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Among several unique characteristics of the impact cratering record on Venus are 1) the globally uniform and spatially random distribution of craters (1), 2) the constancy of the crater size/density distribution from area to area, and 3) the pristine condition of most craters. The cratering records on all other terrestrial planets and most outer planet satellites show non-uniform and spatially non-random crater distributions due to different ages and intensities of resurfacing events, variations in the size/density distribution due to resurfacing and erosional processes at different times, and a complete spectrum of crater degradation states due to resurfacing and erosion. For example, in the plains regions of the Moon, Mercury and Mars the craters have rims that range from completely to partly buried, and ejecta blankets that range from completely embayed to completely intact. The crater size/density distribution of all craters on the plains regions shows variations from area to area depending on the intensity and/or age of resurfacing events. Only the fresh crater population is a reliable indicator of the production population that records the accumulation of impacts since the last resurfacing event.

Although some craters on Venus have been highly fractured or partially embayed by lava, the crater size/density distribution remains constant. From a total of 840 craters covering 89 percent of the planet only 35 (4 percent) have been embayed by lava, and only 63 (7.5 percent) are highly fractured. These craters are strongly concentrated in very limited regions of recent volcanism and tectonism as discussed by Schaber, *et al.* (2) in this volume. A comparison of the crater size/density distribution on the lowlands and Aphrodite Terra, where many of the most fractured and embayed craters occur, shows no appreciable difference (Fig. 1). This indicates there has been no significant loss of craters due to resurfacing or tectonism on Aphrodite. These data strongly suggest that the surface of Venus records a crater production population, and that recent resurfacing events are localized in small areas and not of sufficient magnitude to significantly alter the existing crater population. The low crater density and the estimated collision rate of Venus-crossing asteroids (3) indicate an "average" surface age of $0.5 \text{ Ga} \pm 0.3 \text{ Ga}$.

The uniform size/density and spatial distribution of impact craters, their pristine morphologies, and the strongly non-random distribution of rare lava-embayed craters strongly suggest that the observed crater population accumulated and has remained largely intact during the last 0.5 Ga as a result of a significantly reduced rate of volcanism and tectonism. This does not preclude a currently active planet, but requires a lack of plate tectonics and substantially less tectonic and volcanic activity than on Earth.

Although the occurrence of previous events can not be resolved by crater analyses, a thermal history model of Venus by Arkani-Hamed and Toksöz (4), their preferred model 4, provides a plausible explanation and time-scale that agrees remarkably well with Magellan observations. The greater apparent depth of compensation of Venusian surface topography and the strong correlation of topography with gravity anomalies imply strong coupling of mantle convection to the lithosphere (5) and favor a free boundary condition at the surface for mantle convection (6). The thermal evolution calculations (4) suggest that a free boundary condition on Venus has resulted in rapid cooling of the interior. The cooling rate was so high that Venus' core solidified during the last 10^9 years accounting for the present lack of a magnetic field. According to the model, about 0.5 Ga years ago the mantle temperature was reduced to the extent that the vigor of convection diminished and allowed the development of a permanent crust, in good agreement with the geology and surface age deduced from the cratering record. At this stage the tectonic style changed from

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recycling of crustal plates to hot spot volcanism. The model implies a completely solid planet at the present time except for localized partially molten regions in the upper mantle, in agreement with the observed localized nature of recent tectonism and volcanism.

Thus, Venus may have experienced extensive resurfacing events during its history until about 0.5 Ga years ago, which completely obliterated the previously existing cratering record. The planet has subsequently experienced only minor localized volcanic and tectonic activity which has not significantly altered the observed cratering record. Therefore, the present surface is largely a remnant of the last resurfacing event. If this is the case, it provides a unique opportunity to understand the geological and geophysical mechanisms of such an event.

References: 1. Phillips, R.J. *et al.*, 1992. *J. Geophys. Res.*, (Magellan Special Issue), submitted. 2. Schaber, G.G. *et al.*, 1992. *this volume.*; 3. Shoemaker, E.M. *et al.*, 1991. *Reports of Planetary Geology and Geophysics Program -1990*, NASA TM 4300, 389-390.; 4. Arkani-Hamed, J. and Toksöz, M.N., 1984. *Phys. Earth Planet. Interiors*, **34**, 232-250.; 5. Phillips, R.J., 1990. *J. Geophys. Res.*, **95**, B2, 1301-1316. 6. Schubert, G. *et al.*, 1990. *J. Geophys. Res.*, **95**, B9, 14105-14129.

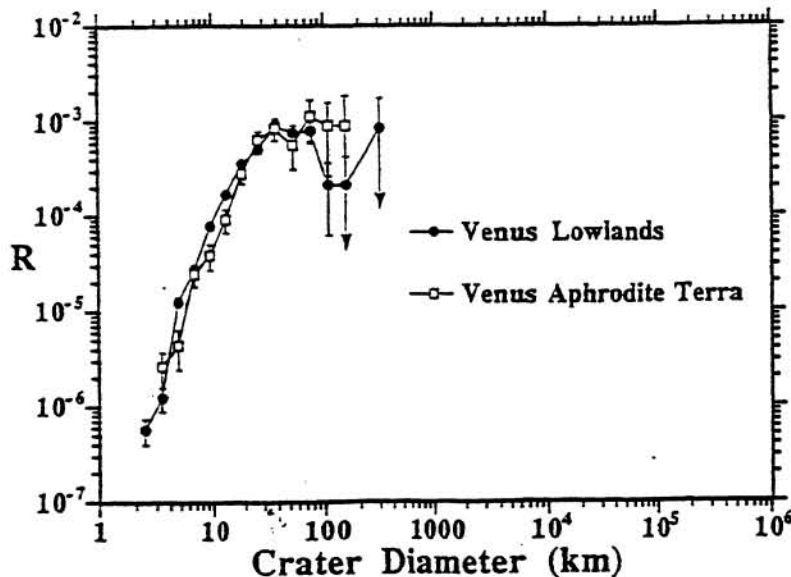


Fig. 1. "R" plot comparing the crater size/density distribution of the Venus lowlands and Aphrodite Terra.