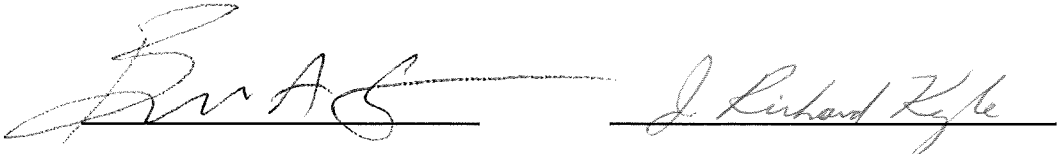
Timing and Characterization of the Cave Peak Porphyry Molybdenum System, Culberson County, Texas

Mert Ugurhan

ABSTRACT

The Cave Peak molybdenum deposit is a breccia-hosted porphyry system located on the eastern flank of the Sierra Diablo mountains in western Texas. The Cave Peak intrusive system consists of an outer rhyolite breccia mass with a complex intrusive core that was overprinted by multiple hydrothermal events. Molybdenite is the primary Mo-bearing mineral and occurs as stockwork veinlets commonly with quartz and biotite and as fine disseminations. At least three spatially and temporally different Mo zones were identified by exploration in the 1960s (Sharp, 1979). Elevated concentrations of Sn, W, F, Nb are also present. The Marble Canyon Stock is an unmineralized, compositionally zoned, monzodiorite and monzonite to quartz syenite pluton located 1.5 km southwest of Cave Peak; previous studies have suggested a genetic link between the two plutons. Petrographic and geochemical studies were conducted on core samples to understand the 3D nature of Cave Peak system. The deposit shows a within-plate geochemical affinity, average (n=10) Nb, Rb, and Sr concentrations of 730, 690, and 61 ppm, respectively, and a highly differentiated magma series. Rare earth element (REE) concentrations are elevated, with average REE+Y concentrations of 758 ppm (n=10) and 437 ppm (n=9) for Cave Peak and Marble Canyon, respectively. Major oxides show linear correlations with silica on Harker variation diagrams. Trace element plots of Rb, U, Th, and Mo also show linear trends implying a link between Cave Peak and Marble Canyon as suggested by Audetat (2010). Quartz syenite and monzonite from the Marble Canyon Stock yielded zircon U-Pb ages of 36.2 ± 0.15 Ma and 36.1 ± 0.09 Ma, respectively. The youngest major intrusion at Cave Peak, an alkali feldspar granite porphyry, yielded a zircon age of 34.8 ± 0.4 Ma, further suggesting these intrusions are related.

We also present Mo isotope signatures of molybdenite samples for the Cave Peak porphyry Mo system. The δ^{98}Mo of 8 Cave Peak samples range between -0.39 ‰ and +0.77 ‰. The mean δ^{98}Mo values decrease from the early upper Mo zone (+0.21 ‰, n=5) to the late lower Mo zone (-0.24 ‰, n=2). One sample from the transitional intermediate Mo zone yielded δ^{98}Mo value of +0.19 ‰. These results might display the progressive evolution of fluids within the system and suggest that fluids exsolved from early intrusive events were enriched in heavier Mo isotopes. Minerals incorporated with heavier Mo isotopes during fractional crystallization leaving the melt enriched in lighter Mo isotopes. During the later stages of hydrothermal events, molybdenite incorporated lighter Mo isotopes. Additional Mo isotope analyses, including for secondary Mo minerals, and Re-Os geochronology of molybdenite from the upper and lower Mo zones is in progress to constrain the specific relationships between the hydrothermal events.



Advisors: **Brent A. Elliott** **J. Richard Kyle**