PRISTINE IMPACT CRATER POPULATIONS OF MARS. R. V. Chauhan[1] and J. J. Plaut[2], [1]Dept. of Earth and Space Sciences, Univ. of California Los Angeles, Los Angeles, CA 90024, chauhan@ucla.edu, [2]Jet Propulsion Laboratory, California Institute of Technology.

Introduction: This study focused on obtaining size frequency distributions of pristine crater populations from various terrains of Mars. Images from the Viking Orbiter (VO), Mars Orbital Camera (MOC), and Thermal Emission Imaging System (THEMIS) were utilized for this study. The results may aid in providing information about crater production functions and resurfacing events on Mars [1].

Method: Three regions that were expected to have pristine surfaces were chosen for the study. They were Arabia Terra, Ares Vallis, and Elysium Planitia. Elysium Planitia was broken down into four regions: Athabasca, northeast Athabasca, Albor Tholus, and Marte Vallis. The three criteria used in defining a pristine surface were a sparse crater population, fresh/sharp looking craters, and a steep size frequency distribution slope ($\geq$-3) when graphed on a cumulative plot.

Initially MOC images for each area were selected. The resolution of the MOC images ranged from l.5 m/pixel to 6 m/pixel. VO and THEMIS images, which, either overlapped or were within close range to the associated MOC image were then selected. The resolution of VO images ranged from 14m/pixel to 230 m/pixel. The resolutions of the THEMIS images were either 18m/pixel or 100 m/pixel. Crater counts were then conducted on these images. Cumulative and incremental plots were then created, based on the crater counts. Areas containing more than one mappable unit were divided according to unit boundaries and separate cumulative and incremental plots were made of each unit.

Discussion: Figures 1 and 2 are cumulative plots of the images for which craters counts were conducted. Since all three image data sets (MOC, THEMIS, VO) were employed, crater diameters for certain areas ranged over 5 orders of magnitude. Crater abundances, at certain diameters, varied up to 2 orders of magnitude. Counts from Athabasca seem to fit under either of two crater production functions, indicating two different age units. Table 1 shows the range of size frequency distribution slopes found in each area based on the cumulative plots.

Past research shows that craters less than 1 km in lunar mare populations have a "steep branch" with size frequency distribution slopes of -3 to - 4 on a cumulative plot [2,3] . As Table 1 illustrates, Ares Vallis and Elysium Planitia craters both have slopes from –3 to –5, with "steep branches" across a wide range of diameters. Steep slopes are good indicators of unmodified surfaces, and therefore may reflect the production population. Steep size frequency distribution slopes are observed in both MOC and THEMIS images.

In certain cases, a change in slope can also be observed. For example, in one of the Ares Vallis sites, the slope is –0.94 (shallow) for crater diameters between 15 m to 75 m, and then steepens to –2.16 for crater diameters between 75 m and 635 m. The shallow slope is perhaps due to resurfacing processes, which have resulted in a loss of craters smaller than 75 m [1].

Some incremental plots are consistent with the 10 My, 100My, and 1 Gy isochrons established by Hartmann [3]. For example, a site in northeast Athabasca contains crater diameters from 35 m to 125 m, which correlate to the 10 My isochron; however for diameters smaller than 35 m the curve drops, suggesting crater obliteration at smaller diameters. There are also sites that are not consistent with the isochrons. Some sites have incremental plot trends that cross over all three isochrons, thus making it difficult to make a reliable estimate of the age of the surface.

A few complications arose during this study. There were discrepancies in crater abundances between counts made from different image data sets. A variety of terrains were examined, such as interfingering lava flows, some of which could only be seen on the high- resolution images. Craters that were counted included those that were part of clusters and those that may have been filled in, possibly biasing some of the counts. The incorporation all three image data sets has nevertheless allowed for a better understanding of crater production functions and resurfacing processes on Mars.

References: [1] Plaut, J.J., 2001, LPS XXXII, abstract 2171. [2] Neukem,G. et al, 1975, Proc LPSC 6, 2596-2620. [3] Hartmann, W.K., 1999, Met. And Planet. Sci. 34, 167-177.

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Area Name	# of MOC images	# of THEMIS images	# of Viking images	Ranges of size frequency distribution slopes	
				MOC	THEMIS/VO
Arabia Terra	3	2	0	-1.47 to -2.44	-0.66 to –2.13
Ares Vallis	4	2	6	-0.94 to -3.03	-1.7 to -2.96
Athabasca	7	4	2	-0.80 to -3.65	-0.63 to -3.34
Albor Tholus	1	0	1	-1.17 to -2.81	-2.25
Marte Vallis	6	3	0	-2.52 to -4.57	-2.02 to -5.07

Table 1. Summary of crater counts. Size frequency distribution slopes are fit to straight line segments in cumulative plots for crater diamters < 1 km.

Figures 1 and 2 below: Summary of all crater counts shown on cumulative plots.

Figure 1

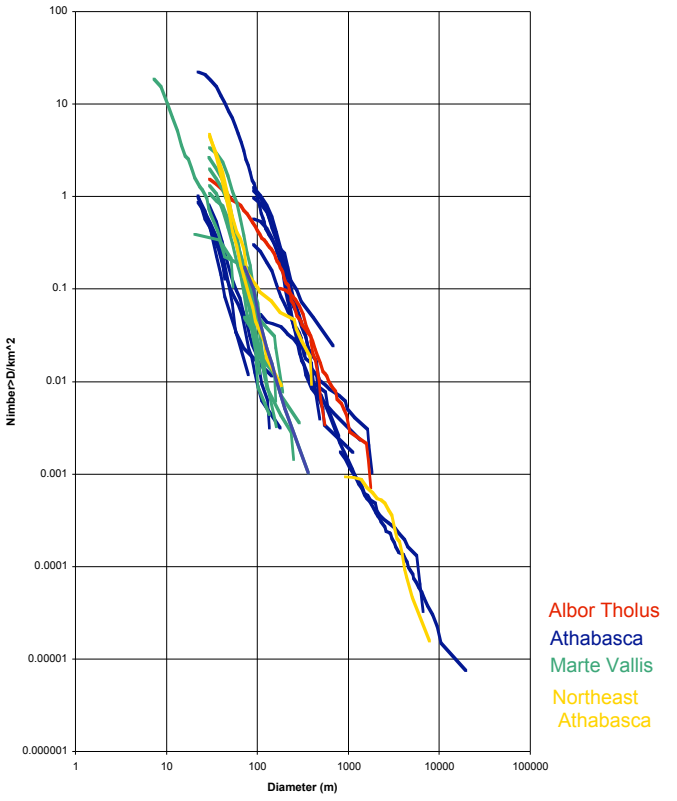

Figure 2