Comment on recent study of Re and ^{187}Os decoupling in molybdenite using nanoscale technology

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The post-crystallization decoupling of Re and ^{187}Os within molybdenite has long been recognized and is well documented[1,2,3].

Spatial Re and ^{187}Os decoupling within molybdenite is sometimes observed at the (a) microscale, such that an extracted fragment of a single molybdenite crystal, usually coarse grained, deformed, and/or geologically old, yields an erroneous Re-Os age, or (b) nanoscale, where spurious Re-Os ages are documented by LA-MC-ICP-MS with laser beam of 100 μm[3,4]. In both cases (a and b), a geologically meaningful age is possible by mechanically powdering (homogenizing) a molybdenite crystal and isotopic analysis by ID-NTIMS[3,4].

In order to study Re and ^{187}Os decoupling at the nanoscale, Barra et al. investigated two young molybdenite samples from El Alacrán, Mexico (61 Ma) and Miranda, Chile (36 Ma) using EMPA-WDS and NanoSIMS mapping technologies[5]. They concluded no decoupling between Re and ^{187}Os was present based on distribution patterns of ^{185}Re and mass 187 (^{187}Re + ^{187}Os). We calculate ^{187}Os abundances at mass 187 are 0.1% and 0.06% based on well constrained Re-Os ages for El Alacrán and Miranda, respectively. As mass 187 is dominated by ^{187}Re (>99.9%), resolving ^{187}Os to document possible diffusion is qualitative at best. Ideally, a composite map built by subtracting ^{187}Re from the 187 mass using mapped ^{185}Re and Re isotopic composition could show ^{187}Os distribution and possible decoupling but their approach is problematic given [Re] >>> [^{187}Os].

Although qualitative analysis of isotopic mapping by NanoSIMS may not provide insight into Re-^{187}Os decoupling, it is still a powerful tool to study nanoscale distribution of Re and Os in geologic samples.

[1] Stein et al. (1998) SEG Newsletter **32(1)**, 8-15.
[2] Stein et al. (2000) Terra Nova **13(6)**, 479-486.
[3] Stein et al. (2003) GCA **67**, 3673-3686.
[4] Selby et al. (2004) GCA **68**, 3897-3908.
[5] Barra et al. (2017) Nature, Scientific Reports **7,** 16054.