RELATIVE PLOTS OF VENUSIAN IMPACT CRATERS: COMPARISON WITH THE INNER SOLAR SYSTEM CRATERING RECORD. N. G. Barlow, Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058.

Crater statistical techniques provide a means for determining the relative ages of planetary terrain units. The Relative crater size-frequency distribution plotting technique (or R-Plot) clearly shows frequency variations within a particular diameter bin, variations which have been interpreted as indicative of distinct populations of impacting objects (1). Within the inner solar system, two populations of impactors have been detected: an older population which displays a multi-sloped distribution curve and which is preserved in the heavily cratered regions of the moon, Mercury, and Mars, and a younger population recorded in the lunar and martian plains whose distribution curve can be approximated by a power law distribution of -3 differential slope within the diameter range 8 to 70 km. The structured curve of the heavily cratered regions is believed to be reflective of the size-frequency distribution of impactors dominating the cratering record during the period of heavy bombardment early in solar system history. The single sloped curve of younger regions reflects the distribution of impactors since the end of heavy bombardment (2). Relative ages of geologic units on a single planet can be determined by consideration of the curve shapes and crater densities; comparison of terrain ages between planets requires some knowledge of the crater flux intensity throughout the solar system.

Crater statistical information for Venus generally has been lacking due to the difficulty of distinguishing impact craters on the radar images of the planet. However, the detailed imagery and altimetry derived from the Venera 15/16 spacecraft encounters with Venus provided some of the best evidence of impact craters on the venusian surface (3). A list of craters of almost certain impact origin has recently been obtained from analysis of Venera 15 and 16 data and has been published by Basilevsky, et al. (4). Using the 146 entries in this list, R-Plots have been computed for four regions of the venusian surface north of about +20°: Plains, Ridge-and-groove belts, Lakshmi plateau and surroundings, and parquet terrain (Fig. 1, 2). The craters ranged in diameter from 8 to 144 km and displayed relatively fresh morphologies, suggesting that all probably post-date the formation of the surface on which they are found. Because of the restricted number of craters in the analysis and the large sizes of these craters, the resulting relative ages should be considered as averaged over the relevant regions.

R-Plots for all four of these terrain units reveal a very low crater density and thus a very young age. The regions are statistically indistinct from one another, indicating that all record an approximately simulataneous average age of formation. All four curves can be approximated by a power law of -3 slope index for diameters greater than about 20 km, indicative of post heavy bombardment emplacement; at lower diameters erosion or incomplete resolution coverage appears to affect the curves. No geologic units with heavy bombardment-type size-frequency distribution curves are seen within the region covered by Venera 15/16 images. The vertical location of the four curves near log(R)=-3 suggests a lower crater density than any seen on the various terrain units on the moon, Mercury, or Mars (5, 6). However, if estimates that the cratering flux at Venus is the same as that at the moon and half as much as that at Mars are correct (7), the crater densities for the venusian units are similar to those seen in the Tharsis plains and around Olympus Mons on Mars. Nevertheless, the cratering record for the regions imaged by Venera 15 and 16 denote that the area north of +20° on Venus is one of the youngest regions in the inner solar system.

References: (1) Strom, R.G. and E.A. Whitaker (1976). NASA TM X-3364. (2) Woronow, A., R.G. Strom, and M. Gurnis (1982). In Satellites of Jupiter, 235-276. (3) Ivanov, B.A., et al. (1986). Proc. Lunar Planet. Sci. Conf. 16th, D413-D430. (4) Basilevsky, A.T., et. al. (1987). J. Geophys. Res., 92, 12869-12901. (5) Leake, M.A. (1981). PhD Dissertation, Univ. Az. (6) Barlow, N.G. (1987). PhD Dissertation, Univ. Az. (7) Basaltic Volcanism Study Project (1981). In Basaltic Volcanism on the Terrestrial Planets, 1080.

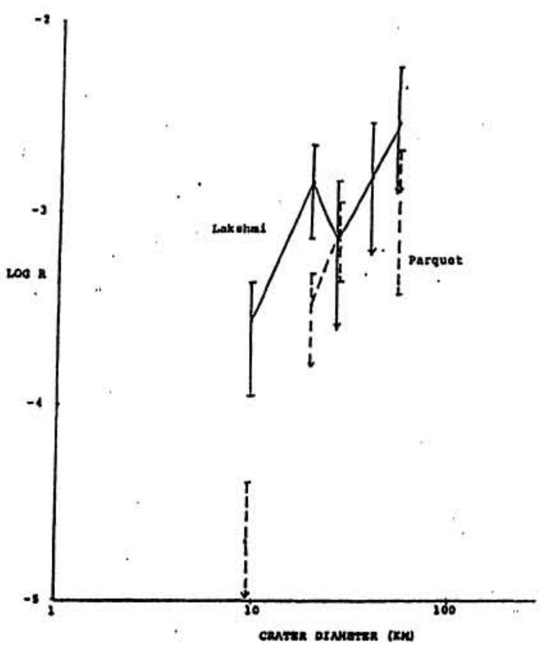

FIGURE 1

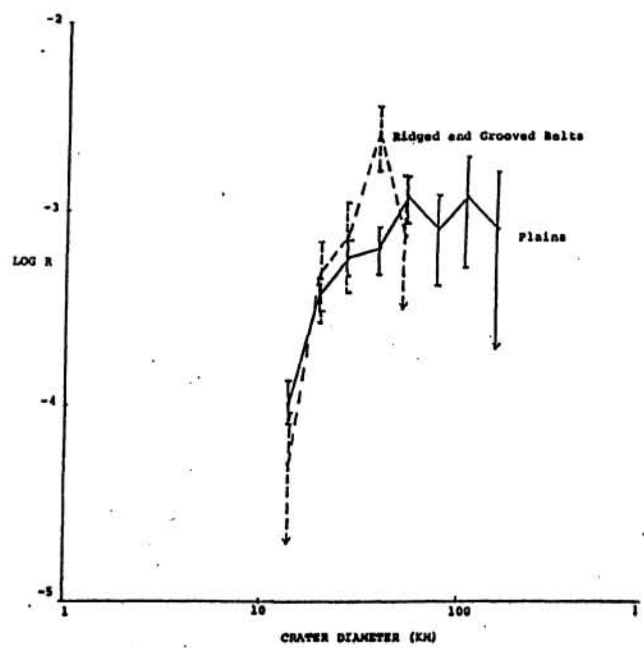

FIGURE 2