An in-situ K-Ar dating system and possible landing sites for future exploring mission to Mars

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Mars has a variety of surface features affected by geologic processes. Although crater-based dating has been used to estimate surface ages on Mars, no radiometric age with a clear geologic context has been determined there. Absolute ages have only been reported for a mudstone at Gale crater by the Curiosity rover [1] and Martian meteorites. The authors are developing an in-situ K-Ar dating system for future landing mission on Mars [2]. This paper discusses the aims of our chronologic investigation using the system and proposes landing sites.

Studies of impact crater densities present three major eras for Mars; Noachian, Hesperian and Amazonian [3]. Abundant water should have existed early in Martian history, but most of them disappeared. In order to understand habitable environment and the timing of the climate change on Mars it is important to determine the absolute ages of geologically-well-defined samples. Considering crater chronology, mineralogy, geological setting and tentative engineering requirements (e.g., altitude, latitude), we propose three Hesperian-aged regions as candidates of chronologic investigation; Syrtis Major Planum, north-east side of Tharsis and peripheral area of Amazonis Planitia. We applied crater counting based on CTX and HRSC images to specific areas. So far seven areas in the former two regions provide the surface ages ranging in 3.0 - 3.6 Ga (the ages were derived after the model [4]). Among which, two areas in Syrtis Major reveal resurfacing evidences; the younger Hesperian lava with thickness of ~40 m covers the older bedrock. One area in the last region indicates multiple resurfacing evidences.

[1] Farley *et al.* (2014) doi: 10.1126/science.1247166. [2] Cho *et al.* (2014) *LPC* #1205; Cho *et al.* (2015) *Spectrochimica Acta Part B* **106**, 28-35. [3] e.g., Tanaka (1986) *JGR* **91, suppl.**, E139-E158. [4] Hartmann and Neukam (2001) *SSR* **96**, 165-194.