Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28110

# Stable Sr Isotope Constraints on Crust-Mantle Interactions in the South Pole-Aitken Basin: Insights from Chang'E-6 Samples

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The lunar dichotomy, a prominent concept in lunar geoscience, is characterized by pronounced asymmetries between the nearside and farside of the Moon in terms of topography, crustal thickness, and chemical composition. The Chang'E-6 (CE-6) mission returned 1935.3 g of regolith from the South Pole-Aitken (SPA) basin, the Moon's oldest and largest impact structure, providing unprecedented insights into farside magmatism and crustal evolution. This study presents stable Sr isotope ($\delta^{88}Sr$) compositions, whole-rock elements composition, and Eu anomalies of CE-6 basalts, KREEP basalts, anorthosites, breccias, and soils, along with nearside samples and lunar meteorites.

The CE-6 low-Ti basalts exhibit $\delta^{88}Sr$ values variation overlapping nearside analogues but exhibit weaker negative Eu anomalies, despite their high magmatic evolution magnitude (Mg# = 21–38). Rayleigh fractionation models indicate that the $\delta^{88}Sr$-Eu/Eu* and $\delta^{88}Sr$-Mg# trends in CE-6 basalts primarily reflect source processes rather than fractional crystallization. Similarly, KREEP basalts from the SPA basin also show elevated $\delta^{88}Sr$ and higher Eu anomalies compared to nearside KREEP basalts, suggesting the unique source nature. Mixing models reveal that SPA magmas incorporated plagioclase-rich crustal materials during ascent. Two texturally distinct anorthosite types further support post-impact melt sheet evolution. More detailed discussion on the role of the SPA impact in driving lunar compositional asymmetry will be presented at the conference.