

Peaks, Peak-Rings, and Multiple Ring Spacing in Impact Basins:  
 Discontinuities in the Function Relationship  
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The origin of interior peaks and ring structures in large impact craters has been a subject of controversy. It has been suggested that there is a continuous morphologic progression with increased diameter, from the occurrence of central peaks, to peak rings to multiple rings (1,2,3,4). However, recent data indicate that this assumption may not be valid. Hale and Head (5), suggest that the transition of central peak to peak-ring may not be describable as a simple, gradual transition. We suggest that not only is the morphologic transition from central peak to peak-ring is functionally discontinuous, but the morphologic transition from peak-ring to multi-ring basin is also functionally discontinuous.

The spacing of adjacent rings in terrestrial planet multi-ring impact basins has been shown to be about  $\sqrt{2}$  of the adjacent ring diameters (2,6,7,8). But for peak-ring basins the relationship of peak-ring diameter and rim diameter has been shown to be about:

$$D_{pr} = 0.54 D_r - 9.67$$

for the Moon, Mercury, Mars and Ganymede (9,10,11), and about

$$D_{pr} = 0.54 D_r - 5$$

for the Earth and Callisto (11), where  $D_{pr}$  is the diameter of the peak-ring (inner ring) and  $D_r$  is the diameter of the rim (outer ring) (Figure 1). Hence, the spacing of the rings in multi-ring basins is different than that for peak-ring basins suggesting that a smooth transition does not occur from one type to the other. These data suggest that impact basin formation models based on the hypothesis that impact basins have a continuous morphologic progression of interior mountain structures that can be described with a single cratering equation can be rejected.

#### Bibliography

- (1) Wood, C.A. and Head, J.W. (1976) Proc. Lunar Sci. Conf. 7th, p 3627-3651; (2) Hartmann, W.K. and Wood, C.A. (1971) The Moon, p 3-78; (3) Wood, C.A. (1980) Proc. Lunar Planet Sci. 11th, p 2221-2242; (4) Croft, S.K. (1980) Proc. Lunar Planet Sci., 12A., p 227-258; (5) Hale, W. and Head, J.W. (1980) Proc. Lunar Planet Sci. 11th, p. 2191-2205; (6) Hartmann, W.K. and Kuiper (1962) Comm. Lunar Planet. Lab. Univ. Ariz., p 51-66; (7) Fielder, G. (1963) Nature, V 220, p 1102-1107; (8) Pike, R.J. (1981) NASA TM 84211, p 123-125; (9) Head, J.W. (1977) Impact and Explosion Cratering, p 563-573; (10) Head, J.W. (1978) Lunar Planet Sci. Conf. 9th, (Abs), p 485-487; (11) Boyce, J.M. (1980) NASA TM 81776, p 339-342.

## PEAKS, PEAK-RINGS

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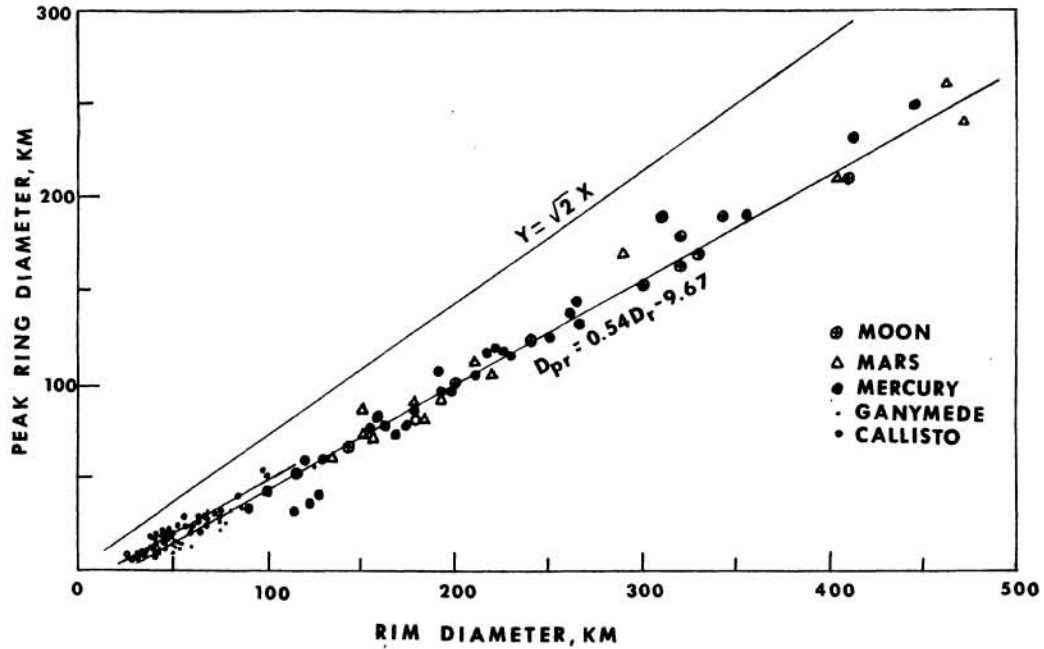


Figure 1. Relationship of rim diameter and peak-ring diameter of peak-ring basins. Data points for the Moon, Mercury, and Mars are from Head (10) and for Callisto and Ganymede are from Boyce (11). The 2 curve that corresponds to the appropriate basin ring spacing relationship has been included for comparison.