T-2407

A ROCK AND HYDROGEOCHEMICAL EXPLORATION SURVEY IN THE MOUNT BELKNAP CALDERA AREA, UTAH

by

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T-2407

A Thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Master of Science of Geochemistry

Golden, Colorado

Date: 11 Dec, 1981

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ABSTRACT

Rock and hydrogeochemical surveys were conducted in the vicinity of the Mount Belknap caldera, south-central Utah, during the summer of 1979. The Mount Belknap caldera is composed of leucocratic rhyolitic rocks which contain elevated concentrations of elements such as Nb, Be, Ga, Y, Sn, Th and Mo and low concentrations of elements such as Ba, Mg, Ca, Fe, Sr, and Cu. These geochemical relationships suggest that a highly differentiated felsic magma evolved under the caldera, and was the source for the rhyolites and possible intrusive bodies. The geochemical environment of the area is well suited for the formation of porphyry-type molybdenum and associated vein-type uranium mineral deposits. Geochemical exploration utilizing rock and hydrogeochemical samples was conducted to define areas where porphyry-type molybdenum and vein-type uranium mineral deposits may occur.

A 4-level hierarchical sampling design and an analysis of variance were used in the rock geochemical survey. These statistical techniques indicate a 0.64 km^2 sampling cell reflects regional variability for most of the elements used in this survey. The results of the regional rock geochemical survey suggest that a minimum elemental suite

containing Ca, Sr, Fe or Mg; Mo, Nb or Y, would be useful to assess an area's mineral potential in similar physiographic regions. Water samples were collected on an availability basis. The results of the hydrogeochemical survey suggest that a minimum constituent suite containing SO_4, Zn, F or Mn, U, Mo, K or Mg and the pH would be useful to assess an area's mineral potential in similar physiographic regions. The areas of high mineral potential defined by the single element analysis of the two media coincide very nicely.

Q-mode factor analysis was utilized as a data reduction technique. Four factor models, which depict four geochemical suites were selected for interpreting the rock and hydrogeochemical data sets. Factors 1 and 2 for both data sets depict geochemical suites interpreted as reflecting the rhyolitic and intermediate composition rocks within the survey area. Factors 3 and 4 for both data sets depict geochemical suites interpreted as reflectng mineralization and (or) alteration processes that have been superimposed on the original rocks. Factor 3 of the rock geochemical data has high scores for Mo and Ti and is interpreted as reflecting molybdenum mineralization. Factor 4 has high scores for Nb, Ti, Fe and Ni and is interpreted as reflecting possible halos associated with the emplacement of a highly differentiated body. Factor 3 of the

hydrogeochemical data has high scores for SO_4, Ca, Mg, Cl, U, Li, Be, K, F and specific conductivity is interpreted as reflecting uranium mineralization. Factor 4 has high scores for Mo, Ba, Sr, As, F, Ca, B, SO_4 and Cu and is interpreted as reflecting molybdenum mineralization. The definition and spatial distribution of factor anomalies coincides nicely between the two media. The single element data was useful in data interpretation; however, the application of Q-mode factor analysis greatly facilitated and focused the interpretation of the geochemical data for both media.

The use of a varied geochemical exploration scheme has identified several areas within which porphyry-type molybdenum deposits and possibly associated vein-type uranium deposits may be found. More geochemical and geologic work is required to further assess any economic potential of these anomalies.

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