EXOFIT field trials: experience learned from the use of ExoMars/RLS Qualification Model and representative Raman prototypes

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The ESA/Roscosmos ExoMars mission to Mars is scheduled to be launched in 2020. Seeking to prepare the ExoMars operation team to manage the engineering and scientific challenges arising from the Rosalind Franklin rover soon operating at Oxia Planum, a rover prototype equipped with representative ExoMars navigation and analytical systems was recently used in two mission simulations (ExoFit trials).

The first field test was carried out in Tabernas (Spain), a desertic area characterized by the presence of clays, partially altered sedimentary rocks and efflorescence salts. The second ExoFit trial was performed in the Atacama Desert (Chile), in a sandy flat land displaying diorite-boulders, clays patches and evaporites.

The Raman Laser Simulator (RLS) team participated in both simulations: portable spectrometers were used to determine the mineralogical composition of subsoil samples collected by the rover-drill and to investigate the possible presence of biomarkers. In-situ analysis were carried out by means of the RAD 1 system (Raman Demonstrator), which is a portable spectrometer that follows the same geometrical concept and spectral characteristics of the RLS flight model (FM).

In the case of Tabernas trial, additional analysis were performed using the RLS qualification model (EQM2) which at the moment was the most reliable tool to understand the scientific outcome that could derive from the RLS operating on Mars.

Prior to analysis, geological samples were crushed and sieved to replicate the granulometry of the powdered material produced by the ExoMars crusher. After flattening, from 8 to 10 spots were analyzed and Raman data and interpreted.

From each site, two cores were drilled and analyzed. On one side, the main mineralogical phases detected in the first Atacama core are quartz and calcium carbonate. In addition to those, the mineralogy of the second core also includes hematite and calcium sulphate.

On the other side, RAD 1 spectra gathered from Almeria core-samples confirmed the presence of quartz as main mineralogical phase. However, peaks of medium intensity at 146 and 1086 cm⁻¹
were also observed, confirming the detection of rutile and calcium carbonate respectively. The same samples were further characterized by means of the RLS-EQM2 system: beside confirming the detection of the abovementioned mineral phases, additional Raman biomarkers-related peaks were also found.

Even though deeper Raman analysis of ExoFit samples need to be performed, the preliminary results gathered in-situ suggests that Raman spectroscopy could play a key role in the fulfillment of the ExoMars mission objectives.