PLATINUM STABLE ISOTOPE TRACING OF EARTH'S ACCRETION AND DIFFERENTIATION.

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The platinum group elements (PGE: Ru, Rh, Pd, Os, Ir, Pt) are highly siderophile and therefore strongly partitioned into the metallic cores of terrestrial planets during planetary differentiation. This behaviour has provided key constraints on the accretion and differentiation of Earth [1–3]. The relatively high concentrations and chondrite-like relative abundances of the PGE in Earth's mantle are thought to reflect late addition of ca. 0.5% of Earth's mass of chondritic material after Earth's core had largely formed [4,5]. However, experimental data suggest that the PGE may become less siderophile at higher pressures and temperatures, and thus the observed mantle concentrations of PGE could instead reflect different physical conditions during core formation [3,6]. The recently developed Pt stable isotope system [7,8] provides a unique tool for investigating this problem, as a late veneer of chondritic material would be expected to imprint the mantle with a Pt stable isotopic signature that is distinct from one produced by metal-silicate differentiation.

We will present Pt stable isotope data for a range of carbonaceous, enstatite and ordinary chondrites, primitive achondrites and iron meteorites and compare those with samples of terrestrial mantle. Preliminary data show that chondrites are isotopically similar to the mantle, while primitive achondrites, which represent parent bodies that have undergone only the most preliminary stages of planetary differentiation, are fractionated towards heavier isotopic compositions. This suggests that planetary scale metal–silicate partitioning should fractionate Pt stable isotopes toward extremely heavy isotopic compositions. The concomitant depletion of Pt in the post-core-formation mantle means that the extreme Pt stable isotopic composition could be easily overprinted by addition of the proposed late-veneer.

References:

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