The Ru isotope composition of the Earth's pre-late veneer mantle

M. FISCHER-GÖDDE[1], B.-M. ELFERS[1], C. MÜNKER[1], K. SZILAS[2], W.D. MAIER[3], T. MORISHITA[4], H. SMITHIES[5], N. MESSLING[1]

[1]Inst. f. Geol. und Min., Univ. of Cologne, Germany
[2]Department of Geosci., Univ. of Copenhagen, Denmark
[3]School of Earth and Ocean Sciences, Cardiff Univ., UK
[4]Faculty of Natural System, Kanazawa University, Japan
[5]DMIRS, WA Gov., Australia

The presence of primordial accretion-related isotope signatures in the Earth's mantle has been suggested based on ^{182}W anomalies in 3.8 Gyr-old Archean rocks. However, the combined observation of modern mantle-like HSE abundances in the same rocks and the discovery of ^{182}W anomalies in modern basalts pose a problem for the straight forward interpretation of ^{182}W anomalies to represent such primary signature. Therefore, in this study we expand the search for primordial mantle signatures by using mass-independent Ru isotope compositions for a set of ultramafic rocks from different Eoarchean to Paleoproterozoic terranes. We report the first high-precision Ru isotopic data for 3.8 Gyr-old rocks from SW Greenland, which exhibit a $^{100}Ru/^{101}Ru$ isotope composition that is on average 17±3 ppm (95% conf.) higher than the present-day mantle. The ^{100}Ru excess in these rocks indicates that their mantle source was at least partially isolated from the late veneer and thus contains a fraction of Ru that pre-dates the late veneer. Moreover, because the pre-late veneer Ru is enriched in nuclides produced by the slow neutron capture process (*s*-process) of nucleosynthesis, its distinct isotope composition can only be balanced by late accretion of *s*-process depleted meteoritic materials to yield the Ru isotopic composition of the modern mantle. Therefore, these data relax previous Ru isotope constraints on the nature of the late veneer and reopen the possibility for late accretion of water and volatiles with the late veneer.