

### **Mineralogy and Geochemistry of REE-Enriched Cryolite-Molybdenite Melt in a Porphyry Molybdenum Deposit, Trans-Pecos Texas, USA**

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The Cave Peak deposit is a Paleogene diatreme-hosted, fluorine-rich molybdenum porphyry system enriched in Nb, REE, and other critical minerals. The Cave Peak intrusive system was emplaced into Paleozoic strata near the western boundary of the north-trending Salt Basin graben during incipient regional extension that culminated in the Rio Grande Rift in central New Mexico. Cave Peak is genetically related to the nearby but unmineralized Marble Canyon Stock and is a highly evolved endmember of this alkalic magmatic system. The Cave Peak intrusive system consists of an outer rhyolite breccia mass with a complex intrusive core, which has been overprinted by multiple hydrothermal events that formed the molybdenum and associated mineralization. Molybdenite is the primary Mo-bearing mineral and typically occurs in stockwork veinlets, commonly with quartz, biotite, and fluorite. Anomalous Cu, Pb, Zn, Sn, and W concentrations are also present.

Unusual molybdenite-bearing aluminofluoride veins are locally present within the Cave Peak deposit, where disseminated molybdenite spherules occur within a matrix of cryolite, ralstonite, elpasolite, pachnolite, chiolite, fluorite, biotite, and amphibole. Geochemical trends and spatial relationships suggest aluminofluoride melt formed during the late-stage of alkali feldspar granite evolution, when the residual melt became enriched in F, Na and Al, depleted in Si and K, and saturated with molybdenite. Whole-rock geochemistry of a representative cryolite-molybdenite sample revealed concentrations of fluorine, Na<sub>2</sub>O, Al<sub>2</sub>O<sub>3</sub>, and molybdenum exceeding 10% (analytical detection limit), 28.9%, 22.5%, and 0.6%, respectively. REE+Y concentrations in the sample are elevated, reaching 3295 ppm. The sample is also enriched in the trace elements of lithium and bismuth, with concentrations reaching 221 ppm and 68 ppm, respectively. Energy-dispersive spectra obtained from scanning electron microscopy revealed the presence of monazite in another cryolite-molybdenite sample.