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Applying recent advancements in Re-Os methodology to molybdenite

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For over two decades, molybdenites from around the globe and spanning most of geologic time have been successfully dated using the Re-Os (rhenium-osmium) geochronometer. Given its high Re (ppb to %) and negligible initial ^{187}Os contents, molybdenite is an ideal candidate for Re-Os geochronology; accurate and reproducible ages are acheivable using a wide variety of procedures and instruments. Nonetheless, as advances in Re-Os methodology have been applied to other sample types (low-level sulfides, hydrocarbons, cherts, etc.), a renewed assessment of the applicability to molybdenite has value.

A coarse, massive clot of molybdenite from the Mount Emmons deposit in Colorado provides the basis for this study. Pure molybdenite sample powders from 0.02 to 1.00 grams were drilled from multiple locations within this single clot. Spatial distribution of Re and ^{187}Os was assessed.

Several potential improvements were tested for Re and Os extraction after sample digestion. Os extraction remains largely unchanged, using solvent extraction followed by micro-distillation. A critical reduction in blank contribution to Os measurements was achieved by pre-treatment of HNO_3 with H_2O_2 [1].

Rhenium extraction procedures, on the other hand, have seen improvements in both initial extraction (acetone-NaOH solvent extraction in place of anion exchange chromotography [2]) and subsequent resin bead "clean-up” [3]. Samples with extremely high Mo:Re, such as the one analyzed, are known to complicate Re column chemistry. Digested molybdenite solution was split and Re extracted via columns and solvent extraction (with and without resin bead clean-up). All measured ratios plot within analytical uncertainty but with improved intensities (and precision) when our newest analytical procedures were used.

[1] Yang *et al.* (2015) *Anal.Chem* **87**, 7017−7021. [2] Georgiev *et al.* (2018) *Chem.Geol* **483**, 151-161. [3] Yang *et al.* (2019), this volume.