MARTIAN FLUIDIZED EJECTA BLANKETS AS SEEN IN THE PHOBOS '88 TERMOSKAN DATA SET; B. H. Betts and B. C. Murray, California Institute of Technology

In February and March, 1989, the Termoskan instrument on board the Phobos '88 spacecraft of the USSR acquired a limited set of very high resolution simultaneous observations of the reflected solar and thermal emission from Mars' equatorial region. The data set has already yielded a number of interesting results. We are currently involved in a number of separate analyses using this data. In one branch of our analyses, we are using the high spatial resolution of the Termoskan data to study the thermal properties of fluidized crater ejecta and to compile a unique database on these craters.

Termoskan was a two channel optical-mechanical scanning radiometer with one visible channel (0.5-1.0 μm) and one thermal infrared channel (8.5-12.0 μm) [1,2]. The instrument was fixed to the spacecraft, pointing in the anti-solar direction. Resolution per pixel at nadir was 1.8 km for 3 of the 4 panoramas acquired and 300 meters for the remaining panorama. These resolutions are better than those obtained by Viking (about 5 to 170 km) and that which will be obtained by Mars Observer's Thermal Emission Spectrometer (3 km per pixel).

Many groups have studied Martian crater ejecta blankets in the past. The study of these ejecta blankets gives us information not only about the state of the Mars surface, but also about the subsurface. What the Termoskan data gives us is insight into the thermal properties of ejecta blankets at a scale never before possible, allowing us to thermally resolve some ejecta blankets for the first time. We see a number of interesting phenomena.

In the Termoskan data tens of ejecta blankets can be seen as thermally distinct from their surroundings. Most of these appear primarily in only one region of the data: just south of Valles Marineris. Some examples can be seen in Figure 1. All of these thermally distinct ejecta blankets correspond to fluidized ejecta blankets seen in Viking Orbiter images. However, not all fluidized ejecta blankets seen in Viking images appear thermally distinct in the Termoskan data. For similar times of day and in localized regions, some ejecta blankets appear warmer than their surroundings and some appear cooler. Although difference in albedo relative to surroundings may help to explain some differences, albedo differences appear to not be solely responsible. Profiles in both the thermal and visible channels vary greatly from one crater to another. Sample profiles can be seen in Figures 2 and 3.

Thermal differences between ejecta blankets could be due to a number of possible characteristics of the upper few centimeters of the ejecta deposit. Possible factors include: albedo, density, particle size, composition, percentage of large blocks, degree of cementation, and degree of dust blanketing. A variety of processes may have caused the current state of the deposits. Probably part of the thermal signature that we observe is due to the characteristics of the subsurface layer excavated by the impact. For example the amount of subsurface volatiles probably had some effect on the thermal nature of the ejecta blanket. Structurally or compositionally different layers would also affect the resulting ejecta blankets. We hope to distinguish which processes were most significant in order to learn more about the subsurface and martian impact processes. It is also possible that secondary processes such as preferential erosion or deposition may play important roles in governing the thermal properties of the ejecta blankets.

In order to better understand which processes have been the most influential, we are compiling a systematic database of all thermally distinct crater ejecta seen in the Termoskan data as well as other crater ejecta nearby. The database includes information for each crater including location, size, geologic setting, temperature differences, times of day, albedos, and thermal inertias. We are looking for physical correlations with the thermal observations. Initial results of our analysis will be presented at the conference. In addition, we are studying the most interesting groups of craters in greater detail in conjunction with Viking data.

The Thermal Emission Spectrometer on Mars Observer and Termoskan 2 on Mars '94 will both provide opportunities to extend this analysis to the entire Mars surface and to provide greater diurnal and seasonal coverage.

REFERENCES: (1) Murray,B.C., M.K.Naraeva, A.S.Selivanov, B.H.Betts, T.Svitek, V.D.Kharlamov, M.L.Santee, Y.M.Gektin, D.A.Fomin, D.A.Paige, A.S.Panfilov, D.Crisp, J.W.Head, S.L.Murchie, and T.Z.Martin (1991). *Planetary and Space Science*, in press; (2) Betts,B.H., T.Svitek, M.L.Santee, B.C.Murray, D.Crisp, D.A.Paige, M.Naraeva, and A.Selivanov (1990). In *Lunar and Planetary Science XXI*, pp. 77-78.

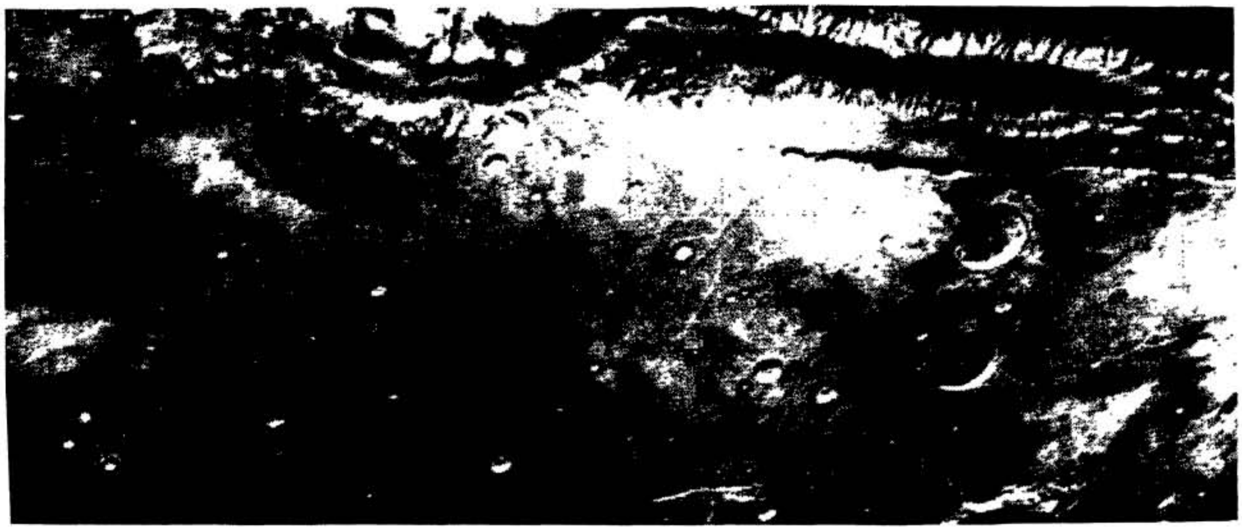

Figure 1: Termoskan infrared image of region just south of Valles Marineris. Darker regions are cooler. Time of day is near local noon. North is towards the top. Note the thermally distinct fluidized ejecta deposits seen in the lower left of the image (seen as bright annuluses surrounding craters). These deposits are warmer by 2K to 5K than their surroundings. Some craters with distinct ejecta deposits cooler than surroundings can be seen in lower right of image. Note that many craters in the image do not show thermally distinct ejecta deposits. Also, notice the radial features emanating from the large crater at the right of image. This appears to be the only occurrence of this type of radial feature within the data set.

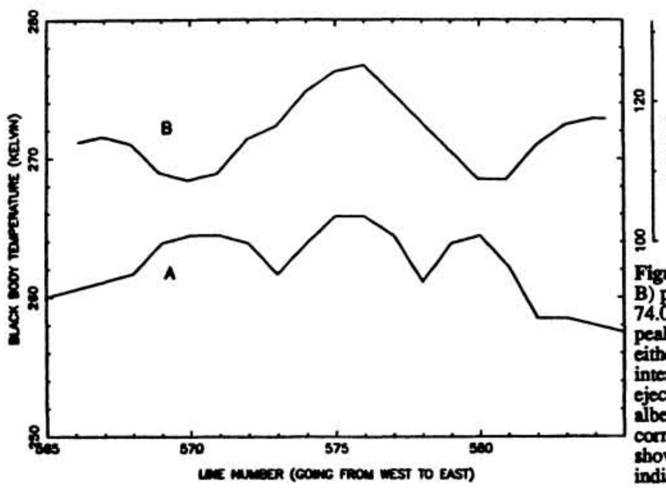

Figure 2: West to East Termoskan infrared (curve A) and visible (curve B) profiles across fluidized ejecta blanket and crater located at 18.4 deg S, 74.0 deg W. Note the three peaks in the temperature curve. The outer peaks correspond to the warm (relative to surroundings) ejecta blanket on either side of crater. The central peak corresponds to the warm crater interior. Note the inverse correlation between the temperature of the ejecta blanket and the visible signature, implying that in this case an albedo difference helps explain the warmer ejecta. This inverse correlation exists in only some of the crater profiles. The crater interior shows correlation between temperature and visible signature, possibly indicating some degree of low inertia dust mantling in the crater interior.

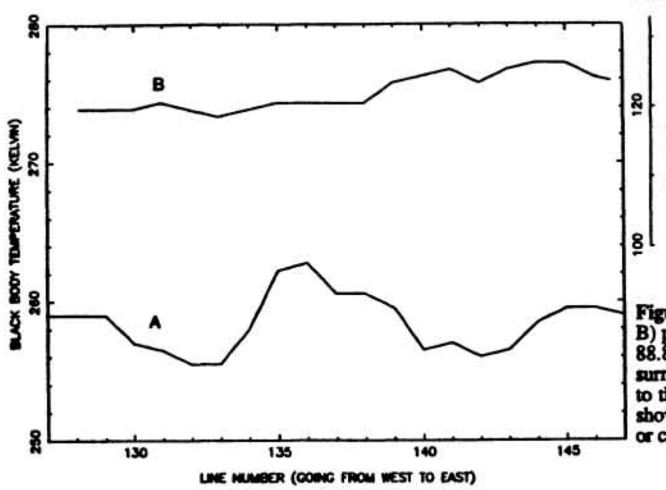

Figure 3: West to East Termoskan infrared (curve A) and visible (curve B) profiles across fluidized ejecta blanket and crater located at 18.5 deg S, 88.8 deg W. This crater has an ejecta blanket that is cooler than the surroundings. Notice the 2 dips in the temperature curve that correspond to the fluidized ejecta blanket. Note that for this crater, the visible curve shows very little correlation to the temperature in either the ejecta blanket or crater interior.