Vesuvio

Alternative name: Vesuvius/Somma-Vesuvius

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Last Updated: November 26 2021

Short Description

Vesuvius is one of the three active volcanoes of Campania (south Italy). This is a strato-volcano less than 39,000 years old and completed its first phase of activity, dominated by lava flows and low-energy explosions, about 22,000 years ago. The volcano has since generated 4 Plinian eruptions with VEI 5-6, each preceded by long periods of quiescence and all accompanied by summit caldera collapses (Somma caldera), and several less energetic explosive events, including sub-Plinian to Strombolian and effusive events. The last Plinian eruption was the eruption of 79 BC and once again modified the Somma caldera, inside which the recent cone has subsequently grown due to an alternation of periods of persistent Strombolian and effusive activity. In historical times the other more energetic events have been the sub-Plinian 'Pollena' (472 BC) and 1631 eruptions. The last eruption occurred in 1944. The rocks composition vary from slightly silica-undersaturated (K-basalt to K-trachyte) to highly silica-undersaturated (K-tephrite to K-phonolite).

The eruptions of Vesuvius presented in the Eruption Search section of the catalogue are selected on the basis of major events like Plinian and sub-Plinian eruptions, and other relevant open conduit events, as for the importance they had. The catalogue includes eruptions of the past 4 ka.

Central Volcano

Parameter	Parameter info
Lat, lon:	40°48´N, 14°25´E
Elevation (m a.s.l.):	1281
Type:	Stratovolcano with summit caldera
Summit ice cover:	No
Dominant type of activity:	Violent Strombolian (VEI 3) to Subplinian (VEI 4)
Magma type:	K-trachyte to K-phonolite
Known precursors:	Anomalous seismicity, ground deformation, gas emission, opening of fractures
Expected precursors:	Anomalies respect to the background of the geophisical and geochemical parameters
Eruption characteristics:	null
Type of products:	Pyroclastic fallout and pyroclastic density currents, lava flows, debris flows
Volcanic Explosivity Index:	Max: 5-6; most freq: 3-4; min: 1-2
Column height:	From few km to 30 km

Parameter	Parameter info
Duration of eruptions:	From days to years
Bulk volume tephra (km3):	Max 4.4; Med 0.1-1.0; Min 0.01.
Fallout beyond 1000 km:	Two in the past 2000 years
Tephra <63µm at 30 km:	null
Bulk volume lava (km3):	Max: ~0.03; min ~0.004
Longest lava flow (km):	6 km
Gas emissions, sulphur:	null
Interval between eruptions (years):	Plinian and sub-Plinian (102-103 years); last 400 years (open conduit condition, 7 years).
Last significant eruption:	1944. VEI 3, airborne tephra 0.1-0.2 km3, total erupted magma 0.2 km3 (DRE)
Seismic characteristics:	Last 5 years: about 1,000 VT Mdmax 2.8
Deformation characteristics:	After the last eruption: subsidence, mainly concentrated in the upper part of the edifice
Monitoring level:	High
Current activity:	Quiescence
Distance to international airports:	Capodichino 15 km, Bari 200 km, Fiumicino (RM) 210 km
Principal hazards:	Tephra fallout, pyroclastic density currents, lahars, earthquakes

Fissure swarm

Parameter	Parameter info
Exists:	No fissure swarm associated.
Length:	null
Trend:	null
Ice cover:	null
Type of activity:	null
Magma type:	null
Eruption characteristics:	null
Type of products:	null
Volcanic Explosivity Index:	null
Bulk volume tephra (km3):	null
Fallout beyond 1000 km:	null
Tephra <63µm at 30 km	null
Bulk volume lava (km3):	null

Parameter	Parameter info
Longest lava flow (km):	null
Gas emissions, sulphur:	null
Interval between eruptions (years):	null
Last significant eruption:	null
Seismic characteristics:	null
Deformation characteristics:	null
Current activity:	null
Principal hazards:	null

Detailed Description

1. Geological setting and tectonic context

The volcano is located at the intersection of NW-SE and NE-SW-trending fault system. Results of geophysical and geological investigations have shown that the shallow structure of Somma-Vesuvius includes 1.5-2 km of interbedded lavas, volcanoclastic, marine, and fluvial sedimentary rocks of Pleistocene age, overlying Mesozoic limestone basement at 2.5-3 km depth b.s.l. Seismic tomography studies and the pattern of local volcano-tectonic seismicity exclude the presence of magmatic reservoirs with a diameter in excess of 0.5-km within the upper 0-5 km of the crust. However, seismic tomography studies have indicated the presence of a widely distributed (at least 400 km^2) low velocity layer, with a flat top at about 8 km b.s.l. beneath the volcano, interpreted as the top of the present-day magma reservoir.

The Moho discontinuity in the Vesuvian area is at about 30 km, significantly shallower than the Moho below the Apennines, as a consequence of back-arc extension in the Tyrrhenian Sea.

2. Morphology and topography

The Somma-Vesuvius stratovolcano covers an area of around 150 km^2 and reaches a maximum height of 1281 m a.s.l. It is made up of an older edifice, Somma, with a summit caldera formed during several phases, and the more recent Vesuvius, which has grown inside the caldera. Somma-Vesuvius edifice is located along the coastal sector of the Campanian Plain. This latter is the largest coastal plain of Campania, 150 km NW-SE elongated and bordered by the Apennine chain. The volcano, in particular is surrounded by three unconnected alluvial plains: Sebeto to NW, Acerra-Nola to N and Sarno to SE.

The edifice itself can be subdivided in 4 main morphological features: 1- the apron, a low-angle slope area (6-10°) connecting the edifice and the three plains; 2- a coastal sector, between S. Giorgio a Cremano e Torre Annunziata, and a gentle slope from 600 a.s.l. and the coast, characterized by a poorly evolved drainage pattern and formed by the progressive accumulation of recent lava flows. 3- the Monte Somma and its slopes, composed by the high angle slopes of the volcano between an elevation of about 1000 m a.s.l. and the apron and containing a well-developed and dense radial valleys, which are the main feeding system of the alluvial phenomena affecting the apron. 4- The upper part of the edifice, including the caldera and the Gran cono. The caldera is a 5 km long elliptic depression E-W oriented, bordered toward N by the Monte Somma scarp and, at W and S, by a buried caldera rim marked by an increase of the dip at an elevation of abot 600 m a.s.l. It results by multiple collapses and by the accumulation of recent pyroclastic deposits and lavas. Finally, the Gran Cono has an almost regular cone shape, grown within the caldera.

3. Plumbing system and subsurface structure

In the last 22 ka, Somma-Vesuvius has erupted about 50 km^3 of magma of variable composition, ranging from slightly silica-undersaturated to highly silica-undersaturated (K-tephrite to K-phonolite). The activity of Somma-Vesuvius has alternated between open- and closed-conduit conditions. During the open-conduit regime, the volcano was characterized by semi-persistent low-energy activity. The closed-conduit regime has probably favoured the formation of shallow magma chambers, the activity of which culminated in Plinian or sub-Plinian eruptions. Geochemical and isotopic data suggest that in the 'deep' magma reservoir, whose top is located at a depth of about 8 km b.s.l., mantle-derived melts stagnated, differentiated and were probably contaminated by continental crust, as a likely consequence of the high temperatures reached by crustal rocks because of repeated intrusion of magma into the storage reservoir. From the 'deep' reservoir, magma rises to form shallow magma chambers at variable depths, in which it experiences low-P differentiation and mixing, before feeding volcanic surface activity.

The present state of the volcano has been abundantly investigated through active seismic, teleseismic, magnetotelluric and integrated (gravity, magnetic and self-potential data) tomographies. All these data have evidenced a high velocity anomaly below the crater area, extended down to 5-6 km and interpreted as a rigid, high density residual left by the crystallization of magma filling the shallow plumbing system and "plugging the chimney". However, the spatial resolution of all tomographic methods performed at Vesuvius does not exceed 300-500 m, being unable to reveal the presence of high aspect ratio, prolate (cigar-like) magma bodies with volume of about 0.1-0.2 km^3. All these data seem to rule out the presence of a large magma chamber at the same depth of those which characterized in the past the reawakening of the volcano. A possible zone of magma accumulation is also suggested by seismic data at 8-10 km depth, mainly constrained by reflected-converted seismic waves. This depth is roughly consistent with the pressure estimated for the mafic melts feeding shallow magma chambers during open-conduit periods.

4. Eruption history and pattern

Since its last eruption, in March 1944, Vesuvius has remained dormant and no significant "signs" suggest impending unrest. However, during its eruptive history Vesuvius often experienced long periods of quiescence that lasted, in some cases, centuries or tens of centuries, with an "awakening" more and more violent the longer the repose-time preceding the eruption. Vesuvius has a relatively brief eruptive history.

The Somma stratovolcano, the oldest edifice, formed mainly by lavas in a short time between 40 and 22 ka. The volcano experienced an abrupt change in the style of activity around 22 ka, when the first and largest Plinian event (Pomici di Base eruption) occurred. Related to this eruption, a polyphased caldera began to form, continuously changing and enlarging after each major explosive event. Other Plinian eruptions occurred at 9 ka (Pomici di Mercato), 3.9 ka (Pomici di Avellino), and on 79 CE ("Pompeii" eruption). Several sub-Plinian outbursts punctuated the inter-Plinian periods, the two most recent occurring in 472 CE and 1631 CE.

Alternating with these major eruptions, several smaller explosive and effusive eruptions occurred. Evidences of lava effusions and cone building phases are lacking between about 16 ka and the 79 CE eruption.

An important increase in the eruption frequency followed the 'Pomici di Avellino' Plinian eruption, and was marked by a progressively larger number of events per unit time accompanied by decreasing erupted volume associated with each event.

All Plinian eruptions were characterized by vent opening, sustained column and pyroclastic flow and surge phase and were accompanied by volcano-tectonic collapses. Sustained columns, which reach maximum heights of about 30 km, generated widespread fallout deposits with volumes between 1.5 and 4.4 km^3 of magma (DRE) and areas covered higher than thousands of km2. Pyroclastic currents with volumes of magma between 0.25 and 1 km^3 (DRE) were dispersed along the volcano slopes and within the surrounding plains, reaching maximum distances of over 20 km from the vent.

Sub-Plinian events are characterized by eruption column less than 20 km high and pyroclastic currents travelling distances not in excess of 10 km. They can be subdivided in Sub-Plinian I and II events on the basis of their energy and magnitude.

The last Plinian eruption occurred in 79 CE and once again modified the Somma caldera, inside which the recent cone has subsequently grown due to an alternation of periods of persistent Strombolian and effusive activity. In historical times the more energetic events have been the sub-Plinian 'Pollena' (472 CE) and 1631 eruptions. This latter was followed by three centuries of continuous activity, in an open conduit condition, during which effusive, strombolian and ultrastrombolian and Sub-Plinian II events occurred.

5. Characteristics during non-eruptive periods

Non-eruptive periods at Vesuvio have had length between tens to thousand years. The longer periods have preceded the most energetic eruptions (Plinian and Subplinian) and lasted hundred to thousands of years. Presently the volcano is quiescent since the last eruption occurred in 1944.

Currently, the volcano is characterized by low-level seismicity and hydrothermal activity, small ground deformations and geomorphological processes.

Seismic activity: epicenters are clustered wthin the crater area and ipocenters are particularly concentrated between sl and -1 km bsl, generally shallower than 3 km. Their number is about 1000/year and their magnitude (M_d) is generally <1, with few events with $M_d$dmax 2.8, October 2018) Almost all earthquakes are volcano-tectonic events.

Hydrothermal activity: The degassing area of the Vesuvius is characterized by the presence of fumarolic vents located along the crater rim and walls, and at its bottom. Fumarolic fluids discharged along the crater þÿwalls are of relatively low temperatures (<75 C) and their compositio
components. Fumaroles from the crater bottom have a composition that shows H_2O and CO_2 as the major components, followed by H_2, H_2S, N_2, CH_4, CO and He (in order of decreasing content), and discharge þÿtemperature of about 95 C, i.e. the condensation temperature of fuma
= 0.91 bar). Furthermore CO_2-rich groundwaters are present along the southern flank of Vesuvius and in the adjacent plain.

Ground deformation: geological data and measurements carried out through the surveillance network indicate that the edifice is charaterized by a low subsidence, which amount is variable at a local scale. The present subsidence affects mainly the Gran Cono and is interpreted as a contraction phase of the edifice, likely due to gravitational and compaction phenomena of loose deposits. Some large magnitude eruptions (like 79 and 1631) have been preceded by ground uplift which amount and timing is difficult to be estimated.

6. Precursory signals

Observed signals:

Chronology and description of the phenomena that preceded and accompanied the 1631 sub-Plinian eruption:

Underground noise, months before and during the eruption

Ground deformation, months before and during the eruption

Continuous tremor, about 1 month before and during the eruption

Variation of the groundwater chemistry, 15 days before the eruption

Darkening of the groundwater of the wells, days before the eruption

Earthquakes, days before and during the eruption

Furthermore, description of precursors of eruptions of the last three centuries are available.

Instrumental signals:

The monitoring system managed by the INGV-Osservatorio Vesuviano, acquires the following parameters:

Seismicity (spatial and temporal distribution of tremors, energy, focal mechanism, sprectral characteristics);

Ground deformation (vertical and horizontal movements), (leveling, tiltmeter, GPS, tide gauge, SAR);

Geochemical and thermal variations of fumarolic fields and thermal springs;

Other useful information come from gravimetric and magnetic field variations, as well as from geological and volcanological observations (i.e. opening of new fractures, groundwater level variation end of the spring supply, new fumaroles etc.).

It is necessary to clarify that, at the current state of knowledge, it is not possible to establish the timing of the reactivation dynamics. In fact, the ascent of magma could be associated with an earthquake of large magnitude, or with numerous earthquakes of minor magnitude. Likewise, for ground deformations, rapid as well as slow dynamics could be observed.

7. Erupted material & Grain size distribution

The total erupted magma in the past 22.000 years is about 50 km^3.

The Pomici di Base plinian eruption ejected K-trachytic to K-latitic magmas

The Mercato Pumice eruption erupted K-phonolitic magma

The Avellino Pumice eruption erupted K-phonolitic- K-tephriphonolitic magmas

The Pompeii Pumice eruption erupted K-phonolitic-K-tephriphonolitic magmas

During the 1631-1944 period, characterised by a persistent activity under open conduit conditions, a shallow reservoir (ca 3 km depth) was continuously tapped through effusive and mild to violent strombolian activity erupting tephrite to phonolitic tephrite magmas.

Plinian eruptions:

Main fallout deposit: massive to faintly stratified, thick pumice fallout beds. Maximum thickness from 10 m (Pomici di Base) to 1 m (Avellino Pumice) in the medial sectors, dispersed over areas of thousands of km^2.

Pyroclastic density currents: complex interlayerings of PDC deposits in the form of thinly laminated, plane parallel to dune bedded ash beds, or massive, topographically controlled, matrix supported, pumice-bearing lobes. Lithic-rich, massive to stratified, matrix supported deposits are present in all the eruptions.

Ash fall: ash fallout deposits, up to 10-15 km downwind, during the opening phase. Regionally dispersed, thick sequences of accretionary-lapilli bearing ash blankets during the waning phase of the eruption.

Sub-Plinian I eruptions :

Pumice fallout: stratified (Greenish, 472 CE) or massive (1631 CE) pumice and scoria beds.

The stratification is marked by the interposition of thin ash layers.

Maximum thickness from 3 m (Greenish Pumice) to 0.5 m (1631 CE) in the medial sectors.

Pyroclastic density currents: Major topographically controlled, massive to internally stratified, ash- and lithic-rich PDC deposits related to the caldera collapse and to the final phreatomagmatic phase (472 CE, 1631 CE). Minor, cross-laminated, dune bedded PDC deposits.

Ash fall: ash fallout deposits, mainly dispersed on the slopes of the volcano, during the opening phase (Greenish

Pumice, 1631 CE). Regionally dispersed, thinly stratified, often accretionary lapilli-bearing, coarse and fine ash beds, during the final phreatomagmatic phase.

Sub-Plinian II eruptions:

Main fallout deposit: thinly stratified, poorly to moderately sorted, scoria beds. Thin ash interlayers, sometimes accretionary lapilli-bearing.

Maximum thickness ranges from 1 m (512 CE) to 0.5 m (AP2) in the medial sectors.

Pyroclastic density currents: thin, cross-laminated, ash deposits from diluted PDCs, confined to narrow sectors along the slopes of the volcano (512 CE) or radially dispersed in the vent area (AP1 and AP2).

Ash fall: thin, accretionary lapilli-bearing ash fall deposits during the opening phase mainly dispersed on the volcano slopes. Bedded sequence of massive, accretionary lapilli-bearing ash deposits and vesiculated tuffs during the final phase. Thickness of few decimetres on the slopes of the volcano.

Violent strombolian eruptions

Main fallout deposit: massive to crudely stratified, coarse to fine scoria lapilli. The deposits of many post-1631 eruptions have lithic-rich, clast supported lapilli beds interlayered or on top of the sequence. The clasts of these lithic-rich beds present a distinctive red-ash coating. The total thickness of the lapilli beds ranges from few centimetres (e.g. 1707 CE, 1730 CE) to 1 m (PM2, PM3).

Pyroclastic density currents: hot avalanches restricted to the summit cone (1944 CE) or to the upper slopes of the volcano (1822 CE).

Ash fall: Thin phreatomagmatic (lithic-rich and accretionary lapilli-bearing) fine ash beds dispersed up to the medial sectors during the final phreatomagmatic phase.

Continuous ash emission eruptions:

Sequences of laminated to stratified fine ash fall beds interlayered with thin, well sorted to faintly stratified, massive beds of scoria lapilli. Thickness ranges from 0.5 m (AP3) to few centimetres (eruptions of Middle Age activity) in the medial sectors.

Lava flows: lava flows are very frequent in the activity older than 22 ka and in the historical period. In particular after the 1631 eruption, tens of lavas were emplaced with volumes ranging between 4 and $24x10^6$ m^3, with maximum flow reaching about 6 km from the source.

8. Volcanic hazards

On the basis of the reference scenario, Sub-Plinian I type of eruption (see previous chapter) four areas exposed to different hazards are defined as follows:

Red zone 1 and 2. *Red zone 1* includes the area of high PDC inundation frequency for the main eruptions of Somma-Vesuvius during the last 22 ka. The area has a frequency >1 and is also consistent with the area affected by emplacement of pyroclastic currents of Sub-Plinian I type of events. This hazard zonation is based almost exclusively on the occurrence of PDC deposits of past eruptions. *Red zone 2* includes the areas east of the volcano exposed to thick pyroclastic fallout accumulation in which edifices are exposed to high risk of roof collapses.

Yellow zone. It is defined on the basis of recent studies and numerical simulation of the ash distribution during a sub-plinian eruption of Vesuvius using variable wind direction and velocity. The Yellow zone includes the area with 5% probability of exceeding 300 kg/m^2 of ash fallout load, considering all winds.

9. Activity status and monitoring

The activity status of Vesuvius is monitored by INGV-Osservatorio Vesuviano, through the observation of geophysical and geochemical parameters. The detection and measurement of such parameters is done by means of monitoring techniques with the help of a network of instrumentation properly designed. In particular, various instruments for continuous monitoring activities are installed at Vesuvius, which are to detect seismicity, ground deformation, and gas emissions from the ground and from the fumaroles. Moreover, periodic field campains are done for the measurement of the geophysical and geochemical parameters (see figure of surveillance network at Vesuvius). Both time-dependent and field campain data are automatically analyzed, then controlled and interpreted from researchers in different fields. The current status of Vesuvius is characterized by the presence of an hydrothermal system, which feeds the fumaroles inside the crater, and is also characterized by a modest seismicity of a few hundred small earthquakes/year. Of these, only the major events are felt by the people that live in the Vesuvian area. More details are found in the monthly bulletins of INGV-OV. The permanent seismic network includes 18 sites equipped with short-period and/or broad band seismic stations, which transmit in real time the data to the Surveillance center located in Napoli. The geodetic measurements are carried out through the following networks with continuous recording: a GPS network composed by 8 stations, a tiltmetric network composed by 8 stations, a tide-gauge network. Discrete measurements of the ground level are carried out through periodic levelling campaigns. Gravity measurements are performed during periodic surveys. Monitoring of the thermal anomalies is carried out using a permanent network of infrared thermal cameras installed along the Vesuvius rim and with periodic (monthly) measurements with mobile thermal cameras and thermocouple. Fluid geochemical surveillance is carried out by continuous measurements of the: CO_2 flux from the ground, temperature of the main fumarole and the temperature gradient with multi-parametric stations FLXOV6, installed along the crater rim and within the crater floor. Periodic sampling of the fumaroles active along the crater rim and floor is carried out as well as measurements of the CO_2 flux and temperature gradients in selected fixed sites.

10. Possible eruption scenarios

For the definition of the reference scenario, the probability of occurrence of different scenarios, corresponding to three types of explosive eruptions, was evaluated (Plinian with VEI 5, Sub-Plinian with VEI 4 and Violent Strombolian with VEI 3).

Based on the statistical studies, for Vesuvius it would be more likely (slightly higher than 70%) the lower energy event (VEI-3), however a sub-Plinian type explosive eruption with VEI 4 (probability 27%) has been assumed as the reference scenario. It should be emphasized that in the current state of knowledge, if phenomena related to a probable reactivation occur, it would not be possible to establish from the analysis of precursors what will be the type of eruption.

11. Largest known eruption

The volcanic history of Somma-Vesuvius has been characterized by a large number of variable intensity eruptions, among which the largest are four Plinian eruptions. They are the "Pomici di Base" (about 22,000 years BP); the "Pomici di Mercato" (about 9.000 years BP); the "Pomici di Avellino" (3900 years BP); and the "Pomici di Pompei" (AD 79). The calculated volumes of the fall deposits range from 1.5 km^3 for the "Pomici di Avellino" to 4.4 km^3 for the "Pomici di Base" eruption, which represents the Somma-Vesuvio largest event.

The deposits of this eruption have been related to three main phases: (1) opening, marked by the deposition of thin ash and pumice fall deposits; (2) Plinian, dominated by pumice and scoria fallout forming thick deposits dispersed in an E-NE direction over an area of about 3,000 km^2 (considering the 10 cm isopach); (3) phreato- magmatic, during which the emplacement of lithic-rich pyroclastic fall, surge and flow deposits accompanied the first caldera collapse of the volcano. The Plinian fallout is by far the most significant deposit of Somma-Vesuvius activity. It consists of compositionally zoned products from a basal white, K-trachytic pumice bed to an upper black, K-latitic scoria.

The most famous large event of Vesuvius is the Poimici di Pompei, the last Plinian event of Somma-Vesuvius. Its eruption history has been divided into three phases. An opening phase, which emplaced only a few centimetres of accretionary lapilli-bearing ash fall and very minor surge beds, followed by the Plinian phase, characterized by an eruption column that raised till about 30 km and dispersed toward SSW a tephra fallout (volume ~3 km^3), white and grey pumice layers, phonolitic to tephriphonolitic), dispersed over an area of about 3,400 km^2. During the deposition of the upper part of the fallout sequence (grey pumice) the Plinian column collapsed at least four times, producing low concentration, turbulent PDCs, which form a large part of the thick sequence covering Ercolano. According to Pliny the Younger's letters to Tacitus, the Plinian phase of the eruption lasted about 20 hours. It was followed by a phreatomagmatic phase whose initial stages (formation of a short-lived sustained column concluded with the generation of high-energy turbulent PDCs) coincided with the onset of the caldera collapse that enlarged to the South the existing depression. These PDCs reached Stabiae at a distance of about 15 km from the vent. The AD 79 eruption ended with the emplacement of "wet" PDC and of a thick succession of accretionary lapilli-bearing ash beds. The eruption was followed by a long phase of generation of lahars.

12. Extent of knowledge and bibliography

Volcanic history of the 1631-1944 period is well documented, including contemporary descriptions of the major events of the last two centuries. Dispersal maps and volume estimates for all the Plinian and sub-Plinian events are available, as well as for the main eruptions of the period 1631-1944. Papers dealing with various aspects of Vesuvius are hundreds.

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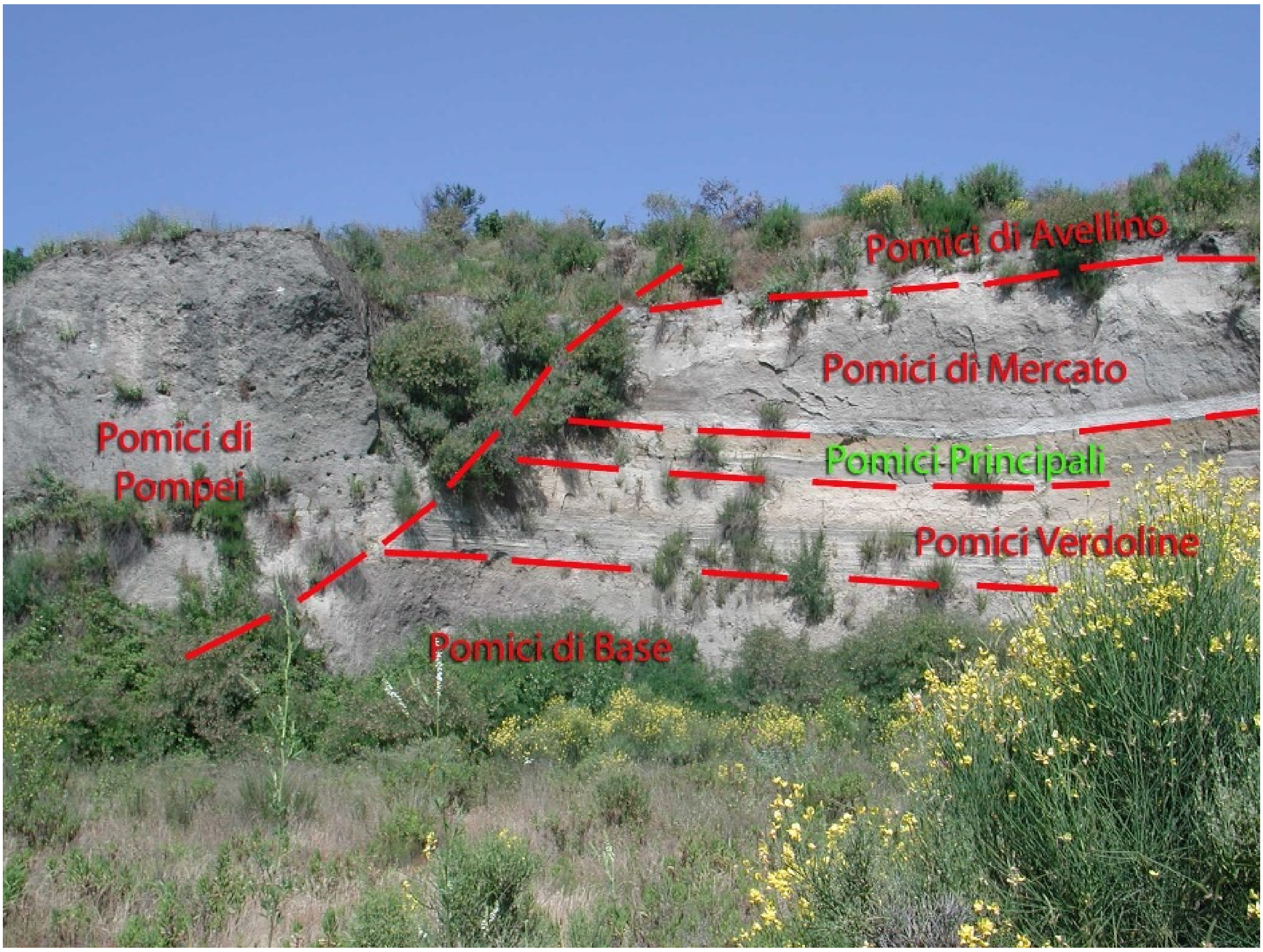
14. Selected figures

View from west (city of Napoli) of the Somma-Vesuvio edifice. Mt. Somma is on the left side and Vesuvio on the right. On the small hill in the center of the photo there is the Osservatorio Vesuviano observaty (red building) and to its left the 1944 lava flows which destrojed part of San Sebastiano and Massa di Somma towns.

View from east of the Somma-Vesuvio edifice, in the background, and sequences of paleosols and Plinian deposits generated by Vesuvius during the past 22 ka. The sequence is exposed in a quarry in the Campanian Plain.

Vesuvius crater within the "Gran Cono", in the background the scarp of the Mt. Somma caldera. Photo by Mauro A. Di Vito, 2006.

Scarp of the Mt. Somma complex caldera. The rocks exposed are a sequence of lavas and scorieae, crossed by dykes, emplaced in the initial stages of the activity of the volcano. The light brown lava flow at the foot of the scarp is that of the 1944 eruption. Photo by Mauro A. Di Vito, 2003.



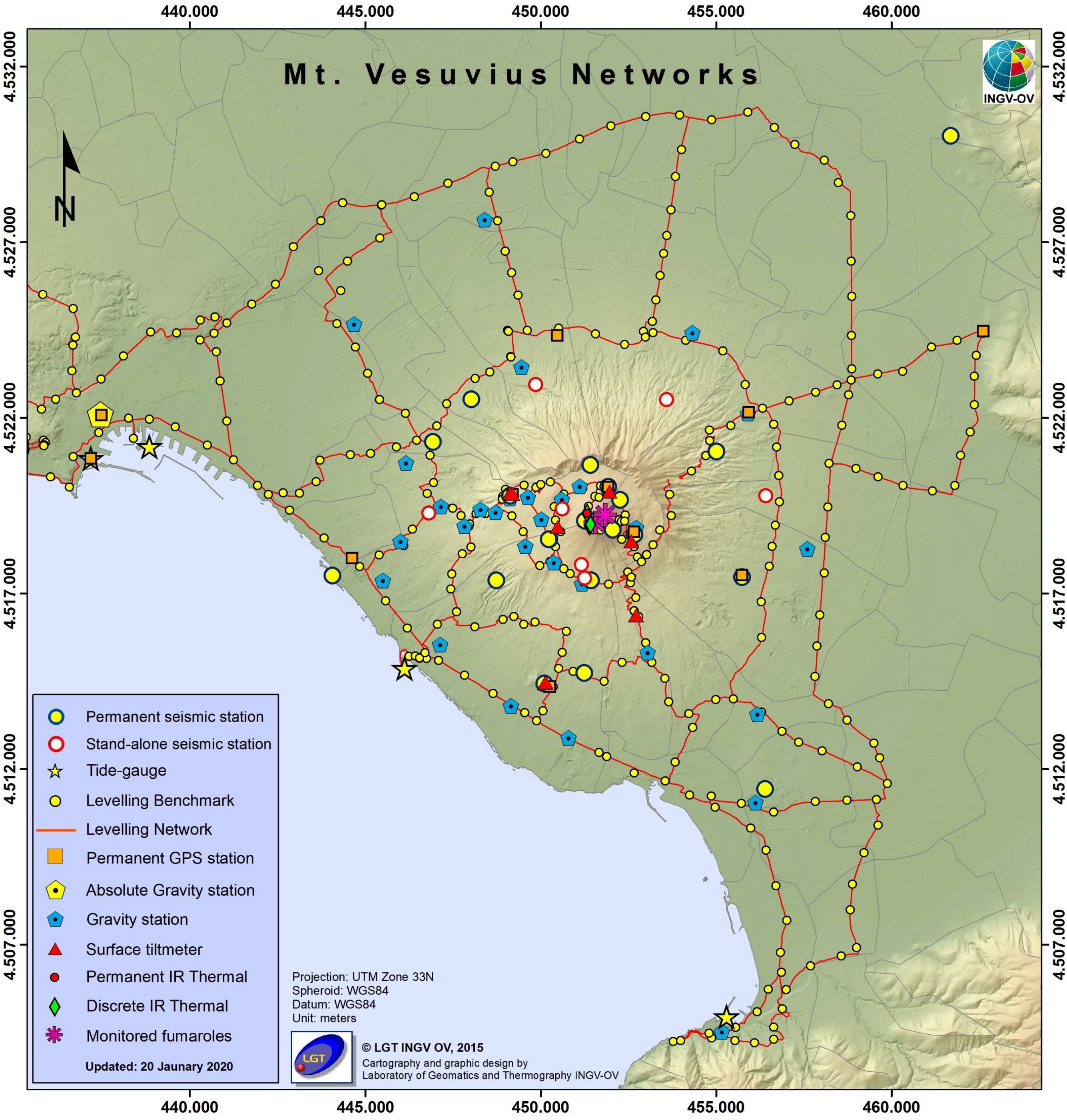
Quarry along the northern slopes of Monte Somma. Sequence of pyroclastic deposits and paleosols, including fallout and flow deposits of 5 Plinian eruptions of Vesuvio (in red) and 1 Plinian event of Campi Flegrei (in green), emplaced in the past 22 ka. Photo and reconstruction by Mauro A. Di Vito, 2014.

Historic building of the Vesuvian Observatory seen from the south-west. The Royal Vesuvian Meteorological Observatory was founded by Ferdinand II of Bourbon, King of the two Sicilies, who, accepting the requests of foreign and Italian scientists, had the first and the oldest in the world volcanological observatory built between 1841 and 1845, on the slopes of Vesuvius. Photo from the archive of the Osservatorio Vesuviano Museum (1871).

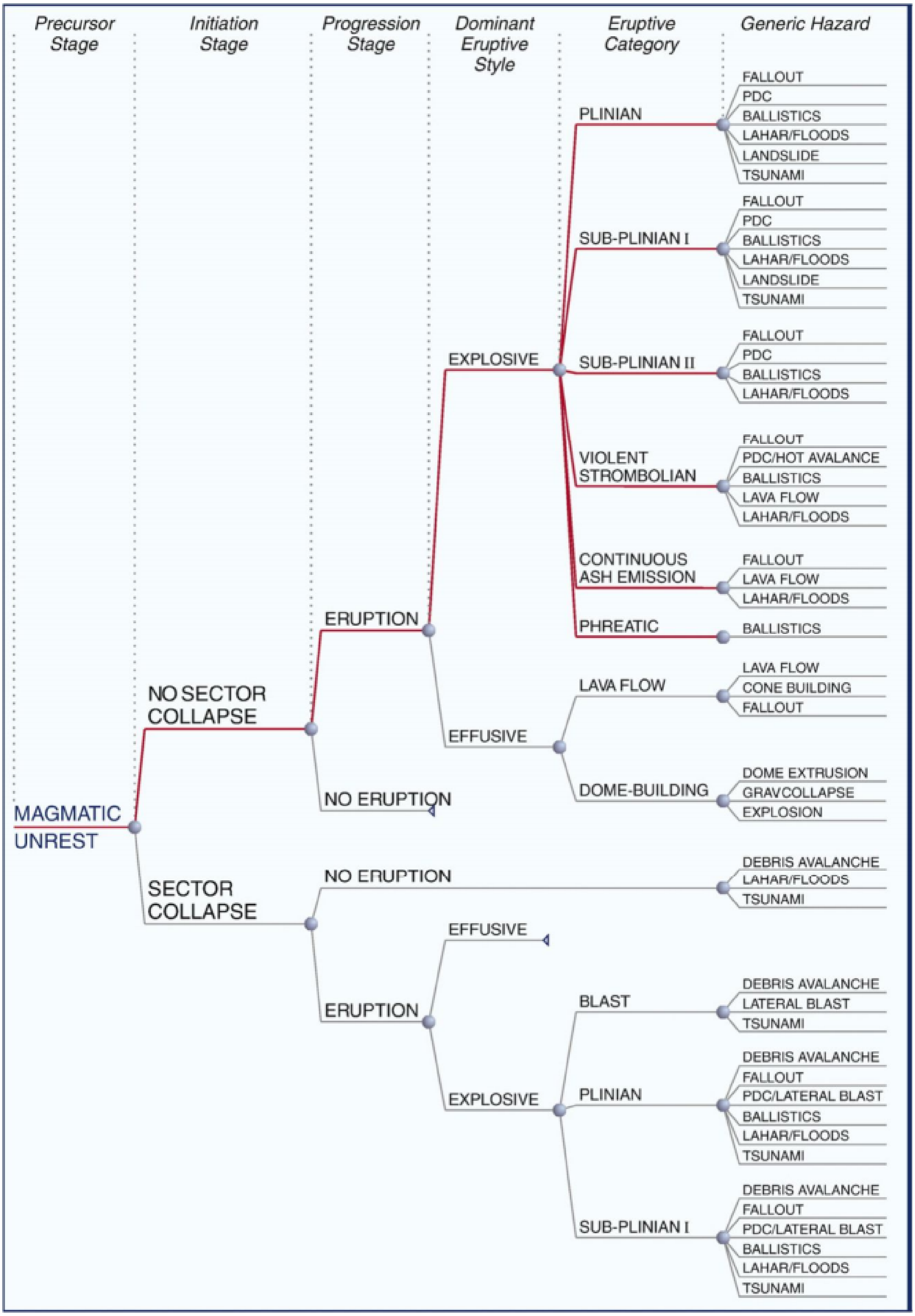
Eruption of Vesuvius of the 8th April 1906. The photo shows one the most intense phases of the eruption. In the foreground, the Vesuvian Observatory shrouded in ash from the eruption; it suffered widespread damage which was not repaired until 1911, under the direction of Giuseppe Mercalli. Photo from the archive of the Osservatorio Vesuviano Museum.

Northern slope of the Vesuvius crater. In the foreground, the entire sequence of products of the different phases of the eruption of March 1944, the last eruption of Vesuvius. Photo by Mauro A. Di Vito, 2020.

The historical site of the Vesuvian Observatory, now a Museum, houses a rich heritage of high scientific and cultural value, unique in the world for its richness and variety, which tells the story of the first observatory in the world, strongly connected with the activity of the Vesuvius and the dedication of many men of science who have dedicated their lives to the study of volcanoes. Photo by Mauro A. Di Vito, 2015.



INGV surveillance network for Vesuvius, which includes all monitoring activities and instrumentation as listed in the figure legend.



Precursor Stage
Initiation Stage
Progression Stage
Dominant Eruptive Style
Eruptive Category
Generic Hazard
MAGMATIC UNREST
NO SECTOR COLLAPSE
SECTOR COLLAPSE
ERUPTION
NO ERUPTION
EXPLOSIVE
EFFUSIVE
PLINIAN
SUB-PLINIAN I
SUB-PLINIAN II
VIOLENT STROMBOLIAN
CONTINUOUS ASH EMISSION
PHREATIC
LAVA FLOW
DOME-BUILDING
BLAST
FALLOUT
PDC
BALLISTICS
LAHAR/FLOODS
LANDSLIDE
TSUNAMI
PDC/HOT AVALANCE
LAVA FLOW
CONE BUILDING
DOME EXTRUSION
GRAVCOLLAPSE
EXPLOSION
DEBRIS AVALANCHE
LATERAL BLAST
PDC/LATERAL BLAST

Event Tree for Mount Vesuvius based on expert elicitation procedure, taking into account a multihazard perspective. The progression in the scheme starts with a precursor stage and, through an initiation and progression stage, gets to an eruptive style and category, and related hazard. The whole progression is quantified by means of a calibration excercise made of ten volcanological questions on Vesuvius, with the aim of getting numerical scores to make the Event Tree for Vesuvius quantitative (Neri et al., 2008). Related researches and further developments on the presented theme are by Marzocchi et al. (2004, 2008, 2010), Selva et al. (2014), Sandri et al. (2009), Tonini et al. (2015), Cooke (1991), Newhall and Hoblitt (2002), Aspinall (2006). A full synthesis on the Event Trees for Vesuvius can be found in Doronzo et al. (2020) at http://doi.org/10.5281/zenodo.4399167