THERMAL INERTIAS FOR THE ELYSIUM AND AEOLIS QUADRANGLES OF MARS.
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Low-resolution infrared data from the Viking Infrared Thermal Mapper (IRTM) have been used to produce a global map of thermal inertias on Mars [1,2], however, little of the high-resolution data have been examined thus far. This work presents results and interpretations obtained from mapping high-resolution thermal infrared data in the Elysium and Aeolis quadrangles at equatorial latitudes on Mars. Comparing thermal inertias to surface features and geologic units leads to a better understanding of the geologic processes which take place in this highly diverse region of the planet.

The two quadrangles studied are distinctive both thermally and geologically. Elysium (0° to 30°N, 180° to 225°W) contains the volcano Elysium Mons, the Cerberus low albedo feature, and several craters with accompanying low albedo patches [3]. Aeolis (30°S to 0°, 180° to 225°W) contains the transition from the smooth plains of Elysium Planitia to the older, elevated, more heavily cratered areas of the southern hemisphere.

The thermal inertias mapped in Elysium and Aeolis range from a low of 1 (x 10^{-3} cal cm^{-2} sec^{-1/2} K^{-1}) to a high of 14. The lowest values were recorded at Elysium Mons and the highs correspond to dark patches in craters and channels in the south (e.g. 18°S, 197°W) which appear to have trapped the low albedo, high thermal inertia material. This range of thermal inertias differs slightly from the global map for this area which has a low of 1.5 and peaks at about 10 [2]. Overall, the high-resolution thermal inertia values and their correlation with albedo agree very well with the global trends. The larger range of values in the high-resolution data is due primarily to the diminishing effect of averaging data (global mapping determined an average thermal inertia value for 2° x 2° areas while the high-resolution data are averaged in 1/8° x 1/8° bins).

Craters often appear to contain aeolian material [4,5,6] and show thermal inertia patterns markedly different from the surrounding terrain. One 80 km diameter crater (3°N, 198°W) has low albedo material on the floor of the crater and on an adjacent SW-oriented streak. Thermal inertias increased from 3 for the surrounding plains to greater than 9 for the crater interior. This crater represents one of the few features in the Elysium Planitia area that has not been completely covered by fine grained material (interpreted to be aeolian dust) which blankets these plains [1,7].

Directly north of this crater is the Cerberus low albedo region. This collection of dark material also has high thermal inertia values (8-9) when compared with the Elysium Planitia region. This is consistent with the global correlation between low albedo and high thermal inertia [1]. Two lower resolution sequences which crossed Elysium Mons display thermal inertias consistent with the global data (1-3 on and around the volcano).

The two quadrangles have geologic units ranging from some of the oldest areas on the planet to much younger plains [8]. The thermal signature of the younger units is quite distinct; for example, thermal inertia values for the Elysium Planitia region average around 2-3, which corresponds to a surface covered with fine grained material (<1mm) [1]. Since the material overlays all geologic features and is thought to be aeolian in origin [1], the thermal inertia values are consistent with aeolian activity which post-dates all geologic terrains.
Most of the older geologic units occur south of Elysium Planitia in a region that does not appear to be heavily mantled by dust. The oldest terrains are very heavily cratered [9] and patches of dark material within many craters could contribute to a higher thermal inertia signature [1,12]. Though there is a concentration of thermal inertias of 6-8 in this region, a peak of values also occurs at 3. It should be stressed that the higher thermal inertias are much more pronounced here than are the lows. However, the fact that there is a considerable amount of low inertia material in the highlands is significant. Again, aeolian dust is probably blanketing portions of the surface, although not as completely as on the younger units. The low albedo, high inertia material which has the most pronounced thermal signature in the older regions is also proposed to be aeolian in origin [10,12] and it is considerably coarser (.5mm) than the bright dust [1].

The geologic unit described by Scott and Carr [8] as "knobby material" is interpreted to be older than the surrounding plains and it might be expected to show high thermal inertia values similar to older units to the south. However, thermal inertias for this terrain were found to be about 3, without a peak at a higher value as with the other older units. This indicates that its surface characteristics may be completely masked to the IRIM by a covering of fine-grained material.

Using Christensen's block model [13] (where 10 cm sized blocks are assumed to have a thermal inertia of 30) an assessment of the abundance of unresolved high inertia materials can be made. Thus far, block abundances have been determined only for the MC-23NE subquadrangle (15°S to 0°, 180° to 202.5°W), where a wide variety of geologic terrains are present. The values are quite uniform, averaging about 5%. The only features with distinctive block abundances were some isolated high thermal inertia (-5) patches located at 12°S, 190°W where the block abundance dropped close to 0. This indicates that the thermal inertias observed there are due primarily to the collection of dark sand-sized material and not a mixture of a wide variety of particle sizes. Thus, the high inertia material here would appear to be aeolian materials that have become size sorted through saltation and surface creep [12].

Between the thick dust deposits of Elysium Planitia and the dark, cratered terrain of the south, aeolian processes dominate the distribution of thermal inertias in this portion of the planet. Thermal mapping of the rest of the equatorial region of Mars should reveal additional information about interaction between the wind and the surface materials on Mars.


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