EPSC Abstracts
Vol. 7 EPSC2012-901-1 2012
European Planetary Science Congress 2012

Mineralogical characterization of Los Escullos (Cabo de Gata) using spectroscopic techniques

F.Rull (1,3)*, G. Klingelhöfer (2), G. Venegas (1), J. Medina (1) J. Martínez-Frías (1,3)

(1) Unidad Asociada UVA-CSIC al Centro de Astrobiología, Valladolid, Spain, (*) rull@fmc.uva.es.
(2) Institut für Anorganische and Analytische Chemie, Germany.
(3) Centro de Astrobiología CSIC-INTA, Ctra. Ajalvir km.4, Torrejón de Ardoz, Madrid, Spain

Abstract

In this work a detailed mineral spectroscopic analysis has been performed in the area of Los Escullos, wich is of the great astrobiological interest. Spectra were taken in-situ using portable Raman, LIBS and Mössbauer instruments and complementary data were also obtained at the laboratory using XRD and IR.

1. Introduction

The occurrence of sulfates on Mars, such as jarosite was unequivocally identified in Meridiani Planum [1], which is of prime importance in the context of the geological evolution of the planet. Jarosite identification provides clear mineralogical evidence for past liquid water activity, hence the importance of studying the water-rock interactions in volcanic and hydrothermal systems.

Figure 1: From left to right: general view and detailed photo of the Los Escullos (directly affecting hydrothermal volcanic rocks).

In Spain there are some areas of great astrobiological interest, such as the volcanic-hydrothermal-evaporitic system of Jaroso-Sorbas-Cabo de Gata (Almería province). Los Escullos site is located in the volcanic area of Cabo de Gata and forms part of such general system.

2. Experimental

In-situ analysis using simultaneously Raman, LIBS and Mössbauer techniques was performed at several locations in the area (figure 2) [2-4].

Figure 2: Raman and Mössbauer instruments analysing in-situ minerals at the surface.

The Raman instrument is a prototype derived from the one on development for ExoMars 2018 mission to Mars. Mössbauer instrument MIMOS II is a prototype of the one on board of Spirit and Opportunity in the MER mission working for several years in the Mars surface.

For the analysis at the laboratory on collected samples the same instrument were also used. Complementarly a Raman spectrometer HoloSpec illuminated with a 632.8 nm laser, detection was performed with an Andor CCD of 1024x256 pixels and a Raman head probe was used. Also laboratory XRD, XRF and IR instruments were used.

3. Results

The techniques have identified sulphates as Jarosite and Gypsum, oxides-hydroxides like Goethite, Hematite and Anatase, carbonates such calcite and tectosilicates such as orthoclase.

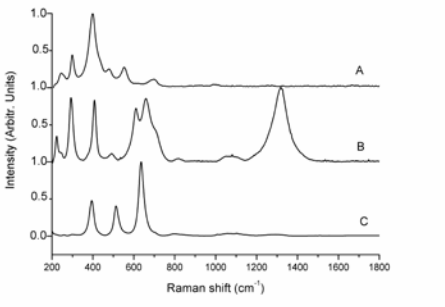

Figure 3: Raman spectra of Goethite (A), Hematite (B) and Anatase (C) in the 200–1800 cm-1 spectral range obtained from Los Escullos.

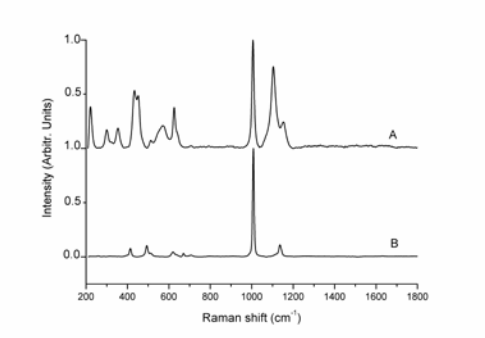

Figure 4: Raman spectra of Jarosite (A) and Gypsum (B), obtained from Los Escullos.

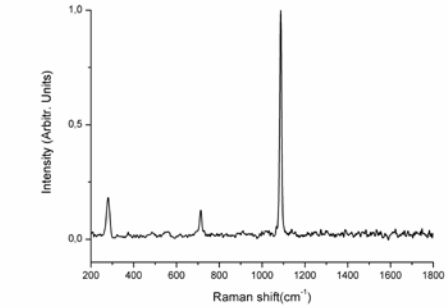

Figure 5: Raman spectra of Calcite obtained from Los Escullos.

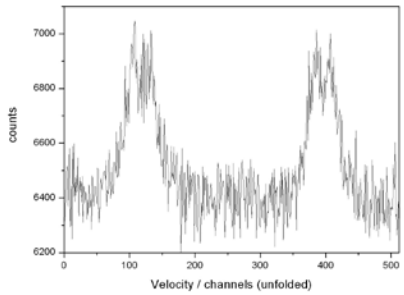

Figure 6: Mössbauer 'not-folded' spectrum showing the mirrored spectrum as well.

4. Conclusions

Raman is under development for ExoMars mission and Mössbauer has a wide experience of mineral analysis at the surface of Mars. The capability of each technique and their synergies on working in coordination are stressed.

Comparison between results obtained in-situ with results obtained in laboratory allow to evaluates the potential of these techniques for field in-situ analysis and their potential for application in planetary exploration. The results obtained also allow to introduce important insight in the knowledge of the mineral processes associated with the different hydrothermal events. In particular the coexistence of mineral group like jarosite, which forms in acidic environments, with carbonates such as calcite.

5. References

[1] Klingelhöfer et al., Science 306, pp. 1740-1745,2004.

[2] Rull, F. et al., European Planetary Science Congress, Vol. 5, 845, 2010.

[3] Rull, F. et al., Lunar Planetary Science Conference, XXXIX, 2008.

[4] Klingelhöfer, G. et al., Workshop at Université Cady Ayyad, Ibn Battuta Centre – Morocco, 2011.