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FROM THE METALLIFEROUS SOURCES TO THE CITADEL
COMPLEX OF ANCIENT PAPHOS:
ARCHAEO-ENVIRONMENTAL ANALYSIS OF THE MINING
AND THE BUILT ENVIRONMENT

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Abstract

Fieldwork carried out in the context of the *Palaepaphos Urban Landscape Project* (PULP) since 2006 led to the discovery of previously unrecorded urban monuments. A purpose-built complex designed to serve storage needs and industrial activities was revealed on the plateau of *Hadjiabdoulla*, one km to the east of the sanctuary of Aphrodite; 70m north of the plateau, which is now confidently viewed as the citadel of the royal dynasties of Paphos in the 5th and 4th centuries BC, the hillock of *Laona* was identified as a man-made mound that had been raised over an early 5th-century BC rampart. The well-preserved status of the new monuments offered an unprecedented opportunity to approach the political economy of the city-state of Paphos in the Cypro-Classical period. “From the metalliferous sources to the citadel complex of Ancient Paphos: archaeo-environmental analysis of the mining and the built environment”) was the answer to the urgent need of PULP to develop a state-of-the-art, archaeo-environmental component. It initiated the macroscopic and microscopic study of a wide range of primary data from the built environment and enabled comparison and integration with data extracted from the macro-scale analysis of the catchment of Paphos, especially in relation to the study of copper slag located within the metalliferous foothills of the Paphos Forest. Preliminary results reveal resource exploitation strategies in relation to raw materials from the hinterland (e.g., timber and copper)

and the coast (e.g., purple shells), and suggest that olive orchards but also palm trees existed in the landscape. The provenance of imported amphorae provides a link to the polity's participation in Mediterranean commercial networks. Besides meeting its initial goals, MEANING established a field school and training ground for environmental archaeology and palaeoeconomy. At its completion, the project had endowed PULP with the expertise of a group of scientists, who will continue to provide specialized service to the Built Environment, the Storage Amphorae and the Mining Environment teams set up under MEANING.

Introduction and objectives

In 2002-2003 the Archaeological Research Unit of the University of Cyprus and the Laboratory of Geophysical-Satellite Remote Sensing and Archaeo-environment (Mediterranean Institute, Foundation for Research and Technology-Hellas) implemented the "Palaepaphos Digital Atlas Project" (Sarris et al. 2006). The development of a GIS linked to an entity-related geo-database and a multi-sensor geophysical survey allowed us to initiate a landscape analysis approach, which led to the establishment of the *Palaepaphos Urban Landscape Project* (hereafter PULP) in 2006 (Iacovou 2008). The primary research quest of PULP was to identify the structure of the urban nucleus of Ancient Paphos and to investigate its relation to the local system of economy and political authority.

Paphos was one of the most resilient polities of Cyprus. In the 12th century BC, when the rest of the island was struggling to overcome the Mediterranean-wide crisis, Paphos had the human resources and the expertise required for the construction of a megalithic *temenos* in the sanctuary that has 'the longest unbroken cult tradition in Cyprus – from the Late Bronze Age (c.1200 BC) to the Late Roman period (end of the 4th c. AD)' (Maier 2000, 496). Epigraphic and literary evidence (cf. Michailidou-Nicolaou 1976) confirm that the city-state retained its political autonomy almost to the end of the 4th century BC. Nevertheless, the assets and resources that were efficiently mastered towards this long-term success are as invisible as the urban landscape of the polity, which has long been overshadowed by its sanctuary (Iacovou 2014, 162; 2019, 206). From its foundation as a gateway to the sea in the 2nd millennium BC, to its development as the capital centre of a city-state, the settlement structure of Paphos is, to this day, almost invisible (Iacovou 2012). Despite their rich content, the Late Bronze Age burial clusters (cf. Karageorghis 1990) and the extensive Iron Age cemeteries of Paphos (cf. Karageorghis and Raptou 2016) do not provide evidence as to the size of the urban nucleus at any period (Iacovou 2007) since their spatial relation with a visible settlement has not been defined.

PULP was designed from the start as an open-ended multidisciplinary landscape analysis project that was to expand and diversify based on new evidence (Iacovou

2017a). Landscape analysis began with (a) the medium-scale documentation of the plateau of the sanctuary and the three neighbouring plateaus to its north and east [Fig. 1]. With the initiation of fieldwork, we also developed (b) a micro-scale analysis to document standing monuments and movable finds in each of the sectors where we carried out targeted excavations. Finally, for a project that aspired to focus on issues of political economy, it became necessary to introduce (c) a macro-scale analysis of the *chora*, the unknown but rich in primary resources hinterland, which we arbitrarily identify with the hydrological basin of Paphos (Agapiou 2010; Agapiou, Iacovou and Sarris 2013) [Fig. 2].

Excavations were meant to be short-term. However, the unexpected discovery of standing monuments to the east of the sanctuary forced PULP to develop a new working methodology and to introduce a detailed archaeo-environmental component to the landscape analysis project. The new project, “From the metalliferous sources to the citadel complex of Ancient Paphos: archaeo-environmental analysis of the mining and the built environment”, has received the acronym MEANING. Well-preserved secular structures dating from the era of the Archaic and Classical city-states of Cyprus have rarely been found and, to this day, none has undergone a state-of-the-art palaeo-environmental analysis. Fieldwork on the plateau of *Hadjabdoulla* revealed a stone-built complex preserved to a height of almost 2m that extends over 65m along the north side of the plateau [Fig. 3]. The newly found complex lies to the west of an edifice, which since its discovery in the 1950s, is known as ‘the Late Archaic palace’, largely due to its cut-stone architecture (Maier 2004, 74). The ground plan of the East Complex is incomplete and its content unpublished. Nevertheless, the ceramic material from both complexes suggests that their construction was initiated at the end of the Cypro-Archaic period. Only 70m to the north of *Hadjabdoulla*, we recognized the anthropogenic character of a mound (tumulus) known locally as *Laona*. The mound was found to have been raised over a fortress whose construction also dates to the end of the 6th century BC (Iacovou 2017b).

With the establishment of the East and West Complexes on *Hadjabdoulla* and the fortress on *Laona*, the landscape to the east of the sanctuary must have become the administrative centre, hence the citadel of the *polis* [Fig. 4]. The agency that had conceived and carried out this ambitious building programme was more than likely a new dynasty that rose to power ca 500 BC (Iacovou 2019, 222). In the next two hundred years, until the extermination of the last royal family of Paphos by Ptolemy I Soter in 310/9 BC (cf. Iacovou 2013, 280), the material culture on the citadel - the buildings, their design and their furnishings - expressed the decisions and economic plan of the political authorities.

The construction and maintenance of the fortress on *Laona* [Fig. 5], whose walls survive to a maximum height of 6m, would have required considerable labour and expertise; the mysterious mound that covered it is so unbelievably large that the locals, also many archaeologists, saw it as a natural feature of the landscape (Iacovou 2017b, 317). The *Hadjiabdoulla* West Complex is a large-scale edifice constructed on stepped terraces and supported by retaining walls against the north slope of the citadel [Fig. 6]. Circulation corridors lead to storage and processing units [Fig. 7] equipped with millstones, hearths, industrial installations, an efficient system of drains and plenty of storage vessels. Its walls were plastered and there is evidence pointing to the existence of an upper floor roofed with sizable roof tiles. No evidence dating to the Roman period has been identified in this part of the urban landscape (Iacovou 2014, 167-8). At *Laona*, sometime in the 3rd century BC when the fortress was already in a state of abandonment, it was completely buried under the huge earthen mound (Iacovou 2017b) [Fig. 8]. In the West Complex ceramic analysis suggests that the units were abandoned at different times but not later than the end of the 2nd century BC.

For the first time since the development of the archaeo-sciences, the unexpected discovery of an extremely well-preserved citadel complex, which had not been disturbed since Antiquity, provided a singular opportunity for the study of the economic system of a Cypriot polity, primarily in relation to the exploitation and management of resources. It was urgent to set up a training ground for environmental archaeology and to ensure best practise in the collection of primary data, whose analyses would provide informative, though preliminary, results regarding the economic activities (e.g., agricultural, industrial) of Paphos under its Cypro-Classical regime (Iacovou 2014). These objectives were met through MEANING, and with the establishment of two spatially distinct data collection zones: in the built environment of the citadel and in the copper- and timber-rich foothills of the Paphos Forest.

Brief Review of the state of the art

Projects and studies on Pre-Modern economies, trade, crafts, labour and on the finances of Mediterranean polities in Antiquity (cf. Chaniotis 1999; Zurbach 2015 Migeotte 2015; O'Halloran 2018) have been on the rise since the beginning of the 21st century. They have enriched and transformed our perspective of city-states, especially in relation to the development of institutions (cf. Terpstra 2019), and networks (cf. Tartaron 2013). Institutions introduce stability by establishing rules and regulations; they include the exploitation of land and resources, the minting and circulation of coins, the spread of an international trade network (Bresson 2016). Networks, in particular, are of primary importance to island archaeologies and, therefore, critical to the archaeology of Cyprus, which has, at last, claimed its distinct island identity as a result

of the establishment of a School of Cypriot Archaeology in the University of Cyprus. Why then, is Cyprus not featuring prominently in programmes on the Archaeology of Pre-Modern Economies? Because comparative data based on material remains are insufficient. “It is our aim to record and analyze economic systems and areas of pre-modern societies in their structure, capacities, and dynamics and to study their interaction with physiographical, political, social, religious and cultural components. The emphasis lies firmly on the material remains, though considering all relevant sources” (Benz and Helms 2018, vii). The statement, from the editors’ introduction to a recent conference volume published in the context of the Research Training Group Archaeology of Pre-Modern Economies (a joint programme of the universities of Cologne and Bonn), underlines the key significance of material remains.

In 1996, when *The Development of the Cypriot Economy from the Prehistoric period to the Present Day* (Karageorghis and Michaelides 1996) was published, out of 16 papers not even one could examine the economy of the Archaic and Classical city-states of Cyprus. The reason for this gap is the limited number of archaeological projects that have been directed towards the identification and landscape analysis of the *polis* and/or the *chora* of any one of the Cypriot mini-states. Admittedly, one of the most promising long-term projects conducted by the French Mission at Salamis (cf. Yon 1993) had to be discontinued following the Turkish invasion and occupation of the north part of Cyprus in 1974. In the 2nd millennium BC, when Cyprus’s international prominence is traditionally attributed to the export of copper (Earle et al. 2015), we have a controversial understanding of the political structure of Cyprus-*Alashiya* (cf. Peltenburg 2012), but the processing of material remains from field projects that have been investigating Bronze Age Cyprus is more advanced (cf. Knapp 2008). In the 1st millennium BC, when the existence of independent city-states is textually confirmed, we know close to nothing of their institutions and their political economies. Cypriot sculpture and Cypriot pottery are found all over the Mediterranean in the Iron Age, but the economic resilience of the Cypriot polities continues to rely on literary texts and historical assumptions. Before the identification of the plateau of *Hadjiabdoulla* as the citadel of Paphos, three monuments situated on citadels had been identified as Iron Age palace complexes at Vouni, Idalion and Amathous. The Vouni palace, currently in the occupied part of Cyprus, was excavated in the 1930s (Gjerstad et al. 1937, 111-290), long before the development of the archaeo-sciences. Fortunately, Amathous (cf. Hermary 1993) and Idalion (cf. Hadjicosti 1995) are more recent projects. Their palace complexes have extensive storage areas and the processing of the finds is currently under way. Furthermore, the French School at Athens has initiated a diachronic documentation of the settlement history of the *chora* of Amathous (Briois et al. 2005), and the Idalion palatial complex has provided the first economic archive ever to be found in Cyprus (cf. Amadasi 2017).

This most promising attempt to discuss the political economy of a Cypriot polity is Keswani's paper on "Olive Production, Storage, and Political Economy at Late Bronze Age Kalavassos" (2015). In the case of this particularly well-executed field project, carried out by Alison South at Kalavassos-*Ayios Demetrios*, the careful processing of the raw data by the excavator (cf. South 1996) offered the means for a theoretically grounded analysis and discussion. Keswani's pioneering paper is a model that shows how much information can be extracted from the analysis of systematically collected primary data. It is also a wise note of caution in case one forgets the big picture: the context of all micro-remains is the economic landscape.

The Amathous and Idalion projects and the project carried out by the French Archaeological Mission at Kition (cf. Fourier 2018), along with the detailed archaeo-environmental method we have implemented for the systematic collection of data from *Hadjiabdoulla*, *Laona* and the Paphos Forest, allow us to think that, before long, the polities of Ancient Cyprus will feature in comparative studies concerned with the political economies of Mediterranean city-states.

Methodology

The field methods and the priorities of PULP's annual excavation schedule were redefined in order to comply with the requirements of a holistic archaeo-environmental project and the need to document and maintain a fine-scale record of the depositional history of the excavated monuments. Besides implementing best practice for the collection of organic and inorganic materials, industrial and other residues from production areas and storerooms of the Built Environment are expected to be analysed with particular reference to the resources available in the hydrological basin of Paphos.

The work packages of MEANING were undertaken by three teams. The work of every team in terms of (a) selection of data, (b) samples analysed and (c) results of analyses were monitored and recorded by two postdoctoral researchers. Stella Diakou built the data-bases and Athos Agapiou transferred data onto macro- and micro-GIS records and maps.

The Built Environment Team

- (a) Besides stonework, the construction of the monumental *Laona* rampart made extensive use of mudbricks. A study of the mudbricks, based on analytical techniques (pXRF, SEM-EDS, granulometric and petrographic analysis), was undertaken by Marta Lorenzon. The goal was to identify their mineralogical and chemical composition and to address issues such as the procurement of raw materials and the characterization of manufacturing and construction phases.

- (b) Thin sections from the tumulus of *Laona* were collected and processed in the context of the study of sediment and soil micromorphology. The aim of the micromorphological study, which was undertaken by Takis Karkanas and Myrsini Gkouma, was to determine the materials, techniques and mechanisms that had been applied in the construction of the tumulus.
- (c) The units of *Hadjiabdoulla's* West Complex provided a large amount of data that had to undergo botanical (Anaya Sarpaki) and anthracological analyses (Maria Ntinou). Phytolith and starch extraction analyses were also carried out by Calla McNamee and Georgia Tsartsidou with samples taken from drains, industrial installations, millstones and container vessels (e.g., pithoi). Furthermore, when one of the units (Unit 2) was found full of purple shells [Fig. 9], we requested the assistance of Dimitra Mylona, a specialist on marine resources, who undertook the archaeomalacological study of the purple shells.

The Storage Amphorae Team

Led by Professor Antigoni Marangou, the team concentrated on the spatial distribution of amphorae in the West Complex. An amphorae database was created for the contextual, chronological and typological analysis of the fragments and their identification as local or imported. Ware and fabric could also be described but, due to their fragmentary state, in many cases the type (shape) is not recognizable. However, since all of them could be assigned to the workshop that had produced them, in Cyprus or in the Mediterranean, the amphorae were also associated with an upper and lower production date.

The Mining Environment Team

Led by Professor Vasiliki Kassianidou, the Mining Environment Team collected slag samples from the cupriferous zone and the woodland resources located within the catchment of Paphos (at least 25 km from the coast), which constitutes the maximum spatial extent of PULP's landscape analysis. The collected samples, slag and other archaeometallurgical debris, found in PULP's excavations were to be used for the first study of the archaeometallurgy of the region.

Samples of slag and other metallurgical debris, collected from two of the largest slag heaps (Pevkos Pera Vasa and Agios Georgios Emnon), were analysed chemically (Andreas Charalambous) and microscopically (Dimitrios Ioannidis). Samples of slag and metal from the excavations at *Hadjiabdulla* and *Laona* were also analysed chemically and microscopically. Likewise, slag samples from the forest and the built environment were chosen for lead isotope analysis in an effort to identify the fingerprint of copper produced in the catchment of Paphos.

Findings and analysis

Despite the short-term duration of the project (24 months), MEANING produced a wealth of important and often unexpected results. At *Laona*, despite the fact that the excavations of the tumulus and the rampart have not been completed, the scientific reports have led to two research papers.

Laona: the earthen architecture of the Cypro-Classical rampart

In the first paper (Lorenzon and Iacovou 2019), the potential of geoarchaeological research to investigate production, manufacturing and environmental issues regarding raw material selection in relation to earthen architecture has been tapped for the first time in the archaeology of Cyprus with the scientific analyses of earthen building materials: the mudbricks of the rampart [Fig. 10]. Mineralogical, geochemical and archaeological data have been combined to investigate manufacturing and construction events; they have highlighted specific manufacturing practices and also environmental choices with respect to raw material selection in the context of a public project carried out by a central authority circa the mid-1st millennium BC. We now have the actual recipes with which the mudbricks were produced. Interestingly, mineralogical analyses document the use of locally available sand (instead of chaff) as the predominant temper in the production of the *Laona* mudbricks, either because chaff was unavailable or not available in sufficient quantities.

The identification of the different steps in the *chaîne opératoire*, from raw source collection to construction techniques, showed that the required quantity of the mould-made mudbricks was evidently linked to a centrally organised form of production and was carried out by multiple teams of local workmen. This is probably the first time that the material remains of a state-endorsed building project have been linked to a local workforce. The techniques employed during the production and construction of the mudbricks highlight intimate traditional knowledge and expertise of the local builders. Consequently, the most compelling aspect of this research is the establishment of mudbrick as a powerful source of information on the social and cognitive aspects of monumental architecture in the archaeology of Cyprus.

Laona: the tumulus

The second paper (Gkouma, Karkanias and Iacovou forthcoming) is a multi-scalar geoarchaeological interpretation of the massive mound of *Laona*; it presents the excavation method, which was specifically designed for this site, and the high-resolution microstratigraphic analysis, which revealed the careful selection of construction materials and the variability in the construction methods [Fig. 11]. The study establishes that the tumulus was not a product of earth accumulation but an accomplished architectural

feature, purposefully constructed to form a pronounced landmark and to remain intact as an ancestral testimony. Therefore, the main geotechnical achievement related to the construction of the tumulus is its stability. The application of specific techniques and the alternating use of selected sediments enhanced the engineering properties of materials to achieve the maximum stability and the preservation of the monument through time. The sequence and pace of construction was decoded with the identification of four building stages, repairs and phases of exposure of the sediments.

The construction of tumuli is a cultural process aiming to create a prominent landmark (cf. Karkanias and Goldberg 2018, 219). Irrespective of the burials and built tombs, on top of which many tumuli have been raised, these earth-constructed mega-monuments are meant to be permanent and dominant features of the landscape. They are ‘mounds of memory’ (Papadopoulos, 2006) destined to transmit messages from the ancestors to future generations. In the case of *Laona*, the memory was completely erased and the identity of the tumulus as a man-made cultural monument was lost. Until the day PULP exposed the earlier fortress that had been for centuries covered by the tumulus, it was viewed by the locals as a natural feature in an agricultural landscape. Chronological indicators suggest that the construction of the mound would have taken place in the early 3rd century BC, therefore, at the time of, or not long after, the Ptolemaic take-over of Cyprus. However, to this day, the episode that led to this labour demanding mysterious project, and the personality that had the political power to order its construction, have not been identified (Iacovou 2017^a, 209; 2017^b, 327).

Hadjiabdoulla West Complex: macroscopic and microscopic analyses and results

The final reports on the archaeobotanical evidence from the units of the West Complex contain insightful and often surprising information on the palaeo-environment and the palaeo-economy of the polity. Significant quantities of olive stones, millstones, basins and presses found in three different units strongly suggest that the production of olive oil was one of the main operations taking place in the West Complex. Sarpaki was able to identify macroscopically at least three different olive species. The production of wine has not been established so far.

Destruction by fire has not been observed; therefore, the wood charcoal material from the different units is treated as the remains of fuel that accumulated in the fills or on the floors because of industrial activities. Carbon samples were, therefore, few but extremely eloquent. The microscopic analysis of charred wood fragments by Ntinou led to the identification of 13 taxa: 11 hardwoods and two conifers, all native to the flora of Cyprus. With respect to oleiculture, Ntinou reports that branches used as fuel had come from the pruning of young olive trees, most likely grown in nearby orchards. Olive waste from pressings would have been an additional high-quality fuel alongside

olive pruning. Olive and pine firewood were more frequently used than any of the other woody plants identified at the site. The fact that pine firewood came from the trunks and branches of pine trees (*pinus brutus*), which today are found only in the Paphos Forest, therefore at a distance of at least 25 km from the citadel, suggests that the climate was wetter and forest trees grew much closer to the coast.

The reports by McNamme and Tsartsidou on the microscopic analyses of starch and phytoliths, respectively, have concluded that the slow and long-term abandonment of the complex has led to the contamination of deposits left in storage vessels, drains and containers. Although neither found secure evidence for the storage of cultivated cereals in any of the excavated units, both reported that all their samples contained phytoliths of palm trees, which would have existed in the surrounding landscape. This rather surprising discovery requires the treatment of a larger collection of samples and, ideally, confirmation provided by carbonized material.

Finally, the malacological study carried out by Mylona on the unprecedentedly large quantity of purple shells (430 kg), stored in Unit 2 for secondary processing [Fig. 12], confirmed that purple dye was produced in Paphos under royal management. This unexpected discovery led to the establishment of a collaborative project with the Institute for Aegean Prehistory (INSTAP) Study Center for East Crete and to the joint organization of a workshop on ‘The materiality of purple dye production and use in Cyprus and the Aegean from Prehistory to the Late Roman period’ (cf. Iacovou and Mylona 2019).

Hadjiabdoulla West Complex: local and imported amphorae

Over 700 amphora fragments were catalogued by unit and stratum, and almost all of them came from two units (Units 1 and 3). Although the chronology of the amphorae stretches from the 7th c. BC to the end of the 2nd c. BC, Units 1 and 3, where the amphora fragments were found, had only one use-layer (floor); the stratigraphic analysis has shown that the deposition of the fragments does not support a bottom-up chronological sequence (from the Archaic to the Classical and to the Ptolemaic period). Evidently, before the collapse of the heavy roofing material that sealed the units, the storerooms had been disturbed following the cessation of production activities in the West Complex.

The fragments that belong to imported amphorae are as numerous as the fragments of amphorae produced in Cyprus. The study of the locally produced amphorae require the development of a new project that will carry out ceramic analyses in order to define the characteristics of the still unknown Paphos workshop, especially by comparison with the amphorae produced in workshops associated with the palaces of Amathous and Idalion. The fragments of imported amphorae have come to the citadel

from all over the Mediterranean: from the Levantine coast (Phoenicia), South Syria, North Africa (Carthage) and especially from the Aegean (Samos-Miletos, Mende, Rhodes, Kos, Chios). Surprisingly, even after the abolition of the local dynasty shortly before the end of the 4th c. BC, a wide selection of imported wine amphorae continued to be received and stored in the West Complex. This opens a new research venue into the economic and political history of the early Ptolemaic period in Cyprus, especially with respect to the poorly known 3rd c. BC.

Metal and Slag from the metalliferous sources and the citadel complex

The report submitted by Kassianidou is the foundational study on the exploitation of metallic resources in the Paphos cupriferous zone of the Troodos. The presence of slag heaps in the Paphos Forest had been noted shortly before the end of the last century (Stos-Gale, Maliotis, & Gale, 1998). PULP's survey and geolocation of slag heaps in this long-abandoned metalliferous area on the southwestern fringe of the Troodos forest (Iacovou 2014a, 170-171) has allowed us to argue that copper procurement and, most likely, also shipbuilding (if epigraphical and literary sources are taken into consideration) may have been the main industries of the polity of Paphos. Following the discovery of slag samples and other archaeometallurgical debris from the built environment of the citadel, this model can begin to be tested despite the fact that the assemblage is still very small; it provided too limited a comparative material corpus for the identification of a common fingerprint with the slag samples from the Paphos Forest. In the case of the West Complex, chemical and microscopic analyses have shown that slag from Unit 3 is related to iron metallurgy; secondary smelting operations were, therefore, taking place in the industrial quarter. In addition, samples of charcoal from the West Complex and from the two slag heaps at Pevkos Pera Vasa and Agios Georgios Emnon that were studied by Ntinou (above) confirmed that the preferred species of wood used as fuel was pine (*Pinus Brutus*). This is in accord with a recently published study by Socratous, Kassianidou and Di Pasquale (2015).

The lead isotope analysis of the samples from the *Laona* mound proved even more interesting: of two samples, which turned out to be metal rather than slag, one seems consistent with the ores from the area of Kalavassos, indicating the import of copper metal from the mines of neighbouring regions; the other, though an outlier as it falls far beyond the mass of the Cypriot ores, overlaps with a single slag sample from Pera Vasa. This intriguing result, as well as the fact that slag samples from *Laona* seem to be consistent with the ores from the Solea mining district, justify the continuation of the project, especially when more samples will be collected from the built environment.

The procurement of copper from the Paphos Forest in the Late Roman period is not in doubt. Most, if not all, of the large slag heaps in the Paphos Forest date to the

Late Roman period (cf. Iacovou 2014, 170), and this is now further confirmed by three samples of charcoal from slag heaps that have been radiocarbon-dated. However, as in the rest of Cyprus's mining sites, because of the continuity and the extent of copper extraction in Late Antiquity, the evidence of earlier exploitation is deeply buried.

Conclusions

In the course of the 2019 field campaign of PULP, which took place shortly after the official completion of the University of Cyprus AG Leventis Foundation funded project MEANING, the singular significance of the detailed methodology and best practice system we had implemented in the collection of data from the field led to the discovery of the first administrative inscription on an *ostrakon* from the West Complex. Written in Greek in the Cypriot syllabary, the inscription is an account of products and quantities [Fig. 13]. Idalion is no longer the only palace where accounting documents were kept (Iacovou and Karnava 2019).

If the long-term PULP has exposed a politically charged urban landscape, whose built monuments on the plateau of the citadel and the mound of *Laona* must have absorbed some of the most dramatic moments in the history of Paphos, especially in relation to the termination of the last royal dynasty of Nikokles and the transition to the Ptolemaic era, the short-term MEANING project has succeeded in establishing a long-lasting archaeo-environmental research venue. The findings presented above, all in the context of the institutionalization of political authority, are without precedent in the archaeology of the city-states of Cyprus. MEANING, therefore, is acknowledged as a pioneering multi-disciplinary pilot project that has introduced operational methods and has established research alliances. The Pre-Modern economy of one of the most resilient city-states of Cyprus is no longer beyond reach.

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Fig. 1

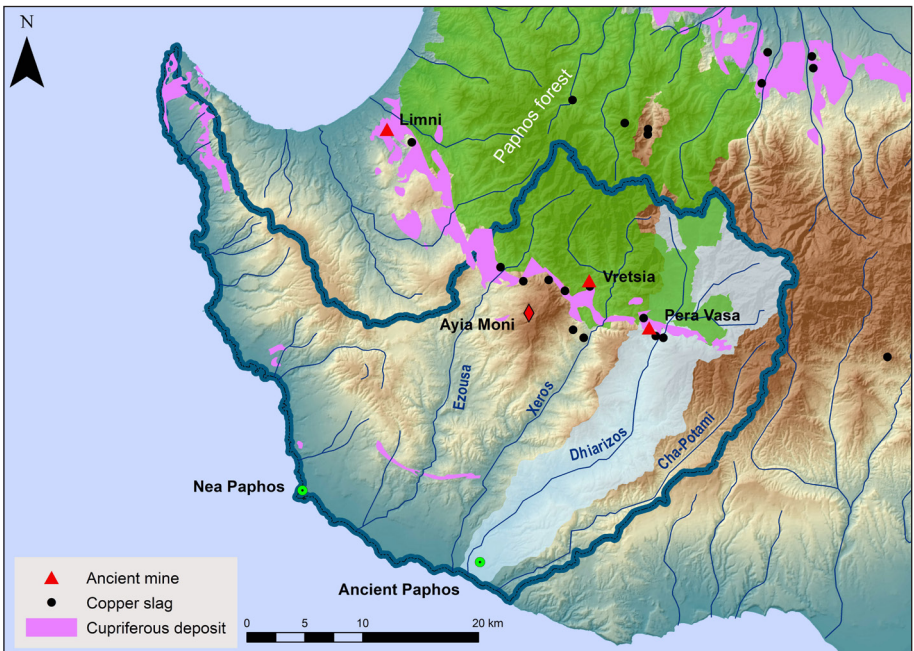


Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10

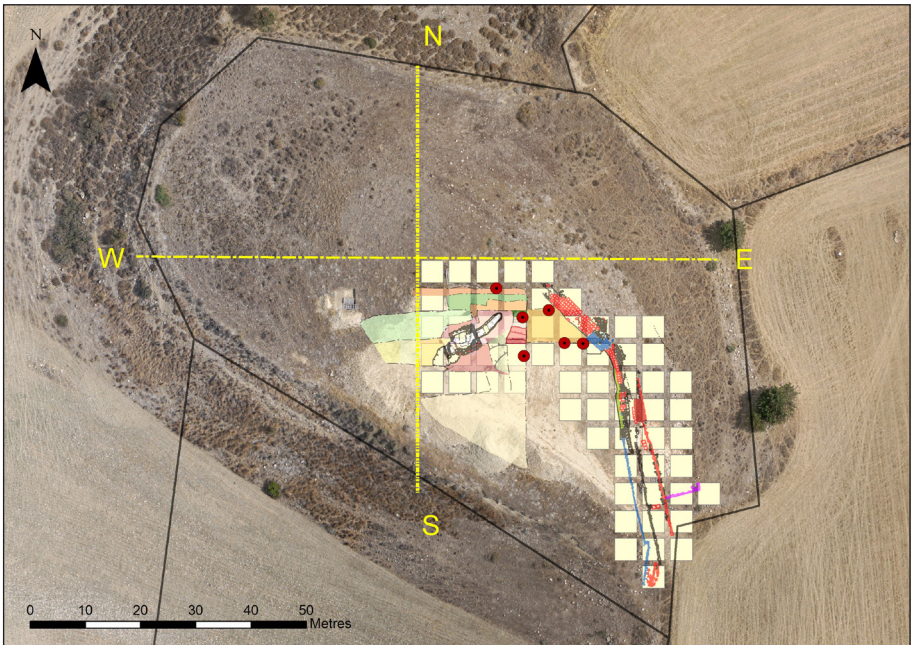


Fig. 11



Fig. 12

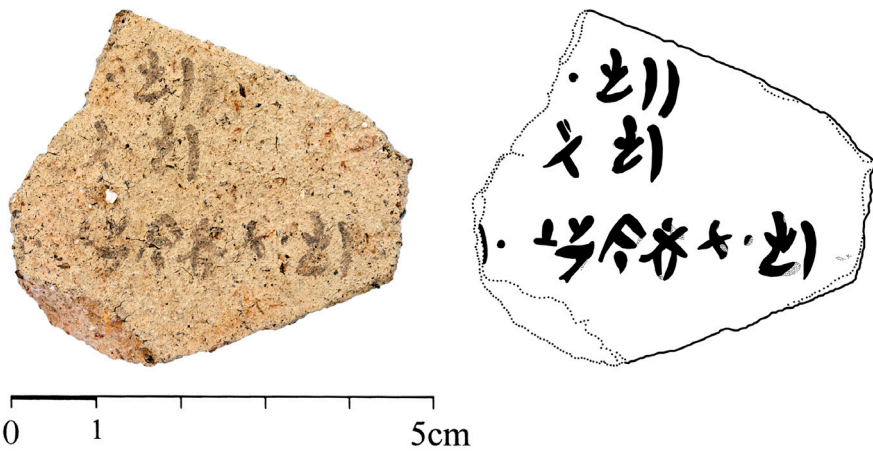


Fig. 13

Illustrations 1-13

1. Site locations within the Palaepaphos urban landscape. Background: aerial orthophoto of 2008; source: Department of Lands and Surveys, Cyprus. Drafted by A. Agapiou (PULP@).
2. The Paphos hydrological basin (catchment). Digital geological data from Cyprus Geological Survey Department. Drafted by A. Agapiou (PULP@).
3. Drone orthophoto mosaic of excavated area of Workshop complex across the north side of the citadel (plateau of *Hadjiabdoulla*). Drafted by A. Agapiou (PULP@).
4. *Hadjiabdoulla* and *Laona* from the east; oblique low altitude image taken during the October 2020 UAV campaign; K. Themistocleous & A. Agapiou, the Eratosthenes Research Centre, Cyprus University of Technology (PULP@).
5. East side (internal) of *Laona* fortress; excavation of facing staircases (Photo: M. Iacovou. PULP@).
6. Ground plan of Workshop Units 1- 9. Background: orthophoto mosaic generated from annual series low-altitude UAVs orthophotos over the plateau of *Hadjiabdoulla*; K. Themistocleous & A. Agapiou of the Eratosthenes Research Centre, Cyprus University of Technology (PULP@).
7. Workshop Unit 8 with mill basin. 3D by V. Tringas (PULP@).
8. Low altitude (UAV) photogrammetric survey of the north and north-west side of the tumulus of *Laona*. Cyprus University of Technology: Remote Sensing and Geo-environment Lab (PULP@).
9. Workshop complex Unit 2, found filled with crushed purple dye shells. 3D by V. Tringas (PULP@).
10. Mudbrick construction of north side (internal) of *Laona* fortress exposed to 1.20m from top (Photo: M. Iacovou. PULP@).
11. *Laona* ground plan, also indicating position of micromorphological samples. Drafted by A. Agapiou (PULP@).
12. Buckets filled with crushed purple dye shells collected from Workshop Unit 2 (Photo: M. Iacovou. PULP@).
13. Ostrakon with logistic entry in the Cypriot Syllabary (Greek) from the Workshop complex. Photograph and drawing by A. Karnava.