



COLD-BASED MOUNTAIN GLACIERS ON MARS: WESTERN ARSIA MONS

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Surface environmental conditions on Mars are presently extremely cold and hyper-arid, most equivalent to polar deserts on Earth. Coupling newly acquired Mars MOLA and MOC data with field-based observations regarding the flow, surface morphology, and depositional history of polar glaciers in Antarctica, we show that the multiple facies of an extensive fan-shaped deposit on the western flanks of Arsia Mons, Tharsis Rise are consistent with deposition from cold-based mountain glaciers. An outer ridged facies that consists of multiple laterally extensive, arcuate and parallel ridges, resting without disturbance on both well-preserved lava flows and an impact crater, is interpreted as drop moraines formed at the margin of an ablating and predominantly receding cold-based glacier. Inward of the ridges lies a knobby facies that consists of irregular and closely spaced equidimensional knobs, each up to several kilometers in diameter; this facies is interpreted as a sublimation till derived from in situ downwasting of ash-rich glacier ice. A third facies comprising distinctive convex outward lobes with concentric parallel ridges and aspect ratios elongated downslope likely represents rock-glacier deposits, some of which may still be underlain by a core of glacier ice. Taken together, these surficial deposits show that the western flank of Arsia Mons was occupied by an extensive mountain glacial system accumulating on, and emerging from, the upper slopes of the volcano (above ~7000 m) and spreading downslope to form a piedmont-like fan. Similar deposits exist on the other Tharsis Montes, suggesting at least one phase of late Hesperian aged glaciation in the equatorial Tharsis region.