THERMOPHYSICAL PROPERTIES OF ISIDIS IMPACT BASIN, MARS. N. Murphy, B. M. Hynek, B. M. Jakosky, S. Martínez-Alonzo, N. E. Putzig, M. T. Mellon, and S. Pelkey, Laboratory for Atmospheric and Space Sciences, University of Colorado, 392 UCB, Boulder, CO 80309. nate.murphy@lasp.colorado.edu

Introduction: Isidis Planitia was the chosen landing site of the European Space Agency's Beagle 2 lander. We have examined the thermophysical properties of the landing ellipse in the context of the rest of Isidis Basin and the surrounding region using data from the Thermal Emission Imaging System (THEMIS) and Thermal Emission Spectrometer (TES). These results, in conjunction with other remotely-sensed data, allow a better understanding of the surficial geologic history of this region of Mars.

Geologic Setting: Isidis Planitia is a 1,100-km-diameter ancient impact basin centered at 16º N and 272º W. Situated on the crustal dichotomy boundary separating the cratered southern highlands and the northern lowlands, Isidis is one of the oldest and largest impact basins on Mars. The basin has experienced a complex geologic history. Noachian-age erosion of the highlands acted to degrade the rim of Isidis basin, as evident by the many valley network systems carved on the southern margin of the basin. The original basin has experienced much infilling of sediment (from early fluvial and later aeolian sources) as well as contributions from Syrtis Major, a large volcano directly west of Isidis [1]. This has resulted in a relatively smooth, flat, lightly cratered basin floor. In this paper, we examine the thermophysically distinct terrain units that comprise this region of Mars and their implications.

Methods: Several data sets were utilized in our analysis. Here, we will focus on THEMIS- and TES-derived products from the thermal infrared portion of the spectrum. TES-derived thermal inertias (3 km resolution) were calculated using established methods [2,3] and updated to include data acquired through May, 2003. Daytime and nighttime THEMIS data acquired through September, 2003, were used to produce calibrated radiance and brightness temperature maps. Specifically, band 9 (12.57 microns) images covering the region of interest were radiometrically and geometrically corrected using ISIS software (http://isis.astrogeology.usgs.gov/). These georeferenced images were then mosaicked using an in-house program that adjusts the radiance of overlapping scenes by applying a linear regression. This correction is necessary because the images were acquired at different local times and seasons and are thus subject to time of day and seasonal temperature effects. The nighttime calibrated radiance mosaic was converted to a brightness temperature map via a look-up table. This map has 100-meter resolution and coverage is largely continuous over the region of interest. Finally, thermal inertia was calculated for the THEMIS mosaic using a similar method to the TES derivation (see [4]).

Results and Discussion: Figure 1 shows a THEMIS-derived nighttime brightness temperature mosaic of Isidis Planitia. Temperatures range from 160-233 K in this region, with the landing ellipse itself showing >20K variance and having an average temperature of ~200K. Abundant structure is evident in the mosaic. Some of these features correspond to albedo features or landforms such as craters while others have no apparent signature at visible wavelengths.

The most striking feature of Figure 1 is the high-temperature region in the southern portion of the image. Temperatures are greatest along the southern margin of the basin and grade northward into cooler temperatures. Both TES- and THEMIS-derived thermal inertias are >400 J m^{-2} K^{-1} $s^{-1/2}$ in this region. The southern edge of the high-inertia region corresponds exactly with the dichotomy boundary to the south. It is likely that aeolian activity, including possible slope winds related to the dichotomy, has scoured this region leaving it relatively dust-free. These features sometimes correlate with low albedo areas, which is another indication of aeolian stripping. Alternatively, coarse grained material may have been deposited at the base of the southern rim.

Also of interest is the area of high brightness temperature (>200K), that extends northward from the southern boundary of the basin at 271º W (Figure 1). Both TES and THEMIS data show this region to have a higher thermal inertia and nighttime brightness temperature compared to other areas in the basin. With no evident geologic features differentiating this region from other areas in the basin, the high thermal-inertia values suggest that aeolian processes have altered this region by either removal of fine grained material by scouring or deposition of coarse grained material.

There is a general trend of decreasing thermal inertias and nighttime brightness temperatures toward the northern and western reaches of Isidis (Figure 1). The southeast quadrant of Isidis basin generally shows higher nighttime brightness temperatures (~210K) and TES thermal inertias (~400 J m^{-2} K^{-1} $s^{-1/2}$) than regions to the west and north. The higher thermal inertias suggest that coarser grained material covers the surface in the southeastern quadrant of Isidis, possibly ejecta from impacts along the eastern and southern boundaries of Isidis.

Relative to the full scene, the Beagle 2 landing ellipse has intermediate brightness temperature and thermal inertia. Nighttime brightness temperatures of the ellipse range from 192-214 K with an average of 200 K. Thermal inertias of the ellipse are 260-310 J m^{-2} K^{-1} $s^{-1/2}$, which is roughly equivalent to Viking lander I [5].

Lava flows, marked by the arrow in Figure 1, originating from Syrtis Major are visible along the western edge of Isidis. The lower nighttime brightness temperature and thermal inertia of the flow indicate there may be slight differences in the surficial thermal properties between the two regions; the sharp boundary at the margin suggests local physical control of the surface properties. The difference in the thermal properties is small, however, suggesting that the surficial layers in both the flow and surrounding areas are relatively similar.

Conclusions: Some thermophysical features of Isidis correspond to features such as impact craters, valley networks, or tectonic features. However, the majority of the striking variation in thermal inertias and nighttime brightness temperatures across the floor Isidis basin do not correlate with topographical features, which suggests that aeolian processes are causing significant stripping and deposition across the basin. The extremely high thermal inertias and high nighttime brightness temperature at the base of the southern rim and extending northward from the south rim at 271º W suggest aeolian processes have dramatically altered the landscape compared to the northern and western regions of Isidis basin.

References: [1] Greeley R. and Guest J.E. (1987) *Misc. Inv. Series Map I-1802b*. [2] Jakosky B.M. et al. (2000) *JGR*, *105*, 9643-9652. [3] Mellon M.T. et al. (2000) *Icarus*, *148*, 437-455. [4] Putzig N.T., et al. (2004) *LPSC XXXV* (this meeting). [5] Putzig, N.T. et al. (2003) *LPSC XXXIV*, #1429.

Figure 1. THEMIS-derived nighttime brightness temperature mosaic of Isidis Planitia, Mars.