Geophysical Research Abstracts
Vol. 21, EGU2019-16584, 2019
EGU General Assembly 2019

ExoMars/Raman Laser Spectrometer (RLS)– spectroscopic system for the potential recognition of wet-target craters on Mars

Marco Veneranda (1), Guillermo Lopez-Reyes (1), José Antonio Manrique (1), Jesus Saiz (1), Jesus Medina (1), Henning Dypvik (2), Stephanie Werner (2), and Fernando Rull (1)

(1) University of Valladolid, Spain (marco.veneranda.87@gmail.com), (2) Centre for Earth Evolution and Dynamics (CEED), PO 1028 Blindern, 0315, Oslo (Norway)

The Planetary Terrestrial Analogues Library (PTAL) project1 has the purpose of providing the scientific community with an extensive multi analytical database (Raman, NIR, LIBS and XRD) of terrestrial analogues samples. In the framework of the PTAL project, the present work deals with the characterization of an impact breccia sample collected from the ICDP-USGS Eyreville core of the Chesapeake Bay Impact Structure (CBIS). Powdered material was first characterized by means of a laboratory Raman spectrometer and the results compared to those provided by the Raman Laser Spectrometer (RLS) ExoMars simulator, which represents the most reliable tool to effectively predict the scientific capabilities of the ExoMars/Raman system that will be deployed on Mars in 20202. Afterwards, molecular spectroscopic results were compared to mineralogical data obtained from a X-Ray diffractometer (XRD). In a whole, this work aims at: 1) assessing the capability of Raman spectrometers to detect minor and trace compounds that cannot be detected by XRD, and 2) evaluating the scientific capabilities of the ExoMars/RLS instrument in the discrimination of wet-target craters on Mars.
The XRD results obtained in this study agree with those presented by J.W. Horton Jr. et al.3, identifying quartz, cristobalite, illite and feldspars as main mineralogical components of the breccia sample. Regarding Raman analysis, both the laboratory system and the RLS ExoMars simulator were able to detect additional compounds that were not identified by XRD, such as shocked quartz, coesite, rutile, hematite, ilmenite, barite and siderite, proving the higher mineralogical complexity of the sample.
Among the detected minor and trace compounds, the Raman discrimination of shocked quartz, barite and siderite could have a strong scientific relevance in the field of planetary exploration. On one hand the detection of the shifted quartz, being the consequence of a pressure-induced amorphization of the crystalline structure4, confirms that this spectroscopic technique is capable of identifying the mineralogical evidences necessary to confirm the impact origin of a crater. On the other hand the detection of barite and siderite, compounds crystallizing under hydrothermal conditions5, represents the analytical data that could confirm the presence of water on the impact site. Considering that these three compounds were clearly detected by means of the RLS simulator, the obtained results suggest that the ExoMars/RLS Raman spectrometer could have the capability to analytically discriminate the presence of wet-target craters on Mars.

Reference

1. Planetary Terrestrial Analogues Library (PTAL) project: https://ptal.eu/
2. G. Lopez-Reyes, F. Rull, G. Venegas. F. Westall, F. Foucher, N. Bost, A. Sanz, A. Catalá-Espí, A. Veas, I. Hermosilla, A. Sanasano, J. Medina, European Journal of Mineralogy, 2013, 25, 721.
3. J.W. Horton Jr., M.J. Kunk, H.E. Belkin, J.N. Aleinikoff, J.C. Jackson, I.M. Chou, The Geological Society of America Special Papers, 2009, 458, 266
4. P.F. McMillan, G.H. Wolf, P. Lambert,. Phys. Chem. Minerals, 1992, 19, 71-79.
5. J.S. Hanor, Barite-Celestine Geochemistry and Environments of Formation. Reviews in Mineralogy and Geochemistry, 2000, 40,193.