DARK, INTRACRATER DEPOSITS ON MARS. *Philip R. Christensen, Department of Geology, Arizona State University, Tempe, Arizona 85287*

Localized occurrences of relatively dark material can be observed within numerous Martian craters. These features have been inferred to be composed of mobile, aeolian material based on the observation of dune forms (1), their observed orientation on the downwind side of craters (2) and the apparent deflation of material to form dark, exterior streaks (3). However, direct, visual evidence for aeolian activity only exists for a very small fraction of these dark 'splotches', nor do these observations provide quantitative estimates of the particle size of the material in the splotches. Visual observations are therefore of limited use in determining the physical characteristics of these features.

Several physical properties of the intracrater features have been derived from the thermophysical measurements of the Viking Infrared Thermal Mapper (IRTM) experiments. These properties include: the thermal inertia, which can be related to grain size, the albedo, the presence or absence of surface blocks and the thermal emission characteristics (4). Once determined, these properties can be correlated with crater morphology, regional thermal inertia and albedo, and geographic location.

Dark, intracrater features have previously been observed to have a relatively high inertia compared to the surrounding terrain (5). This observation was utilized to systematically locate high-inertia crater features. The IRTM data taken between Oct. 5, 1977 and Oct. 23, 1978, after the 1977 global dust storms had decayed, at a range less than 16,000 km and an emission angle less than 35° were searched for local inertia anomalies which were more than 2 x 10^{-3} cal cm^{-2} $sec^{-1/2}$ K^{-1} higher than the regional inertia. These anomalies were matched with craters using the atlas of crater locations compiled by Arvidson et al. (6), taking into account the known positional errors of up to 30 km in both data sets. This search will obviously only locate crater deposits which are local inertia maximums. and does not determine the inertia of all dark, intracrater features. A complete analysis can not be done automatically, given the uncertainty in position.

Approximately 1300 high-inertia intracrater features were located between -55°S and 30°N with inertia values ranging from 4 to 21 (4). The maximum observed corresponds to the dark interior of the crater Holden, located at -26.5°S, 34.0°W. If this material was unconsolidated and rock free, it would have an average grain size of 1 cm.

The inertia of the intracrater features is correlated with regional properties, increasing as the inertia of the surrounding terrain increases, and as the regional albedo decreases. There is some indication that the mode inertia of intracrater deposits varies with latitude, from a minimum of 8 at -45°S to a maximum of 11 at 15°N. There is, however, no correlation of crater inertia with the crater morphologic parameters of rim continuity, rim height, crater depth or the presence of an interior splotch, as determined by Arvidson et al. (6) from Mariner 9 images. The lack of correlation may, however, be due to difficulties in determining crater morphology from those images.

One means of increasing the inertia of the intracrater deposits relative to the surrounding terrain is an increase in the number of blocks on the surface. However, the diurnal variation of the difference in brightness temperature between the IRTM bands can be used to estimate block abundance (7) and indicates that the intracrater deposits have less than 10% cover. Given the observational variability, these data are consistent with the surfaces being block free. In either case, the intracrater features do not have significantly more blocks than their surroundings, which have block abundances between 5 and 20% (7).

A second mechanism for raising the inertia is bonding. However, there is no obvious means of selectively bonding some of the interior material without affecting the remaining interior and exterior materials.

The high-inertia intracrater features therefore most likely result from a real increase in particle size. The general correlation of intracrater inertia with the regional properties suggests that these materials are locally derived. In addition, the large variation in the intracrater inertias implies that these materials did not come from a single, global source, but instead represent a selection process whereby the coarsest material locally available for transport is collected within the crater. A mechanism for locally enhancing the particle size within craters is aeolian redistribution and sorting of mobile material. Because of the asymmetry of the crater rim profiles, material which is marginally mobile on the gentle exterior slope cannot be transported back up the steeper interior slope and will remain trapped inside. This sorting process will occur regardless of the actual magnitude of the particle sizes, wind velocities or slopes because only the relative transportability into, versus out of, the crater is important. The possible absence of blocks or bonded materials is consistent with these features being deposits of unconsolidated sediments which were transported by the wind. However, the large particle sizes implied for many of these deposits indicates that not all are collections of saltatable material. Instead, many may be lag deposits, or low, broad zibars. These features cannot be assumed to be sand deposits and included in the global sand inventory, nor can the lack of visable dune forms be used as a criteria for estimating the minimum thickness, and therefore volume, of these deposits.

REFERENCES

1. *Breed, C.S. (1977), Icarus, 30, 326-340.*
2. *Arvidson, R.E. (1974), Icarus, 21, 12-27.*
3. *Thomas, P. et al. (1981), Icarus, 45, 124-153.*
4. *Christensen, P.R. (1981), Ph.D. Thesis, Univ. of Calif., pp. 229.*
5. *Christensen, P.R. and H.H. Kieffer (1977), J. Geophys. Res., 84, 8233-8238.*
6. *Arvidson, R.E. et al. (1974), The Moon, 9, 105-114.*
7. *Christensen, P.R. (1982), submitted to J. Geophys. Res.*