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Osmium isotopic composition of pre-late accretion mantle from the "world's oldest" peridotites

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A range of isotopic and geochemical proxies indicate that late accreted materials were not fully mixed into Earth's mantle before the formation of the oldest known mantle-derived rocks. A number of studies have focussed Eoarchaean rocks from SW Greenland, which show significant isotopic anomalies in a number of short-lived and stable isotope systems [1,2]. Of particular interest is the Ujaragssuit Intrusion, SW Greenland, which shows evidence of a Hadean formation age or mantle depletion event, and nucleosynthetic Ru isotope anomalies consistent with incomplete late accretion [3,4]. We present a combined field mapping, U-Pb zircon and Re-Pt-Os isotopic study with the aim of confirming the age of the Ujaragssuit Intrusion, and constraining the Os isotopic composition of pre-late accretion mantle. Surprisingly, Re-Pt-Os isotopes give a concordant ^{187}Os-^{186}Os age of ~3.25 Ga. A re-examination of previous studies shows this is consistent with all previously published Re-Pt-Os data, and we find no evidence for Hadean mantle depletion. This age is also consistent with field relationships and U-Pb zircon data, and confirms long-term survival of mantle domains poor in late accreted materials on a ~billion year timescale [4]. Combining our data with that of previous authors [3] means the Ujaragssuit Intrusion has the most precisely measured ^{187}Os-^{186}Os composition of any single mantle-derived suite on Earth. We discuss the significance of this data for the Os isotopic composition of pre-late accretion mantle and the long-term survival of accretionary anomalies in various isotopic systems.

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