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A reassessment of the iron isotope composition of the Moon and its implications for accretion and differentiation of terrestrial planets

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Iron isotope composition of planetary bodies may provide constraints on their accretion modes and/or differentiation processes but Fe isotope systematics of key planetary reservoirs need to be precisely determined. New δ^{57}Fe analyses of >30 lunar mare basalts and highland rocks, combined with published data, reveals a significant δ^{57}Fe difference between low-Ti and high-Ti mare basalts. The mean δ^{57}Fe for highland rocks is not defined precisely enough to be of critical use for comparative planetology. The non-representativeness of the aliquots of coarse-grained highland rocks appears to cause the Fe isotope heterogeneity. The newly obtained δ^{57}Fe of the bulk Moon is akin to that of the Earth, and higher compared to other planetary bodies. Only Si shows similar planetary systematics, pointing to the involvement of metallic cores of the Earth and Moon in the interplanetary Fe and Si isotope fractionation. We envisage partial vaporization of the liquid outer metallic core in the aftermath of a Moon-forming impact rather than via high-pressure metal–silicate fractionation at the core–mantle boundary.

Cite abstract as:
Poitrasson, F., Zambardi, T., Magna, T., Neal., C.R. (2019) A reassessment of the iron isotope composition of the Moon and its implications for accretion and differentiation of terrestrial planets. Paneth Kolloquium, Nördlingen (Germany), abstract URL: http://www.paneth.eu/PanethKolloquium/2019/0019.pdf (abstract #0019).