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PHYLLOSILICATES AND OPALINE SILICA ON MARS: OCCURRENCES IN FAN DELTAS AROUND VALLES MARINERIS AND XANTHE TERRA

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Phyllosilicates are unambiguous proofs for the presence of water in every environment, being correlated to aqueous alteration of pristine minerals on Earth, Mars, and other celestial bodies (e.g. meteorites). On Mars the phyllosilicates were first identified with the help of Mars Express OMEGA data set, with most abundant occurrences in Mawrth Vallis region [1], and Nili Fosae [2]. Opal is another water derived product that is identified on Mars, either as an alteration product [3] or a hydrothermal spring deposits.

Their presence is being constantly revealed in many small areas on Mars, taking advantage of the high spatial resolution of CRISM spectrometer data set aboard MRO. We were able to identify new areas of occurrence for this class of minerals, choosing places where morphologies are consistent to water erosion, transport and deposition systems. On Mars such systems usually involve delta and/or fan delta like deposition environments.

We expand the list of the presence of the phyllosilicates in studied areas, revealing a good delta-phyllosilicate correlation: many of the targeted areas in a planned survey gave positive identification, strengthening the categorization as water derived morphologic and mineral geologic units. The phyllosilicates so far, have been identified in similar settings in Holden, Eberswalde and Jezero craters [4] considered mostly to be allochtonous alteration result of sediments transported and deposited in water pounding depressions. We present two cases with distinct phyllosilicate occurrences: 1) An unnamed crater south of Nanedi Vallis 2° N 51' N, 51° 40' W presents a clear hydrated mineral band south of deltaic deposit onward flow direction. The hydrated minerals are present in the lower terrace in a band with a parallel trend to the delta front, pointing to an allochtonous type of alteration, and 2) phyllosilicates present in a layer underneath the surface in an unnamed crater 9° 50' S, 96° 15' W pointing to sapping type of erosion, with possible hydrothermal water triggering of the collapse, and possible in-situ alteration type. The 1.37, 1.90 and 2.19 µm absorption spectral bands are characteristic for the first case consistent to silica powder maturation. Similar findings of opaline silica [3] where described on Valles Marineris, this is the first time an Opaline silica has been found associated with a fan-delta. In order to simulate possible formation of this particular deposit, a synthetic silica powder (SSP) was generated starting from a basalt alkali carbonate fusion, with HCl insolubilization. Figure 1 shows the best fit of CRISM data (phase 3 maturation of SSP), whilst the second case is characterized by 1.4, 1.90 and 2.22 µm band absorptions (most likely nontronite).

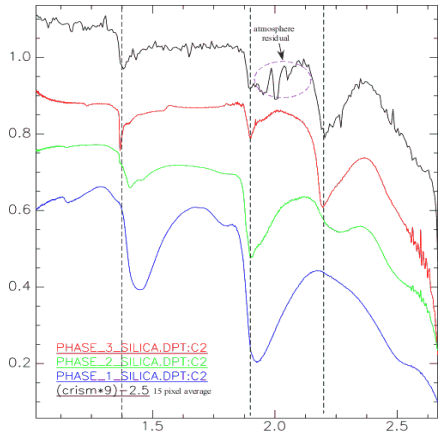

Figure 1 The spectral fit of the CRISM spectrum (featureless ratioed of 15 pixels average) with synthetic silica powder derived from a HCl insolubilization of a basaltic carbonate fused solution with various stages of water loss (1-3)

The experimental silica generation can prove a valid formation path for the observed area, as well the equilibrium state between hydrated silica phase and the current Mars atmosphere.

References

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