EPN2020-RI

EUROPLANET2020 Research Infrastructure

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4th Annual Report of TA1 access

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Responsible WP Leader: INTA, Felipe Gómez

Project funded by the European Union's Horizon 2020 research and innovation programme		
Dissemination level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Service)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (excluding the Commission Services)	

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Abstract: Under Horizon 2020, the Europlanet 2020 Research Infrastructure (EPN2020-RI) is promoting access visits to external users to already validated Earth Analogues to external users through the Trans National Activity 1 (TA1). The selected sites provide the most realistic terrestrial analogues of the surface and near surface geological-geomorphological environments of Mars, Europa and Titan.

Five Planetary Field Analogues, PFA, Rio Tinto (Spain), Ibn Battuta (Morocco), Danakil depression (Ethiopia), cold and hot environments in Iceland (PFA) and Lake Tirez (Spain) were selected to provide Transnational Access (TA) during this reporting period of the project to a set of well-characterized planetary analogue field sites. These PFAs form part of EPN2020-RI´s strategy to provide researchers from a board spectrum of disciplines with the capability to undertake comprehensive multi-disciplinary research strategies needed to support planetary missions.

The focus areas of the projects that were carried out during this reporting period can be broadly grouped into three categories: projects focussed on the analysis of geological structures and processes, projects looked at biological processes to answer questions of planetary habitability and projects focussed on the development and testing of mission instruments.

1. Explanation of the work carried out by the beneficiaries and Overview of the progress

All the extreme sites offered to external users on TAs activities had applications.

Sixteen scientific teams were granted access to the Europlanet installations during this reporting period. Lake Tirez in Spain, managed by INTA, hosted two scientific teams, Ibn Battuta in Morocco, managed by IRSPS hosted five teams within this reporting period, Danakil Depression in Ethiopia, also managed by IRSPS, hosted four teams and the Iceland installation, managed by Matis OHF (PFA) hosted three teams. Rio Tinto field site hosted one team in this period.

Details of the scientific teams, the topics covered and publications resulting from these visits are listed below.

Description of the Trans-national Access activities during the 4th reporting period (1st September 2018 – 31st August 2019):

Description of the Trans-national Access activity in Tirez Lake:

The two visits to this site were:

ESF Project No.	Title	Proposer	Visit
18-EPN4-074	Assessing the life detection potential on Europa through GC-FID/GCMS investigations of Lake Tírez brines	Caroline Fressinet	16.07. – 19.07.19
18-EPN5-059	E-MELT: Exploration of Microbial Extremophiles in Lake Tírez	André Antunes	07.07.19 – 12.07.19

ESF Project 18-EPN4-074: Assessing the life detection potential on Europa through GC-FID/GCMS investigations of Lake Tírez brines: Lake Tírez has been suggested as a Europa ocean analog, with its hyper-saline waters and chemical similarities to Jupiter's moon liquid water, characterized with the Galileo's Near Infrared Mapping Spectrometer on Europa's surface. Lake Tírez also harbors numerous forms of living organisms, in both oxic and anoxic niches. This makes Lake Tírez a perfect Europan analog for testing instruments designed to look for signs of life, e.g. GCMS. GCMS is a robust technique for detecting and identifying picomoles of organic molecules. The intrinsic limitation of GCMS is that the molecules need to be volatile to be amenable and analyzed by GCMS. For this reason, an upstream wet chemistry (derivatization or thermochemolysis) is usually required for the analysis of complex or polar molecules such as amino acids or high molecular weight carboxylic acids, key molecules for the prebiotic chemistry and for life. Investigating the distribution of the whole range of simple and complex molecules, as well as the enantiomeric excess, by both pyrolysis-GCMS and derivatization-GCMS, is key to identify the origin of the organic matter, either abiotic or biological. With this aim, the thermochemolysis with tetramethylammonium hydroxide (TMAH) will be considered. Further, the use of the dimethylformamide dimethyl acetal (DMF-DMA) derivatizating reagent has a particular interest in that it preserves the chiral

center of the molecules it derivatizes, allowing to measure any enantiomeric excess. However, the wet chemistry experiments use solvents that are generally sensitive to water and sample mineralogy, and their response to high concentrations of salts is unknown, questioning the efficiency of wet chemistry in the case of Europa. Therefore, investigations of the derivatization reaction on natural brines, with and without sample pre treatment (water scrubbing, desalting), is necessary to determine the maximum salt concentration compatible with our analytical technique and prepare the optimal procedures for future in situ analyses at Europa.

Field campaign to Tirez was carried out in July. Sampling was achieved in three different locations. Lake 1 (Longar) sampling consisted of three samples locations (Eastern part) and one additional sample location on the second day (Western part). For the first location, we broke the thin salt crust and sampled the black muddy part underneath. Lake 2 (Larga) was separated in two parts. One filled with water flowing from a river, the other dry. As for Lake 1, the water was collected under a thin crust of salt, easily breakable. Below the clean water, a thicker crust of salt was present, and when broken, the water became black, likely from the black sulfur from the anoxic area underneath the thick salt crust. Sampling at Lake 3 (Peñahueca) consisted of 3 sites. At the first location, water was collected both above and below the thick salt crust, on a wide exposed water pool. The second location was a little pothole, initially filled with cleaned water, but bubbling and getting black while walking around to collect the water. The third site was located on the shore of the lake, in an artificial (likely) salt marsh, where liquid water percolated to the surface. We returned at this lake on day 5 for additional sample amount collection at the three sampling sites. Lake 4 (Tirez) was presupposed to be completely dry, as it has been the case permanently for the past few years, according to our host. However, an artificial pool had been dug down to 2 meter below the floor level of the lake, and muddy liquid water was exposed, under a 2-cm thick salt crust, which allowed us to sample water. Below the water, a thicker (and unbreakable) layer of salt was present. Salt crust and mud was also collected.

Laboratory – samples preliminary analyzes

Laboratory work, at the host institution (CAB) in Madrid. The analyses were performed on an Agilent GCMS, equipped with a DB1701 column (30 m x 0.25 mm x 0.25 .m). First, a blank was run to confirm that the system was clean (no liquid injection). The program used was almost the same for blank and subsequent samples: the column temperature started at 40 °C, was ramped up to 300 °C at a 15°C/min rate (20 °C/min for samples), and held at 300 °C for 2 min. The injection split ratio was 10 for the first blank and first sample, 1 (splitless) for the subsequent runs, and helium carrier gas flow was set at 1.5 mL/min. Because of the cleaning solvents used in the autosampler, hexane and dichloromethane were detected in the blank, as well as in all the subsequent experiments. Lake 3 was particularly investigated, with injection of 0.2 .L of pure sample from site #1, #3 (clear water) and #2 (black water), and injection of 0.2 .L of sample from site #1 after a 3-min centrifugation at 13 G. The centrifugation step did not show any substantial difference in the GCMS run.

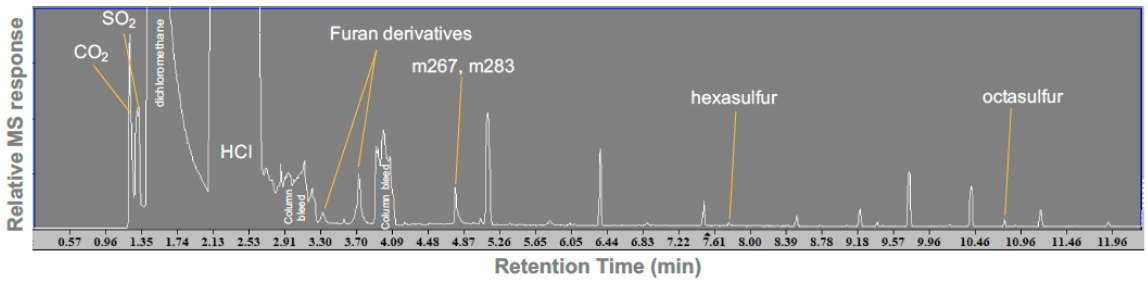

Fig. 1– GCMS run of Lake 2, sample #16. Some relevant peaks identified on the chromatogram. Details of the run conditions in the Dr. Freissinet report.

ESF Project 18-EPN5-059: E-MELT: Exploration of Microbial Extremophiles in Lake Tírez: Lake Tírez is a very interesting hypersaline site which has been frequently highlighted for Astrobiological-based studies, namely as a terrestrial analogue to the briny ocean of Europa, and to the salt deposits of Mars. Previous studies on Lake Tírez have provided important insights into its geochemistry and its microbial diversity, with identification of the dominant taxa and reporting of seasonality effect. Despite such efforts, the number of reported isolated strains from this site remains very low, partly due to the focus on cultivation-independent approaches. It is the ideal extreme environment were to test improvements in sequencing protocols.

Table 1. Overview of samples and data collected from El Longar Lake

Location	Sample	Latitude	Longitude	Transect	Temperature
El Longar	LO.1	39°42’6.00”N	3°19’15.00”W	1	42.8-43
	LO.2	39°42’5.00”N	3°19’14.00”W	1	42.8-43
	LO.3	39°42’4.00”N	3°19’13.00”W	1	42.8-43
	LO.4	39°42’6.00”N	3°19’9.00”W	2	39.8 (45.6)
	LO.5	39°42’7.00”N	3°19’12.00”W	2	40 (47.2)
	LO.6	39°42’13.00”N	3°19’10.00”W	3	38.4
	LO.7	39°42’10.00”N	3°19’8.00”W	3	42.6 (47.4)
	LO.8	39°42’9.00”N	3°19’8.00”W	3	39.8
	LO.9	39°42’13.00”N	3°19’7.00”W	4	36.2-37.4
	LO.10	39°42’11.00”N	3°19’6.00”W	4	40.6 (43.4)
	LO.11	39°42’7.00”N	3°19’6.00”W	4	39.6-40.4
	AFM.1	39°42’16.00”N	3°18’58.00”W	X	39.2-39.6
	AFM.2	39°42’18.00”N	3°18’60.00”W	X	32.6

	AFM.3	39°42’19.00”N	3°19’8.00”W	4	36.6-37.8

Table 2. Overview of samples and data collected from Peña Hueca Lake

Location	Sample	Latitude	Longitude	Temperature
Peña Hueca	PH.1	39°31'9.00"N	3°20'8.00"W	30.2-31
	PH.2	39°31'2.00"N	3°20'8.00"W	36.4
	PH.3	39°31'1.00"N	3°20'11.00"W	31.8

Preliminary data from the samples taking during the campaign reports positive results in the classical cultivation techniques, as well as innovative approaches. These include the use of a new gel-stabilised gradient-cultivation method, recently developed by members of visiting team, and the application of the “optical tweezers” technique, which allows us to isolate individual cells from mixed cultures. Both approaches are expected to significantly boost our capabilities to isolate new microbial strains from this location. None of these techniques have been previously applied to this site.

We have started a full characterisation of microbes representing new taxa and complement our studies with whole-genome sequencing and with studies focusing on exposure to several simultaneous extremes (an often neglected field of study when analysing extremophiles).

Fig. 2: Salt crust view under the sunset at Peña Hueca Lake. (Photo by Dr. André Antunes).

Description of the Iceland Trans-national Access activity:

During the reporting period, three visits of funded proposals to the Icelandic TA site were conducted (Table 1). In addition, a team from EUROPLANET was visiting Iceland to film video footage to highlight the work of the project. Three projects that were funded by EUROPLANET could not be carried out before the end of the project (Table 2). In one case this was due to a schedule conflict with teaching responsibilities (18-EPN4-002) and in one case necessary equipment and assistance was not available (18-EPN5-015). One proposer (17-EPN3-052) did not respond to any e-mail when we were trying to arrange the visit in 2019.

During early July 2019 (2nd – 4th July 2019) a film crew was shooting video footage to celebrate the visitors and the research in the Icelandic TA site of EUROPLANET and to highlight the vast variety and potential of Iceland as research site in the future. The aim was to showcase the diversity of the landscape/sites (hydrothermal, glacial, geological, volcanic, lava tubes) and the uniqueness of Iceland with the science a landscape like this can enable. The team visited e.g. the hydrothermal areas at Hveragerði (SW Iceland) and also interviewed Prof. Dr. Viggó Marteinsson about the astrobiological and planetary research done in Iceland and the success of the EUROPLANET project.

Table 1: Funded research visits to the Icelandic TA site during the reporting period.

ESF Project No.	**Title**	**Proposer**	**Visit**
18-EPN4-036	IceSTAR – Iceland Sample Tracing and Return	Pablo Sobron, Centro de Astrobiologia, Spain	05.09. – 11.09.18
18-EPN4-059	Microbial colonization of analogue terrestrial surfaces by depositing airborne microorganisms	Tina Santl-Temkiv, Aarhus University, Denmark	12.09. – 16.09.18
18-EPN5-035	Unmanned Aerial System (UAS) Survey of Active and Relict Patterned Grounds and Glacial Moraines in Iceland as an Analogue for Mars	Paul Knightly, University of Arkansas, U.S.A.	28.06. - 13.07.19

Table 2: Granted proposals that were not conducted before the end of the EUROPLANET project and have been cancelled.

ESF Project No.	**Title**	**Proposer**
17-EPN3-052	MILaCE : Mars Investigations and Landing Cameras Experiment	Giacomo Colombatti, CISAS G. Colombo - University of Padova, Italy

18-EPN4-002	Extremophile microbial eukaryotes in Mars-analogue field sites	Thorsten Stoeck, TU Kaiserslautern, Germany
18-EPN5-015	GPR characterization of glacial terrains as analogue of mid-latitude regions of Martian surface in the framework of Exomars 2020	Sebastian Lauro, Roma Tre University, Italy

Brief project summaries:

ESF Project 18-EPN4-036 (IceSTAR – Iceland Sample Tracing and Return): The project focused on testing an Autonomous Airborne Sample Tracing And Recovery (AA*STAR) system that increases the efficiency of planetary and terrestrial resource exploration applications. AA*STAR utilizes leading planetary exploration technologies in miniature high-performance sample acquisition, fault-tolerant processing, mature UAV autonomous navigation and control. A Scoop Sampler was deployed onboard a DJI Matrice 600 Pro UAV, remotely piloted it to a location, collecting soil and gravel samples, then returning to the base of operations. A number of tests were successfully performed during this field test, including several scooping operations in different mineral deposits, and a flight stress test of the UAV, which included flying up to approximately 80 meters above ground level, and flying 5 km round trip without depleting the battery. Testing was also performed to demonstrate the ability to grab rocks with a claw end effector and to analyze hydrothermal deposits using a standalone laser Raman system. The project demonstrated a critical need of both ESA and NASA's Planetary Science Programs and made substantial improvements relative to currently available technologies for free-flying robots which operate in human environments and/or assist humans.

ESF Project 18-EPN4-059 (Microbial colonization of analogue terrestrial surfaces by depositing airborne microorganisms): The purpose of the project was to understand the biodiversity and biological adaptations and mechanisms of microorganisms during colonisation of newly created terrestrial surfaces, e.g. fresh lava flow. Air and rock samples were collected in the proximity of Fimmvörðuháls lava flow, which formed in spring 2010, between the Eyjafjallajökull and Mýrdalsjökull glaciers, over a period of 3 days. A series of 6 air samples was collected in order to: (i) quantify and characterize the input of total and metabolically active depositing cells (ii) isolate airborne strains of bacteria and fungi to use as model colonizing species and (iii) quantify and characterize ice-nucleating particles. The samples were collected with a high-volume impinger. This technique is improved for the collection of large volumes of air, which is important, as the atmosphere contains lower per volume density of microbial cells than any other microbial environment. Triplicate samples of volcanic rocks, having different age were also collected in proximity to the air sampling sites. In total, 9 rock samples will be collected and preserved in the same fashion as the air samples, so that both the total and the active community can be assessed in the same way. Six volcanic rocks per site were sterilized by autoclaving and exposed to colonization from air. These rocks (18 in total), will be collected after one year of exposure in 2019.

ESF Project 18-EPN5-035 (Unmanned Aerial System (UAS) Survey of Active and Relict Patterned Grounds and Glacial Moraines in Iceland as an Analogue for Mars): The project utilized a small unmanned aerial system (UAS), a DJI MavicPro, to study active lateral and terminal glacial moraines and periglacial patterned ground in Iceland. The UAS was piloted along planned flight paths and collected aerial imagery to build a digital elevation models (DEM) of each study site. These DEM's are being utilized to derive surface roughness and texture profiles to develop a set of diagnostic characteristics of present-day activity of periglacial patterned ground and glacial moraines and to associate surface roughness characteristics with relative age of the features. The results of this terrestrial analogue study will then be applied to the study and characterization of similar features on Mars. UAS survey flights were conducted in 3 separate regions of Iceland (Flateyri in the Westfjords, the Highlands along the Blanda River south of the Blöndulón reservoir and at Vatnajokull National Park) as part of a broader study to understand the micro-morphological characteristics of periglacial patterned ground, polygons, and glacial moraines. Once morphological profiling of the UAS data from this field work is complete, the datasets will be compared to DEM's generated from HIRISE imagery of patterned ground and glacial terrains on Mars in order to assess the age and present level of activity of these features.

Publications:

15-EPN-006: Qu, Z., Groben, R., Marteinsson, V., Agatha, S. & Stoeck, T. (2018). Redescription of Dexiotricha colpidiopsis (Kahl, 1926) Jankowski, 1964 (Ciliophora, Oligohymenophorea) from a hot spring in Iceland with identification key for Dexiotricha species. Acta Protozoologica, 57: 95 - 106. doi: 10.4467/16890027AP.18.009.8983.

18-EPN4-028: Pineau M, Chauviré B., Rondeau B., Baron F., Le Deit L., Mangold N. Influence of temperature and microstructure on the spectroscopic properties of geyser opals. To be submitted to American Mineralogist.

Conference & workshop talks:

15-EPN-028: Tuerke, A. Subsurface Observatory at Surtsey, SUSTAIN Drilling Project. IODP/ICDP Kolloquium Bochum, Germany, March 2018.

17-EPN3-20: Hynninen, A. Microbes and Basalt - a SEM study. Yearly Meeting of the Stockholm University Astrobiology Centre, Tartu, Estonia, 23. – 25.05.2018.

15-EPN-006: Stoeck, T., Filker, S., Groben, R. & Marteinsson, V. Microbial eukaryotes in Mars analog field sites on Iceland. 12th International Congress of Extremophiles, Naples, Italy, 16. – 20.09.2018.

16-EPN2-064 & 17-EPN3-004: Prieto-Ballesteros O., Molina A., Carrizo D., Neto-Lima J., Muñoz-Iglesias V., Fernández-Sampedro M.T., and Rodriguez-Manfredi J.A. ANALOG STUDIES ON ICELAND FOR SUPPORT OF THE MEDA INSTRUMENT OF THE FUTURE MARS 2020 NASA MISSION. EPSC. Berlin (Germany). September 2018.

16-EPN2-064 & 17-EPN3-004: Prieto-Ballesteros O. and Molina A.THE ICELAND ANALOG FOR MEDA STUDIES. MEDA science meeting. Huelva (Spain). October 2018.

16-EPN2-064 & 17-EPN3-004: Prieto-Ballesteros O., Molina A., Carrizo D., Neto-Lima J., Muñoz-Iglesias V., Fernández-Sampedro M.T., and Rodriguez-Manfredi J.A. LOS SISTEMAS GEOTERMALES DE ISLANDIA COMO ANÁLOGOS DE AMBIENTES DE MARTE: ESTUDIOS DE APOYO AL INSTRUMENTO MEDA DE LA MISION MARS 2020. XXIII CEA. Cuenca (Spain). November 2018.

18-EPN4-036: Indky S., Sobron P., Ford S., and Zacny K. (2019) Autonomous Airborne Surface Sample Collection and Return. In: Astrobiology Science Conference, pp 481643. https://agu.confex.com/agu/abscicon19/meetingapp.cgi/Paper/481643

Conference & workshop posters:

17-EPN3-20: Hynninen, A. Microbes in basalt. 4th Colloquium of Finnish Geosciences, Turku, Finland, 14. – 15.03.2018.

Follow-up projects:

15-EPN-006: High-throughput sequencing and transcriptomics studies of Icelandic samples for the MExEM (Mars EXposed Extremophiles Mixtures) experiment. Funded by the German Federal Ministry for Education and Research (BMBF).

15-EPN-006: Extremophile microbial eukaryotes in Mars-analogue field sites. Funded by EUROPLANET under Grant No. 18-EPN4-002.

15-EPN-028: Proposal to ICDP, to be submitted August 2018. Status unknown.

18-EPN4-036: VAMPYR (Volatile Aerosol Measurements for Planetary flybY Recon). Proposed to NASA

Comment: The projects 16-EPN2-064 & 17-EPN3-004 are thematically linked and the grant holders are from the same institute / research group. Talks are therefore based on results from both projects.

Description of the Trans-national Access activity in Rio Tinto (Spain):

ESF Project 11452: Rio Tinto as a natural laboratory to understand formation of acidic salts and preservation of biosignatures under aggressive low-pH conditions of early Mars. D. Fernández-Remolar. Univ Grenoble Alpes, CEA, CNRS, IBS, Metalloproteins Unit, F-38000 Grenoble.

We have performed a field survey to identify the location and distribution of the ancient ferruginous acidic deposits formed the Rio Tinto and Odiel fluvial basins by using a drone with a 4K camera. This is essential to identify the different geological units that have recorded the biological activity in the last 30 million of years in form of fragments of biomolecules. Such biosignatures that have been preserved under the same extreme acidic conditions as the Hesperian low pH systems can provide key information about the preservation potential of the acidic deposits of Mars.

The weather conditions that preceded the field trip were very adverse for the sample collection of acidic salts. In this regard, very rainy conditions washed away the acidic salts, so there were no remaining evaporite outcrops that could be sampled for their study. Consequently, we focus on the survey for the ancient deposits in the fluvial basins of Rio Tinto and Odiel river, as both have recorded the geological evolution of the acidic systems in a very extensive region. As it was proposed, we used a drone bearing a 4K camera that took high resolution aerial images (2.5 cm/px) which are producing Digital Terrain Model (DTM) using some special software. The air survey performed in Rio Tinto covered different areas including springs, headwaters and main downstream around the locations of Pena de Hierro (Upper Gossan), Barranco de los Locos (intermediate terrace), Nerva (intermendiate terrace), Alto de la Mesa (upper terrace), Las Zarandas (intermediate terrace), Berrocal (downstream terrace system) and Valdetimones (downstream upper terrace). Furthermore, in the Odiel river basin the drone captured images around the right bank of the Olivargas stream where several outcrops of ferruginous terraces have been previously detected.

All data collected in form of several tens of Gigabytes of high-resolution aerial images and DTM is being used in a second step to reconstruct the distribution and evolution of the ancient acidic systems in both Rio Tinto and Odiel fluvial basins. This will provide key information to understand the preservation pathways of the paleoenvironmental and paleobiological signatures in the ancient conditions of the acidic systems of Mars.

Publications In preparation:

Fernández-Remolar, D.C. The occurrence of molecular biosignatures under low-pH and oxidizing conditions in the Rio Tinto subsurface and the potential preservation in the early Mars underground acidic environments. To be sent to GCA

Fernández-Remolar, D.C. The Geological evolution of the acidic basin of Rio Tinto. To be sent to Earth Science Review.

Sobron P., Misra A., Rull F., and Sansano A. (2019) Raman Spectroscopy: Field Measurements. In: Remote Compositional Analysis: Techniques for Understanding Spectroscopy, Mineralogy, and Geochemistry of Planetary Surfaces, edited by CU Presss, pp In Press.

Sobron P., and Wang A. (2017) Exploring Planetary Analogs With an Ultracompact Near-Infrared Reflectance Instrument. In: AGU Fall Meeting Abstracts, pp P41B-2836.

Description of the Trans-national Access activity in Ibn Battuta Centre (Morocco):

During the reporting Period the Ibn Battuta Facilities has hosted 5 research group spending 7 access. The scientific subjects spanned from wind patterns and aeolian bed forms to weathering patterns.

Project summaries:

ESF Project 18-EPN4-037: Trace gas signatures from a Mars analogue site: implications for NOMAD

Ben Stephens and Michael Macey, Open University, Walton Hall, Milton Keynes, UK

from 6 March 2019 to 12 March 2019

The project objective was to identify and characterize Volatile Organic Compounds characterise them and identify Biological Volatile Organic Compounds. The field area has been the area around Layounne.

ESF Project 18-EPN4-049: Manganese supergene enrichment in Tafilalt Merdani formation Morocco as terrestrial analogue for the Gale crater deposits

Ciprian Popa, IANAF, Naples, Italy and Setalia Popa, "Gr. T. Popa" University Iasi, Romania

from 27 April 2019 to 7 May 2019

During the project they have been able to detect an anomaly regarding the spectral response of the carbonates within the rocks of the Tafilalt region probably due by pervasive hydrothermal activity.

ESF Project 18-EPN5-013: Life in extreme environments: Can infrared light drive oxygenic photosynthesis in Martian-like environments

Dennis Nurnberg, Freie Universität. Biophysics and Photosynthesis, Berlin, Germany and Daniel Canniffe, Institute of Integrative Biology, University of Liverpool, UK

from 17 May 2019 to 14 Maay 2019

During the field work the scientists explored the richness and abundance of chlorophyll *f*-containing cyanobacteria and their ability to use near-infrared light to perform oxygenic photosynthesis in Martian-like environments.

ESF Project 18-EPN4-092: Saharan Dust Devils: study of the meteorological and electric signatures and comparison with the Martian data

Gabriele Franzese, INAF, Naples, Italy and David Alegre Vaz, Centre for Earth and Space Research of the University of Coimbra, Portugal

from 27 May 2019 to 14 July 2019

The subject of the project was to understand the electric forces and the lighting phenomena occurring during windy events and, in particular, during dust devils.

ESF Project 18-EPN4-090: Understanding the nature of the Martian large ripples through the study of potential analogues in Morocco

Simone Silvestro and Giuseppe Mongeluzzo, IANAF, Naples, Italy from 27 May 2019 to 19 June 2019

The subject of the project was to understand the process and constraints for the formation of aeolian megaripples on Mars

Description of the Trans-national Access activity in Danakil depression (Ethiopia):

This year the Danakil field campaign lasted 14 days organised in two legs of one week each.

These are the research group and projects:

ESF Project 18-EPN4-008: Life at the limits: An organic molecular and isotopic 'fingerprint' of microbial metabolism in the Dallol geothermal sites, Danakil Depression

Yvette Eley and Tom Dunkley Jones, School of Geography, Earth and Environmental Sciences University of Birmingham Birmingham, UK

from 17 January 2019 to 26 January 2019

We investigated the metabolic strategies of microorganisms capable of thriving in the most extreme environments found on Earth.

ESF Project 18-EPN4-022: SolHySalts – Solar or Hydrothermal Salts? The Example of Dallol Site

Pascal Allemand, Laboratoire de Géologie de Lyon Université Lyon 1, France

from 10 January 2019 to 26 January 2019

Pascal investigated the geology of Dallol and surrounding area by using satellite data and high-Resolution images from UAV (drone)

ESF Project 18-EPN4-032: Magnetic characterisation of the Danakil magmatic plumbing system north of Erta 'Ale: a useful contribution to interpret potential trace gas sources that will be detected in volcanic regions of Mars by ExoMars TGO

Daniel Mege, Space Research Centre, Polish Academy of Sciences, Warsaw, Poland and Hanijn Choe, Institut de Phyisque du Globe, Paris, France

from 10 January 2019 to 26 January 2019

We conducted a ground magnetics survey in the salt flats south and north of Mount Dallol in order to characterise the hydrothermal and magmatic structure below the topographic surface.

ESF Project 18-EPN4-079: 3D vision capabilities for stratigraphy, sedimentary architecture, impact cratering history, and paleoenvironmental information

Christian Koebler, natural History Museum Vienna, Austria

from 17 January 2019 to 26 January 2019

The subject was to understand the imaging capability of the Mast-Z camera aboard Mars 202.

Annex. PFA participants

PFA participants are listed below.

Participant	**Permanent personnel**	**Personnel hired by the project**
5. INTA	Dr. Felipe Gómez Gómez Dr. José Antonio Rodriguez Manfredi Prof. Ricardo Amils Dr. Olga Prieto-Ballesteros Dr. Juan Angel Vaquerizo Nuria Rodríguez Fernando Camps	
9. IRSPS	Prof. Gian Gabriele Ori Professor Kamal Taj Eddine Dr. Monica Bufill Daniela D'Alleva Dr Goro Komatsu Dr Monica Pondrelli Barbara Cavalazzi	
20. MATIS OHF	Dr. Viggo Thór Marteinsson René Groben	

PFA Structure – wp2 – TA 1: Planetary Field Analogues Coord.: INTA with partners INTA, IRSPS and MATIS OHF

PFA activities consist of one work package with three different sites managed by three partners. These activities consist of the following tasks:

- *Task 2.1. Rio Tinto field site: Managed by INTA*
- *Task 2.2. The Ibn Battuta Field Centre. Managed by IRSPS*
- *Task 2.3. Iceland Field Sites. Managed by MATIS OHF*
- *Task 2.4. Tirez Lake. Applicable as TA1 report after second year of the project. Managed by INTA.*
- *Task 2.5. Danakil Depression (Ethiopia). Applicable as TA1 report after second year of the project. Managed by IRSPS.*