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Tungsten Isotope Systematics and Mantle Geochemistry.

A. Scherstén(1), T. Elliott(2) and C. Hawkesworth(2)

(1) Faculteit der Aard- en Levenswetenschappen, Vrije Universiteit, De Boelelaan 1085, 1081 HV Amsterdam, Netherlands, (2) Department of Earth Sciences, University of Bristol, Will's Memorial Building, Queen's road, Bristol BS8 1RJ, UK (Anders.Schersten@falw.vu.nl / Phone: +31 20 598 7335)

The ^{182}Hf-^{182}W system provides powerful constraints on early planetary evolution since core formation strongly fractionates Hf/W ratios. W isotope compositions of iron meteorites are unradiogenic relative to chondrites, whereas terrestrial and meteorite silicate (SNC, HED and lunar) samples are super-chondritic. These data firmly establish that ^{182}Hf-^{182}W was extant during approximately the first 50 million years of solar system history and that iron segregation during core formation was the dominant cause of the W isotope variations. Mass balance for a chondritic bulk Earth requires that the Earth's core is about 2 parts in 10 000 less radiogenic than the estimated bulk silicate Earth (BSE). This assumes that BSE has a homogenous ^{182}W/^{184}W composition and that the core-mantle difference is entirely due to core formation. However, mantle ^{182}W/^{184}W heterogeneities could form through a core contribution to the mantle or by meteoritic influx. Continuous or episodic addition of unradiogenic tungsten to the mantle from the core should lower the ^{182}W/^{184}W of mantle-derived rocks over time or produce anomalously unradiogenic tungsten in e.g. plume rocks that carry a core contribution. High precision ($\sim$10 ppm external reproducibility) ^{182}W/^{184}W provides constraints on core contribution to the mantle and the extent to which there were any mantle heterogeneities due to core-mantle disequilibrium. We have investigated the W isotopic composition of Hawaiian picrites. The same rocks have been argued to contain a core component from both Os isotope and Fe/Mn measurements, although problematically, the variations in these independent proxies do not correlate. We argue that W isotopes provides a more robust measure of possible addition of core material to the silicate mantle. We find no evidence for a core contribution to the source of the

Hawaiian picrites.