The Istituto Nazionale di Geofisica e Vulcanologia (INGV), in collaboration with the Associazione Italiana di Vulcanologia (AIV), Dipartimento della Protezione Civile (DPC), Parco Nazionale del Vesuvio, Regione Campania and the Universita di Napoli Federico II, Dipartimento di Scienze della Terra, dell’Ambiente e delle Risorse (DISTAR), are presenting a proposal to organise the 10th edition of Cities on Volcanoes (CoV 10) to be held in the city of Napoli, Italy.

Introduction

“Millennia of Stratification between Human Life and Volcanoes: strategies for coexistence”

Italy is one of the most highly exposed countries to volcanic risk. The Neapolitan area in particular, with the two active explosive volcanoes of Vesuvio and Campi Flegrei, as well as the volcanic island of Ischia, is the highest volcanic risk region in Italy and indeed one of the highest in the world. The Metropolitan City of Napoli, with its more than 3 million people and a population density of about 2,700 inhabitants/km², is one of the best examples of Cities on Volcanoes. Despite the proximity to the three active volcanoes, the volcanic risk perception of the Neapolitan resident population is still quite low (Barberi et al., 2008, Ricci et al., 2013). This is common in regions and urban areas where active volcanoes are characterised by prolonged periods of repose (i.e. since 1944 for Vesuvio, since 1538 for Campi Flegrei and since 1302 for Ischia) so that perception of risk is not associated with the direct experience of a volcanic eruption. The main concepts developed in the “Cities on Volcanoes” Conferences over the years, were initially outlined during the first event of the series held in 1998 in Roma and Napoli. The next CoV is to take place 20 years after that first meeting, and we believe that this will be an ideal occasion to gather the entire international community again in Napoli to review what has been the cultural impact of 20 years of activity of Cities on Volcanoes events in bridging Science and Society, and to work together to outline future developments.

We believe that the next CoV in Napoli could be a great success and we expect a strong response and participation from the large international community dedicated to hazard and risk studies. The proposed meeting title ‘Millennia of Stratification between Human Life and Volcanoes: strategies for coexistence’ intends focusing attention of the Conference on the inherent resilience of human societies to volcanic risk, as millennia of coexistence with volcanoes prove that volcanic environments are fundamentally perceived as resources. At the same time, building and strengthening this resilience in modern and complex societies exposed to volcanic risk, especially on volcanoes with long periods of dormancy where risk is poorly perceived, is a challenge. It requires the constant adaptation of strategies and approaches, so that mitigation to significantly reduce the impact of future volcanic eruptions remains effective. We propose that the next CoV in Napoli should emphasize the importance of integrative studies, of fostering partnerships and networking, as well as the equal participation of all stakeholders in processes leading to emergency plans and mitigation measures. To achieve this objective, the proposal includes symposia that host, in addition to scientific contributions, studies focused on forecasting eruptions, and on the interaction between scientists, stakeholders and citizens in defining mitigation actions. To explore these interdisciplinary and cross-relational aspects of the activities in the volcanic hazard and risks field and to encourage greater participation and impact of CoV 10, we have included in the proposal
a few initiatives to promote the interaction between scientists attending the conference and resident communities.

The proposal has been prepared by the entire Italian volcanological community in partnership with the representatives of all stakeholders that have directly contributed in the last 20 years to the significant advancements in preparing the Neapolitan region for the next eruption. Given the large gaps to be filled, especially with the local community’s risk perception, the hosting of the next CoV in Napoli represents a significant opportunity for the City of Napoli and the entire region to direct the attention of the population, media, city authorities, managers and planners towards the volcanic risk issue.

The proposed program includes a wide range of pre- and post-conferences excursions that will enable participants to visit and discuss in detail other Italian areas affected by volcanic risk, including Etna and the Aeolian Islands.

The venue proposed for the meeting is located inside the Campi Flegrei Red Zone and very close to the INGV - Osservatorio Vesuviano, also giving the meeting attendants the chance to visit the Monitoring System dedicated to the Surveillance of the Neapolitan volcanoes.

Napoli city centre with Somma-Vesuvio in the background; view from the San Martino hill
**Dates**

September 2018, specifically 16-21 September 2018

**Venue of Conference**

*Conference Center Mostra d’Oltremare*

Mostra d’Oltremare was officially inaugurated as the Triennial Exhibition of Italian Overseas Territories on May 9, 1940, by King Vittorio Emanuele III. It was planned by the government as a universal exhibition or world’s fair. The Mostra d’Oltremare in Napoli is one of the main Italian trade fair locations and, together with the Fiera del Levante in Bari, the largest in Southern Italy. It covers an area of 720,000 sqm including buildings of historic and architectural interest, as well as most modern exhibition pavilions, fountains (including the monumental fountain dell'Esedra), a tropical aquarium, gardens with a large variety of tree species and an archaeological park.

Inside the Mostra d’Oltremare area is the *New Oltremare Conference Centre (Palacongressi Oltremare)*, divided into a total area of 6000 sqm (including storerooms and service areas), as well as about 5000 sqm of open space available for events. The main central body of the building facing the garden houses the user services area on the ground floor: reception areas, cloakroom, luggage deposit, secretarial rooms; the remaining open spaces are designated for the exhibition (sponsor areas). The two connecting areas symmetrically located at the entrance foyer give access to the various conference halls, varying in size. In the northern section of the building they are arranged on two levels; the multi-purpose hall with its capacity of 500 seats is located in this section, and can also be used for light lunches. The *Auditorium Europa*, with a capacity of up to 1200 seats, is located on the left side of the entrance.

The Mostra D’Oltremare is located in the Fuorigrotta quarter of Napoli: the area is connected with the rest of the city via the integrated transport system. Detailed maps and more information on the Mostra d’Oltremare Conference Centere are provided in **Appendix 1**, and on the web site (*www.mostradoltremare.it*).
Transport options for international attendees

Napoli is the largest city in southern Italy and is connected to the rest of Italy and to foreign countries through a broad network of communications.

Napoli International Airport, called Aeroporto Capodichino, is located 7.5 Km north of Napoli. Buses with stops at Piazza Garibaldi and Piazza Municipio are frequent. Taxis are available outside the arrivals hall. It is the largest airport in southern Italy, with around 140 national and international flights arriving or departing daily (www.aeroportodinapoli.it).

The city's main railway station is Napoli Centrale, located in Piazza Garibaldi; other significant stations include the Napoli Campi Flegrei and Napoli Mergellina. Napoli' streets are notoriously narrow (it was the first city in the world to set up a pedestrian one-way street), so the general public commonly use compact hatchback cars and scooters for personal transit. Since 2007, Napoli has been connected to the main Italian cities by a high-speed railway run by Treno Alta Velocità, with trains running at almost 300 km/h (186 mph), reducing the journey time to about 1 hour to Roma, less than 3 hours to Florence and about 4 and half hours to Milan (www.trenitalia.com; www.italotreno.it).

The port of Napoli runs several public ferry, hydrofoil and SWATH catamaran services, linking numerous locations in both the Neapolitan province, including Capri, Ischia and Sorrento, and the Salerno province, including Salerno, Positano and Amalfi. Services are also available to destinations further afield, such as Sicily, Sardinia, Ponza and the Aeolian Islands. The port serves over 6 million local passengers annually, plus a further 1 million international cruise liner passengers. A regional hydrofoil transport service, the "Metropolitana del Mare", runs annually from July to September.

Napoli is served by several major motorways (it: autostrada; www.aiscat.it). The Autostrada A1, the longest motorway in Italy, links Napoli to Milan. The A3 runs southwards from Napoli to Salerno, where the motorway to Reggio Calabria begins, while the A16 runs east to Canosa.
A16 is nicknamed the *autostrada dei Due Mari* ("Motorway of the Two Seas") because it connects the Tyrrhenian Sea to the Adriatic Sea. Napoli has an extensive public transport network, including trams, buses, funiculars and trolleybuses, most of which are operated by the municipally owned company Azienda Napoletana Mobilità (ANM; www.anm.it). Three public elevators are in operation in the city – one within the bridge of Chiaia, one in via Acton and one near the Sanità Bridge. The city furthermore operates the Napoli Metro, an underground rapid transit railway system which integrates both surface railway lines and the city's metro stations, many of which are noted for their decorative architecture and public art. Suburban rail services are provided by Trenitalia, Circumvesuviana, Ferrovia Cumana and Metronapoli.
Volcanism in the Neapolitan area

The Neapolitan volcanoes are located within the Campanian Plain which is bordered by the Southern Apennines (Fig. 1) and they are mostly related to Quaternary extensional tectonic phases. The Apennines mountain chain is made up of Mesozoic carbonate and Mio-Pliocene terrigenous sequences, overlain by Quaternary continental deposits, including volcanic sediments. The Campanian Plain, in which lie the active Neapolitan volcanoes, made up of a sequence of Plio-Quaternary sediments, mostly continental and subordinately marine, intercalated with volcanic deposits. It is underlain by a graben formed during activation of NW-SE and NE-SW trending normal faults which, at least during Quaternary times, have downthrown the western Apennines. The regional stress regime, leading to the formation of the plain, has also favored the generation and ascent of the magmas that have fed recent and active alkaline volcanism. The active volcanoes of the Neapolitan area, within the Campanian Plain, are the Campi Flegrei (Phlegraean Fields, literally ‘burning fields’) and the Somma-Vesuvio. A third active volcanic field is the island of Ischia, located 20 km to the south-west of the city of Napoli, at the north-western corner of the gulf of Napoli. Between Ischia and the Campi Flegrei is the island of Procida, another volcano whose last eruption occurred about 18 ka bp. The majority of the volcanic rocks in the continental portion of the Neapolitan area have been generated by Campi Flegrei and Somma-Vesuvio volcanic systems, only very few by the Ischia volcano. Deposits related to the long history of human inhabitation in the area are also widespread.

Fig. 1. Geological sketch map of the Campanian Plain (from Vitale and Isaia, 2014).

The city of Napoli partially lies, with its western sector, within the still active and restless Campi Flegrei caldera, while its eastern periphery is at the foot of the western slopes of Somma-Vesuvio. The two volcanoes, separated by the Sebeto alluvial plain, are very different. The Somma-Vesuvio is a strato-cone 1,281 m high and visible from all the Campanian area, while the Campi Flegrei is a more complex caldera system, composed of many hills that are either remnants of volcanoes predating the main caldera collapses or younger monogenetic volcanoes.
Vesuvio is a young volcanic cone that has built up within the caldera of an older edifice, the Mt. Somma developed mostly in the last 20 ka.

The Somma-Vesuvio volcanic history is characterized by long periods of repose/inactivity with obstructed closed conduit, interrupted by violent explosive eruptions of either Plinian (Volcanic Explosivity Index, VEI=5) or Sub-Plinian (VEI=4) type. Four Plinian eruptions occurred between 18.3 ka and the year 79 AD (the famous Pompei eruption described by Pliny the Younger) (Fig. 2) and each produced a collapse that modified the dimensions and shape of the Mt. Somma summit caldera. Plinian eruptions were preceded by repose periods lasting from several centuries up to nearly one thousand years (Cioni et al., 2008 and reference therein); shorter but still very long were the repose periods preceding the Sub-Plinian events (about 500 years before the last of these eruptions occurred in 1631). Two Sub-Plinian eruptions occurred in historical time, after the Plinian Pompei event of 79 AD: the so-called Pollena eruption in 472 AD and that of 1631. Plinian and Sub-Plinian events were characterized by the same eruptive and syn-eruptive phenomena but differ for both volume of the emitted magma and energy of the eruptions, that are lower for the Sub-Plinian. Both kinds of eruptions emitted evolved potassic tephro-phonolitic or phonolitic magmas from compositionally zoned shallow magma chambers (Cioni et al., 1998 and references therein). In all Plinian and Sub-Plinian events the eruption begins with a phreatic or phreatomagmatic vent opening, followed by a sustained eruptive column with widespread downwind ash fallout (mostly toward the eastern sector) and then by a column collapse phase generating pyroclastic flows. Dangerous lahars, with flooding in some morphological lows, are generated by rain mobilization of loose ashes on the steep slopes of the cone and the Apenninic relieves.

After the occurrence of a major Plinian or Sub-Plinian eruption, the volcano usually begins a new phase of activity. This is characterized by an open conduit, high frequency of eruptions of basic magmas producing lava flows with associated subordinate explosive events (VEI up to 3), some of which generated by explosive magma-water interaction (Cioni et al., 2008 and references therein). After the last Sub-Plinian eruption of 1631, Vesuvio underwent such an open-conduit phase that lasted until 1944. Since then the volcano has been in a new phase of quiescence.

Fig. 2. The inhabited area around Vesuvio volcano in a 3D perspective view from West; DTM overlaid with digital color orthophoto (Laboratory of Geomatics and Cartography, INGV-OV)
The Campi Flegrei volcanic system was active from more than 80 ka, and is currently characterised by an irregular landscape including different volcanic landforms, plains, lakes, and coastline (Fig. 4).

The main volcanological feature is a caldera structure formed during the two main events of the Campanian Ignimbrite (e.g. Fisher et al., 1993; Rosi et al., 1996; Giaccio et al., 2008; Costa et al., 2012) and Neapolitan Yellow Tuff eruptions (Orsi et al., 1992; Scarpati et al., 1993) occurring at 40 and 15 ka, respectively. During the last 15 ka, within the caldera several volcanic edifices were built up and destroyed as the result of about 70 eruptions. Volcanism was mainly concentrated in discrete periods which alternate quiescence periods of variable lengths (Di Vito et al., 1999; Isaia et al., 2009). Eruptions often occurred in short time intervals, varying from a few decades to centuries. After about 3,400 years of rest the last eruption of Monte Nuovo occurred in 1538 AD (Fig. 5).
The volcanic activity at the Campi Flegrei was mainly explosive with phreatomagmatic and magmatic eruptions while only few effusive events were recorded. During the last 15 ka, only two high-magnitude eruptions occurred, while medium and low magnitude events were predominant. The magnitude variability of the events are testified by the differences in deposits areal distribution and volume of emitted magma, which only during the high magnitude eruptions exceeded 1 km$^3$ (Orsi et al., 2004; Smith et al., 2011).

The sites of the eruption vents have changed over time, with the more recent one largely in the central-eastern sector of the caldera. Contemporaneous eruptions within the two different sectors were also recorded (Isaia et al., 2009; Pistolesi et al., 2016). The emitted magmas were trachytic in composition except for a few latitic and trachybasaltic products (e.g. D’Antonio et al., 1999). The eruptions were generally dominated by phreatomagmatic explosions alternated with magmatic phases and minor Strombolian events, which represented as the ending phase of more powerful eruptions. Pyroclastic density currents were generated during the phreatomagmatic events and formed deposits whose areal distribution was related to the eruption magnitude and vent location. Tephra fallout followed the magmatic phases, dispersed products mostly downwind toward the East, from Plinian and sub-Plinian columns, and in variable directions, though prevailing northeast, from low eruptive columns.
The caldera was affected by ground deformation phenomena that led to a total uplift of about 100 m in its central part, during the last 12 ka. Recent slow ground movement events, called bradyseisms, have occurred periodically. The significant unrest crises of 1970-72 and 1982-84, accompanied by hundreds of earthquakes and 3.5 m of ground uplift, forced the inhabitants of Pozzuoli to be evacuated. An ongoing unrest phase, mostly involving the central sector of the caldera, has prompted the Civil Protection to move the Campi Flegrei volcano from base level (green) to warning (yellow) alert levels from the end of 2012.

**Volcanic hazard and Risk in the Neapolitan area**

The active volcanoes in the Neapolitan area may produce effusive and explosive eruptions, the latter being associated with higher hazard. The most severe risk in the foreseeable future arises from pyroclastic flows associated with a sub-Plinian eruption involving the ejection of a large ash column with partial collapses. Pyroclastic flows are considered so destructive that the only countermeasure is a complete evacuation of the risk zone at the very onset of the volcanic crisis and before the eruptive phase occurs. In addition, ash fallout may cause the collapse of the roofs in the urbanized area around the volcanoes. At this latitude, stratospheric winds mostly blow eastward. This considerably reduces the hazard of ash fallout in Napoli in the event of an explosive eruption of Vesuvio, this volcano being located in the eastern sector of the city. However, Napoli is highly exposed to ash fallout produced by an eruption of Campi Flegrei, located in the western sector.

Several stratigraphic studies of the deposits of Vesuvio and Campi Flegrei, have enabled estimating the occurrence probability of the different sized eruptions, ranging from lava flows to sub-Plinian and Plinian eruptions. It is however worth noting that the monogenic nature of the past Campi Flegrei eruptive vents, introduces additional uncertainty in the location of the future eruptive vent inside the Campi Flegrei caldera.

This knowledge, coupled with numerical simulations of different eruptive scenarios, formed the basis for the hazard maps from pyroclastic flows, lahars and ash fallout of the Neapolitan area. It was adopted by the Civil Protection in Italy in order to define the emergency plan, the hazard zones and the appropriate countermeasures.

The vulnerability of the Neapolitan area is another important parameter making the volcanic risk extremely high. Moreover, the vulnerability of the buildings increases with the earthquakes and ground deformations associated with the volcanic eruptions. In the Neapolitan area, there is an extraordinary range of building types that have been developed over many centuries. These have generally made use of the volcanic rocks and soils, and adopted forms that are suited to the climate, the economic conditions and the available building technology of the period. The older buildings have undergone a process of continuous adaptation to changing economic and social needs. In the second half of the 20th century, the Neapolitan area experienced a period of rapid industrial development and a substantial increase in the number of buildings constructed on the volcanic areas. In particular, until the beginning of the last century, most of the buildings were no more than three storeys high and built using rubble stone masonry for the walls. Later, there was a gradual decline in rubble stone masonry in favour of cut-stone masonry and, eventually, reinforced concrete, but building heights did not increase. However, in the second half of the last century, the dramatic increase in population created a huge surge in building, mainly in apartment blocks, up to 10 storeys in height. Clearly, this also augmented the vulnerability to earthquakes and, in general, volcanic risk in the area. Recent studies, based on stratigraphic data from past volcanic events,
numerical simulations of pyroclastic flows and ash fallout, and analysis of the vulnerability of the different types of building, have allowed compiling detailed maps for the volcanic and seismic impact in the Neapolitan area.

Due to the uncertainty of the expected events and the high population density in the Neapolitan area, the hazard and risk maps and the Emergency Plans are extremely critical. Continuous updates are needed to take account of the scientific progress and the evolution of cities. It was estimated that about 680,000 people living in the “red zone” of Vesuvio (25 municipalities of the Vesuvian area and 3 quarters of Napoli), the zone subject to hazard from pyroclastic flows and heavy fallout and 500,000 people living in the “red zone” of Campi Flegrei (7 municipalities and 11 quarters of Napoli), the zone subject to hazard from pyroclastic flows. Both these areas are at the highest risk and need to be evacuated in case of a volcanic crisis. In addition, about 3 million people live in the so-called “yellow zone”, subject to ash fallout that may cause roofs to collapse.

The National Emergency Plans for Vesuvio and Campi Flegrei have recently been updated by the Dipartimento della Protezione Civile in collaboration with the Campania Region, based on the recommendations of the scientific community. In particular for Campi Flegrei, the red zone, which must be evacuated in case of resumption of the eruptive activity, was redefined. Also the yellow zone, namely the area outside the red zone exposed to significant fallout of volcanic ash and pyroclastic materials, has now been delineated. The Vesuvio Emergency Plan is also continuously updated, since the first version dating back to 1995.
Figure 6 gives an example of the recent changes in the risk zoning at Campi Flegrei carried out by the Civil Protection authorities on the basis of the inputs received from the scientific community, particularly those produced by the “Eruptive scenarios and alert levels” working groups established in 2009 by the Dipartimento della Protezione Civile. The most relevant outcome is the significant widening of the red area with the inclusion of new municipalities and a larger sector of Napoli. Alongside the activities for updating emergency plans, Civil Protection authorities together with the scientific community and local authorities have carried out risk mitigation initiatives with the involvement of the local community. Information campaigns and simulation exercises have been organized to educate and instruct citizens and test the organization and intervention models in order to improve emergency planning effectiveness. The Osservatorio Vesuviano, in collaboration with
the Dipartimento della Protezione Civile promotes education initiatives to disseminate knowledge of volcanic risk and the emergency plans, as well as on behaviour guidelines during a crisis. Other training projects have been addressed to specific stakeholders who are directly involved in the development of civil protection plans and emergency management and who have the chance of becoming, during a future crisis, authoritative interlocutors for the citizens.

**Strategy to focus on cities and on volcanic risk mitigation**

The UN declaration of the 1990s as the International Decade for Natural Disaster Reduction was in recognition of the growing vulnerability of human populations to extreme natural hazards. The most recent Sendai Framework for Disaster Risk Reduction 2015-2030, adopted by UN in 2015, extends such a message and identifies the key challenges and actions needed for an effective disaster risk reduction. Although historically volcanic eruptions have not caused deaths on the same scale as earthquakes, windstorms or floods, the potential for great loss of life and economic disruption has become a reality with the rapid growth of human settlements in the vicinity of many of the hundreds of explosive volcanoes that exist around the world.

The volcanic environment is a very dynamic system, which undergoes rapid and sometimes dramatic changes that involve a profound re-moulding of its physical surface. Volcanic events, however, can represent an extraordinary tool for reconstructing the history of human settlement, highlighting a dynamic framework of coexistence between human communities and volcanoes. The Neapolitan region has witnessed human settlement since prehistoric times, and since then people have coexisted with eruptions of varying energy and territorial impact, alternated with prolonged periods of quiescence. Vesuvio and Campi Flegrei, as well as Ischia island, are outstanding examples of integration between volcanic activity and human environment. Vesuvio, close to the city of Napoli, is probably the most famous volcano worldwide. The eruptive history of Somma-Vesuvio is a unique case of interaction between past and present human activity and volcanic eruptions, even experiencing several of Plinian or sub-Plinian scale. These include the Avellino Eruption at 3.9 ka (Di Vito et al. 2013,) the AD 79 destruction of Pompeii and Herculaneum (Sigurdsson et al., 1985; Gurioli et al., 2005; Zanella et al., 2007), the AD 472 Pollena eruption (Grattan, 2006 and references therein), and the 1631 eruption. This 1631 eruption impacted highly also on cultural and scientific thinking, leading to the birth of the Grand Tour and the founding of the first volcano observatory in the world. The quiescence since the last 1944 eruption and the plugging of the volcanic crater are creating conditions that may favour an explosive event when Vesuvio next erupts.

Moreover, since 1995 Vesuvio has been declared a National Park for its extraordinary geological and historical value, with hundreds of thousands of visitors each year. Similarly, the caldera of Campi Flegrei, north-west of Napoli, is the most active caldera in Europe having undergone more than 70 eruptions within the last 15 ka (Smith et al.2011, and reference therein). Activity started more than 80 ka B.P. and includes the generation of the large caldera-forming Campanian Ignimbrite eruption (CI, ~40 ka B.P.) and the second major caldera-collapse eruption of the Neapolitan Yellow Tuff (NYT, ~15 ka B.P.). The most recent eruption was that of Monte Nuovo in 1538 A.D. (Guidoboni e Ciuccarelli, 2011) In recent decades, Campi Flegrei has shown significant deformation phenomena in the central part of the caldera with an uplift of several tens of meters from the sea bottom. Several bradyseismic crises have significantly impacted the
Campi Flegrei territory as well as the resident communities. In particular, the two most recent major ground deformation events occurred in the 70’s and 80’s, with a total uplift of 3.5 meters, forcing residents of Pozzuoli to evacuate and be permanently relocated. Since then, the caldera surface has been slowly subsiding, with intermittent though significant uplift episodes. While Vesuvio is not currently showing any sign of impending eruption, Campi Flegrei is an unrest caldera, undergoing significant ground deformation, hydrothermal and seismic activity.

Due to the high volcanic hazard and the densely populated urban context, the Neapolitan volcanic area has been the terrain to develop complex risk mitigation strategies aimed at emergency planning. Such outcomes are the result of very close collaboration between the Dipartimento della Protezione Civile, Regione Campania, INGV and particularly the Osservatorio Vesuviano and the entire national volcanological community. This cooperation has been an open laboratory where relationships among the various institutional authorities involved in volcanic risk mitigation, as well as between them and the population at risk, have progressively grown stronger.

Particularly relevant too are the more recent efforts in investigating the social aspects of volcanic hazard and the early warning system development, both devoted to augmenting the resilient response to volcanic risk.

We therefore believe that the Neapolitan area represents an excellent test-case to study the major challenges that high-risk volcanoes pose to our modern society and to plan the best way forward for safer coexistence. The possibility to host the 10th edition of Cities on Volcanoes in the same city that hosted the very first meeting is a unique opportunity to bring the international community together to discuss the results of 20 years of research and ideas. An ideal location for fruitful discussions on hazard related studies, monitoring systems, interaction between scientific community and stakeholders, probabilistic mapping of multi-hazards, implementation of complex emergency plans and importantly the involvement of local population.
Updated National Emergency Plan for Vesuvio (above) and Campi Flegrei (below)
(www.protezionecivile.it)

Program

The proposed CoV10 at Napoli will develop themes that are closely related to the objectives of The Science and Technology Roadmap to Support the Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 (https://www.unisdr.org/files/45270_unisdrscienceandtechnologyroadmap.pdf). The proposed scientific program is therefore designed to discuss the progress and delineate future development to fulfil the expected outcomes, actions and deliverables indicated in those documents, with specific application to volcanic risk reduction strategies.

Symposium 1: Multi-disciplinary approaches to improve the understanding of volcano dynamics and hazards

Suggested Topics:

- Volcanic processes: magma transport, storage and eruption
- Bridging the long term field geology-based record with the short term monitoring-based record
- Time and length scales of precursors and unrest phase
- Eruptive scenarios, occurrence probabilities and mapping volcanic hazards and their uncertainties
- Hazard on Volcanic Islands
- Hazard for mass movements in volcanic and peri-volcanic areas
Symposium 2: Assessing and managing volcanic risk
Suggested topics:
  • Risk mitigation strategies: understanding local and specific requirements and public involvement
  • Communicating volcanic hazards and risk, and the relationships with knowledge and responsibility
  • Volcanic emergency and false alarms
  • Leadership and coordination mechanisms
  • Learning from past experiences: post-eruptive reviews and sharing best practices and failures

Symposium 3: Cities on Volcanoes: enhancing preparedness and resilience
Suggested topics:
  • Impact of explosive volcanic activities and human resilience Best practices in “Build Back Better”
  • This is my volcano! Learning to love and respect our territory as a practice to enhance relationships man vs. volcanoes
  • Volcanoes as resources: Geothermal exploration, Geotourism and Geoparks
  • Volcanic hazard/risk and Media

The symposia will be preceded by plenary speakers on the symposia themes

Workshop
To be held either before or after the meeting

“Best practices for volcano observatories - Towards an international reference for volcanic hazard forecasts and communication standards”
The goal is to contribute to developing an international framework for best practices to be adopted in the daily activities of the volcanological observatories; respecting cultural differences, social and economic differences between countries concerned. The VOBP workshop is a joint project of USGS and INGV with additional support from USAID and IAVCEI and endorsement by GEO and UNESCO, and was already held for three editions

"Educational activities and Outreach exchange"
This workshop is addressed to anyone interested in education, outreach, information and communication of volcanic hazard and risk. The purpose is to provide a forum where recently developed outreach products, educational projects, teaching activities, educational videos, webpage models, new ideas, etc. will be presented and shared for discussion. Furthermore, the workshop will help promote educational activities developed for teachers and students in one country being tested in another country, during the school year. Results will be presented and discussed in the workshop.
Parallel scientific programme

In order to extend the impact of COV10 in the Neapolitan volcanic area, we promote the interaction between scientists attending the conference and resident communities. In particular, we intend to develop initiatives devoted to

Interacting with the education system:
- Meetings for teachers, researchers and students on scientific topics connected with volcanoes, also in order to share and evaluate educational approaches and activities focused on volcanic hazard and risk.
- Meetings to present and share outcomes from projects developed ad hoc by schools, in particular from Ischia Island, focused on both volcano hazard and the volcano as a resource.
- Outreach activities in collaboration with the Science Centre “Città della Scienza” located in Campi Flegrei, for audiences ranging from science teachers to the wider public, and that could also be presented during the annual event “Three days for School”.

Interacting with the local community:
- Events like exhibitions / video projections themed Volcanoes of the World, set up in public spaces, also simultaneously
- Public meetings (e.g. municipal libraries, Vesuvio National Park, outdoor public spaces, etc.) with Italian researchers/DPC/local administrators, archaeologists, etc. to highlight topics such as geo-archaeology, volcano-resources, geotourism etc. in order to promote how to "recognize" the signs and the presence of the volcano in everyday life

Interacting with local civil protection representatives and operators
- National and Regional Civil Protection Authorities has to support the Municipalities of Campanian volcanic area to improve best practices in the management of volcanic risk. Meetings and social events will be organized to present examples of emergency planning and risk mitigation actions, developed by the Municipalities of both red areas of Vesuvio and Campi Flegrei. The initiative will mainly encourage the mayors of the red areas municipalities to promote actions on enhancing the citizens' awareness of the impending risks in their territory, acquaintance with the emergency planning and the dissemination of behaviour guidelines in case of an evacuation. The challenge of this initiative should be to stimulate the active participation of the community, highlighting the role of different stakeholders to support future actions in preparing or updating the emergency plans. To help foster a new sensibility towards understanding, preventing and mitigating volcanic risk in Campania Region, a special award will be offered to the most effective example of emergency plan carried out by the Municipalities.
Field Trips

- Pre-meeting

*The city of Napoli and its active volcanoes (4 and half days)*

Two of the most famous active volcanoes in the world surround the city of Napoli, the Somma-Vesuvio stratocone and the Campi Flegrei caldera. Both volcanoes have been characterized by prevailing explosive volcanism, though resulting in two different volcanic systems. The Somma-Vesuvio, east of Napoli, is made up of an older volcano, Mt. Somma, truncated by a summit caldera, and a more recent cone, Vesuvio, within the caldera. The caldera is a complex structure resulting from several collapses, each related to a Plinian eruption (Cioni et al., 1999). The growth of the Vesuvio cone occurred, though with some minor summit collapses, during periods of persistent low-energy open-conduit activity, the last of which occurred between 1631 and 1944 (Arrighi et al., 2001). The history of the volcano has been characterized either by long quiescence periods, interrupted by Plinian or sub-Plinian eruptions, or by periods of persistent volcanic activity, with lava effusions and Strombolian to phreato-magmatic eruptions, related to the alternation of closed and open conduit conditions, respectively. Driving along the southern slopes of Somma-Vesuvio gives a good introduction to the geology of the volcano, looking directly over the caldera depression and its steep walls deeply cut by dykes and partially filled by the lava flows of the last 1994 eruption. Once reaching the top of the Vesuvio cone, it will be possible to discuss the last eruption of Vesuvio in 1944 and the evolution of the crater after the 1906 eruption. Here one may have a complete view of the intense urbanization around the volcano and discuss volcanic hazard and risk. These topics could be addressed in greater detail during the subsequent visit to the Vesuvio Observatory historical building, the oldest volcanological observatory in the world, and today hosting a museum. In an old Vesuvian quarry the visitor can see proximal pyroclastic sequences showing the main characteristics of pyroclastic density current, fallout and lahars deposits of Plinian and Subplinian eruptions. During the visit to archaeological excavation sites, destroyed by the A.D. 79 Pompeii eruption, we will address the main problems related to Vesuvio’ explosive activity, and the different effects on inhabited areas related to pyroclastic fallout and pyroclastic flow activity.

The itinerary in the Campi Flegrei caldera, starting from the Camaldoli hill (457 m asl), allows observing some of the main volcanic structures and to discuss the volcanic history of the Campi Flegrei. From this point, it is possible to observe the high-angle slopes that represent the edge of the Campi Flegrei caldera. At the base of the scarp, it is possible to see the Piperno and Breccia Museo deposits of the Campanian Ignimbrite caldera forming eruption which are overlaid by younger pyroclastic deposits then mantled by Neapolitan Yellow Tuff, the second large caldera forming eruption. Several sites will be visited to observe and discuss the post caldera volcanism, including outcrops of pyroclastic density currents and fallout deposits of the youngest Agnano-Monte Spina plinian eruption and Astroni tuff ring eruptions. In this sector of the caldera, we will also observe different preserved volcano edifices and volcano tectonic structures, such as the smaller Agnano caldera. A visit to the Solfatara volcano will be centred around both the activity and structure of this maar-diatreme volcano and the fumarolic and hydrothermal active field hosted inside the crater and on its flank. The several diverse monitoring stations at Solfatara provide an opportunity to illustrate the surveillance network of the INGV-OV for the Neapolitan volcanoes and discuss prediction
strategy on active volcanoes. On the western sector of the caldera, the trip takes in a visit to the Averno lake, the crater of an eruption occurring contemporaneously with the Solfatara, and a climb up the Monte Nuovo cone formed during the last eruption at Campi Flegrei (1538). The remnants of the Serapeum Roman market and the Pozzuoli harbour, are the best examples where the ground movements at Campi Flegrei, renowned as bradyseismic phenomena, are recorded. These sites will enable discussing ground deformation dynamics, caldera unrest and to focus on the possible future eruption scenario and the risk related to a possible resumption of eruptive activity at Campi Flegrei. A half-day boat trip in the Gulf of Napoli and Pozzuoli, will provide a wide view from the sea of the volcano tectonic structure of the entire volcanic field of Campi Flegrei. This is a fine opportunity to point out the land-sea geological reconstruction and mapping of the area as well as the relationships with the activity of Ischia and Procida volcanoes.

During the field trip, both at Vesuvio and Campi Flegrei, selected sites will be visited for the presentation and discussion of initiatives carried out on the territory by local authorities (e.g. Campania Region, Municipality etc.) and schools on the prevention of natural risks and risk mitigation actions.

Field and monitoring data to reconstruct the eruptive activity of Mount Etna and its impact on the urban area (3 days)

Mount Etna is a persistently active volcano that, for its continuous explosive and effusive eruptions, as well as for the important terrestrial ecosystems and the unique quality of the landscape, has been a UNESCO world heritage since 2013. This volcano, close to the city of Catania, is surrounded by densely populated areas and for this reasons it is one of the best monitored in the world.

The field trip sets out to describe the main volcanological features of the most recent eruptions which are exposed in the summit region where the active craters are located, as well as to provide a summary of Mount Etna activity in the last hundreds of thousands of years, shown in the stratigraphic successions outcropping in the Valle del Bove.

After this overview of the recent and past activity of the volcano, the field trip will focus on describing the impact of volcanic activity on human activities. To this end, after analysing the structure of a multiparametric monitoring station located in the summit area, the control room of INGV-OE in Catania will be visited. Here, real-time data sets are managed to provide rapid and useful information of ongoing eruptive activity to the Italian Civil Protection and Aviation. The last part of the field trip seeks to show the impact of the most destructive flank eruption of historical times, occurring in 1669. The 1669 lava field, which covered about 40 km² and reached a maximum length of 17 km, destroyed several villages and part of Catania, determined the subsequent expansion of the city, and caused considerable economic damage. Accordingly, the
knowledge of such a huge eruption provides key information to evaluate how to manage a hypothetically similar event today. The itinerary will show how the 1669 lava flow has impacted the monumental edifices of the city of Catania (Ursino Castle and Benedictine Monastery) and the low SE flank of the volcano (old church of Misterbianco village). Nevertheless, the 1669 lava flow also represented a refuge for the population of Catania during the Second World War, when the air-raid shelters built at its base allowed people to take shelter from bombardments.

Summit craters of Etna, 26 October 2013 - Strombolian activity at the New South-East Crater and ash emission at the North-East Crater.

- **Intrameeting (1 day)**

*The Campi Flegrei caldera, post caldera volcanism and Bradyseism from Roman times to the present*

The Campi Flegrei is an active volcanic field that started its eruptive activity at least 80,000 years ago with several monogenetic volcanoes, in the form of tuff rings, tuff cones and rarely lava domes, exposed outside, on the edges, and within a large caldera formed mainly during the large eruption of the Campanian Ignimbrite (40 ka). This eruption, known as the major event of the Mediterranean area over the last 200,000 years, was followed by an intense volcanic activity, with the formation of pyroclastic deposits from several volcanic centres. A second large eruption dates back 15 ka with the emplacement of the Neapolitan Yellow Tuff (NYT), on which much of the city of Napoli was built. Following the NYT eruption, activity within the caldera generated at least 70 volcanic eruptions, concentrated mainly in discrete periods alternating with periods of quiescence of variable length. The eruption of Monte Nuovo in 1538 A.D. was the last eruption of the caldera. The volcanic activity of Campi Flegrei was characterized mainly by explosive eruptions of low and medium magnitude and less frequent effusive events. The location of eruptive vents has changed over time, and simultaneous eruptions in the two different sectors of the caldera also occurred from the Solfatara and Averno volcanoes.
The caldera underwent ground deformation that resulted in a total uplift of more than 100 m in its central part during the last 15,000 years. Even over several decades before the Monte Nuovo eruption, ground uplift had reached several meters. Following the 1538 eruption, Campi Flegrei began a phase of subsidence that continued until 1950. Recently, slow ground movement (bradyseism) has occurred in this area, with two major bradyseismic crises (1970-72 and 1982-84) accompanied by hundreds of earthquakes and 3.5 m of ground uplift, leading to the partial evacuation of the town of Pozzuoli. Different episodes of ‘micro-uplift’ with maximum displacement of a few tens of cm occurred in the last 30 years and are currently underway.

The itinerary in the Campi Flegrei caldera allows observing some of the main volcanic structures, providing an opportunity to illustrate and discuss the volcano history of the Campi Flegrei, the ground deformation dynamics in a resurgent caldera, and the possible future scenario and risk related to an eventual resumption of the eruptive activity at Campi Flegrei. The visit to the active fumarolic field of the Solfatara area, as well as to the Pozzuoli harbour and Serapeo Roman archaeological ruins, will allow discussing in depth volcanic hazards related to unrest episodes and the relationships between unrest episodes and eruptions. There will also be the opportunity to assess from inside the volcano the physical relationship between volcanic and human activities. For example, we may talk about territory zoning, emergency planning and risk mitigation strategy for the Campi Flegrei volcano which includes a large part of the city of Napoli.

Somma-Vesuvio volcanic history and impact of the 79 AD eruption in archaeological excavations

The Somma-Vesuvio is built up from an older volcano, Mt. Somma, truncated by a summit caldera, and a more recent cone, Vesuvio (1281 m a.s.l.), within the caldera. Mt Somma consists of a pile of thin lava flows interbedded with spatter and cinder, cut by a nested, poly-phased caldera structure formed by several collapses related to the main explosive eruptions. About 20 ka ago, the mainly effusive activity of Mt Somma changed to explosive with at least four high-magnitude plinian eruptions, together with intermittent minor events covering a large range of magnitude and intensity. The first plinian event, the Pomici di Base eruption, ejected K-trachytic to K-latitic magmas and was followed by three other plinian events, each preceded by long repose periods: Mercato Pumice eruption (8.0 ka, K-phonolite), Avellino Pumice eruption (3.9 ka, K-phonolite - K-
tephriphonolite), and Pompeii Pumice eruption (A.D. 79, K-phonolite - K-tephriphonolite). The Vesuvio cone began to form after A.D. 79, growing discontinuously (with minor summit collapses) during periods of open conduit activity, which possibly occurred in the I-III centuries, V-VIII centuries, X-XII centuries and in 1631-1944. High-intensity, explosive eruptions sporadically occurred, the two largest being the subplinian events of A.D. 472 (also known as the Pollena eruption) and A.D. 1631. The most recent period (1631-1944) was characterised by lava effusions and semi-persistent, mild explosive activity (small lava fountains, gases and vapour emission from the crater), interrupted by pauses lasting from months to a maximum of seven years.

An introduction to the geology and the volcanological evolution of the volcano will be possible along an itinerary starting from Napoli to the summit of Mt Vesuvio, driving along the southern slopes of Somma-Vesuvio and inside the Mt Somma caldera. On the top of the volcano the view of the present crater will give an opportunity to describe last eruption of Vesuvio in 1944 and the evolution of the crater after the 1906 eruption. Here, we can take in the wonderful view of the Vesuvio surroundings and shed light on the physical and socio-economical features linked to the volcano activities. At an elevation of 609 m a.s.l.- is situated the Osservatorio Vesuviano, the oldest volcano observatory in the world, founded in 1841 by King Ferdinand II of Bourbon. The historical building of the Osservatorio Vesuviano, today hosts an information centre on volcanic hazards and risk and represents the perfect site to discuss future eruptive scenarios and the emergency plan for the Vesuvian area. The itinerary will be completed by a visit to one the main archaeological excavation sites, the Villa di Poppea in Oplontis, the Herculaneum and the Pompei excavations. During the visit to the sites, destroyed by the A.D. 79 Pompeii eruption, we will address the main problems related to Vesuvio’s explosive activity, and the different effects on inhabited areas related to pyroclastic fallout and pyroclastic flow activity linked to the most renowned Plinian eruption.
Napoli and its volcanic tuffs: cavities and monuments

Millions of people in the world live in cities at risk from volcanic eruptions, mostly for soil fertility and abundance of volcanic rocks which are good building materials. The Neapolitan area has been inhabited for a very long time, as shown by archaeological excavations which have brought to light evidence of the presence of people living in Napoli since Eneolithic times. The development of an organized society in the Neapolitan area began with the settlement of Greek colonies (VI-V century BC).

The landscape of the city of Napoli has been modelled by tens of thousands of years of volcanic activity, largely by high-magnitude caldera-forming eruptions, low-energy cone-forming events and a few lava domes. The volcanic rocks used as building stones in the Neapolitan area are lavas, various types of tuff, mostly Campanian Ignimbrite and Neapolitan Yellow Tuff, and loose pyroclastic deposits. These materials have been extracted from underground and open quarries since the Greek-Roman times.

The aim of this field trip is to illustrate the close relationship between the volcanic history of Napoli and its geology, clearly visible through the underground cavities and urban cultural heritage. The itinerary begins with a visit to Underground Napoli which, since at least 5 ka, represents a parallel urban environment: tombs, aqueducts, air-raid shelters and warehouses are only the main uses of the huge network of artificial cavities carved in the Neapolitan Yellow Tuff. We then come up from the underground world to continue the visit to some of the most important monuments of the Historic City Center of Napoli, inscribed in 1995 in the UNESCO World Heritage list. This will be an occasion to observe architecture ranging from Angevin times (13th century) to the most recent decades and visit outstanding examples built with local volcanic stones, such as Piperno and Neapolitan Yellow Tuff. The excursion also includes a visit to the Royal Mineralogical Museum of the Federico II University, instituted in 1801 by Ferdinand IV of Bourbon and hosted in the ancient Library of the High College of Jesuits. Here, the 46.102 finds are divided into several collections of considerable historical and scientific value, among which the Vesuvian collection, acquired and organized in 1844 by Arcangelo Scacchi, is unique for the variety and number of finds.

Main façade of Gesu’ Nuovo Church (left); Bourbon tunnel (center); Royal Mineralogical Museum - Monumental Hall (right).

- Post-meeting

Aeolian Islands (3 days)

The Aeolian volcanic arc is one of the main geological features in the Mediterranean area. It consists of seven main islands including a number of active (Stromboli and Vulcano) or dormant (Panarea and Lipari) volcanic islands together with extinct volcanoes. Indeed, the Aeolian
archipelago is considered a “type” for the scientific discipline of Volcanology as testified by the definitions of ‘strombolian’ and ‘vulcanian’ styles of eruptive activity. The complex succession of volcanic events, highly variable structural setting and wide range of magmatic compositions at the Aeolian arc enable discussing the nature and timing of volcanic phenomena (such as eruptions, caldera and lateral collapses) and landslides, the origin and evolution of magmas and their relationships to geodynamics and volcanology and the hazard from subaerial and submarine eruptions and collapses in the archipelago and surrounding areas. Implications for volcanic hazard are primarily related to the currently active volcanoes of Stromboli and Vulcano, but also include the hydrothermal field of Panarea and the island of Lipari.

The itinerary will start from Vulcano island, the southernmost of the Aeolian Archipelago. This is an active volcano in a state of solphataric activity since the last eruption (1888–1890), with a broad fumarolic field in the northern part of the island, on the active part of the “La Fossa” crater, and low temperature fumaroles and seawater bubbling in the Baia Levante area. The ascent to the summit craters of the active Gran Cratere di La Fossa cone give us an opportunity to look at and explain the main volcano-tectonic features of this volcano and discuss the volcanic activity and historical eruptions of Vulcano island. A visit to the INGV - Carapezza volcanological center will focus on the volcanic hazard and risk of this volcanic island. Moving on to Lipari, a tour by boat around the island will enable observing and describing the main stratigraphic features of the volcanic succession and its most important volcanic and volcano-tectonic structures. The tour will start from the northeastern coast where the obsidianaceous lava flows and pumiceous pyroclastic products of the Holocene to historic eruptive activity of Lipari crop out. The itinerary will continue with a visit to the museum of Lipari and then transfer to Stromboli Island. This is a strato-volcano that rises from a depth of ~2000 m b.s.l. in the Tyrrhenian Sea with a subaerial portion 924 m high. Stromboli is an open conduit volcano characterized by a persistent strombolian activity that was interrupted in the last decades by effusive eruptions occurring in 1985, 2002, 2007 and 2014. The ascent at sunset to the summit active craters of Stromboli, will allow closely observing the typical strombolian eruptions with their recurrent explosions and gas emission.

La Fossa crater of Vulcano Island with islands of the Aeolian archipelago in the background

**The Neapolitan volcanoes as source for landslides (2 days)**

Since distant historical times, volcanic rocks in Campania have been involved in many types of slope instabilities, which, in turn, have induced a severe threat to the local population. The aim of this field trip is to highlight the main typologies of mass movements characterizing the volcanic
products of the Phlegraean Fields and Somma-Vesuvio, with particular attention to the lithostratigraphic, geomorphological and engineering-geological aspects of the issue. Rock falls from lava domes and lithified pyroclastic deposits make up a large part of the volcanic lithologies of the region. Among these, the Neapolitan Yellow Tuff, Tufi Biancastri and Breccia Museo outcrops make the Phlegraean district, and especially the Camaldoli hill in Napoli, one of the most fitting sites to observe the effects of these phenomena coupled with the outcomes of anthropic intervention aimed at slope stabilization. However, the pumice and ash pyroclastic fall emplaced by the Campania volcanoes within the Phlegraean Fields, on the slopes of the Somma-Vesuvio and in the peri-volcanic areas of the region, undoubtedly represent the main source for mass movements, prevalingly of the flow-like type, usually triggered by intense and prolonged rainfall. In this respect, the so-called “Sarno event”, in May 1998, causing 160 deaths in five foothill municipalities of the region, was the most important episode in recent decades. In the Sarno area, along the slopes of Mt. Pizzo d’Alvano, outcrops of these pyroclastic covers are clearly exposed and may be well worth a field trip to illustrate both the features of the intermediate to distal pyroclastic fall deposits and the triggering and evolution mechanisms of these slope failures. Similarly, good examples of extremely rapid flow-like movements can be found in the Sorrento Peninsula, where the pyroclastic covers are mainly made up of the Plinian phase of Campanian Ignimbrite (ca 39 ka B.P.) and Somma-Vesuvio 79 A.D. eruption fall deposits.

Slide-flows in pyroclastic deposits along the slopes of the Camaldoli hill, Napoli (left) and of Mt. Pizzo d’Alvano (right).

**Ischia volcanic island (3 days)**

The island of Ischia is an active volcano and part of the Phlegraean Volcanic District, which also includes the Campi Flegrei and Procida volcanoes. It is an active resurgent caldera, largely made up of volcanic rocks, epiclastic deposits and subordinate terrigenous sediments. Volcanism on the island began prior to 150 ka and has continued sporadically until the latest eruption in 1302 A.D. The island covers an area of about 46 km$^2$ which represents the emerged top of a large volcanic complex rising more than 1,500 m and dominated by Mt. Epomeo (787 m a.s.l.). Ischia has long been known as the site of intense and widespread hydrothermal circulation, with surface thermal manifestations including hot springs and fumarolic gas emissions. Continuing unrest of the volcano is also testified by the last eruption occurring in 1302 A.D., ground movements in historical times, and seismicity. This state of activity and the explosive nature of the volcanism make the volcanic hazard very high. Ischia hosts a permanent population of ~50,000 that significantly increases
during summer. The presence of a large hydrothermal system makes phreatic explosions an additional potential hazard on the island. Ischia is a good example of a high-risk volcanic island. An itinerary by sea along the coast will allow observing and discussing the, morphostructural evolution of the island and implications with volcano-tectonics. Discussions may focus on a wide range of issues, including a) the coastal differential uplift and recent subsidence, coastal marine terraces, relict morphologies and the suspended hydrography, the archaeological sites; b) the relict caldera morphostructure, type of volcanic edifices, lava domes, ignimbrite deposits ; c) recent geomorphological evolution: debris-avalanches, debris-flows, mud-flows, rock-fall, recent effusive eruptive processes and coastal dynamics and d) the geological, volcanic and coastal erosion risks. The most prominent feature of the island of Ischia, namely the Green Tuff of Epomeo, will be the subject of a second itinerary. The trip takes a route into the heart of the island, where geological, naturalistic, archaeological and historical features make up a unique landscape. Along the way, it will be possible to observe the whole island and fully appreciate the main elements of its morphostructural setting, including: stratigraphy and structural characteristics of the Mount Epomeo succession; typical morphologies due to the processes of weathering and wind erosion; deposits and landform due to slope gravitational processes (landslides, debris-flows, debris-avalanches), geological features derived from the volcano-tectonic processes characterizing the recent evolution of the territory; modifications of the landscape and land use due to anthropic activities. A third itinerary will be dedicated to the most recent period of activity. Volcanism began about 10 ka and has mainly been concentrated in the past 2.9 ka, with almost all the vents in the eastern part of the island. Significant outcrops showing the products of effusive eruptions, emplaced lava domes and high-aspect ratio lava flows, as well as pyroclastic sequences of explosive eruptions, both magmatic and phreatomagmatic, which generated tuff cones, tuff rings and dispersed pyroclastic-fall and -flow deposits, will be visited.

Sequences of older pyroclastic rocks along a sea cliff (left) and the Green Tuff of Monte Epomeo (right)

The Campanian Ignimbrite: the largest eruption of the Mediterranean area in the last 200,000 years
The trachy-phonolitic Campanian Ignimbrite (~39 ka) was emplaced by the largest eruption from the Campi Flegrei caldera and is the largest eruption in Europe in the past 200 ka. The eruption produced a widespread fallout deposit of both Plinian and co-ignimbrite origin and a complex series
of pyroclastic density current deposits with many differences between proximal and medial-distal deposits. A densely welded PDC deposit (Piperno Tuff), a coarse, fines-depleted lithic breccia with spatter bombs (Breccia Museo), and a poorly lithified crystal-rich PDC deposit, is found inside the caldera (underlain by the pumice fallout). The medial to distal deposits are the basal fallout covered by a laterally discontinuous lithic and crystal-rich layer, which in turn is overlaid by the main Campanian Ignimbrite, a lithic-poor deposit with highly vesiculated pumice lapilli that is variably zeolitized according to temperature profiles. Correlation of these deposits has been the subject of several studies that have used stratigraphic, paleomagnetic, and geochemical techniques. Many studies have been made to broaden our understanding of the caldera and the Campanian Ignimbrite. Many questions about the eruption remain, such as the correlation between proximal to medial and distal deposits in different directions around the vent area, the timing of the Breccia Museo eruption within the CI sequence and its relationship with caldera collapse and/or multiple vents, the apparent absence of the main CI in the western and southern sectors of the CF caldera, and the transition between the Plinian and PDC phases of the eruption. Enormous amounts of volcanic aerosols are injected into the stratosphere during these events, affecting regional and possibly global climate. The widely dispersed ash deposit from this “super-eruption” provides geoscientists with important temporal and stratigraphic markers that are invaluable in correlating and establishing the chronology of archaeological and paleoclimate archives. Proximal, medial and distal outcrops will be visited to show the main characteristics of the CI deposit and to discuss the estimation of the key eruption parameters, such as volume, PDCs transport mechanisms, eruption duration, column height, and the tephra dispersal footprint, which have important implications for impact assessment of such catastrophic events. The CI eruption provides an ideal case study for assessing the widespread impact of large eruptions on climate, ecosystems and human populations.

Locations where distal Campanian Ignimbrite tephra is found (red boxes) and the general dispersal area (shaded) [left]; vineyard in an old quarry of Campanian Ignimbrite Tuff [right].

Geothermal resources in volcanic regions and public acceptance: The Roman Geothermal Province (3 days)
Just 100 km north of Napoli a chain of Quaternary and quiescent calderas and stratovolcanoes is the site of one of the largest geothermal regions in the world. These are the Colli Albani, the Sabatini,
the Vico and the Vulsini volcanic complexes which extend around Roma capital city. Geothermal exploration and development in this region faces a highly and historically urbanised territory of incomparable beauty and cultural richness, which has fuelled a controversial relationships between local communities and developers.

The field trip will cross the four Quaternary volcanic complexes and the historical cities of Roma and Viterbo, focussing on the recent volcanic history of each volcano and the characteristics of the associated geothermal systems, highlighting both the potential and the possible hazards. The itinerary include as first day the visit to the beautiful Tuscolo archaeological area located on the caldera rim and perfectly situated for a panoramic overview of the structure and stratigraphy of the volcano. Moving to the Albano maar lake, site of the most recent volcanic activity and of the main manifestations of the active medium enthalpy geothermal system, it will be possible to discuss about present potential and hazards for the metropolitan territory of Roma capital city.

The visit to the Sabatini calderas, located just 50 km north of Roma, allows participants to see the beautiful caldera and maar lakes and observe the maar deposit successions, an ideal spot to discuss the type of geothermal reservoirs and their potential as high enthalpy systems. The nearby Vico caldera will be the destination for the second evening and night. The last part of the itinerary is a trip to the Vulsini calderas (Bolsena and Latera) and thermal areas around the beautifully preserved medieval city of Viterbo. We will visit the abandoned site of Latera geothermal power plant and discuss past and current failures of geothermal exploration and development policies and practices to highlight what we can learn for the future use of geothermal energy in highly urbanised and culturally rich territories.

The field trip includes a visit to the Dipartimento di Protezione Civile of Roma, where it will be possible to see the operations center and discuss the prevention and emergency actions that Civil Defense promotes and coordinates in collaboration with Regional and local Governments. It will also be a chance to learn about the prediction activities carried out with the participation of the scientific community with the aim of assessing risk scenario and mitigation actions.

Hydrothermally altered pyroclastic rocks (left); Roma city centre with Colli Albani volcanoes in the background (right)


Arrangements for logistics and handling of these by the host country:

Napoli, meaning "new city", is the capital of the Italian Campania region and the third-largest municipality in Italy, after Roma and Milan. In 2015, around 975,260 people lived within the city's administrative limits. The Metropolitan City of Napoli had a population of 3,115,320. Napoli is the 9th most populous urban area in the European Union and one of the largest metropolises on the Mediterranean Sea.

Napoli is one of the oldest continuously inhabited cities in the world since the Eneolithic Age Greek settlements were established in the Napoli area in the second millennium BC. The city was refounded as Neápolis in the sixth century BC and became a cornerstone of Magna Graecia, and remained influential after the fall of the Western Roman Empire, serving as the capital city of the Kingdom of Napoli between 1282 and 1816. Thereafter, in union with Sicily, it became the capital of the Two Sicilies until the unification of Italy in 1861.

Napoli was the most-bombed Italian city during World War II. Much of the city's 20th-century periphery was constructed during reconstruction efforts after World War II. In recent decades, Napoli has constructed a large business district, the Centro Direzionale, and has developed an advanced transport infrastructure, including a high-speed rail link to Roma and Salerno, and an expanded subway network, which is planned to eventually cover half of the region. The city has experienced significant economic growth in recent decades, and unemployment levels in the city and surrounding Campania have decreased since 1999.

Napoli has the fourth-largest urban economy in Italy, after Milano, Roma and Torino. It is the world's 103rd-richest city by purchasing power. The port of Napoli is one of the most important in Europe, and has the world's second-highest level of passenger flow, after the port of Hong Kong. Numerous major Italian companies are headquartered in Napoli. The city also hosts NATO's Allied Joint Force Command Napoli, the SRM Institution for Economic Research and the OPE Company and Study Centre. Napoli is a full member of the Eurocities network of European cities. The city was selected to become the headquarters of the European institution ACP/UE and was named a City of Literature by UNESCO's Creative Cities Network.

Napoli's historic city centre is the largest in Europe, covering 1,700 hectares (4,200 acres) and embraces 27 centuries of history, and is listed by UNESCO as a World Heritage Site. Napoli has long been a major cultural centre with a global sphere of influence, particularly during the Renaissance and Enlightenment eras. In the immediate vicinity of Napoli are numerous culturally and historically significant sites, including the Palace of Caserta and the Roman ruins of Pompeii and Herculaneum.

Napoli is a major national and international tourist destination, being one of Italy and Europe's top tourist cities. Tourists began visiting Napoli in the 18th century, during the Grand Tour. In terms of international arrivals, Napoli is among the most-visited city in the world. In the last few years Napoli has become one of the favourite destinations for all those Italian and foreign tourists who love spending their holidays in cities of artistic interest. Unlike cities in which art is stored in museums, Napoli's distinctive trademark is its folklore: culture is very much daily life happening on the streets, with people living and working among the artistic beauties of the city.

Tourism has become a key factor in the city's economy. Buildings, churches, streets, ancient fortresses and castles in the sea, as well as natural caves and places impregnated with mystery and mysticism, all go to make Napoli unforgettable in the minds of travellers.
Over the last few years, the quality and range of hotels and other accommodation on offer in Napoli has achieved new levels of excellence. New hotels and other forms of accommodation are being registered and categorized all the time, and these are all professionally run, competent businesses that work hard to respond to the needs of an ever-more demanding clientele. These range from American style chain B&Bs to 3 star hotels, from tourist villages with restaurant service to youth hostels and from the big luxury hotels to the more intimate bijoux ones. If you want to stay in Napoli you really can ‘at any price’! A list of Hotels in Napoli is presented in Appendix 2.

In Napoli initiatives and projects are promoted for Accessible Tourism, creating “tourist and cultural itineraries for people with disabilities”. By "Accessible Tourism" the Peepul Association means "Tourism for EveryOne", in other words, a tourism for those who suffer from motor, sensory and cognitive disabilities, for all those people with special needs, for the elderly and those who have to follow special diets. By "Tourism for EveryOne" we mean any urban and suburban itinerary of everyday convenience or place of historical, cultural and touristic interest. These itineraries are made possible thanks to special carers trained to help people with any type of disability.

More information about the city of Napoli, its facilities and its hospitality services can be obtained from the website of the municipality of Napoli (www.comunedinapoli.it).

Potential sponsorship

Comune di Pozzuoli
Riserva Naturale - Oasi WWF - Cratere degli Astroni
Federalbergatori Isola d’Ischia
Platypus Tour
Slow Food Ischia e Procida

Preliminary estimates of the registration fees

The registration fee expected for each participant is 500 Euros

National Committee

Chairman: Dr. Roberto Isaia

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