ST.180

Lithogeochemical Vectors and Mineral Paragenesis of Hydrothermal REE-Bearing Fluorite Veins and Breccia Deposits in the Gallinas Mountains, New Mexico

Evan Owen[1], Alexander Gysi[1, 2], Virginia McLemore[2]

1. New Mexico Tech Department of Earth and Environmental Sciences, Socorro, NM, USA, 2. New Mexico Bureau of Geology and Mineral Resources, Socorro, NM, USA

The Gallinas Mountains district, located in Lincoln and Torrance Counties, New Mexico, is host to hydrothermal REE-bearing fluorite veins and breccia deposits. The rare earth elements (REEs) are found in bastnäsite-(Ce) ([La,Ce]CO_3F), which is also the primary ore mineral mined in several important carbonatite deposits (e.g., Mountain Pass in California; Bayan Obo in China). Minor production of REEs, fluorite, Cu, Pb, Zn, Ag, and Fe has been recorded in the Gallinas Mountains district between the early 1900s and the 1950s. The REE-bearing fluorite veins and breccias are hosted in Permian sedimentary rocks as well as genetically related trachyte/syenite sills and dikes emplaced between 30 and 28 Ma. Previous studies have described the REE occurrences in the Gallinas Mountains, but the controls of hydrothermal processes on the transport and deposition of REEs in the district remain unclear. In this study, we combine microtextural observations with mineral and bulk-rock chemistry of hydrothermal REE-bearing fluorite veins and breccias to determine the vein types and alteration styles and establish a detailed mineral paragenesis. The goal of this study is to determine lithogeochemical vectors towards REE-rich zones in the district by linking thin-section and deposit-scale observations with mineral and bulk-rock geochemistry. This district is an exceptional natural laboratory for studying the role of hydrothermal processes for transport/deposition of REEs in an alkaline F-rich magmatic-hydrothermal system because very few deposits worldwide have such well-preserved and exposed geology.

Hand samples of hydrothermal veins and breccias containing fluorite ± calcite ± barite ± bastnäsite-(Ce) were collected from outcrops, prospect pits, and mine dumps. Optical microscopy was used to identify minerals and determine the textural features and crosscutting relationships of the different fluorite veins. The veins were classified into i) hematite-fluorite veins, ii) barite-bearing bastnäsite-fluorite veins, and iii) barite-bearing (fluorite)-calcite veins. Nearly all of the barite crystals in the fluorite veins display dissolution textures (skeletonized crystals) with infilling of mostly fluorite and minor calcite, suggesting that barite is part of an earlier paragenetic mineral assemblage. Bastnäsite-(Ce) is commonly found in veins containing barite and occurs either as disseminated crystals in the fluorite veins or together with fluorite infills around large barite crystals. A few of the barren fluorite-calcite veins display an intergrowth with euhedral barite crystals indicating that these could be part of an earlier barite paragenesis. These textural observations suggest a key control of REE mineralization in the Gallinas Mountains district by a coupled dissolution of barite-bearing (fluorite)-calcite veins and precipitation of later bastnäsite-fluorite veins. Geochemical bulk-rock data collected from the New Mexico Bureau of Geology and Mineral Resources database were analyzed using the IMDEX ioGAS™ program to define geochemical signatures of rock types, alteration styles, and vein types. Preliminary data analysis indicates a positive correlation between Ba, F, and total rare earth oxides (TREO). These trends corroborate with the observed vein microtextures, suggesting that the interaction of a hydrothermal fluid with the barite-bearing (fluorite)-calcite veins represents a key process for defining geochemical vectors in the district.