MARS EOLIAN PROCESSES: EROSION IN LEE OF A SIMPLE RAISED-RIM CRATER IN DAEDALIA PLANUM COMPARED WITH 1974 WIND TUNNEL MODEL. K. S. Edgett and M. C. Malin, Malin Space Science Systems, P.O. Box 910148, San Diego, CA 92191-0148, USA.

Introduction and Background: In 1974, Greeley *et al.* [1, 2] published two papers describing results of attempts to model the wind flow around simple, bowl-shaped, raised-rim impact craters. Their purpose was to gain understanding of the underlying causes of various bright and/or dark streaks observed in the lee of craters and other obstacles in Mariner 9 images. Their work concluded with a description of zones of erosion and deposition induced by the flow of wind around a raised-rim crater similar to those observed in Daedalia Planum west of Arsia Mons (see Figure 1 in [1] and Figure 24 in [2]). They concluded that dark zones in wind streaks might result from erosion of bright sediment in the "tail" formed behind each crater, while bright zones might form from preferential deposition of sediment in a "shadow zone" immediately behind the crater and along the margins of the erosion zone in the crater lee. While it has always been acknowledged that this is not the only way to form a wind streak [*e.g.,* 1–3], new Mars Global Surveyor Mars Orbiter Camera (MOC) images of wind streaks in Daedalia Planum provide an array of observations with which to test wind streak formation models. Fig. 1 shows a wind streak that appears to demonstrate—in a natural setting—the most basic features observed in wind tunnel tests—specific zones of erosion and deposition in the lee of a small, bowl-shaped, raised-rim crater.

Observations: MOC image M08-03122 was acquired in October 1999. The intended target was a pair of craters and their associated wind streaks located near 10°S, 143°W in western Daedalia Planum. The inset in Fig. 1 shows the location of the image relative to the two targeted craters, each of which was less than 3 km in diameter. A subframe of the image dominates Fig. 1. It shows the western rim of one of the intended target craters and the adjacent wind streak surface. The context image shows that at about 240 m/pixel scale, the streak exhibits a bright zone (relative to the surrounding terrain) with a somewhat serrated fan shape in contact with the crater. The margins and the tail end of the streak are dark relative to the surrounding terrain. The high resolution image reveals that the surrounding terrain consists of a severely ridged and grooved surface in which individual ridges are spaced ~15 m apart. This grooved surface is common in this portion of western Daedalia Planum and in fact corresponds to the location of the Mars radar "stealth" region described by Muhleman *et al.* [4]; also see [5]. The wind streak surface that dominates Fig. 1 is characterized by the absence of the grooved material, and it is apparent along the margins of the wind streak that the grooved material is a veneer that is not much thicker than the apparent height of the ridges within the unit. A few ridges are present in scattered locations within the wind streak, and a cluster of ridged material occurs at the center left margin of the MOC image. The bright material apparent in the context frame appears to be a thin coating on top of the surface of the wind streak. The dark material along the margins of the streak seen in the context image likewise appears to be a thin coating, but in places this material appears to be banked-up against ridges within the grooved unit.

Discussion: The modeling of Greeley *et al.* [1, 2] showed that in a unimodal wind regime where wind streaks are produced in the lee of a small, raised-rim impact crater, there is a zone of erosion in the crater lee and there is also a zone of deposition (or, at least, non-erosion) in the immediate lee running approximately down the long axis of the streak (see Figure 24 of [2] for more detail). The MOC image in Fig. 1 shows a case where no grooved material occurs in the area behind the crater—this is the zone that Greeley *et al.* [1, 2] characterized as an area of erosion; likewise, the patch of grooved material within the wind streak at the left-center portion of Fig. 1 corresponds to the a zone of deposition (or non-erosion) in their models. This picture provides confirmation of the general model for a flow field in the vicinity of a small, raised-rim crater.

The story here is more complex, however. Either the zone behind the crater was once covered by grooved material which has now been stripped away, or the material in which the grooves formed was never deposited in this zone. We suspect the former because the image shows some outliers of grooved material within the eroded zone. The bright and dark streaks visible in the context frame appear to be a feature separate from the grooved material and apparent zone of erosion. The bright material is probably an optically-thick coating of dust. Its presence suggests that erosion in the lee of the crater has not happened very recently, or, alternatively, there is a similar thin coating of bright material on the grooved terrain, but this terrain is rough and thus appears darker (perhaps) because of shadows amid the grooves. The dark material along the streak margins appears to be a sediment that can saltate and thus form drifts and bank against small ridges. The dark material has no obvious source but might have been exposed from beneath the grooved surface.

References: [1] Greeley R. *et al.* (1974) *Science, 183*, 847–849. [2] Greeley R. *et al.* (1974) *Proc. R. Soc. Lond., A 341*, 331-360. [3] Zimbelman J. R. and Williams S. W. (1996) *Geomorphology, 17*, 167-185. [4] Muhleman D. O. *et al.* (1991) *Science, 253*, 1508–1513. [5] Edgett K. S. and Malin M. C. (2000) "A meter-scale view of the Mars radar 'Stealth' in southwestern Tharsis," this volume.

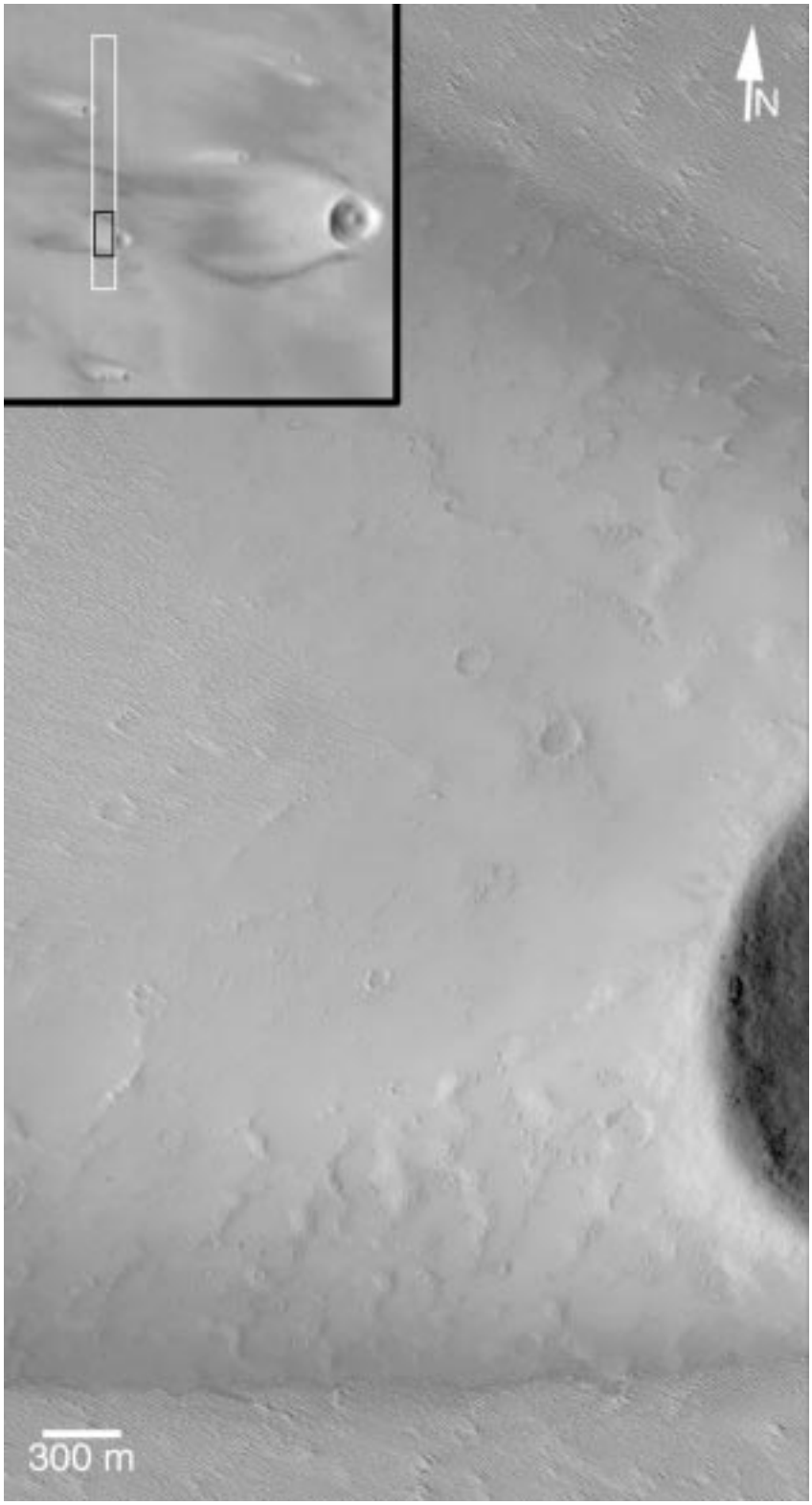

Figure 1. Wind streak in west Daedalia Planum near 10.1°S, 142.9°W. Inset is subframe of the MOC context frame (M08-03123) taken at the same time as the high resolution view (M08-03122). Black box in inset shows location of the high resolution subframe. Both scenes are illuminated from the left.