FTIR SPECTRA OF POSSIBLE END PRODUCTS OF MARTIAN SURFACE WEATHERING

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Introduction: The available IR spectral data of soils, dust and rocks on Marsm make it possible to compare the Martian spectra with spectra of terrestrial minerals, sedimentary deposits, and those of artificial materials and products of their alteration and weathering. Collection and a comparative analysis of terrestrial IR data can be useful for interpretation and deciphering of Martian spectra as well as for determination of reasons of an unique chemical composition of the Martian surface and rocks. Now, almost all present studies of Martian surface spectra are aimed to answering the global Martian question about past environmental conditions and signs of the possible past life.

Experimental setup: It is obvious now that simple terrestrial analogs which could be correspondent to weathering and alteration scenarious of soils, dust and rocks on Mars can't be find. At that time, images and spectral data show many objects and secondary substances formed by chemical (or semi-cosmic – UV and vacuuming) alteration of Martian surface. It has been supposed that Martian weathering products peculiarities are stipulated by this specific semi-cosmic weathering. Martian weathering can lead to separating destruction of surface rocks. That is why, IR spectra of silicate, aluminum-silicate and aluminum were registered using a FTIR instrument InfraLum FT-02 followed by the comparative analysis.

Results and discussion: Presented in the Figure 1, spectrum 1 shows a decrease in a transmittance level near the CO_2-absorption region and changes in a spectral curve shape. This peculiarity can be observed in TES spectral data. The positions of the CO_2-absorption band in our terrestrial and Martian spectra are the same. Spectra of Martian surface and rocks are made with dotted lines. Spectrum 2 of artificially altered red bricks is imposed on the spectrum of Martian surface (type I). The double peak indicates the presence of a small quantity of the crystalline form of SiO_2. The possible origin of SiO_2 on Mars are shown by spectra of kyzelgure (3), silicagel (4) and calcinated tripoli (5). One can readily see that Martian silicon dioxide is very similar to amorphous (or water bearing) terrestrial SiO_2.

The specific shape of spectral curves can depend on and be stipulated with various reasons. For example, spectrum 6 of aluminum-potassium alum is close by its shape with that of the upper substance of Bounce Rock. Spectra 7 and 8 obtained from calcium aluminum calcinated at 1000 Cº and 800 Cº, respectively, indicate that the inner part of the rock consists of an aluminum compound. When comparing spectra 9 and 10 of ferry silicate and calcium silicate with spectra 7 and 8 and those of Martian surface (type I) and rocks, the folloving conclusion can be made: the unique feature of Martian spectra (registered by TES and Mini-TES) between 850 – 800 cm^{-1} is caused by separating of some amount of amorphous SiO_2 and bounding of metals. The Martian weathering process leads to appearance and opening of ferry silicate and ferry aluminum components of the rocks.

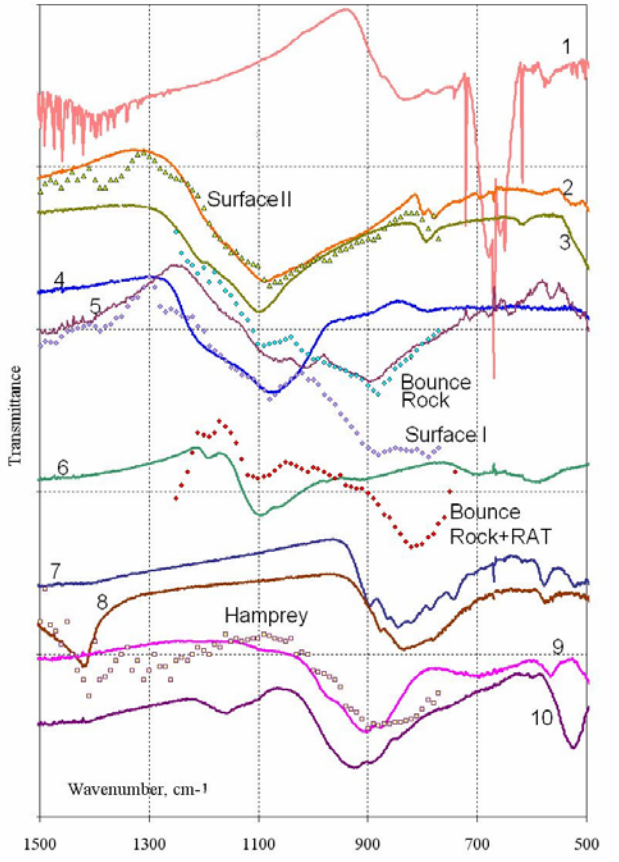

Figure 1. IR spectra of Martian surface and terrestrial substances.

Conclusions: The semi-cosmic Martian weathering results in amorphous silica dust and open unique ferry aluminum/ferry silicate Martian rocks. Their compositions are unusual and can be characterized as a specific ferry clinker.

References: [1] Bandfield et. al. (2000) *Science*, [2] Christensen, P.R. et. al. (2001) JGR, 106, [3] Ruff et. al. (2002) JGR, 107, doi:5110.1029/2001JE001580, [4] Schneider, R.D. et. al. (2006) LPSC XXXVII, Abs.#1929