THE SEARCH FOR EVIDENCE OF CHEMICAL INTERACTIONS BETWEEN THE CORE AND MANTLE

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Coupled ^{187}Os-^{186}Os systems and ^{182}W have been proposed to be potentially useful in the search for evidence for chemical/isotopic interaction between the core and silicate Earth. The premise behind Os as a diagnostic tool is that the outer core has evolved to an isotopic composition that is distinct from anything produced in the mantle. Also, for the core to have evolved to a unique composition, the inner core must have formed sufficiently early and solid metal-liquid metal distribution coefficients must be sufficiently large. Whether or not these conditions are met by the core is debatable. Previous work has reported coupled enrichments consistent with predicted outer core contributions to some Hawaiian picritic lavas [1]. Although sources for similar coupled enrichments have been proposed for some mantle processes, such sources have not yet been confirmed by measurement. Higher precision measurements of Hawaiian picritic lavas reveal greater complexities than earlier studies reported. For example, the correlation between ^{187}Os and ^{186}Os is less well defined for Mauna Kea lavas than previously revealed, indicating mixing processes were more complicated than simple two component mixing between ambient upper mantle and core, or between ambient upper mantle and an enriched mantle component.

Tungsten could provide independent or corroborating evidence for core-mantle interaction. Mass balance arguments suggest that the core should be depleted in ^{182}W relative to the silicate Earth by about 2 parts per 10,000. One previous study reported no resolvable depletion of ^{182}W in Hawaiian picrites that do show coupled ^{187}Os-^{186}Os enrichments [2]. Our measurements of W concentrations in Hawaiian picritic lavas, however, reveal generally high concentrations that are inconsistent with derivation from a W depleted mantle source. The excess W may reflect the presence of recycled W-rich crust in the mantle sources of at least some of the lavas. At present there are insufficient data to assess whether W concentration correlates with other indicators of crustal contamination or whether any Hawaiian picrites are sufficently depleted in W so as to be useful in the search for a core component.

[1] Brandon A.D. et al. (1999) *EPSL* **174**, 25-42.
[2] Schersten A. et al. (2004) *Nature* **427**, 234-237.