Timing and Origin of HREE-Enriched Fluorite Mineralization in West Texas and Southern New Mexico, Including Sierra Blanca and the Franklin Mountains

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The main goal of this study is to determine the mineralization timing and origin of the unique Y+HREE (heavy rare earth element) deposit hosted by Round Top Mountain in the Sierra Blanca laccolith cluster in west Texas and compare it to fluorite deposits elsewhere in west Texas and southern New Mexico. Initial operations at the Round Top deposit are underway and the project is estimated to have a mine life of >20 years. Whole-rock geochemistry reveals that the magmatic rocks at the Sierra Blanca cluster are high-K, metaluminous rhyolites. A detailed mineralogical review shows that most of the Y + HREEs reside within the Ca-deficient yttrofluoride, yttrocerite, fluocerite, xenotime and cheralite. New zircon and xenotime U-Pb LA-ICP-MS geochronology data from the Sierra Blanca area indicate magmatism occurred from 38-34 Ma. Inherited zircon show a cluster of ~1.1 Ga dates, which suggest the involvement of granitic basement similar to the 1.1 Ga Red Bluff Granite exposed in the Franklin Mountains. Zircon Lu-Hf (-4 to -10 εHf t) and zircon δ18O (5.5-6.5 ‰) isotopic data from the Sierra Blanca area suggest enriched mantle-derived magma sources. Fluorite from the Organ Mountains caldera (ca. 36 Ma) and the Red Bluff Granite was investigated using LA-ICP-MS for U-Pb dating and REE concentrations to compare with the Round Top deposit. Fluorite from the Organ Mountains contained significant common Pb and did not yield reliable ages, but the data suggests that mineralization occurred during the Cenozoic. Fluorite from the Red Bluff Granite is significantly more enriched in REE (~9000 ppm REE+Y) than the Organ Mountains fluorite (~400 ppm REE+Y). In addition to fluorite, another purple-colored, REE-bearing mineral was identified in the Red Bluff Granite that is tentatively thought to be hydrothermal zircon with up to 10 wt. % REE=Y. U-Pb analysis of this mineral yields an age of 1.05 ± 0.05 Ga. These new data and our ongoing investigations will help provide a more comprehensive understanding of the genesis of the Round Top HREEs deposit and the generation of REE-enriched fluorite mineralization throughout the region.


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