze these crystals to quantify other elements that were not included in our analyses.

Field Area

Looking south along the main pit at Getchell

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

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

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:

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<th>Fe</th>
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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 is 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.

References

Joralemon, P. (1951), The occurrences of gold at the Getchell mine, Nevada, Econ. Geol., 46, 276-310.