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

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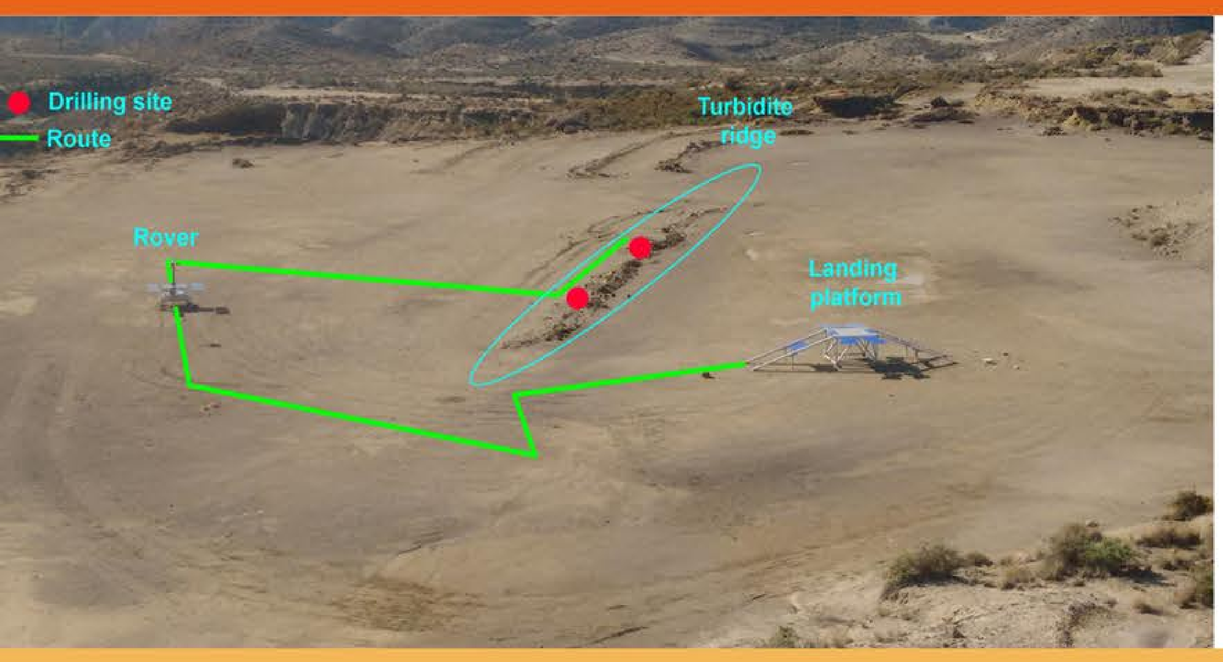


Mission simulation at the Taberna desert (Spain)

ExoFit trials are field campaigns fiundedby ESA to test the Rosalind Franklin rover and to enhance collaboration practices between ExoMars working groups. During the first trial, a replicate of the ExoMars rover was remotely operated from Oxfordshire (United Kingdom) to perform a complex sequence of scientific operations at the Tabernas Desert (Spain). By following the Reference Surface Mission (SMC), the rover investigated the Badlands subsoil and collected drill cores, whose analytical study was entrusted to the RLS team. The preliminary characterization of core samples was performed in-situ through the RLS Engineering and Qualification model (EQM-2) and the Raman Demonstrator (RAD1), being this a new, portable emulator of the RLS. In-situ results where then complemented by laboratory analysis using the RLS ExoMars simulator and the commercial version of the Curiosity/CheMin XRD system.

Simulating Martian surface operations: Charlie rover

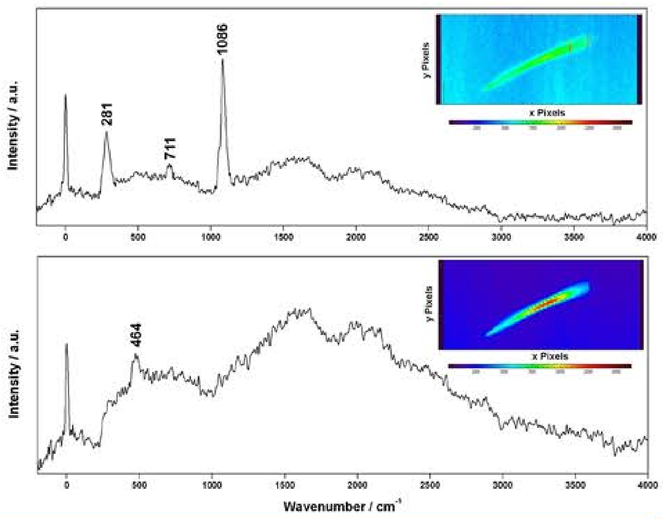
By simulating the activities of 9 Martian sols, ExoMars panoramic instruments were used to investigate the site. After descending the landing platform, Charlie reached multiple areas of high scientific interests by avoiding rocks and further physical obstacles. At each area of interest, a combination of close-up images of the surface (CLUPI) and Radar subsurface stratigraphy investigations (WISDOM) were performed to identify the best spots to be drilled. After drilling, subsurface materials were finally analyzed by the RLS team, who joined the ExoFit activities with a group of researchers and technical personnel from the University of Valladolid (UVa) and the National Institute for Aerospace Technology (INTA).

The analytical results obtained by means of the multiple Raman systems are provided below.

Analytical characterization of Tabernas drilled cores: Lessons learnt by the RLS team

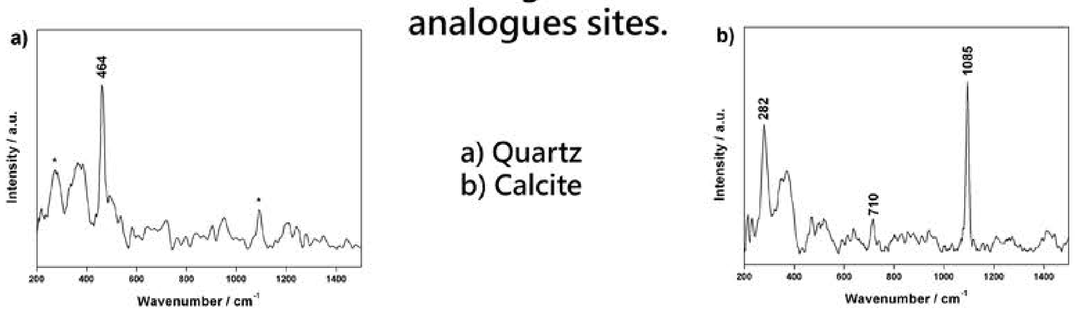
RLS Engineering Qualification Model EQM-2 (7 spectra)

Whitin the limited time assigned for the in-situ Raman characterization of drilled cores (1 hour), only 7 spectra could be collected. Comparing with reference XRD data, it was proved that the RLS EQM-2 was able to detect the main mineral phases of the samples (quartz and calcite).



Raman demonstrator RAD1 (7 spectra)

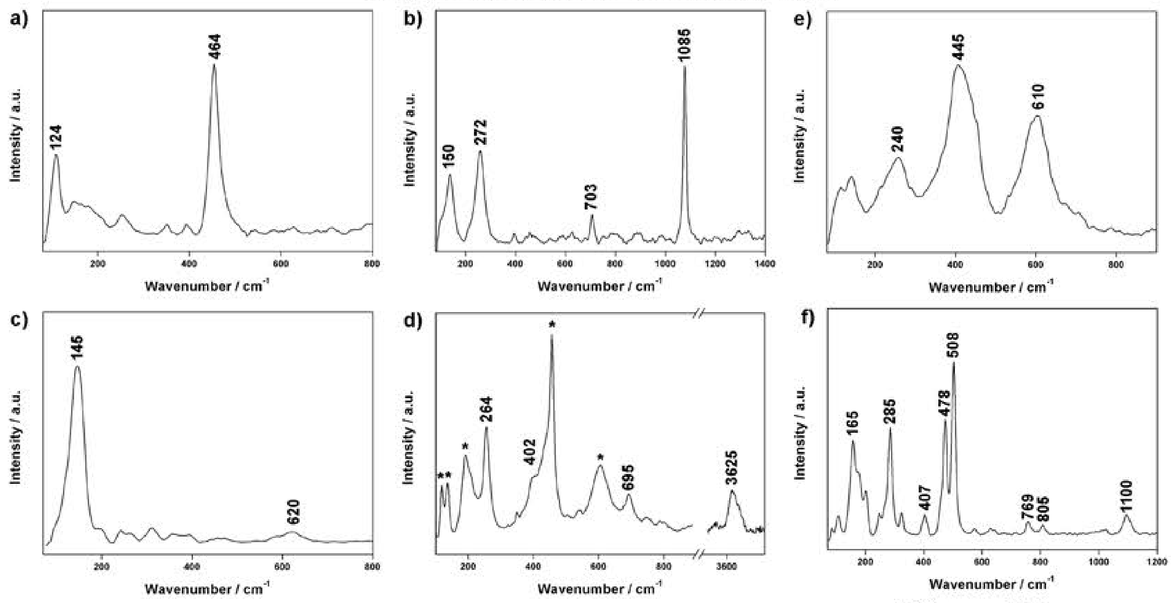
EQM-2 data perfectly agreed with those collected through the RAD1 system, thus demonstrating that this portable RLS simulator can be a valuable tool for the in-situ investigation of ExoMars-related terrestrial analogues sites.



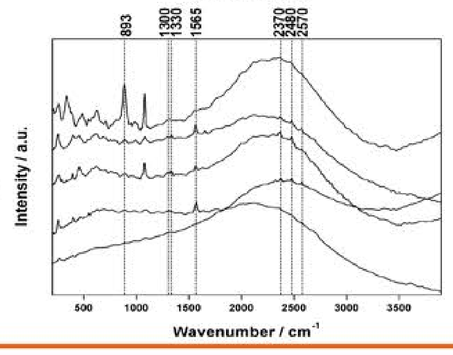
a) Quartz
b) Calcite

RLS ExoMars Simulator (39 spectra)

Laboratory Raman analysis, performed by closely emulating the operation constraints of the mission, helped demonstrating that the multipoint Raman analysis of powdered samples is the optimal analytical strategy to maximize mineral detection.



Besides the detection of mineral phases, laboratory analysis of drilled cores enabled the identification of multiple biomarkers. This result confirms the RLS could be able to identify the potential presence of organic compounds in the subsurface of Mars.



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