



EPN2020-RI

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**Deliverable 7.2 - Commissioning report & delivery PFA2 to
TA 1**

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Responsible WP Leader: INTA, Felipe Gómez

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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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Author (s)	Felipe Gómez (INTA-CAB)

Abstract: Under Horizon 2020, the Europlanet 2020 Research Infrastructure (EPN2020-RI) promotes visits to 3 Earth Analogue sites (Iceland, Rio Tinto and Ibn Battutu) to external users through the Trans National Activity 1 (TA1).

The main objective of the JRA1 activity is to validate two extreme environments as Earth Analogues and after that, to provide them for TA1 external users visits during the last two years of the EPN2020-RI infrastructure. Those two new sites are Tirez Lake (Spain) (D 7.1) and Danakil depression (Ethiopia) (D 7.2).

Two new field sites have been studied, mapped and characterised during the first two years of the project in order to validate them as Earth analogues to be included in the TA1 activity during the last two years of the project. These new sites are now available to external users for developing their own research. The selected sites provide the most realistic terrestrial analogues of the surface and near surface geological-geomorphological environments of Mars, Europa and Titan available.

The Danakil depression is a unique place on Earth and has inspired a lot of dissemination and outreach activity (Nationally and Internationally). The work package is working with local schools and scientists in Ethiopia to help promote the access to the site and encourage knowledge exchange with the local students.

Part of the work of the JRA is to provide safe and reliable logistics for visitors to the field sites.

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

1. Objectives:

The main objective of the JRA1 activity is to validate two extreme environments as Earth Analogues and, after validation, to them for TA1 external users visits during the last two years of EPN2020-RI infrastructure. Those sites are Tirez Lake (Spain) and Danakil depression (Ethiopia).

The preparation of those sites as field facilities for the TA1 activity requires extensive groundwork to develop theories and models of the interior, surface and atmospheric conditions of the planetary analogues. This extensive field and laboratory work to prepare the Planetary Field Analogues (PFAs) will fully characterize the geology, hydrology and geomicrobiological environments, determine the feed-back mechanisms between the regional geology, soils, climate and biology and establish how these mechanisms vary throughout the year. As part of TA1 in years 3 and 4, these two extreme and diverse environments will represent a tremendous new resource for the planetary science community, and will undoubtedly become sites for ongoing research for external users. In order to prepare the sites for those future activities we need to develop ground work as well as laboratory work in order to validate those sites as Earth Analogues.

Task 7.3. Characterisation of PFA 2 – Danakil Depression (Ethiopia).

The Danakil Depression field area has been the object of three expeditions/visits in order to collect data and check logistical details.

The first mission has been executed by Barbara Cavalazzi from 18th to 29 January 2016. During this mission Dr Cavalazzi has collected samples for the time series reconstruction of the environmental changes of the Dallol system (started 3 years ago). Moreover, she has expanded the area of investigation with further observations, data collections and sample collections. Lab analysis related with this field campaign are in progress. The Europlanet project will take advantage of the data collected in the last year in reconstructing the environmental changes

The second mission, from 3rd to 9th April 2016, and the third from 15th to 30th January 2017, have been carried out by Drs Felipe Gomez and Barbara Cavalazzi with two main objectives: to set up some organisational contacts at the Mekelle University and to sample the Dallol area. Samples have been recovered and are under analysis at Cab and University of Bologna.

The studies being carried on at the laboratories are as follows:

Physico-chemical characterization. As in others environments, physico-chemical parameters were measured in situ: temperature and conductivity (Orion 120), pH and redox potential

(Orion 420), and dissolved oxygen (Symplair Sylaud Ins.). Sulfate and carbonate were also determined in situ with Hanna Instruments kits (Hanna Sulfate LR-HR H1-38001A for sulfate and Hardness HR H1-3812 for carbonate). Other anions and cations (Cl⁻, Na⁺, K⁺, Mg²⁺, Ca²⁺, etc.) were determined in the laboratory by elemental TXRF analysis and NO₃⁻ by ionic chromatography.

Metabolic assays and isolation of pure cultures. Inoculation of fresh media bottles was done on site. Several media was used in order to growth and isolate the most representative bacterial groups present on the samples.

DNA extraction and PCR. Cells from the homogeneous sediment-water samples were disrupted and DNA was extracted using FastDNA kit for soils BIO101 according to the manufacturer's protocol. The 16S rRNA genes from mixed microbial DNA were amplified by PCR.

Clone libraries and sequencing. The amplified 16S rRNA genes (length 1465-1467 bp for bacteria and archaea respectively) were cloned using TOPO Cloning Kit (Invitrogen Corporation, San Diego, California) and then transformed into competent *E. coli* cells. Plasmid DNA inserts were extracted by alkaline lysis method (Miniprep). The archaeal clones were grouped according to their restriction pattern obtained after digestion with *Sau3AI*. Plasmid inserts were amplified by PCR using the M13 primer set (Invitrogen). Automated DNA sequencing was performed with an ABI model 377 sequencer (Applied Biosystems).

Sequence analysis. Sequences were compared with the NCBI database by using the basic local alignment search tool (BLAST, <http://www.ncbi.nlm.nih.gov>) to identify the closest sequence.

Atmospheric measurements. Weather stations were settled on the site in order to follow atmospheric parameters during the duration of the field campaigns.

Some results:

Weather conditions in the area are very restrictive since the temperature is very high and rain precipitation is low. Air temperature, velocity and direction are very stable at different days. This is why figure 1 represents mean values of different days along the week of the campaign.

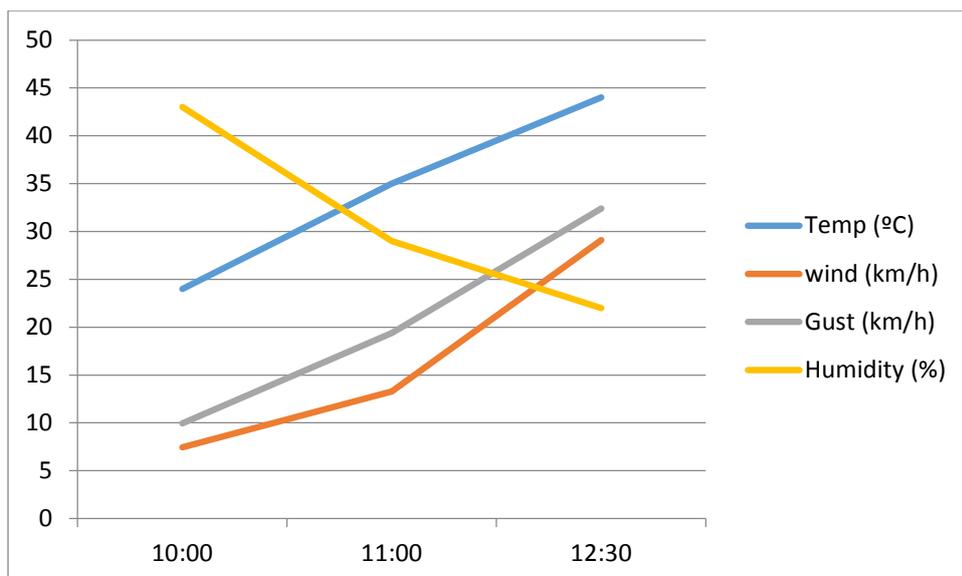


Fig. 1: Graphic representation of several days means values of temperature of humidity, air temperature, wind velocity and gust intensity.

Physico-chemical parameters of the extreme environment:

sample	D8	D10	D12	D13	D14	D15
pH	0,25	2,42	0,5	1,5	1,75	1,73
T ^{°C}	86	47	45	44	40	40
C	188	262	ND	91	270	272
Eh	411	412	ND	ND	ND	ND

Table 1: Values of pH, temperature of the water, conductivity and redox potential at different sampling locations in Dallol area.

As table 1 shows, physic-chemical parameters of the water samples are very extreme, with pH values of 0.5 and 1. Temperature in D8 water is 86 °C, which means that the possible natural bacteria population in this ecosystem would be thermophile.

Microbial diversity:

Samples from Dallol were carried out to the laboratory for further analyses. We finally got signs of life on those samples. In spite of the very extreme conditions microbial life is present at Dallol.

All the results summarized in this report will be published in international peer-review scientific journals.

Currently, Gian Gabriele Ori and Hagos Miruts are working on overtaking administrative, importation and military problems in order to get the permission to perform a photogrammetric and spectral survey of the Dallol volcanic system. This will be the first high-resolution

photomosaic, geological map and geomorphological/digital elevation model rendering of Dallol. This activity will provide a reference for future scientific activities, for the analysis of environmental changes and for the monitoring of the volcanic activity in the subsurface and magmatic chamber.

2. Deviations from Annex 1 (if applicable)

2.1 Tasks (if applicable)

Not applicable: No task for this wp at this moment.

2.2.1 Unforeseen subcontracting (if applicable)

Not applicable

2.2.2 Unforeseen use of in kind contribution from third party against payment or free of charges (if applicable)

Not applicable

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 Goro Komatsu Dr Monica Pondrelli Barbara Cavalazzi	

PFA Structure – wp1 – TA 1: Planetary Field Analogues Coord.: INTA with partners INTA and IRSPS

PFA activities consist of one work package with three different sites managed by three partners in TA activities but two partners in JRA1 activity. These activities consist of the following tasks:

- *Task 7.2. Tírez Lake validation (Spain). Applicable as TA1 report after second year of the project. Managed by INTA. (D7.1)*
- *Task 7.3. Danakil Depression (Ethiopia). Applicable as TA1 report after second year of the project. Managed by IRSPS/INTA. (D7.2)*