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Mapping the impact of LA-ICP-MS/MS on Re-Os geochronology of molybdenite

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Determining absolute age is fundamental to understanding geologic processes such as ore formation. Re-Os geochronology is a powerful tool to directly date sulphide mineralization through analysis of minerals such as molybdenite, pyrite, and chalcopyrite. Re-Os dates have traditionally been produced by bulk techniques such as isotope dilution-negative thermal ionization mass spectrometry (ID-NTIMS). Precise, accurate, and reproducible dates are produced by the ID-NTIMS approach at the loss of spatial resolution and spatial context of phases hosting Re and Os. Retention of the petrographic context and spatial resolution are two of the greatest advantages of modern in-situ measurement techniques such as laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). However, the measurement of Re-Os isotopes by LA-ICP-MS have proven challenging due to the inability to resolve the isobaric interference of ^{187}Re from ^{187}Os requiring corrections >90%. The use of ICP-MS/MS 'tandem' mass spectrometry provides a method to separate ^{187}Re from ^{187}Os through use of a collision-reaction cell placed between two quadrupole mass separation filters in the presence of a reactive gas.

For this study we present the results of LA-ICP-MS/MS Re-Os geochronology analyses of molybdenite ranging in age from ~27 Ma to ~2800 Ma. A (CH_4 + He + H_2) gas mix was added into the collision-reaction cell of an Agilent 8900X ICP-MS/MS coupled to a RESOlution-SE laser ablation system to chemically separate ^{187}Re from daughter ^{187}Os by mass shifting ^{187}Os to mass 201 with minor (~0.2%) ^{187}Re reaction, requiring further interference correction prior to date calculation. Moly Hill molybdenite was used as the primary calibration material. Using static ablation conditions of (6 J/cm^2, 10 Hz, 64-80µm spot, 300-600 laser shots) Re-Os weighted mean ages for molybdenites analyzed were found to be within uncertainty of the preferred age. Laser mapping of individual molybdenite crystals for Re-Os dates was completed using the same ablation conditions and scanning at 3 µm/sec. Preliminary results demonstrate largely homogeneous Re-Os date distributions, however further work will investigate heterogenous date domains present in some samples and correlate age heterogeneity to trace element distributions collected along with Re-Os isotopic compositions.