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火星着陸探査機におけるその場 K-Ar 年代測定に向けた着陸地点検討
Possible landing sites on Mars for an in-situ K-Ar dating by future Japan's Mars rover mission

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Mars shows a variety of surface features affected by geologic processes. Though the crater-based dating has estimated surface ages, ranging from nearly 4.5 Ga age to recent, the absolute ages have not been determined for Martian samples except a mudstone at Gale crater by the Curiosity rover mission (4.21 ± 0.35 b.y.) and meteorites that come from somewhere on Mars. The authors have been developing an in-situ K-Ar dating system for future Japan's landing mission on Mars (e.g., Cho et al., 2014, 2015). In this paper, aims of the chronologic investigation using the system onboard a Mars rover/lander and appropriate landing sites are discussed.

Studies of impact crater densities present three representative eras for geologic history of Mars; Noachian, Hesperian and Amazonian (e.g., Tanaka, 1986). Abundant water should have existed early in Martian history (likely the Noachian and a part of the Hesperian), but most of them disappeared. In order to understand habitable environment, climate changes and atmosphere evolution of Mars it is important to determine the absolute ages of geologically-well-defined Noachian/Hesperian samples. Considering crater chronology, mineralogy, geological setting and engineering requirements (altitude, latitude and thermal inertia), we propose three regions that are covered by Hesperian volcanic rocks as candidates of chronologic investigation; Syrtis Major Planum, north-east side of Tharsis and peripheral area of Amazonis Planitia. Crater counting based on CTX and HRSC images applied to five specific areas in Syrtis Major provides ages ranging in 3.0 - 3.6 Ga (where the model by Hartmann and Neukum, 2001 is adopted). Among which, two areas reveal resurfacing evidences; the crater frequency gives older ages of 3.7 - 3.8 Ga for the sizes >1 km in diameter and the thickness of the younger lava (for the sizes <1 km) is estimated to be ~ 40 m. Syrtis Major, having gentle slope and less abundant dust, is a highly recommended region for the landing site. Further information such as local morphology and shock and alteration phenomena should also be considered.

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