# CHAINS OF SMALL CONES ON MARTIAN LOWLANDS AND ROLE OF INSTABILITY OF WATER, OUTCROPS AND FISSURES IN REGOLITH

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**Introduction:**

In [1] the authors considered a small region in Chryse Planitia where several chains of cones are found, Fig. 1. They suggested that instability of water due to decrease of atmospheric pressure was responsible for some of these cones. The region is covered by lacustrine deposits (Amazonian-Hesperian).

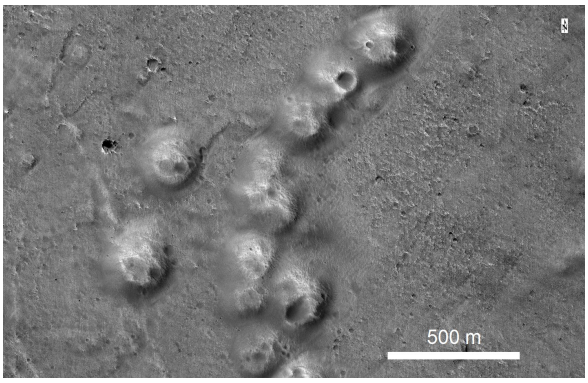


Fig. 1. Some chains of cones in Chryse Planitia. These chains probably were formed along the outcrops of sediments with high content of volatiles, see [1, 2]. HiRISEPSP_009063_2185 NASA.

**Mechanism of cones formation**

On Mars, chains of small cones occupy vast areas of the Martian lowlands such as Isidis Planitia and Chryse Planitia [2, 3, 4]. On other terrestrial planets such chains are not as common. Therefore [1, 2] try to explain the origin of these chains by specific conditions on Mars. Such explanation has obvious advantages.

In geological history tof Mars there was a period when vast Martian hydrosphere became unstable due to the gradual decrease of atmospheric pressure [5]. Mars has lost a dense atmosphere in the late Hesperian period (~3.6 Ga). Similar situation have never been occurred on other terrestrial planet in Solar System.

After [1, 2] we consider a few mechanisms of cones formation based on the instability of the water in regolith of Mars. Let assume that a fissure is formed extending from the surface to an aquifer. Then the pressure in the aquifer will drop, the water could be unstable and it will boil violently. The resulting steam will flow through the fissure into the atmosphere, entraining grains of sand. These grains could formed cones. Of course according to the law of energy conservation, the temperature of the aquifer will drop due to the heat of vaporization. Approximately 13% of water evaporates and the rest freezes during this proces (without additional sources of heat) [2]. Similar chains could be formed above old channells where regolith was sutured with volatiles. Such a case is probable for situation presented in Fig. 4, where two chains converge (like two rivers).

Similar ideas were considered in a few other works for several regions, e.g., [3], [4]. Of course, some details of geometry and mobilisation of water can be different.

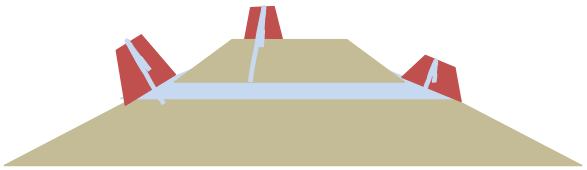

Fig. 2. The ideas of some hypotheses. Chains of cones are formed here along the outcrops of deposits rich in volatiles (2 cones on the slopes) and a smaller cone above the fissure connecting with volatile rich deposits.

**Chains of cones on Isidis Planitia**

Isidis Planitia is a circular plain located within a large impact basin, approximately 1500 km in diameter. Isidis is formed 3.9 billion years ago

during the Noachian period. There are thousands of small craters. Some of them form chains, e.g. Fig. 3. There are observed curvilinear ridges known as thumbprint terrain. For us the most interesting are small cones similar in size and shape to cones in Chryse Planitia considered by [1, 2]. These cones usually form chains. Adjacent chains are often subparallel.

The similarity of cones in Chryse Planitia and in Isidis Planitia suggests their common origin. Therefore we believe that they are also a result of water instability resulting from decrease of the atmospheric pressure. This suggestion is supported by observation of CRISM. Spectroscopy indicates large amount of gypsum on cones and chains of cones – Fig. 4. Gypsum is deposited from lake, sea water and in hot springs. It could be a result of hydration of anhydrite.

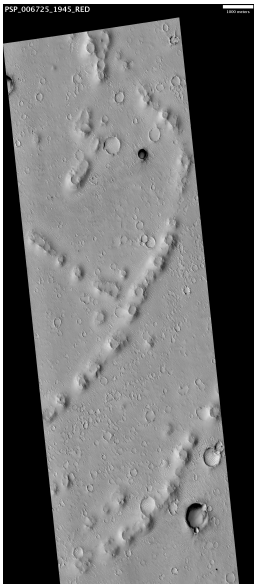


Fig. 3 Some chains of small cones in Isidis Planitia. The white bar is 1 km long. After NASA/JPL/Univeristy of Arizina.

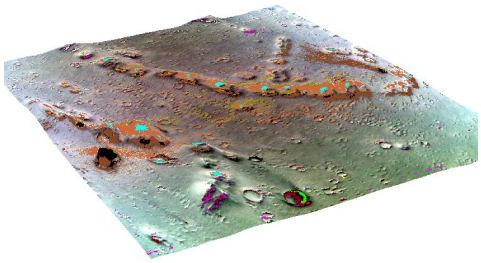

Fig. 4 The 3D picture of the part of region presented in Fig. 3. The brown and cyan colors indicate gypsum.

**Conclusions**

We believe that water instability resulted from decreasing of the pressure is probably an important factor responsible for many Martian small cones. It confirms some results of [2] and some other scientists.

**Acknowledgements:**

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**References**

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