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Advanced Monitoring of Active Volcanoes

The Neapolitan Volcanic area

GUIDEBOOK

September 28th-30th - 2015, Naples (Italy)



COMUNE DI NAPOLI

Con il patrocinio
 della 2^a Municipalità



The present guidebook was prepared for the International Workshop on *Advanced Monitoring of Active Volcanoes*. It reports information on the Partenopean volcanic area and illustrates the sites visited during the tour. The guidebook synthetically provides information on i) the major morphological and structural features of the volcanoes, ii) the deposits of the eruptions and their impact on the territory, iii) their present state and iv) the geophysical, petrological and geochemical networks operating at the Osservatorio Vesuviano. The tour will be devoted to illustrating the intimate relation among natural setting, archeology and urbanization of the high risk and deeply monitored Campi Flegrei and Vesuvius. It also presents the Osservatorio Vesuviano edifice that maintain the memory of the oldest volcanological observatory in the world and the earlier monitoring instruments. The references used in this book will be useful to detail the knowledge on the Campi Flegrei and Vesuvius volcanic area and to recover other interesting and more focused papers. This guidebook, finally, includes a list of churches and historical buildings, nearby the workshop location and that can be visited during your stay in Naples.

Introduction

Vesuvius and Campi Flegrei together with Ischia and Procida volcanoes are located in the Campanian Plain, (Fig 1). The Plain is a structural depression delimited by the Southern Apennines mountain chain to the east, south and north, and by the Tyrrhenian Sea, to the west. It is infilled by 2-3,000 m of Plio-Quaternary continental, deltaic, and marine sediments, intercalated with volcanic deposits, as detected by drilling and geophysical surveys (Piochi et al., 2005a and references therein).

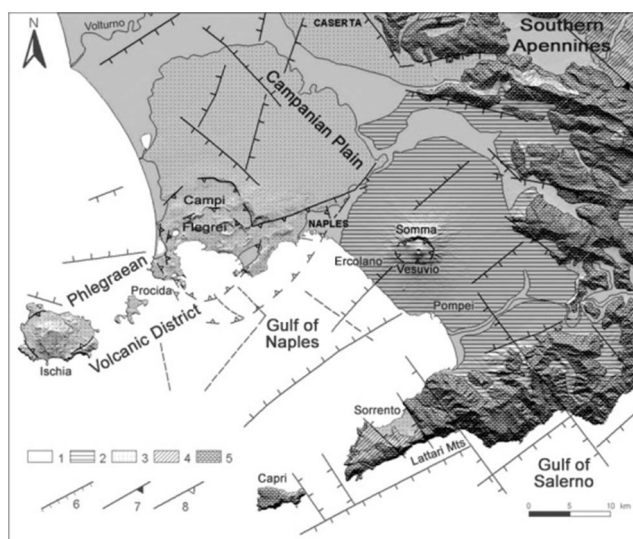


Figure 1. Geological sketch map of the Partenopean Volcanic area in the Campanian Plain. 1) Quaternary and active terrigenous sediments; 2) Somma-Vesuvius volcanics; 3) Phlegraean District volcanics; 4) Pliocene and Miocene terrigenous sediments; 5) Mesozoic carbonate units; 6) faults; 7) overthrusts; 8) caldera margins.

The volcanoes are part of the Campanian Comagmatic Province and belongs to the potassium-rich Italian belt. Vesuvius experienced the well-known plinian eruption of Pompei; Campi Flegrei is a supervolcano due the catastrophic Campanian Ignimbrite eruptions. Erupted magmas are at least 400 ka old; at Procida volcanism ended 18 ka bp, at Ischia in 1302 AD, at Campi Flegrei in 1538 AD, and Vesuvius in 1944 AD (Fig. 2). Produced rocks span from shoshonite to trachy-phonolite, and, for Vesuvius, from alkalibasalt to leucititic phonolite (Fig. 2).

The knowledge of volcano history, fundamental for evaluating both unrest phenomena and possible future pre-eruptive scenarios, essentially derives from petrological and geophysical studies. Petrological studies used several methods among wich mineral chemistry by XRD, major/trace elements and isotope geochemistry (TIMS), H₂O vs. CO₂ contents by FTIR of melt inclusions to decipher magma evolution (e.g., Piochi et al., 2006; Pappalardo et al., 2002; De Astis et al., 2004) and recover magma volatiles and pressure of magma storage (e.g., Belkin and De Vivo, 1993; Cioni, 2000; Marianelli et al., 1999; Arienzo et al., 2010; Mormone et al., 2011a; Piochi et al., 2014). Geophysical studies (e.g., Zollo et al., 2008; Piochi et al., 2014 for a review) indicate a main magma storage at ~10 km depth bsl. Shallower storage has been only suggested on the basis of petrological, sedimentological and drilling data (e.g., Belkin and De Vivo, 1993; Cioni, 2000; Piochi et al., 2014 for a review). The drilling data allowed the knowledge of the geothermal system and surface structure (Mormone et al., 2011b, 2015; Piochi et al., 2014; 2015). Traces of human presence, at least since the 39 ka, but very frequent since the Early Bronze age (Di Vito et al., 2009) have been recognized within the volcanic deposits and the intercalated paleosols formed during quiescence. The well-known Pompeii eruption on

August 24 of AD 79, destroyed the towns of Herculaneum, Oplontis, Pompeii and Stabiae, leaving interesting records of the interaction between buildings, humans and volcanic activities, for example the Villa di Poppea, at Oplontis

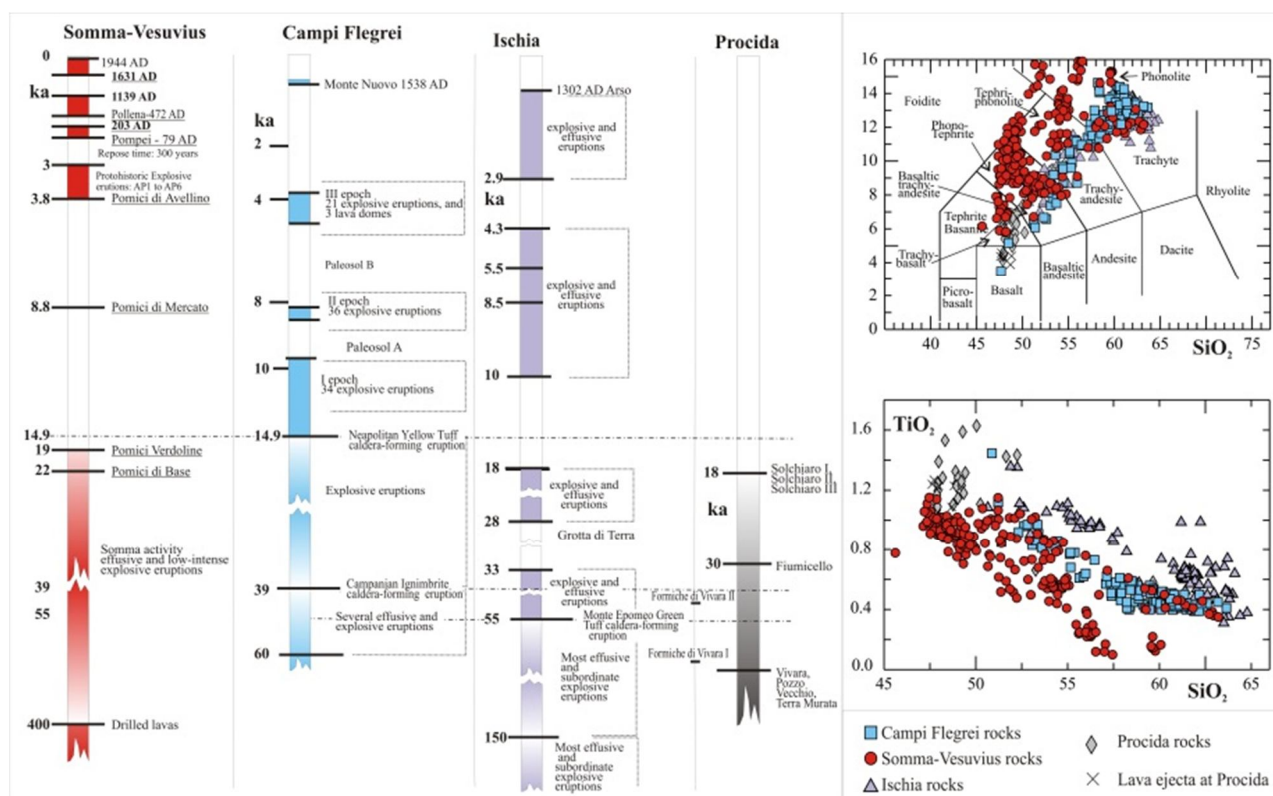


Figure 2. Timing and compositions of volcanism at the Somma-Vesuvius, Ischia, Procida and Campi Flegrei (see Piochi et al., 2014).

Somma-Vesuvius

Somma-Vesuvius is a composite central volcano that consists of the older volcano caldera, Monte Somma, and a recent cone, Mount Vesuvius. Somma deposits from effusive dominantly on low energy explosive events, occur in the inner wall of the caldera Lava and on the Apennine Chain, always intercalated with the Campanian Ignimbrite (Di Renzo et al., 2007).

In the last 22 ka, the Vesuvius characterized either by long quiescence periods (from few centuries to millennia), interrupted by Plinian or sub-Plinian eruptions, or by periods of open conduit volcanic activity (Fig. 2). All plinian eruptions characterized by vent opening, up to 30 km height sustained column and pyroclastic flow and/or surge phases reaching distances of over 20 km from the vent (Cioni et al., 2003; Gurioli et al., 2010). They were accompanied by volcano-tectonic collapses, partial or complete emptying of the feeding, sometimes deeply recharged and zoned, magma chamber and magma/water interaction. Vesuvius cone mostly formed during the last period of persistent low-energy open-conduit activity between 1631 and 1944 (Arrighi et al., 2001). The total volume of erupted magmas has been estimated to be ~300 km³ (see in Piochi et al., 2005). During open conduit conditions deep, volatile-rich magma batches rise to less than 2 km of depth and mix with the crystal-rich, volatile-poor resident magma, triggering eruptions (Marianelli et al., 1999). Leucite is a typical mineral of Vesuvius; carbonate and skarn clasts are common in the pyroclastic deposits.

Campi Flegrei

The caldera, mostly submerged beneath the Gulf of Pozzuoli, formed during the Campanian Ignimbrite eruption (39 ka; Gebauer et al., 2014 and references therein, Rosi and Sbrana, 1983), which is the largest magnitude explosive event of the Mediterranean area over the past 200 ky, and the Neapolitan Yellow Tuff (14.9 ka; Vitale and Isaia, 2013). The erupted products, aged since at least 60 ka (Fig. 2) and up to 400 km³. The majority of eruptions produced less than 1.5 km³ of pyroclastic deposits from monogenetic centres (e.g., Piochi et al., 2005a; Di Renzo et al., 2011). Effusive eruptions sporadically formed lava domes. The last event was in 1538 AD, after about 3.0 ka of quiescence, and formed the Mt. Nuovo tuff cone (Piochi et al., 2005b). Fallout deposits can be recovered along the western margin of the Apennines, at about 50 km from the vent; pyroclastic currents outcrop within the caldera floor and sometimes in the Campanian plain. The two main most recent eruptions are Agnano-Monte Spina and Pomici Principali (Di Vito et

al., 1999). However, the most widespread rocks are tuffs, forming the main scarps, such as the Posillipo hill, and used as building materials.

In the past 15 ka, the caldera floor has been affected by tectonics causing a maximum net uplift of about 90 m at the La Starza marine terrace with its definitive emersion at ca. 4000 years BP (Isaia et al., 2009). Ground movements are also documented during the past 2.0 ka and, in particular, since late 1960s, unrest episodes have been recorded by the Osservatorio Vesuviano monitoring system; the largest ones took place in 1969-72 and 1982-84 and generated uplifts of 170 and 180, respectively, and the evacuation of part of Pozzuoli town. Geometry of these short-term deformation events is very similar to that of the long-term deformation, likely indicating a similar stress regime over at least the past 5 ka (Del Gaudio et al., 2010).

The geothermal system developed at the Campi Flegrei has been studied in several papers (Rosi and Sbrana, 1987; De Vivo et al., 1989; Piochi et al., 2015; Carlino et al., 2012) thanks to drilling activities having as main goal the geothermal explorations.

The visiting sites: present state and monitoring network

1. *The Vesuvius volcano and the 1944 eruption: stop to the Piano delle Ginestre and the Crater*

The road runs along the slope of the Volcano and their main structures, the most important associated to four main collapse episodes occurred during the more energetic Plinian eruptions (Cioni et al. 1999): at ~22 ka (Pomici di Base), 8.8 ka (Mercato), 3.8 ka (Avellino) and in AD 79 (Pompei). The Piano delle Ginestre is an elliptic constructive-destructive structure, nested in the Pomici di Base caldera and formed during the 3.8 ka Pomici di Avellino Plinian eruption. The thick pyroclastic surge deposits emplaced in the final phases of the eruption contributed to build the Piano delle Ginestre rim, together the effusive and pyroclastic products of the following eruptions. Along Piano delle Ginestre we will see also variable types of lavas including the lavas emitted during the first two days of the 1944 eruption. The structure is delimited to the north by the crescent-shaped Observatory Hill relief, while its south-western flank is formed by a wedge of pyroclastic deposits. This later is mostly related to the deposits from Avellino and Pomici di Pompei eruptions, which formed a rampart lying on the old edifice.

The trail to the crater, then, goes across the deposits produced during the phreatomagmatic final phase of the 1944 eruption. These deposits include reddish and violaceous lapilli and bombs deposits, and coarse ash beds, rich in leucite and pyroxene, topped by grey ash deposits rich in lithic fragments, mainly composed of fresh and hornfelsed lavas (Fig. 3a). Downwards, the 1944 succession also includes black and grey scoriaceous lapilli and bombs deposits with interlayered coarse ash beds emplaced during the formation of the buoyant ash column (Fig. 3b), a densely-welded crudely-stratified spatter succession emplaced during the lava fountaining phase, and a grey massive lava.

The lava flow is visible for the absence of vegetation within the Valle dell'Inferno. This valley is delimited to the north by the caldera wall formed by very thick, lithic rich pyroclastic flows and dubiously related by to the 8,8 ka Pomici di Mercato eruption. Several dikes intruding the rock wall are visible.

The 1944 deposits are part of the older sequence dominated by lavas, with minor spatter and scoriae beds, exposed along the north-eastern portion of the crater slope (Fig. 3a). The crater allows viewing the panorama on the housing-lands and the Gulf of Naples, as well as the sequence that started in 1914, horizontally fills the 1906 crater and unconformably covers the pre-existing sequence of rocks exposed in the 1906 crater (Fig. 3a).

Within the crater fumarole activity discharge fluids rich in atmospheric gases with outlet temperatures ranging from 60 to 75°C. The fumarolic fluids of the crater bottom emit H₂O as a major constituent, followed by CO₂, H₂, H₂S, N₂, CH₄, and CO in order of decreasing concentrations, and undetectable SO₂, HCl, and HF. These fumaroles, whose outlet temperatures have been close to the local water boiling point since 1988 and cooled from 1944 to 1960 temperatures, are fed by a Cl-rich hydrothermal brines located underneath the crater. Fumarolic CO₂ has a not clear origin with an about 150 td⁻¹ of output (Chiodini et. al., 2001a). The isotopic ratio of helium and carbon dissolved in Vesuvian groundwaters and fumaroles have the magmatic signature (Federico et al., 2002; Martelli et al., 2008), but no input of fresh magma at shallow depths took place after 1944 A.D. (Chiodini et al., 2001a).

The fumarolic activity associates to low-magnitude seismicity distributed along the crater axis down to 6 km of depth bsl (e.g., De Natale et al., 2004a, 2004b; Zollo et al., 1996), governed by a not-uniform stress acting within a pre-fractured medium and triggered by pore pressure variations related to the downward migration of hydrothermal fluids (Vilardo et al., 1999).

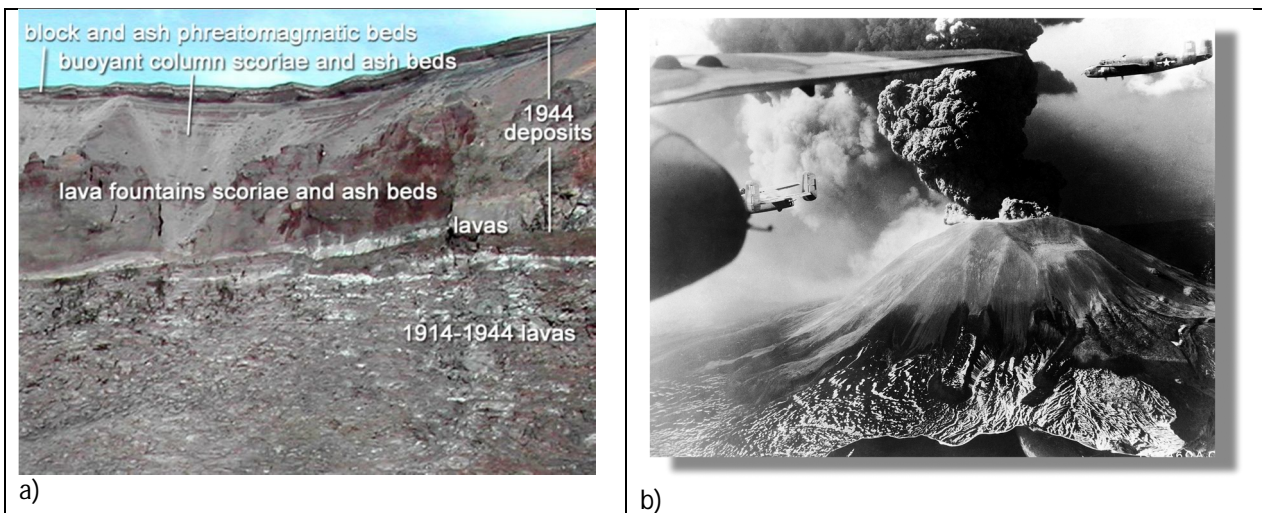


Figure 3a. View of the north-eastern portion of the Vesuvius crater. 3b. Buoyant column phase of the 1944 Vesuvius eruption.

2 The Osservatorio Vesuviano: stop to the historical building

The Osservatorio Vesuviano was founded in 1841 by the Bourbon King of two Sicilies, Ferdinand II. It was inaugurated during the 7th Congress of the Italian Scientists, held in Naples in 1845. The historical site of the observatory is an elegant neo-classical building designed by the architect Gaetano Fazzini and strategically located on the Salvatore hill, at an elevation of 608 m a.s.l. It presently hosts a museum, recently inaugurated and renovated, and a permanent exhibition called “Vulcanica: an itinerary through the world of volcanoes”, in which the visitors are introduced to volcanism and related hazards, the monitoring systems of active volcanoes, and the history of Mt. Vesuvius and its Observatory and of the others active Italian volcanoes. The museum is visited by a public of about 16,000 people per year, mainly composed of students from both Italy and other countries.

The position of the building was particularly favourable since the site, hosting already a small church and a hermitage dating back to 1600, had never been damaged by the very frequent eruptions, occurred after the large 1631 event. The first director was Macedonio Melloni, one of the most prominent experimental physicists and his successor was the physicist Luigi Palmieri, who provided the Osservatorio with a meteorological tower. Then, Luigi Palmieri built the first electromagnetic seismograph, with which he wanted to “make the smallest motions of the ground clear, recording them on the paper or indicating their nature, strength and duration”. He first detected harmonic tremor caused by magma oscillation and degassing in the conduit and concluded that such a phenomenon could be used to forecast an eruption. Among the following directors, Giuseppe Mercalli is famous for the homonymous scale of seismic intensity, drew the first modern classification of volcanic eruptions, and Giuseppe Imbò managed to forecast the 1944 eruption and to inform the authorities.

The Campi Flegrei state

Ground dislocation is typical of the volcano (Parascandola, 1947). The Roman “Serapeo Marketplace” ruin testifies the phenomena thanks to its columns showing lythodomes holes up to 7 m and the submersion of the monument below the floor (Fig.4a).

Subsidence and sea invasion occurred until the X century AD when the uplift of the Pozzuoli coastal area began, culminating with the 1538 Monte Nuovo eruption. The recorded phenomena at time of the eruption after 3,000 years of quiescence are similar to the present ones. Pre- and syn- eruptive stages of the eruption required tens of days (Piochi et al., 2005a).

In 1883, Issel coined the word bradyseism (from the greek bradi = slow and seism = movement) to mean slow subsidence or uplift of the ground. In particular, during the 1982-84 large episode with 1.5 m of uplift (Fig. 4b) and more than 16000 low magnitude ($M_{max} \approx 4$) earthquakes were recorded (De Natale and Zollo, 1986; D’Auria et al., 2011). Gravimetry also recorded significant changes (Berrino et al., 1984). During this crisis, further seismic crises occurred in 1989, 1994, 2000 and 2006, and in 2012 all connected to minor ground uplift phases (Troise et al., 2007).



Figure 4. Evidences of ground movements in the last 2000. in a): the Roman city submerged below the sea level, and in b): the tourist harbor today and the sea level (arrows) in the 1982.

4. Volcano downhole monitoring: stop to CFDDP (Campi Flegrei Deep Drilling Project) borehole station

The CFDDP hole was drilled in the subsiding Bagnoli Plain (eastern sector of Campi Flegrei caldera). The Plain is a sparsely inhabited zone waiting for requalification as it is one of the largest Italian dismantled industrial sites, affected by metal contamination. The hole crossed intercalation of marine and palustrine sediments and volcanic deposits younger than 14.9 ka, the Neapolitan Yellow Tuff - in the depth range 200-260 m - and a thick gray sequence down to the bottom hole sited in a gray tuff older than 40 ka (Mormone et al., 2015). The hole allowed to recognize a geothermal systems at 110°C in equilibrium with the present gas discharge at the surface (Figure 5a). The hole is instrumented with an optical fiber sensor for the temperature measurement, a pressure gauge for the well-head pressure monitoring, and a systems of pressure valves for water and gases sampling. The temperature profile to 475m downhole is obtained by using a distributed remote sensing (Stimulated Scattering Brillouin). A Brillouin stimulated scattering measurement is the wavelength shift of modulated light pulses , determined by temperature on the fiber core structure. Our system provides a temperature measurement accuracy of 1 degrees C and a spatial resolution of about 1 m. The well-head is configured for the upgrade of the system with further sensors for gas monitoring (Figure 5b, c) .

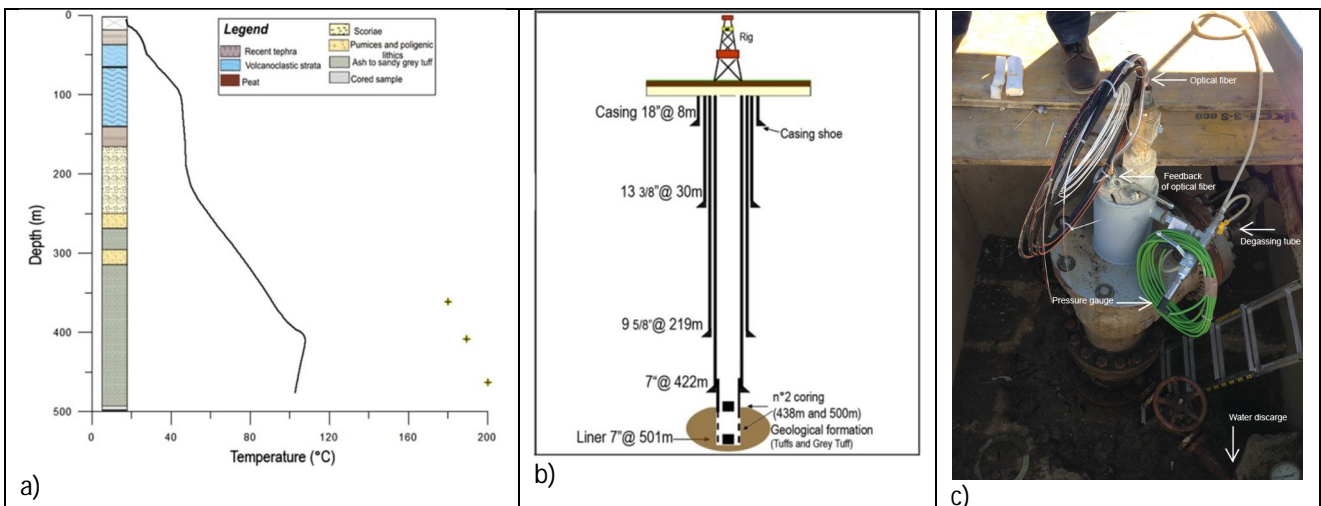


Figure 5. a) Sketch of CFDDP pilot borehole stratigraphy (eastern caldera) inferred from the cutting, and temperature profile obtained by the continuous remote sensing of the well, down about 475m of depth. The points on the right side represent the temperature recorded on the western side of the caldera at the same depth. b) Section of the CFDDP pilot borehole. c) Configuration of CFDDP well-head for the monitoring of temperature and pressure.

5 The Volcano monitoring network: stop to the Osservatorio Vesuviano Monitoring Centre

Most of the data collected by the volcano monitoring networks of Osservatorio Vesuviano are transmitted and gathered in real-time at the Monitoring Centre of Naples (Via Diocleziano). The Centre hosts facilities allowing the h24 surveillance of the three Neapolitan Volcanoes and of Stromboli.

Seismic recordings are shown in real-time on more than 50 monitors (Fig. 6a). This is aimed at ensuring the detection and the rapid analysis of small earthquakes, often having negative magnitudes. Together with the visualization, signals are processed in real-time to detect and locate micro-earthquakes (Fig. 6b) and to provide supplementary information (e.g. spectrograms, polarization). Another set of monitors is intended for the visualization of other geophysical and geochemical signals (i.e. GPS, tiltmeters, thermal cameras, etc...).

The Centre also hosts facilities for the manual revision of earthquake hypocenters and for detailed analysis of geophysical and geochemical time-series.

The surveillance activities are aimed at promptly reporting to the Italian Civil Protection (DPC) the occurrence of earthquakes and other significant phenomena related to the activity of the volcanoes. The communication with DPC and the National Earthquake Centre in Rome is guaranteed by advanced redundant systems.



Figure 6a. The Monitoring Centre of the Osservatorio Vesuviano, Istituto Nazionale di Geofisica e Vulcanologia.

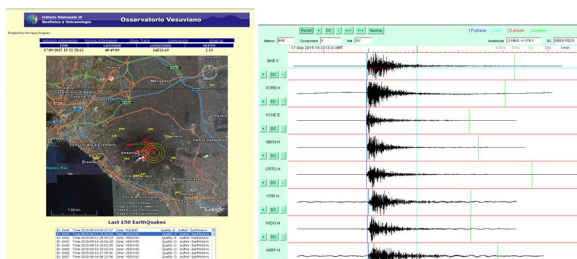


Figure 6b. Automatic location of an earthquake at Vesuvius and its corresponding seismograms.

6 The Campi Flegrei active field: stop at Pisciarelli/Solfatara

Pisciarelli is the active fumarolic area that develops on the slope of the Solfatara volcano, about 2 km east-northeast of Pozzuoli. The crater is sub-rectangular, shaped by NW-SE and SW-NE trending faults (Fig. 7) and is a really altered area due the gas emissions. The volcano was generated by a low-magnitude phreatomagmatic and subordinate magmatic explosions drilling the Monte Olibano dome (Di Vito et al., 1999; Isaia et al., 2015). The sulfate alteration area develops on the the Astroni, Solfatara, Olibano, Agnano-Monte Spina (4.1 ka) Tephra and made of mostly of allunita and native sulfur over several S-bearing minerals (Piochi et al., 2015b).

The site shows an intense hydrothermal activity since Greek times, although the Pisciarelli sector and Solfatara crater differ in terms of liquid vs. vapor - dominated geothermal systems, respectively. Fumaroles display average temperatures of 95°C at Pisciarelli and up 160°C within the Solfatara crater, and neutral pH that only locally reaching low values between 1 and 2.7 (e.g., Valentino et al., 2004; Chiodini et al., 2010). The emitted gases has a general dominance of H₂O and CO₂, subordinate H₂S, N₂, H₂, CH₄, He, Ar, CO, and hydrocarbon species, with traces of HCl and HF.

The most recent estimates (Chiodini et al., 2001b; 2010; 2011; Aiuppa et al., 2013) amount up to 1560 tons/day of CO₂ (300-400 tons/day of which from fumarolic vents) and a ratio of H₂S/SO₂ of 850-2000 on a molar basis. At Pisciarelli, emitted gases display a H₂S/CO₂ ratio (0.004) and δ¹⁸OH₂O values (-3 ‰) that are comparable or slightly lower than at Solfatara (0.004-0.01 and -1 ‰, respectively; Moretti et al., 2013).

The activity in Pisciarelli has been increasing since 2006, showing a rise in fumarolic discharge, the formation of boiling pools and water springs (March 2009) and the opening of energetic geyser-type vents (November 2010) that are still active.

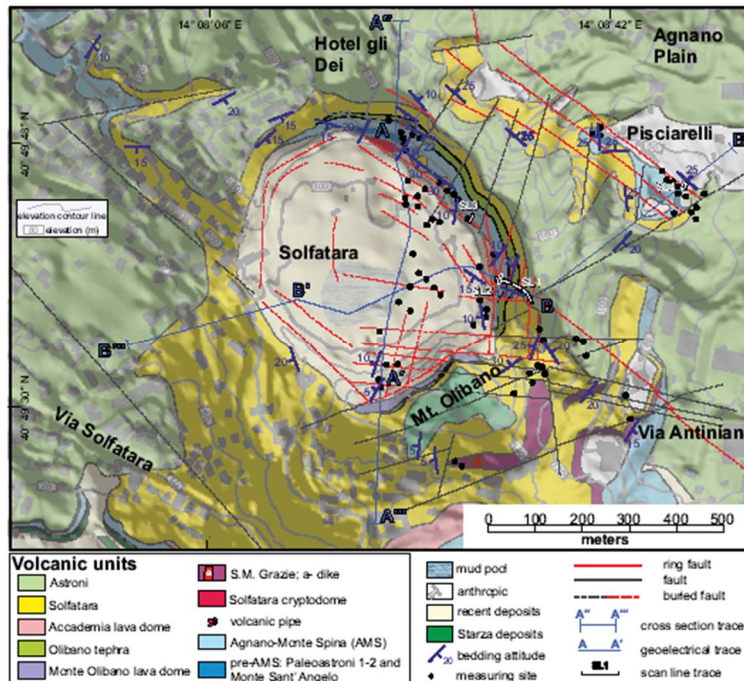


Figure 7. Geology and structure of the Solfatara crater (from Isaia et al., 2015).

Since 2004, Chiodini et al. (2010) have also documented the expansion of the area affected by soil degassing of deeply derived CO₂, in absence of significant variations in the carbon, oxygen and helium isotopic compositions (Piocchi et al., 2015). δ³⁴S data depict a progressive decrease through time at least since 1956, associated with a lowering of the SO₂/H₂S ratio. The conceptual model based on fluid geochemistry is in Fig. 8a, together the structure of the present geothermal system (Fig. 8b) obtained thanks to the merging of surface and subsurface data (Piocchi et al., 2015). The authors indicated a low-sulfidation system hosting acid-sulfate deposits in its active degassing area. The acid-sulfate environment developed on an argillitic facies that thins outwards and is characteristic for steam-heated and magmatic-steam environments.

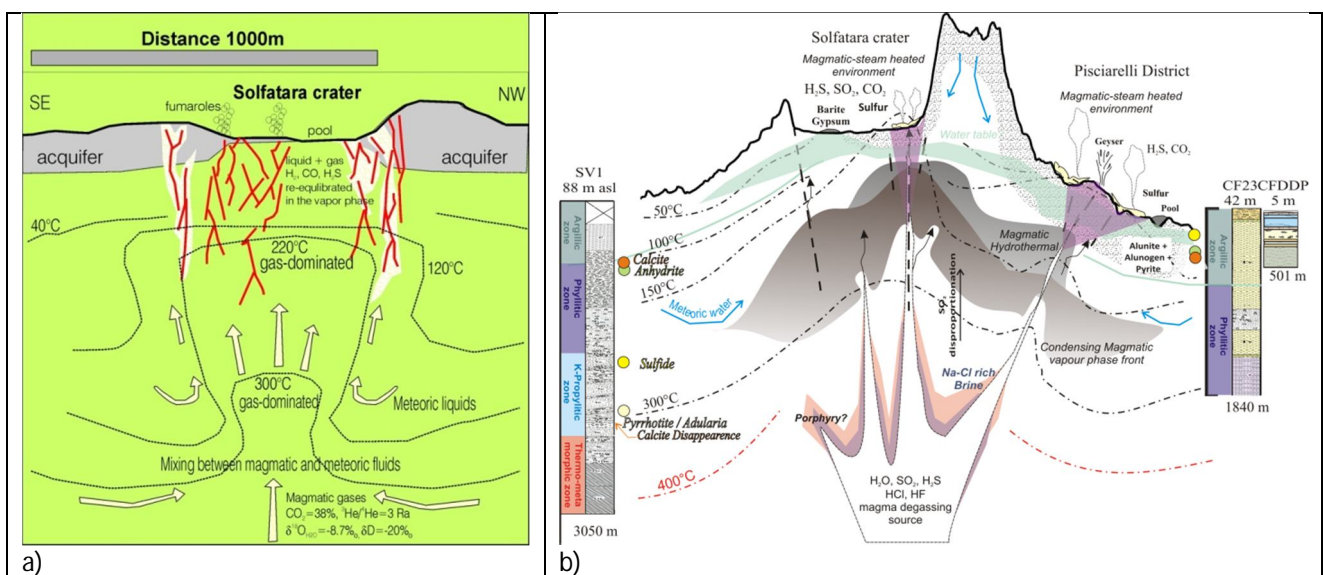


Figure 8a. Conceptual model of Solfatara modified after Caliro et al. (2007), considering results from simulation (Chiodini et al., 2010; Troiano et al., 2011) and, in 8b, as described in Piocchi et al. (2015).

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The Naples City Centre

The Decumani

The history of Naples is an oldest and most eminent one in the World. It starts with the first Greek settlements in Italy, in the first half of the VIII century BC, at Ischia island (ancient name Pithecusa), Southwest of Naples, by people from Euboea Greek region. From the island, Euboea settlers, together with settlers coming probably from Cuma eolica, founded Cuma few decades after, Northwest of Naples, and then the urban settlements giving origin to Naples. The first urban center was named 'Paleopolis', or 'Parthenope', founded in the third quarter of the VIII century B.C.

The area of ancient Naples corresponds to the first settlement of 'Neapolis' (founded at the very end of the VI century B.C.), 'New City' in Greek, so called to distinguish it from 'Paleopolis', or Parthenope, the old town originally built on the Pizzofalcone hill.

The urban plant of Neapolis was characterised by a chessboard structure formed by three large roads oriented E-W, called 'Decumani' by Romans: decumanus superior (Via Sapienza, Via Anticaglia, etc.), Decumanus maior (Via Tribunali), Decumanus inferior (Via B. Croce, Via S. Biagio dei Librai, etc.), crossed by N-S roads called 'Cardines'.

The ancient city center of Naples is very peculiar with respect to the other Italian and Worldwide cities: here, in fact, are present the subsequent stratifications of all the hystorical periods, starting from 600-700 years BC, in all of them Naples was at the top of Culture, Civilization and Urban development, until the 1860 when it was occupied by the Piemonte army to become part of the new Italian Kingdom (1861).

Naples, for instance, together with her satellite cities of Cuma and Gaeta, was the only city of the Western Mediterranean which continued, after the fall of the Western Roman Empire, to cross the Mediterranean sea with his fleets, having booming commercial relations with the richer East, just like the Middle Age were never started. It was, since the fall of the Western Roman Empire and till the 12th century when it was finally conquered by the Normans, a rich and independent Dukedom, nominally under the rule of the Eastern Roman Empire, but in fact strong and independent, resisting for centuries to the most powerful armies crossing the Western Europe at that times (Arabs, Longobards, Normans, etc.). It is also noteworthy that Naples, together with Gaeta and Cuma, was actually the very first powerful Maritime 'Republic' in Italy, but it is usually not listed in that number (including Amalfi, Pisa, Genoa and Venice) just because it was considered not a 'Republic' but a 'Duchy' under Bisantium influence.

You can see below a sketch map of the main roads of the ancient city center, called Decumani, with the main Historical Buildings indicated. Furthermore, you will find a more accurate description of some of these monuments.

All of these monuments can be visited from Monday to Saturday (from 9:00 to 14:00) and many of them also on Sunday morning.

40. Church of San Pietro a Maiella

The Church, realised at the beginnings of the XIV century, is dedicated to **Pietro da Morrone**, ermit on the Maiella, elected as Pope with the name of **Celestino V** and canonized in the 1313.

Restored and widened at the end of the XV century and rehandled in the XVII and XVIII centuries, it suffered a stylistic restauration at the beginning of the XX century.

The inside, in Gothic style, has a Latin cross plant with three aisles. Through the side aisles, the noble chapels are accessible, where works by Francesco De Mura, Giacomo del Po, Giuseppe Troccola (XVIII century) can be admired.

Beside the apse there are two chapels for side, In the second chapel on the right there are the **frescoes** of St. Martin's Stories by the same author of the "Chapel of the Lioness".

In the first chapel on the right, there is the statue of St. Sebastiano by **Giovanni Merliano da Nola**, **the greatest exponent of the Renaissance sculpture in Naples**.

In the first chapel on the left, a floor in majolica tiles, azulejos, of the Aragonese period can be admired.

The baluster and the main altar, in marble inlay, have been realised respectively by Cosimo Fonzago and by Bartolomeo and Pietro Ghetti in 1645.

The trusses coverage of the central aisle and the transept has a coffered ceiling drawn by Bonaventura Presti. It contains works by **Mattia Preti**, the Calabrian knight, with the episodes of the life of St. Celestino V and St. Caterina in Alexandria, considered the most expressive of the Italian painting of the XVII century.

Under the 14th century bell tower, it opens the Portal of the side entry.

38. The Pontano Chapel

Interior, the altar

The chapel was made to build by **Giovanni Pontano** in 1492 to the memory of his wife Adriana Sassone. Its structure is of classical rectangular inspiration and it stands on a high basement with pilasters in composite order supporting a simple trabeation.

The exterior presents two marble portals, both of which overhung by inscriptions with the family's coats of arms and small windows bedside which are marble slabs with Latin inscriptions.

The wall behind the altar is frescoed a triptych of the **Madonna with St John the Baptist and St John the Evangelist** (late 15th century).

The late 15th-century **glazed tiled floor** is beautifully executed and depicts the Pontano family's and his wife's coats of arms as well as geometric design, vegetable and animal subjects.

37. Church of Santa Maria Maggiore (also called della Pietrasanta)

Built in the first half of the 6th century in the oldest part of the city, this was the **first basilica dedicated to the Virgin Mary**. In the middle of the 17th century, it was rebuilt on a central plan conceived by Cosimo Fanzago.

The ancient sacred stone with an engraved cross found in this church gave it its most common name. The interior has a valuable eighteenth-century **terracotta and majolica tiled flooring**.

In the crypt we see signs of the early Christian basilica and the remains of a Roman mosaic. A Medieval **bell tower** stands in front of the atrium, the 11th-century remains of the original church, the oldest of the city.

At the fronts there is the **Chapel of the Saviour**, restored in the second half of the 18th century with an excellent altar in polychrome marble and a majolica floor.

35. Church of Purgatorio ad Arco

This church is annexed to the homonymous **Congregation**, founded in the 17th century for prayers offered to the souls in Purgatory. It has a single aisle with side chapels.

In the area of the apse, which is richly decorated with polychrome marbles, an alto-rilievo showing the winged skull together with similar works of art on the exterior, is testimony to the theme of death which is so deeply felt in the popular tradition of Naples.

Paintings by **Massimo Stanzione**, **Andrea Vaccaro** and **Luca Giordano** respectively adorn the main altar, the third chapel on the right and on the left of the aisle. Below the church (hypogeum) there is the ancient burial place.

33. Church of San Paolo Maggiore

This church was built in the 8th century in the area of the forum of the Graeco-Roman city on the ruins of the temple of Dioscuri. From the 16th century, the early-Christian church was radically restructured by the architects Francesco Grimaldi and G.B. Cavagna.

The Latin cross interior has three aisles with side chapels. The vaulted roof is divided into various sections and frescoed by Massimo Stanzione to illustrate the deeds of the apostles Peter and Paul.

On the left side of the aisle there is the statue of the Guardian Angel by Domenico Antonio Vaccaro. The beautiful frescoes by Solimena in the sacristy show scenes of the Conversion of St Paul, the Fall of Simon Mago and the Virtues. In 1671 Dionisio Lazzari planned the extension of the façade of the Basilica, which retains two of the original Corinthian columns which decorated the pronaos of the ancient pre-Christian building.

29. Church of San Lorenzo Maggiore

This church was erected in the second half of the 13th century on the site where the 6th-century early-Christian Basilica stood. The Latin cross interior has a single nave with side chapels and a tie-beamed ceiling. The apse, which was designed by French architects, has a splendid ambulatory from which a series of chapels radiate off. One of these chapels is the Barrile Chapel with Scenes of the life of the Virgin Mary by an unknown Neapolitan painter of the school of Giotto. A funeral monument of particular interest in the area of the apse is dedicated to Catherine of Austria, the work of the sculptor Tino di Camaino. Some of the walls of the right-hand transept are decorated with 14th-century frescoes by Montano d'Arezzo. Signs of other alterations made in the 17th and 18th centuries are seen in the third chapel to the right of the nave with polychrome marbles by Cosimo Fanzago and, on the external façade, by Ferdinando Sanfelice.

28. Archaeological area of San Lorenzo Maggiore

Below the Basilica of San Lorenzo Maggiore are the remains of public buildings of the Graeco-Roman city, the centre of which corresponds to the present-day Piazza San Gaetano.

Apart from the 6th-century AD early-Christian Church, traces of pre-existent buildings of the 4th century BC have been found, including the "macellum", the ancient food market.

Various other buildings, including the treasury building, scattered along a considerably long stretch of road, bear witness to the complex stratification which has come about with numerous changes to the urban plan over the centuries.

31. Monumental complex of Girolamini

Not far from the Cathedral, on the road which leads from Piazza Cavour to the sea, stands the Chiesa dei Girolamini, called also Gerolomini or Girolomini, the exact name is uncertain. It was built between 1592 and 1619 to a design by the Florentine architect G. A. Dosio, and belongs to a huge religious complex

with two cloisters (now a Cultural Center with a Library and an extremely well-stocked Art Gallery) on an upper storey. The façade was built to a design by the architect D. Lazzari; it is decorated with statues by Sammartino. It was greatly altered by Fuga in 1780.

The aisled church, which has been closed since the 1980 earthquake, still houses paintings by artists from the most celebrated Neapolitan school such as Stanzione, Cavallino, Fanzago and Giordano (St. Mary Magdalene de' Pazzi, Expulsion of the Profaners from the Temple), Azzolino, Santafede and Solimena. There is no lack of artists from schools of other regions, such as G. Reni (St. Francis, St. John the Baptist, Christening of Jesus), Pietro da Cortona (St. Alexis Moribund), Pomarancio, Dionisio and Jacopo Lazzari. In the presbytery are the outstanding Angels holding torches by Sammartino. Inside is in Baroque style, large and luminous, it is divided in three naves by granite columns. The ceiling is magnificent, golden in carved wood.

30. Pio Monte della Misericordia

This small church around the corner from the Duomo holds one of Naples' greatest treasures, Caravaggio's Seven Works of Mercy (1607). Based on the Seven (Christian) Corporal Works of Mercy, it is considered one of the most important religious works of art of the 17th century. Prominently hung over the high altar of the church, it was commissioned by the charitable organization Pio Monte della Misericordia, Pious Mount of Mercy. Founded in 1601 by a group of seven young Neapolitans inspired by the Corporal Works of Mercy, their organization is still in operation today. Dedicated to Santa Maria della Misericordia, this middle 16th century octagonal church is the work of Francesco Antonio Picchiatti, better known for his Scalone d'onore (1651) at Palazzo Reale. It replaced a smaller church built by Giovan Giacomo for Pio Monte della Misericordia in 1604. Above the church on the first floor is the Quadreria, the Picture Gallery. Opened in 1972, the gallery underwent a 2 year renovation during which 31 canvases were restored. Reopened to the public in 2003, the gallery features an impressive collection of 16th - 19th century works, especially from late mannerist painters active in Naples such as Giordano, Ribera, Vaccaro, and Caracciolo. The foundation of the collection was a charitable donation of 192 works by Francesco de Mura in 1782 although only 42 of those remain today.

Admission to Pio Monte della Misericordia includes an audio guide for the Picture Gallery. Additionally, a Museum Information Kiosk is located near Caravaggio's Seven Works of Mercy. Visitors can navigate to and enlarge specific parts of the painting to see them in greater detail, and text descriptions explain how Caravaggio depicted each of the Works of Mercy.

Pio Monte della Misericordia, Ufficio Quadreria, Via dei Tribunali 253 - 80139 Napoli, tel. 081 44 69 44/ 081 44 69 73

45. The Monumental Complex of Santa Maria della Pace

The complex was built on the site of the 15th-century **Palazzo of Ser Gianni Caracciolo**, Great Seneschal of the Kingdom and the lover of Queen Giovanna II. It comprises the Church and the hospital of the Hospital friars of S. Giovanni di Dio founded in 1587, which is now the seat of the San Lorenzo - Vicaria constituency.

The structure of the ancient palace is still visible in the entrance portal, which is a large polylobed arch in florid Gothic style; at the base of the vestibule the 15th-century walls can be seen. The whole place is built around two cloisters on different levels because of the sloping site.

Worth a visit are the Lazzaretto Hall and the Church dedicated to S. Maria della Pace in memory of the end of hostilities between Philip IV King of Spain and Louis XIV King of France.

The Church

Building began in 1629 on a plan by **Pietro de Marino** and completed in 1659. The architectural structure is a Latin cross. There are three chapels on each side. The floor is of majolic and terracotta tiles made by Donato Massa and designed by Domenico Antonio Vaccaro. The apse is by Nicola Tagliacozzo Canale.

The Lazzaretto Hall

Access to the hall is by the staircase whose entrance is on the left of the vestibule.

It is called the Lazzaretto Hall because it was here that lepers and, in times of plague, numerous plague-victims were gathered. It is 60 metres long, 10 metres wide and 12 metres high. At the end of the hall, a valuable marble altar commissioned in the 18th century separates the hall from the area which was at that time a medical room.

Halfway up along the wall there is a balcony, from where food and drink were served to in-patients to avoid contagion. Above the gallery, between the windows and below the vaulted roof there are frescoes by **Giacinto Diano** and **Andrea Viola** showing the Virgin Mary and saints of the order of S. Giovanni di Dio.

Santa casa dell'annunziata "ruota"

The wheel of the foundlings

This Sacred House was erected in the 14th century together with the annexed church as a **charitable institution for the care of abandoned infants**. It was reconstructed first in the 16th century in Renaissance form, and then in the 18th century by Luigi and Carlo Vanvitelli, after a fire. The fine marble portal, made in the 16th century by the Lombard artist **Tommaso Malvito** and his son Giovan Tommaso, has wooden doors carved by Pietro Belverte and Giovanni da Nola in the 16th century; it is through this portal that we enter the monumental courtyard of the House and the wooden "Wheel".

Abandoned babies were placed in a kind of wooden cylindrical drum and taken out on the other side by the nurses who were always ready to receive them. On the exterior, above the wheel, there was a marble putto with the inscription: "O father and mother who throw me here / We recommend ourselves to your charity". **The "guests" of the institution were called "children of the Madonna", "children of Nunziata" or "esposti" (foundlings)** and enjoyed very special privileges.

Some were found with a sheet of paper bearing the parents' name tied around their neck, or they carried a piece of gold or silver; others had nothing. Everything they wore and every sign they bore was noted in a book in order to facilitate an eventual recognition by parents. **The Wheel, so sadly fascinating, was one of the best known in Italy; it was last used in 1875.**

The marble portal, the wooden doors and the interior lunette fresco representing the Annunciation attributed to **Belisario Corenzio** are now on public view after the restoration completed in November 1996. The restored "Wheel" was added in 1997. The museum is managed by the Servizio Patrimonio Artistico Museale of the Commune of Naples with staff of the Commune and by socially useful workers.

Address Via Annunziata, 34 - Tel. 081/289032. **Opening times**, From Monday to Saturday 9 am - 7 pm.

Decumano Inferiore – Spaccanapoli

The itinerary starts in Piazza del Gesù and continues through Via Benedetto Croce, Via San Sebastiano, Piazza San Domenico Maggiore, Piazzetta Nilo, Via San Biagio dei Librai, to end in Via San Gregorio Armeno. Several beautiful Churches and Monumental complex can be enjoyed during the walk:

2. The Church of Gesù Nuovo

One of the most magnificent churches in Napoli, Chiesa del Gesù Nuovo also has the most interesting façade in the city. The rusticated pyramidal shaped squares on the façade belonged to the 15th century Palazzo Sanseverino, which was purchased by the Jesuits in 1580 for the construction of their church. Only the façade was retained while the interior was completely rebuilt in a splendid Baroque style. The elaborate Baroque doorway was added in the 17th century to the original portal of the palace. Numerous renowned Neapolitan artists, including Cosimo Fanzago, Lanfranco and Francesco Solimena,

contributed to the rich works of art within. The church is named "Nuovo", i.e. "New", to distinguish it from an older Jesuits church in Naples. When the Jesuits were expelled from Naples in 1767, their church was for a while occupied by the Franciscans, but it was later totally abandoned and closed for decades. It was not until 1900 that the Jesuits returned to Naples and to this church.

3. The Church of Santa Chiara

Located just off Piazza del Gesù on the western end of Centro Storico, Santa Chiara is one of the most beautiful and beloved churches in Naples. Set in a walled, citadel like complex, the church is rare example of the city's austere Gothic history and a pleasant contrast to the countless churches that were highly ornamented during the Baroque era. Owing to the Angevin Dynasty (1266 - 1442), Santa Chiara is the early 14th century project of King Robert the Wise and his wife Queen Sancha Majorca. The largest Gothic church in the city, it is best viewed from above, from a vantage point such as Piazzale San Martino where Robert's son Charles started construction on the San Martino Charterhouse. Devoted patrons of the Franciscan Order, Robert and Sancha built an unusual double convent to house both nuns of the Order of the Poor Clares and monks of the Order of Franciscan Friars and they dedicated the church to *Santa Chiara*, Clare of Assisi. The King's Royal Chapel and family burial place, Robert's tomb still stands behind the altar of this apse-less church. To the left and right of him, the tombs of his son Charles, Duke of Calabria who preceded him in death, and Charles' second wife Marie Valois. Like its counterparts, Santa Chiara was restyled in the 18th century, the work of Neapolitan painter, sculptor and architect Domenico Antonio Vaccaro. But after being nearly completely destroyed by Allied air raids on August 4, 1943, a controversial ten year long renovation restored the church to its original Gothic splendor. Reopened in 1953, the first chapel on the left just past the entrance was dedicated to the 23 year old Neapolitan and Italian national hero Salvo D'Acquisto. A Carabinieri during WWII, Salvo sacrificed his own life to the Germans during WWII so that 22 others could live. The famed Majolica Tiled Cloister that was redesigned as part of Domenico Antonio Vaccaro's remodel and adorned in hand painted Neapolitan ceramic tiles by Donato and Giuseppe Massa is located behind the church. From there you can reach the Museum of the Works which documents the restoration of Santa Chiara and houses a fine collection of sculpture, pottery, reliquaries and decorative art that survived the WWII bombings. Outside of the museum is a 1st century AD Roman Thermal Bath Complex that emerged after the air raids. There is also an 18th/19th century Neapolitan Presepe collection in a small room just off of the cloister.

12. The Church of San Domenico Maggiore – YOU ARE HERE

Take your time and savour one of the most beautiful churches in Naples. A church filled with so many treasures, no matter how many times you visit, you will always discover something new. Royal sepulchres, fragments of 14th century Giotto-esque frescoes, 16th century Neapolitan sculpture, Cosimo Fanzago's high altar (1652), a Baroque era panelled ceiling (1670), and 24 side chapels, each one, more beautiful than the next. One of the largest convent complexes in the city when it was built by the Angevins (1238 - 1324), San Domenico Maggiore served as the Aragonese royal church, the mother church of the Dominicans, and the monastery was the original seat of the University of Naples. It was here that Saint Thomas Aquinas studied and where he returned in his final years to teach theology. Beyond his chapel in the right nave, the sacristy is not to be missed. It features Francesco Solimena's frescoed ceiling, *Triumph of Faith over Heresy by the Dominicans* and a 3 sided double-tier gallery with 45 coffins containing the remains of members of the Aragonese court. At the end of the right nave, is the Chapel of San Michele Arcangelo a Morfisa, a 10th century church that was incorporated as a side chapel when the complex was built. It is through this chapel that most visitors enter the complex from Piazza San Domenico Maggiore. But this is not the main entrance, and explains the less than regal facade, the polygonal walls of the apse we see from the piazza. The front of the church is set in a courtyard on the north side of the church, where you'll also find entry to the ancient convent which was reopened to the public for May of the Monuments 2012 after a lengthy restoration. Find your way around San Domenico Maggiore with the help of placards that are located at each chapel, with a lengthy descriptions in Italian and abbreviated descriptions in English. An audio guide is also available from the ticket office in the Sacristy.

13. Cappella San Severo

The Cappella Sansevero (also known as the *Capella Sansevero de' Sangri* or *Pietatella*) is a chapel north of the church of San Domenico Maggiore, in the historic center of Naples. The chapel is more properly named the Chapel of *Santa Maria della Pietà*, or the *Pietatella*. It contains works of art by some of the leading Italian artists of the 18th century.

Its origin dates to 1590 when John Francesco di Sangro, Duke of Torremaggiore, after recovering from a serious illness, had a private chapel built in what were then the gardens of the nearby Sansevero family residence, the Palazzo Sansevero. The building was converted into a family burial chapel by Alessandro di Sangro in 1613 (as inscribed on the marble plinth over the entrance to the chapel). Definitive form was given to the chapel by Raimondo di Sangro, Prince of Sansevero, who also included Masonic symbols in its reconstruction. Until 1888 a passageway connected the Sansevero palace with the chapel. The chapel received its alternative name of Pietatella from a painting of the Virgin Mary (La Pietà), spotted there by an unjustly arrested prisoner, as reported in the book "Napoli Sacra" by Cesare d'Engenio Caracciolo in 1623. When the chapel was constructed it was originally dedicated to Santa Maria della Pietà, after the painting.

Address, Via Francesco De Sanctis, 19, Tel. 081 5518470, **Opening Times**: Monday-Saturday 10,00-17,40, Sunday 10,00-13,00

17. The Church of Sant'Angelo a Nilo

This church stands in Piazzetta Nilo, whose name derives from the ancient quarter of the Graeco-Roman city where the cult of the God of the Nile was practised. Built in 1385 by order of Cardinal Rinaldo Brancaccio as a tribute to St Michael, it was renovated by Guglielmelli in the 18th century. The church is commonly known as the Brancaccio Chapel because it was this family's private chapel.

The single-aisle interior contains, in the large apse chapel, the tomb of Rinaldo Brancaccio, sculpted in 1427-28 in Pisa by Donatello and Michelozzo and then sent to Naples. This sepulchral monument, which is in the "baldacchino" style typical of Gothic tombs, is of great importance as a product of Neapolitan Renaissance art.

The seventeenth century monument of Cardinals Francesco and Stefano Brancaccio, realized by Bartolomeo e Pietro Ghetti, is of particular importance.

Over the main altar, opposite the 17th-century monument of the Cardinals Francesco, Stefano Brancaccio di Bartolomeo and Pietro Ghetti, we notice the 1573 panel by Marco Pino of Archangel St Michael.

The sacristy leads to **Palazzo Brancaccio** (15th century) where in 1690 the first public library of Naples was opened.