Origin of Earth's late-stage building blocks

Hellmann*, J.L., Spitzer, F., Kleine, T., *Max Planck Institute for Solar System Research, 37077 Göttingen, Germany (hellmannj@mps.mpg.de)

Determining the origin of Earth's building blocks and the timing of their accretion onto Earth is central to models of terrestrial planet formation. Nucleosynthetic isotope anomalies allow to distinguish between materials originating from the inner (non-carbonaceous, NC) and outer (carbonaceous, CC) solar system. Of these, Mo isotope anomalies are particularly useful, because owing to its moderately siderophile behavior, most of the Mo present in the bulk silicate Earth (BSE) was delivered during the final 10 to 20% of accretion. Based on a mixed NC-CC heritage of the BSE's Mo it has been concluded that the late stages of Earth's growth contained a relatively large fraction of CC material [1]. More recently, however, it was proposed that the BSE and the NC-type IAB iron meteorites have identical Mo isotopic compositions, implying that Earth's late-stage accretion was predominantly NC [2]. Here, we present new Mo isotope data for main-group IAB iron meteorites. We show that the Mo isotopic compositions of IAB irons are distinct from the BSE. This implies that the BSE has a mixed NC-CC Mo isotopic composition, indicating the late-stage addition of CC material to Earth.

[1] Budde et al. (2019) Nat. Astron. 3, 736–741.
[2] Bermingham et al. (2025), GCA 392, 38–51.