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Remnants of Lunar Differentiation and SPA Impact Found in Chang'E 6 Clasts

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The prevailing explanation for the chemical, age, and petrographic diversity of lunar rocks collected by the Apollo, Luna, and Chang'E-5 missions on the nearside supports a initial large scale melting of the Moon, lunar magma ocean (LMO). Cooling and crystallization of the LMO formed diverse cumulates, which later underwent an overturn and partial melting. The sampling of regolith from the South Pole-Aitken (SPA) basin by CE6 offers a unique opportunity to test these models with farside material.

Here, we present radiogenic Sr-Nd-Hf isotopic analyses of soil and clasts collected by the Chang'E-6 (CE6) mission, revealing two distinct mantle reservoirs beneath the SPA basin, including the low-Ti basalts and KREEP-bearing basalts. Assuming that the low-Ti basalts formed at a same age to recently published CE6 low-Ti basalt clasts (~2.8 Ga), its initial Sr-Nd-Hf isotopic features indicate a more depleted source than known lunar nearside mare low-Ti basalts. The other reservoir displays enriched Sr-Nd-Hf isotopic features, resembling the nearside KREEP-bearing samples for its enrichment in K, REE, and P. This discovery implyies that the KREEP component spreads in both nearside and farside moon, supporting the LMO model through the whole moon.