



The geologic evolution of Mars: Episodicity of resurfacing events

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Twelve prominent regions on Mars have been investigated in detail with respect to their geologic evolution through time on the basis of detailed geologic mapping exercises and determining age relationships through crater counting techniques using imagery. New data in combination with previously obtained data have been analyzed by way of a refined method of cratering age extraction that also gives fine details of periods of resurfacing. We have found that there has been volcanic and fluvial/glacial geologic activity on the Martian surface at all times from >4 Ga ago until today. This activity shows episodic pulses in intensity of both volcanic and fluvial/glacial processes at ~3.8–3.3 Ga, 2.0–1.8 Ga, 1.6 to 1.2 Ga, ~800 to 300 m.y., ~200 m.y., and ~100 m.y., and a possible weaker phase around ~2.5–2.2 Ga ago. In between these episodes, there was relative quiescence of volcanic and/or fluvial/glacial activity. The episodes we find on the Martian surface in the crater frequency analyses of HRSC, MOC and THEMIS data coincide with some age groups of the Martian meteorites (~1.3 Ga, ~600–300 m.y., ~170 m.y.). It appears that the surface activity expressions and their episodicity are related to the interior evolution of the planet when convection in the asymptotic stationary state changes from the so-called stagnant-lid regime to an episodic behavior. Similarities in episodic behavior are found for the other terrestrial planets: Venus, the Earth's moon, and the Earth itself suggesting a common general relationship in the evolutionary tracks.