Europlanet TA Scientific Report

PROJECT LEADER

Project number: 20-EPN-017
Name: Enrico Capezzuoli
Home Institution: University of Florence, Department of Earth Sciences
TA Facility visited: MATIS

Project Title: LITRASV – LIfe in TRAvertine-Sinter Veins: a possible key to recognize extra-terrestrial life in tectonically-driven depositional systems.

Scientific Report Summary.
(plain text, no figures, maximum 250 words, to be included in database and published)

Detailed study of travertine and sinter depositional systems and related feeder conduits (veins) in cold desertic setting (Lýshuoll and Hveravellir sites - Iceland), as possible repository of subsurface life to be observed in extra-terrestrial setting. The performed field activity allows reconstruction of the structural control in these sinter/travertine depositional systems, with stratigraphic-sedimentological characterization of the travertine-sinter lithofacies. 16 travertine/sinter samples were collected from the two sites, together with the basic physical characterization of the thermal springs (T, pH, Cond). Due to the local conditions, all the collected samples derive from fossil/inactive systems (veins and crusts samples). Among these, one sample derives from a sinter vein recognized in the Lýsuholl site, while all other derive from fossil vents or close surroundings.

Samples returned to Italy for future petrographic and geochemical characterization in order to detect and define possible organic presence in such extreme environment.

Full Scientific Report on the outcome of your TNA visit

As for their subaerial counterparts, siliceous/carbonate veins forming in thermal environments are among the most promising containers preserving possible microbial life in the subsoil for an indefinite time (at least up to its exposition and dismantling), especially in arid environments, where water action (and the consequent rock erosion) is limited or even inhibited (as the case of extra-terrestrial sites similar to Mars).

With these perspectives, activity of the LITRASV project was addressed to the study of Iceland, fossil and active travertine-sinter depositional systems of Lýsuholl and Hveravellir.

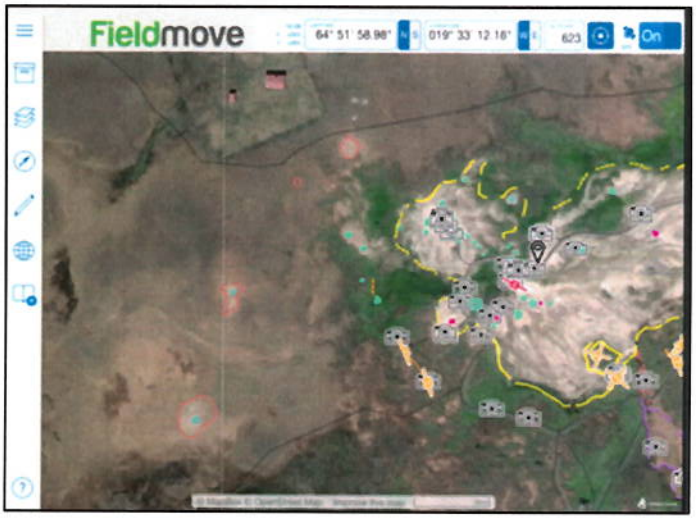
The workplan, organized with logistic support of MATIS, was based on 8 days activity, comprising arrival in Iceland and transfer to the Lýsuholl site (1st day) with fieldwork during the successive 2nd and 3rd day. After transfer to Hveravellir during the 4th day, the local field activity was leaded during the 5th, 6th, and concluded with the transfer to Reykjavik for the final meeting at the Geothermal & Glacial Environments of Iceland centre (MATIS – 7th day), and successive return to Italy (8th day). The fieldwork, devoted to field-mapping, structural analysis, sampling and stratigraphic-sedimentological characterization of the travertine-sinter key bodies with special attention on the presence of veins, was performed by the two proponents of the project (Enrico Capezzuoli University of Florence, and Andrea Brogi, University of Bari Aldo Moro).

The geothermal site of Hveravellir, with hot pools and fumaroles

Facies analysis was performed through macro-scale observations, stratigraphic sections, line drawings, lithofacies mapping and characterization using the most recent nomenclature. Field mapping has been mainly addressed to reconstruct the extension of the sinter and carbonate deposits in both areas, and locate the position of the geothermal manifestations (i.e. thermal springs, fumaroles and hydrothermal alteration zones). Additional lithotypes have been mapped in order to better characterize the geological setting of the substratum. Fractures and veins (rare) have been also mapped and geometric/kinematic data have been collected in order to define the tectonic setting. The obtained geometric and kinematic setting has also been compared with that one reconstructed by the analyses of the nearby fissured lava shields and fissure swarms, in order to infer the local strain field controlling the geothermal manifestation and their deposits.

Sinter vein recognized and collected in the site of Lysuholl.

16 travertine/sinter samples were collected from the two sites, together with the basic physical characterization of the thermal springs (T, pH, Cond). Due to the local conditions, all the collected samples derive from fossil/inactive systems (veins and crusts samples) and were storage in simple plastic bags. Among these, one sample derives from a sinter vein recognized in the Lýsuholl site, while the other derive from fossil vents or close surroundings.
Fieldmapping, collection of geometric and kinematic data, as well as location of the collected samples and stations for structural analyses were done using Fieldmove App for tablet.



Screenshot of the Fieldmove App used during the fieldwork

The finding and collection of such samples allow us to start the phase two of the research, with the recognition and possible characterization of organic material contained in such extreme material and possibly in partnership with appropriated labs of the Research infrastructure network of the Europlanet 2024 project. In this view, preliminary ideas have been discussed with MATIS.

- Give details of any publications arising/planned (include conference abstracts etc)

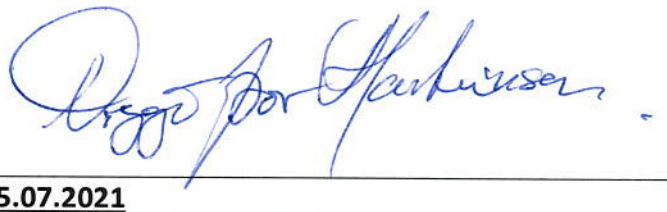
Performed reconstructions and interpretation are aimed at delivering outputs of peer-reviewed papers with high-IF as the minimum output of the performed activity. Due to the data collected, we will prepare papers dealing with (i) the tectonic control on the geothermal manifestation to be submitted in appropriate journals (Tectonophysics, Tectonics...) and (ii) the stratigraphic and sedimentologic evolution and features of the deposits, to be submitted in other specific journals (Sedimentology, Sedimentary Geology...). Several further manuscripts will be written opportunistically as and when opportunity presents by members of the team in appropriate conference/events (e.g. EGU Wien 2022, ISC Beijing 2022, EGC2022 Berlin).

- Host confirmation

Please can hosts fill in/check this table confirming the breakdown of time for this TA project:

Dates for travel to accommodation for TA visit (if physical visit by applicant)	Start Date of TA project at facility	Number of lab/field days spent on TA Visit pre-analytical preparation	Number of days in lab/field site for TA Visit	Number of days spent in lab for TA Visit data analysis	End Date of TA project at facility	Dates for travel home (if physical visit by applicant)
Departed: 03-07-21 Arrived: 03-07-21	04-07-21	0	6	1	10-07-21	Departed: 11-07-21 Arrived: 11-07-21

The host is required to approve the report agreeing it is an accurate account of the research performed.

Host Name	**Viggó Þór Marteinsson**
Host Signature	
Date	**15.07.2021**

- Project Leader confirmation

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Project Leader Name	**Enrico Capezzuoli**
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Date	**15/07/2021**