Pt isotope anomalies in chondrites

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Isotopic heterogeneities in bulk meteorites have been reported for various elements, including Mo and Ba, suggesting incomplete mixing of at least some nucleosynthetic components in the early solar system. Here, we present the first results obtained in a coupled search of nucleosynthetic and stable Pt isotope anomalies in chondrites, to better constrain the nature and origin of such isotopic heterogeneities.

Platinum is a highly siderophile element with six stable isotopes of very different abundances: ^{190}Pt (0.01%), ^{192}Pt (0.78%), ^{194}Pt (32.97%), ^{195}Pt (33.83%), ^{196}Pt (25.24%), and ^{198}Pt (7.16%). Precise Pt isotope measurements are hindered by various isobaric interferences (^{190}Os, ^{192}Os, ^{196}Hg, ^{198}Hg) and potential peak tailing effects (^{191}Ir, ^{193}Ir). Since the low abundance ^{192}Pt is the only Pt isotope that is almost exclusively formed by slow neutron capture (s-process) during nucleosynthesis, it is imperative that samples are carefully purified prior to isotopic analyses to ensure reliable determination of nucleosynthetic Pt isotope anomalies. The method for high-precision stable Pt isotope measurements utilizes a Pt double spike with enriched ^{198}Pt and ^{196}Pt [1].

To separate Pt from the chondritic sample matrix, and in particular from Os and Ir, we modified and optimized chemical purification procedures described in earlier studies [2] [3]. To date, both spiked and non-spiked Pt isotope measurements were carried out on the IRMM-010 Pt standard reference material and two ordinary chondrites from North West Africa (NWA).

Our preliminary analyses document an essentially identical stable $\delta^{198/194}$Pt for the chondrites (NWA-1 $\delta^{198/194}$Pt = –0.04‰; NWA-2 $\delta^{198/194}$Pt = +0.02‰; n = 6, ±0.07‰ 2SE) relative to IRMM-010 Pt ($\delta^{198/194}$Pt = 0). The first analyses of nucleosynthetic Pt isotope anomalies returned patterns that are not in accord with modelling results of purely nucleosynthetic Pt isotope effects, potentially due to exposure of the samples to cosmic rays. Additional isotopic measurements on various ordinary and carbonaceous chondrites are in preparation to confirm these initial results.

[1] Creech *et al.* (2013) *J. Anal. At. Spectrom.* **28**, 853-865. [2] Rehkämper *et al.* (1997) *Talanta* **44**, 663-672. [3] Creech *et al.* (2014) *Chem. Geol.* **363**, 293-300.