POROSITY OF THE PRIMAL REGOLITH OF MARS AND IMPLICATIONS FOR THE ORIGIN OF RUNOFF CHANNELS AND THE STATE OF THE PALEOCLIMATE

(Letter to the Editor)

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Abstract. The porous state of the early Martian regolith, due to constant impact gardening by the impactors of the heavy bombardment period means this surface layer should have been able to hold pockets of subsurface water that could be responsible for runoff channel formation upon exposure to the planet's surface. This explanation of the runoff channel formation/heavy bombardment time correlation early in Mars history indicates a warm paleoclimate is not necessary in explaining the presence of runoff channels.

The presence of runoff channels on the Martian surface which formed early in the planets history has been argued as evidence for the existence of a warm paleoclimate on Mars (e.g., McKay and Stoker, 1989). The presence of a warm paleoclimate in the planets history is thought to be important for the formation and evolution of life on Mars. This, however, is not necessarily true since life could form and evolve in subsurface aqueous environments making the requirement of a warm paleoclimate on Mars necessary for the formation and development of life on the planet unwarranted. The argument for a warm paleoclimate on Mars is questionable. The period of concentrated runoff channel formation on Mars corresponds with the period of heavy bombardment early in Martian history (Carr and Clow, 1981). Runoff channels most probably resulted from headward sapping of groundwater on the Martian surface (Pieri, 1980). An important correlation can be drawn between the corresponding period of runoff channel formation/heavy bombardment and the presence of groundwater.

During the period of heavy bombardment the surface regolith of Mars is constantly being remixed by impact gardening. This implies that the regolith layer is constantly porous during this heavy bombardment period. Subsurface water can be sustained in the pockets of space in the regolith layer. Therefore, the exposure of these pockets of subsurface water to the Martian surface could commonly result in the surficial flow of water.

At the end of the heavy bombardment period, impact gardening of the Martian regolith would cease and a more compacted surficial layer would develop with time. This would result in the elimination of subsurface pockets of space available

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for the containment of subsurface water and, thus, eliminate the common process of runoff channel formation.

The concept of a warm paleoclimate on Mars should remain questionable.

References

Carr, M. H. and Clow, G. D.: 1981, *Icarus* **48**, 91–117.
McKay, C. P. and Stoker, C. R.: 1989, *Rev. Geophys.* **27**, 189–214.
Pieri, D.: 1980, *Sci.* **210**, 895–897.