Geophysical Research Abstracts
Vol. 21, EGU2019-17290, 2019
EGU General Assembly 2019

Miniature Raman spectrometers for field detection of microbial pigments in gypsum

Jan Jehlicka and Adam Culka
Charles University, Prague, Czech Republic (jehlicka@natur.cuni.cz)

Terrestrial field detection of biomarkers using miniature Raman spectrometers in Mars-analogue sites can be seen as a training for next Martian missions. In fact both the European Space Agency (Exomars) and North American Space Agency (Mars 2020) robotic rovers will include Raman spectrometers. Suitable biomarkers present in extremophilic cyanobacteria and algae include photosynthetic pigments, UV-absorbing compounds, osmotic solutes and lipids. Raman spectroscopy is an excellent tool for detection of microbial pigments1. Portable instrumentation permits to detect biomarkers including carotenoids fast and onsite under field conditions2,3.
New possibilities of miniature Raman spectrometers equipped with green lasers allowing resonance Raman signals of carotenoids to be collected are evaluated here. Possibilities of collecting spectra of carotenoids under non resonant conditions using a portable sequentially shifted Raman spectrometer (832 and 1064 nm lasers) are shown as well. The results of studies of stratified microbial communities within evaporite gypsum crusts in hypersaline saltern evaporation ponds in Eilat (Israel) are presented. Here, rich and complex colonizations by different microorganisms occur. Vertical layers of orange unicellular cyanobacteria, green filamentous cyanobacteria, and purple sulfur bacteria are distributed in coarsely crystalline gypsum. This gypsum crystallizes from seawater evaporated to a salinity of 150-200 g/l. Raman spectra obtained by direct illumination of crystalline material using miniature Raman spectrometers show the presence of myxoxanthophyll, echinenone, and spirilloxanthin-like carotenoids in different layers of the microbial mat. Other examples of onsite detecting pigments in gypsum endolithic colonizations as well as of fossil traces in different types of gypsum of sedimentary settings of Tertiary age are presented as well (Southern Sicily). Observed shifts of positions of Raman features of pigments are discussed and critically evaluated.

[1] Jehlička J., Edwards H.G.M., Oren A., Applied and Environmental Microbiology, 2014, 80, 3286–3295
[2] Malherbe C., Hutchinson I.B, McHough M, Ingley R., Jehlička J., Edwards H.G.M., Astrobiology, 2017, 17, 351–362.
[3] Jehlička J., Oren A., Journal of Raman Spectroscopy, 2013, 44, 1285–1291.