Remote Raman Spectroscopy in Mars analog sites: instrumentation for the study of the hydrology and the mineralogy. P. Sobron[1], T. Acosta[1], A. Vegas[2], F. Rull[1] and A. Sanz[1], [1]Unidad Asociada Universidad de Valladolid-Centro de Astrobiología CSIC-INTA. Facultad de Ciencias. Paseo Prado de la Magdalena s/n. Valladolid-47011, Spain. (psobron@iq.uva.es), [2]TCP Sistemas e Ingeniería. C/ Fernández Caro,7. Madrid-28027, Spain.

Introduction: There is a growing interest in the study of Martian sulfates since they could host information on the aqueous past of the planet and could play a role in defining potentially habitable past environments. Mars Missions Viking 1 and 2, Mars Pathfinder, and the Mars Exploration Rovers (MER) have found sulfur-rich compounds on Mars surface, including jarosite [$(Na,K)Fe^{3+}_3(SO_4)_2(OH)_6$] and other yet unidentified ferric sulfates [1]. OMEGA on Mars Express has recently identified kieserite ($MgSO_4•H_2O$), gypsum ($CaSO_4•2H_2O$), bassanite ($CaSO_4•0.5H_2O$), and some yet unspecified polyhydrated sulfates [2].

Because of the importance of sulfates for the understanding of Martian evolution and surface processes, we understand that an unambiguous identification and characterization of those sulfates in terrestrial Mars analog sites is of critical importance. Furthermore, the use of flight-like instruments for the analysis of Mars analogs is crucial in order to develop analytical techniques adjusted to planetary missions instrumental constrains: miniaturization, compactness, minimum-weight and low power consumption, among others.

In this work we describe the features and capabilities of a portable instrument for the daytime remote Raman spectral characterization of minerals that has been optimized for the analysis of samples with relevance in Astrobiology such as sulfate-rich minerals. We also present the remote Raman spectroscopy of some sulfate minerals from Rio Tinto (Spain) and Iron Mountain (CA, Unites States), which are likely to be found on Mars surface.

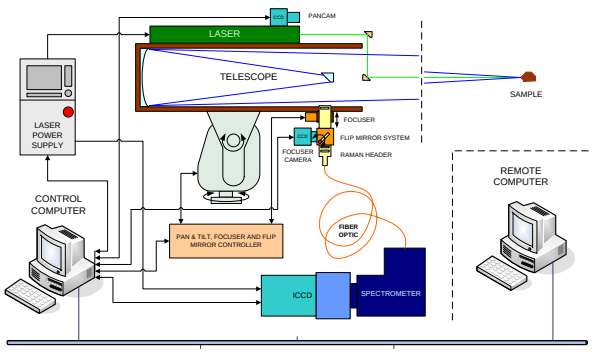

Figure 1. Diagram showing the pulsed remote Raman system with interfaces depicted. 3D motion unit, pulsed laser - ICCD synchronization, signal acquisition and treatment are controlled from a unique software package. Credit A. Vegas

Figure 2. Picture of the remote Raman instrument. Background Rio Tinto, Spain. Credit T. Acosta

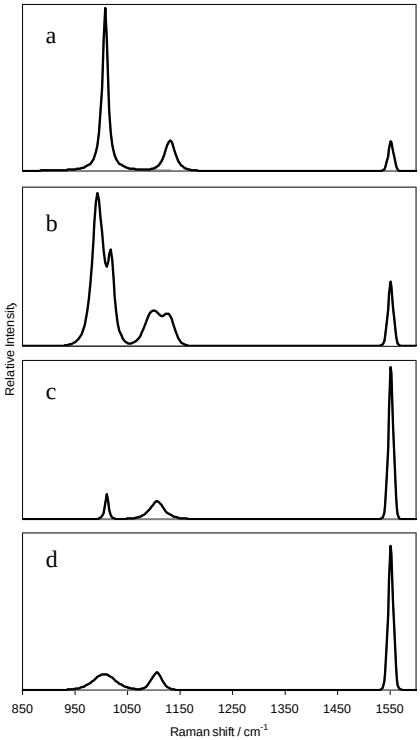

Figure 3. Raman spectra of sulfate-rich samples of Rio Tinto taken in remote mode. Spectra of samples a, b, c, and d resemble those of gypsum, copiapite, quartz, and jarosite, respectively. Those minerals are likely to be

present in acid-mine drainage sites such as Rio Tinto and Iron Mountain, CA.

The compact instrument we have developed allows for unambiguous characterization of molecular vibrations, identification of species and semi-quantitative measurement of their abundance. Major element composition can also be readily obtained. Recent technological developments will allow for our instrument to be reduced to prototype payload requirements.

References: [1] Klingelhöfer G. et al. (2004) Science, 306, 1740. [2] Gendrin A et al. (2005) Science, 307, 1587