A COMBINED RAMAN AND MÖSSBAUER ANALYISIS OF ALTERED BASALTS IN TENERIFE ISLAND: ANALOGIES WITH MARS. F.Rull[1,3], G. Klingelhoefer[2], J.M. Frias[1,3], J.A. Rodriguez[4], J.Medina[1], E. Lalla[1]
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Introduction:

The systematic study of the compositional (mineralogical and geochemical) variations occurred on Mars as a consequence of the fluid-rock interactions at different possible subaerial and submarine frameworks (which include hydrothermal episodes and also weathering processed) is of prime importance in understanding the role of water in the geological history of Mars and also in the searching for possible evidences of past or present life on the red planet. The Canary Islands and in particular Tenerife has been proposed as an area of reference for carrying out research and technological studies with planetary and astrobiological implications [1,2]. First results including the utilization of "in situ" spectroscopic techniques (i.e. Raman spectroscopy) were recently obtained in one of these areas [3]. Several areas were investigated: a) A'a' basaltic lava flows corresponding to Las Arenas volcano and the spectacular area of "Los Azulejos" in Las Cañadas Caldera. Whereas in the first area the alteration reflects weathering processes of the primary volcanic paragenesis, Los Azulejos shows a complex overlapping of hydrothermal fluids which is clearly visible in the field displaying bluish, greenish, and yellowish colours. Analcime and clay minerals of smectite and illite groups, together with iron and managanese oxides are broadly defined at this area [4]. In addition to the hydrothermal episode, further subaerial weathering processes also occurred which are also of great interest. The main objective of the work presented here is the study the mineralogical and geochemical changes associated with low-temperature hydrothermal alteration in such settings.

To perform this study a combined mineralogical and geochemical analysis has bee undertaken using the combination of several techniques included in recent (MER) and future (ExoMars) missions for exploration of Mars surface. The analysis consisted in the in-situ characterization of the surface alteration materials in the area mainly using Raman and LIBS techniques and comparison with laboratory studies using the same techniques. The analysis of samples was also performed with Mössbauer spectroscopy in order to compare the results with LIBS and Raman spectroscopies testing the synergies between these techniques for precise mineral identification of the basic materials and their alteration products and for preparing a future joint campaign of in-situ analysis.

Experimental: Raman spectra were obtained in-situ with a portable i-Raman from B&W TEC Inc, adapted to work under field conditions. The optical head was positioned in front of the samples using a mechanical device which allows mapping the surface at near the mineral grain scale. A baffle was used to minimise the solar light background. The excitation used was a 532nm wavelength laser with ~15mW power on the sample and a spot diameter of 100µm. Spectral resolution was 5cm-1.

At the laboratory the micro-Raman spectra were collected using a prototype of the Raman spectrometer under development for Exomars which is coupled to a microscope through optical fiber. Objectives x50 and x100 wer used.

Mössbauer spectra were collected with a copy of the instrument MIMOS II on board the Mars-exploration rovers (MER). A Co57/Rh source with an intensity of about 50 mCi has been used in backscattering geometry. Measurements have been performed at room temperature.

Results: Figure 1 shows the in-situ operation at Los Azulejos area.

Figure 1. (Left) Raman instrument working at Los Azulejos area. (Right) detail of the Raman measurements at the blue-green minerals characteristics of Los Azulejos.

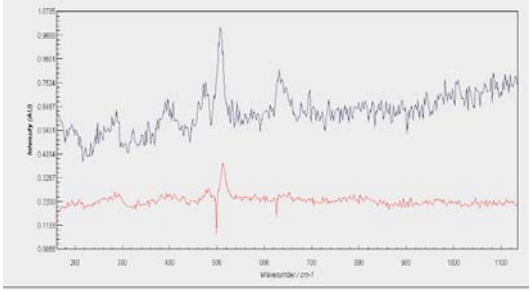

Figure 2. Raman spectra of the white and green materials identified as albite chlorite with minor bands from chlorite and oxides.

These results allow to in-situ identify feldespars, phyllosilicates, quartz and oxides. Results obtained at the laboratory on small collected samples confirmed these results including sulfates (melanterite), magnetite and hematite.
Samples from malpais were also analysed

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