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Mantle heterogeneities derived from the core-mantle interaction

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The anti-correlation between the $^{3}He/^{4}He$ and $^{182}W/^{184}W$ ratios, and the absence of highly siderophile elements observed in some ocean island basalts (OIBs) point to a possible contribution from the Earth's core. However, it remains elusive how to selectively transport He and W but not HSEs from the core to the OIB source. Here, we perform high-pressure experiments and large-scale atomistic simulations to evaluate the efficiency of transporting elements from the core to the mantle via oxide exsolution. Our results suggest core exsolution can selectively transport He and W but not HSEs [1,2]. The selective transport of core-like signatures via core exsolution can effectively explain the observed primordial signatures in ocean island basalts. Based on this finding, we propose a new long-term core-mantle chemical interaction model termed basal exsolution contaminated magma ocean (BECMO) which considers the addition of oxide exsolved from the core into the basal magma ocean [3]. We discuss the implications of BECMO for forming deep mantle geochemical and geophysical heterogeneities of various scales.

References:

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