

EUROVOLC

**European Network of
Observatories and Research Infrastructure for Volcanology**

Deliverable Report

**D17.1 Report on the WP17 TA activities
during the project**

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Summary

Work Package 17 - Access to Guadeloupe Volcanological and Seismological Observatory (**OVSG**), Martinique Volcanological and Seismological Observatory (**OVSM**) and the Piton de la Fournaise Volcano Observatory (**OVPF**) – offered **transnational accesses (TA) to the French volcano observatories** belonging to IPGP (Institut de Physique du Globe de Paris) to foreign users that turned out to be scientist in geosciences even if accesses were opened to wider communities. The funded TA projects have been of either physical or remote access due to the COVID-19 pandemic. They have included access to observatories, volcanoes, existing scientific data and mobile instrumentations.

The main actions carried out by the WP to achieve the goal have been the (i) **definition** of the overall offers of three observatories, (ii) finalization of the WP **services** offered for the first and second call, (iii) **technical evaluation** of the first and second call proposals, (iv) **management of the users'** logistics before access, (v) exploitation of the first and second call activities, and (vi) definition of a **contingency plan** for exploitation of the second call activities due to the **pandemic** force of circumstances. WP17 could finance one access to each observatory for the two calls. Overall, in the two calls, the WP received **13 proposals** (8 in the 1st call and 5 in the 2nd call), of which **4 funded** (2 of the 1st call and 2 of the 2nd call) were technically and scientifically evaluated, given that the second call was restricted to remote accesses.

Besides the mere provision of access and the logistic support offered, some TA activities have also **promoted scientific collaborations** that are still ongoing, thus contributing to the networking and community building aims of EUROVOLC.

Introduction

On one hand, the Institut de Physique du Globe de Paris (IPGP) is in charge of monitoring the three active volcanoes (La Soufrière of Guadeloupe, Montagne Pelée in Martinique, Piton de la Fournaise in La Réunion) located in the French overseas territories, and their local tectonic context. The first two are archetypes of hazardous andesitic volcanoes that occur in many subduction zones such as the Lesser Antilles volcanic arc, while the third is typical intra-plate hot-spot volcano, located in the Indian Ocean. IPGP's volcanological and seismological observatories focus has been on acquiring geological, geophysical and geochemical data and to operating state-of-the-art monitoring networks in collaboration with national and international research teams and the World Organization of Volcano Observatories (WOVO) of the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI). On the other hand, the volcanological community is quite fragmented because of its interdisciplinary nature. EUROVOLC aims at overcoming this fragmentation at various levels. Thus, the WP17 aims at giving access to the French volcano observatories (VO) to facilitate the community building and scientific collaborations. Indeed, the three observatories are volcano labs for users, so that they can access a large data-banks of geological, geophysical and geochemical data collected over long periods of time to generate cutting-edge research or they can also test new technological innovations. For the volcanology community the opportunity of developing a network of accessible volcano observatories and infrastructures represents the key for interconnecting the diverse European institutions dealing with Earth Science. Indeed, the prospect to access high quality

services and facilities will on one hand develop and strengthen the cooperation among the research community and on the other will allow engagement of users belonging to diverse contexts, such as academy, industry, and society in general.

The WP17 activities can be reported according to two steps: the first phase was the preparation of the calls and the second phase was the two calls and the related activities.

First call

Before giving access to the French Volcano Observatories, WP17 worked on the **definition of services** offered to the users in coordination with the TA and VA leader to harmonize and structure them. For the aim, the IPGP filled **questionnaires** for the definition of the WP TA offers with the identification of a referent in each observatory. Web meetings were organized with teams in the French overseas to fill shared documents that i) describe the infrastructures and equipment made available, ii) explain the access modalities, iii) detail the scientific, technical and administrative support and iv) specify constraints related to security and crisis management and v) assessing the risks that would make the facility inaccessible and vi) giving the cost that users can claim to access the observatory.

A description of the three facilities was released in the **milestone MS35** document by June 2018.

Initially, the first call should have offered **15-day access** to each observatory for **one or two persons**. Nevertheless, IPGP decided **not to open the access to la Martinique** facilities because the observatory moved to a new building in 2019. Initially, the moving was scheduled in 2018, but the delivery was delayed. Thus, the first call only included facilities of Guadeloupe and La Réunion.

Evaluation of the proposals of the first call.

After the closure of the first call, in the second half of October 2018, IPGP prepared a technical assessment of each proposal to give to the International Scientific Review Panel (ISRP) indications on their feasibility. The technical evaluation aimed at assessing the logistic, technical, and financial feasibility of the proposals, based on the characteristics and description of each of observatories defined and reported in the TA webpage of the project website.

Komorowski J-C, Lemarchand A, Peltier A, Kowalski P and Moretti R reviewed the proposals and gave the general technical evaluations by October the 31st of 2018.

| Project | Observatory | Evaluation |
|---------------------------------------|-------------------|--|
| CALDERA COLLAPSE (funded) | Réunion | The observatory and IPGP thinks that the project is technically feasible. |
| GaSLAVolc | Guadeloupe | The feasibility is not possible without extra funds. Moreover, the proposal targets the observatory of Montserrat as well which is not part of the call. |
| VANIC (funded) | Guadeloupe | The observatory and IPGP think that the project is technically feasible. |
| <i>TeRos</i> | Réunion | The feasibility is not possible without extra funds, but the project is technically realistic if the installation is limited to one site (RER). |
| <i>POISONS</i> | Réunion | Except the analysis in the field with a portable XRF, the proposal is feasible. |
| <i>PdS Fracture opening risk</i> | Réunion | The feasibility is not possible without extra funds. The petrographical lab is an issue as well, because the analysis work can't be done at the observatory. |
| <i>ConGravPdF</i> | Réunion | The feasibility is not possible without extra funds. |
| <i>Multi-parametric investigation</i> | Réunion | The project is technically feasible. |

The TNA could not finance TeRos proposal because it could not cover all the costs for the installations of field stations although they were scientifically interesting. The proposals required extra funds (few thousands of euros) to be feasible. IPGP interacted with EUROVOLC Steering Board to clarify this issue because the International Scientific Review Panel (ISRP) was keen on giving the access to TeROS proposal. Eventually access was given in **Guadeloupe to VANIC** proposal and **in La Reunion to CALDERA COLLAPSE**.

Accesses of the first call

From April to September 2019, WP17 prepared the logistic of the TA activities related to first call and the activity exploitation of the 2 positively evaluated research projects. Short summaries of the work achieved can be completed with scientific reports.

1. CALDERA COLLAPSE – La Réunion: 30/09/2019-08/10/2019

Users: Freysteinn Sigmundsson (PI, UI) and Siqi Li (Ph.D. student from UI).

Caldera collapses are not well understood and there are only a few examples that have been monitored with modern techniques. The objective of the access is to improve understanding

of caldera collapses through a comparative study of Piton de la Fournaise 2007 and Bardarbunga 2014-2015 collapses, with particular reference to contribution of under pressure development in magma bodies responsible for collapses as well as reduced fault friction on caldera boundaries and the uses of viscoelastic deformation models.

Mission at OVPF: this mission funded by the TNA provided the opportunity for Iceland-France collaboration for comparing two important collapses at European volcanoes. During the mission the project team (PI and PhD student) had the opportunity (1) to access to the OVPF data-bank (deformation data of the 2007 Piton de la Fournaise caldera collapse), (2) to discuss/interact with the OVPF scientific team, and (3) to give a talk on their work already done on Bardarbunga and the perspectives on Piton de la Fournaise. Discussions/interactions are still ongoing between the project team and the OVPF team in order to consolidate the knowledge acquired during the mission, and to continue the modelling tests.

2. VANIC - Guadeloupe: 02/12/2019 – 06/12/2019

Users: Sleeman, Reinoud (PI, KNMI, Netherlands)

Ambient noise interferometry can be a useful technique for such networks to monitor seismic velocity variations - although interpretation is often a challenge. The three main objectives of the access were:

- use and evaluate results from different types of ambient noise cross correlations from seismic recordings from the Guadeloupe seismic network
- compare these with results from the sparse Caribbean Netherlands network
- foster collaboration between OVSG and KNMI on monitoring and research on volcano seismology in the Lesser Antilles.

This mission funded by the TNA provided the opportunity to initiate a KNMI and IGP collaboration and compare the seismic velocity variations of different volcanoes in the Antilles. Preliminary results highlights different characteristics of Mt. Scenery, The Quill, St. Marteen and La Soufriere volcanos.

Second call

The feedback of the first call raised few issues and encourage EUROVOLC TNA providers to clarify some points for users and harmonize the access descriptions with the EPOS transnational access. Thus, the WP17 participated to redefine **the structure of a common database** of services for the EUROVOLC in close collaboration with WP20 and EPOS transnational accesses. Discussions with the Integrated Core Services of EPOS lasted few weeks before the second call to validate a final new database structure. WP17 provides input files in mid-June 2019. Contrary to the first call, the access to la **Martinique Observatory was possible** since the facility and the staff are now ready to welcome users.

Evaluation of the proposals of the second call

Following the closure of the second call (mid October 2019), WP17 received a total of 5 research proposals. All the proposals concerned the access to Piton de la Fournaise Observatory. IGP prepared a technical assessment of each proposal in order to give to the International Scientific

Review Panel (ISRP) indications on their feasibility. For the second call, neither researchers nor stakeholders sent any proposals for the French observatories in Antilles.

Five proposals to access Piton de la Fournaise Observatory:

- EV-C2_001 :Testing Rotational Sensors – **TeRos (funded)**
- EV-C2_027: TExtural Properties, tHermal history and monitoRing of explosive bAsaltic eruptions – **TEPHRA (funded)**
- EV-C2_029: Is the eruptive dynamics at Piton de la fouRnaise vOlcano inflUenced by EarTh TidEs, PIROUETTE
- EV-C2_035:Multi-parametric investigation oF volcanO plumbing systems: fixing the ReceNt spatial-temporal dynamiCs of magmas at Piton de La FournaisE - FORNACE
- EV-C2_040. Process and Impact: Volcanic Trace elements - source degassing to downwind dispersal PIVoT

Komorowski J-C, Lemarchand A, Peltier A, Kowalski P reviewed the proposals and gave the general technical evaluations by October the 25th of 2019, and received the review of the International Scientific Review Panel (ISRP) the 4th of February 2020.

All proposals are well evaluated, technically speaking, and respected the terms of the TNA except PiVoT project. Indeed, it asked the access for five users, although it is limited to two. Nevertheless, all others PI entirely respected the prerequisites and the cost covers by the TNA. The TeRos was resubmitted successfully because the PI considered IPGP's advices before the second submission and after the first call.

The International Scientific Review Panel (ISRP) ranked **TeRos** proposal first and the **Tephra** and **Pirouette** proposals are equivalent in the scientific evaluation. As IPGP could afford to finance a **second project at La Réunion** (see chapter "Use of resources and corrective actions"), Tephra project was chosen to keep a balance between geophysical and geochemical proposals. The letter of acceptance to the users of the two projects, E. Eibl and M. Colombier, was sent the 26th of February 2020.

Following the final selection, the staff of the observatory of Piton de la Fournaise organized the logistics of each project with the PIs, although the activities stood by for few months because of the pandemic restrictions. In the summer 2020, PIs and the staff of the Piton de la Fournaise considered the possibility to **initiate the access remotely**. Discussions highlighted that the staff of observatories was able to i) sample tephra for the project called TEPHRA and ii) install the rotational seismometer at RER site for TeROS project.

In September 2020, WP17 provided to IMO some information regarding the feasibility of carrying out or not the TA activities in the pandemic conditions. The information was given in the frame of a survey that IMO properly made to evaluate the possibility to ask the **European Commission for a 10-month extension** of the project. After several interactions with the users and the Project Coordinator, and in agreement with the management plan rules for the pandemic of each of the involved countries, the **TA to the Piton de la Fournaise was made available in 2021 in agreement with the EUROVOLC contingency**.

Remote accesses of the second call

1. TEPHRA PROJECT - La Réunion: remote

Users: Mathieu Colombier (PI, Ludwig Maximilian University, Germany)

TEPHRA project aims at studying the relation between conduit processes and eruption dynamics during explosive activity at Piton de la Fournaise. The analysis of tephra derived from different kind of eruption can constrain the role of crystallization and viscosity on gas percolation and out-gassing and link the thermal history of tephra to conduit and post-fragmentation processes. The travel tickets and the accommodations for M. Colombier were booked in March 2020 for a trip planned from April the 4th to 19th. The pandemic restrictions forced us to postpone the access to November. In the autumn of 2020, the recommendations of the authorities do not allow to host Mr Colombier to carry out the TEPHRA project before the end of 2020. Therefore, the IP and IPGP have jointly agreed on a remote access. As a result, scientific staff from the Piton de la Fournaise Observatory collected tephra samples derived from the Strombolian to Hawaiian eruptions of Piton de la Fournaise when the conditions for a field trip were met, and sent them to Germany (Ludwig Maximilian University) for textural, rheological and thermal analyses.

TEPHRA project opened a scientific collaboration between the observatory of La Réunion and the German team of Ludwig Maximilian university that resulted in a paper submitted to EPSL:

Colombier, M., Vasseur, J., Houghton, B., Caceres, F., Scheu, B., Kueppers, U., Gurioli, L., Thivet, S., Montanaro, C., Soldati, A., Di Muro, A., Dingwell, B. D. (2021). *Degassing and gas percolation in basaltic magmas*. Submitted to EPSL.

2. TeROS – La Réunion - remote

User: Eva Eibl (University of Potsdam, Karl-Liebknecht-Str. 24/25, 14476 Potsdam, OT Golm, Germany)

TeROS project aims at testing a rotational seismometer on a site where a very broadband seismometer (STS1) is already installed (RER station of Geoscope Network). This installation is an array-like sensor to i) localize volcano-tectonic earthquake and different potential sources of tremors (analysis of back azimuth and wave types for earthquakes and tremor before and during eruptions), ii) assess the geometry of dykes and iii) compare results with location based on the OVPF network.

In 2020, Eva Eibl (PI of TeROS) postponed the installation of the rotational sensor since she could not travel due to the COVID-19 pandemic restrictions. Eventually, the PI and IPGP jointly decided for distant access. Thus, E. Eibl and her team sent the equipment in December 2020 so that it could be installed at RER station in 2021. Firstly, the rotational seismometer was delivered in December 2020 at OVPF. After shorts tests, seismometer didn't work due to damage on the internal network board. Seismometer was sent to Xblue (manufacturer) to be repaired and came back at the beginning of 2021. First, the sensor was tested at the observatory in the same conditions as the station RER to qualify it and validate the data streamed to Postdam. Thus, during the first 2021 semester, OVPF staff tested the seismometer in different configurations and validate it regarding another seismometer (CMG3-ESP) installed in basement of OVPF during few weeks. The observatory set up its acquisition and data processing system to add data of the rotational seismometer. Then the rotational seismometer was installed close to Geoscope seismometer in October 2021.

Data are timestamped with GPS signal of the digitizer of Geoscope and streamed in real-time to the observatory of la Réunion. The rotational seismometer outputs 9 channels of data that are finally transferred them to IPGP data centre that distributes them for the PI.

The preparation, testing and installation of the rotational seismometer and the distribution of its data required extra work and time from the observatory. The collaboration will continue after EUROVOLC since the PI and the observatory agreed to keep the rotational seismometer till October 2022 and to install another one at a new site of Piton de la Fournaise.