DEBRIS APRONS, CHANNELS, AND VOLCANOES IN THE REULL VALLIS REGION OF MARS. D. C. Berman[1,2], W. K. Hartmann[2], and D. A. Crown[2], [1]Department of Geosciences, University of Arizona, Tucson, AZ 85721, [2]Planetary Science Institute, 620 N. 6th Ave., Tucson, AZ 85705; bermandc@psi.edu.

Introduction: The highlands to the east of the Hellas impact basin in the southern hemisphere of Mars contain a variety of complex, interacting geologic structures. The older highland terrain is intermixed with younger, smoother plains; it is dotted with mountains, volcanoes, massifs with debris aprons, and is intersected by several outflow channels.

This work includes a comprehensive survey of images from the Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) of the Reull Vallis region, shown in Figure 1. Through crater counts and stratigraphic analyses, the precise interactions of these various terrains is studied. It is clear that the same processes affect these terrains and their histories are inter-related. By studying not only the youngest surface features, but the geologic history of the entire region, we can gain a better understanding of the continuing activity in the area.

Water plays a primary role in the geologic history of this region [1]. Aside from the outflow channels, water has also influenced the evolution of the volcanoes and the debris flows. We hope to gain a better understanding of the sources of the water, as well as any present content, through this study.

Crater Count Methodology: Using the Hartmann crater counting methodology [4], we have obtaines crater population data for many MOC images. Counting craters on MOC images tends to give small statistics. To make these data more robust, we count multiple images over similar terrains. The counts on each image are then plotted together to see how well they match up. In most cases, they overlap very clearly. In that case, the counts are then summed together, giving counts of a larger, but not necessarily contiguous area.

Channels: This region contains four major outflow channels: Reull Vallis, Harmakhis Vallis, Dao Vallis, and Niger Vallis. Studies of the latter two are underway. Reull Vallis extends for ~1500 km through

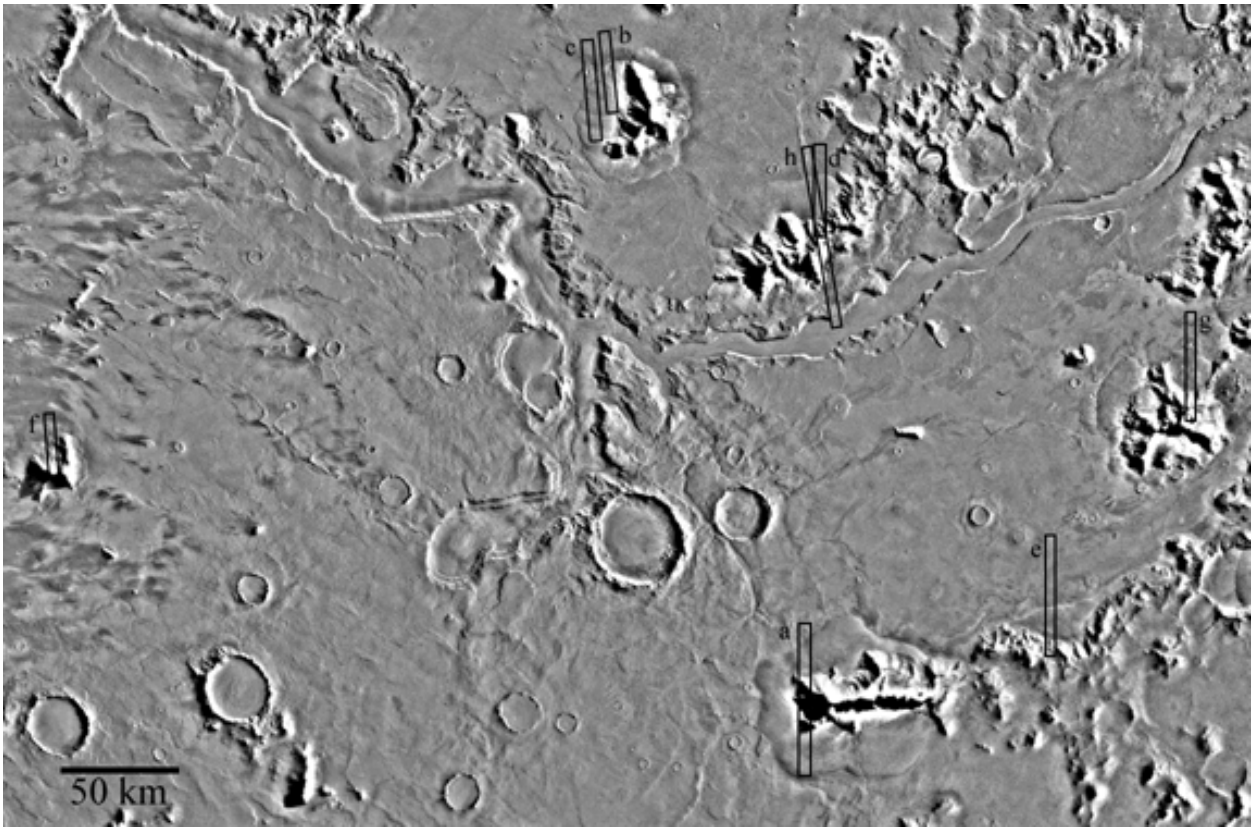

Figure 1. Viking context image showing Reull Vallis and surrounding features. Boxes indicate footprints of MOC images included in crater counts for debris aprons; a) E0501755, b) E0301422, c) M0802752, d) E0101294, e) M0902573, f) E1003119, g) E0300875, h) E1103816.

terrains of varied ages and morphologies, and there is evidence for multiple flow events. The floor of the channel contains infill deposits with pits and lineations that parallel its walls, suggesting possible ice flow activity. Crater counts show an age of 100 My, which is also very close to the surrounding plains.

Debris Aprons: The debris aprons, previously mapped by Crown [3] are clearly very young features. MOC imagery shows few unmodified craters on the debris flows. Distinct, overlapping flows are also evident, which indicates multiple, discontinuous movements down the slopes. The crater counts of the debris aprons show a distinct pattern that differs from almost any other region we have analyzed; the pronounced flattening of the curve at smaller diameters suggests either multiple episodes of flow, with different crater populations on neighboring flows, or even continuous mass movement down the slope.

Paterae: Nearby Hadriaca and Tyrhenna Paterae are broad, low-relief volcanoes with radial channels and ridges on their flanks [1]. Previous studies [2] have suggested these volcanoes are pyroclastic, and may have erupted as a result of interactions between magma and water. Note how the counts for Tyrrhena straddle the saturation line at small diameters, indicating the saturation line is robust.

Conclusions: The geologic history of this region is highly complex, with clear interactions between the various landforms. By using crater counting techniques, we can gain a better understanding of these processes and their chronologic history.

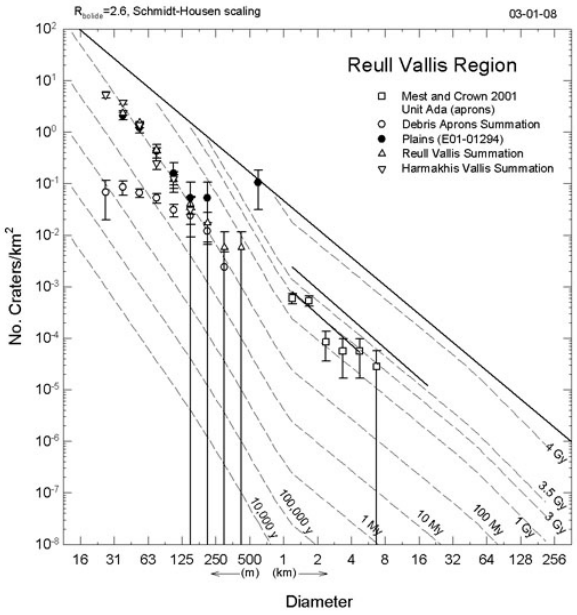

Figure 2. Crater counts for the debris aprons and channels.

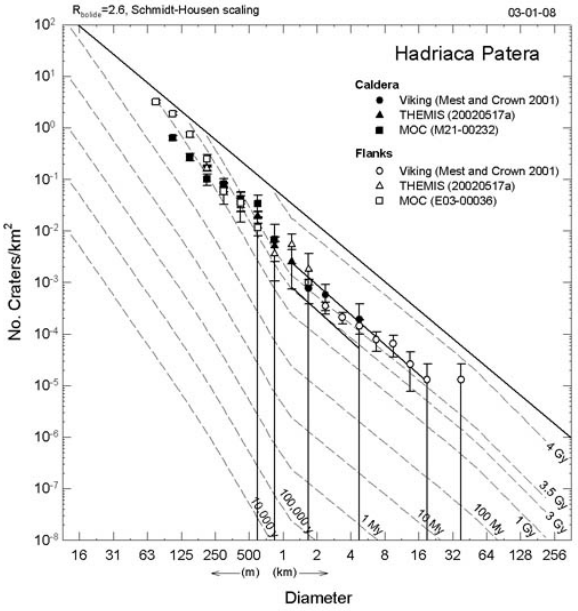

Figure 3. Crater counts for Hadriaca Patera. Black symbols indicate counts on the caldera, white symbols the flanks.

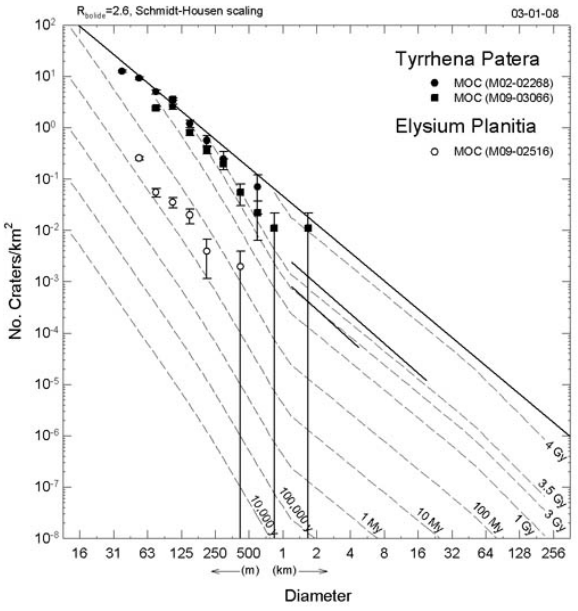

Figure 4. Counts on two MOC images on the flank of Tyrrhena Patera. An intermediate-aged lava flow in Elysium Planitia is included for reference.

References: [1] Mest S. C. and Crown D. A. (2001) *Icarus, 153,* 89-110. [2] Crown D. A. et al. (1992) *Icarus, 100,* 1-25. [3] Crown D. A. et al. (2002) *LPSC XXXIII,* Abstract #1642. [4] Hartmann W. K. and Neukum G. (2001) *Space Sci. Rev., 96,* 165-194.