Examining Potential Geochemoic Indicators of Fenitization in Soil Samples Collected from the Gallinas Mountains, Lincoln County, New Mexico

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FENITIZATION

Fenitization is an alkali metasomatic alteration associated with carbonatite and alkali intrusions. Typically, fenitization occurs with enrichments of potassium (K), sodium (Na), and rare earth elements (REE). REEs are comprised of the 15 lanthanide elements, yttrium, and scandium. REEs are increasing in demand with their use in smart phones, LED lights, solar technologies and electric vehicles. Occurrences of fenitization associated with REEs, such as at the Gallinas Mountains mining district, Lincoln County, NM, are therefore of considerable economic and strategic interest. In the 1950s, bastnaesite, a REE mineral, was produced from the Gallinas Mountains. Several companies have conducted exploration programs to identify REE potential therein. Five types of mineral deposits are found in the district: epithermal REE veins, Ce-REE-F veins, REE-F breccia pipe, carbonate breccias, and iron-oxide breccias. Geologic mapping is underway. Additional, detailed mapping and sampling. Geologic mapping and sampling are underway. Analyses for REE elements were conducted by the New Mexico Bureau of Geology and Mineral Resources. REE data were analyzed for ratio REE analyses. Chemical maps were plotted using XRF and ICP methods and a Bruker handheld XRF instrument (HDFR). The variation in results may be a result of coarse-grain size of the sample split, sample not homogenized properly, or poor precision or accuracy using the HDFR of certain elements.

RESULTS

Several types of Tertiary igneous lithologies are found: 1) trachyte to trachyandesite to latite, 2) syenite to microsyenite, 3) andesite, and 4) rhyolitic to rhyodacite. Magmatic-hydrothermal, intrusive breccia pipes intruded the trachyte/syenite and Yerro Formation. The breccia pipes consist of angular to subangular fragments of sandstone, shale, andesite, granitic, granitic gneiss, and trachyte/syenite, which are up to 1m in diameter. Most pipes are matrix supported and altered.

ALTERATION

The predominant style of alteration is fenitization and is represented by K-feldspar, Na-feldspar, and alkali amphiboles, pyroxenes. Mapping, petrographic, mineralogical, and geochemical studies are underway and will be presented in future reports. The trachyte, syenite, andesite, Proterozoic rocks, and intrusive breccia pipes have been altered locally by two separate episodes of fenitization: 1) trachyte to trachyandesite to tuff, 2) syenite to microsyenite. Temperatures ranging from 400 to 700°C are estimated for fenitization (Eckerman, 1966; Kresten and Morgan, 1986; Le Bas, 1967).

Future Work

Addition fieldwork with both handheld XRF and laboratory geochemical analysis should be continued to determine the feasibility of the Bruker handheld XRF instrument. Reanalysis of the data using ratios may resolve analytical problems. The Bruker handheld XRF instrument has potential for rapid, field reconnaissance of REE anomalies are concurrent with alteration and veining. There is no apparent correlation between K and the four REE tests (La, Ce, Nd, Y). Subsequent mapping and geochemical analyses have indicated that REE anomalies are concurrent with alteration and veining. REE anomalies are concurrent with alteration and veining.

REFERENCES


McLemore, V.T., 2010, Geology and mineral deposits of the Gallinas Mountains, Lincoln County, New Mexico; (modified from Kelly et al., 1946; Le Bas, 1967). This paper is part of an on-going study of the mineral resources of New Mexico at NMBGMR and would not have been possible without the support of Dr. Neila Dunbar, Director and State Geologist. This study was partially funded by the USGS Earth MRI (Mapping Resources Initiative Cooperative Agreement 07-55-00001) and a student grant from the New Mexico Geological Society. Strategic Resources included the samples. Ongoing geochemical mapping by Shari Kelley, Matt Zimmerer, and the senior author aided in the interpretations. Thanks also to Marc Miller and Chris Arrigo for technical support.

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Geologic map of the Gallinas Mountains, Lincoln County, New Mexico (modified from Kelly et al., 1946; Le Bas, 1967; Percha, 1961; 1970; Woodward and Fulp, 1991; Schreiner, 1993; McLemore, 2010; field reconnaissance by the authors).