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Sulfide Minerals in Intrusive and Volcanic Rocks of the Bingham-Park City Belt, Utah

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Abstract

We report here the results of a reconnaissance study of sulfide inclusions in some intrusive and volcanic rocks from the Bingham-Park City belt in central Utah. The study was undertaken to determine whether primary sulfides were preserved in these rocks and, if so, to assess their role in the geochemistry of copper in the magmas. Numerous samples were studied from the Alta, Clayton Peak, and Flagstaff stocks and a few samples were also studied from the Little Cottonwood, Last Chance, and Soldier Canyon stocks, as well as from the Phoenix dike and the Keetley Volcanics. Our results show that sulfides are present in unaltered intrusive and volcanic rocks. Although most of these inclusions lack hematite and pyrite that are typical products of degassing, at least some inclusions appear to have been modified, possibly by reaction with enclosing iron-bearing host minerals. Measurements of the sizes of inclusions suggest that sulfides contain only 20 to 50 percent of the copper in the rock, whereas sulfide selective analyses suggest that all of the copper in the rock is hosted by sulfides. Despite this uncertainty, compositions of sulfides vary systematically from unit to unit. The distribution of sulfide inclusions in different minerals suggests that mafic intrusions were saturated with sulfur over a longer period of time during their crystallization history than were felsic intrusions. Although there are exceptions, chalcopyrite is most abundant in intrusions emplaced at deeper levels, bornite is found in intrusions emplaced at intermediate levels, and pyrrhotite is found in the shallowest intrusions and volcanic rocks. Finally, apparently unaltered samples of the Last Chance, Soldiers Canyon, and Phoenix bodies contain talnakhite, a copper-bearing sulfide mineral that was not observed in the other intrusive rocks. In view of the close association of the Last Chance and Phoenix bodies with the Bingham porphyry copper deposit, this relationship could be of use in evaluation of the mineral potential of felsic intrusive rocks.