SURVEY OF CRATERS WITH ARCUATE RIDGES AND GULLIES IN THE NEWTON BASIN REGION ON MARS. D. C. Berman[1] W. K. Hartmann[1], D. A. Crown[1], and V. R. Baker[2], [1]Planetary Science Institute, 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719; bermandc@psi.edu, [2]Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ.

Introduction: The discovery of hillside gullies on Mars, interpreted by Malin and Edgett [1] to be evidence for recent water release, and recognition of their apparently young ages has caused much excitement and debate. The gullies are mainly observed on the sloping walls of large craters or channels. Most of the gullies are between ~30°-50° latitude (most in the southern hemisphere) and are usually seen on pole-facing slopes.

At the bases of many mid-latitude crater walls smooth, concave depressions bounded by lobate, arcuate ridges with sharp crests can be seen [2, 3]. These features are usually seen at the bottom of gullied walls of craters, but gullies are not always present above them. Some of the ridges are only slightly sinuous and form one continuous ridge around a portion of the base of the crater wall, but in most cases appear as individual scallop-shaped ridges which abut one another. They are often associated with lineations and pitted textures extending from the ridges onto the crater floors. The arcuate ridges resemble terrestrial protalus ramparts or terminal moraines [3, 4] which suggests they may have a glacial origin. Howard [3] noted a few examples of arcuate ridges in craters, but a more systematic survey [2] has shown these features to be fairly common in certain mid-latitude regions, and likely play an important role in the degradation of craters.

Survey: Quadrant MC-24 was selected for a more thorough survey because of the large density of craters in that region with the features in question. All 1153 MOC images from mission phases AB1 through R02 in quadrant MC-24 (-30 to -65º S, 120º W to 180º W) were surveyed for craters containing gullies, arcuate ridges, and related floor deposits. Arcuate ridges were identified according to the classification scheme described below. Gullies were identified on the basis of having at least two of the primary features described by Malin and Edgett (2000): head alcoves, channels, and debris aprons. Craters with floor deposits that resembled those in craters with ridges, but had no ridges at the base of their walls, were also identified. This survey resulted in 364 MOC images which contained one or more of these features. Then all 485 THEMIS VIS images through the 7/1/04 release within the same region were surveyed, resulting in 67 images with the desired features. The images were then grouped by crater, as many of them covered the same crater; giving a more complete picture of many of the craters. This resulted in 225 individual craters, which range in diameter from ~1.5 km - ~50 km, although few craters larger than 30 km in diameter exhibit these features.

Of the 225 craters, 188 contained gullies on some portion of their walls, and 153 had arcuate ridges or related floor materials.

The orientation of the gullies in each of the craters was assigned as either on the north wall, the northwest wall, the northeast wall, the west wall, the east wall, the southwest wall, the south wall, or the southeast wall; if gullies were present on more than one section in the same crater, they were counted separately. These results were then tallied, and can be seen in Fig. 2 and 3 in polar form. There is an obvious preference for pole-facing orientations.

Gullies on the northwest, north, or northeast wall were identified as pole-facing gullies; gullies on the southwest, south, or southeast walls were identified as equator-facing gullies. For craters with coverage of the entire crater (34 craters), 20 had only pole-facing gullies, 2 had only equator-facing gullies, 6 had gullies on both walls, 1 had gullies on the east and west walls, and 5 had no gullies at all. Of the 198 craters that had image coverage of at least some portion of both the north and south walls, 165 had gullies. Of those, 98 (59%) had gullies only on pole-facing slopes, 28 (17%) had gullies only on equator-facing slopes, 32 (19%) had gullies on both walls, and 7 had gullies on the E or W walls. As seen in Fig. 1, all of the craters with gullies only on equator-facing slopes were found between -44º S and -56º S. Craters with gullies only on the pole-facing side were found between -30º S and -48º S. Craters with gullies on both sides were found between -37º S and -64º S. Craters with gullies on the east and/or west walls were found between latitudes -42º S and -50º S.

A total of 111 craters with arcuate ridges were identified; 96 of these craters also had gullies (conversely, 96 of the craters with gullies also had arcuate ridges). An additional 34 craters had related floor deposits, 12 of which also had gullies.

The arcuate ridges have an even stronger preference for pole-facing orientations than the gullies; a polar plot of their orientations can be seen in Fig. 4. Of the 99 craters with arcuate ridges with image coverage of both crater walls, 75 had ridges only on the pole-facing side, 11 had ridges only on the equator-facing side, and 13 had ridges on both sides.

References: [1] Malin M. C. and Edgett K. S. (2000) *Science, 288,* 2330–2335. [2] Berman D. C. (2003) Master's thesis, U. of Arizona. [3] Howard A. D. (2003) *LPSC XXXIV*, Abstract #1065. [4] Arfstrom J. D. (2003) *LPSC XXXIV*, Abstract #1050.

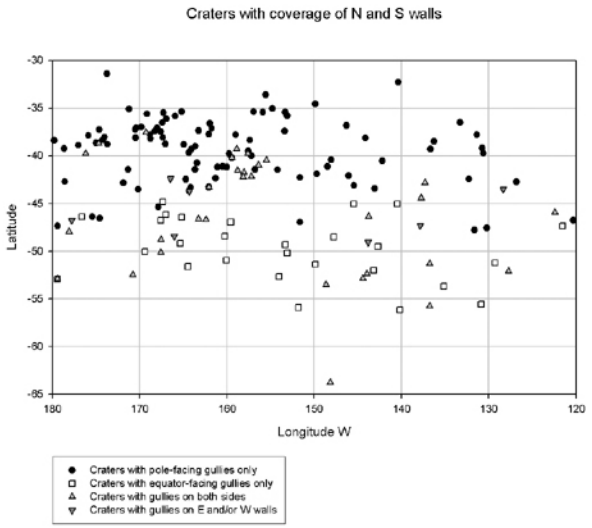

Fig. 1.

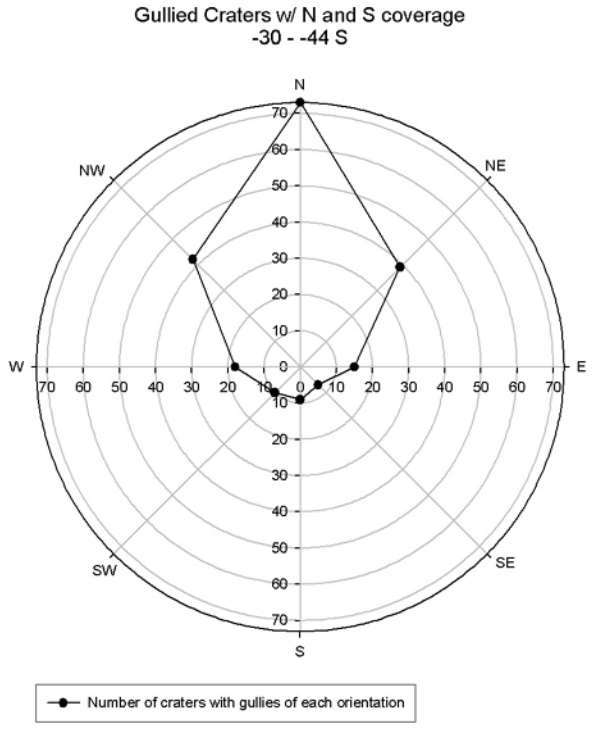

Fig. 2.

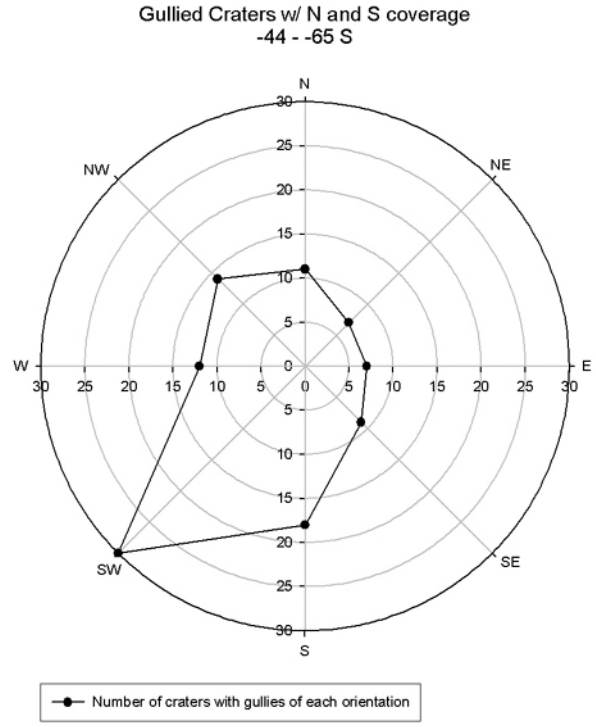

Fig. 3.

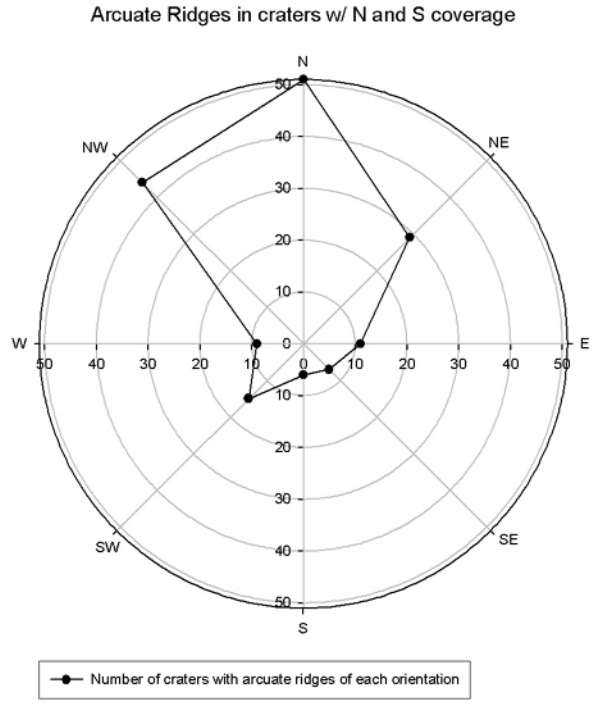

Fig. 4.