

NEW INSIGHT INTO VALLEYS-OCEAN BOUNDARY ON MARS USING 128 PIXELS PER DEGREE MOLA DATA: IMPLICATION FOR MARTIAN OCEAN AND GLOBAL CLIMATE CHANGE.

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Introduction: This work investigates new insight into the relationship between morphology and elevation of Martian valleys termini and hypothetical Martian ocean including their implication for global climate change using 128 pixels per degree MOLA data.

Martian Ocean and Valleys: After the initial proposal of Contact 1 and 2 [1] large number of indications were presented supporting Martian ocean hypothesis [2-7]. First results from the application of the Mathematical Theory of Stochastic Processes (MTSP) to the Lunar and Planetary Science (LPS) domain [8] additionally outlined the correlation between crater density and elevation on altitudes nearby and lower than elevation marked as Contact 0 [9], which is, as all indicates, caused by a drying ocean. Evidences by recent missions also confirm present and/or past existence of water on Mars: Mars Express confirmed H₂O ice near South Pole [10] while Mars Exploration Rovers confirmed minerals jarosite and magnesium sulfate salts that require the presence of liquid water to form [11]. Valley network systems on Mars additionally remain the most unequivocal evidence that water carved the surface of the planet in the distant past and that the climate was different than today [12-15]. Initial study found that the highly distinctive morphology of six large channels that empty into Chryse Planitia disappears near Contact 2 [16]. The algorithms initially developed for analysis of Quasi-Circular Depressions (QSDs) [17] were additionally used for visualization of the channels termini of all 10 major channels/valleys that empty into northern lowlands [18]. Initial results show that this valleys-ocean boundary is placed between Contact 1 and 2 [18]. If we assume that large ocean did exist, this implies that large global climate change from warm and wet to cold and dry conditions happened while proposed drying ocean was between those two elevations [18].

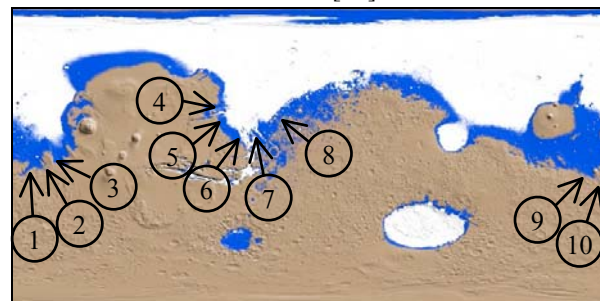


Figure 1: Valleys-ocean boundary at elevation between Contact 1 (-2025m) and Contact 2 (-3440m).

New Insight From 1/128° MOLA Data: Of ten major channels/valleys that empty into northern lowlands, as shown in Fig. 1, the morphology of only the largest two was clearly visible using 1/64° MOLA data. The same resolution basically just confirmed that the termini of other eight was inside valleys-ocean boundary as well. Higher resolution 1/128° MOLA data provides new insight into the morphology of the channels termini of the other eight as well. As shown in Fig. 2-9 their morphology is much more similar to the morphology of the largest two than was possible previously to see using 1/64° MOLA data.

Conclusion: As it can be seen from Fig. 2-9, 1/128° MOLA data confirms that all ten major channels/valleys termini start to lose their morphology near Contact 1 and that even the largest one almost completely lose their morphology near Contact 2. Accordingly, valleys-ocean boundary on Mars on elevation between Contact 1 and Contact 2 was additionally confirmed. While previous work shows that if ocean existed, this valleys-ocean boundary implies that large climate change from warm/wet to cold/dry conditions happened, it is still to be investigated, can we also use this boundary as an evidence that ocean did exist. The lack of other explanations how valleys-ocean boundary was formed certainly encourages this research.

References: [1] Parker T. J. et al. (1989) *Icarus*, 82, 111-145. [2] Baker V. R. (2001) *Nature*, 412, 228-236. [3] Fairén A. G. et al. (2003) *Icarus*, 165, 53-67. [4] Dohm J. M. et al. (2001) *JGR*, 106, 32943-32958. [5] Baker V. R. et al. (1991) *Nature*, 352, 589-594. [6] Cabrol N. A. et al. (2001) *Icarus*, 154, 98-112. [7] Tanaka K. L. and Banerdt W. B. (2000), *LPS XXXI*, Abstract #2041. [8] Salamunićcar G. (2004) *Adv. Space Res.*, 33, 2281-2287. [9] Fairén A. G. et al. (2003) *LPS XXXVIII*, Abstract #1093. [10] Bertaux J.-L. et al. (2004) *LPS XXXV*, Abstract #2178. [11] Jakosky B. M. and Mellon M. T. (2004) *Physics Today*, 57 (4), 71-76. [12] Hynek B. M. and Phillips R. J. (2003) *LPS XXXVIII*, Abstract #1842. [13] Craddock R. A. et al. (2003) *LPS XXXVIII*, Abstract #1888. [14] Phillips R. J. et al. (2003) *6th Int. Conf. on Mars*, Abstract #3021. [15] Stepinski T. F. and Collier M. L. (2003) *6th Int. Conf. on Mars*, Abstract #3100. [16] Ivanov M. A. and Head J. W. (2001) *JGR*, 106, 3275-3296. [17] Salamunićcar G. and Selar-Glavočić D. (2003) *6th Int. Conf. on Mars*, Abstract #3202. [18] Salamunićcar G. (2004) *LPS XXXV*, Abstract #1992.

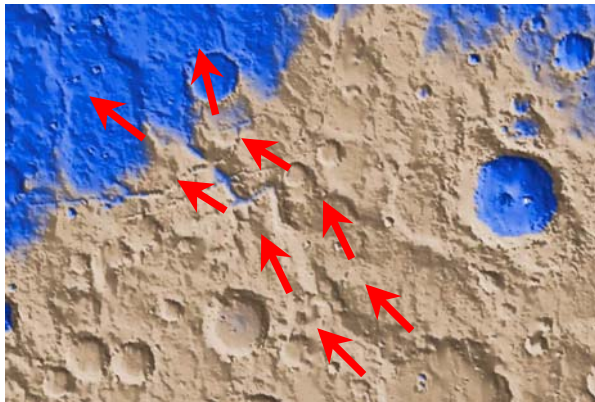


Figure 2: Channel termini at location 1.

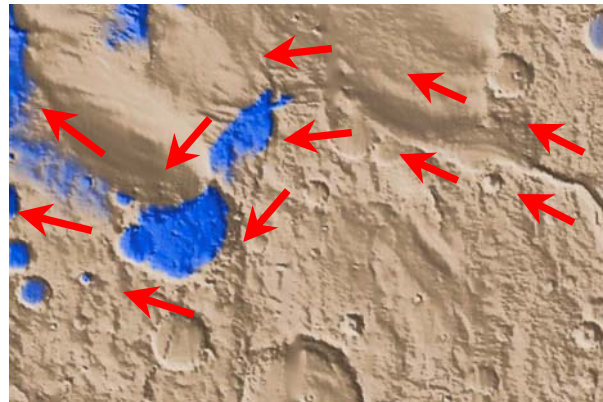


Figure 3: Channel termini at location 2.

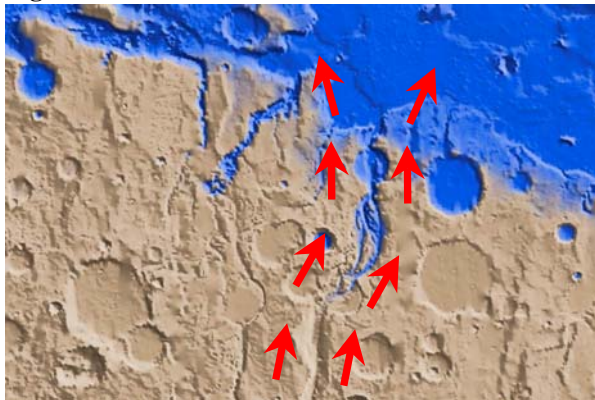


Figure 4: Channel termini at location 3.

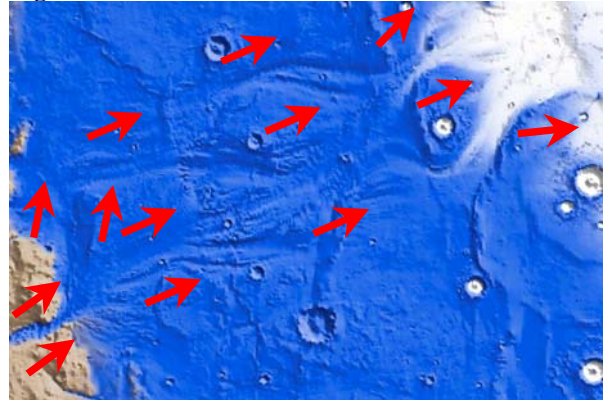


Figure 5: Channel termini at location 5.

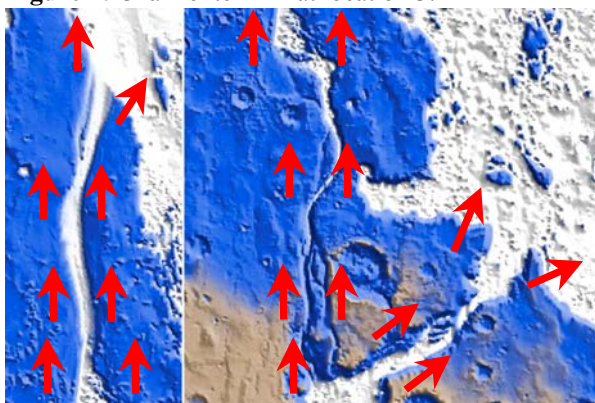


Figure 6: Channel termini at location 6.

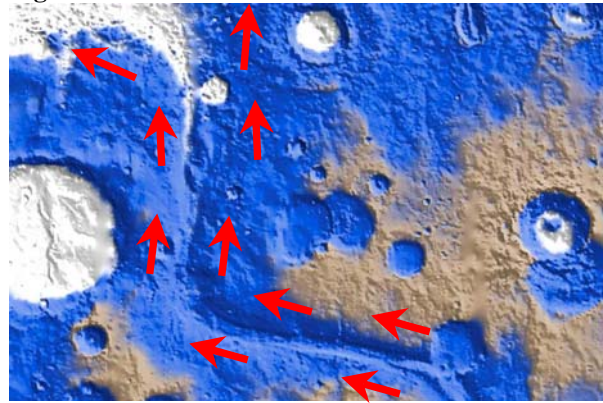


Figure 7: Channel termini at location 8.

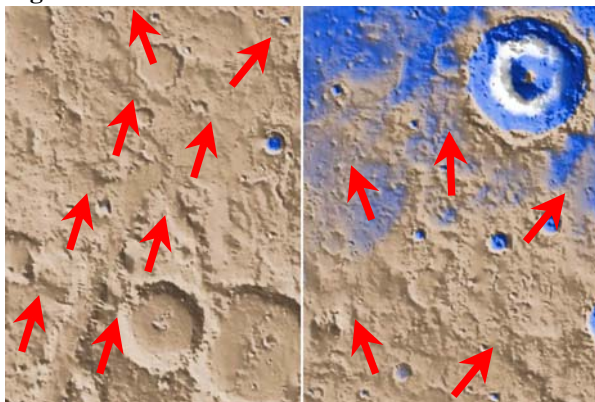


Figure 8: Channel termini at location 9.

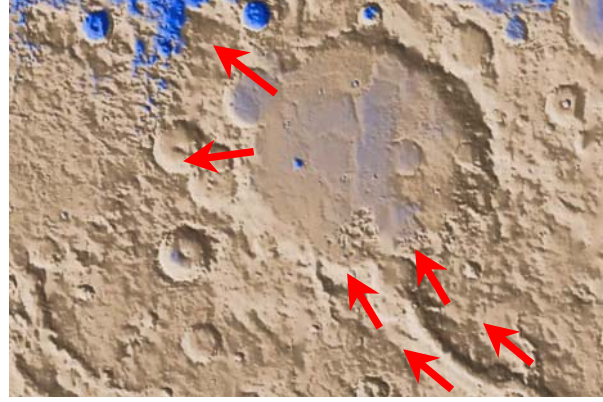


Figure 9: Channel termini at location 10.