EXPERIMENTAL DRAINAGE PITS AS POSSIBLE ANALOGUES TO STRUCTURES ON PHOBOS. Kevin C. Horstman and H.J. Melosh, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721.

Viking orbiter images of the Phobos surface show rows of pits that coalesce to form long grooves. The distributions of the pits suggest that they represent early stages of groove development. The grooves presumably have developed over extensional fractures. The fractures are on what would be minor circles of a sphere (Thomas *et al.*, 1979), and the greatest deformation is near the crater Stickney, although not all fractures intersect that crater. The fractures seem to represent pre-existing fracture zones that possibly were reactivated by the Stickney event; based on crater counts and intersection relationships, the pits and grooves formed geologically soon after the impact of Stickney (Thomas *et al.*, 1979).

The mechanism of drainage pit formation is modelled by homogeneous layers of simulated regolith consisting of dry, granular, non-cohesive material; this regolith is laid over two substrate plates abutted end to end, constituting a simple fissure in a rigid substrate (Figure 1). Each model regolith layer is levelled to assure a uniform thickness. The plates are evenly drawn apart, opening a linear gap beneath the regolith and simulating extension in a natural fissure. Little drainage flow occurs until the width of the fissure opening approaches that of the largest regolith grains. Two experimental regoliths were used: (1) expanded vermiculite that was sifted to approximately 10 mesh in size and containing a diversity of finer grain sizes, and (2) 20-mesh quartz sand with grains that are nearly uniform in size and equant in shape. The expanded vermiculite was used in regolith layers that were 10, 20, 30, 50, 80, and 100 mm thick, and the sand regolith layers were 10, 30, and 80 mm thick. The model extension was preformed repeatedly for each material/thickness combination in order to obtain a large sample population.

Extending the substrate plates initiates regolith drainage through the newly formed fissure into an unlimited void below (Figure 2). With extension and drainage a linear series of pits forms in the regolith above the fissure, and the pit spacings are recorded. As drainage progesses, the pits grow larger and merge to form grooves.

Large numbers of pit spacings were measured, and least-squares regression lines were calculated for each of the two regolith (vermiculite and sand) experiment groups. The resulting equations show that the regression line of the expanded-vermiculite regolith passes nearly through the origin and has a slope of 1.03 (see Figure 3). Similar results are found in the sand regolith experiments: the y-intercept of the regression line lies higher than that of the vermiculite line, but the sand-regolith regression line has a slope of 0.98, a value close to that of the vermiculite experiments. Both sets of calculations for pit spacing versus regolith thickness yield a correlation coefficient of 0.996. The average spacing of pits as determined experimentally, thus, is nearly equal to the regolith thickness and apparently is unaffected by grain shape or degree of regolith sorting.

The relationship between pit spacing and regolith thickness can be used to estimate the thickness of regolith on planetary bodies where drainage pits occur over extensional fissures. The values derived this way reflect the regolith thickness at the time of groove and pit formation. On Phobos, the thickness of the regolith has been estimated using this concept. Pit-spacing measurements have been made in the area of lat 10°—20° N, long 20°—30° W on image 343A29. The spacing of pits from two rows in that region yields a regolith thickness value of 310 m. Similarly, measurements were made from image 248A02 in the region of lat 30°—40° N, long 260°—280° W. The regolith thickness there is estimated to be approximately 287 m using the pit-spacing technique. The concordance of the calculations from two separate locations, therefore, suggests that 300 m is a reasonable estimate of the regolith thickness, at least for parts of Phobos. This thickness value agrees with the interpretation of Dusbury *et al.* (1984) that the regolith on Phobos is as much as a few hundred meters thick; 300 m is greater than the

100—200 m regolith thickness range proposed by Thomas *et al.* (1979), but their interpretation that the Phobos regolith could be fairly uniform is substantiated by the closeness of the two estimates derived here.

References: Thomas, P., J. Veverka, A. Bloom, and T. Duxbury (1979) Grooves on Phobos: Their distribution morphology and possible origin. *Jour. Geophy. Res.* **84**, no. B14, pp. 8457-8477. Duxbury, T.C., J.D. Callahan, and A.C. Ocampo (1984) Phobos: Close encounter imaging from the Viking orbiters. *NASA Ref. Pub.* **1109**, 51 p.

Figure 1

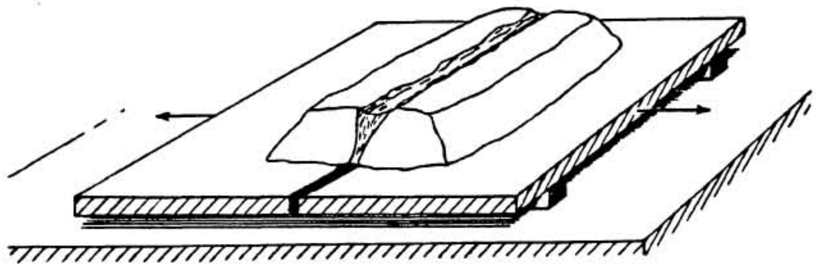

Figure 2

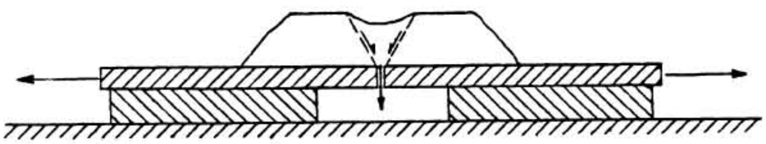

Figure 3