Little Big Data. On-going Archaeological Science-based Researches at Bronze Age Erimi-*Laonin tou Porakou*

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The recent emphasis upon materiality in interpretative archaeology may enhance a focus analysis of the phenomenon of interaction between early societies and environment, under a historical perspective. It has been demonstrated that the interaction between the properties of materials and the way in which they are socialized is a crucial issue for the recent prehistory of Cyprus. In this paper, after briefly reviewing the current approaches in the definition of materiality and how they could benefit the contemporary rapprochement between archaeological theory and science-based archaeology, we will move to outline the preliminary results of on-going bio-archaeological and material-based analyses at Middle Bronze Age Erimi-*Laonin tou Porakou (Limassol). The ancient site has been investigated in greater detail by an Italian Archaeological Expedition, as part of a project by the University of Torino in collaboration with the Department of Antiquities, Cyprus.*

The recent emphasis upon the concept of materiality in interpretative archaeology may enable a gradual and positive cooperation between cultural-historical archaeologists and archaeological scientists. This wide process is actively promoting the historical perspective of the phenomenon of interaction between early societies and environment. In this paper, after briefly reviewing the current approaches in the definition of materiality and how they could benefit the contemporary rapprochement between archaeological theory and science-based archaeology, we will move to highlight the significance of on-going archaeometric and materials-based analyses aimed at outlining a more detailed picture of the Middle Bronze Age community at Erimi-*Laonin tou Porakou* (Limassol).

Facing the physicality of the archaeological record

Some research fields and disciplines, such as anthropology, distinguish themselves into discrete subject areas studying different phenomena: biological anthropologists deal with the biological evolution of humanity, while social anthropologists study the world of meanings that humans create.[1] It might be argued that in some senses archaeology is different because, whatever intellectual positions archaeologists take up, they all evidently study the same wide and complex phenomenon, traditionally labelled as material culture.

While the coherence of the research object is evident, the definition of material culture has created a long-term quid pro quo. As Prown and Jones argued,[2] the common use of material culture itself encompasses a contradiction, suggesting a logical distinction between the matter of the natural world and the ideas that shape the cultural world. Thus, if culture is a set of categories and models produced by humans, how is it possible to have material culture?

A new approach arose in the mid-1990s, with the introduction and characterization of the novel concept of materiality, especially by Gosden.[3] In this view, the notion of materiality sets up a direct relation between artifacts and the environment. In the same way, artifacts and architecture are components of the environment in regard to their physical and mechanical construction as well as to their participation in the social and cultural practices that take place in that environment.[4] While no evident benefit can be found in studying these two aspects as separate and distinct entities, materials science and culture studies appear to be engaged in the same project of enquiry, and they are therefore analytically indivisible.[5]

It has been demonstrated that the interaction between the properties of materials and the way in which they are socialized is a crucial issue for the recent prehistory of Cyprus.[6] The informative value of materials can be emphasized only by considering whether the mechanical properties of artifacts enable their use in certain social practices. This approach promotes the view that the material qualities of the environment actively affect how they are used and how they can be perceived and symbolized during the life of an ancient community.

1 Ingold 2001.
2 Prown 1996; Jones 2004.
3 Gosden 1994
4 Jones 2002: 168-182.
5 Miller 1987.
6 Steel 2013: 190; Knapp and van Dommelen 2010: 6.

The most obvious expression of what any archaeological material might convey is condensed in the term artifact. However, materiality also encompasses the ephemeral, the imaginary, as well as the biological materiality.

Biological materials such as plants and skeletal remains constitute an important component of the archaeological record. While a longstanding research tradition has been demonstrating the relevant contribution of paleobotany and zoology to the reconstruction of early societies in Cyprus, the informational potential of human skeletal remains has long been disregarded and only recently have differently oriented researches been undertaken with the purpose of obtaining relevant data about paleodemography, paleopathology and parasitology.[7] Besides bio-archaeological analyses, in order to increase the body of evidence at our disposal, significant contributions can come from archaeometric analyses of biological materials. For example, radiocarbon dating has become a well-established technique to obtain absolute dates from organic archaeological remains, while the more recent development of stable isotope analysis of bones has become a useful instrument to get paleodietary and paleoenvironmental information on ancient populations.

Thus, the very physicality of the archaeological record, in the form of artifacts, architecture and biological remains, undoubtedly represents a unique peculiarity and needs to be evaluated through a holistic approach, especially in the study of the life dynamics of pre-literate societies.

Within this frame, the Middle Bronze Age settlement and cemetery at Erimi-*Laonin tou Porakou* (Limassol) offers potentials to apply and consequently evaluate the strengths of this broader methodological approach. In this context, the application of different science-based analyses to archaeological materials can effectively enhance the study and inter-comparison of a complex data set, thus allowing a greater clarification of the multifaceted archaeological record.

Erimi-*Laonin tou Porakou* in the Middle Bronze Age

The Bronze Age site of Erimi-*Laonin tou Porakou* is located on the eastern Kouris river slope on a high plateau facing southward the Kouris Dam (Fig. 1).[8] The ancient site is being investigated in detail since 2009 by an Italian Archaeological Expedition, within a joint project of the Universities of Turin and Florence in collaboration

[7] Harper and Fox 2008.

[8] Cadastral Sheet LIII, Plan 46, Plots 331-336, 384; geo-coordinates 34°42’43.00” N, 32° 55’23.00” E.

with the Department of Antiquities of Cyprus. The preliminary evidence paved the way towards further investigations in the site area between 2009-2014, aiming at a greater clarification of the occupation sequence and an increased understanding of the function and use of the different areas of the site.[9] The general chronology of the settlement sequence within the site area, as recorded by survey collections and excavation results on the top of the hill (Area A), first lower terrace (Area B), and a southern off-site area (Area E), hints at occupation throughout two main periods (Periods 1 and 2). Recent fieldwork confirmed that the earlier Period 2 corresponds to the Middle Bronze Age, and is further subdivided into two phases attested (Period 2: Phases A and B); while the subsequent period (Period 1), apparently following a lengthy hiatus, is related to a possible re-settlement during the late-Hellenistic and Roman periods.

The Bronze Age settlement appears to have occupied two main areas, of different use and function, located on sloping limestone terraces. A workshop complex is located on the top of the hill (Area A), while the first lower terrace is occupied by domestic units (Area B). Two distinct clusters of tombs, extending respectively south (Area E) and east (Vounaros cluster) of the workshop and the domestic quarter, are contemporary with the settlement (Fig. 2).[10]

The excavation at the top of the hill revealed a production complex, which currently extends over an area of 25x25 m. The space is functionally organised into eleven discrete 'units' (as currently excavated): five open-air working areas (WA I-V), three wide, roofed areas (SA I-SA III) and three additional rooms, not yet fully excavated, to the east and west of SA I-III.

As to the open-air units, the natural limestone bedrock has been carefully worked to construct emplacements and deep basins carved with varying depths and openings, connected to each other by flow channels.[11]

The same peculiar building technique was also used for the roofed units, where the rectangular rooms are carved into the limestone bedrock and create slightly underground floors. Thus, the general picture of working and storing devices point to a proto-industrial complex devoted to activities organized and carried out following certain steps, each of them possibly to be performed in distinct open-air working units and roofed storage and working units mostly aimed at collecting, processing and preserving raw materials and final products.

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9 Bombardieri 2013: 95-98; Bombardieri 2017

10 Bombardieri *et al.* 2011; Christofi *et al.* 2015.

11 Bombardieri *et al.* 2015.

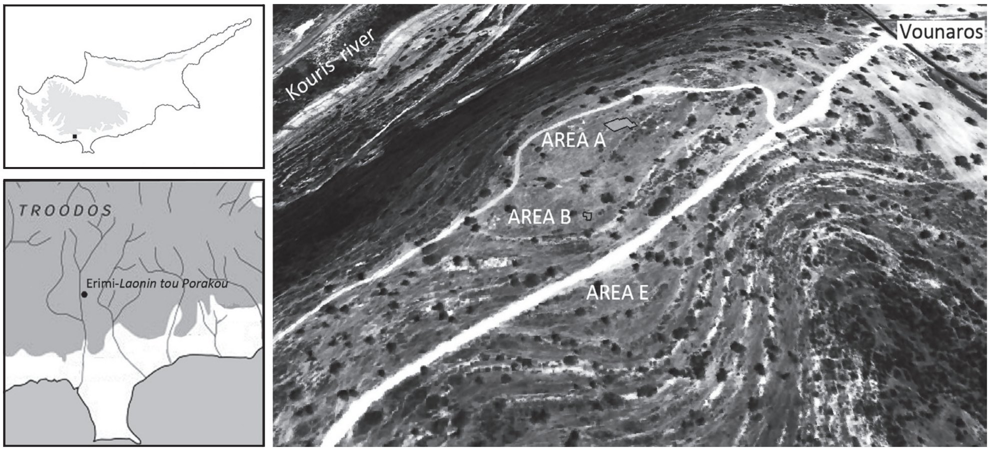

Figure 1: Erimi-*Laonin tou Porakou location and topography.*
Map based on satellite imagery (Ikonos II) and overlain by the digitized contours
on the 1:5.000 topographical map (Archivio Missione Archeologica Italiana a Erimi).

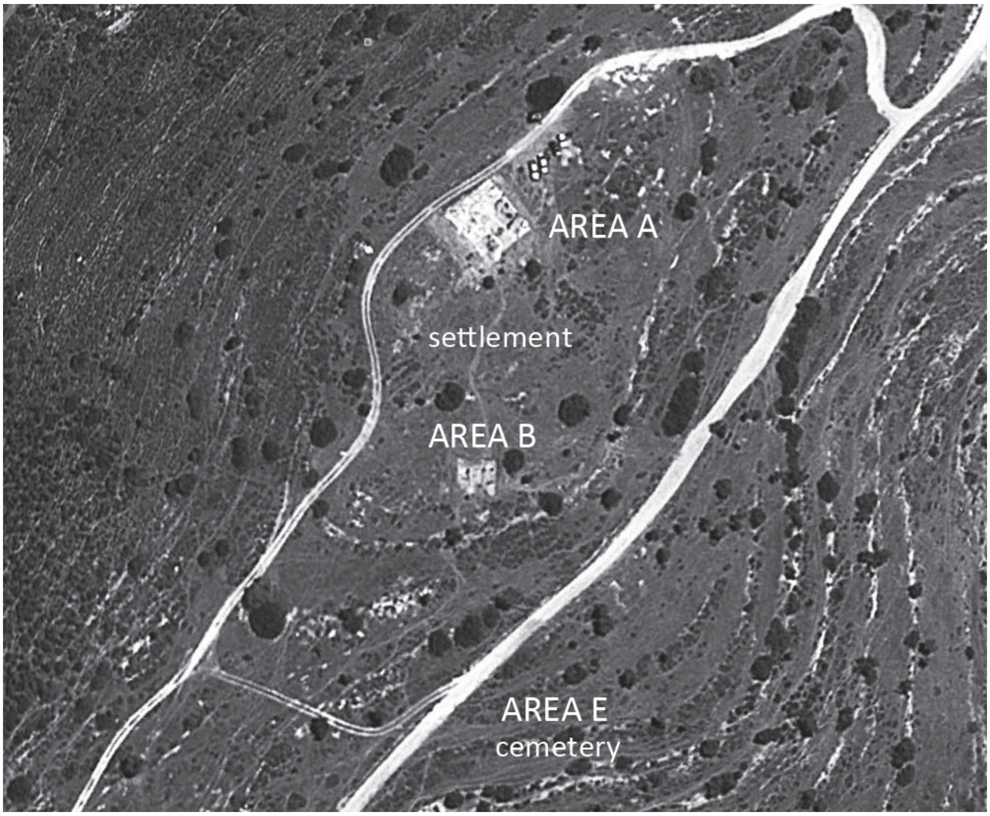

Figure 2: *Location of the* Erimi-*Laonin tou Porakou settlement (Areas A and B) and tomb cluster (Area E) based on satellite imagery (Archivio Missione Archeologica Italiana a Erimi).*

The cross-analysis of residual artifact assemblages, together with installations and palaeobotanical data, suggest that the complex is to be identified as a workshop for producing textiles, in which activities including spinning, weaving and dying were carried out.[12]

The Bronze Age settlement at Erimi-*Laonin tou Porakou* extends over the first lower terrace (Area B). The investigations exposed the foundations of a domestic unit with three large rectangular rooms (Rooms 2, 3 and 5) arranged around a rectangular courtyard (Court 4). The general picture is of a complex of roofed spaces and open areas, linked by entrances and passages. The sequence cleared in Room 2 showed two phases of use during the Middle Bronze Age.

An *extra moenia* cemetery area extends towards the East and South of the Bronze Age settlement. Recent rescue excavations carried out in 2012 by the Department of Antiquities of Cyprus in the nearby area of Ypsonas-*Vounaros* (about 400 m E of the top hill) revealed three graves coeval with a single tomb excavated in 1990 during rescue investigations in the same vicinity and pertaining to the same chronological horizon of the ones previously excavated in the southern Area E.[13] Thus, the new evidence highlight an extended necropolis area, with two distinct and contemporary tomb clusters. The southern cemetery area (Area E) extends immediately outwards from the settlement along two of the natural limestone terraces sloping towards the southeast, where a series of nine rock-cut tombs (Tombs 228-232; 240-241, 248, 328) were excavated during the 2008-2013 fieldwork seasons.

The tombs have single, small, irregularly rounded chambers with a cave-like section; a short dromos leads to the grave chamber of tombs 228-230, located on the upper terrace, where stomia were roughly outlined by regularizing the terrace façade. On the contrary, tombs 231, 232, 240, 241 and 248 without incoming dromoi have a wider dimensional variability. The ceramic assemblage generally points to a typical Early to Middle Bronze Age repertoire with a prevalence of Red Polished (RP) ware and a lower (but significant) percentage of attestations of Drab Polished (DP) ware. The most recent assemblages come from Tombs 228 and 230, located in the upper terrace, and from Tomb 248 on the lower terrace. In particular, the presence of Black Slip II and Red Polished punctured double handled jars and globular jugs recovered in tombs 228 and 248, point to a later date possibly towards the end of the Middle Bronze Age.[14]

12 Bombardieri 2013: 96; Bombardieri 2017: 348-349.
13 Papageorghiou 1991: 72; Christofi *et al.* 2015.
14 Bombardieri *et al.* 2011.

Archaeometric analyses on building techniques and architectural materials at Erimi-*Laonin tou Porakou*

Architecture is a significant result of the cultural choices operated by societies in a specific geographical context. Therefore, architectural remains comprise a very useful dataset for exploring motivations and rationales in social environments, both at the individual and intra-site level.[15] For this reason, the study of the built environment from the selection, procurement and processing of raw materials to the construction and use of buildings as spaces of interaction, is fundamental to the understanding of how societies were organized and how complex was their social structure.

The two major lines of inquiry regarding the examination of the social organization of the Middle Bronze Age settlement at Erimi-*Laonin tou Porakou* are the following:

1. Identification of the different steps in the operational sequence or *chaine opératoire*[16] of architectural material,[17] with a view to assess the technological level and the social complexity of the settlement.
2. Likely reconstruction of spatial organization in both the workshop complex on the top of the hill (Area A), and the domestic area on the first terrace (Area B) through the definition of possible differentiated activity areas (production area, consumption area, etc.).[18]

These aspects are of prime importance to the archaeological interpretation of the site, since they will clarify how individuals and community organised the wide range of social and economic practices that constituted daily life,[19] and pose several questions: Were there differentiated social groups shaping the community? Was there a functional distinction between the two areas of the settlement (e.g. top-hill: productive area; first terrace: domestic area)? Were the different buildings and units reserved to specific activities or were they multifunctional spaces?

Different analytic sets need to be evaluated. The first set concerns the mineralogical composition of building materials (plaster, mud-bricks, renders), and examines whether material properties such as elasticity, strength or durability influenced the choice and selection of raw materials. The second set focuses on the manufacturing

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15 Steadman 2010.
16 Sillar and Tite 2000.
17 Wright 1992; Thomas 2005; 2010.
18 Matthews 2005.
19 Bombardieri 2013; Milek and Roberts 2013.

processes, with a particular emphasis on pyrotechnological aspects of the production to obtain data about the temperatures the materials have been exposed to.

Both these aspects act as basic markers of technological know-how and may indicate the presence of a specialized labour, the scale of production, and finally the dynamics of accessibility and governance of regional resources.

The third analytic set regards the investigation of the deposits within the different spatial units with the aim to outline the complex depositional and post-depositional processes.[20] This approach is fundamental to obtain meaningful data about activity areas and their identification is going to be achieved by combining the study of features such as hearths, basins, storage pits and the spatial distribution of artifacts, with the analysis of micro-residues of human and animal activities deposited on occupation surfaces through thin section analysis.[21] The analysis of stratigraphic relationships and depositional context is essential for studying the organization of activities within buildings (domestic, economic and ritual) and their connection to sociocultural practices.[22]

Micromorphology

Micromorphological analysis bears great potential for addressing these questions. Its principal contribution is that it enables simultaneous high resolution analysis of the microscopic properties of artifactual and bioarchaeological remains, as well as sediments, within their precise depositional and post-depositional contexts in floors and occupation deposits, which are critical sources of sociocultural and environmental information.[23]

Previous micromorphological applications, mainly focused on building materials and ceramic analysis, provide a useful comparanda to assess issues as provenience and technology of these productions.[24] However, the use of micro-analyses for identifying human and animal activities on occupation surfaces provides a new insight into the study of domestic and inhabited Cypriot contexts, fostering new collaborations between archaeology and science.

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[20] LaMotta and Schiffer 1999; Milek and Roberts 2013.
[21] Milek and Roberts 2013.
[22] Matthews 2005.
[23] Courty *et al.*1989; Matthews 2005: 356.
[24] Renson *et al*. 2014; Philokyprou 2012; Thomas 2010; Hein *et al*. 2007.

Micromorphology allows the analysis of undisturbed soil samples with microscopic techniques with a view to identify their different constituents and to determine their mutual relations in space and time.[25] It demonstrated to be a key-technique in understanding the processes involved in soil formation whether they were naturally or artificially produced,[26] thanks to the analysis of thin section from significant soil samples. Thin sections are microscope slides on which a thin (30 microns or µm, where 1 µm = 1/1000 mm) slice of soil material has been mounted after being consolidated in resin; their microscopic analysis allows us a complete examination of the whole soil components (aggregates, voids, mineral grains, anthropic inclusion, post-depositional features).[27]

Sampling and laboratory techniques

Forty-one soil samples have been taken from Erimi-*Laonin tou Porakou* workshop complex and domestic units, and prepared in the Reading University laboratory[28]. They have been distinguished into two groups:

The first one includes thirty 'material samples' which are small samples of 5x5x5 cm on average. They have been chipped away from different features such as floors, walls, hearths, bins and emplacements in different areas and units of the settlement. They are representative of different building materials employed in the settlement (mud-brick, plaster, mortar, limestone).

The samples have been cut to a regular and standardized size, dried, impregnated with resin, mounted on a glass slide and finally ground and polished to obtain a thin section of 30 µm.

The second group includes eleven further samples of undisturbed blocks of soil of 14x7x7 cm on average taken from sections and plinths left inside the units excavated (Fig. 3, Fig. 4).

They were cut out from the stratigraphic section faces, and subsequently dried, cut with saw, impregnated with resin, mounted on glass slides and ground - a slightly different process than the one used for the smaller samples was employed - to obtain thin-sections of 30 µm (Fig. 5).

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25 Stoops 2003: 5.
26 Bullock *et al.* 1985: 9.
27 Bullock *et al.* 1985; Murphy 1986; Courty *et al.* 1989; Stoops 2003.
28 Amadio 2017.

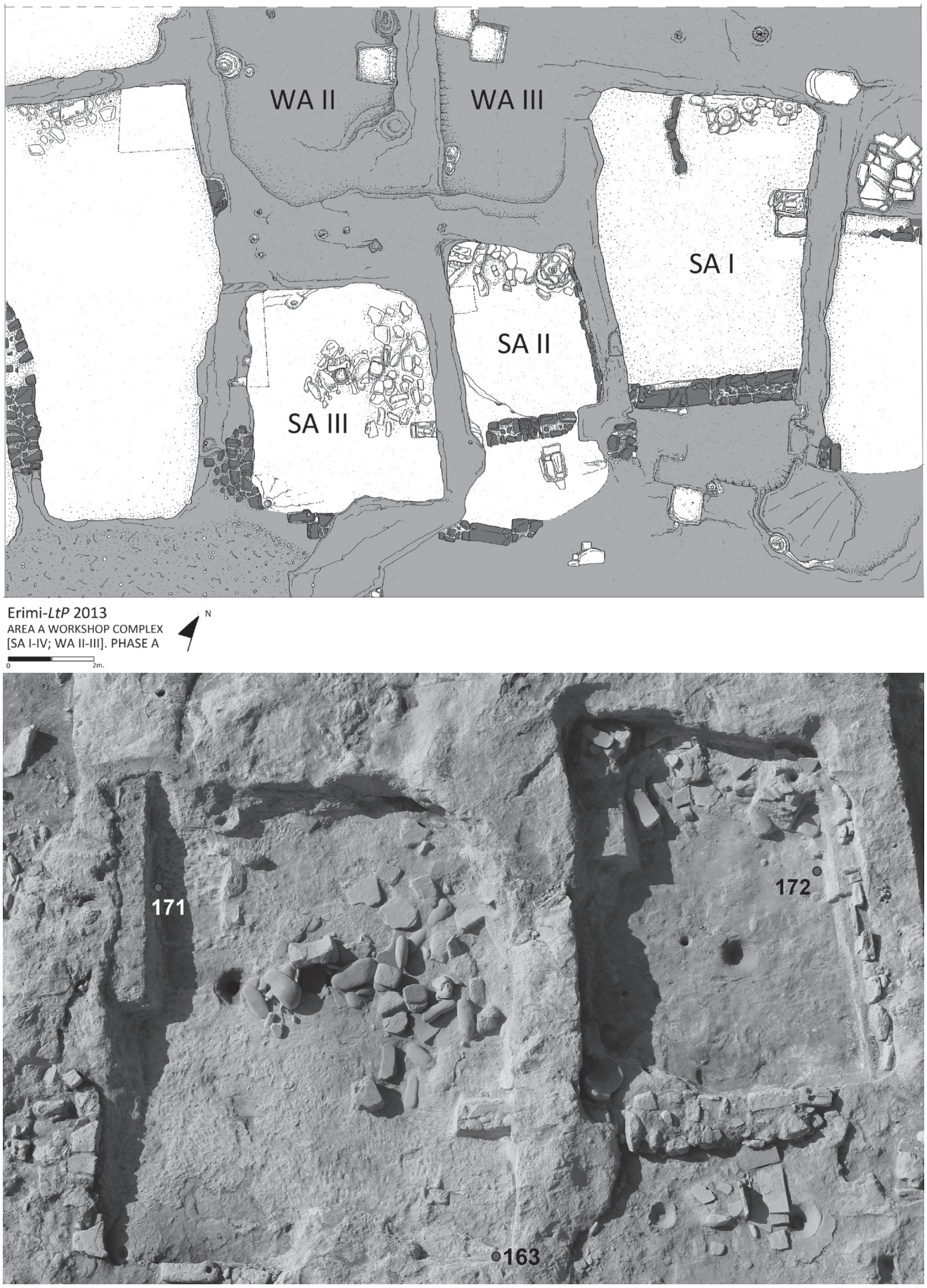

Figure 3: Erimi-*Laonin tou Porakou Workshop complex (Area A), Units SA I-III and location of soil samples (nos. 171-172) (Archivio Missione Archeologica Italiana a Erimi).*

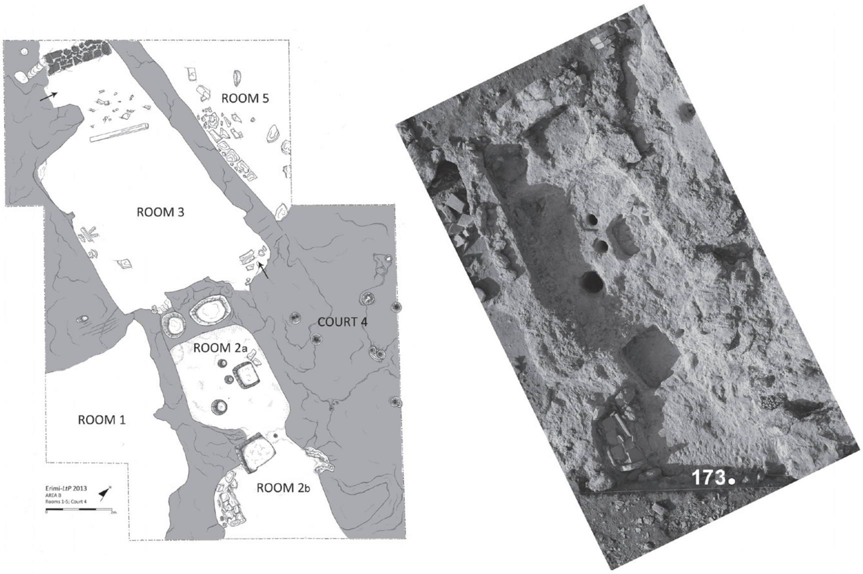

Figure 4: Erimi-*Laonin tou Porakou domestic units (Area B) and location of soil sample (n. 173) (Archivio Missione Archeologica Italiana a Erimi).*

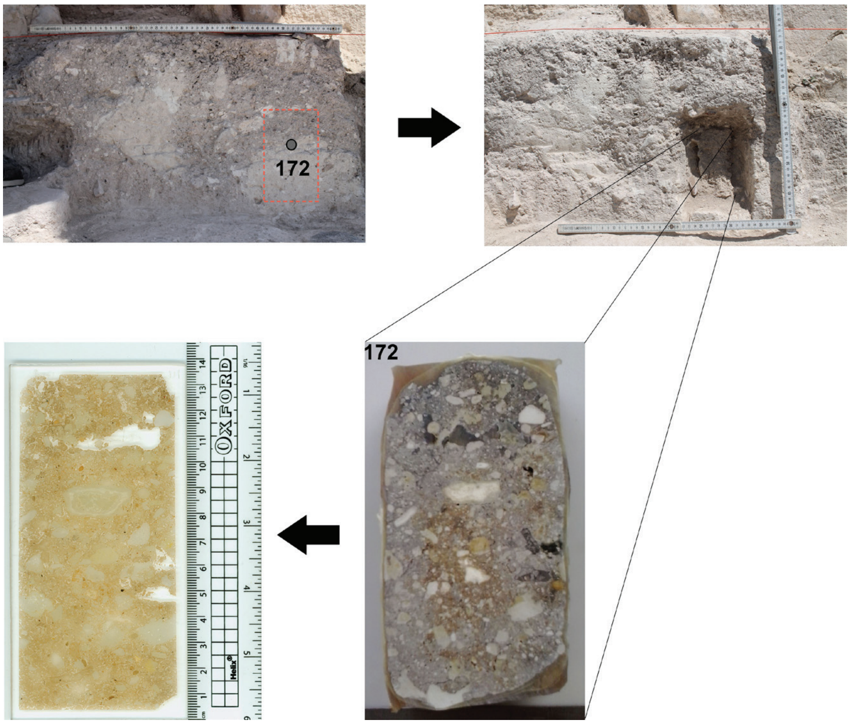

Figure 5: *Steps followed during the field sampling and laboratory processing for the micromorphological analysis (Archivio Missione Archeologica Italiana a Erimi).*

The application of micromorphology to the study of activity areas is limited by the fact that block samples cannot easily be taken systematically across the units and buildings analysed, and by the fact that different activities can sometimes produce similar materials and microstructures being visible in thin section.[29] For this reason the present study will be supported by other analyses, such as the following:

1. Scanning Electron Microscopy analysis, which is employed to determine the chemical composition of the minerals constituting the building materials and their textural features, such as thickness and homogeneity, and to collect additional data on binders and aggregates used in their manufacturing process.[30]
2. X-Ray Fluorescence is used to detect concentration of many light and heavy elements, including metals, as it is an effective means of detecting past metallurgical activities based on the presence of metal concentrations in the sediment.[31]
3. Infrared spectroscopy is employed for obtaining information on the molecular structure of crystalline and amorphous materials as well as organic materials. Infrared spectrometry can thus be used both to identify materials and characterize their states of atomic order and disorder. This is a powerful tool to study materials that have been altered by heating.[32] Therefore, in this specific case, it can provide information about temperatures reached during the manufacturing process, which is important for the study of pyrotechnology.
4. Ethnoarchaeological comparanda will be eventually evaluated, as they can provide a reference framework for interpreting the archaeological record.[33]

Chemical, physical and petrographic characterization of lime binders

This research is grounded in a very recent, but remarkably fertile, archaeometric line of investigation on ancient building techniques and materials. Recent studies have demonstrated that pyrotechnological skills for the production of both gypsum and lime plasters were already adopted in Cyprus since the Neolithic.[34] More recently proof regarding the addition of artificial pozzolana for the production of moderately hydraulic mortars in the Late Bronze Age has been offered.[35] Unfortunately, Early and

[29] Milek and Roberts 2013.
[30] Damiani *et al.* 2003: 346.
[31] Weiner 2010: 266.
[32] Weiner 2010: 275.
[33] David and Kramer 2001.
[34] Kingery *et al.* 1988.
[35] Philokyprou 2012.

Middle Bronze Age plasters and mortars have been relatively less investigated due to a certain slenderness of samples, except for Marki-*Alonia* and Alambra-*Mouttes*,[36] hence there is still much to do and say about archaeological sites, such as Erimi-*Laonin tou Porakou*.

In order to perform a morphological, compositional and functional characterization of the plasters and mortars utilized at the site, a multi-technique investigation has been performed.[37] The purposes of the research were diverse: to verify the selective use of limestone and/or gypsum for the production of local binders, to recognize whether raw materials were subjected to firing processes and, in case, to identify pyrotechnological skills; to determine aggregates and additives and, finally, to identify changes in building practices in the course of the Bronze Age. During the 2011 and 2012 seasons, 40 samples have been collected from Areas A and B, of which 22 have been analyzed as representative of different architectural features (walls, basins, pits, hearts, kilns, etc.) and functional purposes (supporting, coating, flattening, etc.). This analytical schedule employs the following techniques: X-Ray Powder Diffraction (XRPD), Scanning Electron Microscopy coupled with Energy Dispersive X-ray microanalysis (SEM-EDX); Polarized Light Microscopy (PLM) on thin sections, Optical Microscopy, and finally Thermogravimetric Analysis (TGA).

This research has been extensively published,[38] evidencing new interesting data: all the samples have proven to be made of lime plasters, as expected due to the local geology of the Pakhna Formation. This corroborates the work of Philokyprou, who suggested that the use gypsum plaster was probably circumscribed to the Neolithic.[39] The main remarkable point of note is the evident continuity in the pattern of lime plaster production through time, despite the distinctive change in the architectural configuration between Phase A and B. Further data seem to open interesting perspectives about the use of organic and inorganic materials as additives to easily mould binders or, on the opposite, to bestow hardness to plasters. In few cases, in fact, the addiction of artificial *pozzolana* has been observed, suggesting that the addition of crumbled ceramic fractions was likely related to conferring greater resistance and low elasticity to the plaster, rather than to an evident waterproofing purpose.

[36] Coleman *et al.* 1996; Frankel and Webb 1996; 2006.
[37] Amadio and Chelazzi 2013; Chelazzi and Davit 2015.
[38] Turco *et al.* 2016.
[39] Philokyprou 2013.

In parallel, the addition of organic fibres was clearly due to a need for mechanical strength in the manufacture of emplacements and in the coating of basins.

Archaeometric analyses of biological materials

Paleodietary research

Among the different research methods, stable light isotope analysis of mineralized tissues like bones represents one of the best established applications of bone chemistry for reconstructing the diet of ancient communities.[40] Bone is a composite material, characterized by a complex hierarchical structure made up of a mineral phase, essentially hydroxyapatite, and an organic matrix predominantly composed of collagen.[41] Due to the effects of isotopic fractionation, these components display specific isotopic compositions that reflect the isotopic signatures of the nutrients assimilated from the diet during the last years of an individual's life.[42] Depending on which component of bone is utilized for the analysis, specific aspects of the diet can be investigated. In particular, measurements conducted on collagen will mainly reflect the dietary proteins whilst the analysis of the inorganic phase will provide estimates of the whole diet. Measurements of stable isotope abundances are performed with an isotopic ratio mass spectrometer, and the results are expressed as ratios of the heavier isotope to the lighter one, taking the same ratio of standard materials as a reference. The most commonly used pairs of isotopes are $^{13}C/^{12}C$ ($\delta^{13}C$) and $^{15}N/^{14}N$ ($\delta^{15}N$).In fact, $\delta^{13}C$ signatures can reveal the contribution of C_3 (e.g. rice, wheat, barley) versus C_4 (e.g. maize, millet, sorghum) plants to the diet and differentiate a marine versus terrestrial based diet; on the other hand, the measured $\delta^{15}N$ values are indicative of the trophic level and can identify the consumption of aquatic resources.

From the archaeological point of view, the importance of a paleodietary research ranges far beyond the mere reconstruction of past human diet, providing useful data concerning both human impacts on the environment and the cultural behavior of the population (e.g. food preparation, possible socio-economical and religious differences, possible trading among different communities). However, up to now an exhaustive paleodietary research is lacking in the literature for Cyprus, and the unique contribution to prehistoric diet comes from the analysis of few human samples from

[40] Surveys and basic principles of the method can be found, for example, in Ambrose 1993; Tykot 2006; Lee-Thorp 2008.
[41] For an overview of bone structure, see Weiner and Traub 1992; Weiner and Wagner 1998.
[42] Ambrose and Norr 1993.

the Neolithic site of Khirokitia, indicating a mainly terrestrial-based diet with no evidence of regular marine food consumption.[43]

Towards this purpose, important clues about the diet of the population of Cyprus during the Middle Bronze Age have been obtained from the archaeological area of Erimi-*Laonin tou Porakou*, where two cemeteries have been identified and excavated. More specifically, the skeletal remains recovered in Erimi-*Laonin tou Porakou*, Area E (Tombs 228, 230, 248, 328 and 428) have been sampled for stable carbon and nitrogen isotope analysis. Bone samples were collected taking the MNI (Minimum Number of Individuals) of each tomb into account, so that at least one sample from every individual would be sampled. Whenever possible, samples were preferably taken from long bones (femurs and humeri), as they are typically higher in collagen content. Indeed, although collagen is the most commonly analyzed bone fraction for paleodietary research, its yield after the extraction procedure can be very low, as collagen content strongly depends on bone preservation.

Besides producing new unpublished data about Middle Bronze Age diet, the paleodietary results obtained from the skeletal remains of Erimi-*Laonin tou Porakou* have given us the possibility to formulate hypotheses about the provision of food resources and highlight differences in individual food consumption. In addition, paleodietary information has been compared and merged with the data produced by other specific studies (e.g. palaeobotanical analyses, anthropological analyses) in the attempt to better understand the environmental and cultural dynamics of the people that inhabited the area.[44]

Radiocarbon dating

Since its development in the 1940s,[45] radiocarbon dating has had a profound influence on archaeological research. As a matter of fact, this technique represents an essential tool for archaeologists to obtain absolute dates from organic remains often found in archaeological sites, and a prerequisite to verify proposed relative chronologies.

Regarding Bronze Age Cyprus, the chronological framework has been developed over the last decades by several different scholars, and is essentially based on the results of archaeological excavations and pottery classifications, properly synchronized with the Aegean and Egyptian chronologies. However, over the last forty years, new

43 Lange-Badré and Le Mort 1998.
44 Scirè Calabrisotto 2017.
45 Libby *et al.* 1949.

excavations results, coupled with the widespread use of radiocarbon dating, have yielded a large amount of new, sometimes enigmatic, data that have highlighted the need for new schemes of periodization, new chronologies and even new classifications. Among the most recent attempts at revising the chronology of prehistoric Cyprus we can mention the updated review of the pre- and protohistoric Cypriot chronology by Knapp and Manning,[46] Manning's contribution to the special research program entitled SCIEM 2000 - Synchronization of Civilizations in the Eastern Mediterranean in the Second Millennium BC,[47] as well as the research activities of the Cyprus Regional Group of the ARCANE Project, which was conceived in 2002 with the purpose of synchronizing the different chronologies of the Near East and the Eastern Mediterranean in the third millennium BC.[48]

Within this frame, during 2010-2014, dedicated radiocarbon analyses have been conducted on different samples collected from the archaeological area of Erimi-*Laonin tou Porakou*. The principal goal of the research program was to cross-check the chronological context obtained by archaeological evidence with radiocarbon analyses, and, in a wider perspective, to integrate the yielded absolute dates with the results of other chronological studies concerning the Cypriot Bronze Age. More specifically, seven charcoal samples were taken from the workshop complex (Area A) and a total of 17 bone samples were taken from Tombs 228, 230, 248, 328 and 428. Despite problems of bone preservation within ^{14}C measurements of bones, this set of radiocarbon determinations has produced absolute dates in good agreement with the archaeological evidence, paving the way for further investigations.[49]

Beyond this, radiocarbon dating of bones can be very useful in archaeological contexts, primarily because of the possibility to date a material (bone) which is usually strongly connected with the event or the feature to be dated. This is particularly evident when dealing with necropolises, especially those consisting of many tombs, with no stratigraphic relations between them, or very poor or undefined grave goods. On the other hand, due to specific diagenetic processes,[50] archaeological bones often present poor preservation and a consequent tendency to display contamination that could finally alter radiocarbon measurements. Given that premise, radiocarbon dated bone collagen samples from the funerary tomb clusters at Erimi-*Laonin tou Porakou*

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[46] Knapp 2013.
[47] Manning 2007.
[48] Peltenburg *et al.* 2013.
[49] Scirè Calabrisotto *et al.* 2012; Scirè Calabrisotto and Fedi 2017.
[50] See for example: Collins *et al.* 2002; Hedges 2002.

have also been considered for discussing and verifying the relevance of measuring collagen quality indicators so as to obtain reliable and accurate radiocarbon dates.[51]

In conclusion, radiocarbon dating at Erimi-*Laonin tou Porakou* has proved to be effective from three different points of view. First of all, it allowed the sequence of occupation evidenced on archaeological basis to be verified and anchored to an absolute chronology. Secondly, it yielded new data concerning bone diagenesis in Cyprus showing the importance of developing a proper collagen quality screening procedure for bone samples. Finally, as the Middle Bronze Age has been poorly investigated in terms of chronology so far, current and future radiocarbon dating in Erimi-*Laonin tou Porakou* can improve the quality and quantity of data available and contribute to fill this lacuna, in the attempt of providing a valid periodization for the whole Bronze Age period.

Conclusions

As we moved from the reconnaissance of the peculiar physicality of the archaeological record we can finally argue that this evidence, far from being a mere theoretical assumption, can be approached as a key strength in the study of pre-literate societies, such as the community of Erimi-*Laonin tou Porakou* during the Middle Bronze Age.

This opportunity exists for projects that place the question of materiality at their center. The emphasis here should be on a symmetrical form of analysis that focuses not only on the description and characterization of the properties of architecture, artifacts (archaeometry as material-based analyses), human and animal remains (archaeometry as analysis on biological materials, bio-archaeology), but also on how these data contribute to outlining a more detailed account of the social lives of an ancient community. As Jones argued,[52] if the materiality is placed at the center of a web that ties together historical questions relating to social relations, symbolization, physical interactions with the environment and subsistence, then we can set up a dynamic and powerful analytical tool.

Acknowledgments

The project is grateful to the Acting Directors of the Department of Antiquities, Dr. Despina Pilides and Dr. Marina Solomidou-Ieronymidou, for granting the permission to develop the research project at Erimi, and finally to Mr. Yiannis Violaris and to the

[51] Scirè Calabrisotto *et al.* 2013.

[52] Jones 2004: 335.

kind cooperation of the staff of the District Archaeological Museum of Limassol. Their support and suggestions greatly aided the research. The staff of the Italian Embassy in Nicosia is acknowledged for the support, particularly the Ambassador Dr. Guido Cerboni, as well as Dr. Massimo Carnelos and Dr. Beatrice Vecchioni, Deputy Heads of Mission. The project is grateful to the Institute of Aegean Prehistory of Philadelphia (INSTAP), the Mediterranean Archaeological Trust, the Italian Ministry of Foreign Affairs, the University of Turin - Dipartimento Studi Umanistici, the University of Florence - Facoltà di Lettere e Filosofia for funding and support the fieldwork seasons.

Chemical, physical and petrographic analyses are currently being performed at the Dipartimento di Chimica, Università di Torino (Italy). We are particularly grateful to Patrizia Davit and Francesca Turco (Università di Torino) who have performed lab analysis and backed up the interpretation of chemical data; to Salvatore Coluccia and Lucia Operti who have supervised the work. We are very grateful to Eliano Diana for Raman Spectroscopic analyses, to Monica Gulmini for the use of the chemometric software and to Alessandro Borghi for petrographic examinations. This research line was also supported by Associazione per lo Sviluppo Scientifico del Piemonte (ASP).

Micromorphological analyses are currently performed at the the University of Reading (UK). We are grateful to Wendy Matthews and Roger Matthews supporting the project with advices and revisions, and John Jack (laboratory technician) for his essential help in thin-sections preparation.

Paleodietary research was supported by Ca' Foscari Università di Venezia (Italia) and by the IRMS Laboratory of the DiSTABiF-Dipartimento di Scienze e Tecnologie Ambientali Biologiche e Farmaceutiche-of the Seconda Università di Napoli (Caserta, Italy).

Radiocarbon dating was performed at the LABEC (Laboratorio di Tecniche Nucleari per i Beni Culturali e Ambientali) Laboratory of INFN (Istituto Nazionale di Fisica Nucleare) (Italia).

Finally, we are very grateful to our friend and colleague Elisavet Stefani for the Greek translation of the summary, and to the anonymous reviewers for their helpful and appreciated comments and suggestions.

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Περίληψη

Η έμφαση που δίνεται πρόσφατα στο θέμα του υλικού πολιτισμού από τον ερμηνευτικό κλάδο της αρχαιολογίας έχει ως αποτέλεσμα την προώθηση της ιστορικής προοπτικής του φαινομένου της αλληλεπίδρασης που είχαν οι πρώιμες κοινωνίες με το φυσικό τους περιβάλλον. Η προφανέστερη και πιο διαδεδομένη έκφανση του υλικού πολιτισμού είναι, βεβαίως, τα αντικείμενα. Ωστόσο, η θέση αυτή αρχίζει να λαμβάνει μια φθίνουσα ροπή, αν λάβουμε υπόψη το μεγάλο εύρος του υλικού πολιτισμού, ο ορισμός του οποίου περιλαμβάνει θέματα πέραν της φυσικής υπόστασης των πραγμάτων: εμπεριέχει μεταξύ άλλων πτυχές όπως είναι η εφήμερη, η ιδεατή και η βιολογική υλικότητα. Έχει αποδειχθεί ότι η αλληλεπίδραση μεταξύ των ιδιοτήτων των αντικειμένων και του τρόπου με τον οποίο αυτές εντάσσονται στο κοινωνικό γίγνεσθαι, αποτελεί ένα πολύ σημαντικό ζήτημα τουλάχιστον μέχρι την ύστερη Προϊστορία της Κύπρου.

Στο παρόν άρθρο, μετά από μια σύντομη παρουσίαση των σύγχρονων τάσεων σχετικά με τον ορισμός της υλικότητας και του πως θα μπορούσε να συμβάλει στον τομέα αυτό η επαναπροσέγγιση μεταξύ της αρχαιολογικής θεωρίας και της εφαρμογής των θετικών επιστημών στην αρχαιολογία, θα προχωρήσουμε στην επισήμανση της μεγάλης σημασίας των τρεχουσών βιο-αρχαιολογικών αναλύσεων, καθώς και διαφόρων αναλύσεων του υλικού, για την σκιαγράφηση της κοινότητας που υπήρχε κατά τη Μέση Εποχή του Χαλκού στην θέση Ερήμη-*Λαόνιν του Ποράκου* στην επαρχία Λεμεσού. Η αρχαιολογική αυτή θέση έχει διερευνηθεί συστηματικά από την Ιταλική Αρχαιολογική Αποστολή σε ένα κοινό πρόγραμμα των Πανεπιστημίων της Φλωρεντίας και του Τορίνο σε συνεργασία με το Τμήμα Αρχαιοτήτων Κύπρου.

Η γενική χρονολογική ακολουθία του οικισμού στη θέση αυτή, όπως τεκμηριώθηκε από τη συλλογή υλικού κατά την επιφανειακή επισκόπηση καθώς και από τα αποτελέσματα των ανασκαφών στη κορυφή του λόφου (συγκρότημα εργαστηριακών χώρων, Περιοχή Α), στη πρώτη χαμηλότερα αναβαθμίδα (οικιστικές ζώνες, Περιοχή Β) και στη νοτιότερη εκτός οικισμού περιοχής (Περιοχή Ε), εντάσσεται σε δυο κύριες περιόδους (Περίοδος 1 και 2). Πρόσφατες ανασκαφές επιβεβαίωσαν ότι η Περίοδος 2, που καταλαμβάνει το μεγαλύτερο μέρος του οικισμού, αντιστοιχεί στη Μέση Εποχή του Χαλκού, και περιλαμβάνει δυο φάσεις σε ακολουθία (Περίοδος 2: Φάσεις Α και Β). Η επόμενη περίοδος (Περίοδος 1), μετά από ένα μακρύ κενό, συνδέεται με μια πιθανή επανεγκατάσταση στο χώρο κατά την Ύστερη Ελληνιστική και Ρωμαϊκή περίοδο. Όσον αφορά τις επιστημονικές αναλύσεις, έχουν εφαρμοστεί διάφορα είδη έρευνας, δημιουργώντας έτσι μια συλλογική ατζέντα που δίνει τροφή για συζητήσεις,

έρευνες και περαιτέρω ανάπτυξη του αρχαιολογικού προγράμματος σε αυτή τη θέση της Ερήμης. Η έμφαση εδώ δίνεται στην εκπόνηση μιας συμμετρικής ανάλυσης που εστιάζει όχι μόνο στη περιγραφή και το χαρακτηρισμό της αρχιτεκτονικής, των αντικειμένων (αρχαιομετρία ως ανάλυση βασιζόμενη στο υλικό) και των ανθρώπινων καταλοίπων (αρχαιομετρία ως ανάλυση των βιολογικών υλικών, βιο-αρχαιολογία), αλλά επίσης στο πως αυτές οι ενδείξεις βοηθούν στην σκιαγράφηση της κοινωνίας και της καθημερινής ζωής των αρχαίων κοινοτήτων.