
[EJ] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS07] Mars and Mars system: results from a broad spectrum of Mars studies and aspects for future missions

convener: Hideaki Miyamoto (University of Tokyo), Tomohiro Usui (Earth-Life Science Institute, Tokyo Institute of Technology), Ayako Matsuoka (宇宙航空研究開発機構 宇宙科学研究所 太陽系科学研究系, 共同), Sushil K Atreya (University of Michigan Ann Arbor)

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Unprecedented progress in being made in our understanding of the planet Mars, especially because of new data from the US, European, Russian, and Asian missions to Mars. Eight spacecraft are currently operating at Mars, with six in orbit (Odyssey, MRO, MAVEN, Mars Express, Mangalyaan and TGO) and two on the surface (MSL-Curiosity and MER-Opportunity), the largest number ever at any given time. In addition InSight Lander is on track for launch in 2018, and Mars 2020, ExoMars and the Emirates Mars Mission in 2020. All this is a clear demonstration of public's strong fascination with and commitment to Mars exploration and the resulting scientific bonanza. Synergistic investigations with ongoing or already completed missions along with modeling studies and earth-based observations are gradually revealing the nature of Earth's most closely resembling planet that took on a different evolutionary track. Morphology and variable phenomena seen on the surface (RSLs, for example) indicate the red planet may possibly be still active, and require a clear understanding of its current geologic and atmospheric state, climate evolution and habitability. Thus, this session is planned to discuss recent results from a broad spectrum of Mars studies encompassing the interior, surface, atmosphere, plasma environment, and the Mars system including its two satellites. Abstracts on instrumentation and future mission plans are also encouraged for this session, as both the presenters and the audience would greatly benefit from ensuing discussions and feedbacks.

[PPS07-P07] Preliminary Report on U-Th-Pb Isotopic Systematics of NWA 7034: Implications for Geochemical Evolution of the Martian Crust

*Minato Tobita¹, Ryota Moriwaki¹, Tomohiro Usui², Carl B. Agee³, Mizuho Koike⁴, Tetsuya Yokoyama¹
(1. Department of Earth and Planetary Sciences, Tokyo Institute of Technology, 2. Earth-Life Science Institute, Tokyo Institute of Technology, 3. Institute of Meteoritics, University of New Mexico, 4. Atmosphere and Ocean Research Institute, University of Tokyo)

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The SNC meteorites have played an important role in elucidating geochemical evolution of Mars. However, spacecraft data suggest that the SNCs do not represent the Martian crust and cast doubt on their use in modeling a history of the planet [1]. NWA 7034, discovered in Morocco in 2011, is an only Martian meteorite that compositionally resembles an averaged Martian crust measured by orbiters and landers [2]. The discovery of this meteorite offers an opportunity to study a typical Martian crust for the first time. Uranium-thorium-lead isotopic systematics has been a traditional geochemical tracer used in studies of the terrestrial crust. Here, we present a preliminary report on the U-Th-Pb systematics of NWA 7034.

We conducted a five step acid leaching experiment [3] for ~40 mg bulk rock sample of NWA 7034. The trace element abundances (e.g., REEs, U, Th, and Pb) of the five leachates and the residue were measured

with a quadrupole ICP-MS. In addition, the Pb isotopic compositions of the same samples were measured with a TIMS. Lead isotopic compositions of the five leachates produced a linear trend passing through an isotopic composition of common terrestrial Pb [4] in a $^{207}\text{Pb}/^{204}\text{Pb}$ - $^{206}\text{Pb}/^{204}\text{Pb}$ diagram, which implies the effect of terrestrial alteration to the leachate fractions. In contrast, Pb isotopic composition of the acid residue does not participate in the linear trend, suggesting that the residue fraction has not seriously been affected by the terrestrial alteration. This surmise is supported by the REE pattern of the acid residue that is consistent with that of plagioclase in NWA 7034 [5]. To note, plagioclase is the strongest mineral to weathering in NWA 7034 [6].

Two U-Pb ages were reported for NWA 7533, a pair meteorite of NWA 7034; the older age of 4428 Ma recorded in zircons is interpreted to be the timing of crystallization [7], while the younger age of 1357 Ma obtained by the measurements of apatites probably represents the resetting age [8]. The Pb isotopic composition of the acid residue falls closely to those of plagioclase altered at 1357 Ma [8]. We determined the initial Pb isotopic composition of NWA 7034 at 1357 Ma using the Pb isotopic composition and $^{238}\text{U}/^{204}\text{Pb}$ ratio ($= \epsilon$) of the acid residue. In addition, Bellucci *et al.* (2015) [8] has reported the initial Pb isotopic composition of NWA 7533 at 4428 Ma. Taken together, the initial $^{206}\text{Pb}/^{204}\text{Pb}$ ratios of the Martian crust were determined to be 9.89 ± 0.07 and 16.27 ± 0.01 at 4428 and 1357 Ma, respectively. A Pb growth curve with the present ϵ -value of 7.97 passes through the two Pb isotopic compositions. On the other hand, the Martian mantle has been constrained to have ϵ -values of 1.8-4.4 by U-Pb analyses of SNC meteorites [9]. This indicates that the Martian crust represented by NWA 7034 has a ϵ -value about two times higher than that of the Martian mantle.

References: [1] McSween, H. Y. *et al.* (2009) *Science*, **324**, 736-. [2] Agee, C. B. *et al.* (2013) *Science*, **339**, 780-. [3] Moriwaki, R. *et al.* (2017) *EPSL*, **474**, 180-. [4] Stacey, J. T. and Kramers, J. D. (1975) *EPSL*, **26**, 207-. [5] Santos, A. R. *et al.* (2015) *GCA*, **157**, 56-. [6] Hurowitz, J. A. *et al.* (2006). *JGR: Planets*, 111.E2. [7] Humayun, M. *et al.* (2013) *Nature*, **503**, 513-. [8] Bellucci, J. J. *et al.* (2015) *EPSL*, **410**, 34-. [9] Tobita *et al.* (2017) *Geochem. J.* **51**, 81-.