DEVELOPMENT OF A SPECTRAL DATA BASE FOR EXOMARS' RAMAN INSTRUMENT (RLS).
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Introduction: The Raman Laser Spectrometer (RLS) is one of the Pasteur Payload instruments, within the ESA's Aurora Exploration Programme, ExoMars mission[1]. The main science objectives of the ExoMars rover are:

- to search for signs of past and present life on Mars
- to characterise the water/geochemical environment as a function of depth in the shallow subsurface

The ExoMars rover will search for two types of life-related signatures: morphological and chemical. This will be complemented by an accurate determination of the geological context.

Raman Spectroscopy is used to analyse the vibrational modes of a substance either in the solid, liquid or gas state. It relies on the inelastic scattering (Raman Scattering) of monochromatic light produced by atoms and molecules. The radiation-matter interaction results in the energy of the exciting photons to be shifted up or down. The shift in energy appears as a spectral distribution and therefore provides an unique fingerprint by which the substances can be identified and structurally analyzed.

Although you could make an accurate identified compounds detected by Raman spectroscopy analysis using bands, positions, structures, etc, the simplest system identification and the most used is the comparison of these spectra with databases. However, the Raman spectra are quite dependent on the conditions in which they have acquired, the characteristics of the instrument, and the physicochemical conditions of the samples taken as standard.

Therefore, it is necessary to perform a database of spectra to be the most similar conditions to acquire the spectra during the misión.

Similarly, although few more samples you have, the more complete will be selected, they must prioritize the samples that are more likely to be on Mars, apart from those of most interest from the scientific point of view and within the astrobiology target of the mission.

Description

At the moment, in the actual stage of development, we have processed 113 samples. These samples are arranged as:

- Mineral samples: 54. there are a compilation of the most representative minerals and in progress growing towards more specific families.

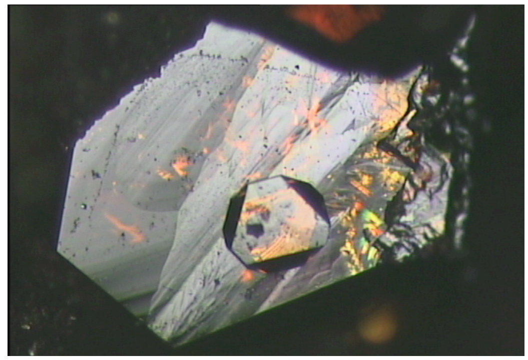

Fig.1 Jarosite Crystal from the samples database

- Synthetic samples: 78. These samples are added as pure standards of well-know compositions in controlled conditions.

- Organic samples: 37. In this group, small biosignatures are included as amino acids, glucids, PAHs, etc.

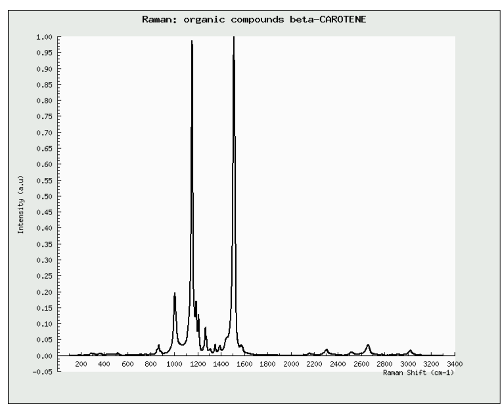

Fig.2. beta-Carotene Raman spectrum from the DB

Requirements and verification

All this spectra are acquired using RLS requirements as irradiance, spot size, grain size, resolution, etc.

To verify the identity and traces composition of the samples used, were applied other spectroscopic tools as XRD, FTIR and LIBS. Also other Raman spectra were compilated to be aware for other external effects as resonancecee, fluorescence, etc.

Management

For a best exploration of the data a set of algorithms are being developed in the framework of the development of the instrument. These algorithms will be integrated in the ground segment tool for scientific data exploitation but also adapted for implementation as on-board operation software.

Fig.3. WEB-based database management

Martian Enviroment

The next step of this development is perfoming these measurements in martian conditions, using a martian chamber developed for this task.

Acknowledgements

The team wishes to thank the Spanish MINECO Project AYA2008-04529-ESP and AYA2011-30291-C02-01 for the funding.

References:

[1] Rull, F., Martinez-Frias, J. (2006). *Spectroscopy Europe 18*: pp. 18–21.