Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36263

In-situ Rb-Sr dating of Martian meteorites using LA-MC-ICP-MS/MS

MILES LINDNER, TIMO HOPP AND THORSTEN KLEINE
Max Planck Institute for Solar System Research

Understanding the evolution and differentiation history of Mars requires knowledge about the timing of major rock-forming events. Thus far, ~240 Martian meteorites have been identified in the meteoritic record on Earth. Over 80% of these Martian meteorites are mafic to ultra mafic magmatic rocks called shergottites. Other types of Martian meteorites are chassignites and nakhlites, as well as orthopyroxenite ALH 84001 and the polymict regolith breccia NWA 7034 [1]. The available crystallization ages of Martian meteorites suggest that only limited periods of the Martian geological record appear to be represented in the meteorite collection. However, crystallization ages are available for only <30% of Martian meteorites [3], reflecting in part limited availability of sufficient sample mass and the time-consuming sample preparation typical for traditional geochronological methods. *In-situ* methods offer higher sample through-put and are nearly non-destructive for the samples. We use laser ablation multi-collector inductively-coupled-plasma tandem-mass-spectrometry (LA-MC-ICP-MS/MS) Rb-Sr measurements with SF_6 as a reaction gas [4] to determine crystallization ages for Martian meteorites that have yet not been dated. Our method includes correction for Y- and Zr-oxides [5], which is important for measuring phases enriched in incompatible elements with high $^{87}Rb/^{86}Sr$, and for obtaining accurate crystallization ages. We determined *in-situ* Rb-Sr crystallization ages of ~193 Ma and ~201 Ma for the two enriched shergottites NWA 8656 and NWA 12960, which are within the range of crystallization ages (165-225 Ma) previously reported for enriched shergottites. The initial Sr isotopic composition [$(^{87}Sr/^{86}Sr)_i$] of ~0.723 for the two samples also is consistent with that found for other enriched shergottites [1]. Crystallization ages for additional shergottites that have not yet been dated will be presented at the conference.

[1] Udry et al. (2025), *PNAS*, 122, 2;
[2] Udry et al. (2020), *JGR Planets*, 125, 12;
[3] Váci and Agee (2020), *Geosciences*, 10(11), 455
[4] Dauphas et al. (2022), *JAAS* 37, 2420-2441
[5] Lindner et al. (2025), Goldschmidt 2025, #30016