SURFACE AGE COMPUTATIONS FOR MARS: A STEP TOWARD THE FORMAL PROOF OF MARTIAN OCEAN RECESSION, TIMING AND PROBABILITY. G. Salamunićcar, AVL-AST d.o.o., Av. Dubrovnik 10/II, 10020 Zagreb, Croatia, Europe, gsc@ieee.org.

Introduction: Many indicators for ocean on Mars were proposed: outflow channels and features related to the evolution of standing bodies of water (polygons, lobate impact craters) [1], features consistent with the shoreline interpretation [2], MEGAOUTFLO hypothesis [3], MOLA data [4, 5], glaciers, fluvial channels and gullies [6], MGS data [7], influence on planetary climate [8], etc. Recently, mathematical approach was proposed [9] providing a way to compute how deep Martian ocean was during each period of the planet history, including the probability that ocean did exist once. The important step toward the formal proof of Martian ocean recession, timing and probability, are surface age computations based on crater statistics.

The algorithm: In Fig. 1, basic classification of Martian periods is shown. When we have some area of $x\ [km^2]$, and on this territory n craters, then density of craters is defined as $d=n/x$. However, the question is how to define density of craters for some point, because this can be done in more than one way. One possible algorithm is a circle to be defined with center in this point, large just enough to contain m craters. Then we can define density of craters as $m/(r^2\pi)$. It should be noticed that the smaller m is, the higher resolution is, but also the influence of noise is higher. Additionally, we may want the same resolution no mater how many craters we have in some data-set. For this purpose, we can define m as e.g. $s/256$, where s is the total number of craters in some data-set. Result for 9496 craters and m that is then 37 is shown in Fig. 2, and result for 22044 craters and m that is then 86 is shown in Fig. 3.

Topography profile diagrams: Once surface age is computed that is younger than 50%, 100% and 200% of the average age, this territory is excluded, and associated topography profile diagrams are computed and are shown in Fig. 4 and Fig. 5.

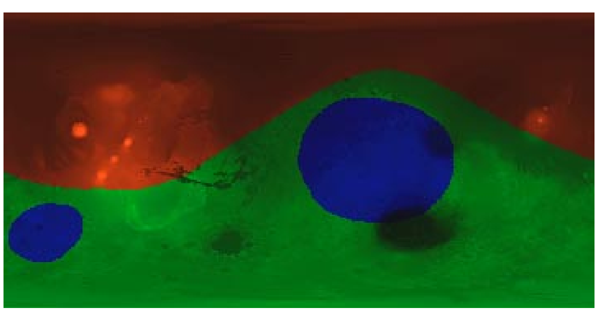

Figure 1: Martian periods basic classification: Noachian (blue), Hesperian (green) and Amazonian (red).

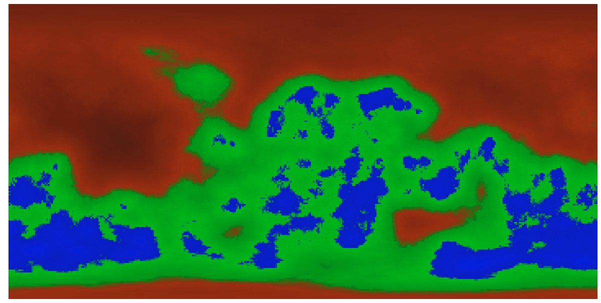

Figure 2: Surface age for 9496 craters: age < 50% (red), 50% < age < 200% (green) and age > 200% (blue).

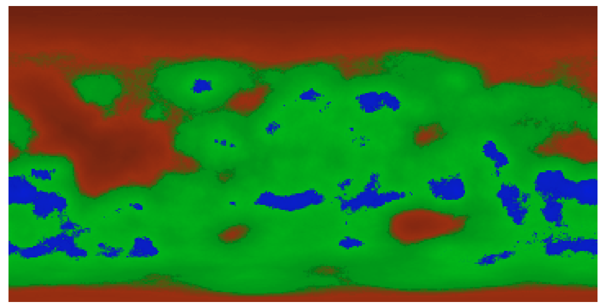

Figure 3: Surface age for 22044 craters: age < 50% (red), 50% < age < 200% (green) and age > 200% (blue).

Conclusion: Results shown in Fig. 2 and Fig. 3 are quite similar, and they are also similar with basic Martian period classification as shown in Fig. 1. Importance of the shown topography profile diagrams is that filtered density of craters curve (full-line) contains growing part for all cases, as shown in Fig. 4 and Fig. 5. This proves that explanation for growing part can not be that lava erased craters on some parts of Martian surface resulting in average value computed lower for those altitudes. On the contrary, increase of crater density with increase of altitude is common to entire territory on lower altitudes, indicating that this part of the planet was covered probably by ocean in the past.

References: [1] Head J. W. et al. (1999) *Int. Con. on Mars 5*, Abstract #6184. [2] Parker T. J. and Banerdt W. B. (1999) *Int. Con. on Mars 5*, Abstract #6114. [3] Baker V. R. et al. (2000) *LPS XXXI*, Abstract #1863. [4] Head J. W. et al. (2000) *LPS XXXI*, Abstract #1750. [5] Tanaka K. L. and Banerdt W. B. (2000) *LPS XXXI*, Abstract #2041. [6] Baker V. R. (2001) *Nature*, *412*, 228-236. [7] Head J. W. et al. (2001) *LPS XXXII*, Abstract #1064. [8] Kimura H. et al. (2002) *LPS XXXIII*, Abstract #1731. [9] Salamunićcar G. (2002) *COSPAR 34*, Abstract #01766.

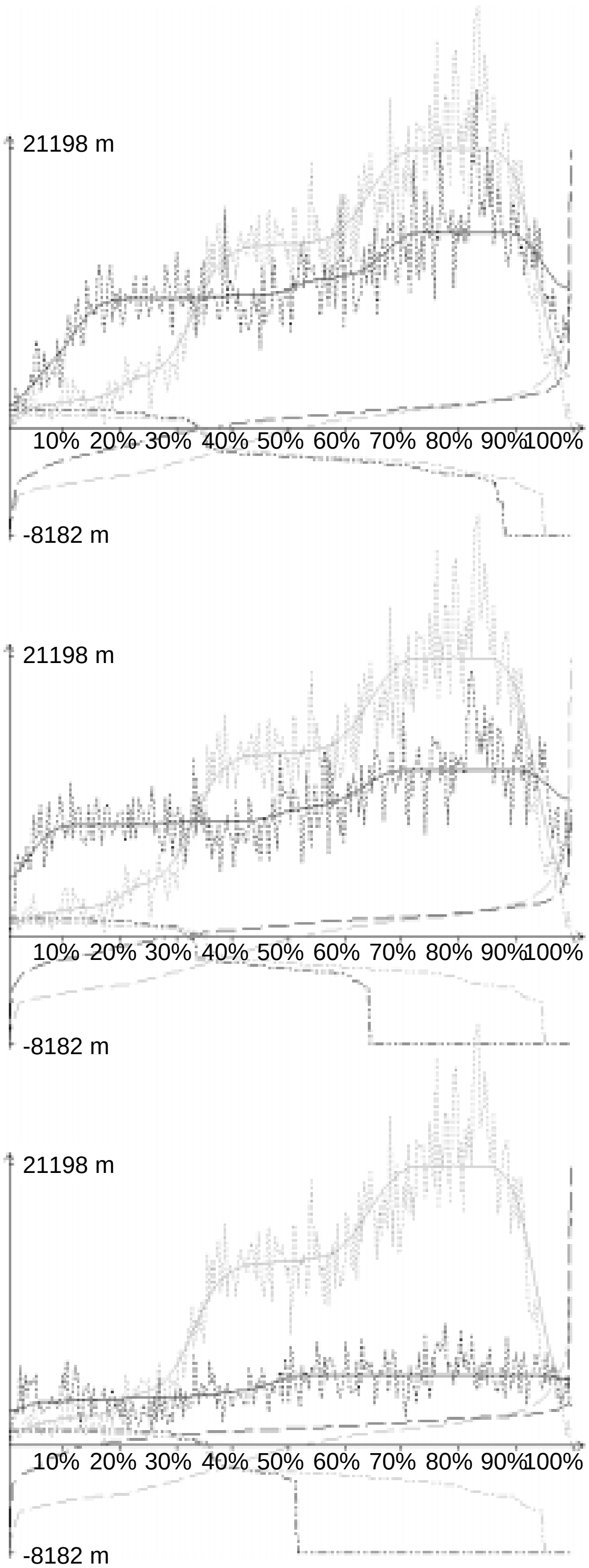

Figure 4: Topography profile diagrams for data-set with 9496 craters when excluded territory satisfies: surface age < 50% (top), surface age < 100% (middle) and surface age < 200% (down).

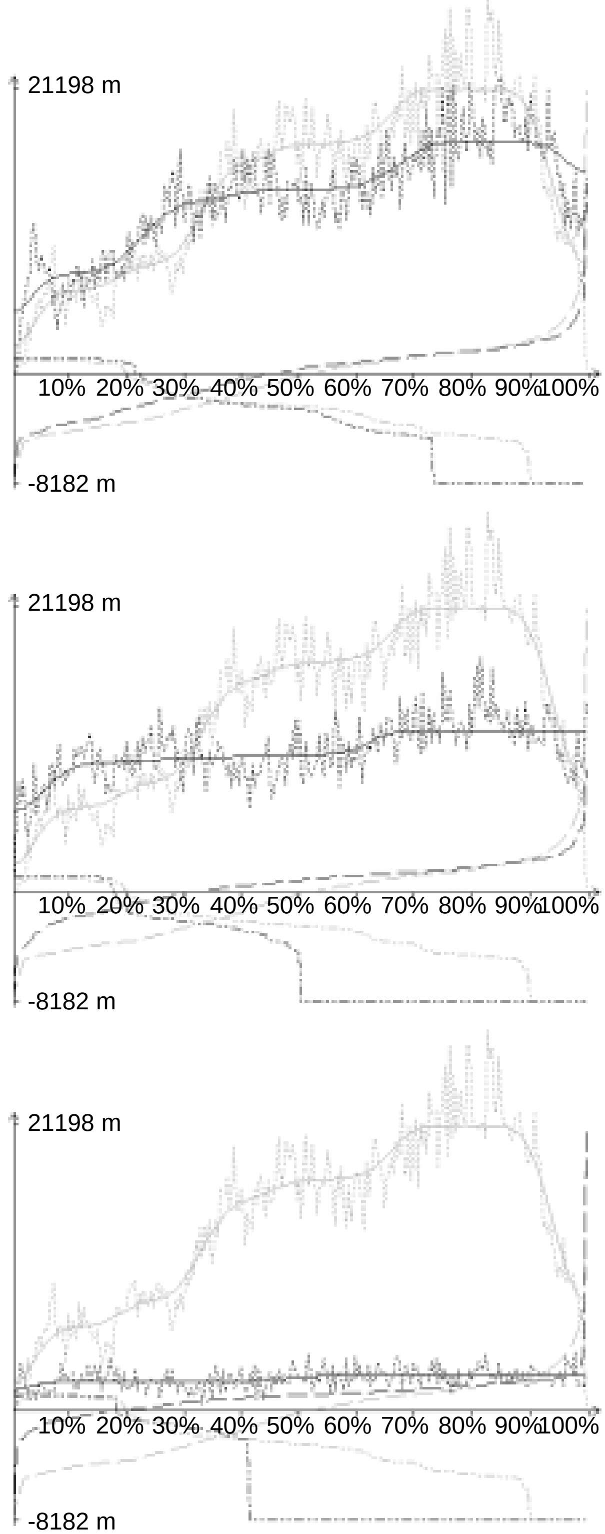

Figure 5: Topography profile diagrams for data-set with 22044 craters when excluded territory satisfies: surface age < 50% (top), surface age < 100% (middle) and surface age < 200% (down).