

# EUROVOLC

## European Network of Observatories and Research Infrastructure for Volcanology

### Deliverable Report

#### D15.1 Report on the WP15 TA activities during the project

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## Summary

The Work Package 15 - Access to the Italian Volcano Observatories and Research Institutions – has dealt with the provision of the Transnational Access (TA) to the Italian volcano infrastructures belonging to INGV (Osservatorio Etneo, Osservatorio Vesuviano and Palermo Branch) and CNR-IGG (Pisa and Pavia). The TAs accepted for funding have been of Physical and Remote kind; the former has included access to laboratories, observatories and pool of mobile instrumentations and the latter access to lithotheques. The main actions carried out by the WP in order to achieve the goal have been the (i) definition of the overall offers of the WP and of the relevant reference persons of the infrastructures/installations/facilities, (ii) harmonisation of the similar offers across the different infrastructures of the WP, (iii) finalisation of the WP offers for the first and second call, (iii) technical evaluation of the first and second call proposals, (iv) management of the users' logistics prior to the 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 majeure. Overall, in the two calls, the WP received as many as 22 (11 in the 1<sup>st</sup> call and 12 in the 2<sup>nd</sup> call) proposals of which 14 (4 of the 1<sup>st</sup> call and 10 of the 2<sup>nd</sup> call) were positively evaluated for funding.

It is noteworthy that besides the mere provision of access and the logistic support offered, some of the TA activities have also promoted scientific collaborations that are continuing, thus contributing to the networking and community building aims of EUROVOLC.

## Introduction

The WP15 activities can be reported according to two phases; the first pertinent to the activities of the First Call and the second to those of the Second Call as follows.

### First call

#### **Preparatory activities**

Prior to the provision of the access to the Italian Observatories and Research Infrastructures, WP15 extensively worked on the definition of the menu of what offer to the users. For the aim, the WP participants were asked to fill in questionnaires for the definition of the WP TA offers with the identification, within INGV and CNR-IGG, of the reference persons in charge of each of the infrastructures/installations/facilities offered, and for the harmonisation of the offer across all the WP Infrastructures – i.e. INGV-OE, INGV-OV, INGV-Palermo Branch, CNR-IGG Pisa and CNR-IGG Pisa. In this frame, meetings either face-to-face or teleconferences were organised. Between May and the first half of June 2018, WP15 prepared and released the MS31 ‘WP15-Definition of the first call’. The document included the information on the TA offers of WP15 for the first call. From the second half of June to July 2018, the reference persons of every installation/facility definitively checked the WP offers, in order to edit the final menu document for the implementation of the TA webpage properly designed for the launch of the first call.

Following the closure of the first call, in the second half of October 2018, the technical evaluation of the 11 proposals relevant to WP15 was carried out. The technical evaluation aimed at assessing the logistic, technical, and financial feasibility of the proposals, based on the characteristics and description of each of infrastructures/installations/facilities defined and reported in the TA webpage of the project website. The same evaluation process was repeated at the end of January 2019 for three of the first call proposals, in order to better clarify some logistic issues. From February to July 2019, WP15 focused on the logistic preparation of the TA activities related to first call and the activity exploitation of the 4 positively evaluated research projects.

#### **Access provision in the First Call per Task**

### Task 15.1 Access to the Volcano Observatories – first call

In the frame of the first TA call, 3 project proposals were accepted for funding (VOSSIA, EPL-REFLECT, and FAME). All projects requested access to the Etna Volcano Observatory infrastructure. In particular, the installations and facilities required were the Pizzi Deneri Observatory and the multi-parametric station, SO<sub>2</sub> equipment, FTIR, and LIDAR included in the pool of mobile instruments. The access of the 3 project users and the related activities were all carried out by July 2019. In the period preceding the users’ access, the reference persons checked the availability of the installations and facilities they were in charge of, and agreed with the project PIs the best periods to carry out their project activities.

A short summary of the TA activities is reported here while details are provided in the associated documents attached.

1. **VOSSIA PROJECT:** The main objective of VOSSIA (Volcanic emissions analysis through SeiSmic and Infrasound Advanced monitoring) project was to advance the understanding of the relationship between seismo-acoustic signals and volcanic eruptions through the application of advanced data processing and waveform inversion techniques to identify volcanic unrest precursors and characterise eruption mechanisms. To the aim, the scientific team requested the use of the INGV multi-parametric station. The TA activities were carried out between 1 and 7 July 2019, as previously agreed by the facility reference person and the project team. The INGV support consisted in the technical assistance for the installation of the instrumentation and logistic assistance for the transfers. The complete infrasound dataset acquired during the experiment, including the continuous raw waveform data and station metadata, is available through the facilities of two free data sharing repository; (i) the Incorporated Research Institutions for Seismology Data Management Center (Zuccarello and De Angelis, 2019) and (ii) Zenodo repository (Zuccarello et al., 2021). Moreover, data are included in the following recently published open access research paper: *S. DeAngelis, L. Zuccarello, S. Rapisarda & V. Minio (2021), Introduction to a community dataset from an infrasound array experiment at Mt. Etna, Italy. Nature Scientific Data 8:247, <https://doi.org/10.1038/s41597-021-01030-6>.*
2. **EPL-REFLECT PROJECT:** The goal of EPL-REFLECT (Etna Plume Lab – near-source estimations of Radiative Effects of volcanic aErosols for Climate and air quality sTudies) was to assess the impacts of weak persistent volcanic degassing on the radiative balance and tropospheric photochemistry at the regional scale. The TA activities were carried out from 8 to 12 July 2019, and the INGV support was both logistic and instrumental. In detail, the research team requested the use of the INGV SO<sub>2</sub> equipment, FTIR, and the LIDAR. For the use of the SO<sub>2</sub> equipment and FTIR facilities, the activities were carried out at variable distances downwind the emitting summit crater of Mt. Etna. In particular, the activity consisted of three tasks:
  - measurements from the volcano summit area, during which INGV offered support to collect data and install gas sensors, LOACs, Lille PM, OPC-N2 for the characterisation of Etnean plume aerosols in the summit area,
  - measurements from distal areas, during which the project team and the INGV reference persons from the facilities offered collected distal data on gas plume and integrated compositional data from FTIR spectra in occultation mode with sun photometer data,
  - installation of fixed radiometers in Milo (Easter flank of the volcano) for measuring the global and diffuse irradiance at different wavelengths to characterise the optical propriety of the volcanic aerosol.

In the frame of the TA project, INGV also provided access to a mobile LIDAR to follow the aerosol dynamics and to make a 4-D (time-space) characterisation of their properties. The team started measurements and instrumental calibrations by LIDAR in the afternoon of 8 July 2019. The use of LIDAR allowed several zenith measurements, during which a high density layer in the low atmosphere until 4 km was observed. Several measurements were carried in azimuth as well. Joint measurements with a photometer toward the Etna plume were also carried out. The good weather conditions and the persistence of aerosols layers related to Etna activity allowed to get good quality measurements. All datasets are archived thanks to the French AERIS atmospheric data centre (<https://www.aeris-data.fr/>). AERIS offers a service

of data archives, with full EPOS compliance. A project submission is ongoing for AERIS support to data archiving and distribution.

- 3. FAME PROJECT:** The FAME (Fiber optical cable: an Alternative tool for Monitoring volcanic Events) project has benefitted from the access to Pizzi Deneri Observatory to deploy a fibre optic Distributed Acoustic Sensing (DAS) system in Piano delle Concazze for monitoring Etna volcanic activity. A 1.5 km long fibre optic cable was installed into a trench at a depth of about 40 cm. The DAS interrogator unit, supplied by a solar panel system, was hosted inside the Pizzi Deneri Observatory. To validate the fibre optic technology, a pool of classical instruments, composed of 26 broadband seismometers and 3 infrasonic arrays, were also deployed. The installation was performed in the period between 1 and 7 July 2019 and the plan was to have the system recording data till mid-September same year. Because of the huge amount of data recorded during the project (more than 10 terabyte), in order to make data available, the users are working on subsampling of the data sets. Nevertheless, part of data has been used in the following recently published open access paper: *G. Currenti, P. Jousset, R. Napoli, C. Krawczyk, M. Weber (2021). On the comparison of strain measurements from fibre optics with dense seismometer array at Etna volcano (Italy). Solid Earth Discussions, <https://doi.org/10.5194/se-2020-216>.*

## Task 15.2 Access to the Research Institutions – first call

As far as the access to the WP15 Research Infrastructures is concerned, during the first TA call, one project requiring access to the INGV Palermo Branch geochemistry laboratories was approved. Even in this case, in the period preceding the user's access, the INGV reference person checked the availability of the installation and facilities he was in charge of, and agreed with the project PI the best period to carry out the activities. A short summary of the TA is reported here:

- 1. FUTURE PROJECT:** The FUTURE (Fluid Inclusions as Powerful Tracer for Constraining the Origin and Nature of the Mantle below the French Massif Central) project used the Geochemistry Laboratories of the INGV Palermo Branch and benefited from the scientific support of the provider. For the aim of the project, the user selected olivine, clinopyroxene (when possible due to the low modal percentage in mantle xenoliths) and orthopyroxene from a suite of about 30 mantle xenoliths from French Massif Central (FMC). These samples were in part analysed during the user's stay in INGV-Palermo Branch infrastructure, while she was refining hand-picking of the minerals. The analyses carried out within EUROVOLC proposal were successful and the first results showed that the mantle beneath FMC has undergone variable phases of partial melting, from fertile composition typical of lherzolite toward high extent of melting in Harzburgite rocks. Finally, the He isotopic ratio varies from MORB-like values to lower and fractionated ratios due to diffusive process during mantle melting. Second call

### Preparatory activities

From February to July 2019, WP15 also focused on the preparation of the second call. To the aim, the installation/facility reference persons revised the list of offers of the first call, which description and related information were reported in the excel file circulated to implement the TA data-base properly

structured for the second call launch and the second WP milestone - MS32 'WP15-Definition of the second call' milestone document. Following the closure of the second call (mid October 2019), WP15 received a total of 16 research proposals, of which 8 asking access to the Etna Observatory infrastructure, 3 to the INGV Palermo Branch infrastructure, and 5 projects access to the IGG-CNR Pavia and Pisa Branches' infrastructures.

By the end of October 2019, according to the steps of the research proposal evaluation process properly agreed by the EUROVOLC consortium for the second call, WP15 provided the first technical evaluation of the proposals to the VA/TA coordinator by filling in a template suitably defined per each proposal. As for the proposals of the first call, the technical evaluation aimed at assessing the logistic, technical, and financial feasibility of the proposals based on the characteristics and description of each of infrastructures/installations/facilities defined and reported in the TA webpage of the project website. A score between A and C was given at each proposal, meaning by "A" proposals that were totally feasible, "B" feasible after some modifications, and "C" proposals that did not meet many of the access requirements. Then, the PIs of the "B" proposals (10 in total) were asked to apply changes to their research proposals and to re-submit them again through the EUROVOLC website.

In the second half of November 2019, a second technical evaluation was repeated on the "B" evaluated proposals to check their feasibility after the suggested modifications. In that frame, one proposal was withdrawn as it was not possible to meet the changes required.

Early in February 2020, after having received the feed-back of the end of the whole evaluation process WP15 was informed by the VA/TA coordinator on the final number of proposals that were positively scientifically evaluated. Considering the process results and the number of fundable projects per infrastructure/installation/facility, WP15 got 3 projects for the Etna Observatory infrastructure, 3 for INGV-Palermo Branch, 2 for IGG-CNR Pisa Branch, and 2 projects for IGG-CNR Pavia Branch.

Following the final selection, the reference persons of each of the required infrastructure/installation/facility discussed the logistics and specifications of each of project with the PIs, although any of the activities could not be carried out ought to the pandemic occurrence. In September 2020, WP15 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 in order 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 TAs to the Italian Observatory and Infrastructures were made available in agreement with the EUROVOLC contingency plan as follows:

<b>Project</b>	<b>Foreseen kind of access</b>	<b>Converted kind of Access</b>	<b>New period of access</b>
VOSSIA2	Physical	-	Second half of July 2021
ELMO	Physical	-	End of June 2021-end of September 2021
G-ET-SUMMIT	Physical	-	Second half of July 2021
TAH	Physical	-	Mid-March 2021
bioTRACE	Physical	Remote	Cancelled
Gas Northern Chile	Physical	Remote	September 2021
TRAcEINCLUSIONS	Physical	Remote	September 2021
DEGASDEC	Physical	Remote	NA
BORSH	Physical	Remote	September 2021
AVOLPE	Remote	-	October 2020

Of the 10 funded projects, 4 remained physical accesses and 1 remote access as foreseen, whereas the rest was changed from physical to remote mode. It is noteworthy that due to the difficulties in the collection and shipping of the rock samples to the TA infrastructure (IGG-CNR Pavia), the DEGASDEC project could not be exploited.

### Activities per Task

#### Task 15.1 Access to the Volcano Observatories – second call

In the frame of the second TA call, 10 project proposals were accepted for funding, of which 3 fall in the frame of the Task 15.1 activities. The 3 projects - VOSSIA2, ELMO, and G-ET-SUMMIT - requested physical access to the Etna Volcano Observatory infrastructure, and in particular, the users required the Pizzi Deneri Observatory, the multi-parametric station, and the gravimeter included in the pool of mobile instruments. One project - TAH - requested physical access to the INGV-Palermo Branch infrastructure asking for the “M. Carapezza” Volcanological Centre. Provided below is a short summary of the execution of the accepted TAs .

- 1. VOSSIA2 PROJECT:** This project (VOLcanic emissions analysis through SeiSmic and Infrasound Advanced monitoring 2 – VOSSIA2) applied to the 2nd call, asking for the multi-parametric station of the Etna Volcano Observatory pool of mobile instruments. The TA activities were carried out between 18 and 26 July 2021 and consisted of the deployment of two seismic arrays, one installed close to Etna’s South East summit and the other close to the Pizzi Deneri Observatory. The equipment was made available in-kind within the framework of an established collaboration between the two team project partners (University of Granada (Spain) and University of Liverpool (UK)) and the Dublin Institute for Advanced Studies (Ireland) as external partner. The first array consisted of five broadband seismic sensors, and two short period seismic sensors. The second array was made by five short period seismic sensors. Furthermore, the users deployed two broadband stations, around the summit craters and two broadband seismic stations, one close to the Rifugio Poggio La Caccia (Mt. Etna W flank) and the other close to the Rifugio Citelli (Mt. Etna E flank). These broadband stations guaranteed better constraint of the low frequency signals sources. The fieldwork was scheduled in four steps (1) check of all instruments (18/07/2021), (2) deployment of the stations (19-20/07/2021), (3) data collection and instruments maintenance (21-23/07/2021), and (4) end of the project 26/07 with database creation. Indeed, the provider gave logistic and technical support for reaching the targeted sites and for instrument installation. In addition, with part of the technical group of INGV-OE, in June 2021 the users installed an infrasonic array to both monitor the Mt. Etna 2021 eruptive activity, and joint this dataset with the seismic dataset to achieve the aims of the VOSSIA2 project. The complete seismo-acoustic dataset acquired during the experiment, including the continuous raw waveform data and station metadata, will be available through the facilities of free data sharing repository such as (i) the Incorporated Research Institutions for Seismology Data Management Center and (ii) Zenodo and/or FigShare free access remote data products repository (<https://www.iris.edu/hq/>; <https://zenodo.org/>; <https://figshare.com/>). In addition, the results and the products will be made available to the scientific community through the “



Principi della Politica dei Dati INGV” (*delibera CDA n. 651/2018; Allegato U al Verbale n. 05 / 2018*; <https://data.ingv.it/docs/principles>).

2. **ELMO PROJECT:** This project (Electrical Monitoring of Ash Plumes at Etna Volcano- ELMO) applied to the 2nd call, asking for the Pizzi Deneri Observatory belonging to the Etna Volcano Observatory infrastructure. The TA activities were carried out following the original remittal of the proposal, although some small variations had to be put in place due to the contingency of the COVID-19 pandemic. The project was carried out between 24 June 2021 and 21 September 2021 with the logistic and technical support from the provider, and consisted of the deployment of only one of the two detectors originally planned. The vantage point of the Pizzi Deneri Observatory nonetheless provided an excellent strategic logistic infrastructure for the deployment of the detector. The antenna was mounted on an existing metal pole anchored to the ground on the observation terrace of the Pizzi Deneri Observatory. The antenna was powered by a 12V/24A DC battery charged by a solar panel. This provided continuous recording of the electrical activity at the deployment site with a sampling rate of 100 Hz. Recorded data was stored locally on the data logger of the antenna and periodically downloaded by the INGV personnel in charge of the TA, in accordance with the level of volcanic activity, accessibility of the installation site and scheduled maintenance of the Pizzi Deneri Observatory.

The generated datasets will be shared with the wider scientific community and related stakeholders through open access data repositories (EPOS, EUROVOLC) after the exploitation of the data.

3. **G-ET-SUMMIT PROJECT:** This project (Gravimetric investigation of the structure of the Etna summit craters system – G-ET SUMMIT) applied to the 2nd call, asking for the gravimeter of the Etna Volcano Observatory pool of mobile instruments. TA activities were carried out from 19 to 23 July 2021 with the logistic/technical and scientific support of the provider. The aim of the gravimetric measurements was to cover the most complete area possible in the immediate vicinity of the summit craters on Mt. Etna. Gravity measurements were performed with Scintrex CG-5 and CG-6 instruments. Relative measurements were referenced to absolute gravity points, specifically according to access to points: Pizzi Deneri, Nicolosi and Serra La Nave. Measurements at these points were made at the beginning and at the end of each field-work day, from which the drifts of the gravimeters were calculated. At least 2 to 3 one-minute readings were taken at each field gravity point. Measurement conditions were unfavourable, unstable ground (unconsolidated eruptive products) and wind. Nevertheless, the mean error of the measured gravity calculated from the control points (11 points repeatedly measured on different field-work days) reached a relatively favourable value of 17 microGal. In addition to these control points, several interconnection points were repeatedly measured on the original profile from 2016. In the northern part of the profile, where we do not expect significant changes in topography since 2016, we measured differences in the gravity of about 60 microGal. Given the elapsed time since 2016 and the different methodology/instruments for measuring position and gravity, we consider this to be relatively satisfactory.

The data (all the deliverables) were uploaded to a Google drive from where they can be downloaded by registered users for free (open access) from now on (no embargo period).

[https://drive.google.com/drive/folders/1q7uu8Uc0cWEKxF\\_xfwJ-BbHIWKDRFJy8](https://drive.google.com/drive/folders/1q7uu8Uc0cWEKxF_xfwJ-BbHIWKDRFJy8)

- 4. TAH PROJECT:** This project (Thermal Analysis of Hydrothermal Systems from Space – TAH) applied to the 2nd call, asking for the Carapezza Volcano Centre of the INGV Palermo Branch. TA activities were performed between 10 and 8 April 2021 with the logistic and scientific support of the provider. The project focused on the study of the thermal anomalies associated with hydrothermal activity in La Fossa Crater of Vulcano (Aeolian Archipelago, Italy). The thermal anomalies can be defined by the degree to which surfaces are heated above their surroundings. The degree to which this anomaly is modified by diurnal heating and cooling will depend on thermal inertia of the two surfaces. Heat transfer to the atmosphere and space is then controlled by the convective heat transfer coefficient and emissivity, respectively; the former being a function of air temperature, humidity, pressure and wind speed. In this frame, the main goals of the users were to define these parameters and uncertainties in them. Thermal anomalies and heat fluxes obtained from the ground will then be compared with those derived from thermal anomalies in satellite data and used to validate a methodology to extract hydrothermal system heat loss from satellite data. The activities in the field during the access involved:
- 200 ground temperature measures at the surface (with radiometers) and at 15-cm depth (with thermocouples) in the inner edge of the La Fossa crater. Measurements were performed in an area of 110 m × 50 m with a grid of 5 metres,
  - download of the data of the two temperature stations installed in 2020 and located at a distance of 60 m each other, in the red and grey areas (colours of the soil) in the inner part of the La Fossa crater,
  - ground temperature measures at the surface along a 50 m profile at the transition zone between the red and the grey area, between the two temperature stations,
  - two ground temperature surveys in a 10 m<sup>2</sup> areas each in the red and grey zone close to the temperature stations,
  - one ground temperature survey in a 5m<sup>2</sup> area in the grey zone,
  - download of the data (air temperature, humidity, pressure, wind speed and rain) from a weather station,
  - acquisition and analyses of thermal images were acquired during ASTER satellite overpasses on 30 March and 6 April daytime from the crater rim on the other side of the fumarole field. Comparison with ground temperature measurements and first attempt of calibration.

At present, the users are still carrying out data analysis.

## Task 15.2 Access to the Research Institutions – second call

In the frame of the second TA call, 10 project proposals were accepted for funding, of which the following fall in the frame of the Task 15.2 activities. Two projects - bioTRACE and Gas Northern Chile - requested physical access to the INGV-Palermo Branch infrastructure asking for the Geochemistry Laboratory Laser ablation ICP-MS Lab and Noble Gas; two projects - AVOLPE and BORSCH - requested access to the IGG-CNR Pisa Branch infrastructure, and in particular remote access to the Lithothèque and physical access to the Neptune TIMS Laboratory; and two projects - TRAcEINCLUSIONS and DEGASDEC - requested access to the IGG-CNR Pavia Branch infrastructure, asking for the Laboratory of Geochemistry Mass Spectrometry La-ICP and SIMS. A short summary of the Tas is provided below:

- 1. BioTRACE PROJECT:** The project (Paleobiomonitoring of volcanic eruptions: evidences from trace elements in carbonatic marine bivalves -bioTRACE) bore as a physical access to the INGV Palermo Branch infrastructure with the aim to investigate if the marine organisms living in volcanic areas could register the occurrence of volcanic events. In detail, the objective of the project was correlating the variations in concentration of trace elements along the shell of marine bivalves with the occurrence of volcanic eruptions in Deception Island during the volcanic reactivations of 1992 and 1999. For this purpose, the users required access to the Laser-Ablation ICP-MS laboratory of the INGV Palermo Branch. However, due to the pandemic, in agreement with the EUROVOLC contingency plan, the project was passed to remote access in August 2021. Due to the difficulties in providing the samples to the laboratory, the project did not start by the end of the EUROVOLC project, and thus the activity was cancelled.
- 2. Gas Northern Chile PROJECT:** The project (Gas geochemistry from northern Chile active volcanoes – Gas Northern Chile) bore as a physical access to the INGV Palermo Branch infrastructure with the main objective to produce detailed conceptual geochemical models in a regional-based survey from northern Chile active volcanoes, able to describe the chemical-physical processes controlling the fluid circulation of these volcanic systems and its contribution to the global degassing fluxes. In particular, in order to achieve the main goal, the user asked access to the Gas Chromatography laboratory of the INGV Palermo Branch geochemistry laboratory. Due to the pandemic, as in the previous case, the mode of access was changed from physical to remote late in August 2021. In this frame the logistic and technical support of the provider changed to scientific execution of the laboratory activities too. However, the users only shipped the gas samples to the laboratory shortly before the delivery of this report, and the shipment has not yet been delivered when this is written. Samples will be analysed (gas chromatography, stable isotopes and noble gases) as soon as they will arrive in Palermo.
- 3. AVOLPE PROJECT:** TA activity could be carried out remotely, being a lithotheque service. 17 rock surface specimens and other core samples belonging to Mt. Amiata volcano were made available to the TA project AVOLPE (Understanding large volume effusive silicic eruption at Mt. Amiata (Tuscany, Italy): an experimental volcanology and petrology study). The 5 surface samples selected by the project PI, among the 17 made available, were prepared and sent by CNR-IGG on 22 October 2020. The whole provided rock samples were remelted and homogenized at high temperature, before their liquid viscosities were measured by using a concentric cylinder device available at the LMU of Munich. After cooling, Raman spectroscopy, devoted to characterise the supercooled melt structure were obtained both at LMU and at the Earth Science Department of the University of Torino. The supercooled glasses were then used to perform petrological measurements devoted to retrieve the Pressure-Temperature-phase equilibria (P-T-X) conditions existing during the storage and ascent of Mt. Amiata samples. Three, 1-week duration experiments were performed under water-saturated conditions (~5 wt% of water according to MELTS calculations) with water-pressurized cold seal pressure vessels (CSPV) at the University of Camerino (Italy). The experiments were performed at isothermal conditions (T=750, 800, 850°C) and at P ~1300 bars. The redox conditions of the apparatus are ~1 log fO<sub>2</sub> units above the NNO buffer. Later, SEM-EDS

measurements and semi-quantitative compositional analysis of the residual glass matrix and mineralogical assemblage were carried out on the three experimental at the University of Sao Paulo (Brazil). The research activities of the project are still ongoing. Data will be made available as excel files that will be emailed to the provider.

4. **BORSCH PROJECT:** TA activity of this project (Tracing high K Plinian eruptions with B and B isotopes – BORSCH) was carried out on a suite of tephra samples which were already available to us, as those were collected during PIs fieldwork in Kamchatka in 2016. From those samples the most unaltered basaltic mafic tephtras were selected by careful examination of thin sections of the same rocks via SEM at University of Leeds. The selected samples (multi shards) carefully washed in B free water and ultra-sonicated the tephtras to remove any alteration and/or secondary materials. After drying the samples in an oven at 50°C, the users hand-picked the most unaltered looking pieces from the >5 mm fraction, which were used in order to produce rock powders. For those, an agate pestle and mortar (by hand) in a B free environment in IGG-labs in Pisa was used. Using the clean laboratory facilities at the University of Leeds some of these powders via HF were also digested. Then the fully digested samples on cation separation columns using Sr-Spec and TRU-spec type resins were also digested. As a result, 10 samples were processed for Sr and Nd isotope analysis. The users conducted B isotope sample preparations on 20 samples, including on the powder splits used for Sr and Nd isotopes. The fraction of the powders for B isotopes (~0.25g) was fused in pure Pt crucibles after addition of flux of ultrapure K<sub>2</sub>CO<sub>3</sub>. Samples were then mixed with B free water and left overnight. Then the samples were centrifuged and B was purified by using a combination of anion (Amberlite) and classical cation column separation techniques set up at IGG-labs in Pisa. The B isotopes of total of 20 samples were processed and then diluted in 2M HNO<sub>3</sub> and analysed on the Neptune MC-ICP-MS at IGG Labs at CNR-Pisa. The results were with exceptional quality and the reproducibility of the internal and external standards that were prepared and/or treated as unknowns was very good and always 1 per mil or better. The analysed samples were mostly scoria and lava samples from normal or High-K series erupted at Shiveluch volcano, but it was also possible to extract data from half dozen samples from the nearby Kluchevskoy and Tolbachik active arc stratovolcanoes (with the help of the MSc student Sian Thomas). Although these are not erupting high- K melts, the users wanted to use this data for establishing the regional background of B and B isotopes characteristic for the normal CA arc volcanic series.

Data will be made available as excel files that will be emailed to the provider.

5. **TRAcEINCLUSIONS PROJECT:** The TA activities of this project (Tracking magma evolution from source to sink under the volcano: evidences from trace elements in phenocrysts and hosted melt inclusions – TRAcEINCLUSIONS) were remotely carried out in September 2021. The samples were prepared according to the LA-ICP-MS laboratory requirements of the IGG-CNR in Pavia: i.e. olivine-rich 60µm thin sections. Trace element concentrations in minerals, glasses and melt inclusions were determined on petrographic thin sections with an LA-ICP-MS housed at IGG-CNR Pavia consisting of a QQQ-ICP-MS Agilent Series 8900 coupled with a GeoLas102, MicroLas (Göttingen, Germany), consisting of an excimer laser (Compex 110, Lambda Physik, Göttingen, Germany) operating with a mixture of 5% F2 in Ar, emitting a radiation of 193 nm wavelength. Spot diameter was typically 30-80 µm. The ablation system was operated at a 10 Hz repetition rate, with a fluence of about 9 J/cm<sup>2</sup>. Background and signal were measured for

about 60 s; signal of standards and unknowns were carefully checked, and the raw data were reduced using the software package GLITTER®, using the reference synthetic glass NIST SRM 610 as external standard. SiO<sub>2</sub> was used as internal standards for olivine, K-feldspar, orthopyroxene, zircons, mica, CaO for clinopyroxene, amphibole, plagioclase, apatite, glass. Precision and accuracy were assessed via repeated analysis of BCR-2g reference material, resulting better than ±10% at ppm concentration level. Due to the pandemic, as the previous cases, the mode of access was changed from physical to remote late in August 2021. In this frame the logistic and technical support of the provider changed to scientific execution of the laboratory activities.

Data will be made available as excel files that will be emailed to the provider.

- 6. DEGASDEC PROJECT:** The execution of the analytical activities related to the DEGASDEC (Degassing processes at Deception Island volcano (Antarctica)) project was adversely affected by the COVID 19 pandemic. In particular, the contingent closure of the sample preparation laboratories initially led to a delay of almost a year in the availability of the petrographic sections. The petrographic analysis of these then highlighted the absence of glassy inclusions in minerals large enough to be considered for analysis with micro-analytical techniques for the determination of light and volatiles, the primary object of the investigations. As a result, new petrographic sections were requested on additional samples, but again due to legislative limitations related to the COVID pandemic, these were not made available to the analysis laboratory in time to meet the deadline of 30 September. This unfortunate and contingent series of contributing causes made it impossible to carry out the project on schedule. Anyway, due to the pandemic, as the previous cases, the kind of access was changed from physical to remote late in August 2021. In this frame the logistic and technical support of the provider might have changed to scientific execution of the laboratory activities.

## Links to concrete results

- Currenti, G., Jousset, P., Napoli, R., Krawczyk, C., Weber, M., 2021. On the comparison of strain measurements from fibre optics with dense seismometer array at Etna volcano (Italy). *Solid Earth Discussions*, <https://doi.org/10.5194/se-2020-216>
- DeAngelis, S., Zuccarello, L., Rapisarda, S., Minio, V., 2021. Introduction to a community dataset from an infrasound array experiment at Mt. Etna, Italy. *Nature Scientific Data*, 8:247, <https://doi.org/10.1038/s41597-021-01030-6>.