Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10206

A review of ^{182}W in terrestrial systems

RICHARD J WALKER

University of Maryland

Presenting Author: rjwalker@umd.edu

The ^{182}Hf-^{182}W isotope system (^{182}Hf: $t_{1/2}$ = ~9 Myr) is a valuable tool for examing metal-silicate and silicate-silicate processes that occurred during the first ~60 Myr of the Solar System, as well as subsequent mixing processes. Over the past decade, a substantial number of W isotopic data have revealed ^{182}W anomalies in both ancient and young terrestrial rocks. Major discoveries include the observations that early Earth rocks appear dominated by comparatively uniform positive ^{182}W anomalies, yet some modern ocean island basalt (OIB) systems include rocks with negative ^{182}W anomalies. The causes of the various anomalies remain highly debated. These findings have led some to assume that rocks with anomalous isotopic compositions are quite common. More likely, the propensity of papers reporting anomalous isotopic compositions stems from the fact that particular rocks (e.g., Eoarchean; modern rocks with high ^{3}He/^{4}He) have been principally targeted for analysis because they have been deemed most likely to record evidence for primordial processes.

Important issues remain and will be discussed including the following two examples. First, do we know the isotopic composition of the modern bulk silicate Earth? Comparatively few modern rocks, such as mid-ocean ridge basalts (MORB), have been analyzed. However, the fact that those MORBs analyzed, and OIB with upper mantle-like ^{3}He/^{4}He have no anomalies suggests that at least the upper mantle has a ^{182}W composition similar to the in-house standards used. Nevertheless, additional data are needed to confirm this supposition. Second, what is the nature of the evolution of ^{182}W in the mantle through time? For example, was there a continuum in decreasing ^{182}W compositions from the positive anomalies that dominated Eoarchean rocks to a modern silicate Earth with no anomaly? Instead, several studies have suggested a rapid decline in the magnitude of ^{182}W anomalies during the Paleoarchean, with most mantle-derived rocks exhibiting normal compositions as the Archean-Proterozoic boundary is approached. Causes of the apparent near step-function change remains uncertain, but could reflect the beginnings of major plate tectonics. However, there remains a paucity of data for rocks from the putative transition period, and especially for rocks generated during the Proterozoic.