

C. PRINCIPE, A. PAOLILLO, S. LA FELICE, S. ARRIGHI

*FORMA VESUVII – 2*  
VOLCANIC MORPHOLOGY AT THE TIME OF  
THE 79 AD PLINIAN ERUPTION

ESTRATTO

da

PHYSIS

Rivista Internazionale di Storia della Scienza

2021/1-2 ~ (LVI)



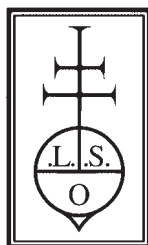
Leo S. Olschki Editore  
Firenze

# PHYSIS

RIVISTA INTERNAZIONALE DI STORIA DELLA SCIENZA

VOL. LVI  
NUOVA SERIE

2021



LEO S. OLSCHKI EDITORE  
FIRENZE

# PHYSIS

RIVISTA INTERNAZIONALE DI STORIA DELLA SCIENZA

*pubblicata dalla*

DOMUS GALILÆANA DI PISA

*in collaborazione con*

SOCIETÀ ITALIANA DI STORIA DELLA SCIENZA

SEMINARIO DI STORIA DELLA SCIENZA DELL'UNIVERSITÀ DI BARI

## DIREZIONE E REDAZIONE

(EDITORS)

*Direttore responsabile (Senior Editor):* STEFANO CARRAI.

*Direttori (Editors):* FRANCESCO PAOLO DE CEGLIA, CARLA RITA PALMERINO, CLAUDIO POGLIANO.

*Comitato direttivo (Editorial Board):* MONICA AZZOLINI, MARCO BRESADOLA, MAURO CAPOCCI, GIOVANNI DI PASQUALE, RENATO FOSCHI, SERGIO GIUDICI, LUIGI INGALISO, SANDRA LINGUERRI, ERIKA LUCIANO, ELIO NENCI.

*Responsabili delle recensioni (Book Reviews Editors):* ANDREA CANDELA, GIULIA GIANNINI, MATTIA MANTOVANI.

*Redazione (Editorial Office):* DAVID CECCARELLI, LUCIA DE FRENZA.

## CONSIGLIO SCIENTIFICO

(ADVISORY BOARD)

MAURO ANTONELLI, GIULIO BARSANTI, MARCO BERETTA, DOMENICO BERTOLONI MELI, PAOLA BERTUCCI, JANET BROWNE, ELENA CANADELLI, LUCA CIANCIO, MARCO CIARDI, GUIDO CIMINO, ANTONIO CLERICUZIO, MARIA CONFORTI, BARBARA CONTINENZA, VINCENZO DE RISI, FEDERICA FAVINO, PAULA FINDLEN, PAOLO GALLUZZI, PAOLA GOVONI, NICCOLÒ GUICCIARDINI, MICHAEL HAGNER, NICK HOPWOOD, MARIANNE KLEMUN, MATTEO MARTELLI, RENATO G. MAZZOLINI, MASSIMO MAZZOTTI, MARIA MONTSERRAT CABRÉ PAIRET, CARMELA MORABITO, STAFFAN MÜLLER-WILLE, GIULIANO PANCALDI, IRINA PODGORNÝ, GIANNA POMATA, TELMO PIEVANI, CLAUDIA PRINCIPE, PIETRO REDONDI, HANS-JÖRG RHEINBERGER, ANTONELLA ROMANO, PAOLO ROSSI, SOPHIE ROUX, DAGMAR SCHÄFER, EZIO VACCARI, STÉPHANE VAN DAMME.

E-MAIL: francescopaolo.deceglia@uniba.it

Ogni articolo è sottoposto alla valutazione anonima di due esperti.  
Each article is submitted to a double-blind scholarly peer review.

Questo volume è stato pubblicato con un contributo del Dipartimento di Scienze Teoriche e Applicate dell'Università degli Studi dell'Insubria.

## SOMMARIO

|   |      |     |
|---|------|-----|
| E. VACCARI, The History of Geological Sciences as a disciplinary crossing point: the Proceedings of the INHIGEO 2019 Symposium .....  | pag. | 1   |
| 1. <i>History of the Earth Sciences in Mountain Environment</i>   |      |     |
| G.A. GOOD, The Astronomers who fell to Earth: or, how the Copernican Revolution was completed in the Alps .....   | »    | 7   |
| A. CANDELA, Visualising the theory of the Alps: the first geological map of the western Lombard Prealps by Christian Leopold von Buch (1829) .....                                    | »    | 21  |
| J. DIEMER, The Geology of the Ural Mountains as understood by Roderick Murchison in 1845 .....  | »    | 33  |
| M. JOHNSTON, The Dun Mountain “ <i>Inoceramus</i> ” or the Maitai Problem. A Nelson perspective on an example of the challenges in dating the older rocks of New Zealand .....        | »    | 43  |
| E. VACCARI, The development of lithostratigraphy in the Alpine region during the early 19th century through the work of Giuseppe Marzari Pencati and Pietro Maraschini .....          | »    | 61  |
| M. HAMILTON, Research in the Austrian Zillertal Valley and Rieserferner Mountains by Friedrich Becke (1855-1931) and Ferdinand Löwl (1856-1908) – a case of successful teamwork ..... | »    | 75  |
| S. MASTER, Geological exploration of the Ruwenzoris, the legendary ‘Mountains of the Moon’ .....  | »    | 85  |
| P. MACINI, E. MESINI, The birth of Petroleum Geosciences in Italy .....   | »    | 101 |
| 2. <i>History of Communication in the Geological Sciences</i>   |      |     |
| P. SAMMURI, Two letters on mining sites in Tuscany by Giovanni Targioni Tozzetti to the Count of Richécourt .....   | »    | 117 |

|  |          |
|--|----------|
| L.F. AZUELA, E. VILLANUEVA-VILLASEÑOR, Joseph Burkart's geological research in Mexico (1825-1834): a paradigmatic case of knowledge co-production . . . . .  | pag. 135 |
| R.M. CLARY, Illustration within Informal Geological Communication during the Golden Age of Geology (1788-1840) – Examples from the respective correspondence and archives of Henry De La Beche and William Buckland. . . . . | » 149    |
| M. KLEMUN, Communicating Geology between Bureaucracy, public, society and layman: private conversation and productivity in the Metropolis Vienna . . . . .   | » 167    |
| J. MATTES, “Central nodes” and “neutral grounds:” boundary-work between scholarship, scientific amateurism and the public in Vienna (1860-1890). . . . .   | » 181    |
| Z. BESSUDNOVA, G. LYUBINA, Paleontologist Maria Pavlova's communication with foreign scientists in the late 19th-early 20th century. . . . .   | » 201    |
| A. HOPKINS, Overrating the exactitude: the role of Geodesy in Alfred Wegener's arguments for Continental Drift. . . . .  | » 221    |
| T. YAMADA, Geoscientists and Buddhist Thought: the popularization of science and ‘Cosmic Consciousness’ in 1920s Japan. . .  | » 235    |
| M. KÖLBL-EBERT, Limits of Communication: Geologists' Letters and the Nazi regime . . . . .   | » 257    |
| <i>3. General Contributions on the History of Geology</i>  |          |
| K. EL GHALBI, Rocks in Arab-Islamic scientific heritage between the 8th and 13th centuries. . . . .  | » 275    |
| C. PRINCIPE, A. PAOLILLO, S. LA FELICE, S. ARRIGHI, <i>Forma Vesuvii – 2</i> - Volcanic morphology at the time of the 79 AD Plinian Eruption. . . . .  | » 289    |
| F. D'ANGELO, Foreign communities, development of metallurgy and mining activities in southern Italy at the beginning of the Bourbon Dynasty (1734-1759) . . . . .  | » 303    |
| M. FACCIOLO, Mineralogical travels and mining knowledge in the 18th century: preliminary considerations on the case of Marco Carburi. . . . .  | » 319    |

- I. VTOROV, The importance of A.E. Fersman research on the island of Elba (1908) . . . . . pag. 333
- L. MORELOS-RODRÍGUEZ, Dolores Rubio Ávila. The first female engineering scholar and academic in Mexico, 1910. . . . . » 351
- D. MUSUMECI, S. BRANCA, L. INGALISO, Towards defining Strombolian activity during the 20th century . . . . . » 369
- M. PANTALONI, The 1:1M Geological Map of Italy: a milestone in geological knowledge . . . . . » 383
- M. YAJIMA, Exhibits observed at the Vienna World's Fair, in 1873, and the introduction of western geological thought and practice to Japan. . . . . » 397

#### Book Reviews

- O. AKOPYAN, *Debating the Stars in the Italian Renaissance. Giovanni Pico della Mirandola's Disputationes adversus astrologiam divinatricem and its Reception* (M. Cosci) – P.D. OMODEO, *Bernardino Telesio and the Natural Sciences in the Renaissance* (S. Gulizia) – A. BLAIR, K. GREYERZ (eds.), *Physico-Theology: Religion and Science in Europe, 1650-1750* (M. Dobre) – H.-J. RHEINBERGER (ed.), *Egon Rheinberger. Die Italienreise 1897* (I. Podgorny) – P. GUARNIERI, *Intellettuali in fuga dall'Italia fascista. Migranti, esuli e rifugiati per motivi politici e razziali* (B. Campanile) . . . . » 403

*FORMA VESUVII – 2*  
VOLCANIC MORPHOLOGY  
AT THE TIME OF THE 79 AD PLINIAN ERUPTION

CLAUDIA PRINCIPE, ANNARITA PAOLILLO, SONIA LA FELICE  
*IGG – CNR Pisa* ★  
SIMONE ARRIGHI  
*DSTP-Pisa* ★★

**ABSTRACT.** This work is aimed at reconstructing the morphology of the volcanic edifice of Vesuvius before the most famous eruption that occurred in 79 AD, destroyed the cities of Pompeii, Herculaneum, and Stabiae, and was described by Pliny the Younger. This result has been achieved by using both volcanological data and historical documents. The previous history of the volcano and the distribution of the deposits of the 79 AD eruption has been used as a guide for the reconstruction of the pre-eruptive morphology. This is consistent with the few indications given by the ancient writings and the frescoes found during archaeological excavations in Pompeii and Herculaneum.

## INTRODUCTION

Today the profile of the Vesuvius volcano, with the semicircular amphitheater of *Monte Somma* circumscribing the inner cinder cone known as *Gran Cono*, is an icon of the Neapolitan panorama (Fig. 1a). But any volcano is a changing place, and the morphology of Vesuvius two thousand years ago, before the most famous eruption of the world that occurred in 79 AD and destroyed Pompeii, Herculaneum, and Stabiae was different

---

\* Istituto di Geoscienze e Georisorse, Via Giuseppe Moruzzi 1, Pisa, Italy, corresponding author e-mail: [c.principe@igg.cnr.it](mailto:c.principe@igg.cnr.it).

\*\* Dipartimento di Scienze della Terra, Via Santa Maria 53, Pisa, Italy, e-mail: [simone.arrighi@unipi.it](mailto:simone.arrighi@unipi.it).

than nowadays. Countless papers have been written on the morphology of the Vesuvius volcano as it was before this eruption, in spite of the fact that there are very few contemporary descriptions of the volcano before 79 AD. These include the Spartacus story, and a few frescoes, found during the excavations of the Roman towns buried beneath the volcanic deposits.

On the one hand, most of these works do not take into consideration the geological constraints posed by the distribution of volcanic deposits and the changes produced by eruptive activity upon the volcanic landscape before and after that eruption. On the other hand, there are doubts that the landscapes that may be extrapolated from documentary data are actually representative of the Vesuvius morphology as it was before the 79 AD eruption.

This work deals with a comparison between the reviewed historical documents and the available geological information regarding the morphology of *Monte Somma* and Vesuvius before the 79 AD eruption, in order to define what can actually be inferred about this fascinating subject.

#### THE 79 AD ERUPTION

The 79 AD eruption was preceded by a huge earthquake – which is generally accepted to have happened on February 5, 62 AD – that caused major damage in Pompeii and Herculaneum, and also affected the town of Naples.<sup>1</sup> Following the reconstruction of Haraldur Sigurdsson,<sup>2</sup> the eruption started early in the morning of October 24 with a small phreatomagmatic explosion that distributed ashes upon the eastern volcanic sectors.<sup>3</sup> The subsequent Plinian phase of the eruption began shortly after noon on the same day. The first Plinian fallout of white pumice was emitted over a period of 7 hours and distributed towards the South (Fig. 2, refer to Colour Plate Section, plate X). It was followed by another fallout, but this was made up of grey pumice, that reached the stratosphere and, blown by winds, was distributed mainly to the South-East. The accumulation of pumice on the roofs caused the collapse of many settlements located downwind, such as Pompeii. At about 1 a.m. on October 25 the first pyroclastic surge was gen-

---

<sup>1</sup> See page on the 62 Pompeii earthquake from the CFT15 Catalogue of Strong Earthquakes in Italy (BC 461 - 1997) and Mediterranean Area (760 B.C. - 1500), GUIDOBONI, FERRARI, MARIOTTI et al., 2018.

<sup>2</sup> SIGURDSSON, CAREY, CORNELL et al., 1985.

<sup>3</sup> See also STEFANI, 2006.



erated. During the next seven hours the Plinian eruption was interrupted six times by surges and pyroclastic flows, hereafter called pyroclastic density currents (PDCs) as a whole. PDCs were generated by repeated column collapse, that resulted in the majority of the casualties suffered in Pompeii and Herculaneum. Surges are testified to have reached also Stabiae and Misenum. According to,<sup>4</sup> the increasing mass discharge from the conduit vent caused a caldera collapse.<sup>5</sup> After this catastrophic event, the final eruptive activity produced fine ash falls and surges rich in accretionary lapilli, due to the activation of phreatomagmatic interaction processes inside an enlarged conduit.

As shown by Fig. 2, there is a good agreement between the distribution of the 79 AD PDCs deposits proposed by Sigurdsson,<sup>6</sup> and the isopach lines of the same deposits drawn by Gurioli et al.<sup>7</sup> In addition, the survey performed by Milia et al.<sup>8</sup> in the Gulf of Naples offshore of the old city of *Herculaneum*, that comprises seismic-reflection profiles and a set of core stratigraphy, highlighted the presence of a huge subaqueous fan, that may be related to the 79 AD PDCs deposits, that matches one of the lobes of on-land PDCs deposits, as identified by Sigurdsson et al.<sup>9</sup> and by Gurioli et al.<sup>10</sup>

#### GEOLOGICAL DATA ON THE VOLCANO MORPHOLOGY PRIOR TO THE 79 AD ERUPTION

This proposed distribution of the 79 AD PDCs deposits calls for the presence of a morphological barrier to the South and of four valleys pre-dating the 79 AD eruption, that acted as escape routes for the PDCs (white arrows in Fig. 2). The westernmost of these valleys is *Fosso della Vetrana* which is controlled by a strike-slip fault striking N320°.<sup>11</sup> The following western valley is *Fosso Bianco*, now corresponding to the interception of the 79 AD southern caldera rim with the *Pomici di Avellino (PdA)* tuff-cone. At the time of the eruption, the valley already existed as the

---

<sup>4</sup> SIGURDSSON, CAREY, CORNELL et al., 1985.

<sup>5</sup> The *ruina montis* by Roman writers, e.g. Silius Italicus, *Punica*, XII, pp. 147-157.

<sup>6</sup> SIGURDSSON, CAREY, CORNELL et al., 1985.

<sup>7</sup> GURIOLI, SULPIZIO, CIONI et al., 2010.

<sup>8</sup> MILIA, MOLISSO, RASPINI, et al., 2008.

<sup>9</sup> SIGURDSSON, CAREY, CORNELL et al., 1985.

<sup>10</sup> GURIOLI, SULPIZIO, CIONI et al., 2010.

<sup>11</sup> PRINCIPE, BROCCINI, ARRIGHI et al., 2010.

erosive morphology produced at the contact between the *PdA* sector-collapse scarp, curved inside the *Cognoli di Levante* volcano, and the tuff-cone formed inside that scarp before the end of the *PdA* eruption.<sup>12</sup> The eastern valleys, *Vallone del Fico* and *Butto del Piscinale* (Fig. 2), were the morphological result of the joint action of the N300°-320° and a N340° regional tectonic trend acting in this portion of the volcano during the time span from 5600 y BP up to.<sup>13</sup>

As a whole, the morphology of the pre-79 AD volcanic edifice is the result of previous volcanic history, which was characterized in turn by building-up phases alternating to destructive events, as follows (numbered in Figure 3a from the oldest to the most recent: refer to Colour Plate Section, plate XI):

(1) A caldera collapse occurred after the *Greenish Pumices* eruption about 20,000 years before the present. This event produced the curved part of the *Monte Somma* cliff under the *Punta del Nasone* peak,<sup>14</sup> as indicated by the toothed circle in Fig. 3a.

(2) A caldera collapse related to the *Mercato Pumices* eruption about 8900 years before the present. This event destroyed the internal portion of the *Cognoli di Levante* volcano (brown colored area<sup>15</sup>). Remnants of this edifice are still clearly visible from Pompeii (Fig. 1b).

(3) A sector-collapse due to the *Pomici di Avellino (PdA)* eruption occurred about 4000 years before the present. This event created the steep walls of the westernmost portion of the *Monte Somma* cliff as indicated by the dashed line in Fig. 3a.<sup>16</sup>

(4) A tuff-cone built during the last phase of the *PdA* eruption (green area in Fig. 3a indicates edifice; crater is indicated by saw-toothed ellipse).<sup>17</sup>

As a result of these actions, at least the westernmost portion of *Monte Somma* cliff pre-dates the 79 AD eruption. While the eastern portion of the cliff was still not formed, and also that portion of the volcanic area still occupied by the *Cognoli di Levante* edifice.

<sup>12</sup> PRINCIPE, BROCCINI, PAOLILLO et al., 2020a.

<sup>13</sup> PRINCIPE, BROCCINI, ARRIGHI et al., 2010.

<sup>14</sup> PRINCIPE, BROCCINI, PAOLILLO et al., 2020a.

<sup>15</sup> PRINCIPE, BROCCINI, ARRIGHI et al., 2020b.

<sup>16</sup> PRINCIPE, BROCCINI, PAOLILLO et al., 2020a.

<sup>17</sup> Ibid.

## GEOLOGICAL DATA DISCUSSION

The portion of the volcano occupied by the *PdA* tuff-cone appears today to be higher than its remaining southern edge (550-500 m amsl vs 500-450 amsl), due to the occurrence of the post-79 AD caldera collapse. Even if mainly buried by the lavas of the subsequent activity of Vesuvius,<sup>18</sup> the southern portion of the 79 AD caldera rim is still visible in the field (Fig. 1c) between the *Fosso Bianco* and *Butto del Pescinale-Bosco della Cupaccia* erosive depressions. However, the situation at the time of the 79 AD eruption was reversed. The southern edge of the volcano was morphologically higher than its western sector, because the latter had already been affected by the sector collapse linked to the *PdA* eruption (Fig. 3a). For this reason, the 79 AD PDCs entered in mass the valleys of *Fosso della Vetrana* and *Fosso Bianco*, filled the *Piano delle Ginestre PdA* crater depression, and passed over the *PdA* tuff-cone rim (Fig. 2). This is why there was a huge quantity of PDCs deposits accumulated on this sector of the volcano and even offshore in front of the old town of Herculaneum, as found by Milia et al.<sup>19</sup> With no need to hypothesize – as proposed by Cinque & Iorollo<sup>20</sup> – there existed a deep erosive cut inside the south-western rim of the *PdA* tuff-cone.

Most of the existing reconstructions of the morphology of Vesuvius before the 79 AD eruption have in common the representation of the volcano as a single large edifice with a regular conical shape and a large crater on top.<sup>21</sup> However, this pre-eruptive morphology appears to be unrealistic considering the distribution of the 79 AD PDCs deposits (Fig. 2). As has been already seen, at least a portion of the northern *Monte Somma* cliff was already present at the time of the eruption. Provisionally accepting the common hypothesis of a giant homogeneous cone emitting a Plinian column affected by multiple collapses, then the resulting PDCs would be expected to have a homogeneous distribution, controlled by the regular conical shape assumed for the cone. However, this is not the case, as the PDCs distribution to the North and to the South of the volcano is far from homogeneous (Fig. 2), as was already noted by Sigurdsson et al.<sup>22</sup>

---

<sup>18</sup> ROSI, SANTACROCE, SBRANA, 1986.

<sup>19</sup> MILIA, MOLISSO, RASPINI, et al., 2008.

<sup>20</sup> CINQUE, IOROLLO, 2008.

<sup>21</sup> See for example PALMIERI, 1880.

<sup>22</sup> SIGURDSSON, CAREY, CORNELL et al., 1985.

Both the large, rounded caldera rim reported in Cioni et al.<sup>23</sup> and the oval shaped caldera rim presented by Sbrana et al.,<sup>24</sup> that are practically occupying all the present summit depression centered on the young Vesuvius cone are purely speculative forms having been reconstructed on the basis of the approximate volume of the erupted products, without considering the complex history of the volcano delineated above. The same holds true for the caldera of about 4 km in diameter corresponding to a magma chamber of about 1,5 km<sup>3</sup> of evolved magma as hypothesized by Sigurdsson et al. in 1990.<sup>25</sup> All in all, following the rounded shape of the still evident southern caldera rim (Fig. 2), it is difficult not to accept a very large caldera for this eruption, nested within the *Pomici di Avellino (PdA)* tuff-cone crater, and able to justify a great portion of the present day summit depression (Figs. 2-3).

#### WRITTEN DOCUMENTS

Unlike the information we have regarding the eruption of Vesuvius on December 16, 1631,<sup>26</sup> the Romans were aware that Vesuvius was a volcano. Many Roman-age historians, including *Diodorus Siculus*, *Vitruvius*, and *Strabo*,<sup>27</sup> recognized the volcanic character of Vesuvius.<sup>28</sup> However, few pieces of information are given in these ancient writings regarding the morphology of Vesuvius before the 79 AD eruption.

The idea that Vesuvius had a single peak before the 79 AD eruption stems mainly from *Strabo's* first century BC description of the existence of a flat portion of the top of the volcano.<sup>29</sup> It is from the latter work that

<sup>23</sup> CIONI, SANTACROCE, SBRANA, 1999.

<sup>24</sup> SBRANA, CIONI, MARIANELLI et al., 2020.

<sup>25</sup> SIGURDSSON, CORNELL, CAREY, 1990.

<sup>26</sup> PRINCIPE, MARINI, 2008.

<sup>27</sup> For a complete collection of the ancient texts about Vesuvius before and after the AD 79 eruption see ARGENZIANO, LANGELLA, MARASCO et al., 2013.

<sup>28</sup> SIGURDSSON, CAREY, CORNELL et al., 1985.

<sup>29</sup> "Mount Vesuvius rises on these places, which has beautiful fields all around, except the top: it has a mostly flat part, all bare, with an ash-like view and shows porous cavities of black rocks below the surface, as if had been devoured by fire, as one might think that this territory was previously burnt and has fire craters and that it died out due to lack of vegetation. Perhaps this is the reason for the fertility around, as in Catania they say that the part nourished by the ash emitted by the fire of Etna made the land rich in vines. In fact, it has substances that fertilize and scorched sods and that produce fruits; therefore, abundant of fire-friendly substance, all rich in sulfur, dried up, spent and incinerated, becomes fertile" *Strabo, Geographica*, V, 4, 8; *Lipsia* edition by C. Tauchnitz.

the subsequent assumption that Monte Somma prior to the eruption was a huge cone truncated on its summit portion which has influenced later literature.<sup>30</sup> Actually, the only information we can extract from the writings of *Strabo* (who lived from about the 58 BC to about the 25 AD), apart from the volcanic nature of the mountain, is that “a portion” of the summit of Vesuvius was flat, perhaps referring to the *Cognoli di Levante* still existing edifice.

Some pieces of information referring to the morphology of *Monte Somma* before the 79 AD eruption can be inferred from the story about the adventure of Spartacus and his gladiators in 73 BC on Vesuvius, narrated by Plutarch and a few other ancient writers.<sup>31</sup>

#### SPARTACUS’S JOURNEY ON VESUVIUS

Keeping in mind the reconstructed morphology of Vesuvius in the paragraph above and the story told to us by Plutarch<sup>32</sup> and other describing the adventure by Spartacus on Vesuvius, we can make some speculations. As is well known, in 73 BC, Spartacus and 64 gladiators fled from the school of gladiators in *Capua* and approached Vesuvius from the direction of *Capua*, followed by the *Clodio Glabro* army (3000 men). The existing Roman consular roads of that time were the “*Popilia-Annia*” road, built around 123 BC, connecting *Capua* to *Reggio Calabria* passing from *Acerra* and *Nola*, and a coastal road passing through *Erculaneum* and *Oplontis* (Fig. 3b, refer to Colour Plate Section, plate XI). The initial crowd of 64 people greatly increased in number along the way, because of the many slaves and peasants who fled to Roman estates to join the rebellion. We assume that Spartacus, followed by the *Clodio* army, firstly used the “*Popilia-*

<sup>30</sup> PALMIERI, 1880.

<sup>31</sup> The sources on the adventure of Spartacus besides Plutarch are: *Velleio Patercolo* (*Historiae Romanae ad Marcum Vinicium consulem*, II, 30; I century AC), *Frontino* (*Stratagemata*, I, V, 21; I century AC), *Lucio Anneo Floro* (*Epitoma de Tito Livio*, III, XX; II century AC), and *Appiano Marcellino* (*Le Guerre civili*, I, XIV, 116, II century AC).

<sup>32</sup> “Then, having been sent from Rome the praetor Clodius with three thousand soldiers, while he besieged them on the mountain that had only one way, an uneven and narrow ascent, which Clodius had surrounded with a guard post, on the other sides steep rocks and banks, abundant wild vines born at the top, cut the useful parts of the branches and having woven strong and long ladders with them so that suspended from above as if they were a tree, they reached the plane, and went down safely, except for one; this having restrained himself because of the weapons, after they had come down he threw down the weapons and after throwing them all last he also saved himself,” *Plutarcus Vitae parallelae*, *M. Crassus vita*, 9,2.

*Annia*” road and then, reached *Acerra*, diverted to the *Monte Somma* higher ground to find refuge on the mountain,<sup>33</sup> using the Roman secondary roads that go to the present day *Somma Vesuviana* village (Fig. 3a).

It is still possible nowadays to do the same journey on-foot from *Capua* to *Somma Vesuviana* in 7-8 hours, using the same roads. It is also still possible today, to reach the ridge of *Monte Somma* from the North in a couple of hours, by means of a path (Fig. 3a) that starts from *Somma Vesuviana* and passes from *Santa Maria delle Grazie a Castello*, until it reaches the base of the *Punta del Nasone* spatter cone, the highest point of *Monte Somma* (1131 m amsl). If they took this narrow valley path, it would not have been possible for Spartacus, as it is not nowadays, to cross the escarpment from the base to the top of the *Punta del Nasone* welded spatter, in order to descend to the plain by following the westernmost *Monte Somma* crest, then continuing on to the *Fosso della Vetrana* fault passage (Fig. 3a), nor to come back along the valley, before to be caught by the Roman soldiers. If that had been the case, the only choice should have been to take the dangerous route of descending from the *Monte Somma* cliff<sup>34</sup> and then, by going along the present *Atrio del Cavallo* and *Fosso della Vetrana* passages to get around the base of *Monte Somma*, from the West (Fig. 3a), and then attack the *Clodius* camp, as is attested in the *Santa Maria delle Grazie a Castello* area, with the aid of the darkness and by approaching from behind. Then Spartacus abandoned the *Vesuvius* area heading towards *Nola* and then continued onwards to *Lucania*.

## FRESCOES

In previous literature, each of the panoramic views that include mountains found in frescoes discovered inside the *Herculaneum* and *Pompeii* excavations have been in turn interpreted as the “true” appearance of the volcano before the 79 AD eruption.<sup>35</sup> These attributions were often done without any consideration of the historical context, but only followed a desire to see depicted there what one was searching for. Actually, the use of ancient paintings for solving this problem has to be considered as quite tricky for several reasons (e.g.: artistic distortion, uncertainty about the subject, etc.).

<sup>33</sup> “*Primo Vesuvium Montem petiere*” *Velleio Patercolo*, cit.

<sup>34</sup> “*Prima velut ara viris mons Vesuvius placuit. Ibi, quum obsiderentur a Clodio Glabro, per fauces cavi montis vitineis delapsi vinculis, ad imas eius descendere radices...*” *Lucio Anneo Floro*, cit.

<sup>35</sup> See for example *RENNA*, 1992.

Among the ancient landscape representations attributed to Vesuvius, the most famous is undoubtedly the one found in Pompeii inside the *lararium* of the *Aulus Rustius Verus* house in 1879, that for this reason is better known as *Casa del Centenario* (Centennial house). This fresco is presently preserved in the National Archaeological Museum of Naples (MANN, inv. 112286; Fig. 4a). There is a general agreement within the literature on Vesuvius that this is a symbolic representation of the western portion of *Monte Somma* and its cliff.<sup>36</sup> The reason is easy to understand by comparing a modern picture of *Monte Somma* from a SW perspective (Fig. 1a) with this fresco (Fig. 4a). However, the *Casa del Centenario* fresco contains other elements of interest for the reconstruction of the morphology of Vesuvius prior to the 79 AD eruption, as was already noted by Catalano.<sup>37</sup> The attentive observations made by Virginio Catalano on some details of the morphology that this fresco represents, were undeservedly considered by subsequent authors, apart from Scherillo, 1982.<sup>38</sup> However, in the fresco what Catalano described as “an ancient gigantic crater of explosions over a kilometer in diameter... in the form of a number 8” is clearly evident (Fig. 4b). This morphological structure appears to be made of two rounded forms, the westernmost, in the Catalano interpretation, is occupied by a little lake. In light of the current volcanological knowledge<sup>39</sup> this morphology easily corresponds to the crater of the tuff-cone that was formed at the end of the *PdA* eruption, presently corresponding to the *Piano delle Ginestre* plain (Fig. 3a), and subsequently the area affected by the crater vents of the so-called “AP” eruptions, as defined by Andronico and Cioni.<sup>40</sup>

Another famous Pompeian fresco has been interpreted as a representation of the shape of Vesuvius prior to the eruption of 79 AD, and is that from the *Casa del Citarista* in Pompeii (MANN, inv. 112282).<sup>41</sup> Actually, this fresco (attributed to the period 10 BC - 45 AD) represents a well-known mythological scene (the amorous encounters between *Aeneas* and *Dido* in Carthage), therefore the mountainous profile in the background actually has no reason to be connected with the Pompeian reality, but most likely reflects the common practice of painters’ workshops to use reproductions

---

<sup>36</sup> See for example STEFANI, 2010.

<sup>37</sup> CATALANO, 1976.

<sup>38</sup> SCHERILLO, 1982.

<sup>39</sup> PRINCIPE, BROCCINI, ARRIGHI et al., 2020b.

<sup>40</sup> ANDRONICO, CIONI, 2002.

<sup>41</sup> NAZZARO, 1999; CIONI, SANTACROCE, SBRANA, 1999.

on cardboard of well-known paintings, to reproduce the various fixed elements of some mythological scenes.<sup>42</sup>

Another category of frescoes that have been interpreted as panoramic representations of Vesuvius,<sup>43</sup> are the landscapes with villas and coastal bays, including the four small frescoes panels inside the *Tablinum* of the *Casa di Marco Lucrezio Frontone* in *Pompeii* (V4, A). Also, in this case, there are no elements to sustain that these panoramas represent real places and/or that they pertain to the geographical area of Vesuvius.<sup>44</sup> More generally, nowadays there are doubts regarding the practice in the Roman world of making representations of real landscapes.<sup>45</sup>

In some of the many printed works on the Pompeii archaeological excavation, frescoes are reproduced which in some cases we no longer have at our disposal as they have been lost. This is the case of the drawing in Figure 4c. Without pretending to use this reproduction as the “true image” of Vesuvius prior to the 79 AD eruption, this picture is the one that is closest to the reconstruction of *Monte Somma* and the morphology of Vesuvius resulting from the geological constraints defined herein and the *Casa del Centenario* fresco.

The four morphological elements visible in this drawing – assuming that the point of view is from the Southwest – are: (1) the Apennine mountain range bordering the *Conca Campana* at the flanks of the volcano; (2) the westernmost portion of *Monte Somma*; (3) the *Pomici di Avellino* related tuff-cone; and (4) the remnants of the *Cognoli di Levante* volcano, that will be truncated by the 79 AD caldera.

## CONCLUSIONS

The joint use of historical and geological data allowed us to make a reliable reconstruction of the shape of Vesuvius prior to the eruption of 79 AD which destroyed Pompeii, Herculaneum and Stabiae and changed the morphology of the volcano, making it more similar to what we observe today.

Only the westernmost portion of the escarpment of *Monte Somma* already existed prior to the eruption, as well as the tuff-cone constructed in the last phase of the eruption of the *Pomici di Avellino*. However, what today

<sup>42</sup> STEFANI, 2010.

<sup>43</sup> STOTHERS, RAMPINO, 1983; ARGENZIANO, LANGELLA, MARASCO et al., 2013.

<sup>44</sup> STEFANI, 2010.

<sup>45</sup> GUZZO, 2007.



we observe as the southern portion of the 79 AD caldera, prior to this eruption existed as a raised morphological relief, that functioned as a barrier to the expansion of the eruption flow deposits towards the sea.

Such morphology compares well with the scarce information that may be extracted from ancient writings and from scenes depicted in the Pompeii and Herculaneum frescoes.

#### ACKNOWLEDGMENTS

The manuscript benefitted of the critical readings of Luigina Vezzoli, Luigi Marini, and Grete Stefani, that are here acknowledged.

#### REFERENCES

- ANDRONICO Daniele, CIONI Raffaello, 2002. "Contrasting styles of Mount Vesuvius activity in the Period between the Avellino and Pompeii Plinian eruptions, and some implications for assessment of future hazards," *Bulletin of Volcanology*, 64, pp. 372-391, doi:10.1007/s00445-002-0215-4.
- ARGENZIANO Salvatore, LANGELLA Aniello, MARASCO Vincenzo et al., 2013. *Alle Fonti del Vesuvio – Dalle origini all'eruzione del 1631*, Roma, Gruppo editoriale GEDI S.p.A. ILMIOLIBRO.
- CATALANO Virgilio, 1976. "Contributo alla morfologia del Somma-Vesuvio. Il cratere anteriormente al parossismo del 79 d.C.," *Rendiconti dell'Accademia delle Scienze Fisiche e Matematiche*, IV/XLII, anno CXIV, pp. 32-58.
- CINQUE Aldo, IROLLO Giolinda, 2008. "La paleogeografia dell'antica Herculaneum e le fluttuazioni, di origine bradisismica, della sua linea di costa," in Pietro Giovanni Guzzo, Maria Paola Guidobaldi (a cura di), *Nuove ricerche archeologiche nell'area vesuviana (scavi 2003-2006) – Atti del Convegno Internazionale*, Roma, L'erma di Bretschneider, pp. 425-438.
- CIONI Raffaello, SANTACROCE Roberto, SBRANA Alessandro, 1999. "Pyroclastic Deposits as a Guide for Reconstructing e Multi-Stage Evolution of the Somma-Vesuvius Caldera," *Bulletin of Volcanology*, 61, pp. 207-222, doi: 10.1007/s004450050272.
- GUIDOBONI Emanuela, FERRARI Graziano, MARIOTTI Dante, COMASTRI Alberto, TARABUSI Gabriele, SGATTONI Giulia, VALENSISE Gianluca, 2018. Historical earthquake data from the CFTI5Med catalogue. PANGAEA, <https://doi.org/10.1594/PANGAEA.896754>.
- GURIOLI Lucia, Sulpizio Roberto, SBRANA Alessandro et al., 2010, "Pyroclastic Flow Hazard Assessment at Somma-Vesuvius Based on the Geological Record," *Bulletin of Volcanology*, 72, pp. 1021-1038, doi: 10.1007/s00445-010-0379-2.
- Guzzo Pier Giovanni, 2007. *Pompeii. Storia e paesaggi della città antica*, Milano, Mondadori Electa.
- MILIA Alfonsa, MOLISSO Flavia, RASPINI Arturo et al., 2008. "Syneruptive Features and Sedimentary Processes Associated with Pyroclastic Currents Entering the Sea: the 79 AD eruption of Vesuvius, Bay of Naples, Italy," *Journal of the Geological Society*, 165, pp. 839-848, doi:10.1144/0016-76492007-110.

- NAZZARO Antonio, 1999. "The Shape of Vesuvius before the 79 A.D. Eruption According to a New Finding from a Pompeii Fresco and Vesuvius Central Cone History in the Last 2000 year," *Annali di Geofisica*, 42/4, pp. 715-723.
- PALMIERI Luigi, 1880. *Il Vesuvio e la sua storia*, Milano, Tipografia Favero, pp. 1-79.
- PRINCIPE Claudia, BROCCINI Debora, PAOLILLO Annarita et al., 2020a. "Structural control during Monte Somma and Vesuvius volcanic history – 2 – Central vents migration and Monte Somma growth," in prep. for *Tectonophysics*.
- PRINCIPE Claudia, BROCCINI Debora, ARRIGHI Simone et al., 2020b. "FORMA VESUVII -1- A New Perspective on the Pomice di Avellino Vesuvius Eruption, based on Geomorphological and Facies Analysis Constraints," submitted to *Geomorphology*.
- PRINCIPE Claudia, BROCCINI Debora, ARRIGHI Simone et al., 2010. *Vesuvius Volcano-Tectonic History – a New Perspective*, IAVCEI Collapse Caldera Commission Workshop, pp. 51-53.
- PRINCIPE Claudia, MARINI L., 2008. "Evolution of the Vesuvius Magmatic-Hydrothermal System before the 16 December 1631 Eruption," *Journal of Volcanology and Geothermal Research*, 171/3, pp. 301-306, doi: 10.1016/j.jvolgeores.2007.12.004.
- PRONTERA Francesco, 2003. *Tabula Peutingeriana – Le antiche vie del mondo*, Firenze, Olschki.
- RENNA Enrico, 1992. *Vesuvius Mons*, Napoli, Procaccini.
- ROSI MAURO, SANTACROCE Roberto, SBRANA Alessandro, 1986. "Geological Map of Somma-Vesuvius Volcanic Complex (scale 1:25,000)," in Roberto Santacroce (ed.), *Somma-Vesuvius. Quaderni de 'La Ricerca Scientifica'*, CNR 114/8, Roma, CNR Edizioni.
- SBRANA Alessandro, CIONI Raffaello, MARIANELLI Paola et al., 2020. "Volcanic Evolution of the Somma-Vesuvius Complex (Italy)," *Journal of Maps*, 16/2, pp. 137-147, doi: 10.1080/17445647.2019.1706653.
- SCHERILLO Antonio, 1982. "Il Vesuvio prima e dopo Plinio," in Id. (ed.), *La regione sotterrata dal Vesuvio*, Napoli, Università Federici II di Napoli, pp. 945-953.
- SIGURDSSON Haraldur, CAREY Steven, CORNELL Winton et al., 1985. "The Eruption of Vesuvius in A.D. 79," *National Geographic Research*, 1/3, pp. 332-387.
- SIGURDSSON Haraldur, CORNELL Winton, CAREY Steven, 1990. "Influence of Magma Withdrawal on Compositional Gradients during the 79 AD Vesuvius Eruption," *Nature*, 345/6275, pp. 519-521.
- STEFANI Grete, 2006. "La vera data dell'eruzione," *Archeo*, 260, pp. 12-13.
- STEFANI Grete, 2010. "Luoghi e personificazioni di luoghi nelle pitture dell'area vesuviana," in Irene Bragantini (a cura di) *Atti del X congresso Internazionale Association Internationale pour la Peinture Murale Antique (AIPMA)*, Napoli, pp. 255-267.
- STOTHERS Richard B., RAMPINO Michael R., 1983. "Volcanic Eruptions in the Mediterranean Before A.D. 630. From Written and Archaeological Sources," *Journal of Geophysical Research*, 88/8, pp. 6357-6371.

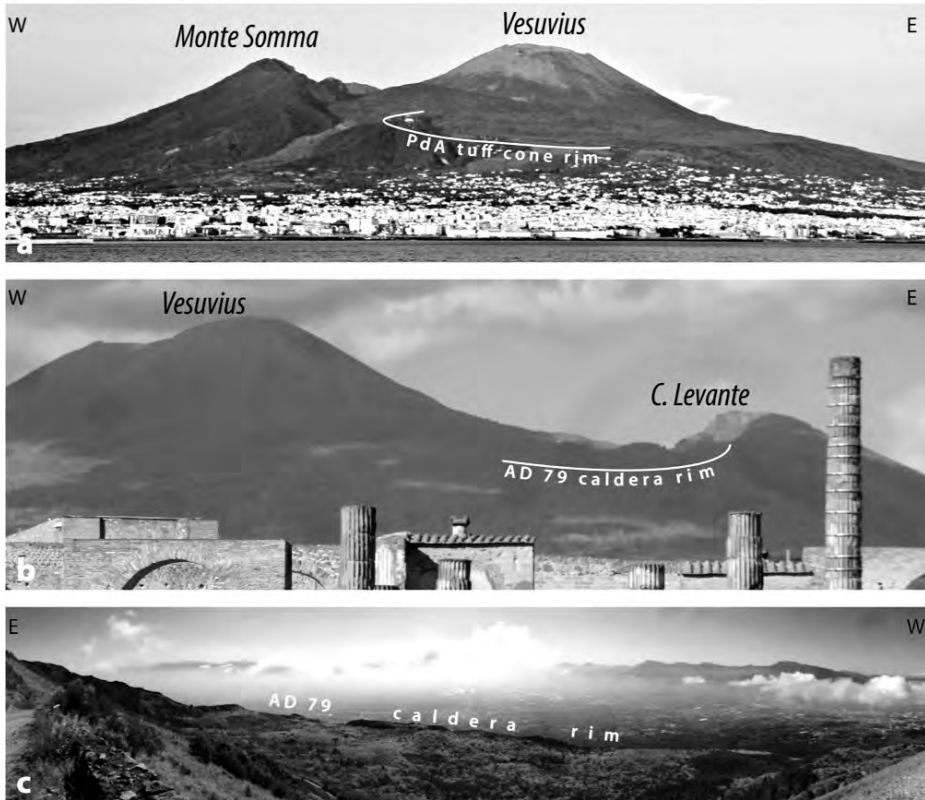
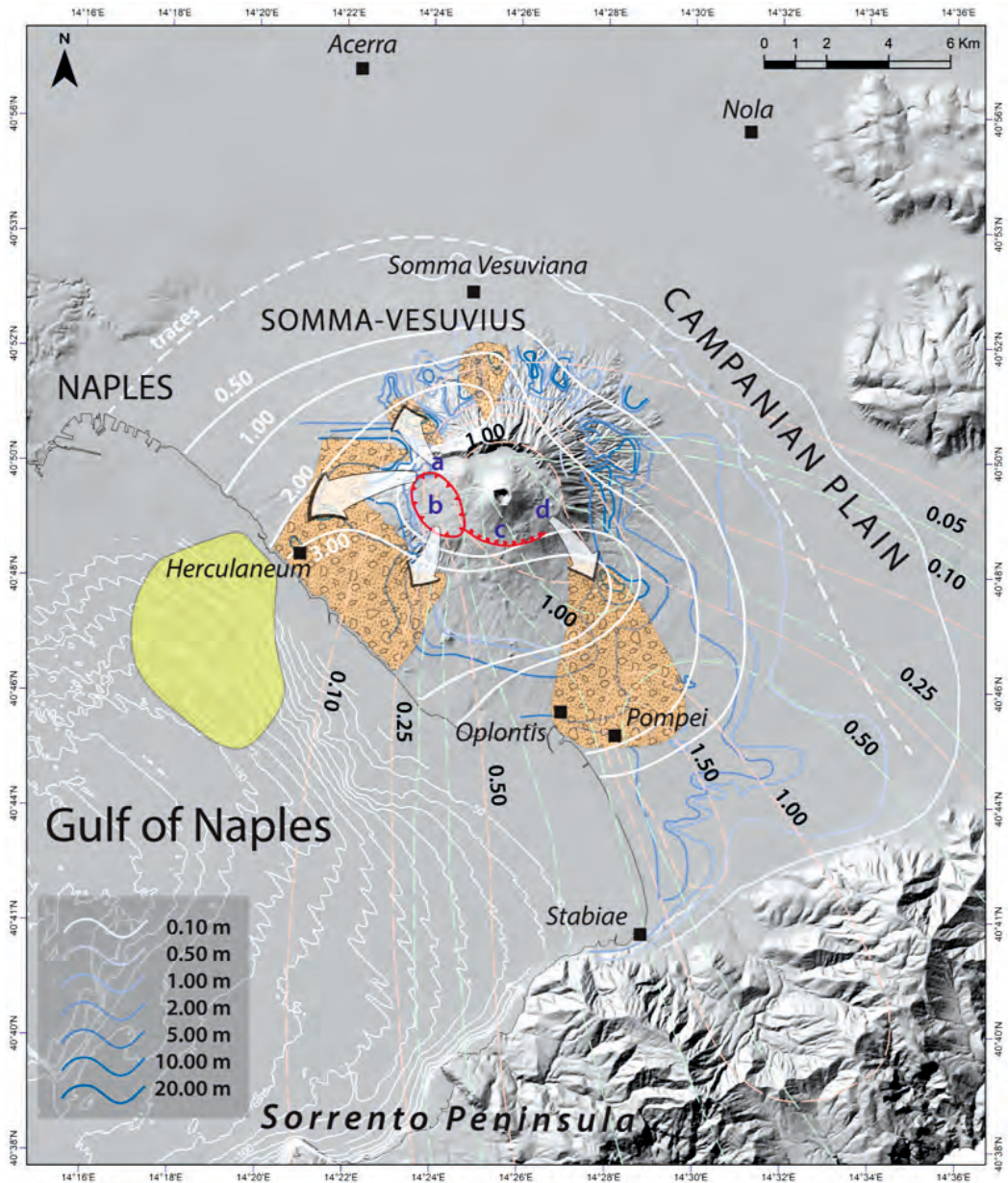
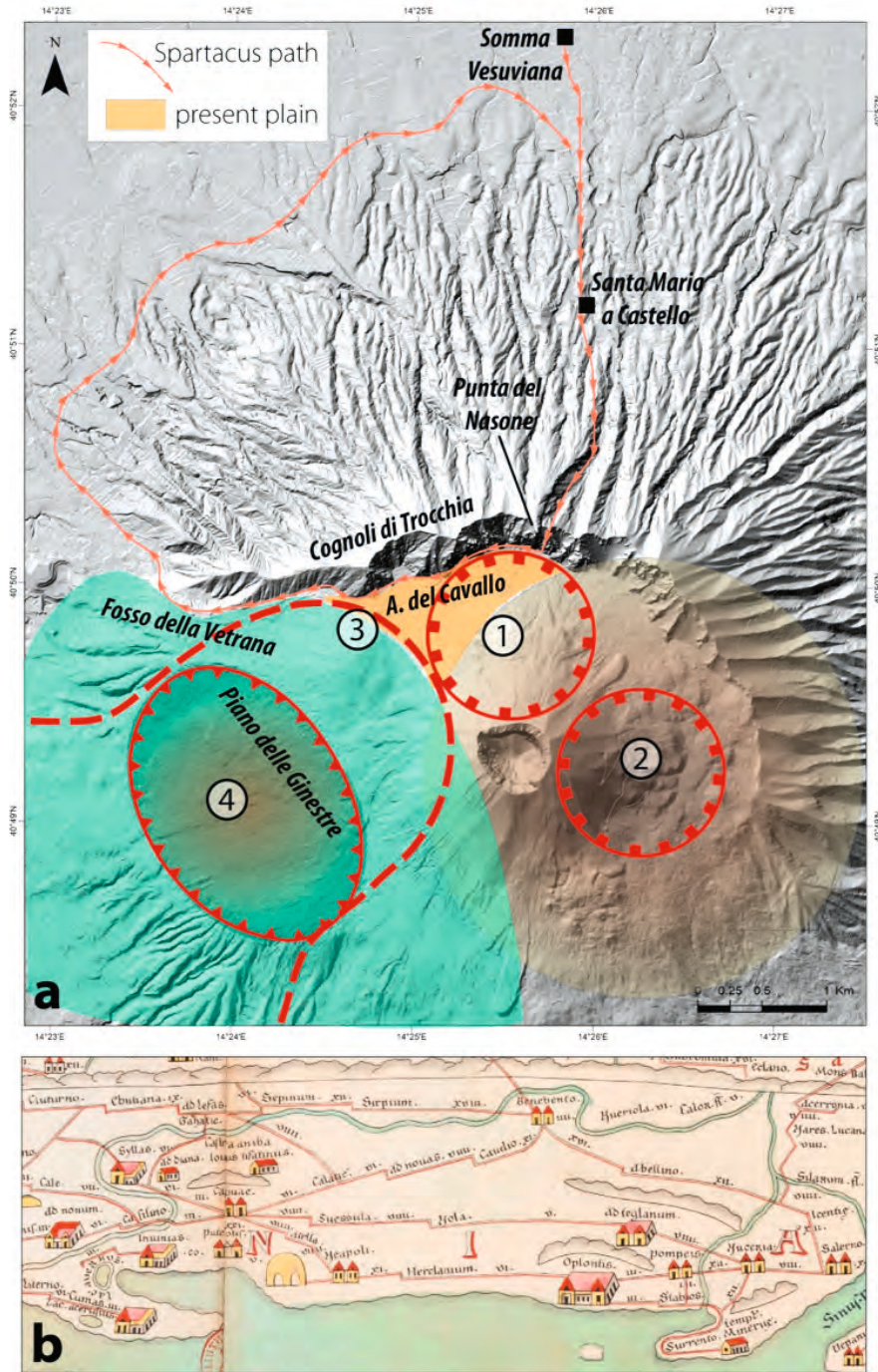


Fig. 1a – Monte Somma and Vesuvius, view from the sea in front of Herculaneum. The white house on top of the hill is the *Eremo* hotel, constructed on a remnant of the rim of the PdA tuff-cone crater (photo Principe, 2017); Fig. 1b – The classical view of the volcano from Pompeii forum (photo Principe, 2017). Fig. 1c – The 79 AD caldera rim southern portion, photographed from the summit of the *Gran Cono* (photo Principe, 2019).



**Plate X** [PRINCIPE et al. Fig. 2] – 79 AD pyroclastic flows dispersed following the volcanic morphology preceding the caldera collapse. White arrows indicate the main escape routes of the 79 AD pyroclastic flows. (a) the *Fosso della Vetrana* fault passage. (b) The *PdA* tuff-cone rim, that enclose the *Piano delle Ginestre* crater, was overwhelmed by the 79 AD PDCs, that spread out from the crater rim up to the present-day *Fosso Bianco* erosional valley. (c) The southern portion of the rim of the 79 AD eruption related caldera. (d) The pathway of the 79 AD pyroclastic flows through the *Butto del Pescinale*, *Vallone grande*, and *Cupaccia* valleys. Thick white lines and orange fields refer respectively to the total surges and to the pyroclastic flows distribution given by SIGURDSSON et al., 1985. Blue lines give the 79 AD PDCs deposits distribution from GURIOLI et al., 2010. The yellow area offshore corresponds to the portion of the pyroclastic flows deposits that entered the sea, as detected by SIGURDSSON et al., 1985. Light pink and green lines are the pumice fallout isopachs. (Digital Elevation Model from Regione Campania data base, data elaboration this work).



**Plate XI** [PRINCIPE et al. Fig. 3] – (a) Monte Somma and Vesuvius morphology prior to the 79 AD eruption, reconstructed on the basis of geological and historical data, gives some constraints for speculating about the movements of Spartacus and his gladiators (orange line) at Vesuvius during 73 BC. Inferred Caldera of *Greenish* (1) and (2) *Mercato Pumices* eruptions, plus the *Cognoli di Levante* edifice (brown). (3) *Pomici di Avellino* related debris avalanche scarp. (4) *Pomici di Avellino* related tuff-cone edifice and crater (corresponding to the nowadays *Piano delle Ginestre*). (Digital Elevation Model from Regione Campania data base, data elaboration this work). (b) Roman roads from *Capua* to *Vesuvius* on a reproduction of the *Tabula Peutingeriana*. Particular from PRONTERA, 2003.

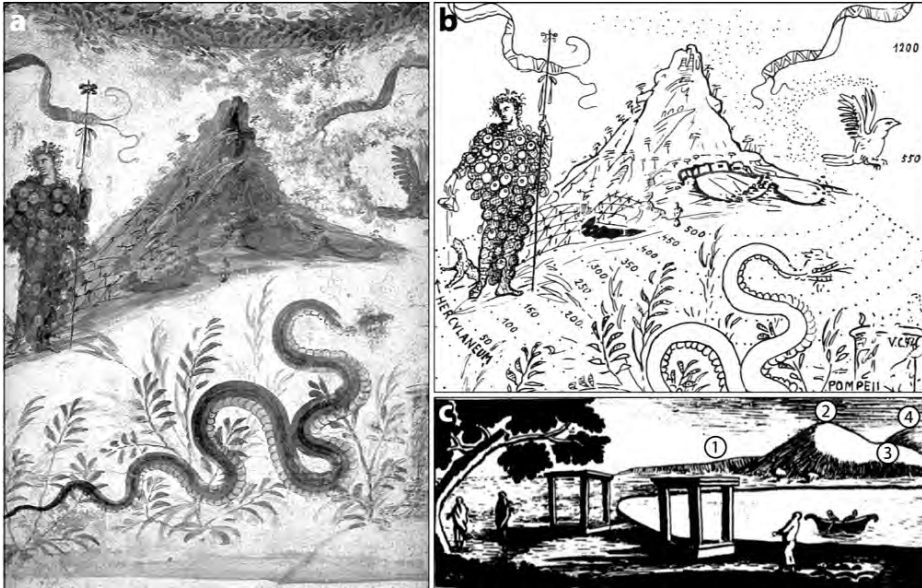


Fig. 4a – Fresco from Pompeii known as the *Casa del Centenario* fresco. Fig. 4b – Interpretation of the same fresco by Catalano, 1976. Fig. 4c – Engraving reproducing a fresco found in Herculaneum during the first stages of the excavations, and now lost (from “*Le antichità di Ercolano esposte*,” vol. VIII tab. LXXVII, Napoli, Regia Stamperia, 1792). For the numbers explanation see the text.

Direttore responsabile: prof. Stefano Carrai

Registrazione del Tribunale di Firenze n. 4026 del 6 novembre 1990

ISSN 0031-9414

---

FINITO DI STAMPARE  
PER CONTO DI LEO S. OLSCHKI EDITORE  
PRESSO ABC TIPOGRAFIA • CALENZANO (FI)  
NEL MESE DI DICEMBRE 2021