



**HAL**  
open science

## Organic matter in samples from hypersaline Tirez lake (La Mancha, Spain); a projection into Europa and Enceladus analyses.

Caroline Freissinet, Valentin Moulay, David Boulesteix, Arnaud Buch, Alex Abello, Felipe Gomez Gomez, Cyril Szopa

### ► To cite this version:

Caroline Freissinet, Valentin Moulay, David Boulesteix, Arnaud Buch, Alex Abello, et al.. Organic matter in samples from hypersaline Tirez lake (La Mancha, Spain); a projection into Europa and Enceladus analyses.. Europlanet Science Congress 2024, Sep 2024, Berlin, Germany. pp.EPSC2024-1107, 10.5194/epsc2024-1107 . insu-04672299

**HAL Id: insu-04672299**

**<https://insu.hal.science/insu-04672299v1>**

Submitted on 18 Aug 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



EPSC Abstracts

Vol. 17, EPSC2024-1107, 2024, updated on 18 Aug 2024

<https://doi.org/10.5194/epsc2024-1107>

Europlanet Science Congress 2024

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



## **Organic matter in samples from hypersaline Tirez lake (La Mancha, Spain); a projection into Europa and Enceladus analyses.**

**Caroline Freissinet**, Valentin Moulay, David Boulesteix, Arnaud Buch, Alex Abello, Felipe Gomez Gomez, and Cyril Szopa

([caroline.freissinet@latmos.ipsl.fr](mailto:caroline.freissinet@latmos.ipsl.fr))

Europa and Enceladus, two ocean worlds in our solar system, are targets of high interest for astrobiology in the decades to come. Past space missions (Cassini-Huygens and Galileo) and recent observations with the Hubble Space telescope have revealed the presence of salts (sulfate and/or chloride) in the plumes of Enceladus and in the components of Europa's surface (1-4). Future missions aiming at evaluating the habitability of Europa and Enceladus and detect potential traces of life on these satellites will face many challenges. One of them is the presence of salts in the oceans and therefore in the surface deposits material that would be sampled. These salts could degrade both the mechanical functioning of a chemical analysis instrument, and their analytical performances. The salts may also interfere with the sample preparation techniques (e.g., pyrolysis, derivatization or thermochemolysis).

*Figure1: Chromatogram of a derivatized sample (from Lillo Lake) with DMF-DMA after evaporation of the water. I.S.: internal standard.*

In this work, we explored natural samples coming from the hypersaline lacustrine system Tirez in Spain, an analogue sample of Europa and Enceladus ocean regarding salinity. The samples studied in this work were collected from seven salty lakes in 2019. They are in liquid state and characterized by a high concentration of Mg, Na, SO<sub>4</sub> and Cl. Spectra obtained from Fourier transform infrared technique were similar to the Galileo spectral data for Europa (5). In addition, micro-organisms from the three domains (bacteria, archaea, eukaryotes) were identified in Tirez lake materials (6). Among the numerous samples collected during the field trip, this work focused on ten of them. These samples were analyzed in order to evaluate the potential impact of the salts on the gas chromatography couple to mass spectrometer (GC-MS) instrument, and associated sample preparation techniques. The results showed that pyrolysis-GC-MS, derivatization-GC-MS and thermochemolysis-GC-MS are complementary analytical tools for the detection of organic molecules (Fig. 1). All the techniques used in this study allowed to detect and identify compounds directly related to the presence of microorganisms in the sample, such as archaea and eukaryotes. Nevertheless, it appeared that thermochemolysis was the best way to extract a large number of molecules by limiting their structural modification and thus facilitating their identification. The strict identification of the biological families remained complicated given the universality of numerous organic compounds amongst the phyla.

**References:** 1. T. B. McCord, Hydrated salt minerals on Europa's surface from the Galileo near-infrared mapping spectrometer investigation. *Journal of Geophysical Research* **104**, (1999).

2. Waite, Cassini Ion and Neutral Mass Spectrometer Enceladus Plume composition and Structure. *Science* **311**, (2006).

3. S. K. Trumbo, M. E. Brown, K. P. Hand, Sodium chloride on the surface of Europa. *Science Advances* **5**, eaaw7123 (2019).

4. S. K. Trumbo, *et al.*, A New UV Spectral Feature on Europa: Confirmation of NaCl in Leading-hemisphere Chaos Terrain. (2022).

5. O. Prieto-Ballesteros, Tírez Lake as a Terrestrial Analog of Europa. (2003).

6. L. Montoya *et al.*, Microbial community composition of Tirez lagoon (Spain), a highly sulfated athalassohaline environment. *Aquatic Biosystems* **9**, 19 (2013).