Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.7283

Chromium isotope composition of Apollo samples: implication for galactic cosmic ray induced reactions

PRÉCILLIA MORINO[1], MARIA SCHÖNBÄCHLER[2], COLIN MADEN[2] AND HENNER BUSEMANN[2]

[1]Institute of Geochemistry and Petrology, ETH Zürich,
[2]ETH Zürich

Presenting Author: precillia.morino@erdw.ethz.ch

It is generally accepted that the Moon formed by a giant collision between proto-Earth and a large impactor, Theia [e.g., 1]. Nevertheless, the composition of Theia remains subject to debate. Several isotopic studies show strong similarities between bulk silicate Earth (BSE) and the Moon [e.g., 2], constraining the formation scenario. A recent O isotope study [3] proposes, however, that this similarity is only apparent and remnants of Theia could be preserved in the deep reservoirs of the Moon. Therefore, it is essential to continue to characterize its isotopic composition with high precision analyses. Each planetary body in our solar system, except Moon and Earth, has its own nucleosynthetic ^{54}Cr isotope compostion and thus ^{54}Cr data have the potential to further constrain the origin of Theia, when compared the solar system inventory [2]. To this end, ultraprecise Cr isotope data for lunar samples are required. Nuclear reactions induced by exposure to galactic cosmic rays (GCR) affect the Cr isotope composition of lunar samples and need correction to obtain the initial isotope compostion [4]. The production of cosmogenic Cr depends on several factors such as chemical composition of the rock, exposure parameters and nature of the GCR-induced reactions [4,5]. Since noble gases are extremely sensitive to GCR irradiation, this study combines He, Ne, Ar Kr and Xe analyses with ultra-high precision Cr isotope data (< 5 and 7 ppm for ε^{53}Cr and ε^{54}Cr (2SE), respectively) for 18 Apollo samples. All isotope measurements are being carried out on the same sample aliquots at ETH Zürich. Our results show that Cr isotope data correlate with the duration of exposure and the specific GCR-induced reactions involved.

[1] Canup, R. M. (2004) *Icarus* 168:433–456. [2] Akram, W. & Schönbächler, M. (2016) *Earth Planet. Sci. Lett.* 449:302–310. [3] Cano (2020). *Nature Geoscience*,13:270-274 [4] Leya I. et al. (2003) *Geochim. Cosmochim. Acta* 67:529–541. [4] Mougel B. et al. (2018) *Earth Planet. Sci. Lett.* 481:1-8. [5] Liu J. et al. (2019) *Geochim. Cosmochim. Acta* 251:73-86.