

Pyrolysis-GC-MS analysis of Antarctic lake sediments. H. Steininger¹ and W. Goetz¹, ¹Max Planck Institute für Sonnensystemforschung, 31977 Kathlenburg-Lindau, Germany (steininger@mps.mpg.de),

Introduction: The NASA/ESA-lead Mars rover ExoMars (launch in 2018) will carry a suite of instruments including the Mars Organic Molecule Analyzer MOMA. Organic material in the Martian soil will be either pyrolyzed at temperatures of up to 1000°C and separated by gas chromatography (GC) or volatilized by a UV-laser. A mass spectrometer (MS) will be the detector for both methods.

We are in the process of testing a large set of terrestrial samples of variable age (from paleozoic to recent) in order to test the capability (including organic detection limits) of this experimental technique (pyrolysis-GC-MS) and guide the ongoing hardware development. Here we focus on recent Antarctic sediments and describe the way how the specific biochemistry and the environmental conditions of biopreservation are captured by the data.

The high temperatures during pyrolysis alters the organic molecules in the sample and creates smaller molecules suitable for the analysis with the GC-MS. Thus using such GC-MS spectra to infer the type of biomolecules in the original samples may not be straight-forward. The samples discussed here are two types of sediments from the bottom of Lake Hoare, Taylor Valley, Antarctica [1]. The two sediments, denoted E4 and H3, were deposited in an oxic and anoxic environment, respectively. Although deposited in a cold and largely dry environment, these samples are too organic-rich in order to qualify as Mars analogue sample. The sediments were sampled in the 1980ies [1] and analyzed in many ways including VNIR, IR, Mössbauer, and Raman spectroscopy as well as isotop studies [1,2,3,4].

Pyrolysis-GC-MS Analysis: The pyrolysis was conducted with a Pyrola 2000 connected to a Varian 3800 GC and a Varian 4000 ion trap MS. The sample (3.5 mg) was heated to 900°C within 15 ms and held at that temperature for 2 s. The generated volatile compounds were directly injected into the GC. The GC-MS spectra of samples E4 and H3 are shown in Figures 1 and 2, respectively. Many of the peaks in these spectra can be associated with aromatic and aliphatic molecules that are likely fragments of organic precursor molecules in the original samples. The most striking difference between both spectra is the evidence for sulfur-rich organic compounds in H3 (Figure 2).

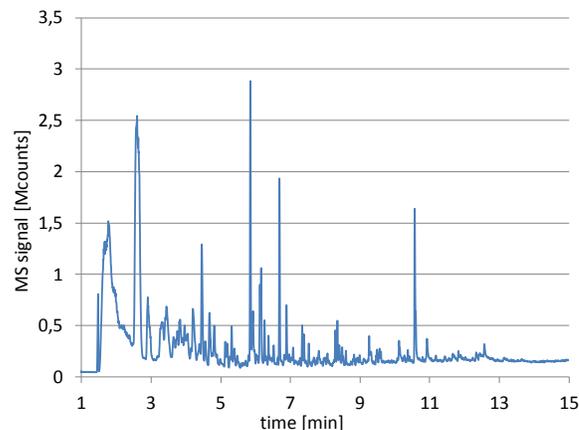


Figure 1: Sample E4 from the oxic layer of Lake Hoare.

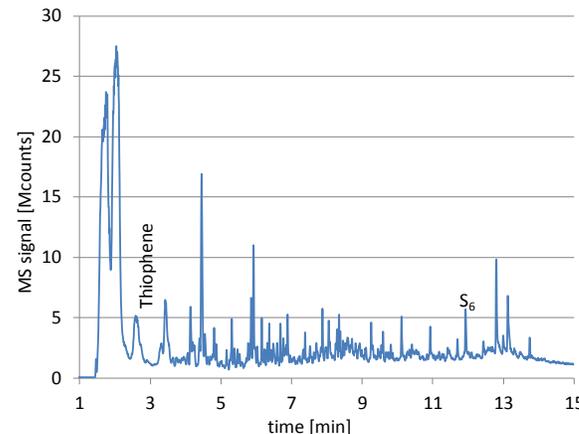


Figure 2: Sample H3 from the anoxic layer of Lake Hoare.

References: Use the brief numbered style common in many abstracts, e.g., [1], [2], etc. References should then appear in numerical order in the reference list, and should use the following abbreviated style:

[1] Bishop J. L. et al. (1996) *Geochem Cosmochim Acta*, 60, 765-785.

[2] Bishop J. L. et al. (2001) *Geochem Cosmochim Acta*, 65, 2875-2897 [3] Bishop J. L. et al. (2003) *Int. J. Astrobiol.*, 2, 273-287. [4] Howell G. M. et al. (2004) *J. Raman Spectr.*, 35, 458-462.

Acknowledgements: This work is funded by DLR (FKZ 50QX1001). We thank Janice Bishop for providing the samples.