

Preferential flattening of poleward-facing walls of impact craters in middle latitudes of the Alba Patera area on Mars

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A statistical analysis of the data obtained from Mars Orbiter Laser Altimeter (MOLA) shows that abundance of poleward-facing steep slopes (more than 20 degrees) is smaller than that of equatorward-facing slopes in middle latitudes in the both hemisphere, and indicates that poleward-facing slopes is preferentially flattened [Kreslavsky and Head, 2003].

In this study, at first, we will identify whether the preferential slope flattening of poleward-facing slopes had or have continued through Amazonian. We research 77 impact craters of which the diameter is greater than 7 km in the Alba Patera area (25 N-60 N, 90 W-120 W) and estimate inclinations of poleward-facing and equatorward-facing inner walls of impact craters by using MOLA PEDR dataset. Most part of the Alba Patera area had been resurfaced during the periods from late Hesperian to early Amazonian [Scott and Tanaka, 1986], so impact craters in the Alba Patera area were formed after the periods. The results show the remarkable trend that the maximum inclinations of poleward-facing walls are smaller than those of equatorward-facing walls from around 30 N to 55 N, which indicate that the north-south asymmetric slope flattening had occurred though Amazonian and might still continue today.

A variety of process may have caused crater degradation, including dry mass wasting, fluvial incision and deposition, glacial and periglacial activities, lava filling, and dust and volcanic ash deposition. However, the systematic flattening of poleward-facing slopes in middle latitudes suggests that slope flattening would be strongly influenced by stability of near-surface volatiles which would be controlled by solar insolation. We consider that viscous flows of ice-rich materials from poleward-facing walls would mostly dominate flattening of craters [Perron et al., 2003], because almost all of degraded craters in middle latitudes in the Alba Patera area display flat floors leaned slightly toward poleward. The preferential flattening of poleward-facing slopes would be formed by filling of crater cavities and/or erosions of rims by viscous flows of ice-rich materials which dominantly occur on poleward-facing walls in middle latitudes.

References

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