IMPROVE

European Training Network

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IMPROVE invites applications for 15 Marie Sklodowska-Curie research fellowship positions in Volcanology

IMPROVE
Innovative Multi-disciplinary European Research training network on VolcanoEs

The Marie Sklodowska-Curie European Training Network IMPROVE is a project funded by the European Commission under the Horizon 2020 Framework Programme

Start: 01 September 2021
Length: 4 years

www.improve-etn.eu

Photo courtesy P. Scarlato

volcanoes

IMPROVE will train the new generation of volcano scientists who manage inter-disciplinary understanding and knowledge, pursue innovation, and cooperate an inter-sectorial, Open Science environment. The IMPROVE Early Stage Researchers (ESRs) are trained to grow as independent scientists with broad overviews and top level expertise, able to convert their knowledge, ideas and skills into scientific advances as well as economic and social benefits. Training develops in the frame of top-level multi-disciplinary, innovative, highly cooperative research, with objectives expected to impact volcano science as well as science-industry relationships. The involved disciplines include geology, geophysics, geochemistry, mathematics, thermo-fluid dynamics, with approaches that span from theoretical to numerical to experimental. Training-through-research develops under multi-disciplinary team work and multiple tutorships, and includes as major training elements a variety of transferable and soft skills aimed at growing a generation of scientists who are highly sought after in science and industry.

Two test cases at Mount Etna (Italy) and Krafla caldera (Iceland) provide ideal conditions to develop advanced methods and understanding of the subsurface structure and dynamics at active volcanoes.

The IMPROVE program includes two multi-disciplinary Field Experiments, four Network Schools, five Specialized Short Courses, three ESRs' Workshops, one Network Workshop on science-business relationships, nine Digital Training Modules, and a Final Conference.

All positions are for a length of 36 months, with EU standard salary for MSCA-ETN fellowships. All of them foresee PhD enrolment, either at the recruiting Organization or through partner Universities.

	Title of the Research ○ Objective of the Research	INSTITUTE Main supervisor
1	At the origin of the Etna dynamics: insight on the volcano behaviour by integrating in-situ and satellite-based deformation/geophysical/volcanological) measurements ○ to constrain the structure and dynamics of the active plumbing system and the shallow volcano edifice; ○ to analyse high-frequency GPS data and evaluate their extended use to intermediate frequencies.	**INGV** Giuseppe Puglisi
2	Numerical simulations of magma and rock dynamics and definition of ground deformation and gravity patterns diagnostic of deep magmatic movements at Mount Etna ○ to model time-dependent 2D/3D coupled magma and rock dynamics during multi-component magma convection and mixing in geometrically complex magma chamber-dyke systems; ○ to obtain synthetic space-time series of gravity anomaly and ground deformation, and compare them with experimental and real signals; ○ to identify sets of geophysical signals diagnostic of magma movements at depth.	**INGV** Paolo Papale
3	Thermo-mechanical modelling of the shallow magmatic body at Krafla ○ to constrain the dynamics and thermo-mechanical properties of the shallow magmatic body and its relationships with the deeper magmatic syste.	**INGV** Paolo Papale
4	Active degassing of mafic magmas from remote multispectral observations ○ to asses the fundamental parameters that control the different modes of active degassing and their transitions at mafic volcanoes; ○ to evaluate degassing in comparison with ground displacement and acoustic data as well as numerical results, test interpretations and constrain an overall conceptual model of magma and volcano dynamics.	**INGV** Jacopo Taddeucci
5	Thermal response of a geothermal system to intrusion and rifting events: The Krafla fires in 1975-1984 ○ to quantify and model with analytical and numerical fluid/heat transfer software the thermal effects of major intrusive events on the geothermal reservoir within a volcanic geothermal area; ○ to assess using heat transfer modelling the importance of intrusive activity in maintaining a high temperature geothermal area.	**UI** Magnus T. Gudmundsson
6	Crustal deformation modelling in the Krafla area based on realistic Earth properties ○ to constrain realistic Earth parameters from multiple techniques including borehole, gravity, seismic tomography, thermal structure and resistivity data, and develop a 3D model of the elastic, visco- and poro-elastic structure of the area; ○ to interpret shallow deformation signals and their origin from geothermal utilization and natural processes, ○ to improve modelling of past and present deformation processes.	**UI** Freysteinn Sigmundsson
7	Time lapse virtual & earthquake source seismic imagery at Krafla ○ to explore current limits and potential of seismic exploration techniques, including seismic reflections from natural and industrial seismic noise and earthquake sources, through comparison with unique knowledge of chamber roof location from drilling; ○ to use new techniques to extract body waves from noise correlation seismograms; ○ to deploy state-of-the-art borehole seismometers as a complement to the surface seismic network, and test additional technological developments of high temperature and corrosion resistant seismic sensors (in cooperation with GSL).	**DIAS** Chris Bean
8	Exploring deformation processes at Etna through analogue modelling – nearfield and dynamic seismic wave analysis ○ to use near field analysis methods to search for static deformations in output data from laboratory experiments; ○ to apply coda wave interferometry to look for seismic signatures associated with known deformation in analogues models; ○ to relate sub-surface processes to surface changes, focusing on frequencies within the transitional window between conventional ground deformation and seismic investigations.	**DIAS** Chris Bean

Evolution of permeability in Krafla's geothermal field and associated seismo-acoustic patterns

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- to determine permeability and resultant volatile flux as well as their evolution with respect to petrology and alteration, in the shallow geothermal field down to the magma/rock interface;
- to link volatile flux through a characterized permeable network to seismic patterns and their evolution in time.

LMU
Bettina Scheu

Deformation processes at Etna through analogue modelling

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- to determine the role of subsurface processes responsible for surface changes, focusing on frequencies within the transitional window between conventional ground deformation and seismic investigation;
- to derive a new interpretation on the role of drivers (e.g. intrusions, gravitational instability, hydrothermal system) on measurable surface deformations, with a focus on frequencies lower than seismic.

ULANC
Mike James

Shallow crustal density distribution and its evolution at the Krafla volcanic system

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- to construct a 3D model of the shallow subsurface density distribution by inverting existing and new gravity anomaly data combined with other multi-parametric data;
- to investigate the short and mid-term evolution of the sub-volcanic system from continuous and time-lapse gravimetric observation.

UNIVBRIS
Joachim Gottsmann

Multi-scale high resolution geophysical imaging of Krafla sub-volcanic system

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- to advance multiscale and multi-method (electrical, seismic, magneto-telluric) imaging of volcanic structures;
- to monitor and locate seismic activity with a dense seismic network;
- to decipher the effect of fluid substitution on seismic and resistivity attributes, with application to geothermal exploration and exploitation;
- to obtain high-resolution geophysical imaging of Krafla's upper geothermal system using new algorithms based on data fusion and joint interpretation of geophysical data.

ISTerre
Jean Vandemeulebrouck

Modelling mass balance and stress transfer at the Krafla volcanic system

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- to deploy a network of multi-parameter stations around the Krafla geothermal system (each station includes an iGrav superconducting gravity meter or a performant spring gravity meter, a broad-band seismometer, a GPS receiver, a meteorological station, and other (in particular hydrological) sensors required to monitor mass movement at the shallow surface);
- to determine subsurface mass and energy transfer from multi-parameter continuous signals, and develop a model of mass (fluid) displacement in the hydrothermal reservoirs;
- to define the relative roles in mass and energy transfer of anthropogenic (injection/extraction) and natural sources.

GFZ
Philippe Jousset

Automatic detection and classification of relevant events in records from broad-band ground displacement monitoring devices at Etna

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- to implement an automatic, real time system to analyze the data acquired by the different types of sensors;
- to mine ground displacement data from multiple sensors over broad frequency ranges to identify meaningful signals, in particular in frequency domains intermediate between those typical of seismicity and conventional deformation;
- to analyse synthetic (model produced) space-time series of ground displacement and compare them to real data.

UGR
Carmen Benitez

Geochemical prospecting and geothermal circulation modelling at Krafla

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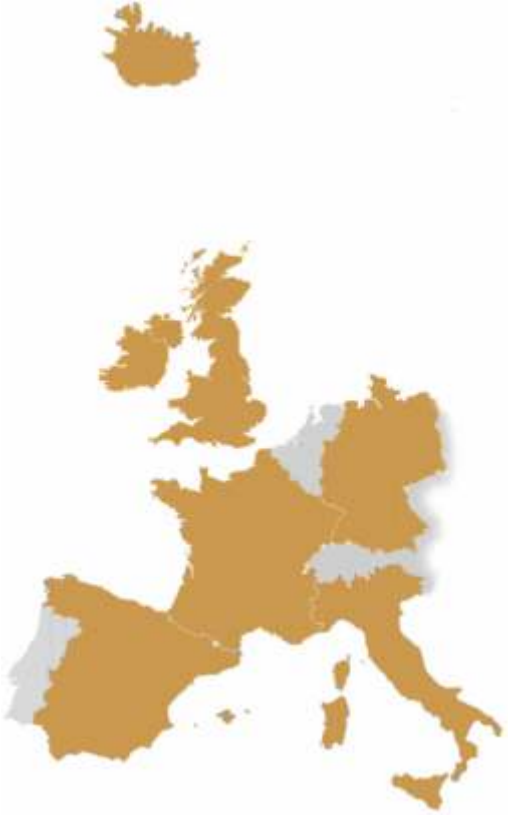
- to produce an advanced geochemical conceptual model of the geothermal system and physico-numerical model of hydrothermal circulation;
- to realize and test new instrumentation for volcano science and geothermal industry purposes (in cooperation with WS);
- to provide the industrial partner LV with advanced knowledge of the geothermal system for revised energy exploitation strategies.

INGV
Antonio Costa



Consortium

The consortium involves nine academic and three industrial partners

Istituto Nazionale di Geofisica e Vulcanologia	INGV	Italy
Haskoli Islands	UI	Iceland
Dublin Institute for Advanced Studies	DIAS	Ireland
Ludwig-Maximilians Universitaet Muenchen	LMU	Germany
Lancaster University	ULANC	UK
University of Bristol	UNIVBRIS	UK
Université Savoie Mont Blanc	ISTerre	France
Helmholtz Zentrum Potsdam Deutsches GeoForschungs Zentrum	GFZ	Germany
Universidad de Granada	UGR	Spain
Landsvirkjun	LV	Iceland
Güralp Systems Limited	GSL	UK
West Systems s.r.l	WS	Italy

Who can apply

Candidates must meet the following requisites:

1. Be of any nationality, but not having resided or carried out their main activity (job, studies, ...) in the country of appointment for more than 1 year in the past 3 years.
2. Be within 4 years from the degree that in their country, or in the country of appointment, gives access to a PhD.
3. Not having completed a PhD. Current PhD students can apply.

How to apply: visit www.improve-etn.eu

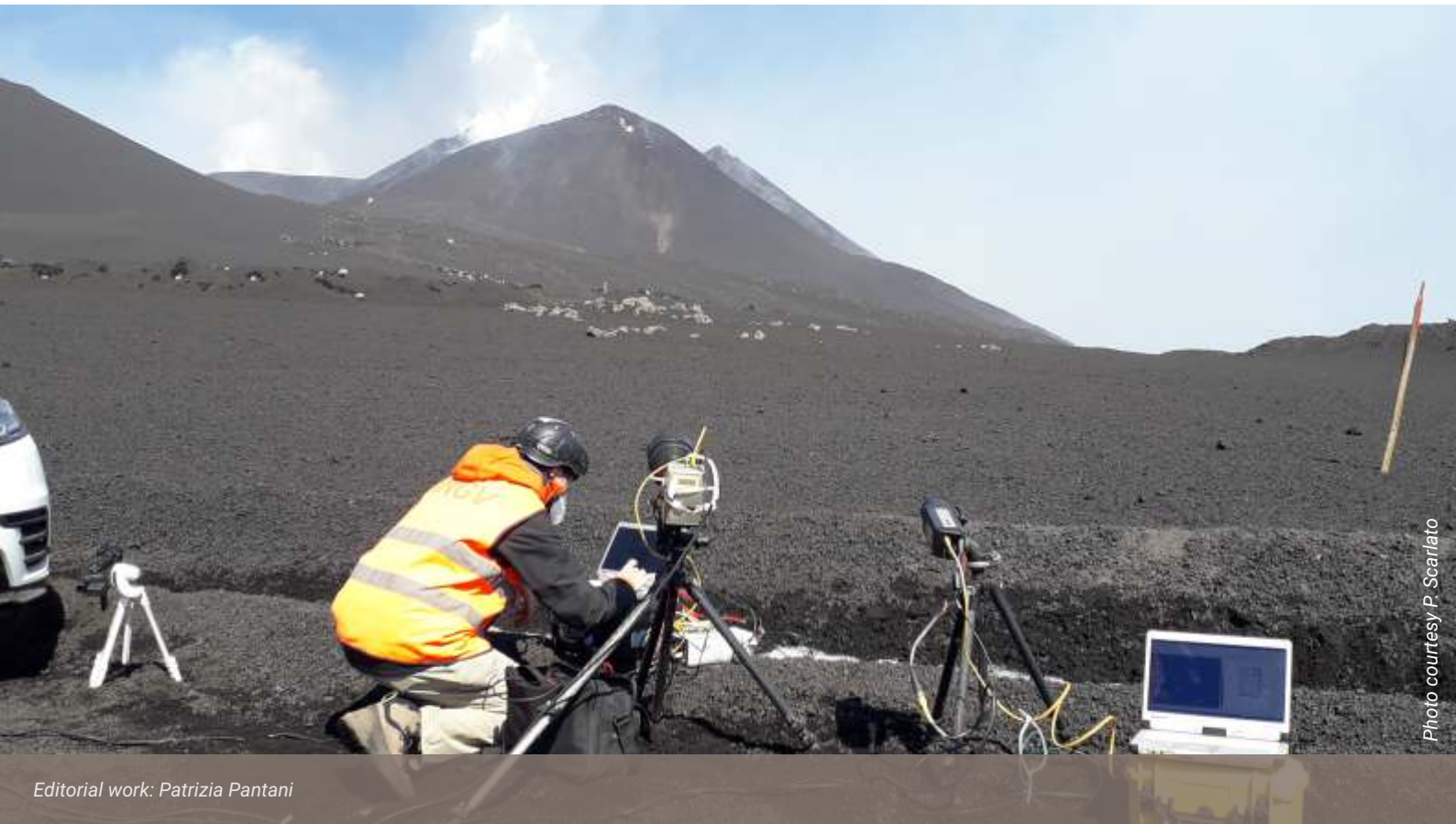


Photo courtesy P. Scarlato

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