UPDATED MAPPING OF THE SURFACE OF PHOBOS USING *PHOBOS 2* IMAGES: A PROGRESS REPORT. Scott L. Murchie and James W. Head, *Dept. of Geological Sciences, Brown University, Providence, RI 02912*; Boris S. Zhukov, *Space Research Institute, Moscow, U.S.S.R.*

Images of Phobos obtained by *Phobos 2* complement those obtained by *Viking*, and can be used to expand our understanding of surface morphology and albedo patterns. *Viking* imaged a large part of the surface west of Stickney (70°-160° W) only at low resolution (100 m) and obliquely at high emission angles; *Phobos 2* obtained 40- to 80-m resolution images of this area at low emission angles. *Viking* obtained low phase angle images of the region from approximately 210°-310°W, revealing bright rims on some craters and grooves that are not evident in higher phase angle images. *Phobos 2* extended the coverage of low phase angle images east to approximately 70°W.

In order to maintain an up-to-date data base on the geology of Phobos, we are constructing updated maps of grooves and crater materials using *Viking* images and raw, contrast-enhanced, and high-pass filtered *Phobos 2* images. Our first results are analogous to maps prepared from *Viking* images by Thomas [1,2]; presently we are remapping the surface using better-controlled base materials. Most additions and modification to Thomas's maps occur in the region west of Stickney where image resolution was improved by about a factor of two. However, *Phobos 2* also imaged several additional areas at lower sun angles than did *Viking*, so that in these areas some new features were recognized. In all, 11 new groove segments and 6 new craters 1 km or more in diameter have been discerned so far, and the location and characterization of additional craters and grooves have been improved.

Crater Materials. Figure 1a, updated from Thomas [1], shows the distribution of craters 1 km or more in diameter. The craters are classified into four morphologic groups, based on the state of degradation by smaller impacts and burial by laterally transported regolith: "fresh craters" with sharp rims and bowl-shaped interiors; "partly degraded craters" whose rims are slightly rounded; "degraded craters" having relatively shallower interiors and subdued rims; and "ghost craters" lacking rims and having shallow interiors. This classification parallels that employed by Thomas, although the classifications of some individual craters have been updated on the basis of the *Phobos 2* images.

Figure 1a also shows the distribution of bright rim materials among the portion of these craters within the region imaged at low phase angles by *Viking* and *Phobos 2* (outlined with a fine dashed line). Bright rims are widely distributed in many areas, but are largely absent between the western rim of Stickney and about 140°W, the region where a lobe of material interpreted as ejecta extends westward from the crater's rim [3]. Bright rims are most prevalent on craters exceeding several hundred meters in diameter, and a lesser fraction of smaller craters appears to have bright rims. Examination of Figure 1a suggests that, in general, the bright rims are also concentrated on less degraded craters. This trend was confirmed by an analysis in which craters larger than 1 km in diameter were classified on the basis of the presence and along-rim continuity of bright materials. The craters were divided into three groups in which bright materials (a) occupy more than half of the rim, (b) occupy less than half of the rim, or (c) are absent. All three fresh craters possess bright materials occupying more than half of the rim. Among 28 partly degraded craters, 57% possess bright materials occupying more than half of the rim, 15% possess bright materials along less than half of the rim, and 28% lack bright materials. Among 10 degraded craters, only one possesses bright material along more than half of the rim, and 6 lack bright materials; 8 of 10 ghost craters lack bright materials along their rims.

Grooves. Figures 1b and 1c show the global distribution of topographic grooves resolved in the combined imagery of *Viking* and *Phobos 2*. The grooves are classified here into the three morphologic groups defined by Murchie *et al.* [4]. "Class I" grooves are linear-walled, raised-rimmed troughs 50-150 m wide and hundreds of meters to 2 km long, which are concentrated immediately east of Stickney and have a consistent northeast orientation. Features of this type have not been recognized in *Phobos 2* images of the area immediately west of Stickney, but image resolution was probably insufficient for this purpose. "Class II" grooves consist of closely spaced or coalesced pits whose centers form a band several hundred meters to as much as 1 km in width. Those occurring east of Stickney have been imaged only by *Viking*; those west of Stickney have been imaged both by *Viking* and, in some places at greater resolution, by *Phobos 2*. Most class II grooves have sinuous to bifurcating traces, prominently raised rims, and depths typically of 30-60 m as determined by photoclinometry [4]. However, distal portions of the longest grooves consist of hummocky bands of coalesced raised-rimmed pits. Class II grooves are arranged subradial to Stickney, and appear to emanate predominantly from the crater's southwestern and northeastern portions. The features taper out and disappear as they approach the satellite's trailing edge (at 270°W).

"Class III" grooves consist of linear chains of coalescing pits generally lacking raised rims, are typically 80-200 m wide, several to 10 or more kilometers long, and several meters deep, and have an overall configuration subradial to the trailing edge [1,2,4,5]. These grooves have been imaged at high resolution over much of the surface by *Viking*, and many such grooves are also visible in *Phobos 2* images. Most of the newly identified grooves are of this type and occur west of Stickney. Class III dominates the overall global groove population but is poorly developed in two areas, (a) near the relatively groove-free trailing edge and (b) in the equatorial region west of

Stickney, where *Phobos 2* images allow resolution of features analogous to those dominating the area east of Stickney. Either the grooves originally did not form as extensively in these areas, or they have been buried subsequently by accumulation of regolith transported laterally across the surface by mass wasting or as crater ejecta. *Viking* images showed that grooves of classes I and II consistently are superposed on grooves of class III, indicating a relatively younger age of class I and class II grooves [4]; the same relation of class II and class III grooves is also observed in *Phobos 2* images of the area immediately southwest of Stickney.

Summary. High-resolution images from *Phobos 2* complement *Viking* imagery and allow improvement in the mapping of craters and grooves. Bright rims are widespread on craters larger than several hundred meters in diameter in most areas; they are generally absent from smaller craters and from the region west of the crater Stickney. The presence of bright crater rim materials has been found to be closely correlated with less degraded and therefore younger craters, probably indicating a genetic relationship. Some new grooves have been indentified, but these features have been found to be less prevalent in the region west of the crater Stickney than in most other areas.

REFERENCES: [1] Thomas, P., *Center for Radiophysics and Space Physics Report 693*, Cornell University, 1978. [2] Thomas, P., *Icarus, 40*, 223-243, 1979. [3] Murchie, S. *et al., Lunar Planet. Sci. XXI*, this volume, 1990. [4] Murchie, S. *et al., Lunar Planet. Sci. XX*, 744-745, 1989. [5] Thomas, P. *et al., J. Geophys. Res., 84*, 8457-8477, 1979.

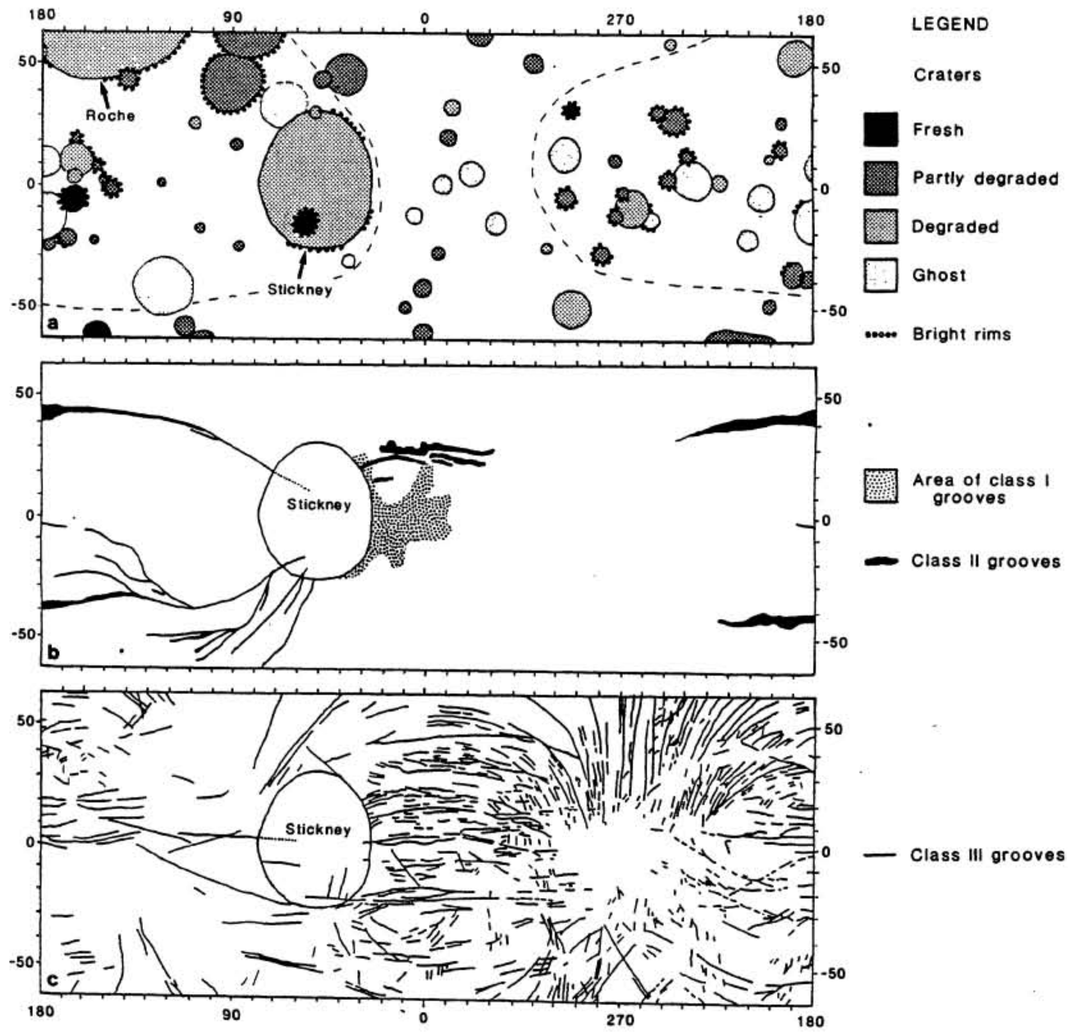

Fig. 1. Maps of crater and grooves on Phobos, updated from Thomas [1] based on combined imagery.of *Viking* and *Phobos 2*. **(a)** Craters >1 km in diameter. Dashed line denotes limit of low phase angle imaging by *Viking* and *Phobos 2*. **(b)** Class I and class II grooves. **(c)** Class III grooves.