

[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-P06] Formation mechanism of Fe-oxide concretions on Earth and its implication for alteration history in early Mars

*Hitoshi Hasegawa¹, Hidekazu Yoshida², Nagayoshi Katsuta³, Sin-iti Sirono⁴, Ippei Maruyama⁴, Masayo Minami⁵, Yoshihiro Asahara⁴, Shoji Nishimoto⁶, Yasushi Yamaguchi⁴, Niiden Ichinnorov⁷, Richard Metcalfe⁸ (1.Faculty of Science and Technology, Kochi University, 2.Nagoya University Museum, 3.Department of Education, Gifu University, 4.Graduate School of Environmental Studies, Nagoya University, 5.Institute of Space-Earth Environmental Research, Nagoya University, 6.Nagoya City Science Museum, 7.Institute of Paleontology and Geology, Mongolian Academy of Science, 8.Quintessa Limited, The Hub, Henley-on-Thames, Oxfordshire)

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Spherical Fe-oxide concretions on Earth, in particular in Utah, U.S.A, have been investigated as an analogue of hematite spherules discovered in Meridiani Planum on Mars, in order to support interpretations of water-rock interactions in early Mars. Although several formation mechanisms have been proposed for the concretions on Earth and Mars, it is still unclear whether these mechanisms are viable because a precise formation process and precursor of the Fe-oxide concretions are missing. Here, we show evidence that Fe-oxide concretions in Utah and newly discovered Fe-oxide concretions in Mongolia, had spherical calcite (CaCO₃) concretions as precursors. Observed different formation stages of calcite and Fe-oxide concretions, both in the Navajo Sandstone, Utah, and the Djadokhta Formation, Mongolia, indicate the formation process of Fe-oxide concretions as follows: (1) calcite concretions initially formed by groundwater evaporation within aeolian sandstone strata; (2) the calcite concretions

were dissolved by infiltrating Fe-rich acidic waters; and (3) mobilized Fe in acidic waters was fixed to form spherical FeO(OH) (goethite) crusts on the pre-existing spherical calcite concretion surfaces due to the pH-buffering dissolution reaction. The similarity between these Fe-oxide concretions on Earth and the hematite spherule occurrences in Meridiani Planum, combined with evidence of acid sulfate water influences on Mars, suggests that the Martian spherules also formed from dissolution of pre-existing carbonate concretions. Formation of recently discovered spherical-shaped nodules in Gale crater on Mars can also be explained by a similar process, although evidence of acid water influence is not obvious in lower strata of the Gale crater. The hematite spherules in Meridiani Planum and spherical nodules in Gale crater are possibly relics of carbonate minerals formed under a dense thick carbon dioxide atmosphere in the past.