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# A pixel-by-pixel searching for C-H bands in CRISM data

Paola Manzari (1), Cosimo Marzo (2) and Eleonora Ammannito (1) - (1) Agenzia Spaziale Italiana, Roma, Italy (2) Agenzia Spaziale Italiana, Matera, Italy.

## Abstract

In the frame of the next ESA and NASA missions on Mars, we begun a work searching for C-H bands in a pixel-by-pixel analysis of CRISM data. The aims are two: comparison of hyperspectral data with data from the upcoming rovers and exploration and identification of other potential organic-bearing landing sites.

## 1. Introduction

The majority of the missions on Mars focus on the search of past/present life on the Martian surface and subsurface. In this view, remote sensing techniques are useful to scan large areas searching for minerals and /or molecules that can constitute potential proxies for life detection.

Since we observed that some isolated pixel spectra show a 3.34$\mu$m absorption, that can be related to C-H compounds, we started to search this absorption in CRISM observations. In this abstract we show the preliminary results of this research.

## 2. Selected area and methods

The first data used for this work are related to a broad area within the Oxia Palus quadrangle (Mars Chart-11, USGS-Astrogeology Research Program). This quadrangle includes the landing site of Ares Vallis, which was explored by the Mars Pathfinder (1996) lander and contains the landing site of the next ExoMars2020 mission: Oxia Planum. Therefore, for a first study the rationale of the chosen area has been the chance to have current and future data to compare with this study.

As a first step we downloaded the CRISM observations already calibrated in I/F that were available in the MC-11 quadrangle. Then, we elaborated a procedure that automatically: 1) converts from PDS to CAT all the files in the directory; 2) runs the photometric and atmospheric correction (only volcano-scan, at present) on all the files in the directory. The I/F data show a strong vertical striping in the IR and spatial/spectral spiking. Therefore, another procedure, correcting these artifacts, allows to find a band absorption in a spectral range chosen by the operator and to compute the GM/MGM in that range, for all the pixels in the hyperspectral cube. These analysis of the spectra pixel by pixel was performed using and adapting an IDL procedure created for processing hyperspectral data from Hyperion, an airborne imaging spectrometer [1] and some data on rocks and meteorites collected by the Spectral Imager SPIM, breadboard of VIR/Dawn mission [2,3].

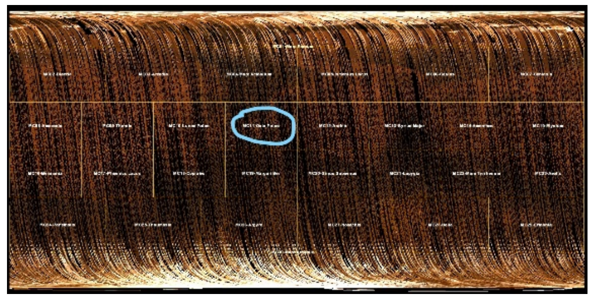

**Figure 1**. **Coverage map of CRISM MRDR I/F tiles observations and the localization of Oxia Palus (cyan circle)**

## 3. Results

The CRISM observations in the MC-11 quadrangle are about 900. For testing, the procedure elaborated the firsts five observations including: 31523, 37E00, 39979, 3A896, 4186 of the MC-11 quadrangle. The band shoulders for calculating the band depth and center were chosen selecting the spectrum of a pixel in which the band absorption at 3.34 $\mu$m was more evident, (for example fig.2).

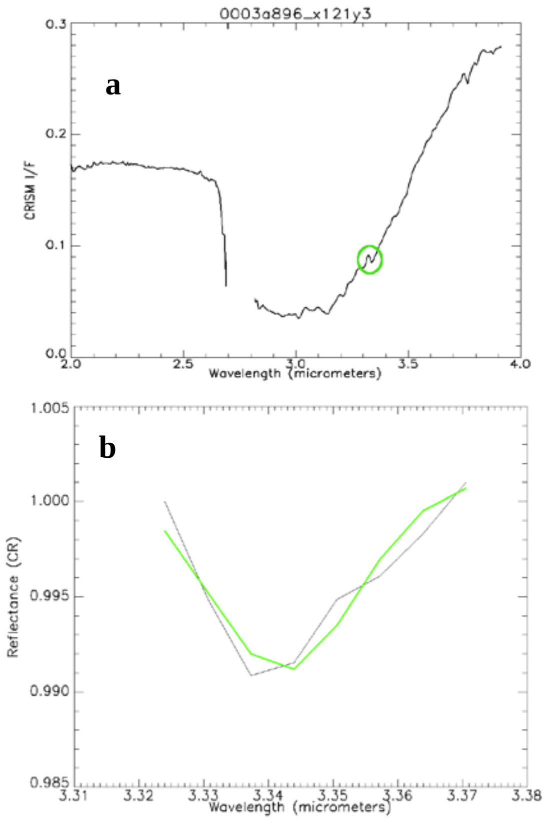


**Figure 2. a) I/F Spectrum of pixel x121y3 in the CRISM observation 0003A896. Green circle surrounds the 3.34 band; b) zoom on the 3.34 μm band in the continuum removed spectrum (black line), and MGM fit (green line).**

Hence, a first preliminary map of some absorptions at 3.34 $\mu$m is shown in fig. 3 (cyan circles) for the CRISM observation 0003a896, setting a threshold on the band depth. The cyan circles were used instead of the single investigated pixels to make the map more readable.

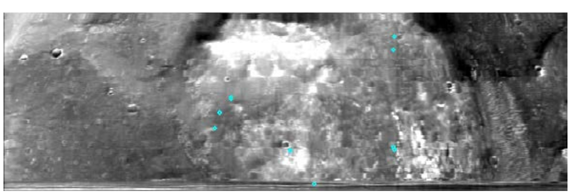

**Figure 3. Map of some pixel spectra (indicated by cyan circles) that show an absorption at 3.34 $\mu$m in the 0003a896 observation.**

# 4. Summary and Conclusions

As first stage of this work, only Nadir data were considered. Nevertheless, the analyses of limbic and other data will provide the necessary cross validation for the correct assignment of organic molecules to the surface. Since the 3.34 $\mu$m band we have observed come from isolated pixels we are led to believe that this band is related to surface composition more than to the atmosphere composition. In fact, in this last case we would expect this band absorption in the overall scene. Therefore, further investigations are ongoing to cross validate these results with other available data and in the view of mapping interesting features for life detection on broader areas of Mars.

# References

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