Archaeology and Volcanology in the Phlegrean Fields

Claude Albore LIVADIE

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Claude Albore LIVADIE
Unité de Recherche Associée 1220
Ecole française de Rome/Centre National de la Recherche Scientifique
Centre Jean Bérard, Via Crispi, 86
80121 Napoli - Italy.
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BETWEEN MYTH AND HISTORY

Greek toponymy, that knew the gulf of Naples as cratere, and the whole of the Campanian plain lying behind the region that we call Phlegrean Fields as phlegreum ("that which burns"), translates a geographical expression strongly influenced by the volcanic activity of the time, that included the coast and islands, Mt. Somma and possibly also the area of Roccamonfina. In fact Polybius, with the term Phlegraia pedia, indicates the entire plain to the sides of the river Volturno, as does Strabo. Timaeus, in Diodorus, locates Mt. Vesuvius at the centre of the Phlegrean plain.

However, rightly speaking it is the volcanism of the Puteoli-Ischia area that would seem to lie at the origin of the location of Greek legends in Campania (the fight of Hercules against the gigants, the myth of Typhon, the pause of Odysseus in the land of the Cyclops and the Laestrygones, and so on), and that explained the violent eruptions and other natural phenomena of the area. If the Gigantomachy, localized in the area of Cumae at the junction with another Phlegrea which also passes as being the stage (the Phlegrea Pallene' in Calcidia), takes us to a
period close to the Greek colonization of the eighth century B.C. when this very coast still clearly preserved the traces of a burnt land, the episodes of the Odyssey, with their clear references to volcanic phenomena that constitute the stories at the court of Alcinous, are to be traced in a moment far earlier than the first Euboic settlements. The fight against the Cyclops, the episode of the Nekyia at Avernus with references to the hot springs and the damned mists of the ara, the episode of the Laestrygones, where "the smoke rises from the earth", belong to the earliest core of the work. They might reflect volcanic activity contemporary with the earliest maritime activity of the Aegeans. They are certainly not a vivid testimony of eruptions, as is the incredible story of the destruction of Thera related with suggestive realism by the Argonauts (Scandone, 1987, 1988). Nonetheless it is clear that the Eolians, those contemporaries of Jason who traversed the same waters that where to see Odysseus, or the Mycenaean Greeks in regular contact with the island of Vivara, would have witnessed precise explosive events, well documented in the deep stratigraphies of the area. These must have had such an impact on the antique image of the territory and its neighbouring islands as to have been placed in man's spiritual geography close to the entrance of Hades and the world of the dead.
PREHISTORY

The date of the earliest volcanic manifestations in the Phlegrean Fields is not known, though the oldest visible products are to be dated c. 50,000 B.P. The flint scrapers found at Ischia, though rare and of limited significance, do show that middle and upper palaeolithic groups inhabited the large continental platform that the seas had freed during the phase of the large Pleistocene glaciations. The formation of the caldera associated with the eruption of Campanian ignimbrite (c. 35,000 B.P.) and its subsequent subsidence have destroyed almost all traces in the central sector of the Phlegrean Fields.

The eruption of Baia and Pisani rather long period of inactivity corresponding to most of the Neolithic and witnessed by a thick and widespread paleosol which, until now, has not yielded archaeological material (Rosi-Sbrana 1987). This long period of inactivity ended with a large tectonic event that raised the northern section of the gulf of Pozzuoli by about 40m. (5,300 B.P.), identifiable in the Starza marine terrace (Cinque, Rolandi and Zamparelli, 1985). The earliest significant documentation of man’s presence in the Phlegrean Fields is to be dated after this event.

It may be assigned to the third millennium B.C. The earliest settlement so far identified lies in località Bellavista, Monte di Procida (Fig. 1 e 2). It was an open village, sited on the slopes of the old volcano of Monte Grillo, which appears to have
abandoned suddenly after the eruption of volcano II of Fondi di Baia. A very thick cineritic mass was also ejected in a north-easterly direction towards Vivara and the eastern section of the island of Ischia (Albore Livadie, 1987) where, in località Cilento, a layer containing pottery, similar to that from Monte di Procida, was found beneath a deposit of ashes (Buchner, 1987).

THE AGE OF METALS

Archaeological evidence referring to the more recent Calcolithic culture (later III millennium B.C.), tombs of which have been found at Naples and Ischia (Lacco Ameno) and sites between Licola and Bagnoli, is both rare and scattered. Sporadic finds from the foot of Monte S. Angelo at Fuorigrotta (Perozzi, 1950), in the area of the purifying plant at Cuma (Albore Livadie, 1987), in the vicinity of the Apennine site of Montagna Spaccata and particularly around the foot of Monte S. Severino at Licola (Albore Livadie, 1985), seem to indicate intense activity in the area during mature Eneolithic times.

In the absence of systematic research, it is not possible to formulate firm hypotheses concerning the relative chronology or contemporaneity of these sites, some of which clearly belong to the so-called Gaudio culture. However, their spatial and chronological proximity could betray successive movements of population groups within short intervals of time. That this may be interpreted in the light of primitive agrarian practices,
permitting the exploitation of the same land for only a short period of time is, for the time being, only a hypothesis to be put to the test.

During the copper age a number of eruptions took place in the eastern section of the Gulf of Pozzuoli, at Monte Spina, the Astroni and Sant’Angelo at Fuorigrotta. Even the appearance of the volcanoes around Baia (Capo Miseno, Porto Miseno, Bacoli) has recently been included between the formation of Monte Spina and that of the Averno (De Girolamo, Ghiara, Lirer, Munno, Rolandi, Stanzione, 1984; Rosi-Sbrana, 1987), whilst some K/Arg. datings place the formation of the lava cupola of Mount Olibano around 3.800 B.P. and that of the cupola of Caprara around 3.750 B.P.

The imposing Plinian event, which had fall-outs past the valley of the river Clanis and the region of Avella, where pumices have been deposited for a thickness of up to 50cm., is probably to be attributed to the volcano of Sant’Angelo at Fuorigrotta. These depositions were influenced by strong winds blowing from the west. Though often confused with the more recent eruption of the Astroni, it is clearly visible in the areas close to the volcano of S. Angelo in the Phlegrean Fields, particularly at the bed of the eruptive material from the Astroni, where its products reach a thickness of 2m. The recent C14 tests, which generally assign a date between 2.320 B.C. and 1.905 B.C., reveal some discrepancies. Some samples undoubtedly belong to the event, datable to around 3.619 and 2.466 B.C., somewhat earlier than the
Astroni eruption. A recently excavated site, lying below the volcanic debris in the valley of the Clanis (Mulino Sant’Antonio) and assignable to the early Calcolithic, provides a clear terminus post quem for the eruption.

The eruption of Monte Spina, around 4,400 B.P., led to a thick deposition of pumice in the north-eastern sector of the Phlegrean Fields, jumping the barrier of the Camaldoli and covering an area estimated to be larger than 400 km² with pyroclastic material. Plinian eruptions of this type constitute one of the most destructive events in the Phlegrean Fields. Total destruction spread over a radius of 4-5 kms. from the mouth. Within this area, nothing was spared by the heavy fall of solid material and the pyroclastic flow, though the latter was limited essentially to the plain of Agnano. This violent eruption was followed by the formation of the volcano of the Astroni, well-dated, through a large quantity of carbonized wood, to between 4,070 and 3,640 B.P.

The Astroni event was characterized by the extrusion of a dome of trachytic lava and by a hydromagmatic explosive activity followed by the effusion of lava within the crater.

As far as we can judge, other eruptions, like that of the Solfatara, and the formation of lava domes, saw the end of the Eneolithic cultures in the area. The frequency and intensity of the eruptive events make this one of the most complex periods of Campanian volcanism.
THE BRONZE AGE

We do not possess details for the various phases of slow development during the Early Bronze Age (circa 2,000-1,600 B.C.) which led to the formation of the Appennine culture, characteristic of the Italian Middle Bronze Age. Only a single mature horizon of the Early Bronze Age is known in any detail, as the Plinian eruption of Somma ("eruption of the pumices of Avellino") buried many settlements belonging to the cultural facies of Palma Campania under a thick pyroclastic flow, permitting an analysis of both archaeological and environmental data (Albore Livadie, 1981; Marzocchella, 1987). The eruption affected the north-eastern section of the Campanian plain, avoiding the entire Phlegrean area (Fig. 3). It would thus be surprising if no settlements of this date came to light in the Phlegrean Fields. Only the earliest site at Vivara (Punta Capitello - trench E) can be attributed to a late moment of the Palma Campania culture, representing a chronological horizon not yet recognized in the various landed settlements buried beneath the "pumices of Avellino". The sites at Punta di Mezzogiorno are connected to the same culture, being a late phase in its evolution. Their insular location reflects the maritime interests of the Palma Campania culture and its precocious links with the Aegean world, also evidenced by typological affinities in the pottery (Bernabò Brea, 1985) (Fig. 4).

The partly contemporary site on Monte Gauro, behind
Pozzuoli, presents new ceramic forms such as the "axe-handle", peculiar to the so-called contemporary proto-Appennine period and not much earlier than the first Mycenean importations. Aegean pottery of Late Helladic I (second half of the 16th century B.C. circa) is documented in the upper structure of Punta di Mezzogiorno and permits an approximate chronological correlation.

An evolved moment of proto-Appennine B, dated to the 15th century B.C. through association with Late Helladic IIA and IIB importations, is well illustrated by the remains of a village at Punta Alaca (Vivara).

For the period of mature development of the Appennine culture (1.400-1.300 B.C.), the faunal remains from pits at Montagna Spaccata are revealing as regards the economy and the environmental interaction of these groups (Fedele in Albore-Livadie, 1987). Food remains come from stock-raised animals (goats, pigs) and, to a lesser extent, from hunting (deer), whilst a butchered dog has also been found. The most significant site is that at Castiglione d'Ischia, to which may be added the finds from Monte Vico, from the area of Mazzola, Lacco Ameno (Ischia) and from the sites of Punta Capitello and Punta d’Alaca, Vivara. Through the Mycenean pottery IIIA and IIIB (1.425-1.230 B.C.), these sites demonstrate the intense and systematic presence in the gulf of merchants from continental Greece and Crete, in search of raw materials, particularly metals. Their goal was the load-bearing hills of Tuscany, though they could
also have searched for the products of Campanian volcanism: red lead and sulphur from the Solfatara, which was very active at the time; alum from the Leucogeean hills, used in medicine, in the preparation of skins, to whiten leather and to stain garments; various sulphates of magnesium and lime; sulphides of iron and arsenic, with their medicinal values; whiteners used in ceramic manufacture, etc.

Both the site of Montagna Spaccata, close to the basin of Quarto, then probably partially occupied by a lake, and the discovery of an Appenninic jar at Pianura, on the edge of a small lake formed after the eruption of the Astroni (3,700 B.P.) when the large quantity of eruptive material blocked the southwesterly part of the natural amphitheatre, suggest that the climatic deterioration of the final sub-boreal period began around the 14th century B.C.

The eruptions of Sengà and the Averno dramatically conditioned the Bronze Age. Unfortunately, the various eruptions of the third millennium B.C. are dated on the basis of C14 analyses of charcoal which create a tight chronological bracket not reflecting the real duration of the intervals between eruptions. It was perhaps an eruption that ended the settlement at Montagna Spaccata, dated to the 14th century B.C., which was found to have been covered by a layer of ashes and small yellow pumices (Fig.5). The activity of Averno must have ended with the
volcanic-tectonic collapse which formed the Lucrine lake and which conditioned the settlement in the area for a long time. It is presumed that, following the explosion of the Averno, a long period of localized subsidence took place principally between Baia, Lucrino and Pozzuoli, with greater effect in the areas close to the Averno (Baia, Lucrino) and concluding with the sinkage of the whole coastline in early medieval times.

The three centuries (c. 13th-10th centuries B.C.) of the Late Bronze Age that followed the apogee of the Appennine phase have not yielded material evidence. This lacuna in the archaeological data, though not in contrast with northern and central Campania, appears rather suspect. In the Phlegrean Fields, settlements of this period should be searched for close to large springs or water courses near lakes.

We have no burials dating to the beginning of the Late Bronze Age (the so-called recent Bronze Age or Subappennine periods) and the few settlements known are on the islands: at Ischia, on Monte Vico (scarico Gosetti) and at Castiglione d’Ischia. Some of the sites that had developed during the Middle Bronze Age on Vivara survive for a short time, whilst little is known about the possible recent Bronze Age sites at localit Ciraccio and S. Antonio, Procida (13th-12th centuries B.C.). Only towards the end of the recent Bronze Age (end of the 10th - beginning of the 11th centuries B.C.), apart from the long-lasting site of Castiglione d’Ischia, is a new site attested
through scattered cemetery material in a prominent position not far from the sea, following a settlement pattern well-attested at this time in Campania and elsewhere. The trachytic rock of Cuma was occupied by a village of huts, with tombs sited in a flat area at the base of the rock as is indicated by the discovery of certain bronze objects found during the excavation of the Greek cemetery.

Continuity of occupation from the Late Bronze Age to the Early Iron Age is probable at Cuma and Castiglione d’Ischia. Some fibulae dating to the first part of the 9th century, and perhaps some weapons, may be placed in sequence between the material dating to the end of the Bronze Age and that from the so-called pré-Hellenic tombs found by Stevens and Osta, at Cuma, between the end of the last century and the first decade of this century.

THE PHLEGREAN FIELDS AND GREEK COLONIZATION

Two layers of pyroclastic fall material were noticed lying above the prehistoric site of Punta Alaca at Vivara. The lower layer consisted of a deposit of pumices of some 10 cm. or little more, covered by a thin dusty layer of like nature, which has been interpreted as the product of a large eruption, probably originating at Ischia (AA.VV., 1975-80; Rosi, Sbrana and Vezzoli, 1988). The layer of pumices lay above a 2 m. thick deposit, which separated it from the protohistoric habitation layers. The finds from the deposit are no later than the Bronze Age if one takes
into consideration the Mycenean III A1 imported pottery. Un upper layer, separated from the lower deposit by a mixed earthy context, was composed of whitish ash with small lapilli and thin plane-parallel laminations. Even though the correlations are not well-defined, it is quite probable that these contexts belong to the phase of prehistoric activity on the island of Ischia and are obviously later than the fourteenth century B.C.

There are may prehistoric and historic volcanic centres concentrated in the depression of the Ischia graben that may have caused this large eruption of pumices in a north-westerly direction. However, the absence of a consistent level of pumices on the hill of Castiglione, which bears only two thin layers of pumices and scoriae (Buchner, 1987), would exclude volcanoes behind the hill. Two eruptions in the western part of the island are well-attested, though do not seem to correspond to the event illustrated by the stratigraphy of Vivara. The first, which is documented by a layer of ash and pumice sand covering tombs containing Corinthian pottery in the valley of S. Montano, Lacco Ameno, must have taken place around 600 B.C. The second, corresponding to the upper layer of pyroclastic material at Castiglione d’Ischia, may be that mentioned by Strabo (Geographica, V, 4, 9) when referring to the abandonment of part of the island by the Syracusan Greeks following an eruption in the first half of the fifth century B.C. (Buchner, 1987). Contrary to the continental part of the Phlegrean Fields, during
the period of Greek colonization, Ischia was the scene of considerable seismic and volcanic activity, as it was also in Hellenistic and Roman times. A further event could be that referred to by Timaeus as having taken place shortly before his time, during the first half of the fourth century B.C. (Timaeus Siculus in Strabo, Geographica, V, 247-248 C.). It is difficult to say whether or not this was the same catastrophe mentioned by Pliny: "a small town was swallowed by the deep and, through another movement of the earth, a lake emerged" (C. Plinus Secundus, Naturalis Historia, II, 203). It is possible to see the formation of the port of Ischia in this description. The near-circular explosive crater was originally occupied by a lacustrine basin (the lago del Bagno). Only in the 19th century was the port isthmus cut, whilst the cone of scoriae at the centre of the crater was removed in the '60's to ease traffic within the port.

The Ischian origin of an eruption of pumice that covered the indigenous tombs at Cuma is also in question. The English excavator Emilio Stevens delightfully described them in his diary as the "morti dei lapilli".

When the Euboean colonists occupied the acropolis of Cumae, around the mid eighth century B.C., until then seat of an indigenous settlement, the surrounding physical and ecological environment was profoundly different to that of the present day, especially as regards the number and extension of lakes, swamps
and marshes. The numerous illustrations of aquatic birds on bronze ornaments and hand-made vases found in the pre-Hellenic tombs are, without doubt, linked to the local environmental characteristics.

Indeed, the various names, such as Palus Acherusia and Selva Gallinaria, and the presence of various lakes (Averno, Lucrino, Miseno, Lago Patria) indicate a rather diversified environment, articulated in coastal lagoons and areas of water separated by marshes where littoral bars imprisoned sea water, creating salt lakes (Licola, Fusaro, Mare Morto). In the area of Lucrino, during the course of the IIInd millennium B.C., a long sand bar was created more or less between Punta Epitaffio and Punta Caruso, on the 10 m. isobath, not far from hot water springs ("Le fumose"). This large artery which, according to mythology was built by Hercules to lead the cattle of Geryon, and from which it takes its name Erculanea, was doubtlessly used as a thoroughfare throughout archaic times and, though subject to submersion, even under the Roman republic. It must have coasted the baths of M. Licinius Crassus Frugi, built on a partly artificial island, virtually in the sea. Concurrently with a greater diffusion of anthropic action on the land, the lagoons were further modified, also indirectly. Some were drained (canalization by the tyrant Aristodemus of Cumae towards the end of the fourth century B.C.) and small lakes were formed. In Roman times, at the end of the first millennium B.C., the mean sea level rose, possibly as a
result of climatic changes: the lakes reverted back to lagoons due to a marine transgression caused by increased erosion of the dune barrier (Arthur, Guarino, Jones and Schiattarella, 1991). Towards the end of the second century B.C. the coastline must have appeared similar to the actual coastline, with the development of a beach-ridge system that blocked the lakes of Licola and Fusaro and led to the backfilling of the port of Cuma. The understanding of the physiognomy of the southern port of Cuma, which backed a littoral bar, is limited by its complex colmatage provoked by deforestation, instability of surface soils, alluviation and pyroclastic depositions. Right from its very origins, Cuma must have been able to count on other harbours, protected from the winds. The model suggested for Cuma, that of a maritime town sited on an isthmus with epineion on the other bank, was widely distributed in the Greek world (K. Lehmann-Hartlesen, 1923). The lagoonal harbours (Fusaro, Miliscola) of the Cumaean littoral between Lago Patria and Miseno were protected from the winds of the II and IV quadrant, whilst the gulfs of Baia and Miseno (Mare Morto) were protected by those from the south. The recent excavations in the area of the purification plant of Cuma have yielded new information for the reconstruction of the ancient coastline north of the acropolis (Tocco, 1987).
THE TERRITORY OF PUTEOLI IN ROMAN TIMES

From the fourth century A.D., bradysism brought about the flooding of the coastline from Miseno to Pozzuoli (Zevi, 1982). Pozzuoli lost its important port functions from the moment that its famous coast and port installations were submerged by bradysismic activity. The port of Baia, carved out of the homonymous volcanic crater, was subjected to an insidious submersion that swallowed the southern part of the Imperial villas and completely modified the harbour basin (Fig. 7). The road running along the low and sandy coastline connecting Miseno and Baia disappeared, though the stretch beneath the castle of Baia (Castagnoli, 1977) is indicated in sixteenth century documents (Cartaro by G. Martini; Villamena) (Fig. 6). The road that continued by crossing the Lucrine lake along the line of littoral dunes, raised in 37 B.C. so as to protect the basin against the waves, was cut to provide a navigable channel, some 40 m. long, between the lake and the sea. Deforestation of the nearby slopes to provide wood for the construction of Agrippa’s fleet must have had no little influence on the rapid infilling of Lucrino’s basin and its abandonment in favour of a new port at Miseno. Remains of the coastal road were documented in front of Punta dell’Epitaffio, at some depth and circa 400 m. from the present coastline, during the first underwater explorations (Lamboglia, 1959). A large part of lower Pozzuoli was also lost: a sculptor’s workshop has been found at about 150 m. from the
actual coastline, at a depth of some 10 m. (De Franciscis, 1977). However, the greatest advance seems to have occurred in correspondence with the Portus Iulius and the gulf of Baia.

Schematic landscapes incised on three of the famous glass flasks of Puteoli (from Populonia, Ampurias and in the (Warsaw Museum) area and suggest that towards the end of the second-fourth century A.D. the buildings of Baia ans the area of Lucrino were still functioning (Ostrow, 1979). During this period Pozzuoli and surrounding areas were inhabited by the Roman aristocracy which enjoyed the amenities and peace of the area, together with its agreeable climate. The letters of Symmachus are valuable testimony to the otium of the Phlegrean villas and the peace and quiet to be found there (Seeck, 1983), and nowhere is bradysism mentioned. The vitality of the port of Pozzuoli is confirmed, in this period, by state interest which saw to the creation of a procurator portus puteolanorum. However, both the excavations of Lamboglia at Punta Epitaffio (1959), and the later excavations of the Soprintendenza Archeologica in the nearby nymphaeum at Baia (Gianfrotta, 1987), agree in dating the fill of the apsed building and the lower part of the nymphaeum to the beginning of the fourth century or little after. The upper levels of the nymphaeum at Baia were occupied before the inexorable bradysismic process had led to the invasion of the whole area by the sea. The structural collapses and the series of longitudinal lesions across the building indicate that the phenomenon was
accompanied by earthquakes, which may also have led to the fall of the statues from their niches. Linked to the bradysism, there was a slow and progressive transgression from the fourth century A.D., followed by a brief emersion in the sixth century. A number of burials have been discovered inserted into the upper layers of the nymphaeum, perhaps datable just before the sixth century, belong to this period of regression. This was followed by a renewed period of negative bradysism that placed Pozzuoli under the sea by "less than an arm". Though, this moment is not testified archaeologically, a late Greek text known as the Acts of Saints Peter and Paul, perhaps dating to the ninth century, leads one to hypothesize a rapid and sudden sinkage (Frederiksen, 1977; Gianfrotta, 1987). The renewal of the ascending bradysism following the eruption of the Solfatara seems to have continued up until the eruption of Monte Nuovo in 1538, followed by a considerable lowering of the land which, by the seventeenth century, at least in the area of Pozzuoli, reached the levels of Roman times.

As opposed to Pozzuoli, less upset by recent volcanotectonic events, a differentiated, more gradual, though greater, marine transgression may be proposed for the area of Baia. The former area saw a violent phase of negative bradysism, limited in time and space to the principal faulted sector, comprising Rione Terra and the eastern extremity of the falaise of the Starza: the same area that witnessed the most recent phase of bradysism.
CONCLUSIONS

Alongside the evolution that man imposes upon nature - a particularly slow process, save for some great and dramatic historical moments or major technological developments - it is necessary to dedicate particular space to the great events imposed upon man, such as the volcanic catastrophes which may have great consequences for the environment, the economy and population life-styles. Campania, land of volcanoes, offers a totally unique field of experience and reflection. Few regions of the world can boast the marvelous interaction between history and land as can this violent and changing territory, where volcanic action and climatic-environmental and anthropic variations have contributed to transform the original physiognomy of the ancient landscape far more than we can imagine from the few studies conducted so far. The Phlegrean area, in particular, offers a palimpsest that archaeologists, geomorphologists and specialists of the earth sciences should decipher in collaboration. A careful reading will help us to better understand the history of man, his adaptation to new conditions determined by volcanic catastrophes (modifications to the habitat, to the soil and to the agricultural resources) and, through the upheavals of ancient cultures, will help us to understand both the processes at work and evolutionary tendencies so as to anticipate future destructive agencies.
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FIGURES CAPTIONS

Fig. 1. Map of the Napels Gulf showing the location of the principle sites mentioned in the text.

Fig. 2. Lithic industry (obsidian from Lipari and from Palmarola nn. 1-13, 18 and flint nn. 14-17) found in the settling of the final Neolithic/ Eneolithic primary on Mount of Procida, probably buried from the Fondi di Baia II volcano eruption.

Fig. 3. Contours relating to the "Pumice Avellino eruption".

Fig. 4. Vessels of the Palma Campania culture from the settling buried from the "Pumice Avellino eruption" from Palma Campania.
Fig. 5. Vessels at Montagna Spaccata (Pozzuoli) belonging to the appenninic cultura from the middle Bronze (XIV century B.C.).

Fig. 6. Baiae extends on the rim of a partially broken crater, invaded by the sea. The nature of the Phlegrean soil and the presence of numerous hot water and sulphur springs favoured the construction of many baths. Tradition maintains that the Roman system of heating, with sauna and hot baths, was invented at Baia in the first century B.C.

Above this print of Villamena (1652) we can note the rests of the "via Herculea", the coast of Baiae and other buildings, schematically showed on the glass bottle from Varsavia.

Fig. 7. Baiae: planimetry of the submerge ruins in the gulf of Baiae. a) Imperial ninfeo-triclinio b) Ninfeo thermal bath c) Villa of L. Calpurnius Piso d) Admission channel to the Baianus Lacus (da G. Di Fraia, N. Lombardo, E. Scognamiglio, Puteoli, IX-X, 1985-1986).
fig. 5
fig. 7
BRIEF BIBLIOGRAPHY


Ibidem, (1973), "University of Rome C-14 dates X", Radiocarbon, 15/1, 175-176.


JACONO, L. (1913), "Note di archeologia marittima", Neapolis, 1, 365 ss.


