

Polygonal Impact Craters on selected Minor Bodies: Rhea, Dione, Tethys, Ceres, and Vesta

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A polygonal impact crater (PIC) is a crater that does not have a full circular shape in plane view but consists of straight crater rim segments. PICs are common on all objects in our solar system that show a cratered surface. Previous studies showed that PICs make up about 10-25% of craters on Mercury, Venus, Mars, and the Moon [1, 2, 3, 4]. Although there have been several studies on PICs on the terrestrial planets, and the Moon there are only very few investigations on PICs on minor bodies, even though there exist surface maps of Rhea, Tethys, Dione, Ceres, and Vesta that have an appropriate resolution. The aim of this study is to get more information about the abundance and characteristics of PICs on these objects.

We analysed all approved craters on Rhea, Dione, Tethys, Ceres, and Vesta using images provided by the IAU/NASA/USGS Planetary Database [5]. For the classification of PICs the definition by [2] was used which states that a crater is polygonal if it consists of at least two straight crater rim segments having a discernable angle. In total 417 impact craters were examined and 227 of them were classified as polygonal. On Rhea about 48% of the approved craters are PICs, on Dione 59%, on Tethys 34%, on Ceres 74%, and on Vesta 56%. The comparison with studies on PICs on terrestrial planets, and the Moon conducted by [1, 2, 3, 4] showed that the percentage of PICs found in this study is much higher. Most of the PICs have two or three straight rim segments and only few PICs are hexagonal or pentagonal. The mean angle between the straight rims yields 121° for Rhea, 124° for Dione, 123° for Tethys, 133° for Ceres, and 134° for Vesta. These angles are well in accordance to an average angle of 112° on Mercury [1]. Also the size distribution of PICs is in accordance to results by [4] who proved that PICs seem to favor small to middle size diameters. The largest diameters of non-polygonal craters on Vesta range from 0.6 km to 450 km while the diameters of PICs only range from 3.1 km to 53.2 km [5].

The study proves that a large number of polygonal impact craters on Rhea, Dione, Tethys, Ceres, and Vesta exist but it is still unclear why the fraction of PICs on these bodies is much higher than for terrestrial planets and the Moon. One possible solution could be the different composition of the surfaces of these bodies in comparison to the terrestrial planets but for definite answers to this question further understanding of the formation process of PICs, which is still unclear, is necessary.

References: [1] Weihs G. T. et al. (2015) *Planet. Space Sci.*, 111, 77-82. [2] Aittola M. et al. (2010) *Icarus*, 205, 356-363. [3] Öhman et al. (2008) *Meteoritics & Planet. Sci.*, 43, 1605-1628. [4] Öhman et al. (2010) *Geol. Soc. Spec. Pap.*, 465, 51-65. [5] IAU/NASA/USGS Planetary Database. (2016), <http://planetarynames.wr.usgs.gov/>.