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Hydrothermal and evaporation minerals of the western Isidis area on Mars

NATALIA ZALEWSKA[1], **JAKUB CIAZELA**[2] AND LESZEK CZECHOWSKI[1,3]

[1]Space Research Center PAS
[2]Institute of Geological Sciences, Polish Academy of Sciences
[3]University of Warsaw, Faculty of Physics, Institute of Geophysics

Presenting Author: j.ciazela@twarda.pan.pl

Thousands of small cones cover the Isidis Planitia basin on Mars. The cones have diameters of 300–500 m and heights of 10–30 m [1]. Many cones form subparallel chains several kilometers in length (Fig. 1). The chains of cones that we analyzed indicate they form larger systems based on which we previously divided Isidis Planitia into several characteristic regions [2]. Some of the chains have a characteristic furrow suggesting the possibility of fissure volcanism [3]. To determine the origin of the cones and their lithology, here, we study available spectral data in the visible light and near infrared range. We use CRISM spectra from MRO. CRISM covers the spectral range from 362–3920 nm with a spectral resolution of 6.55 nm.

Here we show a representative spectrum from the CRISM FRT00009260 scene, which is the most typical for the entire image area (Fig. 2). The scene comes from the northwestern part of Isidis (Fig.1), where the characteristic chains of cones are visible. The spectrum shows the minima at 1.49, 1.98, and 2.04 µm which we assigned to individual minerals. Additionally, the 2 µm range is disturbed by Martian CO_2 influences, which is caused by the imperfect separation of the atmosphere by the "volcano - scan algorithm" (Fig. 2). Gypsum appears to be the most suitable mineral for these minima, although alunites can also be considered.

Gypsum is mostly an evaporate crystallizing from salty, drying water reservoirs [4]. Because Isidis might once have been a highly saline reservoir, gypsum crystallization could occur under such conditions, especially in depressions. Alunites are products of volcanic exhalation, which would explain the origin of the cones.

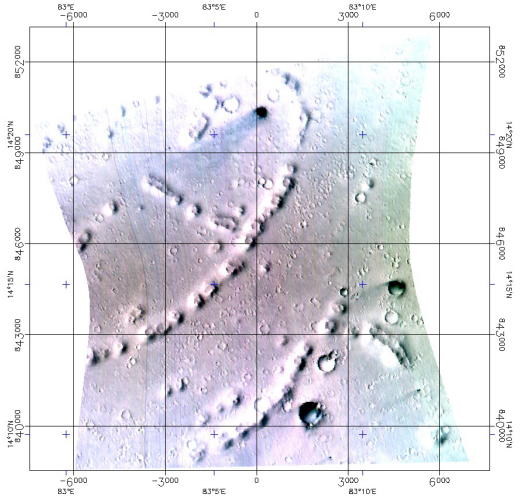

Fig.1 CRISM scene no. FRT00009260_07_IF166L_TRR3. (14.235°N, 83.096°E)

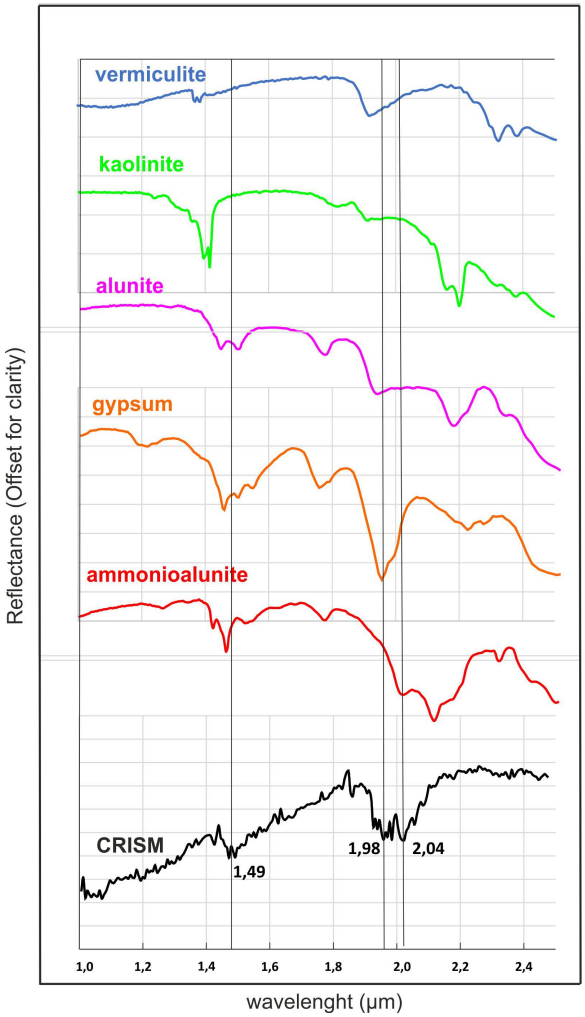

Fig.2 CRISM NIR reflectance spectrum from the FRT00009260 image from Isidis. Three characteristics, that is 1.49, 1.98, and 2.04 µm are visible and compared to laboratory spectra from the USGS library.

References: [1] Guidat, T. et al. (2015) Earth and Planet. Sci. Let. [2] Zalewska N. et al. (2021) LPS 52nd, 2710. [3] Ghent, R. R., et al. . [4] Zalewska N. (2013) Planet. Space Sci.