EPSC Abstracts,
Vol. 4, EPSC2009-457, 2009
European Planetary Science Congress,

Raman investigations of the EuroGeoMars Campaign

L. Wendt[1*], P. Mahapatra[2*], C. Gross[1*], A. Borst[2,3*], B.H. Foing[2*], ExoGeoLab team[2,4] & EuroGeoMars team[2,4,5]

[1]Freie Universität Berlin, Institute of Geosciences, Malteserstr. 74-100D, 12249 Berlin, Germany [2]ESTEC/SRE-S Noordwijk, [3]VU Amsterdam , [4]ESTEC TEC Technology Dir., [5]ESTEC HSF Human Spaceflight

Introduction

Major objectives of the EuroGeoMars [1] field campaign to the Mars Desert Research Station (MDRS) were to demonstrate validate a first stage sample characterisation and analysis in the field as a first stage for a sample return mission to the Moon or Mars, and to support the interpretation of data from current (Mars Express) and future (Exomars) missions to Mars. This first stage analysis included Raman spectral measurements as an easy-to-use and non-destructive method, cross-checked by measurements with a portable Terra XRD-XRF system and sample characterisation by geologists.

The Raman measurements

Samples extracted from selected sites were taken to an improvised laboratory inside the MDRS and analysed using the transportable Inphotonics Inphotote Raman spectrometer provided by NASA Ames, featuring a 785 nm laser with 300 mW output, a spectral range of 250 - 1800 cm^{-1} and a resolution of 4-5 cm^{-1}. The samples included various clays, mudstones and sulphates from the Morrison and Summerville formation and igneous rocks from the dioritic intrusion in the nearby Henry Mountains. The Raman spectra were compared visually and by correlation matching to reference spectra from the RRUFF spectral library [2].

Figure 1 shows the results from X-ray fluorescence, dominated by Ca, X-ray-diffraction and Raman spectroscopy for a sample taken from a giant gypsum nodule in the Summerville formation. Mineral identification by Raman spectra proved to be especially successful for sulphate samples and crystalline rocks, whereas multiple scattering on grain boundaries occurred at fine-grained samples, degrading the quality of the obtained spectra.

For future missions carrying Raman spectrometers such as Exomars, a full understanding of this behaviour and a complete spectral library is essential to best exploit the collected data.

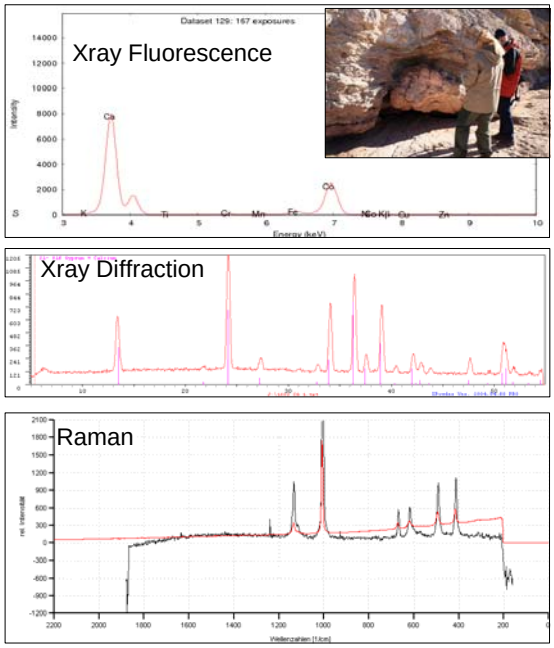

Figure 1: Resuls of XRF, XRD and Raman of a gypsum sample

References

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