MECHANISM FOR EMPLACEMENT OF PERMAFROST ICE LAYERS IN YOUNG MARTIAN TERRANES: EVIDENCE FROM IMPACT CRATERS Joseph M. Boyce*, U. S. Geological Survey, Flagstaff, AZ 86001

Martian rampart and flow-ejecta craters have been attributed to (A) impact into a subsurface permafrost ice or water layer (1); (B) entrainment of atmospheric gasses during impact (1,2); (C) eolian modification of existing craters (3). Current evidence suggests that the most reasonable of these is impact into a subsurface permafrost ice or water layer (4).

It has been suggested that conditions on Mars were once favorable for formation of a subsurface permafrost ice layer (5,6,7,8,9,10,). Such features as patterned ground suggest that near-surface ice is indeed present on Mars (11). Allen (12) showed that rampart and flow-ejecta craters are distributed over most of mars and that there is no correlation between either their occurrence and major geologic unit or their occurrence and elevation. He suggests that if these craters are indicators of subsurface ice or water then the layer of ice or water must be beneath the entire surface of Mars. This distribution of rampart and flow-ejecta craters rules out ascent of juvenile water from the deep interior as a source of the permafrost ice layer, because ascending juvenile waters are usually confined to small areas associated with volcanic vents or fractures. The most reasonable mechanism for development of such an ice or water layer is by soaking in of rain water. Therefore, the emplacement of these types of craters into young rock units has been difficult to explain because, unlike the old terranes, the young terrane show no evidence of being affected by rain (13) which is needed to charge the ground water system. However, the occurrence of rampart and flow-ejecta craters in young terranes can be explained if the thermal gradient in the shallow part of the martian crust is similar to that of the earth (temperature is proportional to depth), then the permafrost ice layer in old units should melt in response to burial by young units because of the insulative properties of the young units. The permafrost ice may also have been melted by heat from young lavas. The melted ground water would migrate upward toward regions of lower pressure. The ascent of the ground water may have been quite rapid because, as pointed out by Carr (10), volcanic rocks such as those characterizing most young areas are commonly very porous and permeable. The ground water should rise until it freezes again into a new permafrost ice layer. This process may account for the presence of a permafrost ice or water layer in both old and young martian rocks.

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