



**European Astrobiology Network Association**

19<sup>th</sup> EANA Astrobiology Conference

3<sup>rd</sup>-6<sup>th</sup> September 2019

**Orléans, France**

## Poster Session 2 – Group 2 (Wednesday 4<sup>th</sup> September)

All posters in Group 2 will be displayed from Wednesday afternoon coffee break until the end of the conference. All Group 2 posters must be removed by the end of Friday lunchtime (2pm).

Space Missions	
Niels Ligterink	A novel laser desorption mass spectrometry technique for the in-situ detection of biomolecules on space missions
Pauli Laine	Accessing Icy Moon's Ocean with Thermonuclear Reactor
Andrea Meneghin	AstroBio CubeSat: a mini laboratory payload for space environment astrobiology experiments
Alessia Cassaro	Biomarker preservation in Antarctic sandstone after space exposure outside the International Space Station
Yuanyuan He	Impact of Calcium perchlorate on the TMAH thermochemolysis reaction: application to SAM and MOMA
Hector-Andreas Stavrakakis	Moon CubeSat Hazard Assessment (MOOCHA) – An International Earth-Moon Small Satellite Constellation and its Possibilities for Astrobiology
Giovanni Poggiali	OSIRIS-REx sample return space mission exploring primitive carbonaceous asteroid Bennu: Spectroscopy of laboratory analogs to understand data from an astrobiology-relevant target
Filip Košek	Raman spectroscopy as a tool for discrimination of sulfates in exobiology: In-situ and laboratory studies
Kensei Kobayashi	Space exposure of amino acids and their precursors in the Tanpopo Mission: results and future Prospects
Naila Chaouche	The derivatization procedure for the in situ analysis of organic compounds on Mars with the MOMA experiment onboard the Rosalind Franklin rover of the Exomars 2020 space mission
Kamil Muzyka	They work, they replicate, they Live! - how space law should regulate the use of synthetic biological organisms used for space industrial operations
Instrumentation and Approaches	
Christelle Briois	67P/CG dust particles composition as measured by the COSIMA/Rosetta Mass Spectrometer
Siveen Thlajeh	Application of two-step laser mass spectrometry to the characterization of fossil organic matter and prospects for Exobiology
Jan Kotlarz	Microbial component detection in Enceladus snowing phenomenon; proposed missions instrumentation analysis
Bram Mooij	Time-resolved Raman spectroscopy for the detection of biomarkers among layered minerals
Biosignatures and Biogeosciences	
Beda Hofmann	Biogenic or not? Morphometric analysis of filamentous structures
Laura García-Descalzo	Biomarker detection in fossilized anaerobic bacterial strains
Adam Culka	Detection of carotenoids of halophilic organisms in inclusions inside complex laboratory-grown chloride and sulfate crystals using a portable Raman spectrometer

Anushree Srivastava	Mars brine chemistries: habitability, biosignatures, and detection
Alex B. Price	Microbial nitrate-dependent Fe(II) oxidation: mechanisms and astrobiological significance
Denise Koelbl	Resolving the microbe-meteorite interface of the extreme thermoacidophile Metallosphaera sedula at nanometer scale
Ana Miller	Searching for subterranean-adapted microorganisms as part of the ESA CAVES and PANGAEA Astronaut training programs for planetary exploration
Jan Jehlicka	Twenty years of Raman spectroscopy in exobiology research
<b>Social Sciences &amp; Philosophy</b>	
Florence Raulin-Cerceau	Charles Cros and Nikola Tesla, Pioneers of Interplanetary Telegraphy
<b>Education, Outreach &amp; Networking</b>	
Hector-Andreas Stavrakakis	Astrobiology and Society. Public interaction activities in Greece
Deborah Kala Perkins	Sonifying the Universe in Quest for Life 2.0: New Tools for Research and Outreach
<b>Space Factor Contest</b>	
Lora Jovanović	Pluto, a distant cousin of the primitive Earth?
Antonín Knížek	Formation of (per)chlorates on Mars
Lefteris Profitis	Automatic rock identification in macroscopic scale using image processing techniques: An application for planetary exploration
Barnabé Cherville	Optimization of the LAB-CosmOrbitrap experiment negative ion mode
Kateřina Němečková	Raman analysis of pigments from Messinian gypsum endoliths
Sayak Mukhopadhyay	Understanding natural genetic networks and engineering artificial gene circuits in microgravity
Corentin Loron	Diversification of complex life on the early Earth: the Proterozoic of Arctic Canada as a case study
Stella Koch	Addressing the fungal contamination – testing antifungal materials and radiation-driven decontamination methods

## List of participants

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Gaia Micca Longo  
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# Searching for subterranean-adapted microorganisms as part of the ESA CAVES and PANGAEA Astronaut training programs for planetary exploration

## Abstract

Caves on Earth are catching the attention of the space agencies for testing new approaches to planetary science investigations. These subterranean environments could protect astronauts from the high levels of cosmic radiation and extremes of temperature during human missions to the Moon and Mars. As these celestial bodies are likely to contain caves and a record of secondary mineralization, studying secondary mineral deposits and associated microbial life in caves on Earth can help us to better understand where to look on Mars's subsurface. In this sense, the development of procedures and of portable instruments able to perform non-invasive, in-situ analysis has provided an impressive impulse not only for the terrestrial geological field, but also for the next generation of planetary surface explorations. In the framework of the CAVES and PANGAEA astronaut training programme organized by the European Space Agency (ESA), microbiological samples have been collected inside volcanic and carbonate rocks caves with the aim of studying subterranean-adapted microorganisms and to compare them and their respective dwelling with the recently discovered exoplanet biosignatures.

This study comprises the most comprehensive technological efforts to characterize microbial life and microbe-mineral interactions in caves. In this sense, improved sampling methodologies and a wide range of both laboratory and handheld analyses for microbial species detection and classification have been performed. Analytical instruments include high-throughput portable flow cytometer, handheld ATP luminescence and next generation sequencing, using the Illumina Mi Seq platform, of the 16S rRNA gene to identify microbial communities associated with the secondary mineral deposits. In addition, the suitability of these cave speleothems as biosignature repositories was investigated by field emission scanning electron microscopy with energy dispersive X-ray spectroscopy (FESEM-EDS).

Our data indicated that the microbial mats and secondary mineral deposits found in the caves contain highly specialized mineral-utilizing microorganisms able to promote biomineralization processes. In addition, this study showed that deep caves offer a challenging subsurface environment for astrobiological research and planetary science explorations.