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Origin of ^{182}W Anomalies in Ocean Island Basalts

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Prior studies have reported deficits in ^{182}W for some modern ocean island basalts (OIB) that are negatively correlated with ^{3}He/^{4}He [e.g., 1,2,3]. Proposed explanations include accessing mantle domains formed within the first 60 Myr of Solar System history (^{182}Hf → ^{182}W; $t_{1/2}$ = 8.9 Ma) [1] and core-mantle interaction [1,2,3]. Surprisingly, prior datasets also have ^{183}W variations that are correlated with ^{182}W. This ^{182}W-^{183}W correlation could possibly be nucleosynthetic in nature, due to having a similar slope to nucleosynthetic *s*-process variations observed in meteorites. To investigate possible causes of correlated ^{182}W-^{183}W anomalies, we measured the W isotopic compositions of Samoan and Hawaiian OIB with previously reported ^{3}He/^{4}He. Some Hawaiian OIB were also measured for their mass-independent Mo isotopic compositions to assess the possible presence of nucleosynthetic effects.

The μ^{182}W values (ppm deviations of ^{182}W/^{184}W from standards) for Hawaiian and Samoan OIB measured in our study range from *ca.* 0 to -15, consistent with prior data. However, no ^{183}W variations or ^{182}W-^{183}W correlation are observed in our data, indicating that the ^{182}W-^{183}W correlation in prior datasets is analytical, rather than nucleosynthetic in nature. Similar analytical artifacts have been observed for TIMS measurements of other isotope systems [e.g., 4].

Viable explanations for ^{182}W variations in OIB include core-mantle interaction, either through direct entrainment of core material or diffusion, or, alternatively, an overabundance of late-accreted materials within OIB mantle sources.

Mass-independent Mo isotopic compositions of OIB overlap with the estimate for the BSE from [5], further supporting a lack of observable nucleosynthetic anomalies in OIB at the precision and accuracy currently attainable by modern analytical techniques.

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[4] Andreason & Sharma (2009) Int. J. Mass Spec. 285, 49–57.

[5] Budde et al. (2019) Nat. Astron. 3, 736–741.