EVIDENCE OF Nb/Ta HETEROGENEITY IN THE EARTH’S MANTLE

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The imbalance between the chemical composition of the silicate Earth and that of chondrites has arisen several geochronological paradoxes, which are used to model planetary accretion and better understand how Earth formed and evolved through time. Some of the key constraints on early differentiation processes assume that our proto-Earth had a bulk homogeneous subchondritic composition in the elements niobium and tantalum (Münker et al., 2003), and that no secular variation in their relative abundance occurred since accretion. Here, we provide new evidence that mantle domains variably enriched in niobium/tantalum, even approaching the chondritic composition, exist and have been periodically sampled since early Archean times by magmas formed at depth and emplaced on the surface. These domains likely reflect re-enrichment of an originally niobium-depleted magma ocean through addition of extra-terrestrial chondritic material. We argue that the postulated enrichment process occurred during a giant impact after core formation, in a time window that coincides with the collision that is thought to have generated the Earth’s Moon.

REFERENCES