RLS INSTRUMENT ALGORITHMS AND TOOLS FOR THE DETECTION AND ANALYSIS OF TRACES OF ASTROBIOLOGICAL INTEREST. G. Lopez-Reyes[1], R. Torío[1], C. Díaz[2], A. Sansano[1] and F. Rull[1], [1]Unidad Asociada UVa-CSIC-CAB (Av. Francisco Valles 8, E-47151, Boecillo, Spain – *lopezrge@cab.inta-csic.es*), [2]Instituto Nacional de Técnica Aeroespacial (Crtra. Ajalvir Km.4, E-28850, Torrejón de Ardoz, Spain).

Introduction: Raman spectroscopy is a very powerful technique for the analysis of all types of materials, minerals or biological samples, given its non-invasive and non-destructive nature. This spectroscopic technique has remained, however, unprecedented in planetary exploration, mainly due to technological limitations. Nevertheless, during the last fifteen years, technology has allowed the miniaturization of Raman spectrometers to a point where they are currently being considered candidates for planetary missions. For example, The RLS instrument is a 532nm spectrometer which forms part of the payload of the rover of ESA's ExoMars mission that will be launched to Mars in 2018. Furthermore, NASA Mars 2020 mission will include, onboard their future Mars rover, two different Raman devices: SHERLOC, a deep-UV Raman spectrometer, and SuperCam, a combined remote Raman-LIBS-image spectrometer.

Raman Spectroscopy for Astrobiology. The use of Raman spectroscopy for the identification and detection of traces of astrobiological interest has been demonstrated [1-3], showing the relevance of the use of this technique for planetary exploration missions such as ExoMars. One of the objectives of this mission is related to the detection of organic materials or traces of astrobiological interest (among other objectives, such as the mineral characterization of the Martian environment).

The RLS instrument for the Detection And analysis of Traces of Astrobiological Interest: The RLS instrument characteristics (continuous 532nm laser) allow it to address at the same time the mineralogical and astrobiological objectives of the ExoMars mission. Obviously, the operation definition of the instrument has an influence on the final acquisition of the spectra. In order to maximize the detection capabilities of astrobiological traces of interest with the RLS instrument, both an onboard acquisition algorithm for the optimization of the acquisition of the spectra of these samples, as well as on-ground tools for the automatic identificacion of spectra (Instrument Data Analysis Tool, IDAT), are being developed and implemented.

Detection of Traces of Astrobiological Interest onboard the RLS Instrument. In the context of planetary exploration, it is necessary that RLS operates automatically to optimize the acquired spectra. This will be done by defining a set of algorithms and methods that will allow the instrument to take decisions based on objective parameters obtained from spectra acquired for reference [4-5]. In addition to acquisition-related algorithms, the RLS instrument will include a dedicated algorithm for the onboard detection of traces of astrobiological interest, to further optimize the the acquisition parameters for this kind of samples. Fig. 1 shows the regions of interest of a Raman spectrum.

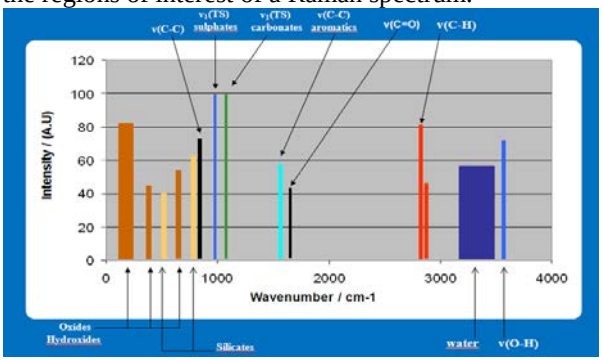

Fig. 1. Raman spectral ranges of astrobiological interest.

RLS Data On-ground Processing. The Instrument Data Anaylsis Tool (IDAT). Once the RLS instrument has been received on ground, they need to be analyzed. In order to obtain the maximum science return, the IDAT is being designed and developed in parallel to the instrument development.

This tool will allow the automated analysis of the spectra when received at the Rover Operations Center. It will include a set of complex automated procedures to both check the instrument health, but also to provide the scientific teams with preliminary results of the analyzed samples in a matter of minutes. Furthermore, this tool will take care especially of samples of astrobiological interest by executing specific routines when this kind of sample is detected among the incoming data.

The analyses performed by IDAT will be of the highest importance in order to improve the knowledge from the samples and the Martian site where the rover is operating, in addition to providing a tool for adequate tactical decision making during the mission. Furthermore, the automated analysis of Raman spectra, with the capability to pay attention to determined types of samples will be extrapolable to many other missions and research fields with (astro)biological implications.

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