Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20307

# Crust recycling into the martian mantle inferred by Rb isotope composition

**CELIA BRESSON**[1], MARTIN SCHILLER[2] AND MARTIN BIZZARRO[1]

[1]Centre for Star and Planet Formation
[2]Globe Institute
Presenting Author: celia.bresson@sund.ku.dk

Rubidium (Rb) is a moderately volatile, fluid-mobile and incompatible element that can trace magmatic and fluid-related processes. We report the rubidium isotope composition of 20 Martian meteorites to understand the Rb isotope composition of Mars and to search for possible crustal recycling on Mars. The selected samples include shergottites, nakhlites and a chassignite (SNCs), representing the range of Martian mantle meteorites. Rb isotope compositions range from -0.213 ± 0.041‰ to 0.297 ± 0.007‰, irrespective of their meteorite group. Notably $\delta^{87}$Rb values co-vary with Rb content and Mg#. The incompatible nature of rubidium results in its preferential enrichment in the melt during partial melting and differentiation, ultimately generating a crust highly enriched in Rb relative to the mantle. However, this process does not appear to generate significant enrichment of the heavy Rb isotope in the melt or resulting crust [1]. Instead, large enrichments in heavy Rb isotopes have been linked to weathering and fluid interactions [2, 3]. As such, assimilation of altered crustal material during magmatic accent appears to be a viable mechanism to explain heavy Rb isotope signatures of SNC meteorites. This agrees with the observation of nucleosynthetic Cr isotope ($\mu^{54}$Cr) variability in Martian meteorites, interpreted to reflect progressive assimilation of a crust enriched in exotic carbonaceous chondrite material[4]. In detail, samples with the highest contribution of exotic $\mu^{54}$Cr also record the heaviest $\delta^{87}$Rb compositions, supporting the idea that crustal assimilation is key to explain the Rb isotope variability of Martian meteorites. Taking into account the possible contamination of Martian mantle melts with crust, the Rb isotope composition of the bulk Martian mantle is best represented by samples with the lightest Rb isotope composition and high Mg# implying that $\delta^{87}Rb_{BulkSilicateMars}$ ~ -0.2‰, indistinguishable from BSE, which disagrees with earlier estimates [5].

1. Zeng, H. et al. *ACS Earth Space Chem.* **3**, 2601–2612 (2019).
2. Zhang, Z. et al. *Geochimica et Cosmochimica Acta* **313**, 99–115 (2021).
3. Hu, X. et al. *Geochimica et Cosmochimica Acta* **336**, 165–176 (2022).
4. Zhu, K. et al. *Science Advances* **8** (2022).
5. Nie, N. X. et al. *Geochimica et Cosmochimica Acta* (2023).