SERS INVESTIGATION OF NUCLEOBASES DEPOSITED ON EVAPORITE MINERALS: A TEST CASE FOR ANALOGUE MARS REGOLITH.

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Introduction: Traditionally, Micro-Raman spectroscopy is one of the primary analytical techniques for the detection of minerals and organic molecules in the laboratory. However, in owe of its versatility and capability to interrogate samples without preliminary purification or concentration treatments, it is one of the frontrunners for the next generation of in situ instrument designed to explore solar system bodies. In particular the Raman capability to unambiguously detect organic molecules and biomarkers might result of great importance to understand if and how primitive life generates in extraterrestrial environments (e.g. Mars). The technique's analytical sensitivity towards organic molecules can be further enhanced by means of the interaction with coin metals nanoparticles [1]. This approach, named Surface Enhanced Raman Scattering (SERS) has proved to be able to detect traces amount of nucleobases adsorbed on Terrestrial [2] or Martian [3, 4] substrates. Even if these studies have shown the suitability of SERS to detect tiny amounts of biomarkers in magmatic rocks, other substrates such as evaporites should result more prone to host biomolecules. According to orbital and rover observations [5, 6] as well as the presence of tiny amounts of evaporitic minerals in nakhlites (Martian meteorites) [7], Martian evaporites are considered to be constituted by carbonates, sulphates and clay minerals. In the present study we focused on the identification of nucleobases on Martian analogue material in order to test the SERS response on such kind of mineral substrates.

Experimental and Results: Two different nucleobases (adenine and hypoxanthine) were deposited on crushed samples made of carbonates (calcite, dolomite, magnesite and siderite) and sulfates (anhydrite and gypsum). Then the Raman spectra were collected under air at room temperature on every single mineral phase. Without depositing Ag nanoparticles (Ag-nps) only the bands attributable to the substrate were observed. However, the addition of Ag-nps enhanced the intensity of the Raman bands of the two nucleobases allowing their unambiguous identification and assessing the SERS capability to deal with subpicogram amounts of nucleobases.

Acknowledgements: The authors would like to thank Regione Toscana for financial support of the project LTSP through the found POR FSE 2007-2013 (Obiettivo 2,Asse IV).

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