

Tracing Earth's Missing Building Materials in Meteorites

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Nucleosynthetic isotope anomalies provide insights into the building materials of planets. The compositions of Earth and Mars follow non-carbonaceous (NC) meteorite trends, suggesting that they accreted from inner Solar System material [1]. However, Earth's composition consistently defines the s-process-enriched endmember of NC trends, implying the contribution of a component absent among known meteorite components.

To search for this component, we analyzed fine-grained, matrix-rich fractions from primitive NC chondrites. Their Ti isotopic compositions deviate from that of the bulk host, shifting toward or beyond Earth. Zirconium isotope data from matrix-enriched fractions indicate s-process enrichment, consistent with an origin in the inner Solar System. We propose that this component represents a missing Earth's building material, heterogeneously distributed within the NC reservoir, and only locally preserved in the matrix.

[1] Burkhardt, C. et al. (2021) Sci. Adv. 7, eabj7601.