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The mechanisms of formation of some small cones in Chryse Planitia on Mars

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Introduction: Small cones are common on Mars. Many cones form subparallel chains several kilometers in length. Their origin is discussed in many papers, however, the mechanism of their formation is not explained [1].

In the present paper, we deal with a small region in Chryse Planitia (~38°13' N and ~319°25' E). The region is covered by lacustrine deposits.

On Mars, chains of small cones occupy vast areas. Therefore, we try to explain the existence of the chains by specific conditions on Mars. We focus on the hypothesis connecting the formation of cones with the loss of water from the regolith due its instability. See e.g. [1], [2], [4], [5].

Mechanism of cones formation: We consider 3 mechanisms of cone formation: (i) a grains' ejection, (ii) from mud or fluidized sand and (iii) explosive formation. The (iii) and (ii) are possible with additional heat sources only.

Assuming that only heat of melting was used for vaporization, then only ~13% of liquid water will be vaporized, If the outgassing effect is to be regolith without water, then there must be also other heat sources. Therefore we consider two coexisting factors required for cones formation: (1) the presence of water in the regolith and (2) some additional heating, e.g. magma intrusion.

The formation of a chain of cones is possible in two situations:

(a) above a linear structure containing water and areal heating. Outcrops of aquifers could serve as linear sources of volatiles.

(b) above a linear source of magmatic heat and the areal aquifer. A dike could serve as linear source of heat.

Conclusions and future plans;

1) Considered cones could be a result of outgassing of regolith due to pressure drop.

2) Subparallel chains of cones were formed along the outcrops of volatile-rich sediments.

3) Numerical modeling indicates that small magma intrusions may not be enough for completely degassing some aquifers.

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References

[1] Fagents, S., Thordarson, T., (2007) The Geology of Mars: Evidence from Earth-Based Analogs, ed. Mary Chapman. Cambridge Univ. Press. [2] Brož,, et al. (2019) JGR: Planets. 124, 703–720. [3] Rotto, S., Tanaka, K. L. (1995) Geologic/ geomorphologic map of the Chryse Planitia: region of Mars. USGS. [4] Barlow, N.G. (2010) GSA Bulletin (2010) 122 (5-6): 644–657. [5] Brož, P., et al. (2020) Nature Geoscience. 13, 403–407.