DIFFERENCES IN DISTRIBUTION IN GT-115225 GLOBAL CATALOGUE OF MARTIAN CRATERS BETWEEN SHALLOW AND DEEP CRATERS AND BETWEEN LARGE AND SMALL CRATERS.

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Summary: The new GT-115225 catalogue of Martian craters was analyzed using 1/128° MOLA data and Topography-Profile Diagrams (TPDs). The results are newly discovered differences in distribution between shallow and deep and between large and small craters.

Introduction: After the initial proposal of Contacts 1 and 2 [1], numerous findings supported the possibility that Oceanus Borealis [2] once existed on Mars, as for example work from [3], [4], [5], [6], [7], [8] and [9]. This is additionally supported with the changing picture of volatiles and climate during Martian history [10], influenced by recent findings such as the radar sounding evidence for buried glaciers in the southern mid-latitudes of Mars [11] and the evidence for calcium carbonate at the Mars Phoenix landing site [12]. In our previous work we: (1) showed, using the catalogue with 9496 craters, that Mathematical Theory of Stochastic Processes can be applied to lunar and planetary science and that some global process significantly influenced craters distribution [13]; (2) proposed TPDs and, using the more complete catalogue with 22044 craters, show that a correlation among elevation and the density/frequency of craters exists at lower elevations for as much as ~78% of planet's surface [14]; (3) merged all the craters from the major currently available catalogues into the catalogue with 57633 craters [15]; and (4) developed a new crater detection algorithm to search for still uncatalogued impact-craters, and extended this catalogue by 57592 craters [16]. In this work, we will present the results of application of TPDs to this new GT-115225 catalogue.

Methods: All TPDs were applied to 1/128° MOLA data and: (1) to entire planet (gray curves in Fig. 1); and (2) when regions marked in Fig. 3. of [14] with major volcanic activities were excluded (black curves in Fig. 1). More specific to methods is as follows:

Shallow and deep craters. In this method, in the first step we created a d/D graph [17]. Using this graph and Eg. (1), we constructed two lines in order to divide shallow and deep craters into two approximately equally large groups. After that, we applied TPDs separately to each data set. For 12556 craters the classification as shallow and deep was not possible because the automated procedure was not capable to estimate crater's d (e.g. too small craters for 1/128° MOLA data), therefore such craters were excluded from computations.

$$d = \alpha \cdot D^{\beta} \quad (1)$$

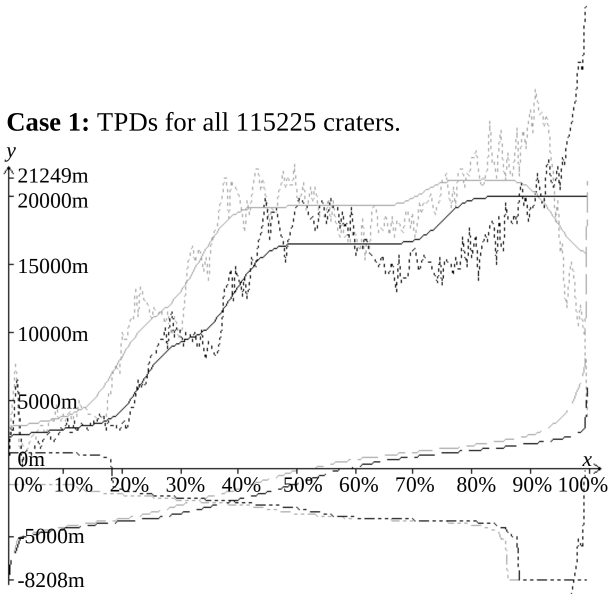
Large and small craters. In this method, we classified craters as 42218 craters with $D > 5$km and as 73007 craters with $D < 5$km. After that, we additionally applied: (1) the classification as shallow and deep craters; and (2) TPDs separately to each data set.

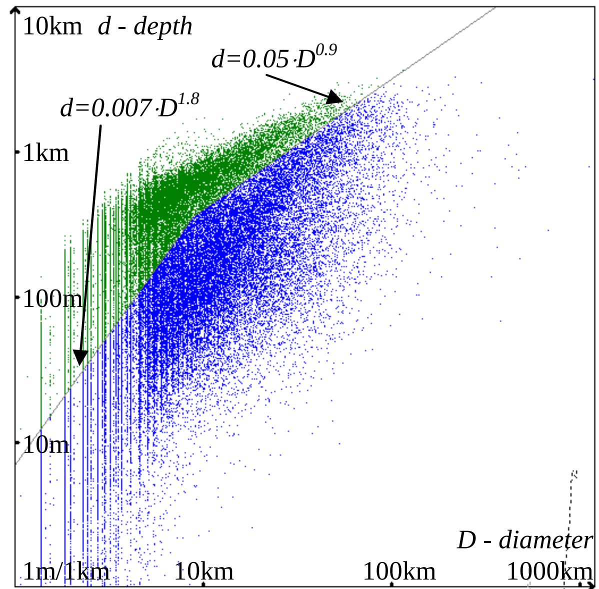
Results: As shown in Fig. 1, the correlation between elevation and the density/frequency of craters is significantly different: (1) for shallow and deep craters; as well as (2) for large and small craters.

Conclusion: As the results show, the global process which significantly influenced the distribution of craters (most likely an ancient ocean) did not have the same effect on shallow and deep craters, as well as on large and small craters. The distributions are different because: (1) deep craters are in principle younger and can be on all elevations; and (2) small craters are more common from the period after the big-bombardment. This should be able to help in constraining the time period(s) when this global process was active. For the future work, we plan to perform additional analysis of this process using TPDs and laboratory craters.

References: [1] Parker T. J. et al. (1989) *Icarus*, *82*, 111-145. [2] Baker V. R. et al. (1991) *Nature*, *352*, 589-594. [3] Cabrol N. A. et al. (2001) *Icarus*, *154*, 98-112. [4] Dohm J. M. et al. (2001) *J. Geophys. Res.*, *106*, 32943-32958. [5] Carr M. H. (2002) *J. Geophys. Res.*, *107*. [6] Fairén A. G. et al. (2003) *Icarus*, *165*, 53-67. [7] Ormö J. et al. (2004) *Meteorit. Planet. Sci.*, *39*, 333-346. [8] Ruiz J. et al. (2004) *Planet. and Space Sci.*, *52*, 1297-1301. [9] Dohm J. M. et al. (2009) *Planet. and Space Sci.*, *57* , 664-684. [10] Jakosky B. M. et al. (2005) *Science*, *310*, 1439-1440. [11] Holt J. W. et al. (2008) *Science*, *322*, 1235-1238. [12] Boynton W. V. et al. (2009) *Science*, *325*, 61-64. [13] Salamunićcar G. (2004) *Adv. Space Res.*, *33*, 2281-2287. [14] Salamunićcar G. (2009) *Adv. Space Res.*, *43*, 308-316. [15] Salamunićcar G. and Lončarić S. (2008) *Planet. and Space Sci.*, *56*, 1992-2008. [16] Salamunićcar G. and Lončarić S. (accepted) *Trans. Geosci. Remote Sens.*, (DOI will be:10.1109/ TGRS.2009.2037750). [17] Salamunićcar G. and Lončarić S. (2009) *LPS XXXX*, Abstract #1085.

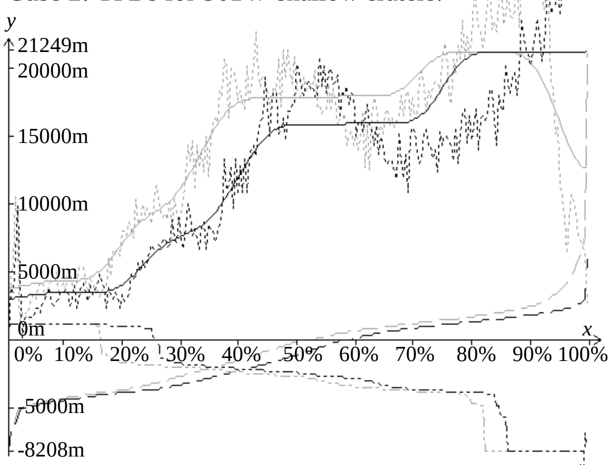
Case 1: TPDs for all 115225 craters.



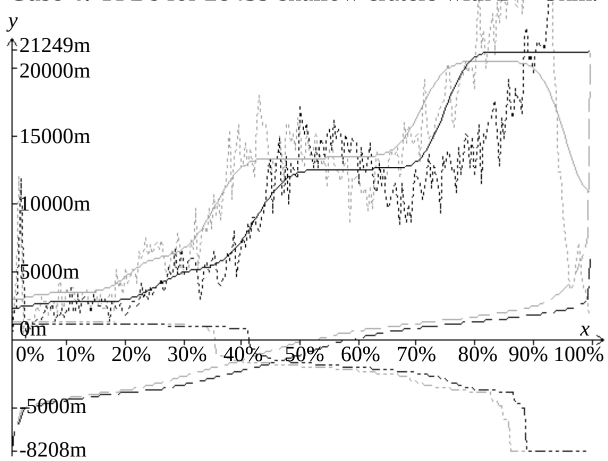


The classification into shallow and deep craters.

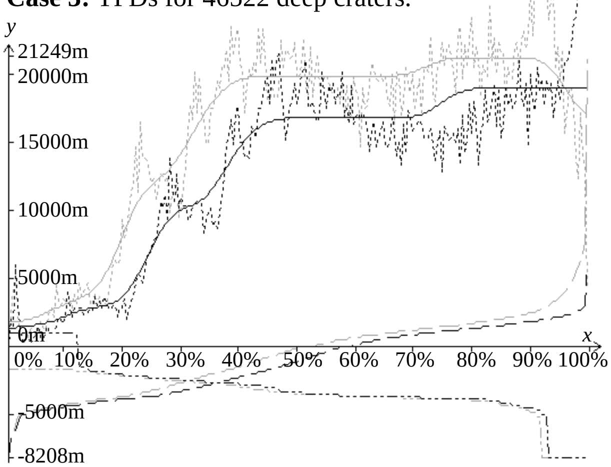
Case 2: TPDs for 56147 shallow craters.



Case 4: TPDs for 28439 shallow craters with D > 5km.



Case 3: TPDs for 46522 deep craters.



Case 5: TPDs for 33135deep craters with D < 5km.

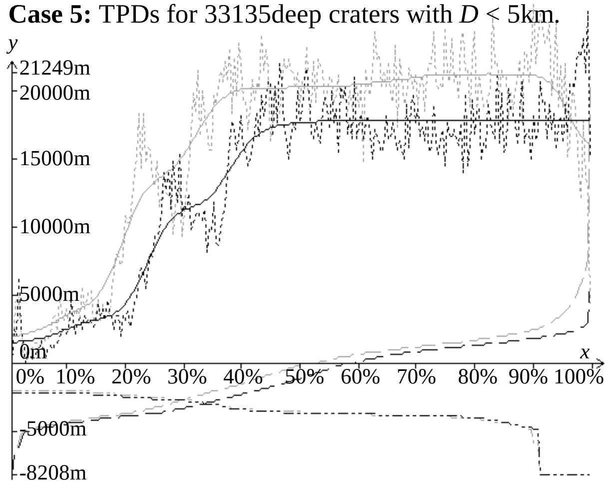


Figure 1: Topography-Profile Diagrams for new GT-115225 global catalogue of Martian craters and 1/128° MOLA data. The differences in the distribution can be noticed between: (2,3) all shallow (old) and all deep (young) craters; (2,4) all shallow and large shallow craters (first extreme); and (3,5) all deep and small deep craters (second extreme).