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Relative Age of Polygonal Impact Craters on Venus

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Introduction

Impact craters form typical landforms on the inner planets of our Solar System, and their number, distribution and conservation status reflect the geological history of the planet. Polygon Impact Craters (PICs) are different from other impact craters by a more or less angular shape [1]. Criterion is that the crater rims are made up of at least two straight adjacent segments. Previous studies (e.g. [5]) have proven that the PICs were found on the Moon, on Mercury, Venus, Mars and several asteroids and icy moons. These papers showed that there are regions where the straight edge of the crater segments seem to align with the local tectonics near the crater, especially at points of lower density, so-called "zones of weakness". With this technique the physical properties of the target material, as well as details of the mechanics of crater formation could be examined.

Relative Age Relations

The aim of this study was to estimate the relative age of polygonal impact craters on the surface of Venus, that means the age in relation to the surrounding geological structures (plains, tesserae, etc.). For example, when a crater is superimposed a regional plain, we can deduce that the craters is less old than the plain. From the approximately 900 impact craters on Venus a list of 121 PICs were identified by [4], from which we selected a set of 22 PICs on Venus with a diameter greater than 30 km. The restriction of the radii of the PICs was necessary because small diameter often lead to ambiguous results (cf. [2]). We scanned for PICs overlaying regional plains with wrinkle ridges. This type of volcanic plains dominates the entire surface of Venus and is usually deformed by wrinkle ridges, which are the result of a weak compression of the plains. Investigations of [3] have shown that the degradation of radar-dark halos in the vicinity of the PICs build up a time sequence. This feature we have additionally used for the temporal classification. The analysis of the examination and the conversion from quantities to relative ages followed the methods developed by [2], whereby the ratio of the numbers of craters leads to a ratio of the ages respectively.

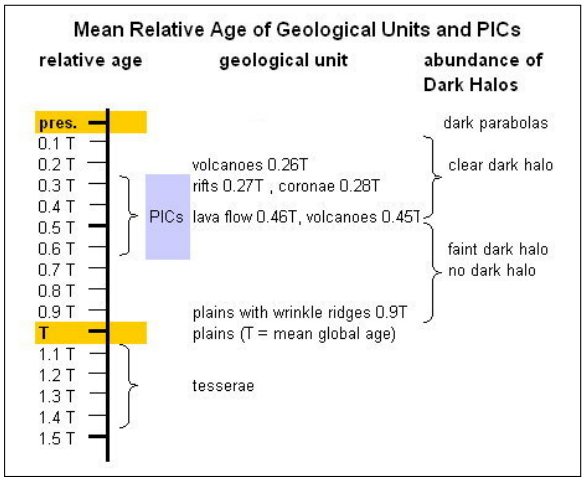

Figure 1: Relative Age of Polygonal Impact Craters on Venus and several other Geological Units of the Venusian surface. Legend: relative age - the scale is representing fractions of T (the mean absolute age of the Venusian surface, estimated to lie within 500 to 750 Myr); geological unit - the relative age of typical units of the surface like tesserae, plains, plains with wrinkle ridges, volcanoes, lava flows, rifts, and coronae; abundance of dark halos types - dark parabolas, clear dark halos, faint dark halos, and no dark halos.

Summary and Conclusions

Our results showed that the estimated mean relative age of PICs is younger than that of the regional plains. The relative age of several geological structures has already been estimated, thus we were able to place the range of the relative ages of PICs in the timeline of the

geological structures (see Figure 1). PICs on Venus have a relative age of about 0.3 T to 0.6 T, whereby T is the global average age of the surface of Venus, estimated to be about 500-750 Myr. We compared our results with the results of similar studies for impact craters of [2] and [4] and achieved a good agreement.

References

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