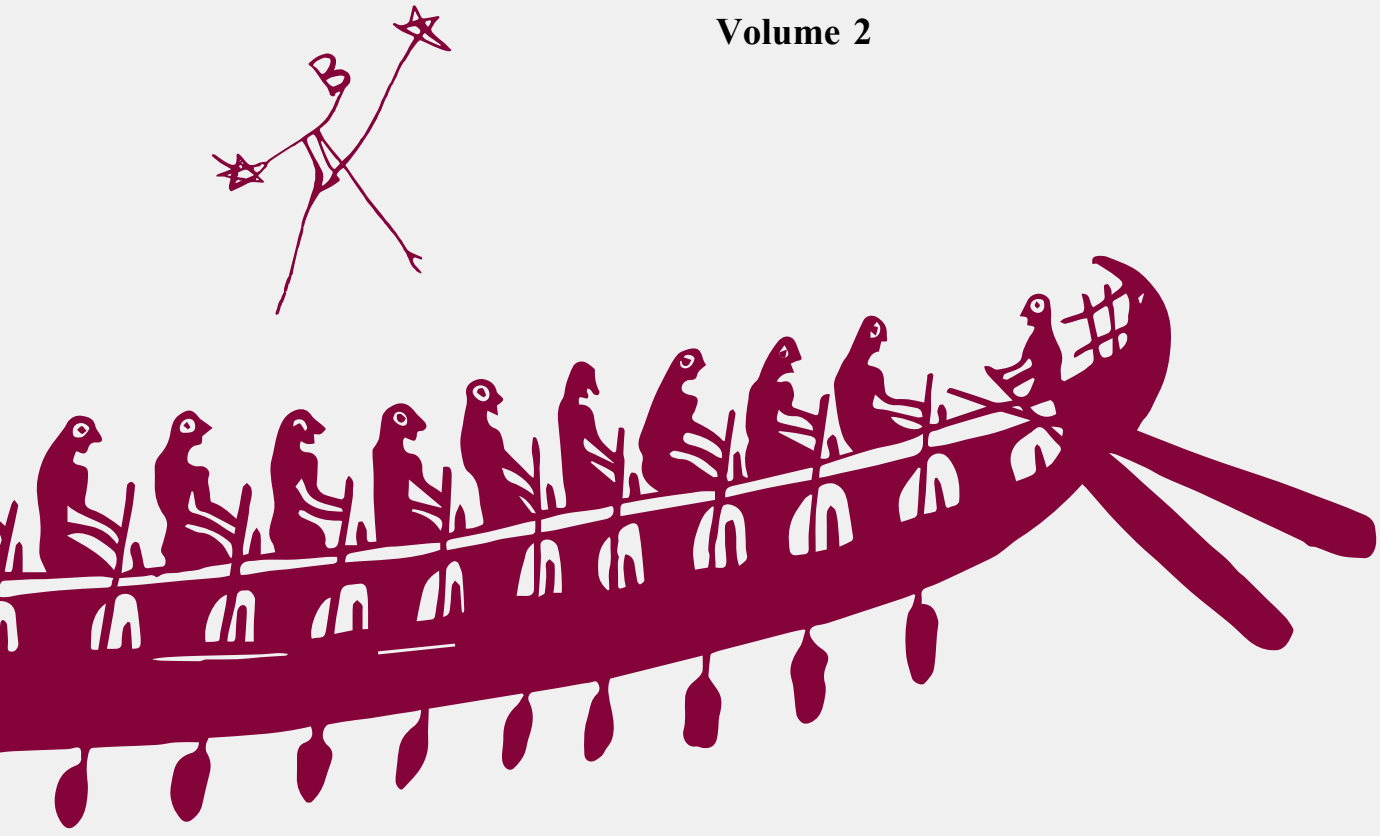
EUBOICA II

Pithekoussai and Euboea between East and West

Proceedings of the Conference
Lacco Ameno (Ischia, Naples), 14-17 May 2018

Teresa E. Cinquantaquattro, Matteo D'Acunto and Federica Iannone

Volume 2



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ABBREVIATIONS

Above sea-level: above s.l.; Anno Domini: AD; and so forth: etc.; Before Christ: BC; bibliography: bibl.; catalogue: cat.; centimeter/s: cm; century/ies: cent.; chap./chaps.: chapter/chapters; circa/approximately: ca.; column/s: col./cols.; compare: cf.; *et alii*/and other people: *et al.*; diameter: diam.; dimensions: dim.; Doctor: Dr; especially: esp.; exterior: ext.; fascicule: fasc.; figure/s: fig./figs.; following/s: f./ff.; fragment/s: fr./frs.; for example: e.g.; gram/s: gm; height: h.; in other words: i.e.; interior: int.; inventory: inv.; kilometer/s: km; length: ln.; line/s: l./ll.; maximum: max.; meter/s: m; millimeter/s: mm; mini- mum: min.; namely: viz.; new series/nuova serie etc.: n.s.; number/s: no./nos.; original edition: orig. ed.; plate/s: pl./pls.; preserved: pres.; Professor: Prof.; reprint: repr.; series/serie: s.; sub voce: *s.v.*; supplement: suppl.; thick: th.; tomb/s: T./TT.; English/Italian translation: Eng./It. tr.; volume/s: vol./vols.; weight: wt.; which means: scil.; width: wd.

Abbreviations of periodicals and works of reference are those recommended for use in the *American Journal of Archaeology* with supplements in the *Année Philologique*.

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NATURAL RESOURCES AND RAW MATERIALS AT ISCHIA IN ANTIQUITY: SOME DATA AND PRELIMINARY REPORTS FROM AN ONGOING, INTERDISCIPLINARY PROJECT

Gloria Olcese
with a contribution by Gilberto Artioli

1. Ischia and natural resources: some recent data and an ongoing project

The new project begun at Ischia, following the investigation of the artisan quarter beneath the church of Santa Restituta of Lacco Ameno[1] (Fig. 1), will focus its studies on the island's natural resources, both environmental and geological, during the period of colonization (but also later periods). These resources have not always been sufficiently considered in archaeological investigations but could yield new and important information. Some themes of the present research include reconstructing the agricultural landscape, the use of the land's resources and modes of production (of wine and ceramics, for example).

Investigations carried out in the artisan quarter beneath the church of Santa Restituta of Lacco Ameno proved the existence of some kilns that were already active in the 8th century BC. Thanks to a supply of local clays[2], these kilns manufactured Euboean ceramics, which are also attested in other contemporary archaeological sites.

Moreover, the production of amphorae in different time periods called attention to wine production as well, which was a fundamental resource for Ischia and a constant theme in the economy of the island over the course of the centuries[3].

Other themes of investigation concern certain metals, gold and iron[4], for example. These have been excluded by many academics because of the presumption that there were no ore deposits on Ischia[5]; other scholars, meanwhile, have seen ore deposits as one of the potential reasons for the Greek presence on the island[6].

Already in 2017, we carried out an initial sampling of sands during a survey trip in the area of Campagnano[7] which allowed us to show for the first time, thanks to laboratory analyses, that there is gold on Ischia; moreover ancient sources led to the Campagnano goldmine[8]. These sources and recent studies, although preliminary, have made it possible to correct the notion that the geological formation of Ischia has made finding gold impossible.

[1] Olcese 2010, 2017, with previous bibliography; for the first data on natural resources, see chapter II.5 of Olcese 2017, whose ancient sources are partly reused here.

[2] Olcese 2017.

[3] To the investigations carried out in the past on amphorae (Di Sandro 1986; Durando 1989, 1998) and those on Greco-Italic ones (Olcese 2010), we must now add a new series of data about archaic amphorae (ongoing study).

[4] The investigations began during the publication of Olcese 2017 on the archaeological area of S. Restituta.

[5] Pais 1908, 231; Buchner 1969, 97-98; 1970-1971, 66. The hypothesis of D. Ridgway on the presence of minerals is well known: «La formazione geologica di Ischia rende impossibile la presenza nell'isola di minerali d'oro e d'argento…Come l'oro e l'argento, così pure il ferro o gli elementi che formano il bronzo, rame e stagno non sono mai stati disponibili sull'isola di Ischia» (Ridgway 1984, 113-116).

[6] Dunbabin and Bordmann held that the Greeks came to the West in order to obtain metals which they needed at home (Dunbabin 1948, who at 7-8 speaks of copper; Boardman 1964, 177, who refers to zinc and iron). For a review of opinions relating to the search for metals and the Greek Colonization, see Treister 1996, chapter 2, 146, in particular the bibliography at notes 697 and 698; for Pithekoussai 164-166.

[7] The survey in the area of Campagnano was organized in May 2017 as part of the *Immensa Aequora* project; participants included the geologists L. Monti and R. Toccaceli, in addition to collaborators D. M. Surace (who also provided an editorial review of this article and the composition of the tables) and A. Razza (who revised the bibliography). A global project on the natural resources of Ischia is underway with them.

[8] Pipino 2009; Monti 2011.

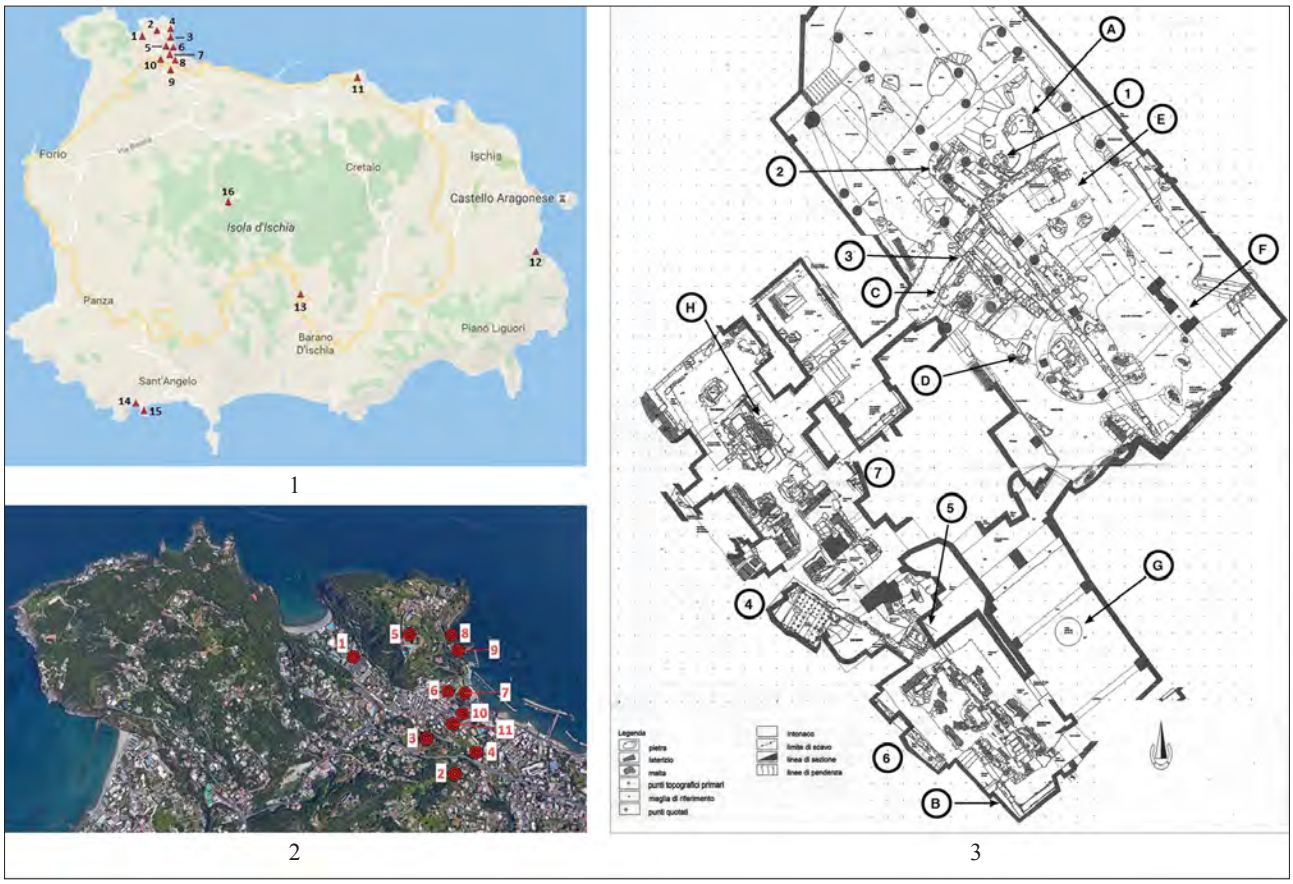

Fig 1. **1.1:** Map of Ischia. 1. necropolis of San Montano; 2. Monte Vico; 3. scarico Gosetti; 4. cave of Varule; 5. church of Santa Restituta; 6. Hotel Regina Isabella; 7. Hotel La Reginella; 8. Pastòla; 9. Mazzola, Mezzavia; 10. Museum of Villa Arbusto; 11. Casamicciola, Promontory of Castiglione; 12. Cartaromana; 13. Toccaneto; 14. Sorgeto; 15. Promontory of Punta Chiarito; 16. Monte Epomeo (map by D.M. Surace in Olcese 2017, 20). **1.2**: Ischia, Lacco Ameno. 1. necropolis of San Montano; 2. Mazzola, Mezzavia; 3. Museum of Villa Arbusto; 4. area of Pastòla; 5. Monte Vico, Acropolis; 6. church of Santa Restituta; 7. Hotel Regina Isabella; 8. cave of Varule; 9. scarico Gosetti; 10. Hotel La Reginella; 11. via Messer Onofrio, ex Casa Migliaccio (D.M. Surace in Olcese 2017, 24). **1.3**) Church of Santa Restituta. General plan of the archaeological area: 1-7. the ceramic kilns. A. the clay deposit; B. "Officina degli Eros"; C. workshop 1, "Officina del mortaio"; D. workshop 2; E. dryer; F. "Figulina attica"; G. "Officina *sub aqua*"; H. "fornace per la calce" (plan by A. Maifreni in Olcese 2017, 56)

At present, it is not possible to establish in which epoch the mining began, although it is documented that the Campagnano Mine was opened around 1300, possibly after the great eruption of 1301-1302[9].

Following these developments, it seemed the time was right to organize an interdisciplinary project within the University of Milan. This project is now ongoing and intends to reconsider the environmental and geological situations on the island in relation to production activities, in an attempt to reconstruct the agricultural landscape. It concentrates research above all on viticulture; the project is also studying sources of metals (gold and iron in particular), as well as alum[10]. One goal is to succeed in evaluating, on the basis of concrete data, the Greek involvement in the exploitation of raw materials, manufacturing technology, and agriculture. As far as it is possible to tell at this point, the Greeks contributed heavily to archaic ceramic production; this was demonstrated by the study of kilns under the Church of Santa Restituta of Lacco Ameno[11].

[9] See Pipino 2009. Of a different opinion is the geologist R. Toccaceli who argues, on the other hand, that the mining activity may refer to more ancient times, as he believes that the eruption of the Arso had no interference, either from a morpho-stratigraphic or volcanological point of view, with the deposits (personal communication and Sbrana – Toccaceli 2006).

[10] The project is being carried out as part of the Di.S.A.A. of the University of Milan, in collaboration with various specialists.

[11] Olcese 2017.

The ongoing debates related to colonization today, although they are interesting, are often theoretical and based on review of published data. They concentrate on the relationship and the role of indigenous peoples with the "colonizers", in an attempt to ameliorate viewpoints that are considered Helleno-centric. In reality, in order to advance in a constructive manner, there is a need for more archaeological data, for more studies of the landscape, material culture, manufacturing technologies, organic remains and modes of production during the period in question.

There are two paths that will be followed in parallel: the first path is to expand our knowledge of the environmental and geological realities on the island in the past. This can be accomplished with the help of geologists, chemists and agronomists. The second path is to reconsider the situation of Ischia in relation to that of Euboea in light of recent studies[12].

1.1 Euboeans on Ischia

Euboeans most probably landed on the beaches of the modern Lacco Ameno, and found a choice landscape, considering the remarkable environmental and geological advantages of Ischia[13]:

- insularity, the island is hilly, allowing for a complete panorama of the sea;
- abundance of bays and protected coves (two right on Lacco Ameno, at the base of Monte-Vico;
- proximity to the coast, which allowed the inhabitants to open trade relations with the mainland;
- a volcanic nature, which rendered the soil of Ischia exceptionally fertile;
- the presence of clay deposits;
- the presence of mineral deposits.

Even in the 1400s and 1500s, Elisio, a doctor in the Aragonese court of Naples, wrote about Ischia: «…Fertilissima è quest'isola di pascoli, di generoso vino, di miniere d'oro, di allume e di zolfo»[14]. He refers to the presence of mines, even of gold, of which there remain accounts in other texts (for example, that of Iasolino in 1588) and in cartography (for example, in the map of the Roman engraver Cartaro in 1586, reproduced in subsequent publications)[15]. Iron is also abundant on the island (see *infra*), contrary to what has sometimes been claimed until now[16].

Such resources can be counted in addition to the fertility of the land, which was already recorded in ancient sources (*eukarpia*) and preferred for its natural volcanic terrain ideal for viticulture and for the presence of clays, which were used over the course of the centuries and up to the modern era to create ceramics and bricks for construction[17].

Reexamination of the data shows that Pithekoussai was chosen and also inhabited for its natural resources, which are reminiscent of, among others, those of Euboea; the Greek island was recently the subject of multidisciplinary studies similar to those being done on Ischia. The studies conducted on the Greek island shed further light on the production of ceramics and working of metals[18]. Contact with the Euboean world seems to have been one factor driving technological innovations on the island. Unfortunately, the scarcity of data about the production situation and the "indigenous" environment on Ischia before the arrival of the Greeks makes it difficult to highlight the effect they brought and, in general, the debate on this matter is deadlocked[19]; what is certain is that the Euboeans found on the island everything they could ever need to establish a settlement and organize «un quartier generale euboico», to use Ridgway's expression[20].

2. Some lines of study for the project

On the basis of data so far collected, the project proposes to confront the themes listed below with a multidisciplinary approach to a larger debate concerning the economic and social history of the island, in relation to the situation in the Mediterranean.

[12] See, for example, the recent contribution by A. Bresson and G. Olcese in the conference *Comparing Greek Colonies* (2018).

[13] Mattera 2013.

[14] Elisio 1519, also reported in Iasolino 1588.

[15] For example, in Buchner Niola 2000.

[16] Bakhuizen 1976, 66; Graham 1971, 42-45.

[17] Buchner 1994; Monti 2011; Olcese 2010, 2017.

[18] Kerschner – Lemos 2014; Charalambidou 2017; for relations and contacts between Euboea and Pithekoussai, see for example Ridgway 2004, in addition to the numerous contributions in *Euboica*.

[19] For example, see Greco – Lombardo 2010; Osanna 2014; Lombardo 2016. For the question of how the Greek colonization was, Hall 2016.

[20] Ridgway 1994.

2.1 The study of the agricultural landscape: vines, vineyards and wine

The project would like to investigate the ancient agricultural landscape, including laboratory investigations, starting from the island's principal resource: vines. As B. d'Agostino emphasized[21], the Euboean's colonization of Pithekoussai is owed to *phytalie*, the cultivation of vines, which, as well as the vine trade, was the business of *basilees* and was part of the *prexis* trade[22]. Strabo describes the *eukarpia* of Ischia; the land's fertility aids in cultivation, as Pliny and Statius write in reference to vines[23]. In addition to wine, which was the primary agricultural resource, the island has always been rich in products of the land and sea[24]; even today, wheat is cultivated in the southern parts of the island; dried fruits are abundant, as are walnuts, hazelnuts and almonds[25].

Wine has played a role for centuries, into the modern day, in the economy of the island and deserves a closer look; a Greek inscription on a Hellenistic *donarium*, found at Lacco Ameno, contains a dedication to Aristaeus, the agricultural divinity particularly venerated in Euboea[26].

The settlement of Punta Chiarito, with multiple phases of inhabitation between the 7th and the 6th centuries BC and excavated by C. Gialanella and S. De Caro, yielded a sort of vessel for pressing grapes, an oval hollow in tufa with a spout, together with amphorae and *pithoi*; nearby was found a series of trenches for planting vines and holes left by the support poles[27].

Local production of amphorae for multiple centuries shows that the production of wine and of containers was always part of the reality of production on the island[28].

In 1867 G. D'Ascia wrote: «fra le piante, la più utile e la più propagata è la vite – la vite attirò le prime colonie su questo vulcanico masso…. La vite cominciò qui ad avere origine dagli Euboici: essi condussero questa pianta dall'isola Eubea […] nella detta isola di Negroponte, che con l'industria e col commercio civilizzava... Quando gli Eritresi approdarono in quest'isola, portarono con esso loro questa preziosa pianta, tenuta come sacra, perché dedicata al loro nume. Trovando quest'isola atta ad una tale coltivazione, perché di vulcanico suolo, tosto ne approfittarono, piantandovi la vite...»[29].

In 1822, Ultramontano described the wine as «la principale risorsa dell'isola, che è la produzione più adatta al suo suolo e alla sua esposizione. L'isola di Ischia è propriamente un solo grande vigneto»[30].

The wine of Ischia maintained an important position until the end of the 1940s, and life on the island was dominated by the production and trade in wine, as photographic evidence from that period suggests. Even today, the landscape of cultivation is mostly uniform and characterized by vines, whose expanse is aided by the volcanic soil and the climate (Fig. 2.1-2)[31].

One of the main open questions that our project addresses concerns the impact of Greek colonization on viniculture and wine production in the Gulf of Naples, and on Ischia in particular, in order to determine the eventual importation of vines different from the autochthonous ones and new techniques for cultivation[32]. Indigenous vines existed in prehistoric Italy. The discovery of remains of wine-making datable to the 9th century BC at Poggiomarino/Longola (Pompeii), excavated by C. Albore Livadie, proved the existence of vine cultivation and wine-making in Campania before the arrival of the Greeks[33].

There are very interesting new avenues of research in the study of viticulture related to the genes of Mediterranean grapevines[34].

[21] D'Agostino 1994, 23 and note 31.

[22] On these matters, see Mele 1979, 63 and notes 47 and 50.

[23] Strab., V, 4, 8; Plin., *N.H.*, XXXI, 9; Stat., *Silv.*, V, 3, 104-106.

[24] Monti 1991, 49 ff.

[25] Monti 1991, 52.

[26] Buchner 1949-1950, 1-12.

[27] De Caro – Gialanella 1998; Brun 2004, 162-163.

[28] For the archaic amphorae of Pithekoussai, Buchner 1981, 268, and 1982, 286; Di Sandro 1986, 108; Durando 1989, 87-88; van der Mersch 1996, 173-174; Sourisseau 2009, 155-156. For the Greco-Italic amphorae, Olcese 2010.

[29] D'Ascia 1867, chapter IX, 69.

[30] Haller 1822 (2005), 87 ff.

[31] Buchner Niola 1965, 105.

[32] Ciacci – Rendini – Zifferero 2012.

[33] Cicirelli *et al.* 2008; Cicirelli – Albore Livadie 2008; Brun 2009.

[34] Scienza – Failla 2016; Campania is one the few "reservoirs" of European vinicultural variability in which it is possible to find progenitors and ancestors of vines cultivated in faraway places.

Fig. 2. 1. Vineyard from Ischia, loc. Frassitelli (photo by G. Olcese); 2. Grape harvest (Piancastelli 2002, 36); 3. Rock-cut unit from the Bosco della Falanga at the foot of Monte Epomeo (Olcese 2017, 29, fig. II.14); 4. Rock-cut unit from Monte Corvo upon Forio (photo by G. Olcese)

To this end, molecular (DNA) analyses are planned based on the study of SNP (Single Nucleotide Polymorphism) markers. These analyses will examine autochthonous variety, grapevine accessions, and grape seeds found at archaeological sites on the island and in other contexts around Campania (such as the site of Longola/Poggiomarino, which has already been recorded, and whose dating precedes the arrival of the Greeks). These studies will be done in collaboration with colleagues, the Superintendency and agronomist colleagues from Di.S.A.A. at the University of Milan[35]. Genetic data will be compared for the purpose of identifying genealogies and genetic relations between old and new world viticulture. The process of domestication and evolution of the species *Vitis vinifera* is clearly recognizable in the morphology of the grape seeds. For this reason, the grape seeds from the archaeological sites will also be compared morphologically using non-destructive methods (such as image analysis) with a variety of modern seeds. The morphological data will be interpreted in relation to evidence of lineage obtained from genetic analyses.

2.1.1 Rock-Cut Units

The whole central area of the island, dominated by the presence of Monte Epomeo, is characterized by the presence of rock-cut units, great basins

[35] De Lorenzis *et al.* 2019, 127; De Lorenzis *et al.* in press; A. Scienza, O. Failla and G. De Lorenzis of the Di.S.A.A. of the University of Milan are involved in the ongoing project.

dug into the tufa and into the rock, for the purpose of turning grapes into wine (Fig. 2.3-4). The rural human settlements of Ischia, in which these basins were inserted, are traditionally traced back to recent times[36], but some rock-cut units of Ischia, comparable to ancient ones in other centers of the Mediterranean, could actually be older.

As part of the regional mapping of rock-cut units in Tyrrhenian Italy[37], a first study of those on Ischia was made. Analyses of residues (using the GC-MS method) were carried out on some production structures on the island. The first results are forthcoming in the proceedings of the 2018 AIAC Congress Cologne – Bonn[38].

2.1.2 Amphorae and wine

Studies, including laboratory studies, were carried out on Greco-Italic amphorae to determine their composition (XRF and mineralogical analysis). On the basis of these studies, the important role played by wine production and wine containers on the island was highlighted. The current studies, in collaboration with the Superintendency, are concerned with characterizing the archaic amphorae[39]. In order to fully understand viticulture on Ischia, it is useful to define the quality of the contents of various classes of vine-bearing amphorae produced at Ischia and sold on maritime trade routes. Some analyses (GC-MS) were then done on the remains of amphorae from Ischia/Gulf of Naples found on some shipwrecks[40].

2.2 The Clay

The abundance and quality of the clays on Ischia, resting above the green tufa of Monte Epomeo and rich in marine fauna, has been known for a long time. The passage from Pliny – in which he interprets the name of the island, connecting it to *pithoi* – seems to leave no doubt, although this reading is not agreed upon by all researchers[41].

Capaccio, in the 1600s, reports the discovery of «vasi antichissimi di creta cotta. Ed ai miei tempi si è scoverto uno fra gli altri considerabile non solo per la sua grandezza, ma per essere da una lamina di piombo internamente ricoperto, e gli artefici non hanno saputo giudicare con quale fornace si servissero per cuocerlo attesa la sua grandezza»[42].

Numerous authors of various periods record much information about the clays. An anonymous author writes[43]: «le miniere dell'argilla, e della creta sono state inesauste, ed immancabili; mentre da tempo antichissimo, che delle stesse se n'è fatto uso continuo per li vasi, e per li mattoni, non sono mai finite, e dimostrano di non volere giamai terminare».

Some clay deposits used in ancient times are found on the northern slopes of Epomeo, above Casamicciola, as M. Cartaro's 1586 map attests[44] (Fig. 3.1). A text from 1783 records that clay from Ischia was still being transported to Naples[45].

Capaccio, in the *Historiae Neapolitanae* of 1607, concerning Pithekoussai, records the presence in Casamicciola of «*ardentes fornaces figulorum*». The whole area of Casamicciola on Lacco Ameno, in particular the area by the coast, was intended for producing ceramics, and the clay was found at «12-15 piedi di profondità... scavata in lunghe gallerie che vanno a zig-zag sotto terra»[46]; the last kilns were still visible on the beach in the 1930s[47] (Fig. 3.2).

The investigation focused on the pottery quarter situated beneath the Church of Santa Restituta, at Lacco Ameno on Ischia at the foot of Monte Vico and near the sea. This context, which is of great interest, was accidentally brought to light in the 1950s by the parish priest, Don Pietro Monti. It covers a surface area of over 1500 m² and consist-

[36] D'Arbitrio – Ziviello 1982, 15 (15th century AD).

[37] Olcese – Soranna, 2013, 307-314; Olcese – Razza – Surace 2015 (www.immensaaequora.org), 2017, and in press.

[38] Olcese – Razza – Surace in press, with a contribution by N. Garnier, as part of the session "Making wine in the western Mediterranean / Production and trade of amphorae: some new data from Italy", during the 19th International Congress of Classical Archaeology (Cologne-Bonn, 22-26 May 2018).

[39] Olcese 2010, 2017.

[40] Garnier – Olcese in press.

[41] For a different interpretation Torelli 1994, 122-123.

[42] The information reported by Monti 1980, 473 is attributed to Capaccio (1607, chapter XX); D'Aloisio 1757, lib. I, C.I, f.1.

[43] Mazzella 2014. Anonymous, author of the text *Ragguaglio dell'isola di Ischia*, should be recognized in Vincenzo Onorato, a priest who lived between 1700 and 1800 on Ischia, moreover cited already by Monti 1980.

[44] Cartaro 1586; Monti 2011, 86.

[45] Andria 1783, 78-80.

[46] Monti 1980, 473; Capaccio 1607, chapter XV.

[47] Monti 1980, 473-475; Buchner 1994.

1 2

Fig. 3. 1. Clay quarry in the cartography by Cartaro 1586; 2. Ceramic factory of the Mennella Brothers in Ischia (from Buchner 1994)

ed of many kilns, seven of which have been identified. These were found along with the crafting area, a dryer for tiles and tools used by ceramists.

Through the use of thermoluminescence and the study of material finds, we have been able to establish an effective chronology for some of the kilns, which are not attributable to the Republican period, as previously thought, but somewhere between the Late Geometric and Hellenistic age[48]. The oldest kiln, the circular one, probably dates back to the first phases of the Greek settlement. The others, rectangular-shaped and variously sized, can be dated to the period between the Archaic and Hellenistic ones.

Currently, these kilns, whose technology changed over time, are the only ones known to exist on the island. For centuries, artisans continued to work in the same area, which was convenient for its location with respect to the sea, well protected and boasted a supply of fresh water.

Ceramics produced during the colonial period, clearly of Euboean derivation, mostly consisted of calcareous table wares. They were produced by method A as defined by M. Picon[49], a privileged method in the Mediterranean. Meanwhile, the cooking wares reflect a different artisanal tradition, perhaps an indigenous one[50].

Archaeometric data obtained through chemical and mineralogical analyses of ceramics from different epochs will serve as reference groups, which consist of materials that were definitely produced locally and whose composition is now known. These groups will attest to the continuity of the supply of raw materials. The clay used in the artisan quarter of Lacco Ameno probably comes from the coast and the slopes of Mt. Epomeo near Casamicciola, just a few kilometers away. Here, up to the modern era, clay was dug in tunnels and transported on the backs of mules to the coast.

The situation here is similar to that recently documented in Euboea, thanks to ethnoarchaeological and archaeometric studies. Fine Euboean ceramics were made with clays whose sources were situated 3 km north of Lefkandi in the area of Phylla. Artisans from Chalkis, even in the last century, transported clay from this area with horses and carts to their workshops[51].

2.3 Alum

The island's volcano-tectonic characteristics favored the circulation of thermal, acidic waters that lead to the formation of mineral deposits, which consisted mostly of alunite. These were already identified in the plan of Cartaro in 1586[52]

[48] Olcese 2017.
[49] Picon 2002; Olcese – Picon 2002, 2003.
[50] Olcese 2017, chapter VIII.
[51] Kerschner – Lemos 2014, 191.
[52] Monti 1980, 477-482; 2011, 88; Pipino 2009; Olcese 2010.

(Fig. 4.1): «sono anco miniere d'allume in molte parti dell'isola e specialmente vicino il Monte della Guardia»[53].

Alum was used in Antiquity in the production of glass, in separating native gold from silver, in the textile industry, in the production of leather, and in medicine as a hemostatic. It was concentrated in few places, and Ischia was one of those (Fig. 4.2). The most extensive and widely-used deposit of fossil alunite was above Casamicciola, in the north part of Epomeo, where brick basins have been found where the mineral might have been ground[54].

Ischian alum was probably already being used in the remote past, but we have news about their exploitation from the XIII century when it was ordered that the tithes on alum were to go to the bishop of Ischia[55]. Alum mines on Ischia were the property of the King of Naples, who conceded mining privileges (the oldest document in this sense is dated to 1299, while the abandonment of production must have taken place at the end of the 16th century[56]).

The large basins that are still visible in the woods above Casamicciola, which we identified during a survey[57] (Fig. 4.3), are effectively similar to those found in one of the rare ancient settlements known for alum production, probably dating already to the Roman period, which was uncovered on Lesbos, at Apothika[58] (Fig. 4.4); such basins in a truncated-cone shape are interpreted on Lesbos as pits for grinding minerals[59].

Further field studies related to the production of alum on Ischia could not only clarify the means of production of alum but also arrive at a more precise dating of the production sites, if datable finds can be discovered that were not identified during the first survey.

2.4 Metals on Ischia: some data and some open questions

As far as metals are concerned, the questions proposed as part of this project concern iron and gold, for now, are only aimed at reopening some unanswered questions and delivering primary data, which will be very preliminary, from the ongoing research.

Control of metal contributed in Antiquity, as is well established, to the formation of political and social structures. If, as some maintain, there is no evidence that the Greeks moved westwards in search of metals[60], and the debate about this topic is closed, it is however possible, for example, that in Antiquity the outcroppings of limonite on the sides of the mountains attracted the attention of the Euboeans, who would have discovered, upon investigation, small deposits of iron and perhaps also natural alum, as well as sulphur.

In any case, contact with the Euboean world was probably one of the factors leading to the arrival of innovative technologies, particularly in the field of metallurgy, and the beginning of the exploitation of the deposits[61]. The existence of a Chalkidian metal industry in the Archaic Age is a definite, undeniable reality. It was connected to deposits of iron in the central part of Euboea[62]. Ore deposits are attested in southern Euboea[63]. The presence of workshops for the refinement of metals from Pithekoussai probably reflects archaic Euboea's vocation to metallurgy, as has long been rightly highlighted for a long time[64].

[53] Iasolino 1588, 27. For other sources, Olcese 2017, 34-36.

[54] Monti 2011, 88; Olcese 2017, 44-46.

[55] Monti 1980, 477 ff.; Pipino 2009. For the most complete study on alum in the ancient times, Borgard – Brun – Picon 2005.

[56] Buchner 1994, 36, note 17.

[57] The survey was done with Dr L. Monti, who is the author of the geological guide of Ischia (Monti 2011), whom I thank for her support for my research, who picked the locations and accompanied us there.

[58] Archontidou 2005.

[59] Archontidou – Blondè – Picon 2005.

[60] For example, Treister 1996, 181; Descoeudres 2008, 361; different opinions on the matter were expressed in Dunbabin 1948, 7-8, and Bordman 1964, 177. S.C. Bakhuizen had formulated some hypotheses about emigration from Chalkis, hypothesizing that part of its trade was in iron, possibly basing itself on the exploitation of local mines. The first groups of Chalcidian emigrants to settle near the Bay of Naples consisted of traders in iron products and iron-smiths (Bakhuizen 1976, 66).

[61] On Euboean metallurgy and the connection with colonization in the western Mediterranean, Bakhuizen 1976; Markoe 1992; Treister 1996, 165-168; Soueref 1998.

[62] Bakhuizen 1975, 19-20; Mele 1982, 9.

[63] For the mineralizations with traces of gold on the island, Kanellopoulos *et al.* 2017. In the 1970s, understandings were different: in fact, according to Mele (Mele 1979, 67), the Chalkidians bought gold, which was not available in their region, to use as a trade good to obtain iron from Etruria, acting as a middle man in the trade: «i Calcidesi, come si è visto, diffondono in Etruria i loro χρυσεῖα; oro in Eubea non ce n'è; essi dunque trattano l'oro al fine di procurarsi ferro». The discovery of the treasure of Eretria (a vase containing many gold objects) in a 8th century BC building is very interesting; the discovery has been interpreted as that of a goldsmith's workshop (Themelis 1983) and, more recently, a monetary reserve, Le Rider – Verdan 2002.

[64] Mele 1982, 11.

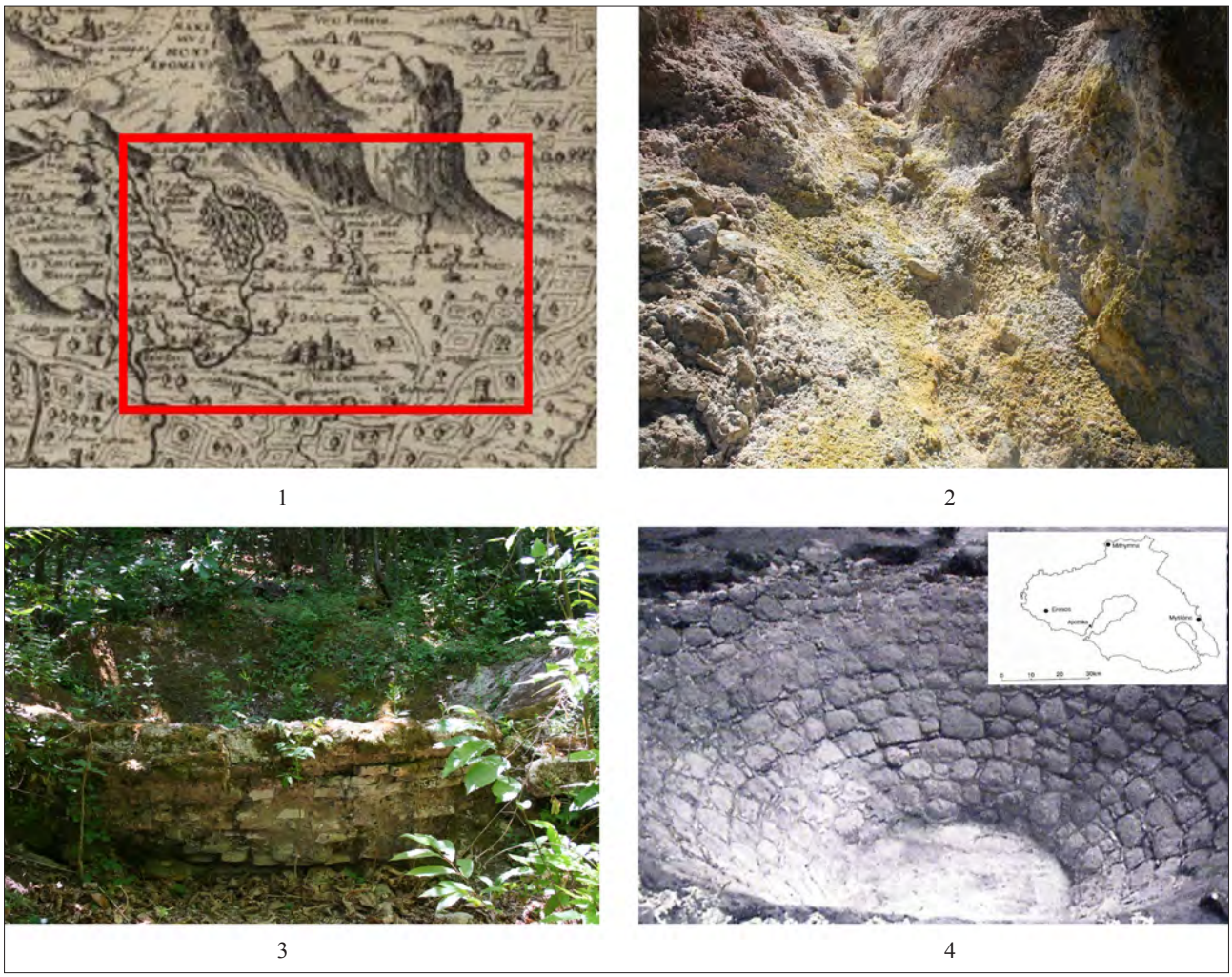

Fig. 4. 1. Sites connected to the alum industry in the in the cartography by Cartaro 1586; 2. Alum field from Ischia (photo G. Olcese); 3. Tank for processing alunite in the area called "le Caulare", above Casamicciola (Olcese 2017, 35, fig. II.26b); 4. Tank from the *atelier* of Apothika, Lesbos (Archontidou 2005, figs. 1, 3)

Important data on Ischian metallurgy, although they refer to sporadic finds, concern the Republican and Imperial periods in the area of Cartaromana (see the following paragraph).

2.4.1 Refinement of metals on Ischia: the finds from Lacco Ameno and Aenaria

As far as the refinement of metals on Ischia in Antiquity, there is the well-known research of G. Buchner in the Mazzola/Mezzavia Quarter, dated to between the middle of the 8th century and the 7th century BC, where he hypothesized that bronze and iron were worked[65]. In addition to this work, a fragment of hematite was discovered amongst the finds from the acropolis dumpsite; these were attributed to the island of Elba[66], although doubts were raised soon after[67].

In the necropolis of San Montano, on a layer from the middle of the 8th century BC, iron slag and an iron sponge were found[68]. During the excavations of 1965, the acropolis dumpsite yielded some finds related to the production of iron[69], which included a clay object identified as the mouth of a bellows (*tuyère*), perhaps from an ironworking furnace; it has been found, however, in other contexts

[65] Buchner 1970-1971; 1971; 1975, 80; Klein 1972; Ridgway 1984, 105-107; Buchner – Ridgway 1993; Giardino 1995, 122; Nijboer 1998, 240-244. An iron sponge is documented on a level corresponding to the middle of the 8th century BC in the necropolis of San Montano, Ridgway 1984, 105-107.

[66] Buchner 1966, 4-12; letter of Marinelli in Buchner 1969, 97-98; Bakhuizen 1976, 66, note 83; D. Ridgway also agrees with this attribution, Ridgway 1984, 104, 108; Ridgway 1992, 99-100; Corretti – Benvenuti 2001, 134-135.

[67] The question is reviewed in Corretti – Benvenuti 2001, 135 and note 38.

[68] Buchner 1975; Ridgway 1994, 108: Nijboer 1998, 240-244.

[69] Buchner 1969, 97; 1975; Ridgway 1984, 104, 108.

and interpreted differently, as *lasana*, which is a support for ceramics in kilns[70] (Fig. 6.1).

One less well known but still a highly interesting piece of evidence comes from the priest Don Pietro Monti in the 1970s[71], who pointed out archaeological traces and a possible foundry in the northeast part of the island, between Cartaromana and Aragonese Castle, on the rocks of Sant'Anna[72] (the area probably coincides with the site of *Aenaria*[73], which was also indicated in the map of Beloch[74]) (Fig. 5.1). It is an underwater context, dated by materials to the late Republican and the early Imperial periods.

A block of galena, which has recently been subjected to analyses, is of uncertain origin as it does not have features that indicate a particular district, but it is common in the Mediterranean basin[75]; this could confirm Monti's hypothesis regarding the presence of a foundry[76]. It must be remembered, moreover, that the area of these discoveries is not very far from the gold mine of Campagnano, which is shown on the map of Cartaro in 1586.

The priest found and displayed at the Museum below Santa Restituta various finds "from *Aenaria*" in a showcase dedicated solely to this context: tiny hollow cylinders of litharge (Fig. 5.2), tin ingots cylinders, a bar of copper (Fig. 5.4), iron cylinders (Fig. 7.4), a fragment of "silver foam". Some of these items are probably related to the cupellation done to separate the lead from the silver, which was done in two crucibles: into the lower one, according to Pliny[77], litharge flowed, creating the cylinders found in multiple sites used for silver production[78]. In addition, he showed some *mortaria*, a sort of lead brazier (*foculus*; Fig. 5.5), which until a little while ago rested in the excavations of Santa Restituta and is of uncertain origin (but probably from *Aenaria*, since it was placed in the showcase dedicated to that context). It is a very interesting item because it was possibly used in metallurgy; other uses, for example heating food, have been proposed on the basis of similar vessels found on various shipwrecks, mostly from the Hellenistic and Roman periods in, for example, Gaul, Israel, and Turkey[79].

At Lacco Ameno, during the excavations of Santa Restituta and in the surrounding area, Don Pietro Monti found a silver-bearing, microcrystalline galena (diam. approx. cm 40 x 29; weight approx. kg 60; Fig. 5.6), together with the remains of the mouth of a bellows[80] (Fig. 6.2), some iron slag, the base of a crucible, and hematite minerals[81]. Such finds, recorded in the unpublished notes of the priest that I have been able to consider only recently, allow for a hypothesis that, perhaps, we don't know where, there could have been an area on Lacco Ameno dedicated to the metalworking[82]; it is, however, a hypothesis that requires further study.

2.4.2 Gold on Ischia

Whether or not gold is present on Ischia has been the subject of discussions over time. Strabo's well-known text[83] speaks of the χρυσεῖα of Pithekoussai, goldmines, whose presence nevertheless was doubted in more recent times for geological reasons[84]. It has been proposed, as is well-known, aside from variant readings (including the desire to replace the word χρυσεῖα with χαλκεῖα or χυτρεῖα)[85], that Strabo was not referring to goldmines but «alle officine in cui il metallo veniva trasformato in utensili e ornamenti»[86].

[70] Papadopoulos 1992.

[71] Monti 1980, 157 ff., 168 ff.; Rittmann – Gottini 1980, 253; Monti 1991, 16-17 and note 9.

[72] Monti 1980, 168; Boni – Gialanella – Knill 1998, 160-164.

[73] Pais connects the Latin name, *Aenaria* with *Aes*, Ridgway 1984, 49.

[74] Beloch 1890, 63.

[75] Boni – Gialanella – Knill 1998, 163.

[76] Monti 1980, 168

[77] Plin., *N.H.*, XXX, 105-108.

[78] Conophagos 1980, Boni – Gialanella – Knill 1998, 160-164.

[79] Pollino 1984 (Benat III shipwreck); Lopez 1994, 51 and 1996, 59-60 (Barthelemy B shipwreck); Galili – Sharvit 1999, fig. 8 (Israele); Beltrame 2002; Purpura 2003.

[80] Together with these finds, Monti, in his unpublished works, also records the presence of another fragment of galena, hematite minerals, iron slag, and the base of a semicircular crucible (cm 5 x 6).

[81] The writings relating to the last period of the priest's life were given to me and Prof. Castagna.

[82] Don Monti thought that ovens for metals could be found at the foot of Monte Vico not far from the kilns; about the finds, the writings make scant reference to either the area of the so-called *fornace per la calce* (base of a crucible, galena, and bellows mouthpiece) or to the location where the Terme dell'Hotel Regina Isabella were constructed (bellows mouthpiece).

[83] Strabo, IV, 4, 9.

[84] See note 5; for a review of the question, Ridgway 1984, 47-49; Mureddu 1972.

[85] Pais 1894, 158, and 1922, 224; the reading χυτρεῖα is accepted by Bérard 1957, 43.

[86] Mureddu 1972, 408; Buchner 1975, 81.

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Fig. 5. 1. Map of the area around the Ischia Castle (Monti 1980, 162, fig. 69); 2. Tiny hollow cylinders of litharge; 3. Tin ingots from Cartaromana (Monti 1980, 171); 4. Bar of copper from Cartaromana (Monti 1980, 173); 5. Lead brazier (*foculus*) displayed in Santa Restituta (photo by G. Olcese); 6. Galena found in Santa Restituta (Olcese 2017, 32, fig. II.18b)

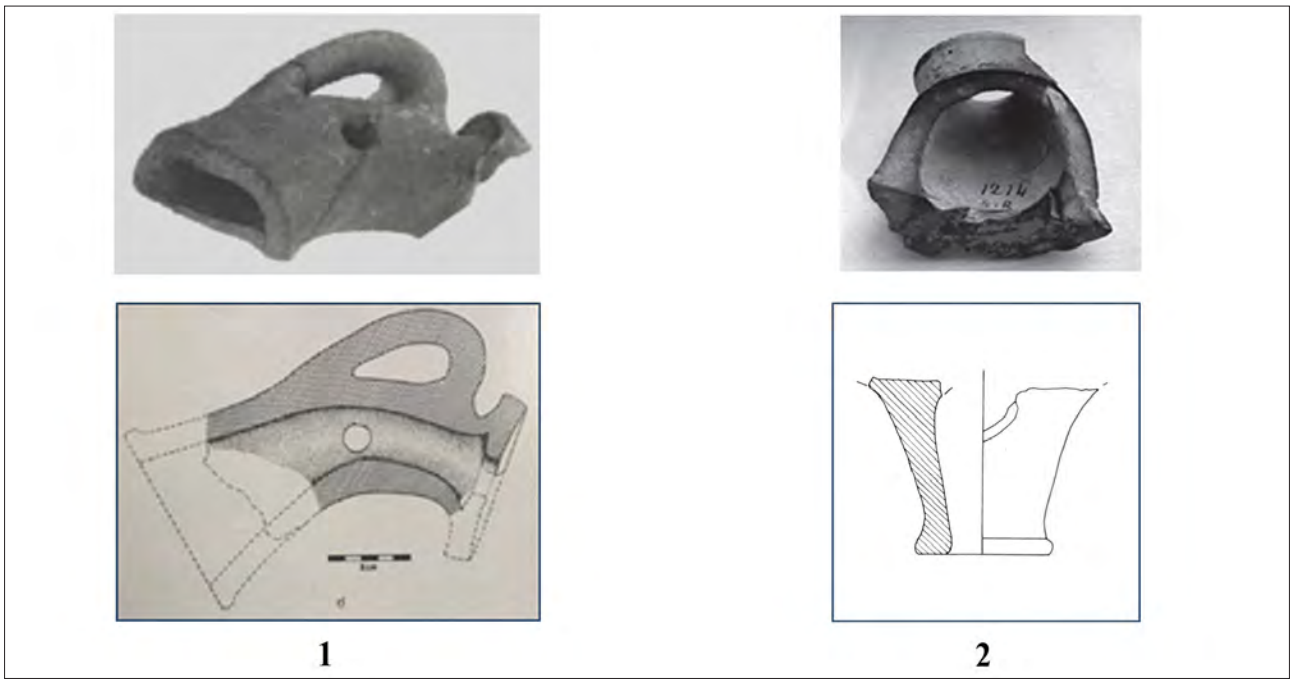

Fig. 6. 1. Archaeological find (*lasana*) identified as the mouth of a bellows for a steel oven found in San Montano (Buchner 1969, fig. 26c, e, d); 2. Remains of the mouth of a bellows from the archaeological area of Santa Restituta (Olcese 2017, 18, fig. I.5; drawing by E. Serafini, scale 1:3)

As has been noted, however, the geographer knew the island well, perhaps from having visited in person, and his inattention would be improbable[87], given that the reports he usually gives about mines have a basis in reality.

On this matter, it is interesting to consider the reports from Iasolino about the «bagno detto Aurifero o bagno dell'oro nella Valle dell'Ombrasco»[88] … «che mostrava una bellissima meraviglia della natura... quando il fonte è pieno… quelle acque mostrano... un sottil velo d'oro finissimo… di più di 24 carati, noi l'abbiamo voluto chiamare bagno aurifero: perché mena seco l'oro siccome si legge fanno molti fiumi; anzi abbiam più volte sperimentato e particolarmente quest'anno, 1583, abbiam fatto vedere a molti signori... che accostando leggermente la pianta della mano sopra la superficie dell'acqua vi si attacca quella tela d'oro… È la miniera di questo bagno... di oro: ma (per quello che io giudico), mescolato con qualche parte di rame, e con alcuni pochi vapori di solfo… né si deve meravigliare niuno di sì fatto bagno, poiché Strabone, e altri scrivo in quella isola essere miniere d'oro, e chiaramente se ne vede una, in quel luogo che dicono Campagnano»[89]. The phenomenon of thin films of gold has been observed with certainty near gold and silver deposits, as a result of its concentration[90].

Cartaro's 1586 map reports the toponym "*Auri Fodine*" in the area of Monte Vezzi - Campagnano[91]. Scipione Mazzella cites in 1661: «...le miniere dell'oro, che furono insieme con quelle dello solfo trovate nel 1465 da Bartolomeo Perdice genovese»[92].

In 1607, Capaccio affirms the presence of: *Auri fodinae, de quibus fortasse Strabo loquutus est...*[93]. G. Iasolino, at the end of the 16th century, informs us that the Venetians «allettati sicuramente da grandi speranze… erano venuti a saggiare il territorio di Ischia per cercarvi l'oro. Ma poiché né Iasolino né alcun altro autore fanno menzione dei risultati di queste ricerche, v'è da credere che i Veneziani, traditi nelle loro aspettative abbiano la-

[87] Mureddu 1972, 407, note 3.

[88] Valley and hill are found in the area of Casamicciola, on the slopes of Epomeo, an area in which also *Fodina aluminis* (alum mine) is found; there are also reports of a *Minera Aluminis e calchanti* on the slopes of Epomeo.

[89] Iasolino 1689; Pipino 2009; Monti 2011.

[90] Pipino 2009, 21-22.

[91] Cartaro 1586; Monti 2011, 92-95.

[92] Mazzella 1661, 19. The news is reported in Giustiniani 1797.

[93] Capaccio 1607, 186.

sciato l'isola senza troppo rumore per andare altrove ad accumulare tesori…»[94].

D'Ascia records: «l'Anonimo Oltramontano ha sottoposto a critica tale asserzione, quante volte dai posteri si volesse accettare letteralmente, e non nel senso figurato il dotto racconto, mentre le prime colonie greche non avevano scavate o possedute miniere di oro, ma che metaforicamente, colle parole di Timeo «propter agri feracitatem et auri fussilia» s'intendea dimostrare l'essenza della ricchezza, che la forza produttiva di questa terra vergine dovea produrre; come in effetti produsse ai primi abitatori. Ma vi furono altri scrittori che più dettagliatamente indicarono esservi stata la miniera di polvere aurifera nel sito indicato, e che i Veneziani ne fecero pruova»[95].

Geo-mineralogical observations concerning Ischia – which described epithermal gold as invisible, composed of submicroscopic particles once the deposits were depleted – drew our attention[96].

Signs point to the presence of metalwork in antiquity: it has already been said that right on the coast of Cartaromana, not far from Campagnano, beneath the deposit indicated on Cartaro's map, there was a metallurgic workshop established in the late Republican period.

Moreover, geologists who analyzed the waters of multiple sites on Ischia for other reasons, found that only the samples from Campagnano (which is also the site where a goldmine is marked on ancient maps) showed anomalous quantities of silver (the highest anywhere on the island), mercury, and antimony[97].

Therefore, we decided to continue our research and carry out verification using scientific methods, which are of course the only means of answering the question regarding the possible presence of gold on Ischia with degree of confidence: analyses carried out in the course of our project with SEM on the sand samples in 2017 in the area of Campagnano, which will be described in the following paragraph, constitute a fundamental proof that there was and there is gold on Ischia.

2.4.3 Gold on Ischia: laboratory analyses completed and ongoing

One of the main goals of our project was, therefore, to provide scientific evidence that actually gold is present in Ischia, disprovising the diffuse assumption that Ischia is devoid of gold resources.

We sampled sands from the waters drain of Piaggia Romana, just downstream from Campagnano[98], where a mine is also indicated on the map of Cartaro, between the churches of San Domenico and San Sebastiano, the presence of which is confirmed by Iasolino[99], and which was lost due to intense urbanization, as well as historical landslides. It is located in the area connected to the great eruption on the island (1301-1302). It is not unlikely that the faults related to the eruption may be linked to the remobilization of old sediments containing heavy minerals, including gold. The sands collected near the beach in proximity of the drain gathering waters from the whole basin actually contained an amazing quantity of gold, well above the level exploitable with ancient techniques. The gold grains were easily detectable by visual survey of the sand grains using mid magnification optical microscopy. Further confirmation of the nature of the gold grains was made by a scanning electron microscope[100].

These data, taken as a whole, should change the understanding of previous ideas about gold on Ischia; it is not possible, however, for now at least, to be certain that gold was continuously available and systematically mined in antiquity. That leaves only the information provided in Strabo, which is known to be variously interpreted. It must, in fact, be also remembered that the archaeological data currently available do not allow us to extract more information; the burial items from the necropolis of San Montano, for example, are almost all lacking in gold jewel-

[94] The text is reported by Haller 1822 (2005), 62.

[95] D'Ascia 1867, chapter VIII, 65-66.

[96] Pipino 2009.

[97] *Atlante geochimico* 2006, 49-50, 112, 162; see also Morteani – Northover 2013.

[98] We carried out the sampling in the area crossed by two faults with volcanic rocks, ideal for the discovery of sands that contained gold.

[99] Iasolino 1588.

[100] The SEM analyses were carried out by Dr S. Crespi (in collaboration with Dr A. Rizzi) of the Department of Earth Sciences of the University of Milan (Bresson – Olcese in press), thanks to the authorization given by Prof. L. Trombino; for the availability of both, I am grateful.

lery[101]. Moreover, thanks to observations and the studies by P. Guzzo of the first gold working in the Phlegraean area in the archaic period, the presence of goldsmith *ateliers* at Pithekoussai should be excluded[102].

Further studies, including archaeological ones, are necessary on the basis of data so far obtained.

Analyses of water are still ongoing in several places on the island[103] and analyses of rocks and soil are planned to confirm the eventual presence of gold also on other areas of the island.

2.4.4 Iron

As for gold, also for iron the opinions about its presence on Ischia are numerous and still contradictory[104]. For some archaeologists, there is no iron on Ischia[105] and «settlers must have worked imported iron, but the origin of the raw material is unknown as yet»[106].

In reality, there is iron on Ischia – and there are numerous recent historical sources that speak of it, with only a few reproduced below – that exists as minerals inside the rocks, although there are no primary deposits[107].

Iron minerals such as hematite, whose presence has been ascertained on the island, and limonite, could have been useable in ancient ironworking, maybe rather than magnetite[108], which is abundant on the island's beaches[109].

In 1697 Capaccio, describing the island, made reference to the *ferri venae in altissimis rupibus, quae in insulam aditum prohibent*[110]. And also Iasolino records that: «si vedono in quelle rupi *(along the sea)* li colori delle miniere, e massimamente del ferro, e dell'ocri; è copiosa di arena nera, ferrigna, che tira la calamita…»[111].

C. Haller in 1822 writes: «ad Ischia… il ferro... le cui particelle, disperse oppure ridotte ad uno stato di ossidazione o di scorificazione più o meno avanzata, entrano nei corpi vulcanici dell'isola. L'infinità di sfumature di rosso e di giallo, che in essi si notano ad ogni piè sospinto, provengono esclusivamente dal ferro… La sabbia nera che si trova allo sbocco dei torrenti e dei piccoli ruscelli dell'isola, contengono una grande quantità di particelle luccicanti, ugualmente attirate da una calamita, e che sono una vera miniera di ferro»[112].

D'Ascia, in 1867, writes: «vi sono gl'indizi di ferro e di solfo altri due potenti principi vulcanici. Ed infatti non solo tutto il masso dell'isola si osserva pregno dell'ossido di ferro; ma il lido accosto al mare, e lunghesso le scaturiggini ed il corso delle acque nelle valli, è sparso di minutissime particelle di ferro non ossidato, confuse nella rena, le quali sono nere e risplendenti, e vengono attirate dalla calamita e dall'acciaio. Questa rena era copiosa fin dai tempi del Jasolino, il quale non mancò di farne motto nell'opera sua. Queste arene formavano un capo d'industria per un meschino branco di travagliatori, che le raccoglievano lunghe le spiagge di Lacco, Citara, ed i Maronti, e circa 2670 quintali di questa rena depurata, venia negli ultimi anni esportata alle ferriere della provincia di Salerno. Molti anni sono si piantò nell'isola una fabbrica di ferro di commercio con questa rena, ma perché era diretta con imperizia, l'intrapresa non fu continuata»[113].

[101] Buchner 1975, 72; Guzzo 2004.

[102] Guzzo 2000 and 2004; Scheich 2004, 249; Scatozza Höricht 2014, who shares the opinions of P. Guzzo.

[103] The samples were carried out thanks to R. Toccaceli, aided by geologist L. Monti. The water analyses by Prof. M. Bononi and Prof. F. Tateo of the Di.S.A.A. of the University of Milan seem to indicate that gold is indeed measurable in the circulating fluids.

[104] Ridgway 1984, 113-116; Corretti – Benvenuti 2001, 135. The hypothesis of Bakhuizen (Bakhuizen 1975, 19 and Bakhuizen 1976) is well known: that the Chalkidians bought iron on Ischia to work and trade for other more precious products; Mele (Mele 1979) presupposes that the importation of Elban iron to Euboea was a valid economic movement, which could have justified the Euboeans' journey, although with the knowledge that in Euboaea itself iron was easily found; see also d'Agostino 1994, 25; moreover d'Agostino in Cébeillac-Gervasoni 1982, 131: «i Calcidesi, gli Euboici di Bakhuizen, portano metallo per il Mediterraneo... andare a portare barre di ferro a Pitecusa è come andare a portare vasi a Samo, dal momento che quegli stanziamenti nascono, come molti di noi danno per scontato in previsione di rapporti con l'Elba…».

[105] Bakhuizen 1975, 22; Ridgway 1984, 113-116.

[106] Bakhuizen 1976, 66.

[107] About the iron, see also Millesovich 1934; Graham 1971; Bakhuizen 1975 and 1976; Delpino 1988; Sperl 1998; Corretti – Benvenuti 2011.

[108] Scacchi 1850, 107-109; Millosevich 1934, 192-193; Pipino 2016.

[109] Monti 2011, 84, fig. 25.

[110] Capaccio 1607, 186.

[111] Iasolino 1588, 38

[112] Haller 1822 (2005), 61.

[113] D'Ascia 1867, chapter VIII, 65.

New interdisciplinary studies are also planned on iron in collaboration with V. Serneels.

(Milano, 2019)

Addendum (2023)

The text published here in its original version was delivered in 2019; some additions are therefore now necessary. It should also be noted that in the meantime the articles appearing in press in the bibliography have been published.

In the contribution Bresson – Olcese 2022, Bresson, who revisited the whole question during a collaborative project, observes that, although most of the manuscripts have χρυσία ("gold things") and just one has χρυσεῖα ("gold mines"), the epsilon could have been dropped and this is perfectly plausible, because both words are pronounced the same. He also emphasizes that the meaning "gold workshops" for the word χρυσία has no parallel, and thus is not an acceptable reading, nor is it plausible to read a reference to Ischia as a center for trade in gold produced elsewhere. According to Bresson, either Strabo's version should be rejected or it is necessary to admit that gold actually was mined at Ischia, as indeed the presence of gold mines on the island in the Medieval period and at the beginning of the modern period makes more plausible. It is very probable, therefore, that gold was present in small quantities, even if this is not enough evidence to reject the text of Strabo or change its meaning (Bresson – Olcese 2022, note 2). A new multidisciplinary project entitled "Archaeology and the environment of the "islands of history" of the Tyrrhenian Sea: the case of Ischia. Multidisciplinary research for the reconstruction of Mediterranean resources and networks over the centuries', as part of the research supported by the École Française de Rome for the period 2022-2026 (https://www.efrome.it/it/la-ricerca/programmi/dettagli-programmi/isole history), in which several scholars are collaborating, has began. The main objective of this project is the reconstruction of the island's resources in antiquity, and of the historical, environmental and economic role of Ischia, through a series of activities relating to geo-archaeological aspects, the palaeogeography of the coastal marine areas, the agrarian (vine and wine) and volcanic landscape, and the production and trade dynamics over the long term (ceramics and metals) (Olcese 2022).

As part of the new project, the following text by G. Artioli is reported.

New Analyses on the Gold-Containing Sand
(G. Artioli, University of Padova)

The sands collected near the beach in proximity of the waters drain of Piaggia Romana, just downstream from Campagnano, were re-analysed.

They proved to contain an amazing quantity of gold, well above the level exploitable with ancient techniques (Fig. 7). The gold grains were easily detectable by visual survey of the sand grains using mid magnification optical microscopy. Further confirmation of the nature of the gold grains was made by a scanning electron microscope equipped with energy dispersive spectometer (SEM-EDS). Chemical analyses carried out at the Department of Geosciences of the University of Padova confirmed the purity of the gold particles (Fig. 8). The nature of the heavy minerals associated with the gold grains (i.e. garnets, pyroxenes, magnetite, etc.), together with the very homogeneous grain distribution, indicates that the analysed sand originates from the re-deposition of very classed and gravitationally processed fractions of earlier igneous and metamorphic layers. Preliminary analysis of several volcanic sediments at different levels of the Campagnano valley do not show minerals compatible with the gold-containing sand sampled near the beach. Therefore the direct concentration of the heavy particles from the local volcanics is unlikely, and the short transport of old sediments, possibly remobilized by the faults connected with the recent eruptions, is suggested. The chemical analyses agree with those previously carried out at the University of Milan. Therefore, it is evident that the presence of light elements (C,O) included in the table of previous analyses (Bresson – Olcese 2022, p. 139, fig. 11) is an artifact due to the materials used for the sample holder.

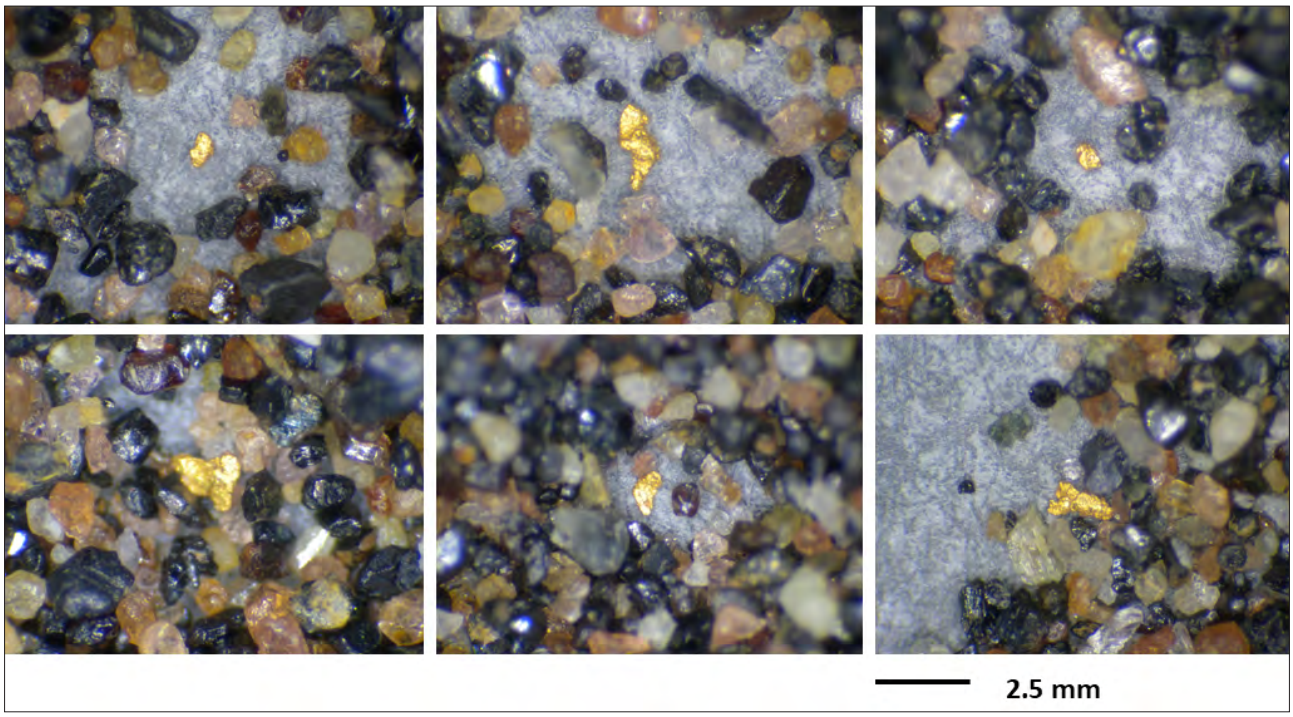

Fig. 7. Optical images by binocular microscope (Nikon SMZ.645) of the gold particles manually isolated from the sampled sand

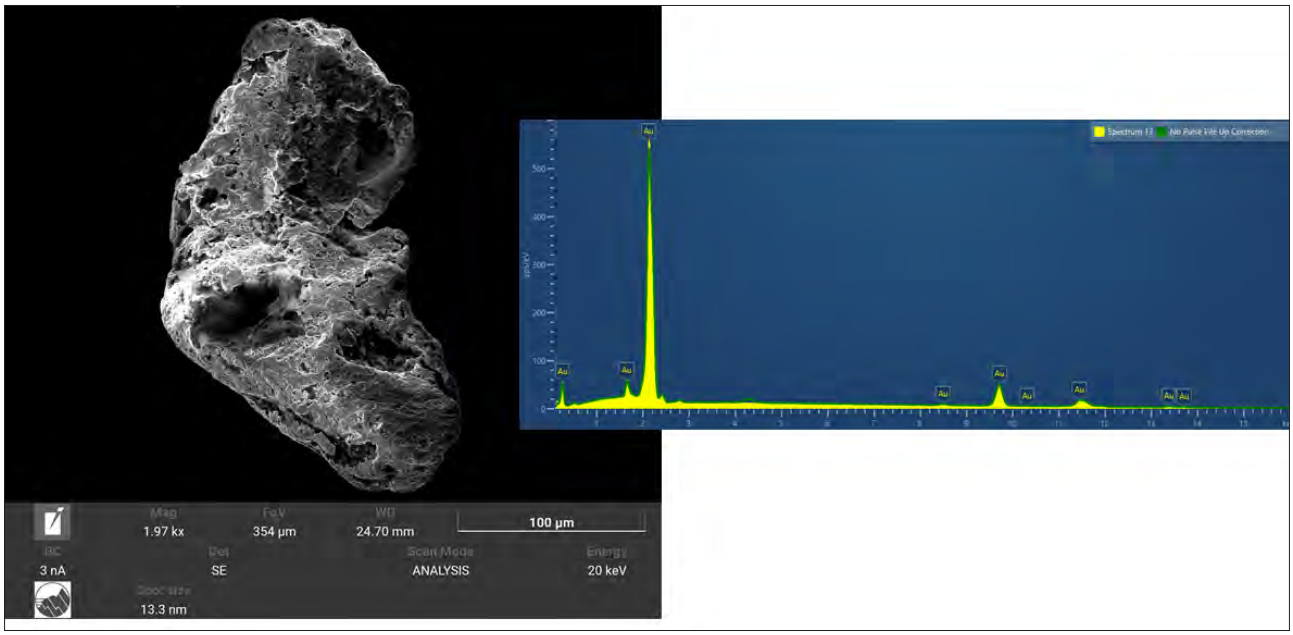

Fig. 8. Secondary electrons image of one of the separated gold grains, with the small-area chemical analysis by energy dispersive spectrometry (TESCAN SOLARIS field emission SEM). The reported EDS graph demonstrates the purity of the particle

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one mention from the post-antique period of epithermal gold in association with the presence of alum, which could not be used to produce objects. Consequently, the only certain metal production documented in Pithecusa is that of bronze fibulae.

Lucia A. Scatozza Höricht, *Pithecusan Gold: Anatolian Connections*

The absence of gold ornaments in Pithecusa, both among the finds in the metallurgical district of Mazzola and the necropolis, from which only objects of gilded silver are known at present, if compared with those of the necropolis of Kyme in Phlegraean fields, re-launches the discussion on the meaning attributed to the term *chryseia* or *chrysia* in the well-known passage of the Greek source. In the ancient world, the search for metals was a major factor in mobility and raised the question of the role of Pithecusa in the gold trade, which involved the relationship between Euboea and the eastern Aegean. What emerges in Pithecusa can be related to the recent archaeological research, which reveals important interconnections between Euboea and the site of Kyme Aiolis on the coast of central-western Anatolia, perhaps as early as the LPG period.

Gloria Olcese (with a contribution by Gilberto Artioli), *Natural Resources and Raw Materials at Ischia in Antiquity: Some Data and Preliminary Reports from an Ongoing, Interdisciplinary Project*

This paper illustrates the new project begun at Ischia, following the study and publication of the artisan quarter excavated beneath the church of Santa Restituta (Lacco Ameno). The research will focus on the island's natural resources, both environmental and geological, available during the period of colonization, but also later. These resources have not always been sufficiently considered in archaeological investigations. Drawing on literary sources and employing specific scientific analyses for the identification of mineral and clay deposits, the project will reconstruct the agricultural landscape, the use of the land's resources, and the techniques of wine and ceramic production, of which the island has yielded important archaeological evidence.

Nadin Burkhardt, Stephan Faust, *First Results of the Excavations at Pithekoussai from 2016-2018 (Villa Arbusto, Lacco Ameno, Ischia)*

Being the first Greek settlement in the Western Mediterranean, Pithekoussai (modern Ischia) has long been at the centre of scholarly discussions about the early phase of the so-called Colonization of Western Greece. New archaeological evidence of this historical process is provided by a recent project that investigates an area next to the "Museo Archeologico di Pithecusae" in the Villa Arbusto at Lacco Ameno. Here, several terrace walls, which consisted of several layers of boulders with finished surfaces on the front, were found. While the dating of archaeological material from the surrounding trenches (including indigenous as well as imported pottery, roof tiles and a scarab) ranges from the Apennine Culture of pre-Roman Italy to the late Archaic Period, the stratigraphy suggests that the site was occupied by the building structures since the Late Geometric Period. They might have belonged to a domestic context or even a sanctuary.

Mariassunta Cuozzo, *Pithekoussai. Pottery from the Mazzola Area*

Here I present about 100 sherds and partly reconstructed vases from the Mazzola area I selected for the reopening of the room dedicated to Pithecusae at the National Archaeological Museum of Naples. After a quick overview of the types distinguishing the main chronological horizons, I dwell here on two specific subjects: a still understudied class for Pithekoussai, namely, "white-on-black" overpainted ware and a figured Late Geometric sherd lacking close parallels in coeval Pithecusan pottery.

Francesca Mermati, Parerga *and* Paralipomena *to the Study of Pithecusan-Cumaean Ceramic Production in the Light of New Research. Twenty Years after* Euboica

For the study of colonial enterprise in the western Mediterranean in the first half of the 8th century

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The intent of the *Euboica II* conference, *Pithekoussai e l'Eubea tra Oriente e Occidente*, held in Lacco Ameno (Ischia, Naples) from 14 to 17 May 2018, was to discuss the themes of colonization, how colonial realities became rooted in different areas of the Mediterranean, the specific traits of Euboean colonization, and forms of contact and relationship between the Greek element and local communities. These Proceedings are divided in two volumes, arranged geographically. They feature a dialogue between historians and archaeologists, with an emphasis on the new important contributions made over the last twenty years by field archaeology in Euboea and in colonial and Mediterranean contexts.