EROSIONAL OUTLIERS OF DUST ALONG THE SOUTHERN MARGIN OF THE THARSIS REGION, MARS. James R. Zimbelman, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560

Thermal infrared measurements of Mars have identified three large regions of low thermal inertia in the martian northern hemisphere interpreted to be deposits of aeolian dust (1-3). The dust accumulation has been related to regional variations in deposition following global dust storms (4,5), the latitudinal location of which may be influenced by cyclical variations in orbital parameters (5,6). Verification of the proposed cyclical changes in the low thermal inertia regions is difficult because these deposits were very stable in position during the Viking observations (2,3). Two locations have been identified as possible erosional remnants of the Tharsis low thermal inertia region which, if correct, provide evidence that this region of dust accumulation has migrated to the north (7).

The IRTM experiment on the Viking orbiters provided the first global maps of the thermal properties on Mars. Broad regions around the Tharsis and Elysium volcanoes and the classical high albedo feature named Arabia have extremely low predawn temperatures (1,2), equivalent to low thermal inertia (1,3). Thermal inertia is related to the effective particle size of the surface material through the assumption of a uniform-sized particulate surface (1). The regions of low thermal inertia are covered by dust-sized (< 40 μm) materials of relatively high albedo (> 0.27) (1). The Tharsis region (Fig. 1) is the largest of the three low thermal inertia regions, covering over 20 million km^2 of the martian surface. Earth-based radar data showed the Tharsis area to be a strong diffusive scatterer (8) and P.R. Christensen recognized that this result placed an upper limit of a few meters on the average thickness of the dust deposit (6). The relatively thin dust deposits could be accumulated through fallout of atmospheric dust on a time scale comparable to the orbital variations in the insolation on Mars, which leads to the hypothesis that the low thermal inertia regions migrate through the martian equatorial zone in response to the orbital changes (6). Variations in the pattern of atmospheric clearing of dust following global dust storms indicates a net south to north transport of dust under present climatic conditions (5). Two locations near the southeastern margin of the Tharsis region provide evidence that the northward transport of dust has been sufficiently prolonged to cause a northward migration of the dust deposits.

The fractured terrain of Claritas Fossae (16^o S, 110^o W; A in Fig. 1) has a thermal inertia lower than its immediate surroundings but comparable to the nearby Tharsis region (2,9). Fractured terrain in Sinai Planum (16^o S, 80^o W; B in Fig. 1) also has a thermal inertia lower than its surroundings, but generally higher than that of the Tharsis region. In comparison to their surroundings both locations have high relief (Figs. 7 and 8 of 10), low reflectivity and high roughness at radar wavelengths (Fig. 7 of 11), and high albedo at visual

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wavelengths (color mosaic described in 12). The Sinai Planum location has less contrast with its surroundings at all wavelengths than the Claritas Fossae location, important because the Sinai Planum location is further from the southern margin of the Tharsis region than is Claritas Fossae. All of the above properties are consistent with a scenario of burial under a few meters of aeolian dust followed by erosional stripping of the dust that progressed in a northerly direction. Both locations have bedrock interpreted to be highly deformed, fractured materials of Noachian age (13). The dust deposits may have been preserved longer on the fractured terrains at Claritas Fossae and Sinai Planum than on the surrounding plains because of a reduction in efficiency of wind erosion caused by the increased local relief on the ancient, fractured materials. The results described here are interpreted to be in agreement with the model of aeolian deposition and erosion proposed by Christensen (6).
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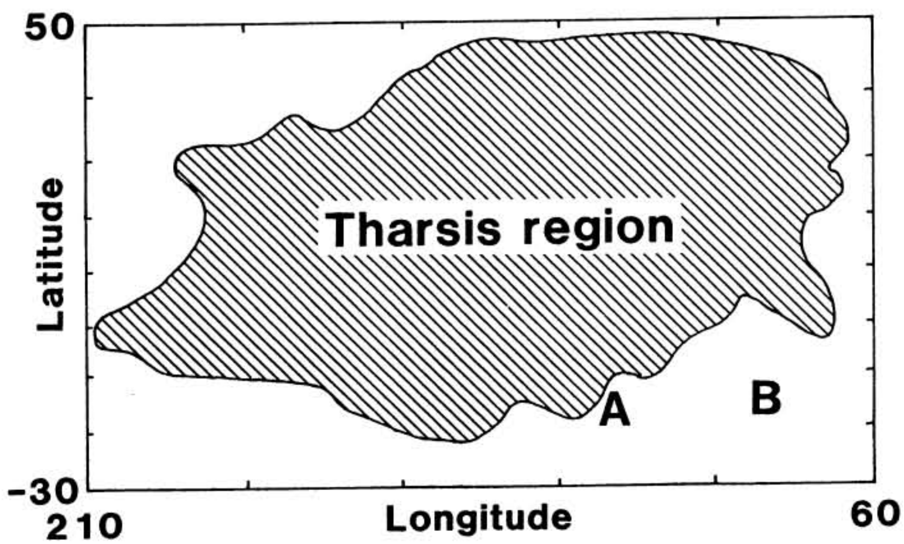

Figure 1. Simplified map of the Tharsis low thermal inertia region and the two locations of dust outliers at Claritas Fossae (A) and Sinai Planum (B).