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Highly siderophile elements in 3.8 Ga ultramafic rocks from Labrador, Canada

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The overabundance of highly siderophile elements (HSEs) in the modern terrestrial mantle, relative to predicted composition is frequently attributed to the late influx of chondritic materials (late veneer) after the efficient stripping of HSEs to the metallic core. Although this model is not universally accepted due to insufficient knowledge of metal-silicate partitioning under high pressure and temperature conditions, broadly chondritic ratios of HSEs in fertile peridotites from a variety of tectonic settings provide strong support for the late veneer model. A recent discovery of ^{182}W enrichments in ~3.8 Ga crustal rocks from Isua, West Greenland suggests that this area of Earth's surface has escaped addition of the late veneer, and remained unaffected by subsequent replenishment. Furthermore, possible secular increase of HSE abundances for the komatiite source has been attributed to the progressive pollution of the HSE-poor deep mantle by the late veneer component between 3.5 and 2.9 Ga. These studies raise the possibility that ~3.8 Ga ultramafic rocks recognized from West Greenland and its eastern extension in Labrador, Canada, can be used to establish HSE abundances of the Earth's mantle before the arrival of the late veneer.

We present HSE abundances and Re-Os systematics for a set of ultramafic rocks from Saglek-Hebron area of northern Labrador. Based on field and geochemical data, they were classified into two suites: residual peridotites occurring as tectonically-emplaced slivers of lithospheric mantle, and metakomatiites comprising mostly pyroxenite layers in supracrustal units. The samples analysed here have been investigated previously for Sm-Nd and Pb-Pb systematics, supporting their >3.8 Ga formation. Thus, the primary aim is to test whether the meta-peridotites and komatiites record peculiar HSE signatures of the early Archean shallow and deep mantle, respectively. The two suites display contrasting HSE patterns that are consistent with their inferred protoliths. The harzburgitic to dunitic metaperidotites are typically marked by depletion of Pt, Pd and Re relative to Os, Ir and Ru, resulting from extensive melt extraction. In contrast, metakomatiites show smooth patterns with gentle positive slopes (except for Re). Overall, in terms of HSE patterns and abundances, both suites do not differ from their late Archean equivalents, such as the harzburgitic to dunitic xenoliths from North Atlantic Craton and the 2.7 Ga Belingwe/Abitibi komatiites. Moreover, a rare lherzolitic sample has a very similar HSE pattern to that of primitive upper mantle (PUM) estimated on the basis of dataset of post-Archean peridotites. These observations suggest that 3.8 Ga mantle has already been influenced by the late veneer. We will discuss the possible reasons for the decoupling between W isotope evidence from crustal rocks and HSE signatures in mantle-derived materials.

Keywords: highly siderophile elements, peridotite, komatiite, Archean, late veneer