Neolithic Bone and Antler Industry of Northern Greece: Temporal and Spatial Contexts

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Abstract

This thesis explores the bone tool industries from the Early to Late Neolithic periods in northern Greece. The Neolithic sites analyzed encompass Paliambela Kolindros, Revenia Korinos, and Kato Agiannis in the Pieria region, as well as Kleitos in the Kozani region. The primary aim is to document the continuities and discontinuities within the cultural contexts spanning these Neolithic periods between 6600/6000 and 3300 BC.

This study encompasses a comprehensive analysis of technology, typology, raw material selection, and tool construction traces. Furthermore, it investigates the persistence or transformation of bone tool traditions within individual settlements and in comparison, with neighboring traditions. The spatial distribution of these tools is utilized to reconstruct the cultural contexts of the Neolithic settlements.

Conducted from 2021 to 2024, this research aims to enhance our understanding of the variations in tool inventories during the Neolithic period across different settlements. Insights gleaned from these sites in northern Greece will contribute to a better comprehension of daily life, the evolution of Neolithic communities, and the interaction between communal practices and domestic units. This dissertation seeks to illuminate and expand upon existing research concerning bone tool industries within their Neolithic social and economic contexts. The assemblages studied are characterized by anomoiomorphy, which, alongside existing studies, aids in distinguishing two distinct traditions of this era in prehistoric times. Furthermore, these findings provide valuable information about the economic activities of the settlements of early agrarian societies in Europe.

Keywords: Bone artifacts, tools, ornaments, Balkan region, Central Neolithic Macedonia, Western Neolithic Macedonia, Paliambela Kolindros, Revenia Korinos, Kato Agiannis, Kleitos, Early, Middle, Late, Final Neolithic.

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Abbreviations:

EN: Early Neolithic, **MN**:Middle Neolithic, **LN**:Late Neolithic, **FN**:Final Neolithic

Chapter 1 - Introduction

Introduction

This thesis explores bone artifacts and their multifaceted significance in Neolithic societies of northern Greece. By investigating the technological and social dimensions of bone artifacts, it aims to emphasize their dynamic role in shaping various aspects of social life within Neolithic communities. The study focuses on the neolithic sites Paliambela Kolindros, Revenia Korinos, Kato Agiannis in the Pieria region, and Kleitos in the Kozani region of Northern Greece (Map 1). Chronologically, these sites span from the Early to the Final Neolithic period.

According to Andreou, Fotiadis, and Kotsakis (1996:538), the Neolithic period in Macedonia is divided as follows: Early Neolithic 6600 - 6000 cal. BCE, Middle Neolithic 6000 - 5500 cal. BCE, Late Neolithic 5500 - 4500 cal. BCE, Final Neolithic 4500 - 3300 cal. BCE, and Early Bronze Age 3300/3100-2300/2200 BCE (Maniatis 2014, Maniatis and Pappa 2020).

This study comprehensively examines the technology, typology, and traces of making and tool use. Additionally, it investigates the continuity or discontinuity of bone tool traditions within the same settlements and compares them with neighboring traditions. The spatial distribution of the tools aims to reconstruct the cultural context of Neolithic settlements.

Northern Greece, particularly Macedonia, stands as an exemplary case with limited research on bone tools in recent decades, unlike materials such as pottery. The absence of published assemblages creates a gap in the comprehensive study of individual settlements, affecting the wider Balkan and Aegean regions. This study seeks to fill this research gap and advance our understanding of the bone industry in Macedonia through a detailed analysis of new material. The research will also trace the degree of interaction between settlements in Thessaly, the Balkans, the rest of Macedonia, and the eastern Mediterranean by reviewing previously published material from these regions.

1.1 Aims and limitation of the study

The proposed PhD dissertation will deal with the study of bone tools and especially:

1. The typology of bone tools in each site.
2. The choice of raw material.
3. The manufacturing and possible use of the objects according to their typology.
4. The temporal distribution of the objects within the settlements through the different periods of the Neolithic.
5. The spatial distribution of the objects within the settlements.

6. The comparison with other Neolithic bone tools of the Balkans and Europe based on the already published material.

One of the practical limitations of the present research was that it began during the quarantine period of Covid 19, which for a long time prevented the transfer to the laboratory of the Aristotle University of Thessaloniki and the study of the material. This resulted in the loss of at least 6 months of study of the material.

As with any archaeological study, this thesis is inevitably affected by various limitations in the analysis and interpretation of the archaeological material. These limitations vary and are largely self-evident and expected. They relate to excavation gaps and questions that have not yet been adequately answered due to the limited or selective excavation of certain sites, the lack of sufficient chronological and stratigraphic data for some excavation assemblages, and the preliminary content of certain studies whose completion would be crucial for the interpretation of the Neolithic bone tool assemblages.

The lack of published assemblages creates a gap in the comprehensive study of individual settlements and consequently in the wider Balkan and Aegean regions. The lack of literature and the different approaches to typology by different scholars create the main problem that there is no universal, homogeneous, concrete typology for all researchers (chapter 3.8).

Any material from different archaeological sites is not homogeneous, it is not in the same state. Categorizing objects initially by material is one way, the most common way, of describing a number of 'small finds' collected during excavations and surveys. In this context, each object category is an incomplete description that can be filled in (Christidou 1999:11).

The materials studied in this thesis have been selected both in terms of their location and in terms of the excavation method that allows us to have a complete picture of the excavation. The selection was also made regarding the palaeoenvironment. In the area of Kozani, the site of Kleitos was located by the lake, while in the area of Pieria, the site had nearby streams, rivers and the sea. Precisely because each site represents a different period of the Neolithic, and in different geographical areas there could not be homogeneity. Each site shows similar but also different tool categories, different preservation, different distribution, and tool preferences. As we will discuss below, this thesis aims to approach all the material in a common way, recording as much information as possible. The methodology used is the same for all materials examined.

1.2 Structure of thesis

In order to achieve the objectives of the study described above, this thesis is divided into eight chapters (including this introductory chapter). These chapters contribute to the definition of the main research questions, the analysis of the relevant data and their synthetic approach.

Chapter 1 presents the aims of the study alongside its limitations. Chapter 2 attempts to provide a chronological context for the Neolithic in Macedonia, focusing on Central and Western Macedonia, and addressing both existing research in the area and issues of site geography and palaeoenvironment. Chapter 3 focuses on the study of bone tools. An attempt is made to approach the theoretical tools available to archaeologists and how these can assist in the study of bone assemblages, such as chaîne opératoire or behaviour chain. Recently published material from Greece, the Balkans and Europe is presented. In addition, the problems of bone tool research are discussed, and the methodology used is presented. Chapters 4, 5, 6 and 7 deal with the four separate settlements investigated in this thesis. All chapters present some initial information about the site and the excavation. This is followed by an analysis of the tools (typology, raw material, processing). Finally, all chapters present the spatial distribution of the objects. Where more than one period is represented, as for example at Paliambela Kolindros, the temporal distribution of the objects is also given. The last chapter contains a discussion based on the previous analysis and an attempt to relate the materials to the other bone traditions.

Chapter 2 - The Research History and Geographic Context of the Northern Neolithic Period in Greece

The Research History and Geographic Context of the Northern Neolithic Period in Greece

Prehistoric Macedonia became a primary focus of scholarly investigation following its integration into the Greek state, particularly during the Balkan Wars and subsequent to the First World War. During this period, French and British allied forces engaged in archaeological endeavors concurrent with their military operations. On occasion, these archaeological findings were chance finds, arising inadvertently from activities such as the excavation of trenches (Kotsakis 2010; Παπαϊωάννου 2011).

The antiquity of northern Greece, in contrast to the south, follows a distinct trajectory. Archaeological efforts in southern Greece had already reinforced the Greek historical narrative and linked the Greek nation to classical and, by extension, European civilization, thereby defining Greek national identity. However, the fluid demographic composition of Macedonia and the absence of significant archaeological discoveries led to a decline in official interest in the region's prehistory, causing considerable embarrassment (Kotsakis 2006: 80-81). Archaeological research in Macedonia, as in Thessaly, has largely challenged the established stereotypes of southern Greek archaeology (Kotsakis 2014; 2010).

The biggest question that still puzzles researchers to this day is whether the prehistory of Macedonia belongs to the north or the south. There is a North-South divide that has been a concern in relation to political developments in Southern Greece that absent in Macedonia, such as the emergence of palatial culture and "social complexity", thus creating a kind of geographical and cultural "border" (Kotsakis 2010). This social complexity is reflected by researchers in southern Greece through the “megara” and palaces, which are absent in Macedonia. However, social complexity can be found in several areas and not only in the area of political organization, nor in particularly in the way power is distributed throughout the social structure (Kotsakis 2010). The representation of Macedonia's past has been framed in opposition to Aegean prehistory, primarily characterized by the recognition of the region's ambivalent role as a passageway. This perspective emphasizes the passive and traditional nature of prehistoric Macedonia (Παπαϊωάννου 2011).

A breakthrough in this perception of a “degraded” Macedonia, due to the lack of major architectural remains, was Heurtley's Prehistoric Macedonia (1939), which presented his surface surveys and excavation research, and his attempt to synchronize sites based on pottery (Andreou, Fotiadis, and Kotsakis 1996: 283; Γραμμένος 1991: 23; Fotiadis 2001:116; Kotsakis 2010). The development of research in Macedonia not only brought to light a wealth of archaeological sites, but also introduced new theories and overturned the data of previous research, which had seen Macedonia as a passage from southern Greece to the north.

It is important to make a note of the geography of Macedonia as it helps us to understand the environment in which Neolithic early agrarian populations moved. The geographical region of Macedonia is defined by the basin of the Axios River, which connects the regions north and south of the modern political borders, from the border of Greece and the Republic of North Macedonia. Macedonia is a place rich in water, with plains, mountains, lakes and proximity to the sea. According to recent palaeoenvironmental studies, the landscape and the climate of the Neolithic period is quite different from the current picture. The climate was particularly cold and dry in winter and early spring, with little or no cooling in summer. Lake levels have dropped and the forest has opened up (Morales-Molino et al. 2024).

The beginning of the Neolithic in Greece has been of interest to many researchers and scholars for many decades. Many proposals have been put forward for the emergence of Neolithic communities in Greece. The debate revolves around 'Neolithisation' or 'Neolithic transformation'. Neolithisation refers to the transfer of the Neolithic way of life through migration and colonisation from the Middle East. On the contrary, the 'Neolithic transformation' refers to the economic and social transformation of society by the very populations that inhabited the Greek area, which during this period seem to have increased to a very large extent. The result of this complex process is what archaeologists are trying to study. Childe is the first to argue that the Neolithic way of life spread from the East, while Perlès believes that the Neolithic way of life came from the Balkans. The complete dataset from the Neolithic period remains partially unavailable and may forever remain incomplete, thus perpetuating ongoing scholarly investigation in this area. What we do know is that the similarity between Macedonia and Thessaly in research, especially from pottery, is indeed much less than the similarities in the Balkans (Kotsakis 2010:4-5).

In Greece, two types of Neolithic settlements can be observed. The first type of settlement is the tell or "toumbes" (especially in Thessaly) and the second is the flat extended settlement (especially in Macedonia). The mounds stand out in the landscape and develop vertically; in these settlements, each new phase of settlement is built on top of the previous one, making them very distinctive in the landscape over time. According to the researchers, the reasons for vertical rebuilding are both practical and social. Residents' insistence on building on the same site may be related to the importance of the location of the house, such as a close relationship with ancestors. Practical reasons could be the availability of space or easier foundations for the new building. The Neolithic man's insistence on living in a specific space of particular importance led to the creation of both a natural and a social landscape: the

foundation of houses with vertical linearity creates the concept of household and continuity in time (Kotsakis 2010:7).

The second type of Neolithic settlement known from Macedonia is the flat extended settlement. The buildings in this type of settlement do not follow a vertical but a horizontal orientation. They were not built on top of each other but side by side, separated by large areas where the inhabitants worked. The construction of the buildings is not as meticulous as in toumpa and they give the impression of being ephemeral constructions. Often, as at Revenia, they were simple pits dug into the natural bedrock and covered with a structure; later, as we know from the sites of Revenia and Makrigialos, they were replaced by semi-subterranean buildings, pit like structures. These settlements are known in Macedonia and further north, in the region of Serbia, and are considered to be part of the Starčevo cultural cycle, a culture spanning the last two centuries of the 7th millennium and the beginning of the 6th millennium BC. Such settlements are the ones we are studying in this thesis. However, Paliambela Kolindros seems to have started as an extended settlement and became a toumba in the Final Neolithic.

2.1 Geography of Central Macedonia, Greece

The archaeological landscape in Central and Western Macedonia exhibits significant heterogeneity, mirroring the diverse geographical and climatological characteristics of the region. This variability is further reflected in the geomorphological processes, the extent and nature of archaeological activity, and likely the patterns of Neolithic occupation.

Central Macedonia, delineated by the rivers Axios and Strymon, exhibits a dynamic environmental history as evidenced by palynological studies. These studies indicate a continuous expansion of deciduous forests in both lowland and mountainous areas during the Early Holocene, reaching a peak around 8000-7000 BC. Subsequent analysis revealed a decline in forest cover around 3500 BC at Philippi and 4500 BC at Giannitsa, potentially attributable to anthropogenic activities (Andreou, Fotiadis, and Kotsakis, 1996). Concurrently, there is evidence of extensive utilization of lowland areas during this period. Geomorphological investigations of the Axios valley suggest that post-8000 BC sea-level rise created a deep bay and areas of brackish water. Recent palaeoecological research in northern Greece offers new insights into vegetation dynamics, landscape evolution, and geomorphological processes such as erosion over the past 20,000 years. Following climatic warming, vegetation reorganizations facilitated the spread of pine-oak forests, with temperate species like Abies forming isolated patches. Early Holocene climate changes further enabled the establishment of sub-Mediterranean broad-leaved oak forests (Gassner et al., 2020).

Reconstructed early agricultural activities approximately 8,200 years ago at Limni Zazari align with archaeological findings. Recent analyses suggest that until the onset of the Neolithic period, around 8,600-8,200 years ago, vegetation was in dynamic equilibrium with the climate. The relatively gradual increase in agricultural activities inferred from pollen data during the early Neolithic period implies local adaptation processes rather than a Neolithic 'revolution' driven by mass migrations (Gassner et al., 2020).

During the Bronze Age, the settlement of Kastana was situated on an island, but successive siltation by the Axios River and episodes of land uplift resulted in the bay being completely silted up by 200 BC.

Efforts have been made to study the region of Central Macedonia, particularly focusing on Pieria, due to extensive excavations and studies conducted in the area. Krachtopoulou and Veropoulidou have attempted to reconstruct the paleoenvironment of this region. Their research, combined with radiocarbon dating, revealed that sea levels in the area over the past 10,000 years have experienced successive phases of rise and fall, with the coastline exhibiting inter-annual shifts. The coastal plain covering northern Pieria at the end of the

Pleistocene gradually submerged until the beginning of the Holocene (Μπέσιος, Κραχτοπούλου, 2001; Krahtopoulou and Veropoulidou, 2014, 2016).

Geoarchaeological research in northern Pieria has focused on the Albian sequences of the Gerakaris and Agios Dimitrios valleys, two streams currently flowing in the north and south of the region, respectively. According to Veropoulos and Krachtopoulou, northern Pieria is a dynamic geomorphological environment characterized by long periods of environmental stability, occasionally interrupted by intense periods of environmental instability, including episodes of erosion and sediment deposition in the stream valleys. These periodic alluvial deposits began at least 40,000 years ago and ended 8,500 years ago, reaching the coastal area of Korinos (near Paliambela) during the Early and Middle Neolithic periods. Concurrently, a rise in sea level created a shallow bay. This process of successive alluvial deposits and sea level rise was completed before the end of the Neolithic period (Krahtopoulou and Veropoulidou, 2014, 2016).

The resulting rich ecosystem from this process was exploited by Neolithic inhabitants, such as those from the settlements of Revenia, Paliambela, and Makrigialos. In Central Macedonia, archaeological data from recent years indicate continuous and intensive occupation and use of the area from the Early Neolithic until historical times (Krahtopoulou and Veropoulidou, 2014, 2016).

In general, paleoenvironmental studies suggest that during the Neolithic period, the region experienced a mild climate, making it ideal for the establishment of settlements. The alternation of plains and low hills between the Pieria Mountains and Mount Olympus, along with the area's streams, created an optimal landscape for Neolithic societies. Most anthropogenic deposits from the period are also found in this area. However, processes of erosion, combined with shallow deposits typical of early extensive settlements and rapid periodic alluvial deposition, have contributed to the low visibility or disappearance of entire sites, resulting in an incomplete picture of the archaeological landscape of the area.

2.2 The Neolithic Period in Central Macedonia, Greece

For the geomorphological phenomena in the region of Central Macedonia, substantial research has been conducted. Most prehistoric sites in Central Macedonia were systematically described by D.H. French in the 1960s on the surface survey. Subsequent identification efforts by S. Casson και D. French and W. Hurtlay has increased the number of known sites to 220. The chronological distribution of these sites provides a broad overview of settlement trends. From the Late Neolithic to the Early Bronze Age there is a marked increase in site density. In the Late Bronze Age there was an increase in the number of sites, but this is accompanied by a decrease in their size (Παππά 2008:22-23)..

During the Neolithic period, settlements began to proliferate across the landscape of Macedonia (Map 2). The population living in these settlements, typically hosting no more than 200 to 300 inhabitants. The plain of Giannitsa, where Nea Nikomedeia was established, was the first area to reveal the existence of an early settlement (Kotsakis, 2010). Excavations initiated in 1961 provided significant impetus for studying the physical environment of past societies using scientific methods (Andreou, Fotiadis, and Kotsakis, 1996: 283-284). This scientific approach, alongside the development of study and research in Central and Western Macedonia, has shaped our current understanding of the prehistoric period in the region. The methodologies developed and employed have fundamentally transformed our perspective on prehistory. Research has shifted focus from merely cataloging finds to examining human interaction with the environment, investigating how people acted within their surroundings, how they exploited resources, and how these interactions influenced the development and shaping of both society and the environment.

In Central Macedonia, research by Grammenos, Fotiadis, Kotsakis and Andreou has documented human presence throughout all periods of the Neolithic, from the Early Neolithic (EN) to the Final Neolithic (FN). As research has progressed, evidence of occupation during the Early Neolithic has been found at a number of sites in Central Macedonia, such as Vasilika, Kato Agios Ioannis, Liti III, Mikri Volvi (Παππά 2008:30-41), Paliambela (Halstead, P. and Kotsakis 2001; 2002; 2005; Kotsakis, K. and Halstead 2002), Revenia Korinos (Maniatis and Adaktylou 2021) etc. During the Middle Neolithic (MN) and Late Neolithic (LN), several flat, extensive settlements were discovered in the Thessaloniki area. Notable sites include ΔΕΘ: Παππά 2008:55-56; Thermi: Kotsos and Urem-Kotsou 2006: 197; Παππά 2008:71-74; Stavroupoli: Kotsos and Urem-Kotsou 2006: 196; Makrigialos: Παππά 2008: 101-310; Mesimeriani Toumba (Kotsos and Urem-Kotsou 2006: 197). These findings underline the importance of the region for understanding Neolithic settlement patterns and the evolution of human settlement in Central Macedonia.

In Pieria, the university excavations at Paliambela Kolindros, Revenia Korinos, Kato Agios Ioannis, Ritini and Kato Agiannis encompass the entire Neolithic period from EN to FN. The university excavation of Paliambela Kolindros has set as its research objective the understanding of the organization of the site through the activities of the Neolithic inhabitants, and allows to follow the gradual transformation from an extensive settlement to a mound (Halstead, P. and Kotsakis 2001; 2002; 2005; Kotsakis, K. and Halstead 2002). The sites of Revenia (Maniatis and Adaktylou 2021), Kato Agios Ioannis and Ritini cover the EN period (Παππά 2008). Ritini dates back to the beginning of the LN. These are settlements where different phases of settlement coexist, with underground pits designated as houses and above-ground buildings. MN deposits can also be seen at the Keramaria site in Pieria. In the wider area of Central Macedonia, the sites of Liti I and Evangelismos cover the MN. At Liti I, scattered pits and ditches of the MN period were uncovered. At Evaggelismos the very fragmentary remains of a small MN settlement were found, consisting of two pits in which MN pottery was found. LN remains have been found at Zagliveri, at Platoma and at Agia Lydia in the Asprovalta area. At all these sites pit remains were found with finds from the LN period. Deposits of the EN and MN periods were found at Liti III and Mikri Volvi (Παππά 2008).

2.3 Geography of Western Macedonia, Greece

Western Macedonia is defined as the area west of the Axios River and is characterized by impressive geographical diversity. The region is predominantly mountainous, encompassing the Gramos, Smolika, and Timfi mountains, which are part of the Pindos Mountain range and form the natural border with Epirus to the west. In the northern part of the region lies Mount Voras, while Mount Vermion is centrally located. The Pieria Mountains mark the southern boundary, separating Western Macedonia from Northern Macedonia and Thessaly. The region features a series of attractive basins, particularly in the northern part. Notable basins include the Prespa basin with its lakes, and the Pelagonia basin. Additionally, the area includes the Eordea basin, which contains the four lakes Zazari, Chimaditida, Petron, and Vegoritida. In the western part of the region is the Orestida Basin, home to Lake Orestiada, the Upper Aliakmonas Basin, and the Kozani Basin. The geophysical character of Western Macedonia is further defined by two major rivers, the Aliakmonas and the Axios, which traverse the region and flow into the Thermaikos Gulf and the Aegean Sea (Arampatzis 2019:35).

During the first half of the Holocene, temperatures continued to rise in Western Macedonia (west of the Axios River), and summers in the highlands may have been warmer during the fifth millennium BC. The impact of Neolithic occupation does not appear to have been significant and is therefore not recorded in the palynological record of the region. In particular, the decline of the forest is not recorded until around 3100-3300 BC. In contrast to Central Macedonia, the landscape of Western Macedonia during this period exhibits considerable differences in forest composition. The development of lakes and swamps in Western Macedonia appears to have been more pronounced than in Central Macedonia, indicating a significantly altered landscape with greater aquatic and marshland features. (Kotsakis 2010).

The area of Kitrini Limni, the focus of this thesis, encompasses several tafroeod basins that have served as depositional sites for lignite and other sediments. The Greek term "Sarigiol," also referred to as Limni, derives from the swamp that covered the lower part of the area until it was drained in the 1950s, subsequently transforming into a fertile plain. The region has experienced significant tectonic activity, which has influenced the topography of the landscape. Paleofaunal and paleofloral studies indicate that, since the Upper Pliocene, the area has been characterized by the formation of lakes, marshes, and swamps (Χονδρού, 2018: 70). The pronounced wetland element is evident in the bone assemblages studied, including artifacts such as harpoons. This aquatic influence has played a crucial role in shaping both the physical landscape and the Neolithic cultures of the region.

It appears that the soil and hydrological conditions of the area during the prehistoric period were significantly different from those of today (Φωτιάδης, 1988). Although precise dating of environmental changes within the lake area is challenging, excavation data from several sites, including Megalo Nisi Galani, Mikro Nisi Akrini, Toumba Pontokomi (Φωτιάδης, 1991), and Kleitos I and II (Ζιώτα, 2014: 327), indicate that these sites were once covered by lake water. For instance, at Megalo Nisi Galanis, Final Neolithic (FN) deposits are overlain by lake sediments. Palaeoenvironmental and palaeo-economic studies reveal that the area surrounding Lake Sarigol (Kitrini Limni) was characterized by a mixed deciduous forest dominated by black pine, oak, cherry, fir, and Maloideae (Ζιώτα, 2014: 330). Similarly, the geomorphological characteristics of the Kastoria Basin closely resemble those of Kitrini Limni. The environmental and geological diversity of the Kastoria Basin—comprising extensive alluvial plains, semi-mountainous and mountainous zones, a complex hydrographic network, a variety of stone resources, and diverse vegetation—renders it a particularly attractive location for various productive activities and economic practices, including agriculture, livestock farming, fishing, as well as transport and communication (Μπεκιάρης, 2018).

2.4 The Neolithic Period in Western Macedonia, Greece

Western Macedonia now boasts an extensive archaeological heritage (see Map 2). However, the situation prior to the 1980s was markedly different. Archaeological research was initially limited to the settlement of Servia, which was the sole example of a prehistoric site in the region (Fotiadis, Chondroyianni-Metoki, and Ziota 2000:217-218). Since then, comprehensive research throughout Western Macedonia has revealed numerous prehistoric settlements, demonstrating that the region was a complex network of communities and populations, particularly towards the end of the Neolithic period. The earliest evidence of habitation in the area is found at Avgi, Kastoria, and dates to the Middle Neolithic (Stratouli 2007:127;Stratouli et al. 2020). Additionally, the site of Dispilio, also in Kastoria, has provided significant evidence, especially regarding wetland settlements, further enriching our understanding of the region's prehistoric landscape.

The earliest Early Neolithic site discovered in Western Macedonia is the settlement of Nea Nikomedia. As previously noted, this site serves as a key reference for both the methodology and dating of Early Neolithic sites across the broader region of Macedonia (Kotsakis, 2010: 6). Although radiocarbon dates for the three construction phases of Nea Nikomedia have not been published (Wardle, 1996: 195), they are generally estimated to fall within the range of 6400-6000 BC (Andreou, Fotiadis, and Kotsakis, 1996: 323).

Kitrini Limni is a plateau region with an altitude ranging from 670 to 750 meters, located south of Ptolemaida and situated between the Vermio and Askiou mountains. Over the past five millennia, from prehistoric times to the present, the area has been continuously inhabited. This enduring settlement pattern is attributed to the favorable conditions provided by the region for agriculture, animal husbandry, access to raw materials such as wood and stone from the surrounding mountains, and fishing in nearby streams and rivers. During the Neolithic period, this led to the development of a dense network of settlements, with their number increasing as research advanced, both within the basin and along its peripheries (Καραμήτρου-Μεντεσίδη 2014:233; Karamitrou-Mentessidi et al. 2001).

Systematic interdisciplinary surface surveys in the Grevena region have identified 21 Neolithic sites, while the Kozani region has revealed a total of 47 prehistoric sites. This high density of early settlements in Western Macedonia underscores the region's significance as a geographic crossroads facilitating movement and communication along north-south and east-west routes (Καραμήτρου-Μεντεσίδη, 2014: 233). Among the 47 identified sites, 13 date to the Early Neolithic (EN) and 15 to the Middle Neolithic (MN) (Χονδρογιάννη-Μετόκη 2008: 449-451). The low mound of Servia, originally situated on a terrace above the Aliakmonas River and now submerged in an artificial lake, was first excavated by Heurtley in

1930 and subsequently during the 1971-1973 rescue excavations (Ridley et al., 2000: 5-10). These excavations revealed occupation phases extending from the Early Neolithic (EN), predominantly through the Middle Neolithic (MN), and into the Early Bronze Age (Ridley et al., 2000: 14-15). Additional salvage excavations at other EN and MN sites have supplemented the findings from Servia. Radiocarbon dating of the Varemenoi/Goulon Island sites (6430-5670 BC) and Paliambela Roditis (6220-5900 BC) supports the notion that the area was densely populated during these early periods (Χονδρογιάννη-Μετόκη, 2008: 453, 457). Consequently, it is now established that the region was already well-populated during these formative stages of the Neolithic.

In the region, settlement forms exhibit both horizontal and vertical development, resulting in a combination of extensive settlements and mounds. Most mounds are low and less perceptible from the ground surface, with notable exceptions such as Megali Toumba in the Agios Dimitrios valley and Megalo Nisi Galanis. Excavations suggest that these sites were occupied successively over a broad area. Some flat settlements, such as Kremasti Koilada and Keramidia Akrini, are also large in scale. Additionally, the settlements of Tetralofos and those extending from Drepano to Proastia follow a model of smaller settlement units. These are predominantly sites build on natural mounds, on hilly country site, often situated on the peripheries and in semi-mountainous to mountainous regions (Καραμήτρου-Μεντεσίδη, 2014: 244).

The archaeological map of the vast region from Florina, including the Amyndeon basin, to Aridaia is based on individual reports (Τρανταλίδου, 1993: 1597, 1614). For the early period of the area (Ζιώτα and Μοσχάκης, 1997; Χρυσοστόμου, Πολουκίδου and Προκοπίδου, 2003). We have a calibrated radiocarbon dating from the site of Apsalos-Grami which indicates a date range of 5701-5622 BC, which would fit the Thessalian scale in MN (Χρυσοστόμου, Πολουκίδου, and Προκοπίδου, 2003: 514).

The archaeological data emerged from large scale excavations as a result of rescue archaeology and offer a revised perspective on Western Macedonia, challenging previous understandings. Contrary to earlier views that characterized Neolithic settlements in Western Macedonia as colonial outposts or marginal extensions of Thessalian cultural cycles, current evidence suggests that these settlements developed independently and concurrently. This shifts the focus to examining the shared and unique characteristics of these communities, as well as their relations and communication networks. Further research is required to elucidate these aspects and better understand the dynamics of Neolithic Western Macedonia.

Chapter 3 - The bone artifacts

3.1 Identifying bone objects within material culture and the theoretical frame.

Archaeology serves as a reflection of social activity, endeavoring to reconstruct the society and culture of the past (Binford, 1962: 219). The study of material remains and material culture has evolved through various theoretical approaches as the discipline has developed. It is crucial for archaeologists to define the theoretical framework guiding their research, as material culture is central to this endeavor. As Boivin asserts, "the material world shapes and transforms us" (Boivin, 2010: 181). Over time, archaeology has transitioned from its earlier treasure-hunting phase to being examined through the lens of anthropology. Initially, archaeology focused on the analysis of objects in isolation, often neglecting their social contexts (Meskell, 2005: 52). This focus shifted with V. Gordon Childe's seminal work, “Man Makes Himself” (1965), which emphasized human agency in shaping material culture. Childe's approach inspired researchers to contextualize objects within cultural frameworks and interpret human societies more comprehensively. Consequently, archaeology evolved into a humanistic discipline, examining the dynamic interactions between humans and their environments (Binford, 1962: 217-218; Kotsakis, 2014: 43). Theoretical approaches in archaeology have progressively centered on broader interpretations that extend beyond the mere analysis of artifacts, aiming to elucidate the relationships between social structures, materiality, and cultural constitution (Meskell, 2005: 52). A significant aspect of this evolution is the contribution of anthropology to the study of material culture (Meskell, 2005: 1).

The use and context of objects are fundamental to their significance. Hodder defines objects as relatively stable in form, but their perception and categorization are intrinsically linked to their uses (Hodder, 2012: 25-31). From this viewpoint, bone tools as all the artifacts should not be analyzed in a linear manner but rather dialectically, considering the environments in which they are situated. Artifacts, such as bone implements, are categorized based on their functions, as they are created to fulfill specific purposes (Dellantonio and Mulatti, 2014: 408; Hilpinen, 2011; Kelemen and Carey, 2009; Bloom, 1996, 1998). Objects can serve a range of functions, including practical, symbolic, social, sensory, and psychological roles. The processes of making, using, discarding, and reusing artifacts are viewed as 'constitutive processes' that shape and reflect cultural practices (Crilly, 2010: 6-10). For instance, a bone tool initially employed as a utilitarian object may later be repurposed as jewelry, illustrating the multifaceted nature of artifacts. Similarly, at the site of Kleitos, an object fashioned from a human skull was discovered, though its use is unlikely to be interpreted as ritualistic. Understanding the function of objects is therefore crucial, and this can only be achieved through a comprehensive approach that combines the study of various

categories, including their function, disposal, raw material, and context of discovery. As Kotsakis notes regarding pottery: "Types of pottery cannot be compared without first understanding the function of the pots and the process of their production within the different social contexts in which they participate and partly produce as elements of material culture. There is therefore a deeper difficulty in formulating an analytical discourse based on stable categories formed by the concept of the ideal boundary" (Kotsakis, 2010: 2). This perspective underscores that all categories of materials must be analyzed in relation to their functional roles and contexts of use, rather than being considered in isolation from their practical applications and socio-cultural significance.

The cornerstone of artifact theory is that of Binford in *'Archaeology as Anthropology'*. Binford divides material culture into three broad categories, the technomic artefacts, the sociotechnic artefacts and the ideotechnic artefacts (1962:219). The technomic artefacts are those that derive from - copy directly from - the natural environment (fossil flora and fauna), the sociotechnic artefacts have their primary functional environment in the social subsystem of a total cultural system (e.g. ideotechnic artefacts have their primary functional environment in the ideological sphere of the social system (e.g. symbols) (Binford 1962:219-220). Schiffer proposed a classification of artefacts by their embodied function and distinguished three different types of function: technical, social and ideological (1992:9-12). He proposed that the technofunction is the utilitarian function of the artefact. The sociofunction is related to the manifestation of social facts, while the ideofunction is related to more abstract ideas such as beliefs or values (Arampatzis 2019:7).

The concept of the cultural group in archaeology refers to the historical reconstruction of peoples and groups based on their distinct spatial behaviors, as evidenced through material culture and archaeological remains. This approach aims to trace ethnic and cultural origins, movements, migrations, and colonizations. However, it has been critiqued for its reliance on a one-dimensional perspective, often focusing disproportionately on pottery and other material culture as markers of cultural identity and origin (Kotsakis 2010:2).

Pierre Bourdieu was among the first to analyze objects within a cultural context, drawing on Claude Lévi-Strauss's theory. Lévi-Strauss advocated for a shift from examining entities in isolation to understanding objects through the relational frameworks that constitute their meaning. Bourdieu aimed to provide a less deterministic perspective on material culture, highlighting how objects shape human behavior and serve as primary instruments for socialization. He emphasized that the use of objects is influenced not solely by their inherent properties but also by temporal and contextual factors. For instance, a harvesting tool is utilized seasonally, reflecting the interplay between the object's function and its temporal

context. Pierre Bourdieu integrated Marxist material practice with phenomenology to explore the secondary dimension of objects, often referred to as the "habitus" of objects (Meskell, 2005: 6). Bourdieu's approach sought to understand how objects are not only products of material conditions but also embedded in social practices and perceptions, reflecting deeper cultural and social structures. This fusion of theories allowed for a nuanced analysis of how objects influence and are influenced by human behavior and social contexts.

In order for a researcher to approach the subject, he or she must first approach its specific characteristics, which we will analyze below, in combination with the social context in which they are found (Hodder 2012:25-31; Kotsakis 2014).

Indeed, the theoretical approaches to material culture and objects have evolved significantly over time and have faced various criticisms. While diving into a deep philosophical analysis of materiality might be beyond the scope of this paper, understanding the theoretical frameworks can still be highly beneficial. Here’s a concise overview of how these theoretical backgrounds inform the study of material culture

3.2 The history (diachronicity) of bone industries

Bone artifacts have been essential elements of human societies worldwide since ancient times, with use documented as far back as the Neanderthal period (about 40,000 years ago) and even earlier. Archaeological evidence from the Lower Paleolithic at the Swartkrans site in North Africa shows that early humans, possibly Australopithecus, utilized bone fragments as tools about one million years ago, though these were not intentionally crafted as tools (D'Errico and Backwell, 2003).

Purposefully modified bone tools first appeared in Africa, with finds at sites like Broken Hill Cave in Zambia and Katanda in the Congo, dating to the Mesolithic period. Similar artifacts have been discovered globally, from Mesolithic tools in South Africa's Blombos Cave to Upper Paleolithic tools across Europe and early tools in Australia and Canada (D'Errico and Backwell, 2003; Pierre and Walker, 2007). The use of bone tools persisted through the Neolithic, Bronze, and Iron Ages, continuing into historic times.

Bone, as a material, has been utilized since early human history, comparable in longevity to stone usage. Early hominids used bone either purposefully or incidentally, while later humans developed techniques for processing it into tools. However, bone artifacts have received less scholarly attention than other materials like stone and pottery. This is partly due to the bone's organic composition, which makes it less likely to survive in the archaeological record compared to the more durable materials of stone and fired clay. Additionally, as Gates St-Pierre and Walker note, bone tools have often been overlooked, with a focus primarily on their typology and technology rather than their broader archaeological context (2007:1–2).

In recent decades, however, researchers have expanded the study of bone tools to explore their roles in the economic, social, political, and ideological dimensions of ancient societies, going beyond just technological and functional aspects.

3.3 The concept of technology

Since the earliest human use of tools, researchers have been focused on understanding how these tools were made, the reasons behind their specific designs, and the ways in which knowledge about tool-making and usage was communicated and passed down through generations. In archaeology, technology is a crucial area of study for understanding prehistoric societies. It involves examining the methods people used to create tools and artifacts and how they interacted with these objects. This investigation not only covers the practical aspects of tool production but also explores how technological knowledge was transmitted, reflecting broader social, cultural, and economic dynamics within ancient communities. (Miller, Heather 2009).

Technology as a concept encompasses a wide range of parameters. Various approaches have been applied to the concept, but at its core, technology encompasses human knowledge and the utilization of tools and crafts. It involves the processes through which objects are created and used, including the energies and materials that contribute to the development of material culture. Essentially, technology refers to the ways in which people employ their understanding to shape the physical world and produce the artifacts and tools that form part of their everyday lives and cultural practices (Pollard and Gosden 2023:9).

Historically, earlier approaches to technology did not distinctly separate it from society. In these traditional views, technology was seen primarily as the practical and mechanical aspects of life, while society was focused on social relations and structures. Technology was considered merely a tool through which people acted, and as technology evolved, it was thought to drive changes in human societies, leading to increased social complexity (Morris 2010). This perspective, however, often led to technological determinism, where technological advancements were viewed as the primary force shaping societal changes. For example, Binford's systems theory exemplified this separation by compartmentalizing society and technology into distinct spheres. His approach aimed to understand the interplay between these two realms but often fell into the trap of viewing technological progress as a deterministic factor driving social evolution. This binary approach highlighted the limitations of understanding technology solely as an isolated force, separate from the social context in which it operates. (Binford 1968). Childe said that technology should be seen as the study of the work that leads to the satisfaction of human needs that cause changes in the material world. On the other hand, scholars who have approached the subject, such as Ingold (influenced by Heidegger) place technology in the movement, perception and engagement of people through tools and technology (Ingold 2007). Anthropologists such as Bourdieu place technology in the context of how people make sense of their world. Habits, our knowledge of

our world, according to Bourdieu, are learned from the earliest years of our lives, so it is not something we learn as we grow up, but something we are. Production and technology have an existential element for Marx, along with politics and economics, which ensures that technology cannot be seen in purely technical terms, nor does it have a deterministic effect on society (Pollard and Gosden 2023:21-24).

As Boivin emphasizes, technology is deeply embedded in and integral to human societies (Boivin 2009). Pollard and Gosden expand on this, stating that technology is a "total social event," reflecting the extensive range of skills and materials humans use to meet their needs. For instance, tracing the use of copper reveals connections to various tools and objects, from axes and chisels to swords and cauldrons, highlighting how technology intersects with diverse aspects of human life and societal development (Pollard and Gosden 2023:57).

All theories of technology share the idea that technological practices reflect and materialize ideological structures and perceptions. This connection allows for the social processes behind technology to be explored and studied through archaeological research (Brodie 2001).

3.4 Archaeological approach to technology

Comparing types of tools requires a thorough discussion of their functions and the production processes within the social contexts they reflect and contribute to as elements of material culture. This approach highlights the complexity of relying on fixed categories developed over time. Instead, it is more legitimate to analyze each object based on its specific parameters, avoiding general categories that assume predetermined meanings and roles.

Of crucial importance, as mentioned above, is the approach to technology, an important part of which relates to typology. The proposed PhD dissertation will deal with the study of bone tools and especially the technology, typology, manufacture processing and the use of tools. The analysis aims to uncover how daily practices shaped Neolithic culture, as everyday actions reflect and record people's concepts, ideas, and beliefs (Geertz 2003). Through this approach, archaeologists strive to access the "meaning of the past" (Hodder and Hutson 2010). Typology will be the essential tool for analyzing and describing artefacts, as it efficiently handles complex variability and provides insights into the past. Typology, when coupled with technical categorization, constitutes a cornerstone of archaeological analysis. This methodological approach, in conjunction with contemporary theoretical frameworks, enables the elucidation of the contextual coordinates of archaeological artifacts. It facilitates the identification of variations and commonalities in production and consumption practices across different contexts (Soressi et al. 2013).

Nevertheless, confining typology to a purely taxonomic perspective can be reductive and fail to encompass the full complexity of archaeological phenomena. Objects should not be viewed merely as discrete events but rather as reflections of responses to specific needs and contexts. This includes considering their functional purposes, life cycles—including use, repair, and discard phases—and the manipulations involved in working with raw materials (selection, processing techniques) (Soressi et al. 2013). Such considerations highlight the variability in artifact production and use across different sites and communities, emphasizing the necessity for a nuanced approach that accounts for the multifaceted nature of material culture.

Following the discussion on typology as a foundational methodological tool in archaeological analysis, it is essential to consider additional significant methodologies, particularly those relevant to the toolkit approach. While typology focuses primarily on the morphology of artefacts (Dobres 2000), it often overlooks the connection between artefacts and their creators or users, as well as the cognitive and social processes involved in their production (Arampatzis 2019:9).

In 1965, André Leroi-Gourhan introduced the concept of chaîne opératoire (operational chain), which offers a more comprehensive analysis of tool production processes. This concept encompasses the entire sequence from the acquisition of raw materials, through the stages of tool creation, use, maintenance (including breakage, repair, and reuse), to the final disposal of the objects (Leroi-Gourhan 1988:225; Vitezović 2013:204). Leroi-Gourhan's approach was influenced by Marcel Mauss's 1934 work, which posited that actions, such as walking, are shaped by cultural as well as physical factors. Leroi-Gourhan extended this notion to include the products of these actions (Shott 2003). The chaîne opératoire concept emphasizes not only the technical aspects of tool production but also the cultural and cognitive dimensions involved. Prominent advocates of this technological approach to archaeology include both Lemonnier and Leroi-Gourhan. Leroi-Gourhan's comparative studies on tool-making and raw material processing were pivotal in developing the chaînes opératoires framework. According to Lemonnier, whose work draws on ethnographic evidence, the chaîne opératoire also reflects a conceptual level of technical knowledge specific to a group, thus necessitating an understanding of the cultural context in which these processes occur (Sellet 1993:107).

Chaîne opératoire analysis represents a technological framework designed to reconstruct the organization and transformation of a technological system at a specific archaeological site. This methodology seeks to describe and understand the entire sequence of cultural and technical changes that a raw material undergoes throughout its lifecycle. It involves a chronological segmentation of actions and mental processes required to produce and maintain an artefact within the technical system of a prehistoric group. The chaîne opératoire begins with the acquisition of raw materials and concludes with the discard or final disposal of the artefact (Leroi-Gourhan 1965; Sellet 1993:106). However, an alternative perspective suggests that the boundaries of a chaîne opératoire are not fixed. According to Hodder, the connections between various elements are perpetually fluid, reflecting an open-ended nature where the beginning and end of technological processes cannot always be precisely delineated (Hodder 2012:86).

The analysis using the chaîne opératoire framework involves a systematic sequence to reconstruct the entire process of technological production and use. Initially, researchers reproduce the objects and techniques used in tool-making, which helps identify the relevant technological criteria. These criteria are then applied to classify the archaeological remains. The next step involves examining all objects present at a site, including both end products and by-products, to understand the complete range of activities associated with tool use. This

includes analyzing reduction processes, use-wear, and disposal methods, all in relation to the raw materials employed (Sellet 1993:109).

Chaîne opératoire analysis allows researchers to move beyond mere typologies by reconstructing the "biography" of artefacts—the sequence of processes from raw material transformation to final disposal. This approach enables archaeologists to gain insights into the decision-making processes of prehistoric people and their technological choices (Leroi-Gourhan 1965; Bar-Yosef et al. 1992; Gosselain 2000). By examining the chaîne opératoire, scholars enrich their understanding of prehistoric cultures, revealing how objects and their makers reflect the broader cultural context. This framework encompasses not only the physical actions involved in production but also the mental processes and conceptual schemes that guide these actions (Leroi-Gourhan 1988:225).

An alternative to the chaîne opératoire approach is the concept of behavioural chains, which parallel the French school's focus on technological processes but emphasize the interaction and performance of activities. Behavioural chains examine how tools are designed and used to perform specific tasks, such as a cooking pot's role in food preparation (Hodder 2012:88). This approach seeks to understand the motivations behind specific actions and consumption choices, linking these behaviours to the production and reproduction of social boundaries and interactions.

Behavioural archaeology offers a flexible framework for studying technological change across various societies, accommodating different theoretical perspectives (Schiffer 2004:579). It involves analyzing human behaviour through the collection and interpretation of data on how people interact with technologies. This includes not only practical technologies related to raw material extraction and food preparation but also those involved in religious, social, recreational, and political activities (Schiffer 1975; 2004). By studying these interactions, researchers can develop analytical models to understand how technological practices influence and reflect broader social dynamics.

In particular, there are strong affinities with the notion of chaîne opératoire in Schiffer's chain of behaviour (Schiffer 1972, 1976). As Schiffer states: "The sequence of activities in the systemic context of any durable element can be grouped into a set of basic processes and represented by a flow model. These processes include procurement, production, use, maintenance and disposal. A process consists of one or more stages. A stage, in turn, consists of one or more activities" (Schiffer 1976:46).

Behavioural archaeology is thus concerned with the interactions and affordances between things in relation to a project or purpose. Like chaîne opératoire, it often involves experimental archaeology and attempts to move towards the objectivist character of objects.

As an example of a behavioural chain, Hodder mentions the precociousness of raw materials in stone tools. The choice of a particular type of stone has consequences for the types of tools that can be made (Hodder 2012, 91). An example confirmed by the present study. As we will see below, certain types of bone are selected to produce certain types of tools. For bones, this pattern is even clearer because of their very specific shape. On the other hand, the quality and abundance of the raw material also affects the practical and social uses to which the tools are put (Hodder 2012, 92). In behavioural archaeology, then, the connections between things are not just interactions and do not just show dependence. Specific objects and dependencies between things push the acting subjects into specific behaviours, orienting and constraining them to their purpose.

Like the chaîne opératoire approach, chains of behavior have been critiqued for portraying culture as a passive outcome, rather than an active and dynamic process (Hodder and Hudson 2010:75). Despite this, both approaches have significantly advanced the field by encouraging researchers to move beyond rigid typological classifications and focus on the active role of individuals and their decision-making processes in shaping material culture.

The active role of humans and their movement within the landscape produces individual biographies that reflect the contacts and interactions of individuals with other people and societies. In this way the landscape can be seen as a movement in time (Tilley 1994, 27-29; Kotsakis 2004, 66). The place is therefore a whole that contains multiple meanings and contains individual wholes and elements, it can always stand independently in relation to the information it exchanges with its environment (Χουρμουζιάδης 1999, 180). Within the settlement, people communicate and produce material culture. Through their repeated and active interaction with the environment, people form their own tradition. In societies such as Neolithic societies, tradition ensures the cohesion and continuity of each society (Ingold 2007). Social cohesion, for both individuals and social groups, is maintained through traditional material culture, which contains and expresses collective and individual memory (Geertz 2003, 17; Choyke 2007, 650). The landscape is thus constituted and 'arrived' in the hands of archaeologists in the form of material remains (either fixed or mobile). These archaeological remains include bone objects, which can provide us with information about technology, the availability of raw materials, and the preferences and uses of these objects by the inhabitants of Neolithic settlements.

Another methodological approach is the biography of objects, which approaches material remains through their involvement in the formation and reproduction of social life and social relations. The idea that artefacts have biographies was first proposed by Kopytoff in 1986. Considering the biography of objects as a way of approaching social life is now a

widely accepted model. The passage of an object from its birth to its death or destruction, when it becomes junk, occurs through many different stages, and each stage in the life of the object seems to play a different role (Ingold 2007:1; Hahn and Weiss 2013).

At first glance, the difference between operant behaviour chains and object biography is not obvious. But object biography focuses more on the object itself and the different meanings it is charged with during its life. In their book *Mobility, Meaning and Transformation of Things (2013)*, Hahn and Weiss give the example of a new and an old car. The new car has more possibilities than the old one. However, if the old car is charged with the meaning of the classic car, it can have not only a larger market value but also an ideological meaning (Hahn and Weiss 2013). The biography of object then approaches artefacts as agents rather than passive recipients (Gosden & Marshall 1999: 169; Hahn and Weiss 2013; Hyysalo, Pollock, and Williams 2018:6-8). In this approach, objects are associated with meanings that are produced through social action and shape the way people perceive and constitute their social world (Μπεκιάρης Τ. 2018:73; Gosden & Marshall 1999: 169). These meanings are not invisible concepts, but manageable quantities that are constantly used, structured and changed at different stages in the lives of objects and people (Gosden & Marshall 1999: 169;Hyysalo 2021). Social domains such as production, ownership, use and ideology can influence how objects are perceived and their social meanings (Hyysalo, Pollock, and Williams 2018:5-11; Hyysalo 2021:16-18). In this context, objects are not understood simply as material forms, but express perceptions and meanings through their active interaction with a variety of social contexts. However, as Ingold notes, objects are active not because they contain activity, but because they are involved in liveliness Ingold 2007:36).

As Bekiaris points out in his dissertation on the stone tools of the site Aygi Kastorias, "the selection of raw materials, their characteristics and modes of acquisition, their transformation into artefacts, their maintenance, their mode of use, reuse, recycling, destruction and disposal, their consumption contexts and their post-abstract deterioration constitute the main aspects of the biography of stone objects"(Μπεκιάρης Τ. 2018:73). In a similar way, the present research attempts to approach bone tools from Central and Western Macedonia.

3.5 The study of prehistoric bone industries in Balkans and Europe

Bone objects were long overlooked in archaeological studies, but recent years have seen a significant increase in both the quality and quantity of research on this subject (Vitezović 2016:7). A pivotal advancement in the study of worked bone artifacts began with Henrietta Camps-Fabrer's work in the 1960s. Her research not only established the foundation for future studies by introducing key typological and morphological frameworks but also brought the production of bone tools into the spotlight of archaeological investigation, which had previously neglected this aspect of material culture.

The study of bone tools began in the same way as archaeology in general. Initially, only the most special and impressive objects were considered, and there was no systematic study of everyday objects, as was the case with other materials (e.g. pottery) (Choyke and Schibler 2007:51). The systematic study of bone tools began in France, where an abundance of Palaeolithic bone and antler tools were first examined. This approach eventually expanded across Europe to encompass a broader range of prehistoric and historical bone objects, extending to the Middle Ages. In Central Europe, the work of Jörg Schibler and Peter Suter (Schibler 1981; Suter 1981) on bone and antler artefacts is the basic typological system followed by many European researchers today (Marinelli 1995; Stratouli 1998; Tóth 2012; Choyke 2005). Many Neolithic Lake sites in Central Europe and the Balkans have yielded very well-preserved bone assemblages. In Central Europe around the lakes of Zurich, Biel, Constance, Zug and others, many Neolithic and Bronze Age settlements have brought to light bone and antler objects that have been studied and analysed (Schibler 2001). The work of Choyke and Schibler focused on the Central European region (Switzerland, Hungary, etc.), while in the Balkan region the work of Russel and Vitezović for Starčevo-Körös-Criș and Vinča Culture was crucial. The Mesolithic and Neolithic period in France has been studied mainly by Eva David, Marianne Christensen, Isabelle Sidéra and others, who have given a new impetus to the study of bone objects. Although they provide useful detailed typologies, they are more technological in nature (Arampatzis 2019:24).

The study of bone assemblages from Europe to the Balkans reveals both similarities and differences throughout prehistory, reflecting variations in quality and quantity. These differences arise from various factors, including taxonomic considerations—such as the superior preservation of artifacts at lake sites compared to the erosion-prone land sites—as well as methodological issues related to excavation practices. Some sites have been comprehensively excavated, while others have only been partially explored. Furthermore,

archaeozoological studies play a crucial role, as bone tools often appear embedded within broader archaeozoological assemblages, potentially skewing our understanding of the worked bones. It would be advisable to mention, at least epigraphically, the bone tool making of the Eastern Mediterranean, because if we remain strictly within modern boundaries, we are likely to lose the full picture of prehistoric routes and traditions. The bone sets from the eastern Mediterranean (Russel 2016) have similar characteristics to those of the Balkans in general, at least in terms of construction techniques. They are differentiated sets, particularly rich in form and decoration. The jewellery from these areas is of particular interest. Rings, dividers, figurines and special motifs decorate jewellery and tools from this wider region. The discussion of this thesis will include further analysis of all these different cultures.

3.6 The research of bone industries in Greece

In Greece, the study of bone toolmaking is relatively recent, having gained prominence over the past 30 years. Pioneering research by scholars such as Georgia Stratouli, Eleni-Antiklia Moundrea Agrafioti, and Rosalia Christidou was instrumental in integrating bone tools into the Greek archaeological context. Their work laid the foundation for subsequent research in the field. Processed bone objects are also reported from Dawkins' excavations at Palaikastro in Crete (Dawkins 1905), and from Christos Tsountas' excavations at Sesklo and Dimini in Thessaly (Τσούντας 1908). Some of the earliest examples of bone tools are reported from the Franchthi cave in Argolida in the Peloponnese (Jacobsen 1981).

Apart from Christidou's dissertation from Macedonia (Christidou 1999), Moundrea-Agrafiotis' dissertation from Thessaly (Moundrea-Agrafioti 1981), Stratoulis' dissertation from Thessaly and Macedonia, analyses from the Tharrounia cave in Evia (Stratouli 1993), Kalithies Cave in Rhodes (Stratouli 1987) and the Kitsos Cave in Attica (Leroi-Prost 1977,1981), new researchers became involved in the study of bone objects and new research was published from the entire prehistoric period from the Neolithic to the Bronze Age. A substantial number of Master's and Ph.D. theses have been dedicated to worked bone assemblages from prehistoric settlements, particularly from the Neolithic, indicating a strong academic interest in this category of artefacts. Northern Greece has seen considerable research activity, with contributions from Arabatzis (2006, 2013, 2016a,b, 2019), Koutsopoulou (2019), Issaakidou (2003), Christidou (1992, 1997, 1999, 2005, 2006), and Stratouli (1998a,b), focusing mainly on Neolithic contexts. Bronze Age studies in northern Greece have been advanced by Christidou (2006), Chondros (2019), and Stathopoulou (2015).

In contrast, research on Central, Southern, and Island Greece is less extensive. Notable contributions include works by Stratouli (1993, 1997), Leroy-Prost (1977), Payne (1973), Giannakopoulou (2009), and Moundrea-Agrafioti (2011). This uneven distribution of research highlights the need for further investigation into bone toolmaking across different Greek regions.

Despite recent advancements in the study of bone and antler objects, many aspects of their abundance remain underexplored. Although significant progress has been made in understanding the morphology, typology, and uses of these objects—particularly through experimental archaeology—the contextual framework within which these objects are embedded remains inadequately addressed. The bone tools of the Balkan Neolithic, for instance, are often described as "common in character" (Moundrea-Agrafioti 1981:264) and "not easily divided into types" (Russel 1985:27). The reliance on morphological criteria has

led to the creation of lists categorized into broad and somewhat generic types: cutting edges, bevelled edges, disc-shaped forms, large and thin points, beads, and similar items (Payne 1973). In more substantial works, morphology is incorporated into the study of construction techniques and, less frequently, into the use of objects. Observations are not hyper-regional or even often 'extra-regional' (Russell 1990: 544)

3.7 Taxonomical issues

Northern Greece, and in particular Macedonia, provides an excellent example of the limited research that has been carried out on bone tools over the last twenty years, in contrast to other archaeological materials such as pottery. The lack of published assemblages creates a gap in the comprehensive study of individual settlements and, by extension, the wider Balkan and Aegean regions. The lack of literature and the different approaches to typology by different scholars create the main problem that there is no universal, homogeneous, concrete typology for all researchers. An object in the literature may be called a "lissoir" in the French bibliography, but a "polisher" in the English bibliography. This in itself creates a huge problem in categorising the typology of objects.

In 2010, an attempt was made by bone tool researchers to create a dictionary for the typology and study of bone tools in general. The primary aim of this dictionary was to compile and translate the main terms used in the study of bone industries into the languages represented in the Groupement de Recherche Européen / European Research Group: Prehistoric Exploitation of Osseous Materials in Europe (GDRE). This dictionary was intended as a tool to facilitate communication and standardization across different linguistic and scholarly traditions. While it lists and translates terms, it does not include definitions, although discussions on definitions were held to establish equivalences in the selected languages. However, translations offered are suggestions rather than fixed concepts, which means that while translations and concepts often align, discrepancies can occur, especially in technical fields where definitions and terms may vary by country or scholarly tradition. Given the evolving nature of the study of bone products, particularly in technological and functional aspects, the decision was made to refrain from finalizing translations and definitions until further progress in the field could consolidate them. In the interim, authors are encouraged to clarify the definitions of the terms they use**.** The list of terms encompasses raw materials, types of materials, different categories of materials, and the principles and methods of working with and using bone materials. It focuses particularly on terminology relevant to prehistory, as per the chronological scope of the GDRE. Nonetheless, many terms of analysis and description are applicable to other historical and modern periods**.**

Despite the dictionary's utility, the lack of a universal terminology for bone tool types still poses problems and confusion in classification and comparison with other bone tool traditions. This inconsistency hampers the ability to form a cohesive understanding and comprehensive study of bone tools across different regions and periods.

3.8 Methodology and recording of bone artifacts.

The bone objects for this study were selected from Neolithic settlements in Paliambela Kolindros, Revenia Korinos, and Kato Agiannis in the region of Pieria, and Kleitos in the region of Kozani. The primary criterion for selecting this sample was the contextual methodological orientation of the study, focusing on the correlations between the bone objects and the spatial remains of the Neolithic community. This focus necessitated selecting archaeological sites where extensive stratigraphic studies had been conducted, allowing for the investigation of spatial correlations within the settlement and with neighboring cultures. Additionally, another crucial criterion was to examine material that would shed light on the relationship of Central and Western Macedonia with Thessaly and the Balkan region.

All the material from the excavations has been studied. The archaeological material covers the period from the Early to Late Neolithic. The study sample includes 2.900 bone artefacts from the excavations at the sites, and come from the undisturbed Neolithic strata of the sites. The material also includes artefacts from unidentified deposits or deposits around the settlements, but which, based on the stratigraphy and relative chronology of the pottery, date to the Neolithic. The material from Kleitos I and II is all together 1353 and in unidentified deposits 155 artefacts. The material from Revenia is all 1.147 and in unidentified deposits 220 artefacts. The material from Paliambella is 378 and in unidentified deposits 134 artefacts. The material from Kato Ayannis is 22 and in unidentified deposits 0.

A key issue in the selection of the sample was the choice of categories and types of bone objects to be included. As mentioned earlier (see section 3.4.1), the typology of bone objects is extremely broad and somewhat heterogeneous, with the boundaries of each category defined according to the nature of the study and the preferences of individual researchers. In this study, all worked bone and antler objects were included, even those whose use was not immediately obvious to the researcher, resulting in the presence of unidentified objects in all the resulting databases. However, the few pieces of bone ornaments from the site of Kleitos were excluded, as they are currently being studied by A. Chondrogianni.

The preparation and basic recording of the archaeological material took place mainly between January 2021 and April 2023. The study and recording of the material were carried out in a fragmentary and discontinuous manner at the Aristotle University of Thessaloniki. In parallel, the study included the additional stages of recording, such as the identification of raw materials, the stereoscopic examination of all assemblages, the final photographic documentation, and the design recording of the objects.

The recording system has been designed and implemented exclusively for the needs of this study, based on the theoretical concepts of object biographies and entrepreneurial chains

described above, and seeks to capture the choices made by Neolithic individuals of the material at different stages of the life cycle of each tool, but above all to integrate them into a general methodological system that can be compared. This system, in its general characteristics, is flexible enough to adapt to the specificities of the materials and the objectives of each analysis. It was not formulated at the outset but evolved during the collection process as needs arose. The present study has been influenced by the French school model in terms of the typology and technological analysis of bone tools. In particular, Stordeur's recording sequence (Stordeur 1978, 20) has been taken into account and was carried out by utilizing methodology and terminology already well known from the studies of other assemblages in Europe and Near East the last forty years (Campana 1989; Christidou, 1999; Legrand and Sidéra 2007; Schibler, 1981).From the entire material, objects were discarded that were between 3 and 5 mm in size, could not be easily identified, and/or showed signs of use and treatment. Also discarded were objects that were not bone tools but simply bones collected during the excavations.

Preliminary research into the recording of bone objects had already been carried out at the master's level. An Access database was created to record the bone objects, based on the data provided by the archaeological material and bibliographic research. A separate database was created for each archaeological site. According to previous research, the classification of bone material from an archaeological site follows a successive spectrum (raw material, construction techniques, morphology, etc.) that forms part of a framework. The context provides object-specific (for the object) and general (bone industry) information (Stordeur 1978, 20). The recording of the present study in the different Neolithic settlements is divided into five phases.

In the first stage, the "identity" of the object is recorded, each artefact studied has been given a unique serial number, an element necessary for the identification of the objects. At this stage, the data of the excavation context are also assigned, preferably from an established stratigraphic sequence. Specifically, the trench, unit, and layer from which the object comes. The chronological and spatial identity of the artefacts is recorded at this stage. Although some bone artefacts have been included that do not come from secure units, they have retained distinctive features. The site from which the artefact came provides important information about the activities of prehistoric people. For example, if it comes from an open/closed space, it may provide information about the community, or the limited nature of the work done with bone tools. In particular, the excavation and layers, the unit number, the small find number, the actual find number, the area and site, the context, and the coordinates (x, y, z), of the find are recorded. The contexts were organized and identified from the

excavation diaries, materials and publications of the excavators. Based on the excavation diaries, the following types were identified: building, open/closed space, pit and ditch/ foundation pit, thermal structures, bone accumulation fill, settlement exterior, etc.

The second stage is the macroscopic analysis which includes assigning artefacts according to their typology. Typology has been based on the morphology of the object, which in turn is usually linked to function (tool or ornament or unknown processed artefact) (Russel, 1990). Afterwards, the specific kind of object will be recorded (awls, double points, chisels, etc.) and the part of the object which is preserved (active edge/distal edge etc.). Furthermore, it is recorded the percentage of the saved tool and which part of it is saved. The orientation system used in this study largely follows the logic proposed and applied by Stordeur. According to this, any intact object, regardless of its shape, is divided into 3 parts: active end, shaft, proximal part, x (length), y (width), z (thickness) (draw 3.1). The active end of the object is identified with the front part. The center of the tool (shaft) is usually the continuous part of the object, which may show signs of processing and use, and the back of the object is the proximal part - the non-active end of the object. In cases where there are multiple use surfaces, the front surface is defined as the surface that bears the most pronounced traces of use or is more extensively preserved than the others. The preserved surface recorded refers to whether the artefact we are trying to identify is intact (the whole object), almost intact (a very small fragment of the object is missing, allowing it to be identified in the tool and ornament categories), or a fragment (a fragment of a bone object that shows traces of processing and use, but hardly allows the object to be identified in the individual artefact categories). Stordeur categorizes tools as either whole (sur bloc) or fragments (sur fragments osseux), believing that such a distinction can reveal what they were intended to do, as well as patterns that are likely to be identifiable with the culture and chronological phase in question (Stordeur 1974, 102; Stordeur 1978a, 88). The categories of almost intact and fragment can be further investigated. Therefore, the surface of the fragment and the position of the fragment were recorded. The fracture surface refers to the part of the bone missing from the tool. For example, transversely the upper or lower part is missing, and longitudinally the right or left part. The fragment position field refers to the parts of the tool that are preserved, e.g. the upper right part, or the whole right part, etc.

Bone measurements were taken at this stage. The tools used for measurement were the pachymeter and the protractor. For the pointed and edged tools, the maximum length, maximum width and thickness were recorded, and the width at 10 and 30 mm, the angle in the pointed objects and the width of the edge in the edge tools (wide active edge) were measured. In this phase of the recording, the type of edge of the cutting edged objects was

also recorded. The categories are as follows: straight/asymmetrical, concave, convex, double bevel. The measurements are necessary if we want to study the breakage patterns and the progression of wear and processing marks. For example, it was observed that, in general, there were traces of use in the awls (in most of them, more than 30 mm) from their active end to 10 mm. On the other hand, from 10 mm and towards the proximal end of the tool, there are traces of processing, indicating that the object penetrated and encountered the material to be processed up to these millimetres. On the other hand, tools with bevel (mainly halved) also show traces of use on their sides, indicating that the object was in full contact with the material being worked. At this stage, the cross-section of the object was also taken: rectangular, circular, elliptical, plano-convex, convex.

The third stage of the inventory concerns the choice of raw material to produce bone tools and artefacts. According to some researchers, the raw material is the most important characteristic for obtaining results on the manufacture of bone tools (Moundrea 1981,268). The raw material (animal size, animal species, anatomical characteristics of the bone, etc.) is recorded, which may prove useful in the final synthesis for understanding the choices of prehistoric humans and the diversity of tool uses (Hodder 2014, 31). The choice of raw materials could also shed light on both preferences and economic choices. Why did they choose a particular species? Was it because it was in the majority? Were some species easier to find or process? First, the size of the animal was recorded. Three main categories emerged from the recording of the material: cattle size, sheep/goat size, and small size animals. Where possible, the family of the animal was also recorded (cattle, pigs, deer, sheep, goats, rodents, hare, fox, dog, bear, wild boar, bird etc.). However, in many cases, it was not possible to classify the raw material due to intensive use or processing. The type of bone was then recorded. There are five main categories of bones found in bone tools and objects: long bones, flat bones, fish bones, antlers and teeth. The first two categories are divided into sub-categories: tibia, metapodial, metatarsal, metacarpal, ulna, rib, shoulder, fibula, humerus, femur etc, right, left, distal, proximal. In addition, the category 'unknown' has been added for bones that are difficult to identify. The identification of the bones was carried out by the author in collaboration with Professor Paul Halstead for the Paliambela assemblage and Roula Chronaki for the Kleitos, Kato Ayannis and Revenia assemblages.

The fourth stage involves a stereoscopic study of the entire material, based on the principle of observing all surface deformations (Semenov, 1964). Different materials (flesh, reeds, skins, roots, clay, soil) leave distinct marks on bone tools. Additionally, bone modification can result from contact with flint, wood, stone, sandstone, and later metal objects (Russell, 1990; Aimar et al., 1998). Stereoscopic analysis is crucial for identifying

traces of processing and use, informed by experimental studies (Legrand and Sidera, 2006). It is important to consider that prolonged burial alters an object's surface. A typology of traces and their grouping is established through systematic microscopic examination. All identifiable working techniques using the stereoscope are recorded, such as longitudinal sawing, transverse sawing, breaking, perforation, scraping, abrasion, and unknown techniques. Manufacturing techniques are documented based on stereoscopic observations, though more techniques may have been used than can be identified. Use-wear traces are grouped and recorded with magnifications up to 00x. Striations along the longitudinal axis of the tool are categorized and recorded as thin/thick, wide, dense/sparse, between dense/sparse, or unknown. Their depth is classified as shallow/deep or unknown, and their orientation is noted as vertical, parallel, diagonal, or combinations thereof, as well as irregular or unknown.

The final stage involves recording the surface of the object and its taphonomic characteristics, including color and sediment presence. Corrosion is classified as low, medium, high, unrecognizable, or unknown. Sediments are categorized based on their nature (reductive sediments, gravel, ash, organic sediments, roots, calcareous) and quantity (low, medium, high, unrecognizable, unknown). Additionally, the color of the sediments and any evidence of burning are documented.

Artefacts were recorded according to size, length, angle, size and type of active end. Bone tool measurements were treated with caution, especially length and edge measurements, as tools are constantly reconfigured during use, breakage and repair. Variations in measurements are not significant in terms of style or function but are related to duration and intensity of use (A. M. Choyke and Schibler 2007). All documentation was stored in a database (Access) and data were statistically analyzed using SPSS (fig.3.1). Photographs and drawings were digitized using Adobe Photoshop and Corel Draw.

Chapter 4 - The Neolithic Settlement of Revenia Korinos in Pieria

4.1 Research history and context

The settlement of Revenia Korinos is located in the northern part of Pieria, bordered by the Aliakmonas River to the north, the Pieria mountains to the west, the Mavroneri River to the south, and the Thermaikos Gulf to the east (Αδακτύλου 2017b; 2017a; Besios, M. Adaktylou, F., Kontogiorgos 2009:1025). It lies between the Gerakari and Agios Dimitrios streams, which originate in the Pieria mountains and flow into the Thermaikos Gulf. The surrounding area features hills to the north and west, while the Korinos plain extends to the south and east (Αδακτύλου, 2017a). Geoarchaeological research in the Agios Dimitrios and Gerakari streams has identified episodes of alluvial deposits dating from the Neolithic period (before 7600-7351 BC) to 1418-1627 AD, affecting the visibility, preservation, and locatability of archaeological sites (Μπέσιος, Μ. Κραχτοπούλου 2001:385).

The excavation campaign at Revenia began in 2001 and lasted in 2004. In total, the excavation covers an area of 850 m2 while the total area of the settlement is estimated at around 40 ha., based on the surface evidence (Μπέσιος, Μ. 2004:357; Besios, M. Adaktylou, F., Kontogiorgos 2009:60; Maniatis and Adaktylou 2021:1025). The excavation was funded by the ΙΣΤ' Ephorate of Prehistoric and Classical Antiquities and the ΚΖ' Ephorate of Prehistoric and Classical Antiquities (Μπέσιος, Μ. 2004:357). The Neolithic site at Revenia Korinos is dated according to pottery finds in EN (Παπαϊωάννου 2011) and recent C14 analyses have confirmed this chronological span (Maniatis and Adaktylou 2021:1025) to the Early Neolithic period. It is an open, extensive settlement, about 5 km from the modern village of Korinos. The C14 analyses prove that the settlement is one of the earliest sites in northern Greece and the Aegean (Maniatis and Adaktylou 2021:1047). The pottery shows that the site has been occupied since the early EN, however, the samples become richer during the late EN period (Maniatis and Adaktylou 2021). The C14 results confirm that the first occupation phase of the settlement is placed at 6600/6550 BC. The initial phase of subterranean or semi-subterranean pit dwellings is succeeded by the phase of above-ground dwellings with rectangular buildings (Besios, M. Adaktylou, F., Kontogiorgos 2009:1025). The period of pit occupation, based on the pottery and C14 results, dates to the early EN and the beginning of a late EN phase, while the above-ground buildings date to a second phase of the late EN (Maniatis and Adaktylou 2021:1026).

The architectural remains

The Neolithic settlement of Revenia presents two types of occupation, the underground pit dwelling which represent the earliest phase of occupation, and the above - ground dwellings which follow chronologically (Besios, M. Adaktylou, F., Kontogiorgos 2009). The

chronological phase with the rectangular buildings can be described as stratigraphically disturbed and rather poor concerning its findings. Therefore, the architectural remains that have been studied in detailed, consist mainly of pits dug in the natural bedrock, postholes, and ditches. In total, more than 100 pits have been excavated. Their density is greater on the eastern side of the settlement, where the first phase of occupation can be seen. (Besios, M. Adaktylou, F., Kontogiorgos 2009:59). The western part of the settlement is situated at a higher level and this has resulted in several pits having a reduced depth due to erosion (Map 3) (Μπέσιος, Μ. 2004:358).

The pits vary in size and shape, they are circular and ellipsoidal, with a diameter from 0.50 m to 5.20 m, but also rectangular with dimensions of 3.25 x 2.95 m, while the depth of their deposits ranges from 0.07 m to 1.68 m (Besios, M. Adaktylou, F., Kontogiorgos 2009; Μπέσιος, Μ. 2004:358).

In Greece, archaeologists have categorized pits according to their use. Thus, they are considered to be residential, storage, disposal or workshop areas. Other approaches include clay extraction pits, pile receiving pits (pile holes), fire pits or pits for thermal constructions (ovens, hearths, cremations), water collection pits and wells, burial pits (for burials and cremations), pits with possible ritual use (for the deposition of animal or human burials, building remains and various artefacts) (Παππά 2008:313-341; Χονδρογιάννη-Μετόκη 2008:464-497). At Revenia, the pits are diverse on terms of their contents both in terms of artefacts and household items (Κοτζαμάνη 2009), suggesting that the inhabitants practised both agriculture and animal husbandry (Isaakidou, Halstead, and Adaktylou 2018). From the pottery and obsidian remains, it seems that the inhabitants of Revenia also had contacts with the Balkans (Besios, M. Adaktylou, F., Kontogiorgos 2009:1027).

Based on construction elements (e.g., size, associated postholes, occasional burnt clay superstructure remains, and other features), some pits were classified as subterranean or semi-subterranean pit dwellings, while others were classified as possible work areas and waste pits. The fills of individual pits also varied considerably, with some being rich in pottery and others in animal bones. It is suggested that the fills of most, if not all, of the pits were the result of structured deposition rather than random discard (Map 3) (Maniatis and Adaktylou 2021; Chapman 2000).

This structured deposition is also observed spatially (Maniatis and Adaktylou 2021:1026 Based on the distribution of finds, the south-east and north-west of the excavated area are dominated by pottery pits, the north-east by bone pits and some with few finds, while between the east and west sides there are four pottery pits. The pottery pits are those that contain a greater quantity of pottery than the other find categories. The bone pits either

contain very large quantities of bone or the bones are in the majority compared to the other finds. In some cases, these pits contained no pottery at all, but mostly bone tools, flaked stone tools and grinding tools. Some of the bones bore traces of broken articulations for marrow and fat. (Μπέσιος, M. 2004:360). In the settlement of Revenia it cannot be assumed that pits with a strong presence of bones and tools indicate the site where tool production took place, since the fill of the pits is a secondary structured deposit. However, the evidence for the extraction of bone marrow from zooarchaeological studies (Isaakidou, Halstead, and Adaktylou 2018) and the coexistence of zooarchaeological material (in animal bone pits) with a large number of bone tools (e.g. pit 18) supports the view that bone tools were processed and shaped during slaughter and food processing (Χρηστίδου 2006). Bone pits occur in dense clusters in the north-eastern region. In addition, the bone pits yielded rich charred material (Μπέσιος, M. 2004:360). The pits with few finds contain all categories of finds, but in small quantities. These pits are rather shallow, but it should be noted that they can be observed in the eastern part of the excavated area, where erosion rates are higher due to the downward slope of the ground (Μπέσιος, M. 2004:358).

Pits with vertical or almost vertical walls are considered by the excavators to be subterranean or semi-subterranean parts of houses with terraces. Most of these spaces, due to their small size, are intended to fulfill the storage needs of the household (Μπέσιος, M. 2004:358). The large pits, with or without terraces, usually had a great depth of fill and contained a lot of pottery, animal bones, daub (including burnt fragments) with organic impressions, and shells (Μπέσιος, M. 2004:359). There are also rectangular pits, which correspondig to rectangular house plans, such as pits 15 and 11. Two small postholes were also preserved in pit 15, while two Neolithic burials were found in pit 11. The dead were found in a contracted position, without grave goods (Μπέσιος, M. 2004:360). The Neolithic burials according to radiocarbon dating methods belong to the earliest phase of the settlement and are among the oldest Neolithic burials in Greece (Besios, M. Adaktylou, F., Kontogiorgos 2009:1025).

A total of 71 postholes were excavated and 43 of which are located inside or outside the pits. The remaining postholes are located in the south-eastern part of the excavated area and the excavators believe that they are part of the wall foundations of a rectangular building with more than one room (Μπέσιος, M. 2004:360). Three ditches were also excavated to the north-west and east of the excavated site. According to the excavators, these were wall foundation trenches for the rectangular dwellings, but no traces of postholes were found in them (Μπέσιος, M. 2004:362).

The initial phase of occupation begins sometime between 6600 and 6550 BC, followed by a rapid increase in the intensity of occupation, at least in the excavated area, after 6500 BC, peaking around 6460 BC. The intensity of occupation remains consistently high until around 6230 BC, when it drops rapidly and continues at a very low peak until just after 6100 BC. Due to the nature of the pit fills, which are thought to be mainly the result of secondary, structured waste deposition, apart from pits which retain traces of domestic use, the exact correspondence between the pottery phases and the dated samples is not always straightforward. (Maniatis and Adaktylou 2021: 1037-1039). Based on the dating of the pottery, which is abundant in the settlement, two phases have been identified. The older phase is characterized by simple shapes, with thick walls, monochrome, well-polished barbotine predominates, while the painted decoration is absent. In the next phase, the previous categories continue but the walls become thinner and the forms more complex with the written decoration dominating (Μπέσιος, M. 2004:362). Therefore, based on the combination of the relative chronology and radiocarbon results, two phases can be identified within the context of the pit occupation; an earlier phase of the Earliest Neolithic (EEN) and a more advanced, later phase of the Earliest Neolithic (LEN) (Maniatis and Adaktylou 2021: 1037-1039).

Many bones have been collected, and there are probably many fragments of sheep, cattle, and sus. Some of them bones show signs of burning, while few were antlers. Large quantities of shells, overwhelmingly dominated by shells of the species Cerastoderma glaucum. Possible structural fragments are many clay straw fragments, fewer floor fragments and raw bricks. (Μπέσιος, M. 2004:363). The small finds were dominated by ground stone and macrolithics artefacts, while very few were stone polished tools (axes, chisels, polishers, grinders). A large quantity of chipped stone tools was found, mainly flint, obsidian, and quartz blades. The cores are very few. Many bone tools, rounded sherds, clay pegs, clay coils, clay figurines (typically heads with the eyes carved or plastic), marble figurines, and clay seals were collected. The ornaments are represented by stone, circular beads, a few stone, bone, and clay pendants, several pierced shells, and a few stone "knobs" (Μπέσιος, M. 2004:363).

The well-defined contexts from the Revenia have yielded rich assemblages of different categories of skilfully made artefacts, as well as ecological objects, indicating a settlement where early agriculture (Κοτζαμάνη 2009) and animal husbandry were practiced (Isaakidou, Halstead, and Adaktylou 2018). The inhabitants of Revenia communicated and interacted with other settlements, and participated in exchange networks, as indicated by

pottery analysis (Urem-Kotsou et al. 2018) and the presence of obsidian in large quantities (Μπέσιος, Μ. 2004; Dogiama 2017; Maniatis and Adaktylou 2021: 1027).

4.2 Bone tools

This chapter introduces the bone industry of the settlement of Revenia in the region of Pieria. The aim is to present the specific categories into which the material under study has been classified. The main characteristics of each group are presented, as well as the questions arising from the archaeological classification. Aggregate data on bone tools, such as the numerical size of the categories (table 1) and their general distribution (table 2) are given, followed by a detailed presentation. For each group, issues of typology, raw materials used, production techniques, traces of use and their geographical and temporal distribution in the settlement phases are discussed, as well as the comparison of their presence or absence with other Neolithic bone tools in the wider region of Greece and the Balkans.

A total of 1485 bone objects were collected from all layers and units of the Revenia excavation (table 2). A total of 1147 bone objects were recorded and photographed, the rest were discarded and included in the zooarchaeological assemblage as they showed no signs of treatment or use.

Of the total of 1147 objects, 1097 are tools, 4 were classified as ornaments, 39 are by-products and 7 are unidentified objects showing traces of processing (table 1). Bone tools are found in most of the pits and represent the third largest category of finds (numerically) from the entire excavated site, after grinding tools and chipped stone tools. The study of the zooarchaeological material from the Revenia pits has been completed, so no further bone tools are expected to be found (Adaktylou 2017a:108). As discussed below, a high concentration of bone tools was found in pits 2,5,7,18,24,42,44,51.

The bone assemblage from the Revenia includes all the known Neolithic tool types (table 1,2) such as pointed tools 25.3%, edged tools 29.1%, these categories include hooks 0.3%, awls 18.7%, arrow 0.3%, perforators/pointed unidentified 5.3%, double points 0.4%, spatula 10.2%, axe 0.1%, edged tool/unidentified 2.3%, scrapers 0.3%, chisels 16.7%, polishers 0.1%, handle 0.1%, part 0.1%, byproducts 3.2%, and a very large proportion is occupied by unidentified bone tools 41.2%. Some of the tools seem to have been used a second time by being resharpened and reshaped. It seems that in Revenia, as in Paliambella, tools are recycled. A first observation about the Revenia bone assemblage is that it is mainly fragmented and shows a very high degree of erosion (table 4). In addition, many of the tools were welded together (new and old fractures), indicating the fragmentary nature of the material. In some cases, only the distal part of a tool is preserved, which can lead to speculation about the type of tool. However, a tool, its use and classification are typologically defined by its active end. Traces of burning for marrow extraction were observed on several tools, and then the bone was processed to make a tool. The treatment for the extraction of

marrow is confirmed by the zooarchaeological study of the zooarchaeological material. (Isaakidou, Halstead, and Adaktylou 2018).

4.2.1 Pointed tools

Although the most common tool category at all the sites investigated (Kleitos, Paliambela) is pointed tools, at the Revenia site edged tools are the most numerous categories (table 2). However, the fragmentary nature of the material and the abundance of fragments contribute to an incomplete picture of the bone assemblage. Based on experimental studies, pointed tools have a shorter durability and life span than edged tools (Christidou and Legrand 2005). It is therefore almost certain that many of the fragments present in the material belong to pointed tools. At Revenia, pointed tools make up 25.3% of the total material. Pointed tools are elongated objects made of bone, antler or teeth, partially or completely configured, varying in length, the active end consisting of a more or less sharp point, sometimes blunt or reshaped, and the proximal part of the tool shaped or unshaped (draw 4.1). (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990). Pointed tools are defined by a pointed tip that is the working end as indicated by use wear, sometimes the distal part is also worked. This category includes any object that has a sharp point. Depending on the degree of processing, there are many types of pointed tools (Leroi-Gourhan 1988:883). Thus, this category includes several classes of pointed tools, such as needles, awls, projectile points, double pointed tools, etc. Most points are produced on the bones of sheep/goats, cattle, red deer and roe deer.

These are tools that were part of the toolkit of prehistoric man, from Palaeolithic hunter-gatherers to the organised societies of the Bronze Age (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:1). This type of tool is associated with the way people lived throughout prehistory. It was originally associated with the tanning of leather, for which there was a need for specialised tools. Over time, however, especially in the Neolithic, these tools became associated with basketry, pottery decoration and other uses (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:1). Over the years, the variety of types has increased, reflecting the diversity of uses. With the advent of the analysis of use wear, albeit with some problems, and the experimental study, the use of the tools was approached from a better position.

The first find of a bone pointed tool dates back to 1833, when Schmerling discovered a long bone fragment with a sharp point and cutting marks in the Engis area (Liège, Belgium) (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:1). For the Upper Palaeolithic, G. and A. de Mortillet already in 1900 defined pointed tools as bones or long bone fragments cut into more or less sharp points. According to Ch. Leroy-Prost (1975), the first classification was made by Didon in 1911. He identified 4 types of pointed tools with a coarse point, irregular point, flat point, and cylindrical point and added to the morphology of the distal part more

detailed distinguishing features such as anatomical origin, dimensions, decoration and observed traces. However, the Upper Palaeolithic produced many more spectacular objects that have been somewhat neglected by researchers (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:2). A classification of Neolithic pointed tools was given by Troyon in 1860. The variety is described according to their cut, their sides, their bases, and the way they were held. Troyon distinguishes categories such as needles, awls, spears, arrows, etc., and all these identifications are made in comparison with modern tools used by saddlers, potters, and shoemakers (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:2). Over the years, many attempts have been made to approach the study of bone tools with different types, such as the Epipalaeolithic and Neolithic typology of the Maghreb and Sahara presented by H. Camps-Fabrer in 1966, and later by Ch. Leroy-Prost who distinguished 4 main types of Aboriginal pointed tools in 1975. However, subsequent studies have also attempted to approximate the typology of bone tools, mainly based on manufacturing techniques and raw materials. The methods of studying bone tools have evolved considerably over more than a hundred years of research (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:2).

As mentioned in Chapter 3.2, although bone artefacts appear in the Neanderthal era and are the longest-lived prehistoric tool (Soressi et al. 2013), systematic study of the entire material is still underdeveloped. Compared to pottery and stone tools, which are considered culturally diagnostic, bone tool potential is hitherto less explored (Choyke and Shibler, 2007, 51, Gates St-Pierre and Walker, 2007, 1). This has contributed to the lack of a specific framework and universal typology for all bone objects. Typology is often left to the discretion of the individual researcher.

4.2.1.1 Awls

Among the pointed tools, awls are the most common category with 18.7% (215). Most awls are slightly corroded (low=101, medium=93), while only a few are severely corroded (high and very high=21) (table 4).

In terms of raw material, most awls are made from long bones (88.4%), while only 3.3% are made from flat bones and 7.9% from unidentified bones (table 5). Most of the awls with unidentified bone as raw material (7.9%) are objects with only the active end preserved and of very short length. For awls, only metapodials, tibiae, fibula and radius have been identified and the majority are long unidentified bones (table 6). Most are from sheep/goat sized bones with only a very small sample from cattle sized animals (table 7). Several of these could not be identified to any animal size. The animal families that could be identified were sheep/goats (58.1%), with only one from fish, one from fox, one from dog, one from carnivore and two from pig. A large proportion were of unknown family (39.1%) (table 8).

Most of the tools are fragments 79.1%, the intact ones cover 13.5% and the almost intact ones 7.4%. A total of 119 items is preserve more than 90% of the tool, 6 identified only the shaft and convergent lines ending in a point, 16 items salvage part/half of a tool from the active end to the proximal part, 64 items salvage only the active end and shaft, 8 items salvage the shaft and proximal part, and one item salvage a very small part of the active end (table 9). In order to classify a tool in terms of typology and to identify the part of the tool that is preserved, manufacturing techniques are also taken into account. If an object preserves the converging lines ending in an active end, it is classified in the appropriate category according to the active end. Although many unidentified tools could belong to the awl category. It was thought appropriate to consider the active end and the typology without hypothetically assigning objects to categories. The fact that in all the assemblages examined, sometimes more, sometimes less, waste of the reduction techniques used were found helps us to understand the steps of the craftsman (chaîne opératoire). There are examples of chisels being used as awls in their second use.

Where possible, the cross section was measured at the active end (at 10mm and 30mm above the tip of the tool), however in some cases where the active end was missing, the cross section was measured in the 10 mm remaining above the active end, as this is the part that most often preserves traces of use. Studying the cross-section helps to understand the movement of the tool, how much it was used, and, more importantly the cross-section largely determines the the extended degree of use of the tool. For example, awls with a highly elliptical cross-section were not selected for use in skin perforation. The cross sections of the active end observed in awls are circular, elliptical, planoconvex, rectangular, and unknown. The highest percentage is elliptical with 43.7%. The unidentified ones are either very eroded or have a lot of sediment.

Almost every known manufacture technique can be found in awls (table 10). These include abrasion, cross-cutting, grinding, scraping, longitudinal sawing and combinations of these. The most common combination is abrasion, longitudinal sawing and scraping. Several items are derived from splinters, and we will discuss these below. The raw material plays an important role in the technique to be applied to an object. The physiology of each bone is very specific and "guides" the craftsman in the choice of manufacturing techniques, so each bone may undergo different manufacturing techniques to produce a tool. A second factor that determines the choice of techniques is the future use of the tool.

Tibia are one of the most common raw materials used by Neolithic people. They can be shaped by percussion and then by abrasion of the active end. The Revenia bone assemblage includes 13 tibia awls. The tibiae found in the Revenia material appear to have

been used intact, without bisection on the long axis of the bone, with the exception of one object that has been split (fig.4.1) One epiphysis is removed by percussion and two convergent notches are made on one side of the shaft by longitudinal-oblique grooving/sawing and then deepened by abrasion to the medullary part of the bone. Initial dissection of the bone was performed by percussion. The bone was then sawed longitudinally, scraped and the edges smoothed by abrasion (draw 4.1d, e). The epiphysis is usually intact at the proximal end of the bone (Base of the object) (this could be removed by transverse sawing). The undivided diaphysis has been fractured obliquely to accommodate the proximal part of the object and sometimes retains traces of this fracture, which may be roughly smoothed, well polished or beveled. The oblique fracture obtained by percussion makes it possible to remove an epiphysis; this zone does not show any traces in the material of the Revenia, except for some by-products in the tools which are complete. Abrasion is not used along the entire length of the tool, but only to shape the active end and smooth the distal part.

The tibia are preserved from 3 to 8 cm. Most of the bones are fragments and only 4 are intact. Those that are intact retain the distal part and some have been ground off and smoothed. All have a polished active end from use, except for one tibia from a fox. The animal families that could be identified on the tibias are the sheep, the goats, and foxes.

There is only one bone awl from a fibula (fig.4.2). It is an elongated pointed object taken from a dog's fibula and has preserved the entire epiphysis (proximal or distal) at the proximal part of the tool. Only the part of the active end and the shaft are shaped. The diaphysis and the distal part are preserved, but the tips converge in the direction of the awl and the length reaches 5 cm. The fibula of small mammals and dogs breaks in the proximal part of the diaphysis, where the bone has a smallest cross-section and therefore less strength (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990:5).

There are only two ulna bone tools and they come from sheep and goats (fig.4.3). One is intact and the other retains the active end and part of the shaft. Their tip is massive with an elliptical cross-section. The one that survives intact retains the epiphysis used as a handle (fig.4.4). The choice of the ulna as a pointed tool was mainly because the active end was easy to shape and that the proximal part did not need to be worked to make a good handle. The rounded projection at the tip, with its flat sides without any bumps or ridges, is perfectly adapted to the width of the hand. The shape of the bone helps to limit the shaping of the distal part, which probably provided a comfortable hold. It is easy to separate from the radius. However, it does not appear as a raw material to any great extent in the Neolithic and Bronze Age, which may have something to do with its resistance to the tasks for which bone tools were used. The technique applied to these very lightly worked objects is the same as that

described for all bones. The first step is to separate the ulna from the radius. The angular fracture of the distal part retained as a point is usually followed by very deep scraping and even abrasion, resulting in very sharp points. The proximal part of the tool may be left rough or partially sawed and then ground. Traces of use are observed only a few millimeters from the tip of the active point, indicating that the tool was not used along its entire length.

The awls from metapodials are 36 in total, 34 from sheep and goats, with both metatarsal and metacarpal being used in equal proportions (fig.4.5), (draw 4.1a, b). The variations in the tools obtained from the metapodials are several and perhaps aimed at different uses of the tool. Although the traces of use were not extensively studied in this thesis, the striations located at the active end of the tool were recorded on all tools and it was observed that they did not all follow the same pattern. This is a hypothesis that could indicate different uses of the tool. Apart from one object that shows few traces of use and appears to be a by-product, there are no awls from unsplit metapodials that preserve the entire epiphysis (distal or proximal) in the Revenia assemblage. One unsplit worked metapodial is from a juvenile and is not yet fused. At this young age, the animal does not have a fully developed bone, making longitudinal dissection difficult. However, several juvenile unfused bones are found in the Revenia assemblage.

Some have an elongated sharp or blunt end and are taken from a dissected metapodial that has retained the entire pulley of the distal part, which serves as the proximal part of the tool, and whose diaphysis has been broken at an angle after removal of the epiphysis. The active end terminates in a point that is often highly polished and can form a very sharp and robust point with concave edges. The cross-section at the active end of these tools is mainly circular and elliptical. This is due to the fact that the metapodials are more easily supported in the wider part and to the anatomical nature of the bone, which forms an internal partition that must also be cut to separate the whole bone. Their cross section is also circular and sometimes elliptical. Contrary to later periods, where it is quite common, as in the NN and FN Kleitos, the proximal part of the tool in Revenia is not smoothed by abrasion on both sides.

In addition to bisected metapodials, we also have metapodial quarters. The bone is broken into four pieces and bisected on both sides (anterior and posterior). The metapodials quarters are mainly found in the proximal part of the bone because it is easier to re-bisect. Their cross-section is elliptical, in some tools where the pointed tip is not preserved, the cross section is planoconvex. The category of metapodials awls also includes those in which the distal part of the bone has been removed and a relatively long bone length has been preserved

(fig.4.6). These are more like needles, but without the distinct hole at the base of the tool, and their cross-section at the active tip is circular.

In all tools the cross-section of the shaft is convex/concave and as we approach the active end the bone is quite polished from use. In most cases, the traces of use do not exceed 1 cm, indicating that the metapodial awls were in contact with the object/material to be worked only at the tip. The same picture is not observed for metapodial awls that spare the proximal epiphysis and resemble needles. In these, traces of use can be found almost along the entire length of the tool. In addition, there are burn marks indicating that they were in contact with heat. However, this may be due to the post deposition processes that the bone undergoes. The length of the awls from the metapodials varies, with the majority ranging between 3 and 7 cm. Fifteen of these awls are preserved intact, and 7 are almost intact, 14 are fragments.

There have been too many experimental studies and reconstructions. Different results are obtained depending on the inclination of the tool during the fracture and the working process. If the impact is perpendicular to the bone, two fragments are obtained, the length of which varies according to the point of impact chosen. This can be either distal or proximal; in either case, there are four possibilities depending on whether the impact is on the anterior, posterior, internal or external surface. If one of the resulting fragments is used in this way, it will necessarily have a full epiphysis, whether anatomically distal or proximal. The bone may have been lightly abraded to smooth the surfaces laterally (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990). It should be noted that the fracture zone is preferably chosen laterally, both because the proximal part of the bone rests more easily on the wider part and because the anatomical nature of the bone creates an internal partition that also needs to be separated.

There are 3 awls from the femur (2 tools) (fig.4.7) (draw 4.1c) and radius (1 tool) (fig.4.8). The awl from the radius is from sheep/goat and is located in pit 11, only the active end and the shaft survive and have been sawed on the longitudinal axis and abrasion. It has an elliptical cross-section and traces of use survive up to ~2 cm; it is fairly polished and smoothed from use. One of the two femur awls is from pig (fig.4.7a) and has essentially undergone only a light grinding treatment on the active end; it is a long bone splinter and was found in pit 29, while the second is from sheep/goat (fig.4.7b), and found in pit 51, is almost intact and has undergone sawing on the longitudinal axis and abrasion. As will be discussed below, the Revenia bone assemblage is quite fragmentary and eroded, and unidentified long bones make up most of the bone tools and include all these categories.

The most numerous category of awls is that of unidentified long bones (134 objects). Three are from small animals, 111 from sheep/goat size animals, 2 from cattle size and 18

from unidentified animals; 79 are whole, 6 preserve only the shaft, 7 the active end, part of the shaft and proximal part, and 42 the active end and part of the shaft. Most tools survive from 2 to 5 cm in length; most have an elliptical and circular cross-section at the active end. In the few millimeters above the active end, most cross-sections follow the physiology of the bone and are planoconvex. Most of the undiagnosed bones (66) have been subjected to abrasion and scraping, 15 of these are splinters, 9 can only be identified by abrasion, in all the rest a combination of grinding-scraping, longitudinal sawing, sawing-scraping, abrasion techniques is observed.

The number of awls from ribs in the Revenia bone material is 6. All rib awls are bisected and come from large animals (draw 4.1f). The procedure is the same as for ribs. The bone is sawn crosswise to the desired length, the lips of the bone are removed by percussion if necessary and then the angle is created by abrasion. The spongy tissue of the bone in the split ribs can be trimmed by abrasion or remain rough. In the Revenia bone set, the ribs are mainly used to make cutting tools such as spatulas. Ribs are very fragile due to their thinness and can be accidentally broken, so there may be fragments of piercing tools in this category, but we cannot be certain that they belong to this group of tools. The length of the pointed tools from side-to-side ranges from 2 to 4 cm, while the cross-section of the active end is elliptical; 2 of them are preserved intact, 1 preserves the active end, part of the diaphysis and part of the distal part, 2 preserve the active end and part of the diaphysis, and 1 preserves the diaphysis and the distal part. All have been subjected to abrasion and longitudinal sectioning and one has also been subjected to transverse cutting.

Only one of the awls is from a fishbone (1049), the only fishbone object preserved in the Revenia bone assemblage. It is abraded and has a circular cross-section.

The distribution of awls within the context of the site is wide, with bone awls found in almost all pits (table 11). The highest concentration is in pit 18, where 17 bone awls were found (7.9% within the tool, 21.3% within the surface). 21.4% (46 bone awls) are found in unidentified contexts, 4 in the area, 1 in pits Pit 3, 4, 45,47,48, 53, 56, 58, 62, 67, 71, 72, 48g, 5g, 76, N. Area, NW Area. Area, NW Area, cobble, 2 in pits 10, 20, 25, 39, 41, 43, 44, 29g, trenches 1a and 1b, 3 in pit 11, SE Area and pit cleaning, 4 in pit 24, 5 in pits 6,29, 6 in pit 5, 18 in pit 5b, 9 in pit 7, 10 in pit 5, 11 in pit 42, 12 in pit 2, 14 in A. Balk, 17 in pit 18, 19 in B. Balk. These represent the largest proportion of the tool categories, and it makes sense that their distribution would be widespread. The spatial distribution and analysis of the architectural remains will be presented for all tool categories together in a later chapter of this paper.

4.2.1.2 Needles

Needles usually have a thin body and a hole, an 'eye', and throughout prehistory from the Upper Palaeolithic in Europe, needles follow a similar pattern in their construction (Stone 2011). They are usually finely worked, delicate and approximately the size of modern needles; the morphometric characteristics commonly recorded are length, width (maximum diameter), thickness (minimum diameter) and cross-sectional shape. The diameter of the eye is rarely reported, although the diameter of the eye and the method of manufacture have been recorded in the present material. On prehistoric needles, the eyes were either drilled on both sides of the proximal end (Flenniken 1978), or a slit was opened on both sides by flaking off scales (Osborn 2004). The first step may have involved removal of bone tissue to create a depression for the insertion of a drill (Lyman 2015:149). Some researchers have made replicas for experimental studies, suggesting that needle eyes were added after final shaping and sharpening (Hoffman 2002), while others have found that final shaping before eye formation often results in needle breakage due to the very small cross-section of the needle shaft. The edges may be convergent, straight or rounded; in relation to those of the shaft, they may be continuous or intermittent. This is the point where the eye is perforated. It is usually characterized by thinning and flattening features, with flattened features being the most common.

There are a total of three needles (0.3%) in the Revenia bone material (table 2, fig. 4.9). None of the objects are intact (draw 4.1g), but the surface of the needles is slightly eroded (table 4,9). All three have an elliptical cross-section of the active end, with part of the active end, shaft and distal part preserved (table 9). All are from long bones/unidentified, and one has been identified as sheep/goat (table 5,6,7,8). All have been sawed on the longitudinal axis and then abraded or scraped (table 10). The eye in one of them has been produced by flaking and rotation, in the other by rotation alone. Their lengths range from 3 to 6 cm.

Their spatial distribution is as follows: 1 in an unidentified context the second in B. Balk and the last in pit 29g (table 11).

4.2.1.3 Perforators (awl with blunter active end)

It is usually an elongated object with the proximal part blunt, rarely sharp, with a smooth axis and the active end tapering to a point. It does not create as acute an angle as an awl, but its active end can be angled from 10o to 40o. Their points were more massive than those of the awls, and were sometimes made ad hoc, more carelessly, from fragments of broken bones left over from meals (Lisowski, Pyzewics, and Frankiewicz 2017:249). These objects are referred to in the literature as awl-type, pointed, rounded points, etc (A. M. Choyke and Schibler 2007; A. M. Choyke 1997; Alice Choyke 2019; Christidou and Legrand 2005; Στρατούλη

1993; Lisowski, Pyzewics, and Frankiewicz 2017; Cristiani and Borić 2016; Vitezović 2016a). There are 61 bone perforators (5.3%) in the Revenia bone assemblage (table 2). The majority are fairly eroded, (34) 20 have better traces of use and treatment, and 7 have a severely eroded surface (table 4). The majority are preserved in fragments (77%), only 8.2% are almost intact and 14.8% are intact. They preserve most of the three bands, only the active end and shaft, and part of the active end, shaft and part of the proximal part (table 9, fig.4.10).

As for the raw material similar to awls, most are unidentified bones of unknown species, but some perforators retain anatomical features that allow us to identify some species (table 7,8). Of the long bones/unidentified, 19 are from unidentified bovid species, 14 from goat and sheep and 1 from cattle. Splinters were observed as in the other categories. The ribs are all from large animals, the tibiae from goat and sheep and one from deer, the 3 ulnae from goat and fox, the humerus from sus and the metapodials from sheep-goat (table 5,6). The cross sections are circular, elliptical, and planoconvex and only 9 are rectangular. The length of the perforations in this category reaches more than 12 cm, mainly in the ribs and long unidentified bones. They are the longest of all the Revenia bone objects. There is a wide variation in the length of the perforators, from 2 cm to 12 cm.

In the case of perforators, the use of all processing techniques and their combination is observed (table 10). The long bones/unidentified have been subjected to abrasion, transverse cutting - grinding-scraping, longitudinal sawing, sawing on longitudinal axis-scraping, abrasion-grinding, scraping, abrasion-sawing on longitudinal axis-scraping, abrasion-sawing on longitudinal axis-scraping, abrasion-sawing on longitudinal axis. The ribs were cut in half in the manner mentioned above and sawed, sawed-scraped, abraded-sawed-scraped and splinted, the shafts sawed-scraped-abraded, abraded-sawed and splinted, the ulna abraded and scraped, the humerus sawed-scraped-abraded, the metapodial abraded-transverse cut, abraded-grinded-scraped-transverse cut and the unidentified bones abraded and abraded-grinded.

As the second most numerous category in the pointed tools, perforators are also widely dispersed in the archaeological context. However, apart from pit 5 where 6 perforators are identified (16.2%, 9.8%), one or two perforators are identified in the other excavation contexts. 1 is identified in: pit 6, 21, 25, 26, 29, 32, 41, 42, 43, 45, 49, 29e, 46b, 48g, 5g, and surface, E. Balk (2.5%, 1.6%). 2 perforations are identified in: pit 2, 10, 18, 19, 20, 39, 51 and from pit cleanouts. 3 perforators were found in pit 24 and in the N. Balk. Finally, 4 perforators were found in pit 7 and 12 perforators were found in an unidentified context (table 11).

4.2.1.4 Double points

Double points are complete or partially formed objects made from antlers or bone fragments with a point at each end. Double points have been found from the Palaeolithic to the Iron Age and can have many uses depending on the period and context in which they are found. These objects are taken from the thickness of the diaphysis of a bone or the tine of a deer antler; they are rod-shaped with two opposing points, which may or may not be symmetrical. They are formed by scraping, abrasion and sometimes light retouching. In most cases, this point has an ellipsoidal or circular cross-section, as the rod is completely smoothed around the point. Sometimes, however, the medullary canal of the bone from which the rod was taken is still visible despite the normalisation of the underside (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990).

J.L. Voruz defined 5 subtypes of Final Neolithic double points in Europe, but it is one type (double point) that is still found from the EN in Greece: 1. Straight, symmetrical, fully formed double point less than 3 mm thick and less than 5 mm wide. 2. Double point with a straight or curved axis, symmetrical, fully formed, which may have flakes in the mesial and cervical part, and bears very fine striations of use, probably derived from the passage of a ligament. 3. A double point with an unformed mesial part, with irregular, sinuous or flat curved edges and which may be rectangular or polygonal in cross-section. 4. A symmetrical double point, fully formed, with two notches in the middle of the upper and/or lower surface, on the sides, resulting from retouching or abrasion. Their length is between 85 and 88 mm, their width is between 6 and 9 mm, their sides are curved with grooves. 5. Double-edged with a regular distal tip and symmetrical edges. The proximal part may be asymmetrical, toothed, serrated, bevelled, pointed and relatively rough due to retouching, scraping or abrasion. These objects often show traces of resin, which may surround the medulla and the proximal part or be arranged in narrow, transverse, vertical or oblique bands according to the joint.

In the Revenia bone assemblage, there are a total of 5 double points (table 2, fig. 4.11) (draw 4.1h), 0.4% from long/unidentifiable bones, two from sheep/goat sized bones (1 tibia), 1 from cattle sized long bone and one from unknown size (table 5,6,7,8). The treatment marks identified in all the double points are abrasion, longitudinal bevelling and scraping (table 10). Three of these are intact and two are almost intact (table 9). As mentioned above, many of the fragments could fall into this category. The cross-section is elliptical in all objects and the length is between 4 and 6 cm. Apart from one, which shows considerable corrosion, the other four show very little corrosion.

Double points were found in one in pit 6, 24, 29, 72 and one on the surface (table 11).

4.2.1.5 Arrow

The number of objects identified as arrows is only 3 (0.3%) (table 2). However, many of the pointed tools or fragments could belong to this category. Two of these are almost intact and one is a fragment but retains the typological characteristics of an arrow (table 9). Two are from unidentified long bones and have a low degree of corrosion (low), while the last is from unidentified bone and has a medium degree of corrosion (medium) (table 4,6, fig.4.12). One is from a goat-sized bone, one from a cattle-sized bone and one from an unidentified animal (table 7). The families of the animals cannot be identified. Two of them have been subjected to abrasion, sawing on the longitudinal axis and scraping. In the latter, the abrasion techniques can be identified (table 10). The cross-section is elliptical in the first two and not preserved in the last, while the length is between 2 and 4 cm.

Arrows were found in pits 24, 34 and in an unidentified context (table 11).

4.2.1.6 Fishhook

Hooks in the Revenia bone assemblage cover only 0.3% (3 objects) (table 2). Their erosion is moderate (2) and low (1) (table 4). Two are from cattle size animals and one from sheepgoat size animals (table 7), while the family cannot be determined, but all are from animal ribs (table 6), which is quite unusual for this category in comparison with the Neolithic Macedonian and Balkan bone assemblages. Two are preserved almost intact, one intact with flake detachment and one preserving the active end, shaft, and proximal part with a detachment of part of the Central point of the tool and the proximal part, the latter being preserved in worse preservation and preserving all three points of the tool but fragmentarily (table 9). The cross-section of the active ends in all three is elliptical. The manufacturing techniques identified are in one abrasion, sawing on the longitudinal axis, scraping, in the second abrasion, perforation, sawing, scraping, and in the third abrasion and sawing on the longitudinal axis (table 10, fig.4.13).

Two fishhooks were found in pit 7, and one in an unidentified context (table 11).

4.2.1.7 Conclusions

According to the study and the statistics obtained, the pointed tools are the second most numerous category in the Revenia bone assemblage, accounting for 25.3% of the total material. It is one of the most important tool categories in all Neolithic bone assemblages. Their basic morphological characteristics can be summarized as follows: they are mostly symmetrical tools, with a straight profile; most of the awls are worked along their entire length so that the sides converge from the base to the sharp end. However, there are some, mainly from the tibia and metapodial, in which the proximal part of the tool remains rough.

The non-symmetrical forms are probably the result of reworking for renewal or repair (Χρηστίδου 2006). In addition, long bone splinters have non-symmetrical shapes because they are only worked on the active end, which is different from the rest of the body. This is observed in all the materials examined, as we shall see in the next section. Among the perforating tools, awls have the highest percentage of 18.7%, followed by the other categories such as perforators, needles, double points, arrows and fishhooks. In the general category of pointed tools, there is little erosion and enough sedimentation to help us with the taphonomic approach.

Most of them come from the long bones of medium-sized animals. Mostly metapodia, tibia, fibula, radius and long bone splinters are observed. A very small proportion are ribs from medium or large animals. It is noteworthy that fishhooks come from the ribs of medium and large animals, which is not observed in Neolithic bone tool manufacture. Fishhooks are usually made from the long bones of large animals. Fish, fox, dog, pig and carnivores have also been observed. Most pointed tools and all Revenia tools are fragments. The cross-sections are mostly circular and elliptical. Their length does not exceed 6 cm. The traces of use on most of the tools reach up to 1.5 cm, which shows the point at which the tool encountered the material to be worked. The traces of processing, summarized show that the pointed tools, depending on the bone (long or flat), followed the treatment predetermined by the bone. The treatment observed in the stereoscopic study is as follows: in the metapodial, the bone was bisected transversely (both the distal and proximal parts are preserved), resulting in two similar blocks. The outer cortex of the bone was then thinned by abrasion and bisected along the longitudinal axis using a cutting edge tool. The final finishing was done by abrasion, as was the shaping of the active end. On the tibia, the process began by fracturing the bone transversely, usually preferring the distal part where the object was intact. The tool and active end were then formed by grinding, scraping and abrasion. It was observed that most of the tibia pointed tools were probably in second use and the original object was a sharp tool. Radius and femur tools were slightly worked on the active end. Ribs that were not used intact were bisected. The lateral edges were first removed and then bisected on the longitudinal axis and normalized by abrasion. In some cases, scraping was observed to shape the active end. In the hooks, in addition to the bisection the bone underwent, a hole was drilled that was widened to accommodate the need to shape the active end. Based on the treatment traces, the hole was drilled by rotation rather than by flake extraction (Fig). The long bones used for double points were treated symmetrically on both sides of the pointed end. They were cut lengthwise and ground by abrasion. Awls follow the same logic, depending on which bone was used as raw material, but here the variation in the range of

angles differs from that of awls. In the perforators, there is a larger angle, not so pointed, and the traces of use are longer in the diaphysis than in the sockets. They are objects that require less care than awls. In the case of needles, both types of drilling, rotation, and flaking, can be observed.

4.2.2 Edged Tools

Edged tools are tools of simple shape, made from bone or antler, whole or cut, with the active part formed into a single edge or double bevel. In the case of antlers, the proximal edge is usually worked and polished. In the case of long bones, the proximal part may be worked to make it easier to hold, or it may have retained the natural articulation of the bone and remain rough.

Such tools were found very early in the deposits. They were called sharp tools because of their presumed function in comparison with the tools already known from ethnographic studies and modern remains. Thus, their general morphology associated them with wedges or knives, sometimes even polishers. These bone tools were identified very early; in 1847, J. Boucher de Perthes illustrated a metapodial preserved and bevelled at its active end, and in 1865, E. Desor published a metapodial split in two, also bevelled at its active end. As early as 1865, E. Lartet and H. Christy presented a deer antler from La Madeleine (Dordogne) with a bevel at the end. Scholars suggested that these tools were used as wedges for splitting or peeling wood or for preparing skins, referring to similar tools often found among Eskimos or North American Indians. Numerous definitions have been given, showing a certain confusion as to the exact identification of these objects: wedges and knives are rarely distinguished and are often associated with grinders. In 1910, Gustave Chauvet reported from sites in the Charente "large chisels cut into bevelled, sharpened blades, more or less wide at one end; the opposite end was struck with a stone or wooden hammer"; he compared them to modern chisels. On the whole, prehistorians of the following decades would retain these ideas and consider chisels as "powerful tools made of horns, the end of which was carefully bevelled" (Camps - Fabrer, H., Cattelain, P., Choi S.-Y., David, E., Pasqual - Benito J.-L., Provenzano, N. Ramseyer 1998). Knives and wedges are not linked and are often followed by the word "probably", which sometimes indicates greater solidity for the angles. They are generally intended for working with wood, leather, and stone.

In the last twenty years, researchers have abandoned functional criteria in favor of a finer morphological analysis. However, the criteria used to differentiate have varied, the question has remained open and each author has his or her own definition. (Camps - Fabrer, H., Cattelain, P., Choi S.-Y., David, E., Pasqual - Benito J.-L., Provenzano, N. Ramseyer 1998).

Cutting edge objects are found in most Upper Palaeolithic, Epipalaeolithic, Neolithic, Bronze Age and Iron Age deposits. They are found throughout the European region. The active end of most objects is bevelled, double-bevelled or convex. As always, the presence of a medullary canal or the appearance of sponginess due to the longitudinal separation of the object determines the inner side. In the case of double bevels, the inner side is determined by the largest bevel.

There were no significant spatial or temporal differences when examining these tools as well as the awls. The differences are due to the choice of handle and are essentially confined to the proximal part of the tool. The edges are parallel, sub-parallel and then converge towards the distal part. The morphology of the body of the object depends on whether it has been worked or left rough, e.g. in antler objects the center of the tool is usually left rough. Bevelled objects made from ulna or metapodial bone retain the natural contour of this bone. The profile is straight or retains a slight natural curve of the bone (slightly concave underside). Bevelling at the end of the antler allows the natural curvature of the antler to be accentuated. The peripheral part serves as an indicator and includes the common criterion for all parts, i.e. a single or double bevel. Obliqueness in long bones, whether broken or not, can affect the upper and/or lower aspect, and can affect one or both ends, or both ends together. In the latter case we have distant parts with 3 or 4 sides. The most common are straight or convex; oncotic or oblique ends are less common and hollow ends are rare (Camps - Fabrer, H., Cattelain, P., Choi S.-Y., David, E., Pasqual - Benito J.-L., Provenzano, N. Ramseyer 1998).

All bones are used as raw material for the specific type of tool, depending on the use of the final tool. Long bones, ribs, antlers and flat bones such as shoulder blades are used. Antlers are usually cut by direct hammering, splitting or transverse cutting. Beveling is done by scraping and abrading, notching and then trimming by polishing or abrading. Grooves are produced by grooving. In long bones, removal of the epiphysis by fracture or sawing. Longitudinal removal by fracture (direct or indirect) or by sawing along the longitudinal axis of the bone. The active edge is treated by an oblique fracture of one of the two edges, followed by shaping by abrasion.

There have been several cases of these tools being used. In addition, in recent years there have been several experimental studies which confirm or disconfirm these uses. Many of these objects should be used as intermediate tools: one edge (active end) to work the material, and the other edge (proximal part) to strike. The result of bevelling is a simple, non-specialised shape that adapts to many tasks. Through the study of surface conditions, experimental reconstructions and ethnographic comparisons, we can hypothesize that they

may have been used for leather working, fat removal, polishing, wood or antler working such as splitting wedges, peeling, chiseling and breaking, sometimes accompanied by flaking and polishing of the active end (Camps - Fabrer, H., Cattelain, P., Choi S.-Y., David, E., Pasqual - Benito J.-L., Provenzano, N. Ramseyer 1998).

4.2.2.1 Spatula

Spatulas are tools whose blanks derive mostly from flat bones, and more specifically ribs of large animals, while less often from long bones. The spatulas have an approximately rectangular morphology with parallel straight edges, a slightly curved profile and an active end with a convex or pointed morphology (Choyke 2014; Mărgărit 2017:202). In some cases, in other bone assemblages, the spatulas are made from a different raw material: antlers, either from the piece of tine or from the tooth, cut diagonally to give a flat surface (Morgenstern 2011). The spatulas in the Revenia bone assemblage, as summarised in the table 2, represent 10.2% (117 objects) of the total material (fig.4.14, 4.15, 4.16). Most of them (60) are moderately corroded, 16 are highly corroded and 41 are slightly corroded (table 4). In general, they belong to the category of relatively well-preserved tools. Eight are intact, 24 are almost intact and 85 are fragmentary. In other words, a high percentage of the whole tool is intact in 41, part of the active end, the shaft and the proximal part in 15, the active end and part of the shaft in 39, part of the shaft and the proximal part in 7 and only the proximal part in 2 (table 9). It is worth noting that several tools are joined or welded together. As shown in the table, animals of the size of a sheep/goat (5) and cattle (111) were used as raw material, in one object the size of the animal could not be identified (1) (table 7). From the sheep/goat family comes 1 object, unidentified sheep/goat size 4, cattle size unknown 111 and unidentified 1. Flat bones are 112 objects and long bones only 1. Ribs are 109 objects and 5 are unidentified flat and long bones (table 5,6,8).

The cross-sections recorded on all objects vary widely, as do the shapes and sizes of the edges. The observed cross-sections include circular, elliptical, planoconvex, rectangular, and unidentified forms. The shape of the edge, where measurable, is predominantly convex and straight, with 41 objects having unidentified edge shapes that could fall into either category. Except for one object with an edge length of less than one centimeter, the remaining objects have edge lengths as follows: 40 objects between 1-2 cm, 33 objects greater than 2 cm, one object greater than 4 cm, and 40 objects with unidentified edge lengths. The total length of the spatulas ranges from 1 cm to over 14 cm, making this category of tools among those with the best-preserved lengths.

The identified manufacturing techniques used in spatulas vary considerably (table 10). These techniques include abrasion with transverse cutting (1 instance); grinding, sawing on

the longitudinal axis, and scraping (2 instances); perforation, sawing on the longitudinal axis, and scraping (2 instances); sawing on the longitudinal axis (1 instance); sawing on the longitudinal axis and scraping (7 instances); abrasion/grinding (1 instance); unidentified (1 instance); abrasion, sawing on the longitudinal axis, and scraping (83 instances); abrasion, perforation, sawing, and scraping (1 instance); abrasion and sawing on the longitudinal axis (9 instances); and abrasion, sawing on the longitudinal axis, scraping, and transverse cut (9 instances). In the ribs, both bisected and whole ribs are observed, with the majority being bisected. The processing sequence for ribs is similar to that used for other tool categories. The bone is sawed transversely to achieve the desired length, the lips are removed by percussion if necessary, and the angle is created by abrasion. The spongy tissue on the divided ribs can be ground through abrasion. Spatulas from the Revenia site, like those from other Neolithic sites, also show decoration. The spatulas from pits 25 and 18 feature small teeth near the handle (fig. 4.17). However, these notches may have had a utilitarian purpose, such as for tying the spatula with a rope (draw 4.2a). The use traces detected under the stereoscope are not very visible. However, on the object from pit 25, there is a strong polish in the notches, suggesting contact with a plant fiber, possibly a rope or string. Spatulas, in their prolonged and fine use polish (with fine chips or details missing), appear to have been used primarily on soft materials, such as skins or clay pottery (Mărgărit 2017:202).

The highest concentration of spatulas was found in pits 7 (13 spatulas 20.8% 11.1%) and 18 (14 spatulas 17.5% 12%). One spatula each was found in pits 13 (100% within the area, 0.9% within the tool), 20, 25, 26, 30, 33, 39, 42, 45, 47, 50, 53, 48a, 48b, Central area. Two spatulas were found in pits 3, 27, 29, 41, 44, 51, 67, 5b, and 5g, pit cleaning. 3 spatulas were found in pit 2, surface and eastern Balk. 4 spatulas were found in pit 5. 5 spatulas each were found in pit 6 and the second Balk. 6 spatulas were found in pit 24. Finally, 26 spatulas were found in unidentified deposits (table 11).

4.2.2.2 Scrapers

The scrapers, as summarized in the table, represent only 0.3% of the Revenia bone tools, a total of 4 objects (table 2, fig.4.18). It is a category that does not belong to the chisels or the spatulas, but they do have distinct edges. Bone scrapers have a straight or concave active edge and are usually made from ribs and long bones. These tools are most commonly used in the fleshing and softening of hides (Arrighi et al. 2016:152). Ethnographic parallels and experimental studies suggest that these tools were used for working leather or were mounted on a wooden handle and used as axes. Their pronounced polishing is probably due to contact with animal material (Clemente-Conte et al. 2013; Arrighi et al. 2016; Morgenstern 2011).

Two out of the 4 have moderate corrosion, 1 has a small amount of corrosion and 1 has a large amount of corrosion (table 4). One tool is intact and 3 are fragments. Two are intact (<90% of tool surface) and the other two have the active end and part of the shaft preserved (table 9).

As shown in the table, the raw materials used were sheep/goat (1) and cattle (3) (table 7). There is 1 object from the sheep/goat family, 1 unidentified cattle size, and 1 cattle (table 8). Flat bone is 1 item and long bone is 3 (table 5). Rib is 1 object and 3 are from long bones, 2 tibias and 1 humerus (table 6).

The cross-section observed is elliptical in 3 and planoconvex in 1. All possible edge shapes are observed: 1 convex, 1 straight, 1 concave, and 1 double bevelled. The length of the preserved edge is >1 (1), 1-2 (1), <2 (1) and 1 unidentified. The total length of one of the tools is <18 cm, while the others are between 4 and 6 cm.

The identified manufacturing techniques are abrasion - sawing along the longitudinal axis - scraping (1), unidentified (1), and two are splinters (the original size and shape of the bone have been sligtly modified by abrasion to create the active tip) (table 10).

Their spatial distribution is 1 in surface layers, 2 in pit 24 and 1 in pit 7 (table 11).

4.2.2.3 Chisels

As mentioned above, tools with a cutting edge are the most numerous category in the Revenia bone assemblage. Chisels make up the largest part of this category with 16.7% of the total material (192 objects) (table 2). Most of them are slightly (116) or moderately (65) corroded, while only 11 objects are heavily corroded (table 4). Due to the small size of one object, it is not possible to determine the degree of corrosion with certainty. Seven objects are intact (no breakage), 27 objects are almost intact, and 158 objects are fragmented. This means that a large percentage of the entire tool is intact in 73 (over 90%), part of the active end, the shaft and the proximal part in 20, the active end and part of the shaft in 90, part of the shaft and the proximal part in 4 and only the shaft in 5 objects (table 9). It is worth noting that, like the spatulas, several of the tools are joined or welded together.

As shown in the table 7, the raw material used was sheep-goat size (163) and cattle size (19) (fig.4.19), for 10 items the size of the animal could not be identified. 141 items were from the sheep-goat family, 3 from goats, 1 from sheep, 1 from roe deer, 1 from goat/roe deer, 15 of unidentified sheep-goat size, 14 of cattle size unknown, 1 from cattle 1, 1 from wild cattle, 3 from sus and unidentified 10 (table 8).

Flat bones comprise 6 objects. The most common bones are long bones 182 and only one is unidentified. Ribs are 6 items, unidentified long bones are 68 items, tibia 94, femur 4, radius 7, metapodials 7, humerus 1, fibula 1 and unidentified bones 4 (fig.4.19). In this

category we also find chisels with the active end close to the epiphysis (distal part), which is not common in Neolithic material, supporting the view of tool and raw material exhaustion (table 5,6).

The cross-section recorded on all objects varies, as does the shape and size of the edge. The cross sections observed are circular (4), elliptical (18), planoconvex (155), rectangular (1), and unidentified (14) (table 11). The shape of the edge, where it could be measured, is predominantly convex (83) and straight (44), double bevel (7), and concave (4), while unidentified, which could belong to more than one category, is 54. Several objects preserve less than one centimeter of edge length (62), the rest preserve from 1-2 cm 90 objects, more than 2 cm 6 objects, more than 4 cm 3 objects and unknown lengths 31 objects. The total length of the chisels ranges from 1 to more than 10 cm. The longest length is preserved by objects with tibia as raw material. This leads to the assumption that this category of finds, the majority of which were made from tibia, used the entire width and length of the bone (draw 4.2b, c). It is a tool category that preserves some of the best-preserved length and erosion-preserved objects.

The manufacturing techniques used in the spatulas that have been identified also vary. They were identified as: abrasion - transverse cutting (2), grinding - longitudinal sawing - scraping - abrasion (4), longitudinal sawing - scraping (1), longitudinal sawing (3), abrasion (9), unidentified (1), longitudinal sawing – scraping/abrasion (101), abrasion - sawing (53), abrasion - perforation (1), abrasion - sawing on longitudinal axis - scraping - transverse cut (2), abrasion (6), scraping (1), splinters (8) ribs include both half and whole ribs (table 10).

The tibiae were shredded like awls, one epiphysis was removed by percussion, and two convergent notches were made on one side of the shaft by longitudinal oblique grooving/sawing and then deepened by abrasion to the medullary part of the bone. Initial dissection of the bone was performed by percussion. The bone was then sawed longitudinally, scraped and the edges smoothed by abrasion. The epiphysis is usually intact at the proximal end of the bone (this could be removed by transverse sawing). The active end was shaped by grinding and beveling. A similar technique is used for the other long bones. The long bones are broken across the shaft, with two convergent notches on one side of the shaft, and then deepened by abrasion to the medullary part of the bone. Except the femur and fibula, where only abrasion is observed.

Despite being the most diverse category of edged implements, they appear to be evenly distributed across the archaeological contexts of the site. This is perhaps indicative of the multiple uses that this tool may have had. The highest concentrations of chisels are found in pits 24 (12: 25%, 6.3%) and 51 (10: 26.3%, 5.2%). One chisel each was found in pits 1, 3,

23, 27, 29, 33, 45, 48, 49, 52, 66, 71, 74, 78, 29b. Two chisels were found in pits 8, 26, 28, 32, 36, 39, 59, 23a, 29g, 5b, 5g. Three chisels were found in pits 26, 34, 43, 44, 56, and 58 and in the pit cleaning. Four chisels were found in pits 4, 11, 46 and 47. Six chisels were found in pit 7, seven in pits 2, 5 and pit b. Eight chisels were found in pit 42 and nine in pit 18. 12 objects were found on the surface. Finally, 32 spatulas were found in unidentified deposits (table 11).

4.2.2.4 Polishers

Polishers make up only 0.3% of the Revenia bone assemblage (table 2). They represent bones that have been used without any obvious modification, although this use has sometimes resulted in considerable reshaping of the artefact. The edges have developed a deep double undulation as a result of use alone. Polishers were most commonly used on unsplit ribs, but also on split ribs and long bones (Russel 1990:531). The only tool recorded as a polisher from the Revenia bone assemblage uses split ribs as blanks (fig.4.20). The ribs are split lengthwise and then smoothed by abrasion. The tool shows signs of use along its entire length and is highly polished. Its corrosion is moderate, only the diaphysis is preserved in fragments (Tables 4,9). The raw material used was a cattle rib (tables 6,7). The family is difficult to determine. The cross section is planoconvex and the length is more than 10 cm. The manufacturing techniques used are grinding and sawing (table 10). The only polisher in the material was found in pit 18 (table 11).

4.2.2.5 Sharp tool/unidentified

Unidentified edged tools are those that, due to fragmentation or corrosion, cannot be assigned to any other category of edged tool. They make up a small percentage of the total material, 2.3% (table 2, fig.4.21). Most of them show little (11) or medium (10) corrosion, while only 5 show a fairly high degree of corrosion (table 4). Only 1 object is intact (showing no breakage), 2 objects are almost intact and 23 objects are fragmentary. In other words, 15 retain a large percentage of the entire tool intact (over 90%), 2 retain part of the active end, the shaft and the proximal part, 7 retain the active end and part of the shaft, 1 retains part of the shaft and the proximal part, and 1 retains only the shaft (table 9).

As shown in the table, the raw material used was sheepgoat size (6) and cattle size (17), for 3 items the size of the animal could not be identified (table 7). Of these, 3 are from the sheepgoat family, 3 are from unidentified sheepgoat size, 17 are from unknown bovine size and 3 are unidentified (table 8). Long bones are 9 items. The most common bones are flat bones 17. From ribs are 17 items, from long bones unidentified are 7 items and from ulna are 2 items (table 5,6).

The cross-section recorded on all objects varies, as does the shape and size of the edge. The cross sections observed are elliptical (12), planoconvex (3), rectangular (10), and unidentified (1) (table 11). The shape of the edge, where it could be measured, is predominantly straight (11) and convex (9), while 6 are unidentified and could belong to more than one category. Several objects save less than one centimetre of edge length (6), the rest save between 1-2 cm 8 objects, more than 2 cm 7 objects and an undetermined length 5 objects. The total length of sharp tools/unknowns ranges from 1 to more than 19 cm. The longest length was recorded for an object with ribs as raw material. This is a category that could belong to more than one sharp object category.

The manufacturing techniques used on the unidentified edged tools that have been identified vary. They have been identified: abrasion - transverse cutting (1), grinding - sawing on longitudinal axis - scraping (1), sawing on longitudinal axis - scraping (5), sawing on longitudinal axis (1), abrasion (1), unidentified (2), abrasion - sawing on longitudinal axis - scraping (11), abrasion - sawing (3), sawing (1) (table 10)

The objects are scattered throughout the archaeological contexts. One object each was found in pits 3, 7, 10, 18, 26, 44, 45, 46, 47, 49, 72. Two objects each were found in pits 4 and 24. Three objects were found in N. Balk and 4 in deposits not identified with a structure or context (table 11).

4.2.2.6 Axe

A single object may have been used as a small axe or as a scraper from long bone of cattle size animal (fig.4.22). The manufacturing techniques used are sawing along the longitudinal axis and scraping (table 10). The cross-section is elliptical, and the active end has an edge length of 1 to 2 cm, a straight edge and a double bevel. It has characteristic flaking at the active end and characteristic cracks caused by impact with the material being worked.

4.2.2.7 Conclusions for edged tools

According to the study and the resulting statistics, edged tools are the most numerous category in the Revenia bone assemblage, accounting for 29.7% of the total material. Together with pointed tools, it is one of the most important tool categories in all Neolithic bone assemblages. Their basic morphological characteristics can be summarized as follows: they are mostly symmetrical tools, with several variations in the straight profile. Depending on the raw material and the shape to be given to the final tool, there is either work only on the active end or along the entire length of the tool, especially when it comes to bisected sides (most of the raw material found in spatulas).

Spatulas occupy the largest percentage of the material of Revenia and cover the largest percentage of sharp tools on the material 10.2%. Medium corrosion is observed in a medium percentage, except for the chisel category, which has low corrosion in the majority.

Unlike pointed tools, edged tools vary according to their use. For spatulas, the vast majority use ribs, or bisected ribs. Bisected ribs follow the usual treatment for bisected ribs, but unlike pointed tools, in many cases, the active end is minimally treated, and traces of use are more visible, as the full length and width of the rib are retained. Like spatulas, the unidentified edged tools and the one object recorded as a polisher use the ribs as raw material with the same treatment, so that many of them could be classified as spatulas to a large extent. The one object recorded as a polisher has a characteristic polish and lustre and based on experimental studies, could have been used for dry leather or clay polishing (Russel 1990:531). The polishing is observed along the entire length of the tool, which has not been observed on other edged tools such as spatulas. The traces of use on the spatulas extend to the center of the tool and then the traces of manufacture are observed.

Chisels mainly use long bones as raw material. Long bones include the femur, humerus, radius, metapodials and most commonly tibia. The tibia is the most common choice for chisels as it is a very durable bone that can withstand hard work and vibration. Although other Neolithic sites appear to have exhausted the bone, this is not the case with the majority of Revenia chisels. Chisels are among the tools that retain a great length of original bone. Most of the chisels show fairly well preserved traces of use. The bone has retained one epiphysis, the bone in the middle and towards the other epiphysis has been struck or cut lengthwise and shaped by abrasion. In a small number of cases, the epiphysis retained as a handle has also been treated, i.e. the pointed ends have been smoothed. It is worth noting, however, that the category of chisels also includes several splinters, confirming the intensive use of raw material.

The scrapers, although very few in the material, have preserved their characteristics quite well, being mainly tibial tools that could also be classified as chisels.

In the category of edged tools, we find mainly large-sized animals such as cattle, wild cattle, pig. We also observe animals of sheep/goat size, such as sheep/goat, roe deer, roe/goat. Most of the sharp tools, as well as all tools from Revenia, are fragments. The cross-sections are mostly elliptical, rectangular, and planoconvex, which helps us to understand the movement of the tools. Their length exceeds 20 cm, depending on the type. The traces of use on the majority of the tools extend to the Central part of the tool, indicating the point at which the tool came into contact with the material to be worked. The location of the wear marks also varies according to the type of tool, e.g. on polishers and scrapers, wear marks can be

seen along the entire length of the tool and on all sides of the tool. The treatment traces, as summarised, show that the sharp tools, depending on the bone (long or flat bone), follow the treatment predetermined by the bone, as mentioned above.

4.2.3 Handle

Only one handle was identified from the 0.1% Revenia bone assemblage (table 2, fig.4.23, draw 4.2d). The object shows very little corrosion and is intact. It comes from a sheep-goat tibia and is 6 cm long and circular in cross section. It has been worked along its entire length. The distal part has been abraded and the pointed tips smoothed to make it easy to hold and not hurt the hand. The cross section is cut and abraded. It appears to have been a handle for another stone or even bone tool, possibly a pointed tool. The bone assemblage of the Revenia consists mainly of fragments that show signs of treatment and use. Some of these are tibiae with a worked distal part, which could belong to the handle category. However, as the active end is not preserved, it is not possible to classify them with certainty. The handle is located in pit 7 (table 11).

4.2.4 Waste

This is a category with clear traces of working but no traces of use or shaping. The total number of waste is 37 (3,2%) (table 1). Most of them have low corrosion (18), 14 have medium corrosion and 5 have high corrosion (table 4). Most of them come from cattle size animals (22), followed by sheepgoats (13) and one from a small animal (table 7 fig.4.24). The identified families are 3 cattle, 12 goats, 1 bird and 21 unidentified (table 8). The bones are 5 unidentified long bones, 19 ribs, 1 unidentified, 3 tibia, 1 ulna, 1 femur, 3 radius, and 4 metapodials (table 6).

Most are fragments (20) and 17 are whole. Fragments in this category are bones where there is a fracture on the treatment trace, i.e. post-positive erosion and fracture of the bone. All cross sections are circular 4, elliptical 7, planoconvex 7, rectangular 5 and unidentified 14.

The identified manufacturing techniques are abrasion 5, abrasion cross-cutting 1, sawing on longitudinal axis 9, sawing on longitudinal axis - scraping 2, sawing on longitudinal axis - cross-cutting 5, scraping 21, cross-cutting 6, splinters 2, abrasion - sawing on longitudinal axis - scraping 2, abrasion - sawing on longitudinal axis - scraping - cross-cutting 1 (table 10).

The objects are scattered throughout the archaeological contexts. One object each was found in pits 4, 6, 9, 26, 29, 33, 34, 46, 51, 56, and 29g. Two objects were found in pits 5, 11

and 24. Three objects were found in E. Balk, N. Balk, surface and 8 in deposits not identified with a structure or context (table 11).

4.2.5 Unidentified tools

A very large percentage of the material is classified as unidentified tools/objects (fragments of worked bones with traces of use). They make up 41.2% of the material (table 2). Most of the corrosion is minor (231 tools), medium (184 tools) and heavy (49 tools). Most of these (245 tools) are from medium-sized mammals (goats and sheep), 173 from cattle and 11 from small animals. The following animal families could be identified: goat (196), goat (1), sheep (1), hare (1), dog (1), carnivore (1), bird (2), cattle (5), boar (1), deer (1), red/fallow deer (2), roe deer (1), goat/roe deer (1), unidentified (253). Long bones identified tibia (82), tibia/MP (1), ulna (2), femur (5), humerus (2), radius (8), MP (21), and long bone/unidentified (156). Flat bones identified were 2 mandibles and 145 ribs. In addition, teeth (5) and horns (2) with traces of treatment were identified. For 37 tools it was not possible to identify the bone used as raw material (table 4-8).

All tools in this category have been recorded as undefined tools because, although they retain most of the tool (over 90%), they cannot be confidently assigned to a tool category (fig.4.25). Most fragments preserve only part of the bone diaphysis with traces of treatment and shaping (334). Only 17 preserve a large part of the tool, 49 only the proximal part, 5 active end - shaft - proximal part, 11 active end - proximal part, 50 shaft - proximal part and 6 are very small fragments with few traces of use (table 9).

Further study of the treatment marks may place some of the unidentified tools in the general categories (sharp, pointed, etc.). However, this is precarious at this stage of the study as, for example, if a diaphysis with treatment marks and the proximal end of a tibia is preserved, it could be placed in both the category of chisels or generally edged tools and the category of pointed tools, for example, awls. Some epiphyses from tibiae, metatarsals, ulna, or femurs may be closer typologically to pointed tools. For example, bisected metatarsal bones usually correspond to awls. In addition, because of their small diameter and anatomy, shanks are usually used to make perforating tools. Ribs, on the other hand, would be more likely to belong to edged tools, as they are statistically used mainly for spatulas in the settlement. Therefore, we cannot classify an object based on a single epiphysis or fragment. It should be noted that in the Revenia bone assemblage, several objects appear to have been welded together, so an attempt was made to weld fragments from adjacent cuts and passes, but this did not yield any results.

Almost all possible combinations of manufacturing techniques were observed, the most common being abrasion - longitudinal sawing - scraping (158), abrasion - longitudinal sawing (102) (table 10).

Due to the large size of this category of material, it seems to be found in most of the settlement contexts, as expected. 1 piece was found in each of pits 17, 23, 27, 32, 37, 69, 84, 1b, 29a, 46d, 48a, 15, northern area, north-western area, midden 1a, 1b, paving stone, cheek scraping. 2 were found in pits 3, 21, 28, 39, 49, 53, 58, 66, 74, 29g, 81. Of 3 objects found in pits 29, 36, 40, 67, 72, and 5g. 4 objects were found in pits 33, 43, 45, 45, 56, 24a, and 5b. 5 objects were found in pits 4, 11 and in the clean-up. Of 6 artefacts found in pits 26, 46, 47 and 48; 7 artefacts found in pits 50 and 48g; 8 artefacts found in pits 5, 6, 25, 34, 41; 17 artefacts found in pit 2, 27 in pit 7, 32 in pit 18, 20 in pit 20, 15 in pit 24, 13 in pit 42, 14 in pit 44, 17 in pit 51, 20 in surface, 11 in eastern Balk, 22 in northern Balk and 88 in undiscovered deposits (table 11).

4.2.6 Ornaments

A total of 4 objects were found that we can confidently identify as ornaments (table 1, fig. 4.26); three are fragments and one is intact; two have low corrosion, one has high corrosion, and one has low corrosion; three have been identified as beads and one as a pendant. The pendant is from a sheep/goat tibia and has two holes, is fairly polished and the holes have been drilled by abrasion. The intact bead comes from a long bone of a rabbit or small carnivore and has two transverse cuts on each side; the other two beads, which are not intact, are from long bones of small animals. The animal's family, a bird, has been identified in one of them. Both are identical to the first bead and have two transverse cuts on each side. The four ornaments were found in pits 5b, 42 and N. Balk (table 11).

4.3 Temporal and spatial distribution of the bone implements of Revenia Korinos

The bone tools come from all over the Revenia excavation and seem to be found in most of the pits. Moreover, they constitute the third (numerical) category of finds after the stone tools of abrasion, percussion, cutting and grinding and the stone chipped tools (Adaktylou 2017a:108). The presence of bone tools is most pronounced in pits 18 (80 tools), 5,5b,5g (63 tools), 7 (64 tools), 24,24a (52 tools), 42 (34 tools), 44 (22 tools), 51 (38 tools), 2 (43 tools), 29 (14 tools, and together with pits 29a,2b,29g 29e: 18 tools), 20 (25 tools), 6 (24 tools), 46 (12 tools, with pits 46b,46d: 14 tools), 34 (13 tools), 26 (17 tools), 25 (12 tools), 41 (13 tools), 47 (13 tools), 6 (24 tools), 4 (13 tools), 11 (16 tools). Less than 10 bone objects were found in the remaining pits and deposits (Map 4).

To understand the role of bone tools in the daily life of the Neolithic inhabitants, it is necessary to refer to the archaeological context (stratigraphy, pits, mobile finds) of each prehistoric settlement in which the archaeological material was deposited and later recovered by archaeologists (Thomas, J., 1999: 64).

At the Neolithic settlement of Revenia, Adaktylou, who was also the excavator of the settlement, has completed and published a complete picture of the excavation and a detailed recording and interpretation of the pits as part of her master's thesis (Adaktylou 2017a; 2017b). This helps us to integrate our material into a very well stratified spatial context. In addition, radiocarbon dating was carried out during the excavation, which helps us to place the objects in their chronological context as accurately as possible. Only the contexts, in this case, pits containing many bone tools and objects (<10 bone objects), were selected for further analysis. These pits are 2,4,5,6,7,11,18,20,24,25,26,29,34,41,42,43,44,46,47,51.

The findings in their spatial and temporal context

Pit 2

Pit 2 was located in the northwestern part of the site. The excavated walls sloped gently inwards to form a circular plan. Its dimensions were measured on the axis 3.22m x E-W: 3.14m (original) and N-S: 2.38m x E-W: 2.90m (final contraction). It belongs to the large category of pits dug in the natural subsoil with very deep deposits (1.07m). Pit 2 appears to cut the NE side of pit 81 and is itself cut to the SE by the later pit 41. Within the limits and within pit 2 there are two postholes, PC 2 (SW) and PC 3 (SE). The stratigraphy of the pit shows that the upper layers (layers 2, 3) of the pit are rich in finds such as pottery, sherds, small finds, middens, etc., while the lower layers (layers 5, 6, 7, 8, 9) are poor in finds. Layer 4 shows a dense concentration of bones.

Based on its contents, it is classified as a pottery pit. However, it shows a high concentration of bones of Cerastoderma glaucum, Poiret. Pit 41 presents a similar picture. The sherds from Pit 2 are significantly larger and thicker than those from Pit 41 to the east, which is smaller and contained comparatively fewer sherds. Bone, clay, unidentified stone tools, ornaments, figurines, beads, chipped stone tools, obsidian blades, flint flakes, triangular stone tools, etc. were also recovered from the deposits.

Based on radiocarbon dates and the relative dating of the pottery, Pit 2 dates to an advanced phase of the Early Neolithic (after 6400 BC, perhaps even after 6200 BC) or to an early phase of the Middle Neolithic (from 6000 BC). The early date comes from the last pass of the pit and is dated to 6595-6507 BC (68.2%) and 6630-6480 BC (95.4%). This likely defines the date of the primary, residential use of the pit. Based on the excavator, Pit 2 is an underground settlement. It is quite large and could have housed more than one person. Since it is more than 1 m deep, no postholes have survived on the outside, around its perimeter, but ΠΣ 2 and 53, found inside and near its perimeter, probably belong to an attempt to strengthen the support of the pit's superstructure or are evidence of a repair carried out at some stage in the life of the dwelling, which has survived precisely because it was opened up internally and sealed with secondary deposits. After it ceased to be a house, Pit 2 became a refuse pit in secondary use, acting as a repository for large quantities of mainly bone and, to a lesser extent, pottery, animal bones and small objects (Adaktylou 2017a:41-45; 2017b:11-12).

Apart from 2 bone tools from layer 5 of pit 2, the rest came from layer 2, suggesting that the bone tools were present in the pit from the time it was used as an underground house. A total of 43 bone tools were found in the pit: spatulas, awls, chisels, perforators/pointed unidentified, sharp tools/unidentified, unidentified objects.

Pit 4

Pit 4 was in the southeastern part of the excavated area, west of test trench A. The walls of the pit sloped gently and smoothly inwards, giving it an almost circular shape, while the floor was flat. Its dimensions were measured on the axis N-S: 2.80m x E-W: 2.30m (original) and N-S: 2.20m x E-W: 1.80m (shrinkage). It belongs to the large category of pits dug in the natural subsoil with very deep deposits (1.17m). Pit 4 crosses pit 9 on its eastern boundary and the original south-western boundary of pit 6. On the north side of pit 4, there is a terrace leading to the basement of the building.

Based on its contents, it is classified as a pottery pit. In general, there are no steep gradients, and three main layers can be distinguished, clayey, dark greyish brown, with tiny unfired orange clays and some charcoal. The quantity of Cerastoderma glaucum collected by

Poiret was greater than that of the pottery, and a moderate quantity of bones and clays was recovered. Among the many small objects found in the pit (Fig. 2), the clay effigy of an oven or hearth with a dome (Re 750) stands out, the only one found in the excavation to be made using the coil technique. Pit 4 is one of the twelve richest examples of the archaeobotanical assemblage of the Revenia, dominated by seeds and (mainly) glumes of cereals, with a much smaller proportion of wild plants and an even smaller proportion of legumes. The deposits of the pit contain many finds and small objects, such as stone tools, grinding tools, marble vessels, chipped stone tools, etc.

Based on radiocarbon dates and the relative dating of the pottery, the pit is dated to an advanced phase of the Early Neolithic (after 6400 BC, perhaps even after 6200 BC) or to an early phase of the Middle Neolithic (from 6000 BC). Based on the excavator, it has been identified as a relatively small cave settlement. It is unclear whether the postholes to the southwest are associated with the pit or with one of the other above-ground buildings in the southeastern part of the excavation. Based on the stratigraphy, none of the layers in the final depth of the pit is poor in finds to indicate the primary settlement phase of the pit. Furthermore, the pit is not characterised by strong episodes of artefact deposition (Adaktylou 2017a:74-76; 2017b:22-25).

A total of 13 bone tools were found in pit 4. Most of the bone tools in pit 4 were found in layers 5 and 6. Based on the information from the excavation, it seems that they were used during the period when the pit was used as an underground house. Awl, sharp tool/unidentified, chisel, unidentified objects, and by-products were found in the pit.

Pit 5, 5a, 5b

Pit 5 is in the northwestern part of the site. It is circular in plan and is the largest and deepest circular pit with vertical walls. It is formed by terraces. Pit 5a was excavated together with pit 5 and was therefore part of the bank of pit 5b. Its dimensions were measured on the N-S axis: 5.20m x E-W: 4.70m and its depth reaches 1.67m. The dimensions of pit 5a in NW-SE: 2.50m. x NE-SW: 1.80m., height 0.41m. and area 4.5m². With access to pit 5. Pit 5b (final contraction of this pit) has dimensions N-S: 1.50m x E-W: 2.70m, height 0.30m and area 4.05m², with access to pit 5. Inside pit 5c, to the north-west, the shaping of the natural depression leads to the formation of a low terrace, dividing the pit into two parts: dimensions NW-SE: 1.46m x NE-SW: 2.16m, height 0.10m and area 3.1536m² with access to pit 5.

Classified as a pottery pit based on its contents, it is dug into the natural bedrock. It is the largest and deepest of the circular pits. Pits 5 and 5a yielded many finds of all categories. During the excavation and sorting of the pottery, several fragments of pottery were collected,

some of which survive in profile or to a fairly high degree. Characteristics are small sections of vessels with anthropomorphic or animal plastic decoration. Many shells (mainly of the species Cerastoderma glaucum, Poiret, but also of the species Solen, sp.), bones, many straw-clay hooves (many of them with traces of burning) and parts of the floors of thermal structures were also collected. There are also many small finds such as figurines, clay effigies of monuments, clay spoons, marble vessels, stones, grinding and chipped tools.

Three terraces are formed within pit 5: the first is pit 5a to the west of pit 5, the second is pit 5b to the south of pit 5, lower and south-east of pit 5a, while in the final configuration of pit 5, within pit 5c, another terrace is formed slightly deeper (by 0.10m). These areas are interpreted as access terraces to the basement of the building. Pit 5 intersects pits 78, 79 and 88 to the NE.

Based on the radiocarbon dates and the relative dating of the pottery, pit 5 dates to an advanced phase of the Early Neolithic (after 6400 BC, perhaps even after 6200 BC) or to an early phase of the Middle Neolithic (from 6000 BC). Pit 5 with its terraces seems to gather many of the necessary elements to be identified as the underground part of a settlement: large size, almost vertical walls, access terraces in its underground part, which was probably used as a storage area, but perhaps also for bedding (Adaktylou 2017a: 40-43; 2017b: 26-37).

In pit 5 a total of 37 bone tools were found from all layers of both pit 5 and terraces 5 a, b and c. The pit contained awls, spatulas, chisel, unidentified objects, wastes, and perforators.

Pit 6

Pit 6 is in the SE area of the excavated site, in an area with a high density of pits. The order of their succession, starting from the oldest, is probably 6, 12, 9, 10, and 4. Its dimensions were measured on the N-S axis: 4.50m x E-W: 1.40 (2.40 including test section A) (original) and N-S: 3.20m x E-W: 1.15 (2.15 including test section A) (shrinkage). The depth of the archaeological layers reaches 1.56m. The walls of the pit to the south-east and south-west are initially gently sloping towards the interior, while deeper into the pit they are almost vertical. To the west, they are almost vertical. To the northwest, initially vertical, but sloping gently inwards deeper down. Much of pit 6 was cut by trial trench A and continued to the east, away from the ditch, so it must have been a particularly large ditch, initially irregular in shape and later circular in plan. Pit 4 cut pit 6 on its original southwest boundary. Pit 6 was divided into three horizontal strata.

Pit 6 is interpreted with some certainty as a large underground dwelling, the basement of which would have been used for storage, while the upper floor would have had a wooden

floor. The level of its primary, residential use, which is located in the third and last level (level 5) of its stratigraphy, is considered, with reservations, to have been preserved from the middle of the level, where the fallen material is found and the finds are few, to the bottom of the pit (at a total depth of about 0.30m).

Based on its contents, it is classified as a pottery pit. In addition to the large quantity of pottery, the pit contains many other finds such as shells, clay, clay figurines and representations of buildings, stone tools, chipped tools, etc.

Based on the relative dating of the pottery and the study of the layers, the pit seems to date to an advanced phase of the Early Neolithic (after 6400 BC, perhaps even after 6200 BC) or to an early phase of the Middle Neolithic (from 6000 BC) (Adaktylou 2017a: 73-74; 2017b:38-40).

A total of 24 bone tools were recovered from the lower layers 6 and 7. The tools found were spatulas, awls, unidentified tools, by-products, perforators, double points, and chisels.

Pit 7

Pit 7 is in the SE part of the site. It is circular in shape and its walls are almost vertical. Its dimensions were measured on the axis N-S: 3.60m x E-W: 2.25m (3.10m including test section A) (original) and N-S: 2.50m x E-W: 2.10m (2.60m including test section A) (contraction) and a depth of 1.63m. Pit 7 is characterised by strong episodes of finds dumping and is considered to be the result of secondary refuse deposits. Three successive layers (4, 5, 6) can be distinguished. All layers are characterised by individual variations, with dense concentrations of pottery, sherds and stones. According to the stratigraphy of the pit, no layer towards the end of the pit is poorer in finds, so the pit can be identified with certainty in its primary use as a settlement site. It is possible that the rectangular pit 15, together with the original boundaries of pit 7, belongs to a wider and older irregularly shaped ditch, within which pit 7 (its circular contraction) and pit 93 eventually formed. To the south of pit 7 is the fragmentary, shallow, preserved, northwest-south-east-facing trench 5, with no postholes inside, which is probably a wall foundation trench belonging to the upper chronological phase of the settlement with the above-ground rectilinear buildings.

Based on the findings, it is a pottery pit dug into the natural bedrock with deep deposits. In addition to concentrations of pottery and bones, Cerastoderma glaucum, Poiret and Solen sp. other objects such as figurines, beads, stone tools and chipped tools were found, as well as a rich sample of archaeobotanical remains. It is worth noting that several bones were also found in the pit, including several jaw parts with teeth and traces of an

attempt to extract marrow from them. This, combined with the abundance of bone tools found, could indicate the process of producing both food and bone tools, or the raw material for making bone tools. Perhaps this hypothesis is supported by the fact that it was mainly floor parts from thermal and other structures that were collected, rather than superstructure clays.

The three radiocarbon dates from it are almost identical, but not as early as the assessment of the pottery it contained. The first radiocarbon dates are quite close to 6400 BC, which is the end of the considered early phase of the earliest Neolithic in which the pottery places it (Αδακτύλου 2017a:64-66; 2017b:42-48).

A total of 64 bone tools were recovered from pit 7. Bone tools were found in all layers of the pit. Spatulas, single-handled, fishhooks, awls, unidentified, perforators, sharp/unidentified, scrapers, and chisels were found. Among the unidentified tools, of which there are several (27), there may be some by-products.

Pit 11

Pit 11 was in the SE area of the site, west of trial trench A. It was a large and deep rectangular pit - one of five that could be confidently classified as rectangular. It measured NW-SE: 3.40m x SW-NE: 2.80m (original) and had a fill depth of 1.05m. It is one of the few rectangular pits to survive in its entirety. Two terraces exist within pit 11: pit 19 and the semicircular formation to the south-east, dug alongside pit 11 (dimensions: NW-SE: 1.40m x NE-SW: 2.00m), which probably served as entrances to the pit. Six human burials were associated with pit 11: burials 1 and 2 were investigated within trial trench A, burials 2 and 3 were investigated during horizontal excavation.

Pit 11 is interpreted as the underground part of a dwelling. It is quite large and the shaped entrance to the south supports such a hypothesis. The most likely interpretation, based on the excavator, is that pit 11 was an underground dwelling and was abandoned. It was then reused as a tomb. In pit 11 there is no surviving layer of primary residential use that could be located below the burials. The early ceramic assessment of the pit (after 6400 BC, perhaps even after 6200 BC) is close to the radiocarbon dates of the skeletons, while the late assessment (from 6000 BC onwards) could be related to later deposits of pottery and other finds, after both the primary residential use of the pit and its use as a burial ground (Adaktylou 2017a:68-71; 2017b:54-61).

Based on the finds can be classified as a pottery pit. However, many antlers, bones, fish bones, clay earrings and figurines, a clay replica of a house, and stone and flake tools

were found. The bone tools from pit 11 total 16 and were found in layers 4 and 5. Awls, unidentified, by-products, sharp tools and chisels were found.

Pit 18

Pit 18 is in the northeastern part of the excavation. It is a fairly large, irregularly shaped pit with relatively shallow deposits, containing a large quantity of bone, some clay, many unidentified stones (including possible tools) and little pottery. Its dimensions were measured N-S: 3.10m x E-W: 2.75m and depth 0.47m.

Based on the finds, it was classified as an animal bone pit. Its fill was consistent. The bones are mainly bones, many jawbone fragments with teeth, but also some fish, bird and possibly turtle bones. The highly fragmented preservation of the bones is due to the extraction of marrow from their interior. The dense bone assemblages were accompanied by a strong presence of chipped stone, fragments, mainly of flint, with fewer abrasive and edged tools. At first glance these assemblages do not appear to be concentrated in any particular area of the pit. Pit 18 had the highest density of abraded tools and generally small objects of all the pits in the excavation. Only pit 2, with its extremely large quantities of bone, and to a lesser extent pit 41, had such a high density of finds.

Radiocarbon dates place it in an advanced phase of the Early Neolithic (after 6400 BC, perhaps even after 6200 BC) or in an early phase of the Middle Neolithic (from 6000 BC onwards (from a cow bone in layer 2, 6472-6442 BC (68.2%) and 6502-6428 BC (95.4%).

The use of the pit seems to have been a repository for large quantities of animal bones. Based on the excavator, the use of the pit may have been wasteful from the beginning. However, due to its large size and relatively shallow surface, it may have originally been an open laboratory space (Adaktylou 2017a:59-60; 2017b:74-77).

The bone tools found in the pit numbered 80 in total and represent a variety of typologies. Spatulas, awls, unidentified tools, by-products, perforators, sharp tools, chisels, and polishers were found. All tools were found in layer 2 of the pit. The study of bone tools has shown that some by-products and tools preserve traces of processing and reconstruct the chaîne opératoire. This further supports the view that this was an open site for the processing of food and bone tools. Based on studies and current research from other Neolithic sites, it appears that the processing of bone tools takes place in areas where the primary processing of meat also takes place. Furthermore, the abundance of chipped tools confirms this, since both the slaughtering and butchering of animals and the processing of bone tools are carried out with chipped tools (Isaakidou, Halstead, and Adaktylou 2018).

Pit 20

Pit 20 is located in the SE part of the excavated area. It measures N-S: 4.85m (western half approximately) x E-W: 2.90m; final contraction: N-S: 2.00m x E-W: 1.50m and a depth of 1.27m. Pit 20 is one of the oldest pits and cuts through the even older Pit 33. It is almost circular in shape from the start of its sides, with its boundaries gradually shrinking to form individual pits until it is almost circular in its final contraction.

The pit was excavated in three layers. On the basis of the finds it is classified as a pottery pit. Apart from pottery, it also contains a large quantity of Cerastoderma glaucum, mainly Poiret. It contained several bones and small objects such as stone tools, chipped tools and rounded shells. Pit 20 may have been a large settlement area cut by the later rectangular pit 11. This interpretation is supported by ΠΣ 9 to the north-west and ΠΣ 124 to the south-west. The level of its primary, residential use does not appear to have survived, i.e. its deposits are the result of secondary, waste deposits. There is no dating based on the excavator or the study of the pottery (Adaktylou 2017a:71-72; 2017b:80-82).

Spatulas, awls, unidentified tools, and perforators were found in all layers of the pit and totalled 25 bone artefacts.

Pit 24

Pit 24 is in the NE area of the excavated site. Its dimensions are N-S: 4.55m x E-W: 3.10m (original) and N-S: 3.10m x E-W: 2.50m (final contraction) and a depth of 0.70m. The walls of pit 24 are almost vertical or gently sloping to the north and northeast, and steeply sloping inwards to the west and southeast. It is a large, relatively deep, almost circular pit, characterised by the strong presence of bone and the minimal presence of pottery. Its deposits consist of layers that are gently sloping at the beginning and become steeper at depth. In all layers 2, 3, 4 and 5 there is a strong presence of bone, including fish bones and a fish tooth, but also three antler fragments and two bird bones. In particular, several jaw fragments with teeth and several bones, probably from cattle, were recovered from the southeastern part of the pit. The bones were heavily fragmented due to the extraction of jelly. In addition, many stones were found to the east, many of which are tools and fragments of thermal structures. In general, there is a strong presence of stone tools and obsidian and chipped tools characteristic of the earliest Neolithic period. Within pit 24, in its western area, two isolated human bones were identified during the examination of the zooarchaeological material: an almost intact right human tibia and three fragments of human skull.

The micromorphological study carried out on a sample taken from the pit revealed the existence of two distinct cultural "episodes" in its fill - an initial, shallow depth at the base of

the pit and a second, deeper depth overlying the first - but it does not help us to characterise its initial use as residential (Besios, M., Adaktylou, F., Kontogiorgos 2009). Similarly, the stratigraphy of the pit does not provide evidence for the preservation of the primary residential use of the pit. According to the excavation data, Pit 24 fulfils several of the conditions required to be identified as an underground settlement. It is quite large. Externally, four postholes were found around its perimeter. There are terraces which support this view, the terrace to the southwest (pit 55) and 24a to the south.

Radiocarbon dating of the samples places the pit in the Early Neolithic (6501-6256 BC) (Adaktylou 2017a:56-58; 2017b:91-95).

In pit 24, as in pits 5, 7, 18, 42, 44 and 51, we have a large concentration of bone tools, a total of 48 tools. Almost all tool categories, such as spatulas, awls, arrows, unidentified, by-products, perforators, double points, sharp tools, scrapers, and chisels were found in pit 24. The bone objects found, as well as the by-products, preserve part of the sequence of the chaîne opératoire. In addition, traces of burning and fire were observed in several of them, which, perhaps in combination with the stone, the chipped tools and the remains of thermal constructions, reinforce the fact that this was a covered area (dwelling) where the processing of food and the tools themselves took place.

Pit 25

Pit 25 is in the north-Central area of the excavated site. It is circular in shape and its walls are almost vertical on the north side and have a gentle slope on the east and west sides. Its dimensions from pit 25 N-S: 2.70m x E-W: 2.30m (original) and N-S: 1.75m x E-W: 2.05m (southern pit 25) and a depth of 0.78m. The fill was uniform and rich in all categories of finds, with the presence of pottery and bone, particularly Cerastoderma glaucum, Poiret. To the south of the pit, two small terraces (0.28m and 0.22m) were formed in the natural environment. Among the microobjects, which include most of the common categories, stone grinding tools predominate quantitatively, followed by chipped stone and bone tools. Pit 25a is semi-circular and lies to the north of pit 25. The original fill of pit 25 has been divided into a northern and southern area by a natural strip, which defines pit 25a to the north.

Pit 25 has been identified as a small dwelling, probably for a single person, with a landscaped entrance (pit 25a). Its flat floor would have been the floor of the house. Supporting this identification are the two terraces (possibly cupboards) to the south, which may have served some basic spatial-organisational needs. No postholes were found around the perimeter or in the interior. The level of its primary, residential use does not seem to have been preserved, i.e. its deposits are the result of secondary, refuse deposits, where dense

debris of mainly pottery, bones, straw hooves and small objects and, secondarily, animal bones are found (Adaktylou 2017a:51-52; 2017b:98-101).

The bone tools found in pits 25 and 25a are spatulas, awls, unidentified, perforators and were found in layer 2. This is not a large concentration of tools, 12 in total. Object 591 was also found in this assemblage and shows decoration. The bone tools found in pits 25 and 25a are spatulas, awls, unidentified, perforators and were found in layer 2. This is not a large concentration of tools, 12 in total. Object 591 was also found in this assemblage and shows decoration.

Pit 26

Pit 26 is located in the north-Central area of the excavated site and measures N-S: 2.33m x E-W: 2.15m and NE-SW: 2.56m with depths of 0.91m and 1.24m (including the deposits of pit 26a). It is circular in plan and divided into two separate shallow ellipsoidal pits, pit 26a to the north and pit 26b to the south.

Pit 26 is interpreted as the underground part of a house, based on its size and vertical walls. The two terraces to the southwest of pit 26, with a maximum width of 0.18m and a height of 0.23m (the southernmost) and 0.61m (immediately north of the first), probably formed the entrance to the house. No postholes were found anywhere in relation to pit 26. As pit 26 is quite deep, it is assumed that the above-ground part of the house had a wooden floor at ground level. The basement may have been used for storage. The pit, according to its stratigraphy, does not seem to have a defined layer towards the end of its deposits, which is poorer in finds to help us conclusively identify a possible layer of primary, domestic use, and therefore its deposits are thought to be be the result of secondary, waste deposits.

Based on the finds, it is classified as a pottery pit. The layers are homogeneous in terms of finds. No layer is superior to the others. Layers 2 and 3 of pit 26 contained large quantities of pottery and bones, while sherds were abundant. There were also several fragments of straw hoofs and flooring from some kind of structure. The bones from pit 26 were also badly damaged by the attempt to extract marrow from them.

Based on the absolute dating of an animal bone among the bones collected from the whole area of the pit, it agrees with that of the pottery in its early estimate (after 6400 BC, perhaps even after 6200 BC, or from 6000 BC onwards) (Adaktylou 2017a:52-53; 2017b:102-105).

The bone tools from pit 26 come from layer 2, 12 in total, spatulas, unidentified, by-products, perforators, sharp tools, and chisels.

Pit 29

Pit 29 is in the north-Central area of the site. It measures NW-SE: 4.90m x E-W: 3.00m and is 0.46m deep. The walls vary, almost vertical to the south and west, steeply sloping to the east, and gently sloping to the northeast and north-west. Pit 29 is a large irregularly shaped pit. After 0.46m of fill, it is divided into five individual pits: 29a, 29b, 29c, 29d and 29e. Their walls vary, even within each pit. Based on these features, all these pits are interpreted as earthwork pits, which probably became refuse pits in a second use.

Based on the findings, it is classified as a pottery pit. Large quantities of pottery, bones and clay were collected from the pit, and animal bones were also found in the pit. The tools are also numerous, mostly stone, chipped and bone tools. An almost intact clay seal was recovered from pit 29c. The most striking find from pit 29 is the fragment of a clay dummy of a square dwelling, the only well-preserved example from the Revenia. Also noteworthy is the clay seal from pit 29c.

According to the preliminary results of the pottery study, pit 29 roughly dates to an advanced phase of the Early Neolithic (after 6400 BC, perhaps even after 6200 BC) or to an early phase of the Middle Neolithic (from 6000 BC) (Adaktylou 2017a:53-54; 2017b:115-129).

The bone artefacts from pits 29,29a, b,g,d, and e total 25 and come from layers 2,5,6,7,8,9. Spatulas, awls, unidentified, by-products, perforators, double points, chisels, and needles were recovered.

Pit 34

Pit 34 is in the SE area of the excavated site and has dimensions of N-S: 2.65m x E-W: 3.16m (original) and N-S: 1.50m x E-W: 1.60m (final contraction), with a depth of 0.52m. The walls are almost vertical to the south and east and are irregular in shape. Pit 34 was probably originally a large pit which later shrank considerably. Pit 34 is cut to the northeast by pits 48 and 48c.

Based on the finds it is classified as a pottery pit. Inside pit 34 a single human bone (metacarpal) was found during the examination of the zooarchaeological material. Shells, bones, chipped and stone tools, etc. were also found (Adaktylou 2017a; 2017b:139-138).

A total of 13 bone tools were found in the pit from layer 7. They include arrows, by-products, unidentified tools and chisels.

Pit 41

Pit 41 is in the north-western part of the excavated area with dimensions of N-S: 2.45m x E-W: 1.40m and N-S: 2.20m x E-W: 1.40m. It is a rather large, circular pit, which is later than Pit 2, having cut it to the southeast. The upper layer was a layer rich in all categories of finds, but mainly in shells of Cerastoderma glaucum, Poiret, and smaller. It also contained much pottery, several bones and many small objects. The second, deeper layer is poor in finds. In terms of microobjects, the tools are dominated by stone tools, followed by chipped and bone tools.

Pit 41 has enough characteristics to be identified as a settlement site, although the postholes from its perimeter, which would give us evidence of its superstructure and strengthen this view, are also missing here. Its size is reasonable, its walls almost vertical and its floor almost flat, which could have been the floor of the house. The primary use of the pit could have been residential, but secondary evidence suggests that it was a disposal pit where large quantities of bones, in particular, were dumped. The deeper level of the pit, following the horizontal excavation, where the dense concentrations of bones are no longer present and the finds are generally very sparse, offers a slight chance of being identified as the level of its primary, residential use.

In any case, the early values of its absolute dating [DEM 2820: 6566-6474 BC (68.2%) and 6591-6467 BC (95.4%), from animal bone, ?30.00-29.66 m] agree with the pottery-based estimate, which also gives an early value (before 6400 BC) (Adaktylou 2017a:45-46; 2017b:160-161).

A total of 13 bone tools, spatulas, awls, unidentified, perforators were found in pit 41, all from layer 6.

Pit 42

Pit 42 is in the north-western part of the excavated area and has dimensions of N-S: 1.90m x E-W: 2.10m (original) and N-S: 1.80m x E-W: 2.00m (final contraction to the north and expansion to the south) and a depth of 1.24m. Pit 42 is a large circular pit located between pits 5 and 36.

Based on the findings, it is classified as an animal bone pit. It contained many bones, stone tools, and chipped tools. The bones show a high degree of fragmentation, the result of the extraction of marrow from them. The pottery was minimal, eroded in the upper layers.

Pit 42 could be a small dwelling, although its size is marginal for such an identification. Its depth is quite large, suggesting some sort of storage use in the basement section, and a wooden floor in the above-ground section. The walls are almost vertical at the beginning (at a depth of 0.15-0.20m) and widen as they go down until they reach the natural

level. Inside, there are two access terraces to the pit, the first to the west and the second immediately to the east. A posthole (ΠΣ 63) was found at the periphery of the pit, at the base of its fill, probably related to the superstructure. In the stratigraphy of Pit 42, there is no discernible layer in the deeper part of the pit that defines its primary, residential use. All appear to be layers of secondary, waste deposits.

The dating places it between 6471-6441 BC (68.2%) and 6497-6429 BC (95.4%) (Adaktylou 2017a:47-48; 2017b:162-164).

A total of 34 bone tools were recovered from layers 3,8,9. There were 1 spatula, awls, unidentified, perforators, and chisels.

Pit 43

Pit 43 is in the north-Central part of the excavated area and is a circular, relatively small pit, identified as a burial pit because it contained two human burials, infant burial 6 (an assemblage of mixed human bones) in the upper layer of the pit and burial 5 (an articulated adult female burial) 0.08-0.16m in front of the natural burial in the pit. The dimensions were measured as N-S: 1.10m x E-W: 1.25m (original), N-S: 1.30m x E-W: 1.35m (enlarged), N-S: 1.00m x E-W: 1.30m (final) and a depth of 0.63m.

Based on the finds, it is classified as a small pottery pit, dug into the natural bedrock with relatively deep deposits. The deposits are rich in finds such as bones, shells, clays, floor fragments, ornaments, stone flakes, stone tools, etc.

Based on radiocarbon dates, the pit is dated to 6385-6259 BC (68.2%) and 6400-6242 BC (95.4%) in layer 13 and to 6246-6103 BC (68.2%) and 6341-6083 BC (95.4%) in layer 11 (Adaktylou 2017a:54-55; 2017b:165-167).

The bone tools found in the pit total 10, all in layer 11. The bone tools that were found were awls, chisels, unidentified tools and perforators.

Pit 44

Pit 44 is in the southeastern part of the site. Its dimensions are N-S: 3.10m x E-W: 3.10m and the depth of the fill is 0.72m. It is a large, relatively deep, almost circular pit and is classified as a pottery pit based on the finds. In addition to pottery, it contained large fragments of pitted straw clay (many with strong traces of burning) bearing impressions of diagonally arranged sticks, evidence for wattle and daub construction techniques, while there were few fragments of thermal construction floors. Bones and shells were abundant, as were small objects such as chipped tools, stone tools, etc. In addition, pit 44 contained 14 earrings (one clay and one

marble). Inside pit 44 a single human bone (left humerus) was found during the examination of the zooarchaeological material.

Pit 44 could be the underground section of a circular house. It is large enough to accommodate more than one person and its base, which would form the floor of the house, is almost flat, although the steep slope of its walls to the north-west suggests the possible use of a wooden floor for the above-ground part of the house. Of concern is the lack of postholes around the perimeter, which would provide information about the superstructure. According to the layers of the horizontal survey, the level of its primary residential use does not appear to have been preserved, i.e. the deposits are the result of secondary waste deposits. In any case, the early values of the absolute dating of pit 44 [DEM 2821: 6393-6263 BC (68.2%) and 6406-6249 BC (95.4%)] from an animal bone, obtained from a depth of 0.25m, approximately in the middle of its epiphyses and 0.20m in front of the natural, are consistent with the early chronological assessment of the pottery (before 6400 BC) (Adaktylou 2017a:66-67; 2017b:168-167).

A total of 22 bone tools were recovered from layers 3, 7 and 8 of the pit. These included spatulas, awls, unidentified sharp tools and chisels. It is worth noting that one bone tool was recovered from pit 44, layer 3, which is probably a bead extraction preparation. The raw material used was the long bone of a bird and there is evidence of cross-cutting and abrasion. This, combined with the large number of earrings found in the pit, may suggest that this particular site was used as a processing area for objects of particular importance.

Pit 46, 46a, 46b, 46g, 46d.

Pit 46 is in the southeastern part of the excavated area. Pit 46 is a large, unidentified animal bone pit dug into the natural ground with shallow deposits. Pit 46 intersects Pit 44 to the northeast and Pit 48 to the northwest and is cut by Pit 45 to the east. Pit 46 is divided into two sub-pits, Pit 46a to the southeast and Pit 46b to the west.

Pit 46a is also a large circular animal bone pit, dug into the natural ground. Pit 46b, which also resulted from the separation of 46, is like the previous large animal bone pit but its shape is ellipsoidal. To the north and northeast, it is cut by pit 46d and intersects pit 44 in its northeastern area. At the eastern boundary of pit, 46b is the ΠΣ 3.

Pit 46c is small compared to the previous pits, with shallow deposits, dug in the natural bedrock and resulting from the division of 46a (into 46a and 46c). Pit 46c has also been divided into two smaller pits, 46c and 46d. While 46d is a large, almost circular animal bone pit, dug into the natural bedrock ground, with shallow deposits.

This group of pits is characterised by the large number of animal bones and the scarce or sometimes absent presence of pottery. In all of the pits, flake and stone tools were found. It is noteworthy that all the bones are fragmented (Adaktylou 2017b:177-186).

A total of 14 bone tools from layers 7 and 8 were found in the pits. Perforators, unidentified, by-products, sharp tools, and chisels were found.

Pit 47

Pit 47 is located in the north-eastern part of the excavated area, its shape is irregular with dimensions of N-S: 2.30m x E-W: 1.35m and a fill depth of 0.82m.

Pit 47 (plans 27, 78) appears to be the oldest in the immediate area to the southeast of pit 24, having been cut by pits 24, 56, 70, 72, 58 and 51. Its original boundaries have only been clarified to the West. It is a moderately sized, deep, irregularly shaped bone pit.

Based on the findings, the pit is classified as an animal bone pit and, apart from bones and some pottery, it contained chipped tools, stone tools, clays and shells of Cerastoderma glaucum, Poiret.

According to the preliminary results of the study of the pottery, pit 47 roughly dates to a probable early phase of the Early Neolithic (before 6400 BC) (Adaktylou 2017a:58; 2017b:187-189).

Pit 47 contained a total of 13 bone tools from layers 3 and 6. A spatula, an awl, an unidentified sharp tool and a chisel were recovered.

Pit 51

Pit 51 is in the northeastern part of the excavation and is almost circular in shape, dug into the natural bedrock. Its dimensions are N-S:2.10m x E-W:2.40m and NW-SE:2.55m (original) and N-S:1.72m x E-W:2.25m (shrinkage) and the depth of the fill is 0.52m.

Pits 51, 57 and 58 to the east of pit 24 are animal bone pits, with pit 51, mainly contained concentrations of bone, flakes and stone tools. They are all later than pit 47, which was cut. Their deposits are rich in animal bones, shells, flint blades, stone and bone tools, while pottery is minimal. Pit 51, in its original boundaries, is adjacent to pit 47 to the northeast, while to the southwest is ditch 1 (grid 422/048). Outside the pit and in contact with its north-west boundary is a posthole, ΠΣ 94, which was dug with its fill, while a second posthole (ΠΣ 4, square 422/038) lies to the east, also within its boundary. Two further postholes (ΠΣ 5, squares 422/038 and 422/048 and ΠΣ 6, square 422/038) lying outside its boundaries are also probably associated with pit 58. On this basis, the possibility that it was a settlement cannot be ruled out, as it is of sufficient size, has a regular circular plan and has a

relatively flat floor. In any case, in this case, too, there could have been a wooden floor for the above-ground part of the dwelling, while the basement would have been a storage area. There are no planned stratigraphies for Pit 51, but it should be noted that, following its horizontal exploration, it could be considered, with great caution, to have preserved the lowest level of its presumed primary residential use, which contained few finds: the lower part of layer 9 of Pit 51 (Adaktylou 2017a58-59; 2017b:202-205).

A total of 38 bone artefacts were recovered from layers 8, 9 and 15. Spatulas, awls, unidentified, by-products, perforators and chisels were found.

Chapter 5 - The Neolithic settlement of Paliambela Kolindros in Pieria

5.1 Research history and context

The prehistoric settlement of Paliambela is situated east of the modern village of Paliambela in the region of Pieria, in the southwestern part of Central Macedonia, approximately 40 km from Thessaloniki (see Map 1). Pieria is rich in archaeological sites, with continuous habitation since the 7th millennium BC. Radiocarbon dating indicates that the settlement of Paliambela Kolindros was established before the mid-7th millennium BC (Μανιάτης Γ., Κωτσάκης, Κ., Halstead 2011). The wider area is bounded by Mount Olympus, the Pierian Mountains, Aliakmonas, and the Gulf of Thermaikos (Kotsakis et al. 2007, 6). This location provided the inhabitants access to various ecological zones and microenvironments, including the sea, rivers, low hills, and surrounding mountains, offering diverse resources for utilization. The geophysical topography of the area also served as a natural boundary for the settlement. The site was discovered in the late 1980s (Γραμμένος 1991; Kotsakis et al. 2007, 7).

The first systematic excavation took place in 1999 with the collaboration of two universities, the Aristotle University of Thessaloniki and the University of Sheffield, UK. The university excavations will continue almost every summer until 2018. The long period of excavation has produced a wealth of fixed and mobile finds. These finds relate to the occupation and lifestyle of the prehistoric inhabitants of Paliambela and their use of the site. The settlement of Paliambela was a long-term settlement and appears to combine both types of urban development found in the Neolithic period. It was transformed from an extensive flat settlement into a mounded settlement (Halstead, P. and Kotsakis 2001:93; 2002:407).

The Neolithic settlement of Paliambela Kolindros was long-lived, spanning from the Early to the Late Neolithic, though continuous habitation is not definitively confirmed. Throughout its history, Paliambela adopted both well-known modes of Neolithic occupation: flat extended and tell sites. Specifically, it transformed from a flat-extended settlement in the Early Neolithic to a tell site in later phases (Halstead and Kotsakis, 2001: 93; 2002: 407). This continuity from the Early to the Final Neolithic aids in reconstructing the processes of transformation and their reflections on various aspects of Neolithic life, such as economy and consumption (Kotsakis and Halstead, 2002).

The architectural remains

We therefore have a good picture of the course and transformations of the settlement over time (Maniatis G., Kotsakis K., Halstead 2011:149) (see map 5,6). In the early phases, i.e., during the AN, it had the characteristics of a flat and extensive settlement, and in the later phases, i.e., during the MN and NN, it gradually takes on the characteristics of an earthen

settlement (Halstead, P. and Kotsakis 2001:93; 2002:407; Maniatis C., Kotsakis K., Halstead 2011:149). Excavations are mainly carried out in the small natural hill (Halstead, P. and Kotsakis 2002:407). The Neolithic deposits chronologically cover the period from the Early Neolithic to the Late Neolithic and the excavated area exceeds 5000m2 (Halstead, P. and Kotsakis 2001:93). The settlement is surrounded by ditches, the earliest of which dates to the late 7th and early 6th millennium BC (Maniatis G., Kotsakis K., Halstead 2011). This early ditch is cut by the ditches of the MN period (Halstead, P. and Kotsakis 2002:410). Late Bronze Age burials have been found in the settlement, while many burials and pits date from the Byzantine period (Kotsakis et al. 2007:8; Maniatis G., Kotsakis, K., Halstead 2011:149).

In the early phases, i.e., during the AN, the settlement had the character of an extensive settlement. The deposits of the AN, in the northern sector, show shallow pits cut and carved into the natural rock. The excavators interpreted the shallow pits as dwellings. The pits yielded various finds such as pottery, flaked stone, burnt clay and bone tools (Halstead, P. and Kotsakis 2005:78 ; Μανιάτης Γ., Κωτσάκης, Κ., Halstead 2011:150). The pit area is cut by two deep ditches (Maniatis G., Kotsakis K., Halstead 2011:150). Based on radiocarbon dating carried out in the settlement, derived from secure passes and layers, the EN is dated to 6600 BC. The period of ditch use ranges from 6400 BC to 6200 BC. The site is then cut by ditches, which cut the pits in a phase dated to the late 7th to early 6th millennium BC, perhaps a transitional phase between a late Early Neolithic and an Early Middle Neolithic (Maniatis G., Kotsakis, K., Halstead 2011:152).

The MN was revealed in the Central sector of the excavation (Maniatis G., Kotsakis, K., Halstead 2011:150). During the MN Neolithic the settlement takes the form of a low mound and the underground pits are succeeded by rectangular dwellings constructed with clay walls separated by pebbled surfaces (cobbles) (Halstead, P. and Kotsakis 2005:78; 2002; Kotsakis 2014). Based on the geological investigations, during the MN period, earthquakes occurred in the wider area of Paliambela that created deep cuts and ditches, cut into the natural subsoil and through the EN pits. Postholes and other structures within the ditches indicate the existence of structures such as fences (Kotsakis et al. 2007, 9). The MN assemblages are reminiscent of the southern Balkans as well as the northern and Western assemblages of Thessaly (Halstead, P. and Kotsakis 2003). A fact that is documented to some extent by the bone tools that are of concern in this paper.

Finally, the NN deposits in the southern sector are quite disturbed by ploughing and erosion (Halstead, P. and Kotsakis 2002; 2003; 2005; Kotsakis, K. and Halstead 2002; Maniatis G., Kotsakis, K., Halstead 2011:150). However, it appears that the ditches of the earlier period are replaced by two stone enclosures and that the settlement in the NN II period

is restricted to the hilltop area (Halstead, P. and Kotsakis 2002:410; 2003:66). The Paliambela site has produced a wealth of finds, including bone tools, throughout the Neolithic period and continues to do so.

The results of the excavations at Paliambela have provided a great deal of information about the spatial organisation of the household and the activities carried out in the settlement, such as storage, food preparation and collective activities.

5.2 Bone tools

This chapter is an introduction to the bone industry of the settlement of Paliambela Kolindros in the region of Pieria, near the site of Revenia. The aim is to present the specific categories into which the material under study has been classified. The main characteristics of each group are presented, as well as the questions arising from the archaeological classification. Aggregate data on bone tools, such as the numerical size of the categories (table 12,13) and their general distribution (table 14) are given, followed by a detailed presentation. For each group, issues of typology, raw materials used, production techniques, traces of use and their geographical and temporal distribution in the settlement phases are discussed, as well as the comparison of their presence or absence with other Neolithic bone tools in the wider region of Greece and the Balkans.

A total of 378 bone objects were collected from all layers and units of the Paliambela excavation (table 12). All bone objects were recorded and photographed. The small number that were not bone tools were discarded and included in the zooarchaeological assemblage as they showed no signs of treatment or use. Of the total of 378 objects, 358 are tools, 17 were classified as ornaments, 3 are unidentified objects. It should be noted that some of the tools could be classified as by-products due to the high degree of erosion and fragmentation of the material. Bone tools are found in most of the layers and contexts of the excavation and represent the third (numerically) largest category of finds (from the entire excavated site, after stone tools and chipped stone tools). The study of the zooarchaeological material from the Paliambela has been completed almost entirely, so no large amount of bone tools is expected to be found. As discussed below, most of the bone tools were found in the open area of house 25, in open spaces, in the ditch, in pits, and less in cobbled and enclosed areas.

The bone assemblage from the Paliambela contains all the known Neolithic tool types such as pointed tools 47.9%, edged tools 19.1%, these categories include hooks 0.3%, awls 30.4%, perforators/pointed unidentified 8.2%, spatula 2.6%, edged tool/unidentified 2.6%, chisels 9.0%, polishers 1.1%, handle 1.9%, digging tools 1,1%, comb 2,4%, dagger 2,4%. appear to have been used as second tools and a very large proportion, 24.3%, are unidentified bone tools. A first observation about the bone assemblage of the Paliambela is that it consists mainly of fragments and shows very high degree of erosion (table 15,16). In some tools, only the proximal part may be preserved, which can lead to speculation about the type of tool. However, a tool, its use and classification are typologically defined by its active end. Traces of burning for the extraction of marrow have been observed on several tools. The treatment for the extraction of marrow is confirmed by the zooarchaeological study of the zooarchaeological material.

5.2.1 Pointed tools.

Pointed tools are defined as tools that have a very pointed tip and are made of various materials such as bone, antler and metal (Leroi - Gourhan 1988, 883). Fabrer formulated the term for bone pointed tools in 1977 and defined that "pointed tools converge and the cross section gradually decreases, forming a very pointed tip" (Camps – Fabrer 1977: 352). Depending on the degree of processing, there are many types of perforating tools (Leroi-Gourhan 1988: 883). The category of perforating tools includes all tools that produce a point, such as simple punches, awls and needles (Russell 1990: 524). They are characterised by a proximal or 'holding' part of the tool (the handle by which the craftsman held it) and the active or pointed tip. The proximal part of piercing tools is minimally modified in the Palliabella bone assemblage (mainly the metatarsals and tibiae are modified), while the angle of the active end varies (5° to 46°).

In the material studied, we find tools that are intact (the whole tool is preserved), flattened at one end formed by the convergence of two linear ends (with a particularly sharp edge) and large smooth holes (with a rounded tip). In Central and Western Macedonia, the morphology and dimensions allow us to distinguish between the types of perforating tools (Christidou 2004, 477).

Most bone tools in the archaeological material from Paliambela are pointed tools. Most of them were made from long bones (metatarsals, tibias, ulnae and long bone fragments). Due to the erosion and fragmentary nature of the tools, no clear characteristics of the different categories have been preserved, such as needles (hole in the proximal part of the tool), except for one object that preserves part of the hole (Fig. 2b, 5a, Fig. 1d, 4f), and they all belong to the awl category.

5.2.1.1 Awls

Among the pointed tools, awls are the most common category with 35,4% (134). Most awls are slightly corroded (low=7, medium=106, none=3), while only a few are severely corroded (unrecognizable=18) (table 16).

Regarding the raw material, most awls are made from long bones, while only a few made from flat bones. Due to the preservation of features in bones, only one object is from an unidentified bone. Almost all long bones were used for awls, such as ulna (4), humerus (1), radius (3), fishbone (1), metacarpal (12), metatarsal (16), metapodial (12), tibia (4), long bones/unidentified (71), unidentified bone (1), splinters (29). Of the flat bones, only the ribs were used to make awls (9) (table 19). The majority were from sheep/goat sized bones (104) with only a very small sample from cattle sized bones (12) and small sized bones (5). Several of these could not be identified to any animal size (13) (table 20). The animal families that

could be identified were sheep/goats (50), fish (1), sus (1), hare (1), goat (3), sheep (5), cattle (3), deer (3), red deer (1). A large proportion were of unknown family (66) (table 21).

Most of the tools are fragments 99, the intact ones are only 17, and almost intact 18. A total of 18 items are intact, 12 identified only the shaft and convergent lines ending in a point, 4 items salvage part/half of a tool from the active edge to the proximal part, 59 items salvage only the active end and shaft, 12 items salvage the shaft and proximal end, 27 item salvage small part of the active end and only 2 saves the proximal part but clearly we can distinguish the lines ending into a point (table 17). As with all the materials examined in this study, and as mentioned in the introduction, many of the unidentified objects in our assemblages could be assigned to several object categories. However, their classification was based on the active edge and the percentage of preserved tool.

As can be seen from the material, the inhabitants of Paliambela, like Revenia (chapter 3), exploited the raw materials available to them. This position is documented both by the length of the tools (very short ones have been preserved intact) and by their manufacture. In the case of the metatarsals, for example, both the distal and proximal parts are re-cut, so that we have four tools from one bone. The cross-section of the tools is mainly circular and elliptical, with strong polishing at the pointed end, despite the short length of the tool.

Almost every known construction technique can be found in awls. These include abrasion, cross-cutting, scraping, longitudinal sawing and combinations of these. The most common combination is abrasion, longitudinal sawing and scraping (table 18).

Several items are derived from splinters. Splinters can be found in all tool categories. Apart from the active end, all categories follow the same process. The majority of splinters are awls (29) (fig.5.1, 5.2). Splinters are quite common for the manufacture of pointed tools (62.5%) (fig.5.2). This is an easily accessible blanks, as it can also be obtained from food remains or from the processing residues of other bone objects. Longitudinal splitting of the diaphysis is usually achieved by simple fracture (draw 5.1a). In some cases, it may be sawed transversely to reduce the length of the tool (fig.5.2) and polished by abrasion (fig.5.1) to make it smooth and easier to use. Overall, the handle treatment is minimal. The centre of the tool - the diaphysis and marrow tissue - has been minimally modified (fig.5.1). The active end of the alder perforating tools is the most treated by abrasion, while like most perforating tools the active end is quite polished from use.

Splinters generally appear to be the longest type of blank used for perforating tools, reaching up to 10 cm in length. They have a straight, long, rather coarse body, with irregular angles at the intersection (fig.5.1). They are usually semicircular in cross-section towards the center of the tool and circular towards the active end. Most perforating tools from long bone

slits show similarities in shape and dimensions. This is mainly due to the strict selection of sclerites of similar shape and size. Experimental studies have shown that these tools may have been subjected to repeated surface treatments (Χρηστίδου 2006). One hypothesis is that the large number of splinters in bone tools, not only from Paliambela but also from other Neolithic sites, probably reflects the abundance of material in settlement waste (Χρηστίδου 2006, Christidou 1989).

Awls from the tibia (4) are represented by a very small sample in the settlement (fig.5.3). In those where the proximal end is preserved, it may be ground and worked (fig.5.3a), while there are also those where the proximal end is rough (in the pointed tools). In the tibia, the distal epiphysis is not removed but left intact and the two converging lines leading to the active end, which is either more (fig.5.3b) or less (fig.5.3a) acute, are sawed off. The marrow is completely removed and the bone profile is cut in half from the diaphysis downwards (fig.5.3). These longitudinally dissected bones usually have a hollow or tubular shape (draw 5.1c). The active end is often broken and can be reused as a perforating tool (fig.5.3a, draw 5.2d). The epiphysis (the proximal end) of the tibia is made up of natural angles that are not useful for holding a tool in the hand and need to be normalized. However, they can often be removed voluntarily by transverse sawing or percussion. The length of tibia awls starts at 4 cm and goes up to 9 cm. With the exception of one tibia tool, the rest retain their distinctive characteristics and can be adapted to the animal species, which is sheep/goat.

The ulna is represented by only 4 tools, which show very few traces of treatment. The bevel of the shaft is made along the longitudinal axis of the bone, creating an oval face with a flattened nose. The most common bevel is on the lateral side of the bone. The ulna has a flattened body, and its epiphysis acts as a handle (fig.5.4). With the exception of one ulna tool, the rest retain their distinctive characteristics and can be matched to the animal species. One is from a goat, one from a hare and one from a deer.

Despite the fact that the anatomy of the bone also influences the dimensions of the tool, and despite the long length of the tibia and ulna, the tools derived from them are relatively short in length (with the exception of one tool that reaches 9 cm). This could indicate either a second use of these tools or their extensive use. However, this is only a hypothesis, we could not draw this conclusion with certainty as the sample of treated tibiae and ulnae was quite small.

Metapodials make up a very large part of the bone tool assemblage of the Paliambela, mainly used and worked as awls (metatarsal 16, metacarpal 12, metapodium 12). However, in the material, metarpodials that preserve only the processed epiphysis without any part of the shaft and active end have been included in the unidentified metatarsal tools and not in the

pointed tools. The metapodials are used in their entirety, i.e. with the whole or almost the whole hind phalanx (fig.5.5), slightly modified or with one of its two pulleys cut lengthwise. The diaphysis is preserved and formed.

In most cases, however, the metapodial is separated by a simple longitudinal impact or longitudinal sawing (Stordeur 1976, 40-41). There is evidence from other sites, as seen at the Paliambela site, suggesting preparation and rejection, perhaps due to destruction of the metapodials during the tool shaping process (Stordeur 1976, 40-41). In the Paliambela assemblage, 26 awls are from bisected metapodials and 7 are classified as unidentified metapodials, probably awls. Only two tools are from whole metapodials, one of which cannot be confidently defined as an awl because its active end is fragmented and heavily corroded.

As mentioned above, metapodial can provide more than one tool and can be configured in different ways. For example, the bone can be broken transversely by holding and re-bisecting longitudinally to produce two tools. They usually have a rounded body with a circular cross-section near the active end and a semicircular one near the diaphysis (figs.5.1 f, g, h) (draw 5.1 b, f, g, h). The length of the metapodials in the Paliambela material ranges from 4 cm to 8 cm.

There are several metapodial quartets in the bone material of the Paliambela. As the metapodial is cut lengthwise into two pieces, it is re-sliced to give two more. Similar to other metapodial (whole and bisected metapodial), the cross section is circular and the body is hollow, while the medullary tissue disappears (fig.5.5). The pulley can be normalised and straightened by abrasion on both sides (fig.5.5) or smoothed on one side only (fig.5.5). Both metacarpals and metatarsals, as well as metatarsals which do not retain the distal or proximal part, are mainly from sheep/goats. Metacarpal: 3 unidentified species, 2 goat, 6 sheep/goat, 1 sheep, metatarsal: 3 unidentified species, 10 sheep/goat, 3 sheep, Metapodials without proximal or distal part: 2 unidentified species, 9 sheep/goat, 1 sheep.

Most awls use long unidentified bones as raw material. Most of these bones do not preserve any distinct anatomical features. These heavily worked tools have very little of the diaphysis and active end is preserved. A total of 71 tools falls into this category. Many of them have a circular or semicircular cross-section (fig.5.6). The species identified from the long unidentified bones are red deer, sheep/goat, cattle and deer.

The awls through ribs and split ribs in the bone material of Paliambela are 9. The procedure is the same for both pointed and edge tools. The bone is cut transversely to the desired length, the lips are removed by hammering if necessary, and then the angle is produced by abrasion. The spongy tissue of the bone on the split ribs can be ground with abrasion (fig.5.7a) (draw 5.3f) or without abrasion (fig.5.7b). It is worth noting that there are

three perforating tools in this category, one from ribs and the other from bisected ribs of a large animal (fig.5.7d), which are interesting because of their peculiar shape. The bone seems to have been cut transversely, leaving a 'nose' on the active part. One (fig.5.7e) has not been bisected and only the genesis of the nose is preserved, while the other (fig.5.7d) appears to have been bisected without removing the rib lips, or only abraded to reach the spongy tissue. It could be a tool for engraving and decorating ceramics. The traces that have survived are not sufficiently clear (draw 5.3g).

The ribs are very fragile due to their thinness and may break accidentally, so that in this category there may be fragments belonging to perforating tools, but we cannot be sure that they belong to this group of tools. The length of the perforating tools from ribs does not exceed 8 cm. It is a rule that either bisected or unsplit ribs have a straight cross section. Expected when we take into account the physiology of the bone. Most of the specimens are fragments, with only one object intact and two almost intact. It is not easy to identify the sides of the animals. However, we were able to identify the size of the animal. So, we have ribs of sheep/goat and cattle size animals.

There are 4 awls from the humerus and radius, 3 from the radius (sheep/goat) (fig.5.8) and 1 from the humerus (pig). Except from 1 which is intact, the other tools save only the active end and diaphysis and have been sawed on the longitudinal axis and abrasion. It has an elliptical cross-section and traces of use survive up to ~2 cm; it is slightly polished and smoothed from use.

The archaeological material from Paliambela preserves a unique fishbone pointed tool (fig.5.9) (draw 5.1e), which retains the 'teeth' of the natural bone in the middle of the diaphysis and along the entire length of the posterior end. From the middle of the diaphysis and towards the active end, the bone is smoothed and forms an angle with the abrasion (Fig. 1e).

The distribution of awls within the context of the site is wide, with bone awls found in almost all context. The highest concentration is in contexts designated as open spaces (27). Followed by the ditch (19) and pits (7). A total of 15 awls have been found in the contexts that have been defined as houses (table 14). Most of the awls found in context that through temporal analysis placed in MN. While the concentration is lower in the EN, LN and FN (table 22).

5.2.1.2 - Pointed tools – Perforators.

Pointed tools are 40 in the bone assemblage of Paliambela. Pointed tools in this category have different characteristics from awls; awls are more standardised in angle and shape. Most awls

are slightly corroded (low=5, medium=28, none=4), while only a few are severely corroded (unrecognizable=3) (table 16).

Pointed tools vary in angle size and have a blunter angle (fig. 5.10). Very small fragments of the active end of pointed tools are also classified in this category. Most of the bones in this category are long, unidentified bones. Among the pointed implements we identified 1 deer antler, 3 sheep/goat tibias, 1 sheepgoat metapodial, 2 cattle ribs, 11 sheep/goat long bones, 21 long bones from an unidentified animal and 1 unidentified bone (table 19,21). The manufacturing techniques identified in the pointed tools are longitudinal section – scraping – rubbing, longitudinal section – rubbing, scraping - rubbing, rubbing, cross section – rubbing, longitudinal section (table 18). The same procedure is followed as in the awls for each bone. However, the active edge on intact pointed tools has a more obtuse angle and the bevel is not as meticulously worked. Only 3 are intact, 4 are nearly intact and 33 are fragments (table 15). However, the fact that all of them have a surviving cutting edge near the active end helps us to understand that they are pointed tools. The cross section on this category is circular and elliptical.

The distribution of perforators within the context of the site is wide, although bone perforators are not found in all contexts. The highest concentration is in contexts designated as open spaces (9). This is followed by ditches (6) and pits (4). A total of 3 pointed tools were found in the contexts that have been defined as houses (table 14). Most of the pointed tools found in the contexts placed by the temporal analysis in MN. While the concentration is lower in the EN and LN. Only one pointed tool was found in contexts of FN (table 22).

5.2.1.3 Needle

Only one needle survives in the Paliambela bone assemblage (table 12) (draw 5.1d). It is the only tool that preserves a hole in its distal part. It is intact and comes from a goat tibia; the manufacturing techniques identified are sawing along the longitudinal axis, abrasion and scraping. Its length is well over 7 cm and the cross section is circular.

The unique needle that completes the bone assemblage of Paliambela was found in open space and it is dated on FN (table 14,22). Despite the fact that, as we will see below, there are no major and significant differences in both the typology and processing of bone tools during the different periods of the Neolithic, needles are a category that is in the majority in the LN and FN positions compared to EN and MN.

5.2.1.4 Fishook

The only hook (fig. 5.11) (draw 5.4b) from the Paliambela bone material is intact. It comes from an unidentified long bone, probably from a large animal, cattle or deer. The

craftsman seems to have paid attention to detail. The fishhook was found in the EN pits of trench 6, designated as open spaces (table 14,22).

5.2.1.5 Harpoon

Six tools are classified in the category of harpoons with a rounded, horned tip (table 12). They account 1.1% of the total material. They all come from deer antlers, are lightly corroded and all retain the active end and the shaft. Three of them are almost intact, while one is fragmentary (table 15). The manufacturing techniques used are abrasion and longitudinal cutting (table 18).

It is possible that the active end has been blunted by use. Two have a hole in the back. Both have been cut lengthwise by sawing and are highly polished. They are shaped on tine segments, and they have two distinct parts: the proximal part, which has the hole on it and a pointed active end, and the proximal part which is the part that is attached to the wooden shaft of the harpoon. The proximal part on the Paliambela bone assemblage is not preserved. Only the emergence of the proximal part is preserved (fig.5.12) (draw 5.5e). The next steps involved the shaping of the main line hole and the shaping of the active end. The type is similar to the harpoon of the site Agioi Anargiroi (Arabatzis 2019: 165). Their angle is not particularly acute and they have a semicircular cross-section, almost straight. First, the manufacturer selected the appropriate tine and extracted the desired part by hammering and/or sawing. The next step was to shape the base in the proximal part of the tine segment by percussion, applied almost in the centre of the blank. The proximal part was then split longitudinally by sawing and grinding to produce a flat inner surface and a plano-convex outer surface. A single object could have come from the distal part. However, as there is no complete harpoon in the material, we could not be sure. It may have been a piece of ornament, such as a pendant. The collection and use of deer antlers in the Paliambela settlement seems to have been unsystematic.

Harpoons located in open spaces and in the ditch of the site and all dated in MN, MN-LN (table 14,22).

5.2.1.6 Conclusions for pointed tools.

As can be seen from the statistical results, pointed tools make up the largest part of the Palia mbela assemblage with a percentage of 46.6%. This is the most important group of tools due to their frequency. The majority of them have a straight profile, and most of them show a treatment along their entire length, so that the sides converge from the base to the pointed end. The non-symmetrical shapes are probably the result of reworking to renew or

repair them (Χρηστίδου 2006). Splinters have non-symmetrical shapes because they are worked only on the active end, which is different from the rest of the body.

In the bone assemblage of the Paliambela, the following categories stand out typologically: awls, needles, perforators, fishhooks; the most numerous are the awls, which are characterized by a more acute angle. Within the group of perforating tools, four general categories can be distinguished in terms of raw material: those made from splinters, long bones, ribs, horns and other types of bone such as fish bone.

By studying the material and calculating the statistical results, we can conclude that the Neolithic inhabitant of Paliambela showed a preference for long bones, rather than ribs or antlers, and in particular the splinters of long bones and the split metatarsals of mainly medium-sized mammals such as goats and sheep. Of course, we should not overlook unidentified long bones, which could produce a different result due to their large number.

Overall, however, there is a high degree of homogeneity in the different groups of pointed tools and in their lengths. As mentioned above, it is the manufacturing techniques and the future use of the tool that determine the final product. The working techniques themselves are determined by the anatomy of the bone. Thus, a pointed tool from the metatarsal or tibia shows homogeneity throughout the period considered (EN-FN). It can be seen that there are no differences in the angles between the different bones, with the metatarsals having slightly smaller angles than the splinters. It should be noted, however, that the range of angles for these tools, including all bones, is large. This is clearly influenced by the subsequent use of the tool. This homogeneity, both in terms of the final product and, more importantly, in terms of the manufacturing techniques, has been suggested to reflect a skilled craftsman. Moundrea (1988) suggests that the high homogeneity of perforating tools from St. Petros, Thessaly, in the two occupation periods he studied reflects a specialised technique. Similar examples exist from other Neolithic sites in Greece (Moundrea 1988, Χρηστίδου 2006) and the Balkans (Vitezovic 2013, 203).

5.2.2 Edged tools

Edged or sharp tools are defined as tools that are elongated, have an active end that is generally straight, does not form an angle and may be rounded. Bone, stone and metal can be used as raw materials. In addition, the base is rounded several times (Leroi - Gourhan 1988, 1113). perforating tools by chamfering, on the opposite sides of the bone. The edge of the active end may be straight, curved, concave, hollow, symmetrical, asymmetrical or with a double bevel (edge where both sides, internal and external, are used in the same way, forming an identical edge on both sides). The cross-section of the active edge varies (Christidou 1999).

Edged or sharp tools are defined as tools that are elongated, have an active edge that is generally straight, does not form an angle and may be rounded. Bone, stone and metal can be used as raw materials. In addition, the base is rounded several times (Leroi - Gourhan 1988, 1113). The edge of the active end can be straight, curved, concave, hollow, symmetrical, asymmetrical or with a double bevel (edge where both sides, inner and outer, are used in the same way, forming an identical edge on both sides). The cross-section of the active end varies (Christidou 1999). There are 69 objects in this category from the Paliambela material, which are in the form of fragments (47), intact (4) or nearly intact tools (18) (table 15). In this category, and due to the fragmentary nature of the material, there could be tools that were used in two ways.

5.2.2.1 Spatulas - dagger

The spatulas cover 2.6% of the material (table 12). Most of the spatulas are slightly corroded (low=1, medium=8), while only one is severely corroded (unrecognizable=1) (table 16). One is intact, 3 are almost intact and 6 are fragments (table 15). One saves shaft only, 4 saves shaft and active end, 1 saves shaft, active end, distal part, 1 active end, 1 intact (table 17). The manufacturing techniques recognised are: sawing on longitudinal - abrasion, transverse cutting - sawing on longitudinal axis, transverse cutting - abrasion, sawing on longitudinal axis (table 18). Their length is 1 from 0 -3 cm, 3 from 5 - 7 cm, and 1 longer than 7 cm.

Regarding the raw material (table 19,20,21), most spatulas were made from flat bones, while only a 3 are from long bones. Five spatulas were found in the Paliambela bone material, which was derived from scapulae (fig.5.13, 5.14, 5.15). In many of the scapulae, although the traces of treatment are clearly visible, the active edge has been severely damaged and eroded (fig.5.14) (draw 5.4 c,d). It appears that the posterior epiphysis in all objects has been abraded, as has the vertical beam of the bone, sometimes to the extent that the spongy tissue is visible (fig 5.13, 5.14).

In this category we have mostly fragments and almost intact tools. They are up to 7 cm long and the surviving edges are straight and asymmetrical, concave and with a double bevel. This is a raw material that is not often found in bone tools or is found in very small numbers. No other scapula tools were found in any other material in this study. They were probably used as scrapers for working leather. Two come from sheep/goats, 2 from cattle and 1 from pig. The traces of use indicate that one of the tools was used as a dagger; the edge is very sharp.

The two rib spatulas follow the same treatment as the pointed tools, their active edge is not modified by abrasion. Also, in the case of the rib spatulas the traces of use seem to cover

almost the entire tool (fig 5.16, 5.17). The tibia spatulas are longer and seem to have been treated less than the pointed tibia tools.

The distribution of spatulas within the context of the site is wide, although bone spatulas are not found in all context. The highest concentration is in contexts designated as open spaces and pits. Two spatulas found in the area that designated as coble yard of House 25. Most of the spatulas found in context that through temporal analysis placed in MN. While the concentration is lower in the EN, LN and FN (table 14,22).

5.2.2.2 Polisher – Spatula/polisher

Polishers make up 1.6% of the assemblage (table 12). Most polishers are moderately corroded (table 16). One is almost intact, and the rest are fragments (table 15). 1 preserve shaft only, 4 preserves shaft and active end, 1 preserves shaft, active end, proximal part, 1 active end (table 17). The recognised manufacturing techniques are: sawing on the longitudinal axis, transverse cutting - abrasion, scraping - abrasion, abrasion (table 18). Their length is 2 from 3 - 5 cm, 2 from 5 - 7 cm and 1 longer than 7 cm.

The majority of this category uses long bone ribs from unidentified animals as raw material (table 19,20,21) (fig 5.18) (draw 5.3 d, e). The method of working ribs is the same as for pointed tools and spatulas. For unsplit ribs, the active edge is worked by beveling. For split ribs, the usual procedure is followed, i.e. the bone is cut crosswise to the desired length, the lips are removed and then the edge is created on both sides by gradual thinning. Some of the split ribs are re-sliced lengthwise. In most cases, the spongy tissue of the bone is treated by abrasion (Fig. 9a,b,c, Fig. 4a). Bones in this category are up to 14 cm long and the edge may be straight, concave, asymmetrical or double bevelled. The cross-section is usually flat or curved and the edges are usually rounded (Fig. 4). side were used as scrapers.

The only spine that has been used has been used intact without any treatment, only the traces of use are visible, which run along the entire length of the tool.

The distribution of polishers within the context of the site is not wide. They were found in ditch and coble yard of the House 25. Except from 1 that is located in contexts of EN the other is located in context of MN (table 14,22).

5.2.2.3 Chisel

Chisels are the largest category of edged tools (34), representing for 9.0% of the total material (table 12). Most are moderately corroded (23) and slightly corroded (low=5, none=2), while 4 are severely corroded (unrecognizable=1, high=3). Most are preserved in fragments (21), while 11 are almost intact and 2 are intact (table 15). Five save more than 90% of the tool so we have all the information. Nine preserve only the shaft and the active

end, 14 preserve only the active end, 3 preserve the shaft with the converging lines ending at the active end, 2 preserve part of the shaft, part of the active end and part of the proximal part, while 1 preserve part of the shaft and the proximal part (table 17). The cross sections observed are predominantly planoconvex, while the active edge is predominantly planoconvex, convex, bevel and double bevel. This is the category of tools from the whole bone material that has preserved the greatest length; most of them are between 5 and 7 cm, several are longer than 7 cm, while a length of up to 5 cm is also preserved (draw 5.2). Regarding the raw material, most chisels are made from long bones and only few are made from flat bones. This is a category in which large and medium-sized animals are almost equally represented (table 20). The following categories have been identified: unidentified deer bones, pig femur, sheep/goat radius, preserve metacarpals and metatarsals, red deer antlers, ribs, long bones of cattle and sheep. In all artefact categories, long bones are predominantly unidentified. The edges in this category are presented as concave, straight and asymmetrical. Their length reaches 6 cm. It is possible that one of them has a hole. There are 26 unidentified long bones with an edge, and they are all fragments. As with the piercing tools, many of the edged tools could belong to the above category (metapodials, tibia, ulna).

The construction techniques (table 18) identified by the study were sawing on longitudinal axis – scraping – abrasion, sawing on longitudinal axis- abrasion, scraping – abrasion, abrasion, sawing on longitudinal axis scraping, sawing on longitudinal axis. Transverse cutting is completely absent from this category. There are 16 chisels from the tibia, only 1 from the radius, 1 from femur and 3 from the metatarsal (table 19). All the long bones used to make chisels are treated in the same way (fig.5.19). But we recognize two main processing techniques observed for this type of bone tool. One involves impacting the tool and then abrasion on the active end (fig.5.19b, 5.20), while the other entails longitudinal sawing or impacting and modifying the entire length of the tool (fig.5.19 c, e, f, 5.21) The ribs are treated in the same way as the spatulas, while the antlers are left intact, and the active end is worked. Many of the unidentified chisel tools could belong to these long bones, but as they do not preserve any distinguishing feature, it was preferred to include them in the category of unidentified long bones. As mentioned above, in the other categories the edge is produced by chamfering the anterior or posterior surface of the bone, and in a few cases the process shows traces of longitudinal grooving. The desired length is taken from the bone and then machined longitudinally to produce the bevel at the active end. In general, beveled tools are longer in length, a phenomenon observed at the Paliambela site and at other Neolithic sites in Greece, and generally in bone assemblages from Neolithic excavations (Soressi et al. 2013; Christidou 1999, 324 - 325; Christidou & Legrand 2003, 388 - 390) (Figs. 6a,8).

The distribution of chisels within the context of the site is wide, although they are not found in all contexts. The highest concentration is in contexts defined as ditches (6). This is followed by contexts defined as open spaces. Most of the chisels are found in the contexts placed by the temporal analysis in MN. The concentration is lower in the EN and LN. Only one chisel was found in FN contexts (table 14,22).

5.2.2.4 Sharp tool

The number of unidentified edged tools is small (10) representing 2.6% of the total material (table 12) (fig.5.22). Most are moderately corroded (9) and only 1 is severely corroded. Most are preserved in fragments (7), while 2 are almost intact and 1 is intact (table 15). One preserves more than 90% of the tool, so we have all the information. Six preserve only the shaft and the active end, 3 only the active end. The cross sections observed are predominantly planoconvex, while the active end is predominantly planoconvex, convex, bevelled and double bevelled. Their length varies from 3 to 7 cm. Ulna, tibia, unidentified long bones and ribs were used, all from sheep and goats and from unidentified animals (table 19,21). The construction techniques identified are sawing along the longitudinal axis - scraping abrasion, abrasion, sawing along the longitudinal axis (table 18).

The distribution of sharp tools within the context of the site is not wide. Sharp tools were found in ditches, open spaces and pits. The sharp tools found in contexts that were placed by temporal analysis in EN, MN and FN. While there are no sharp tools in the contexts of LN (table 14,22).

5.2.2.5 Conclusions for edged tools

The statistics show that tools with edge are the second most common type of tool in the material examined (not including unidentified tools). In total they represent 20.6% of the bone tools. The group of edged tools can be divided into four general categories: spatulas, chisels, polishers and unidentified sharp tools.

Statistically, the majority of sharp tools come from long, unidentified bones. However, the best-preserved tools come from split ribs, mainly from large mammals.

Like the pointed tools, their manufacturing techniques and future use are determined by the anatomy of the bone. There seems to be a homogeneity of morphology in the period studied.

The edge on this type of tool varies, but not all forms are found in this type of tool, which has been recorded in other Neolithic sites (Stavroupoli/ Χρηστίδου 2006, Limenaria, Thermi/Χρηστίδου 1989, Selevaće/ Vitezovic 2013, Vasilika, Galani Big Island/ Christidou 1999 etc.). They have concave, straight, asymmetrical or double bevelled edges. The material

does not have curved edges. The length of the edges does not exceed 3.5 cm. cm, while the length of the tools can be up to 14 cm. The majority are fragments and there are a few almost intact tools.

This category has the freshest fractures and many of the fragments are welded. Those that are of considerable length can be active and their sides are referred to in the literature as daggers or spatulas (Moundrea 1981:311).

Although long bones make up the majority of this category, experimental studies have shown that ribs have a much longer lifespan, whereas long bones wear out in a much shorter period of time. In fact, in the experimental studies that have been carried out scrapers have been used on the skin of long bones and on flat bones. Treatment of skin with flat bone scrapers showed that the tool began to wear out after 105 minutes of use and long bones after 55 minutes. However, this result in this particular example is also related to the type of leather being processed. The natural structure of the hide varies from animal to animal, for example red deer has a softer hide than cattle, which is also easier to work with (Christidou and Legrand 2003, 389). Standardised morphological patterns, except for tools made from split ribs.

5.2.3 Ring

The type of this particular tool is quite elaborate and short in length, so it is not possible to tell what type of bone it is from, except that it is from a long bone (fig.5.23), only one is from an antler. In most of the bones the medullary tissue has completely disappeared, and the bone is very thin (draw 5.4c). The length of the rings does not exceed 4.5 cm. However, due to the fracture some of the rings could be longer. Some are preserved almost intact, others in fragments. The rings are produced by transverse grooves in long bones or antlers, mainly from large or medium-sized animals (goats, sheep, cattle, deer). The medullary cavity had the natural hole required for this type of tool. In several cases they show traces of abrasion on the edges and on the outside. Similar objects have been found at other sites in Macedonia (Χρηστίδου 2006) and in the Balkan region (Vitezovic 2013, 205 - 206). The rings from many sites are classified as ornaments (Χρηστίδου 2006). Apart from the rings that they are in fills, which is unidentified, the one ring found in open space. They are found in contexts dated to MN and LN (table 14,22).

5.2.4 Comb

All combs are from split ribs, which make up 2.4% of the material (table 12) (fig.5.25). Most are almost intact. They come from the ribs of large animals (table 19,20) (draw 5.3 a,b,c). The process is the same as for the pointed and edged tools. First, the bone is sawn

transversely, the lips are removed and cut longitudinally, while the spongy tissue is removed by abrasion. In most objects the 'teeth' have not been preserved intact, only their formation (fig. 5.25). The 'teeth' were produced by longitudinal grooving (fig.5.27). Various lengths and widths are represented in this category. Some show special features, such as the tool in Figure (fig. 5.25 b), where it appears that a transverse cut was made in the base of the tool and deliberately stopped just before it was removed from the tool. This is a deliberate grooving of the bone which may indicate decoration. The base (non-active end) of one of the serrated tools appears to have a deliberately created point (fig. 5.25a), reminiscent of side piercing tools. The fact that some are less and some more worked may indicate the presence or intention of decoration. Similar objects have been found at other sites in Macedonia (Χρηστίδου 2006) and in the Balkan region (Vitezovic 2013, 205 - 206).

The combs found in house 23, ditch and open spaces. The combs are dated based on temporal analysis on MN and MN, LN, the other tools are in identified fills (table 14,22).

5.2.5 Sleeves – Handle

There are two types of sleeves. Sleeves on basal parts with shaft hole and socketed sleeves (table 12) (draw 5.5c). Handles/sleeves for stone or other tools were made of antler of row or red deer (pic 56,57) (table 19,21). Socketed sleeves surface is almost rough on the outside and shows no traces, while the inside and the edges show traces of grinding (fig.5.28). Most of them are preserved in fragments. Their length reaches up to 9 cm, while in the half-preserved ones their diameter seems to be quite large, up to ~ 2.5 cm. Some of these tools may have had a second use as sharp tools. A total of 4 tools from the Paliambela bone material have been identified as socketed sleeves. They are shaped on beam segments, and they have two or one sockets, one accepts stone tool and one hafting hole that was receiving the tenon of the wooden haft (Arabatzis 2019: 100).

A single tool (fig.5.29) appears to have been used as a sleeve on the basal part with a shaft hole and perhaps hammer at the same time, coming from the antler beam rather than the tines of the antler (draw 5.5a). The antler has a hole at the base of the beam made by a circular motion. The tool is quite eroded and has a large amount of sediment on it, but the traces of the hole can be seen to be in concentric circles, possibly indicating that the hole was made by rotating wood on the object. The shaft hole is completely manufactured and is preserved totally so it was possible to measure the dimensions of the holes and to recognize the manufacture techniques. It was shaped through drilling. An identical tool was found at Selevaće in Bulgaria (Russel 1990, 535 - 537), at Dispilio and at Agioi Anargiroi (Arabatzis 2019) from the region of Western Macedonia. The most common practice was to shape the shaft hole close to the base of the antler either in the area between the first and the second

tine or in the first tine. Perhaps this choice for the shaft hole position is related with practical reasons that would matter during the use of the tool like the transfer of the energy of the stroke, the absorbement of the impact or the tools damage (Arabatzis, 2019: 75).

Sleeves located in close spaces and unidentified fills. It is not possible to date all the objects. Some of them are in ditch and open space and they are dated in MN and FN (table 14,22).

5.2.6 Unidentified Tools

A very large proportion of the material is classified as unidentified tools/objects (fragments of worked bones). They account for 24.3% of the material (table 12). Most of these are from medium-sized mammals (goats and sheep) (table 20). Most of the fragments preserve only part of the bone diaphysis with traces of processing and shaping (table 17,18). However, they may only preserve one epiphysis, so we know the anatomical origin but not the type of tool (fig.5.30a).

All bone categories include unidentified tools, except for the fish bone, which is unique (table 19). A unique object derived from an unidentified bone is a very small fragment, but it bears traces of grinding and has therefore been included in the material category.

The study of use, wear and tear, and in particular of processing techniques, could help to include some unidentified tools in the general categories (edged tools, pointed tools, etc.).

Some tibia or metapodial epiphyses may be closer in typology to the pointed tools. For example, split metapodial usually correspond to awls. Furthermore, because of their small diameter and anatomy, splinters are usually used to make pointed tools. Ribs, on the other hand, would be particularly difficult to classify, as they are used for both pointed and edged tools. Usually, however, the polished faces are reserved for the edged tools. In the case of the perforators, it has been observed that the spongy tissue either remains rough or is polished only a few millimeters above the active edge. Of course, this cannot be proved with certainty, so we cannot be sure of classifying an object in a category on the basis of a single fragment. Note that an attempt was made to weld fragments from adjacent trenches and units, but this was unsuccessful. Some of these may be wastes, but as a sufficient number are not preserved and it is difficult to separate traces of use from processing, it has been decided to go with unidentified tools; most of the objects seem to have been used superficially.

The distribution of unidentified tools within the context of the site is wide. The unidentified tools were found in all areas. Most of them found in ditch, open spaces and pits. The unidentified tools found through temporal analysis were placed in all periods of the site (EN, MN, LN, FN) (table 14,22).

5.2.7 Ornaments

The objects identified as ornaments total 17 (Fig. 16, Fig. 16), including beads, separators (draw 5.4a), earrings and pendants (Fig. 13) (table 13) (draw 5.5 b, d). They come from long unidentified bones, metapodials, tibia, ribs, bisected ribs and teeth. Due to the small amount of material and the fairly extensive processing they have undergone, it is not easy to identify the part of the bone they come from. For this reason, it was considered better to include them in more general categories of raw material, such as whether they came from small, medium or large animals. Most ornaments have a hole. The hole could be drilled in a number of different ways.

In the bone objects of the Paliambela, most of the ways of making the hole were clear. Pressure on the inside of the bone to extract flakes is shown on one of the separators, from a tibia (fig.5.31); the bone was grooved by pressure, flakes were removed, and the hole was finished by grinding and abrasion. The spongy tissue of the bone was completely removed. In some objects (fig.5.32) the hole was made with a circular movement (cylindrical tool) from one side of the bone to the other; in both objects the traces of the hole are concentric circles. The hooks are made in the same way (Στρατούλη 2008).

Of particular interest, as mentioned above, are the long bones of small mammals that appear to have been prepared and intended for beads. In some of them, one pineal gland is preserved, while the other has been completely removed. They show traces of a transverse cutting (fig.5.33, 5.34) in which a cutting tool, probably a stone tool, was used. It appears that an attempt has been made to remove the spongy tissue (20a), possibly with a perforating tool or a thin material such as wood or twigs, slowly rubbing and removing the spongy tissue, the basic condition being that the bone is dry.

Similarly, to the tools, the ornaments were recorded on its preserved surface. 35.3% of the material is whole, while most of the material, with a percentage of 4.2%, is preserved in the shaft and part of one end.

Most of the ornaments were found in ditch and in open spaces. Two pendants were found in the pits of EN. In the fills of MN such as ditch, cobble yard of the house 25 and unidentified fills found segregators, earrings, pendant and beads. Only one bead was found in the FN ditch (table 23,24).

5.3 Temporal and spatial distribution of the bone implements

The bone tools come from all over the Paliambela excavation and from all over the different Neolithic periods of the settlement. Bone tools constitute the third (numerical) category of finds after the stone tools and chipped stone tools. Apart from unidentified fills not associated with an AEX[1], most tools and ornaments are found in areas designated as open space (tools 75, ornaments 3). The next highest concentration is in pits, some of which are designated as open spaces, processing areas (food, work areas, etc.) (tools 33, ornaments 2).

In house 20, 7 bone tools were found (2 pointed tools, 3 awls, 2 unknown tools). In house 23 4 bone tools were found (3 awls, 1 comb). In the cobble yard of House 25 were found 18 bone tools (1 pointes tools, 9 awls, 4 unidentified tools, 1 chisel, 2 daggers, 1 polisher) and 1 ornament (earring). In fills that identified as close spaces were found 14 bone tools (1 handle, 9 awls, 1 spatula, 3 unidentified objects). In coble yards were found 11 bone tools (1 pointed tool, 5 awls, 1 spatula, 4 unidentified tools). I the ditch were found 51 bone tools (6 pointed tools, 1 harpoon, 19 awls, 1 digging tool, 1 spatula, 1 comb, 12 unidentified tools, 2 sharp tools, 6 chisels, 2 polishers) and 4 ornaments (2 segregators, 2 beads). In small ditch of the excavation were found 4 bone tools (3 awls, 1 chisel). In fills that identified as open spaces were found 75 bone tools (9 pointed tools, 1 harpoon, 27 awls, 1 digging tool, 3 spatulas, 3 combs, 1 fishhook, 19 unidentified objects, 2 edged tools, 7 chisels, 1 needle, 1 ring) and 3 ornaments (1 earring, 1 pendant, 1 bead). In pits were found 33 bone tools (4 pointed tools, 7 awls, 3 spatulas, 11 unidentified objects, 2 edged tools, 3 chisels, 3 daggers) and 2 ornaments (2 pendants). In possible cobble yards (2 awls, 2 unidentified objects).

The findings in their spatial and temporal context

The material remains of excavations and their study are the only factor through which we can approach prehistoric societies and interpret, to some extent, interpret the way of life of prehistoric people. Archaeological material (pottery, tools, architectural structures, archaeobotanical and archaeozoological remains, etc.) can only be interpreted in the context in which it was found. The domestic unit within a settlement can only be interpreted in the context in which it is found. The whole settlement as it is represented in each temporal phase of the Neolithic is a subject of constant debate in archaeology. The organization of settlements, the layout of houses, cooking facilities and other structures, in conjunction with mobile finds, provide information about the social and economic organization of prehistoric people.

[1] AEX: This is the abbreviation used for finds that are fixed structures.

In order to understand the role of bone tools in the daily life of the Neolithic inhabitants, it is necessary to refer to the archaeological context (stratigraphy, pits, immobile and mobile finds) of each prehistoric settlement in which they were deposited and subsequently recovered by archaeologists (Thomas 1999, 64).

Tools in human societies appear from the Paleolithic era and are a key element in human evolution, both in terms of the technique with which they were made and their use. There are examples of bone tools made by Neanderthals using percussion, in imitation of stone tools (axes, digging and grinding tools). Bone tools such as scrapers are the earliest to appear in Europe, with the earliest examples found at Saltzgitter-Lebenstedt in Germany, where mammoth ribs were found that had been modified by impact and scraping into an irregular shape, probably used for leatherworking (Soressi et al. 2013, 14186). Tools were used by prehistoric people to facilitate their daily tasks, such as grinding seeds, hunting and preparing food. In addition, tools were used for the production of perishable materials such as cloth, leather and baskets, or for the manufacture of pottery, etc.

The present chapter examines and analyses bone tools from the Neolithic period from the site of Paliambela Kolindros in the region of Pieria. The material comes from the whole of the excavation of the settlement carried out so far, with the exception of sections 2 and 3. The stratigraphy is particularly disturbed and, according to the corresponding chronology, belongs to the historical period. Furthermore, no object was found in section 3 that could be identified as a bone tool. Information on the context to which the bone tools belong has been gathered from the excavation record of Paliambela Kolindros, as well as from the research work of colleagues who have worked on pottery in the periods and locations mentioned (Παπαδάκου 2011; Σιαμίδου 2017).

As mentioned above, the excavation is taking place in the area defined as a mound (NN - MN) and as a flat - extended settlement (MN - AN). The shape of the mound is very helpful for the archaeologists because the layers are in chronological order. This fact does not exclude the possibility that there are no disturbed layers, or layers that have intruded into lower or upper levels over time, or even layers that have been defined as a transition from one period to another. It should be noted that these are sites subjected to intense post-positive activity (later pits of different periods, ploughing, ditches, etc.), but it is important to remember that soil is not a static medium (Villa 1982, 279) and the vertical post positive displacement of objects can obscure the possibility of interpretation.

A basic element and indicator of relative dating is pottery, the study of which and the specific sites in which it is found help us to date bone tools relatively. Another element of dating is the immobile remains (AEX) of the settlement, such as floors, houses, paving stones

and pits. Finally, radiocarbon dating has been carried out on many samples, coinciding with the phases of relative dating (pottery) (Μανιάτης Γ., Κωτσάκης, Κ., Halstead 2011).

An important element in understanding and relating the use of tools in general to the lives of Neolithic people is whether they were found in an enclosed or open space. Enclosed space indicates work that took place within the settlement unit (e.g. stirring food, processing seeds), while open space indicates work that took place at the community level (e.g. leatherworking, clay or bark processing, basketry, etc.). This varies according to the period under study.

In the EN, for example, all the work was carried out in a communal context (cutting meat, sharing food, leather processing, etc.) in open spaces, mainly the area in front of the pits which was designated as a workplace, also suggesting the communal character of this particular society. Later in the MN, the settlement unit is limited to houses, suggesting a less communal and more closed character, i.e. in the context of a small number of people, perhaps a family. Finally, the NN has completely lost its group/community character (Kotsakis 2014: 9 - 10).

However, in the Neolithic settlement of Paliambela, as far as bone tools are concerned, it seems that the majority of them (awls, scrapers, combs, antler handles, tools made of teeth and shoulder blades) were found in the open during the entire Neolithic period. This may be due to the fact that the tasks for which the bone tools were used could not have been carried out in the limited space of an MN or LN house. Some tasks may have lost their communal character, but objectively they could not have been carried out in the houses of the MN and LN, such as tanning (a strong smell during leather processing), which contributes to the hypothesis that such work would probably have been carried out even in open spaces, such as the cobbled areas in front of and between the houses. Moreover, as far as the use of tools is concerned, the activities could be carried out not only by one person, but with the help of more than one person, a group, regardless of whether they were linked by family ties. It is worth noting that, in addition to the EN trench, a large concentration of bone tools (several objects together) was not found in a specific location, but scattered throughout the settlement, in all the sections we have examined.

Starting with the EN (6700/6500 - 5800/5600 BC), we see that most of the tools are found in the area of the pits of sections 6, 27 and 21. In total, almost half of the material is concentrated in these sections, scrapers, beads, pendants, earrings, separators, the only hook. Some of the pits were dug down to the natural substrate. The system of all these pits and the EN ditch is cut by the deep postholes (MN) AEX 626 (located in both sections 6,21, pl. 19, Halsted and Kotsakis 2004 - 2005,). The whole area was scattered with pits of later date,

disturbing the sections (Halsted and Kotsakis 2004 - 2005). However, no large quantity of tools was found in the ditches (AEX 626, AEX 2105) that cut these sections, the main finds being, in fragmentary form, awls, scrapers, a bead or possibly a bone prepared for beading and possibly discarded, a divider and a small animal bone (rodent or fish) (Fig. 19).

The pits of the EN are a fundamental structural element of the settlement. In Neolithic settlements, pits can change in size, content and even use, so they can be key factors in understanding the settlements themselves and the past in general (Μπορμπουδάκη 2014: 7). In line with the literature and the need for archaeologists to interpret the formation of pits, a classification of sorts has been adopted according to their function and individual characteristics (Harding 2006: 111-112). The fill of any pit may be formed by natural/geological processes, by processes associated with the systematic use of the pit, or by the erosion of the sidewalls during its use or abandonment; it may even be of an everyday nature, such as the waste of a household or a production process (e.g. the remains of a meal, the cleaning products of a stove, the waste from ceramic work, etc.), but may have a more structured character as a result of deliberate deposition under the influence of specific symbolic factors (Harding 2006: 111-113).

The EN pit of Paliambela are defined as houses and later as workplaces (Kotsakis 2014, 6). This is evidenced by the quantity of pottery, stone tools, organic remains and locally burnt soil in the deposits of the pits. The contents of the pits in the lower - oldest - layers, defined as houses, are 'clean' of finds (from the Paliambela excavation archive) and as much as possible of the remains of the excavation (from the Paliambela excavation archive). found are more likely to have been intruded from upper layers. The deposits in the upper levels of the pits begin to 'fill in' (when they are no longer used as dwellings) with pottery, flaked stone, bone tools such as awls, antlers and other bone tools, sleeves, scrapers, earrings, worked teeth (Fig. 19) and other small finds (Kotsakis and Halstead 2004; Halstead and Kotsakis 2005). The pottery in the specific units we are investigating dates to the EN (Παπαδάκου 2011), in a few cases (upper layers) EN pottery coexists with MN pottery (p. 19). The individual differences in the pottery of the pits are difficult to interpret. They may be due to small chronological differences, to different uses of the pits, to different depositional and post-depositional 'histories'. However, they do not appear to be far apart chronologically. The contents of the pits, the ditch and the deposits between them reveal a great variety of activities that took place between and within these AEX (Halstead and Kotsakis 2002, 2003). By studying the EN at the Paliambela site of Kolindros, it is certain that the production processes took place in open areas, accessible to the whole community. From the structures of

the EN, it appears that the emphasis was on the communal way of life, which provides an opportunity to understand smaller social groups (Kotsakis 2014).

The ditch, which is quite large in size and depth (59.75 to 61.4 m above sea level), indicates that the tools had been discarded, probably due to their destruction. The depth of the ditch suggests that it was used from the end of the EN to the beginning of the MN. Later, from the MN to the LN, the ditch is gradually replaced by a circular stone enclosure that surrounds the upper part of the settlement, as in the settlement of Dimini in Thessaly. From the MN the settlement of Paliambela Kolindros begins to take on the shape of a mound (Kotsakis 2014, 12). Not many bone tools have been found in the ditch deposits (13 objects: awls, beads, a separator, a small animal awl, the only object from an ulna) (Fig. 19), which may indicate the small and rare discard of bone tools due to their intensive use or reuse. We could not omit the small number of bone tools found in the EN and MN ditches. The study of the "trash" of prehistoric people shows that the tools were used until they were exhausted (Goutas et al., 2016) and this may be the reason for the small number of tools in the ditch deposits.

All kinds of tools have been found in the layers of the AN. Knives, scrapers, sharp tools, a hook, an awl, a toothed tool (scallop) and two earrings coexist with the EN pottery in the pits. The pits were open spaces where daily work took place. Food preparation areas, hearths and work areas in the EN seem to be the place where the inhabitants used bone tools. On the upper deposits covering the pits, bone tools and pottery of the MN period and later of the LN period coexist.

During the MN period in the Paliambela settlement (6000 - 5400 BC), a cluster of house groups was surrounded by a system of deep ditches that cut through the pits of the EN (Kotsakis 2014, 12). In the cobbled areas we also find enclosed spaces in which bone tools have been found (Fig. 19). The MN period was found in almost all layers. The MN pottery assemblages contain forms and design styles reminiscent of the southern Balkans, as do the assemblages from sites in northern and Western Thessaly (Halstead and Kotsakis 2002; 2003).

During this period a concentration (trench 13) of large quantities of large mammal and red deer bones was found with a large concentration (32 in number) of bone tools such as awls, combs and scrapers (Fig. 19). This may have been a site where the bones were sorted for processing to extract bone tools, or it may have been the same site where the bone tools were processed.

The cobbles around the houses (trench 4, 20, 25) seem to have been the main place where bone tools were used. The change in the colour of the soil, the presence of charcoal,

burning and cooking pots (trench 21) suggest that bone tools were closely linked to the process of preparing and consuming food and to the animal itself. Antler handles for smaller stone tools, awls and scrapers have been found above the cobbled areas.

Not only in the cobble stones, but also in the pits of the MN, bone tools were found (trench 1,14,15,21), in some of which the tools seem to coexist with cooking vessels, organic remains, pottery, stones, unfired clays (possible building materials). Possible walls (or possible cobble stones in front of the MN house), bone objects (awls, scrapers, scapula tools) together with clay were found in trench 20 near AEX 2001 and 2002, designated as architectural remains. While in trench 15 on AEX 1504, designated as flooring, a bone awl was found along with pottery sherds and an increased amount of bone. A bone ring was found very close to the trench (and in trench 19). In the deposits of trench 21, dated to the MN, the only two separators of the material were found.

In the settlement of Paliambela Kolindros, three houses of the MN period were excavated (trench 20 and 25). The houses of the Neolithic settlement of Paliambela of the MN and NN periods give a different picture of the place where the productive processes took place. In combination with the cobbles of the period, the site seems to be more defined and reflects a less communal character. Bone objects have been found outside and inside the houses of the MN. However, we do not have much concentration inside the houses (Fig. 19). Two of the houses were built over the foundations of the older house (Σιαμίδου 2017), the lower house dates to 5900 BC (Μανιάτης Γ., Κωτσάκης, Κ., Halstead 2011). The upper house was destroyed by fire in 5500 BC (Μανιάτης Γ., Κωτσάκης, Κ., Halstead 2011), but because of this episode it has been relatively well preserved, giving us information about the use of the site. It is a residential settlement. This indicates the use of a dwelling unit with internal structures for the preparation and consumption of food, such as a mortar with a solid clay frame and a burnt pit surrounding it (Σιαμίδου 2017). The structure probably functioned as a mortar and was associated with the grinding of seeds, a fact supported by the solid clay frame, and the fire pit, delimited by post holes, with traces of ash, may have been used for smoking meat or fish (Σιαμίδου 2017). On the north and west sides, the house is surrounded by cobblestones (AEX 2501), above and below which are a number of bone tools (awls, scrapers, tools made from shoulder blades and small animals such as fish, antler tools, possibly an antler awl with a hole with a rounded pointed tool or ornaments).

The upper house contained artefacts, mainly pottery and stone tools. The stone tools consisted mainly of grindstones and axes. The distribution of the latter in the site was not scattered, but they were found on the floor around the perimeter of the walls, indicating that they were probably hung on the walls and remained in place before the house was destroyed

by fire (Σιαμίδου 2017). The pottery included vessels typical of the MN period. Almost complete vases were found, including two bowls, a closed vessel and an almost complete cooking vessel (Σιαμίδου 2017), 13-14). Inside the houses were found tools with a wide active end of scapulae, awls, as well as a single fishbone awl. Perhaps here the hypothesis we make in the chapter on use is confirmed, that such shoulder blade tools were used in the process of food preparation and consumption. The bone tools were also not scattered around the site but near the walls of the house. Some tools were found just outside the walls. The clay spoons and whole pots found around the perimeter of the walls may support this hypothesis (Σιαμίδου 2017).

The witness removed between trenches 6 and 27 would also have been more securely placed in the MN. In this area we also found some bone tools, awls and tools with a cutting edge - scrapers (Fig. 19). Awls and digging tools were found in trench 9 (layer 8 - MN), which was defined as a midden, and in AEX 901, which was defined as a stone structure.

There are several layers where MN and LN pottery coexist. (Halstead and Kotsakis 2000, 2001). Within these layers, several bone tools were found, but it would be uncertain to assign them to either period. In the trench 1 several AEX (104,112/113,114) defined as floors - cobbles, i.e. open spaces, have been found awls, tools with a cutting edge and combs. In the specific layers where MN and LN pottery coexist. In AEX 121 and 124 coexist pottery of the MN and LN, there is a considerable concentration of materials such as fired and burnt clay, charcoal, bones and small finds. None of the tools would suggest a period as we have discussed in previous chapters, all types of bone tools and ornaments were found in layers of all the periods we are examining. For example, the particular type of combs were found in deposits of the EN but also in deposits of the MN and LN.

During the LN period (5400/5300 - 4700/4500 BC) bone tools (awls, scrapers, small animal rodent/fish tools) were found on floors, cobblestones, pits, near walls and stone structures. Several bone tools were found in trench 1 in areas designated as AEX. However, in this period the layers are quite disturbed by Byzantine graves, burrows (Halstead and Kotsakis 2000, 2001), and ploughing (Halstead and Kotsakis 2002, 2003,). AEX 110 was interpreted as a surface of use (floor) based on the accumulation of cobbles, clays and stratified sherds combined with a small number of artifacts (bone tools such as awls, scrapers and a ring, stone tools and shells). It was considered likely that this was a site that had been used and then abandoned and was an internal space. The LN pits (trenches 1, 6) yielded charcoal, shell, clay and pottery shells together with stone and bone tools (awls and scrapers). The pits are defined as open spaces.

Bone tools, mainly awls, were found in interiors defined as walls and floors of LN houses (AEX 601, 603, 613, 617, trench 6), but also near stone structures defined as possible enclosures (AEX 901, 913, trench 9). A circular structure inside AEX 601 (possible floor of building LN) with clay, gravel, a stone structure (possible millstone), bone tools (awls and a worked tooth object) and a large concentration of bones (trench 6) has been defined as a structure for food preparation, but not for baking or cooking as there are no traces of burning. This may have been a place where bone sorting, meat cutting, grain grinding or even the working of bone tools took place. A short distance away, at AEX 602 (open area), the remains of what was probably a food preparation area were found, around which a large quantity of bones, a pile of clay, a millstone, traces of burning and bone tools (hooves) were found. Next to the stone structures of trench 9 (possible enclosures) bone tools (awls) were found.

The bone tools from the area of Paliambela seem to be found mainly in the open spaces, throughout the Neolithic period, such as cobblestones, pits and work surfaces/constructions. In the majority of cases, they are found alongside clays, pottery sherds, stone tools, shells and animal bones. There are some concentrations of bones together with bone tools such as combs, rings, scrapers and awls, in pits and open spaces (AEX 1302, 517 and trench 13) which may represent the working areas of the bone tools. Throughout the period studied, there are no significant changes in the types of bone tools. The main types are pointed tools (perforators) and scrapers (edge tools). In units and AEX containing a significant amount of pottery, bone tools may have been used in the processing of clay or for decoration ornamentation of the vessels, while on units or AEX whose remains indicate the presence of food preparation zones may have been used to advance this process.

Starting from EN to LN, there is a gradual, but not significant, shift of the work carried out with bone tools towards the interior of the spaces. It is argued that now in the Late and Final phases of the Neolithic there are distinct clear settlement units (Kotsakis 2014, 9 - 10). In the EN it seems that all the work was done in the open spaces, where the whole community participated or could watch. While moving up to the LN it is observed that bone tools are found in enclosed spaces or in areas around the perimeter of the houses. There is a shift from the communal to the individual context, as the communal character of the settlements declines, the household is enclosed within the houses (Kotsakis 2014, 12), which is not unreasonable if we take into account the socio-economic conditions of each period separately. Settlement units in general in Northern Greece seem to change gradually from EN to MN and LN. The autonomy of settlement units gradually increases, and they are 'closed' more within the houses. This emergence of the small social unit is represented by the

dwellings of MN and LN. The bone tools are certainly related and associated with food production and consumption. The bone tools come from the remains of the inhabitants but can also be used for food processing, leather and other animal by-products. While in the EN food preparation and consumption seems to have taken place in areas common to the whole settlement, in the MN the landscape changes with the emergence of socially and economically autonomous households (Halstead 1999). It seems that this period towards the Late and Final phases of the Neolithic is a period of change for the settlements of Northern Greece as a whole, leading eventually, in the Bronze Age, to the dominance of a strong settlement unit. Similar to the pottery of the period, we can assume that the objects lose their communal character and become simply utilitarian objects of everyday use (Kostakis 2014, 13). The presence of ditches and walls enclosing and subdividing the settlements indicate the spatial distribution of storage and cooking facilities within enclosed courtyards (Χουρμουζιάδης 1979; Andreou et al. 1996). This difference between collective and internal action may reflect chronological variations, but despite the differences from one Neolithic period to the next, it can be seen through the collective effort to create settlement boundaries (Χουρμουζιάδης 1979), through burial practices (Triantaphyllou 2008) and evidence of collective meat consumption (Halstead 2007, 26; Halstead 2012) that communities throughout the Neolithic period are characterized by collective actions expressed through mutual household assistance. The place of bone tools (open - closed spaces) in this period under consideration is interwoven with the other artifacts and structures of the settlement and is always determined by their use.

Chapter 6 - The Neolithic Settlement of Kato Agiannis in Pieria

6.1 Research history and context

The site of Kato Agiannis is located in the municipality of Korinos in northern Pieria, south of and close to the modern settlement (see Map 1). The excavation was a salvage operation, as the first discovery was made by accident when a digging machine was used by the Municipality of Korinos to level the steep south-north slope of the hill. The digger disturbed the archaeological deposits. In addition, the slope of the hill has caused severe erosion (Μπέσιος, Μ., Αδακτύλου 2008).

The excavation took four years, from 2004 to 2007, and covered an area of 525 square metres, including 21 excavation squares of 5.00 x 5.00 m. Half of the area was explored up to the discovery of the natural subsoil (250 square metres), three other blocks were explored in fragments, and the remainder was not explored as the evidence was unlikely to reveal archaeological remains, as indicated by the surface evidence (Μπέσιος, Μ., Αδακτύλου 2008). Based on the pottery's dating, the site seems to belong to the FN (Μπέσιος, Μ., Αδακτύλου 2008).

The architectural remains

In the Western area of the hill a section of ditch, identified as Ditch 1, was found, 33m long and ~3m to ~9m wide, dating to the Late Neolithic based on pottery dating. The deepest deposits of Ditch 1 in the southern square of the trench are 2.26m below the present ground surface, and 2.44m in the northernmost square, while the deepest deposits are at a depth of 3.22m, some ten metres north of the southern square (see Map 7). The orientation is NW to SE and appears to change course to W/NW, continuing off the alignment. Its continuation to the south should also be looked for outside the trench (Μπέσιος, Μ., Αδακτύλου 2008).

Ditch 1 is V-shaped with vertical walls on the natural bedrock at its western boundaries, while within its fill to the east there is a stone wall, which followed its course and collapsed inside (image). There were 11 levels of terraces within the ditch. The fills of Ditch 1 can be divided into eastern, Central and Western, based on the stratigraphy, but also, during horizontal excavation, the colour and composition of the soil and the number of finds collected. The eastern fill contained mainly pottery, small objects, shells and straw clay. The Central fill contained large quantities of pottery, artefacts, small objects, shells and straw clay. The western fill was very poor in finds. Within the deposits of ditch 1, 3 disturbed burials were investigated, the remains of which were probably thrown and drifted into the ditch (Besios and Adaktylou 2008). Burial 1 was found in a square in the north-western part of the trench, at a depth of 0.80 m from the present ground surface. A stone wall collapsed inside ditch 1. The stones in the wall are often large in size, mainly slow sandstones and marble

flakes, and among them are several rubbings and grindstones in secondary use as building materials.

Another ditch was investigated, Ditch 2, which lies to the east of Ditch 1 at a distance of 2.70m in a NE-SW direction. However, its investigation was not completed. Ditch 2 was shallow with a maximum width of 2.45 m and a length of ~ 7 m. It also did not contain a large quantity of finds (Μπέσιος, Μ., Αδακτύλου 2008).

No settlement was found in the vicinity of the ditch, only two pits. Pit 1 is small (1.30m N-S × 1.08m E-W), circular and shallow (depth of fill: 0.10m) and contains few finds, although it is worth noting that of the thirteen sherds recovered from it, nine are dating back to late antiquity. Pit 2 is located to the southeast of Pit 1, 0.90m away from it, and measures 1.45m in diameter, but was not investigated, only half of it being excavated. The settlement remains have probably been eroded, while we assume that the settlement was located to the east of ditch 1, as its Central and eastern fills contained most of the finds. Ditch 1 probably protected the settlement, while the stone wall that collapsed on its eastern fill probably reinforced its eastern boundary (Μπέσιος, Μ., Αδακτύλου 2008).

Many finds were collected from the deposits of ditch 1, including pottery, animal bones, shells, straw pebbles and charcoal. Several small objects were collected, mainly from the eastern and Central fills of the ditch, such as stone tools, grindstones, whetstones, grinding tools, flaked tools, flint blades, bone tools, ornaments, clay figurines, spindles and bronze objects (Besios and Adaktylou 2008). Animal bones are few and in a poor state of preservation (very friable). There are mainly bones, a few teeth, and a few antlers.

6.2 Bone tools

This chapter is intended to introduce the bone industry of Kato Agiannis, Pieria. A total of 44 bones were collected, of which only 22 showed signs of processing and use after stereoscopic examination (table 25). Even though this is a very small sample of material, it is important to mention that, due to its secure context, it gives us important information about the period of the Final Neolithic. The same procedure was followed as for the other materials in this study. Of the 22 items, 7 are unidentified, 1 pointed tool, 3 awls, 2 spatulas, 7 chisels and 2 spoons (table 25). All the material is very eroded and fragmentary, which does not help us to better synthesise the image.

6.2.1 Pointed tool

The only tool defined as a pointed tool has a pointed end and is probably in its second use or a splinter; its first use was probably a sharp object (fig.6.1). It comes from a cattle tibia and the corrosion is moderate. It is a fragment with only the active end preserved, only traces of abrasion were observed under the stereoscope. The preserved part of the shaft is rough. Its cross-section is rectangular, and it was found in the ditch 1 deposits.

6.2.2 Awls

Three tools have been identified as awls (table 25) (fig.6.2); all three are from medium-sized animals (table 26); two have been identified as belonging to the sheep/goat family, while one fragment has not been identified (table 27). All three use long unidentified bones as raw material (table 28). All are fragments and two consist of two parts joined together. Two preserve only the active end, while one also preserves part of the shaft (table 29,30). All are moderately corroded (table 31) and the construction techniques used are longitudinal sawing and abrasion (table 32). The cross section is circular and elliptical. One was found in the deposits of the eastern wall, while the other two were found in the deposits of ditch 1 (table 32).

One of the awls could be a double point, as there is a homogeneity in the converging lines from both sides, and it is a fairly common type in the FN deposits. However, the tool has not survived, so it is not certain that it belongs to this category.

6.2.3 Spatula

Two tools were identified as spatulas (table 25) (fig.6.3); both were from cattle-sized animals (table 26). It is not possible to identify the family of the animal. Both use split ribs as raw material (table 28). All are fragments composed of several parts joined together (table 29,30). Only part of the diaphysis is preserved. All are moderately eroded, and the manufacturing

techniques used are longitudinal sawing and abrasion (table 31,32). Their cross-section is rectangular and both were found in the deposits of ditch 1 (table 33).

The process of splitting the ribs follows the usual procedure observed in the Neolithic period. First, the ribs are sawed transversely and cut away from the rest of the bone; in both cases the cut was made by transverse grooving; the lip piece seems to have been removed by abrasion rather than by impact; the bone is then cut by sawing along the spongy tissue. It seems that in this case the craftsman chose to leave the spongy tissue rough without any special treatment.

6.2.4 Spoon

Two tools have been identified as spoons, both from cattle-sized animals (table 25,26) (fig.6.4). One is from red deer antler and the other from an unidentified long bone (table 27,28). Both consist of fragments that have been joined together; one is intact and the other is almost intact (table 29). They are quite badly corroded, so that the traces of use are not visible. They also show several taphonomic signs, such as traces of roots.

Although both have been classified as spoons, they are not typologically similar. The antler spoon is more like the Bronze Age spoons found in Greece and Europe. The beam of the antler was used instead of the tines. It is an engraving of great care in its workmanship; the surface has been very carefully smoothed. The handle has also been preserved along its entire length. Its length is 11.2 cm. The other comes from a long bone that has been sawn through, its surface smoothed and preserved >25. Is made up of two parallel lines that converge at the active end and do not create a bend at the active end. However, it maintains the natural curvature, shape V, of the bone throughout its length. The antler spoon was found in B. Balk of Ditch 1, and the other in Ditch 1 (table 33).

6.2.5 Chisel

The most diverse category of material is chisels (table 25) (fig.26.5). A total of 7 chisels were found, of which 3 are severely corroded and 4 moderately corroded, all in fragments with only the active end surviving (table 30, 31) (draw 6). Four of these are from large animals, 2 from sheep/goats and 1 is unidentified. Only in two cases was it possible to identify the animal families on the basis of diagnostic features, one from red deer and the other from sheep/goats (table 26,27). In terms of raw material, 2 are from antlers, 3 from long unidentified bones, 1 from radius and 1 from unidentified bone (table 28). All of them were identified as having been abraded, and 6 of them as having been cut lengthwise; the fragmentary nature of the material makes it difficult to identify all possible working techniques. Their length varied between 1 and 4 cm, and the cross section in which they

could be identified was either elliptical or planoconvex, with the edge length not exceeding 2 cm. Of these, 4 were found in the deposits of ditch 1, 2 in A. Balk and 1 in the stone wall (table 33).

6.2.6 Unidentified objects

The unidentified tools are sufficient (table 25). These are tools that either show traces of treatment or use, but only preserve part of the shaft, so it is not possible to classify them. Most of them are quite corroded and all of them are fragments. Although the tools are quite eroded, the following animal families could be identified: 1 deer, 3 red deer, 1 sus, 1 sheep/ goat, and 1 unidentified; the bones that could be identified are 4 antlers, 1 radius, 1 tooth and 1 unidentified (table 27,28). The processing techniques identified are longitudinal sawing - abrasion (2), abrasion (1), longitudinal sawing (1), and unidentified (3) (table 32). Five of these were found in the deposits of Ditch 1 and the remaining two in the deposits of the stone wall (table 33).

6.3 Temporal and spatial distribution of the bone implements of Kato Agiannis - The findings in their spatial and temporal context

The bone tools and all the artefacts from the Kato Agannis ditch constitute a closed excavation unit that can be dated with relative certainty, although no permanent settlement remains were found apart from the stone wall. All objects came from Ditch 1; three objects were found in the stone wall, 1 in Balk B and 3 in Balk A. No object was found in the second ditch of the site. Ditch 1 was interpreted by the excavators as a ditch to protect the settlement that apparently existed to the east, and the stone wall that collapsed in the eastern fill probably reinforced its eastern boundary. Only a small number of bone tools were found in the ditch deposits like the MN ditch of Paliambela, which may indicate that bone tools were rarely discarded due to their intensive use or reuse. The study of prehistoric human 'litter' shows that tools were used until they were exhausted (Goutas et al., 2016), and this may be the reason for the small number of tools in the trench deposits.

Chapter 7 - The Neolithic Settlement of Kleitos in Kozani

7.1 Research history and context

The site of Kleitos is located in Western Macedonia, northeast of the modern city of Kozani, in the area of the Kitrini Limni, in the southernmost part of the Ptolemaida Basin, near Mount Vermio (see Map 8). It is situated at an altitude of 660 m. Following the draining of the lake at its bottom and in the surrounding area, archaeological research initially identified 14 prehistoric settlements, distributed over an area of 50 km2 and at an altitude of 650-670 m. Their present form has been altered either by natural causes or by intensive cultivation (Ζιώτα 2014a; 2014b; Ζιώτα 1994: 550). The first settlement in the area dates to an advanced phase of the EN (Megali Toumba Agios Dimitrios). At least three other sites were occupied during the MN, but particularly intensive settlement activity appears during the LN and FN (Ζιώτα 2014b).

The site was first identified by Fotiadis in 1988 during his research in the wider area, which included a surface survey and the opening of excavation trenches at the site of Megalo Nisi Galanis (Φωτιάδης 1988). The first excavations at Kleitos began about a decade later, in 1995, by L' EPKA. The most consistent and extensive excavation at Kleitos began in 2006 and continued until 2010. The 2006 survey began with the opening of test trenches and systematically excavated an area of 75 hectares, almost all of the surface scatter of archaeological material. Two adjacent Neolithic settlement sites were revealed, less than 100m apart (Ζιώτα, Χ., Χονδρογιάννη-Μετόκη, Α., Μαγγουρέτσιου 2013; Ζιώτα 2014a:53; 2014b:323). The two distinct phases of occupation at the site were named Kleitos I and Kleitos II and chronologically cover the period of the Late and Final Neolithic. In addition, there are several deposits in Kleitos II that date to the MBA (Ζιώτα 2014a; 2014b).

The site of Kleitos I is located in the south-western part of the excavated area and covers an area of about 20 hectares; the undisturbed layers date back to LN I (5300-4800 BC). It contains at least 10 square above-ground buildings in a sparse arrangement. The settlement of Kleitos II was built on a very low hill and was inhabited during LN II (4800-4500 BC) and FN (4500-3200 BC)[2]. The settlement covers an area of only 2.5 ha and the maximum preserved thickness of the undisturbed layers does not exceed 1.5 m. No more than three settlement phases have been preserved, the earliest of which included a large four-sided ground-floor building. Today, two very low levels can be seen on the site of Kleitos I and II, and the shape of the site has been altered by modern interventions. The excavation revealed interesting information about the geophysical character of the site and the geomorphological evolution of the area. There is strong evidence that the environment before to the original settlement was either lake or semi-lake. In the eastern part of the

[2] The excavation diaries and C14 publications from the area have provided the chronological context. (Maniatis et al. 2014).

settlement of Kleitos I, a tephra-black clay layer with a high content of crushed shells was excavated, overlying the natural clay loam (Ζιώτα 2014b:323-327).

The architectural remains

Kleitos I

Kleitos I was inhabited in LN I and has the characteristics of a flat, extended settlement with clear boundaries, both artificial and natural, such as ditches, wooden enclosures and streams (see Map 9). The houses are four-sided pile dwellings, some of which measure 100-120 sq m. They are built or rebuilt in successive phases on the same site, with little displacement. Outside the houses and up to the perimeter ditches, there are extensive areas with thermal and other structures, with waste pits and storage pots, with buildings of negligent construction, probably of occasional use, with a few burials and several pits/areas, some of which seem to have been intended for clay extraction, while some contained remains of activities, perhaps of a ritual nature (Ζιώτα 2014b:323).

At the site of Kleitos I the remains of 10 houses were discovered. Buildings A, B, C, D, E, G, H, I, F and I. The houses had clay structures for heating, lighting, food preparation and storage, such as hearths, ovens, platforms, cases and storage vessels, fixed in pits. From the various phases of preservation, overlapping layers of clay and coatings are preserved both on the superstructure of the houses and on the clay structures within them (Ζιώτα 2014b:323).

Buildings A and C, in their later surviving phase, had a floor of planks covered with clay. In the second of the three phases of Building A, the floor consisted of the remains of the oldest phase embedded in a solid layer. Building H also had a wooden floor, but in most cases a thin ash-black layer, probably formed by burnt dissolved clay, corresponds to the level of use of the house. (Ζιώτα, Χ., Χονδρογιάννη-Μετόκη, Α., Μαγγουρέτσιου 2013:41; Ζιώτα 2014a:54; 2014b:323-324).

Building E is a pile dwelling that was destroyed by fire, and many pieces of clay that were used to cover the frame retain the impressions of wooden structural elements, some of which preserve grooved decoration with linear patterns. Among the artefacts recovered from the excavation of the building were a variety of pottery, stone and flaked tools, ornaments and parts of clay structures. Based on the relative dating of the pottery, Building E belongs to LN I (Ζιώτα, Χ., Χονδρογιάννη-Μετόκη, Α., Μαγγουρέτσιου 2013:42; Ζιώτα 2014a:54).

Building I appears to preserve the remains of the oldest earthen structure, and a possible hearth and a small pit for fixing a storage vessel were found on its eastern boundary. The ash-black layer and the presence of burnt seeds in parts of the storage vessel suggest that Building I was also destroyed or partially destroyed by fire. Based on the relative dating,

Building I, as well as Buildings A, D and H, appear to be contemporary with Building E. Building B is quite damaged, clay floors and postholes were revealed (Ζιώτα 2014a:55).

In the extensive unbuilt areas outside the houses, the finds suggest storage, laboratory and waste disposal activities. Outside the houses a number of pits were uncovered, most of which were filled with waste and only three of which, lined with clay, can be considered storage pits. Large storage pots fixed to the ground and a large number of structures, either individual or in small groups, were also found (Ζιώτα 2014b).

All the evidence suggests that the open-air structures were used for economic practices that affected the whole community rather than individual social units. There is a concentration of structures around the centre of the settlement, but they were not all used at the same time and their association with specific phases of the dwellings is being investigated. Compared to the structures found inside the houses, most of the structures found in the open spaces are either completely different morphologically, apparently functionally, or differ in terms of individual construction elements and/or dimensions. It is clear that they were used for work of a different nature and/or scale, and in particular the five sets of large basin-shaped earthen structures were intended for specialist work for the benefit of the whole. They were two or three in a row, and three such sets, set at a fixed distance apart, 'lined up' a workshop area at a Central point in the settlement. It is noteworthy that several of these features - structures, pits, storage vessels - were found at a considerable distance from the houses. Some structures had clay roofs, others were covered with perishable materials, but it must be assumed that most, if not all, were protected in some way (Ζιώτα 2014b:324).

Most, if not all, of the site is bounded by a 3-4m wide and 1.5m deep ditch. Two other narrower and shallower ditches were found to the north, east and south-east. Their stratigraphy and construction details suggest that they were constructed in sections. To the north-west and east/north-east, the ditches are combined with double enclosures of palisade fences. The enclosures were based on narrow ditches and no clay was used in their construction. In addition to the outer ditches, there is an inner moat that divides the settlement into two unequal parts. Most of the houses are to the west of this internal boundary. To the east were the remains of five large structures, perhaps of occasional or seasonal use, of which only clay floors or postholes have survived, without the usual domestic finds. The houses were destroyed by fire in almost all phases, but there is no evidence of widespread fires. In no case have more than three successive phases of construction been preserved, and the maximum surviving height of anthropogenic deposits is 1.5-2 m. (Ζιώτα 2014b:326).

Kleitos II

The settlement known as Kleitos II is an extension of the same settlement in a neighbouring area (see Map 10). It was inhabited during the 5th millennium BC, has a more compact form and contains smaller buildings (building 4, 3), which are at ground level and have similar construction techniques to the buildings of Kleitos I. It is bounded by streams on at least two sides, has a much smaller area, limited open spaces and few burials inside and outside the houses. One to three settlement phases have been preserved on this site. The same site was inhabited in the BA and in the Hellenistic to Byzantine periods. The relevant remains are very fragmentary, with the exception of a small Late Roman cemetery and a large stone building (Ζιώτα, Χ., Χονδρογιάννη-Μετόκη, Α., Μαγγουρέτσιου 2013:47; Ζιώτα 2014a:53; 2014b:327).

Building 4 is the northernmost building of the settlement and is located at the highest point. It has an N-S orientation and a construction phase that was destroyed by fire. Several pieces of burnt building material retain impressions of wood and thatch. A black-ash layer was preserved at floor level. No postholes were identified around the perimeter, except for two inside the house and a narrow foundation trench along the eastern boundary. Three shallow pits contained pottery, animal bones and clay pits (Ζιώτα, Χ., Χονδρογιάννη-Μετόκη, Α., Μαγγουρέτσιου 2013:49; Ζιώτα 2014a:57).

Building 3 is similar in orientation and dimensions. It had at least three phases of construction, but the two later phases have been preserved in a very limited area, mainly in the Central part of the house. Concentrations of building clay from the later Phase 1 have survived, under a small section of flooring consisting of superimposed layers of clay over shells. Phase two is also represented by small areas of amorphous concentrations of largely burnt clay and scattered remnants of charred organic remains. In phase three, the outer walls of the building were constructed of wood and clay, as evidenced by impressions on pieces of solidified clay. Four postholes were found in the interior. It has a clay floor, the surface of which has been renewed 3 times. Above the floor, a layer of clay was removed from the damaged superstructure. The lower layer was made from the remains of the roof, which seems to have collapsed first. It was made of reed and covered with clay. Just above the floor a thin layer of charred seeds, charcoal, ash and burnt clay was removed. In the NW section, an ellipsoidal hearth or oven was revealed, with a thick layer of ash inside. The peculiarity of Building 3 is the presence of a large quantity of stored products when it was destroyed. External thermal structures were found in both buildings (Ζιώτα, Χ., Χονδρογιάννη-Μετόκη, Α., Μαγγουρέτσιου 2013:50; Ζιώτα 2014a:57).

Buildings 1 and 2 appear to have a curvilinear plan with a diameter of 4-6 m and clay structures inside. At least three construction phases were preserved in building 2 (Ζιώτα 2014a:49). Four secondary burials - cremations - were also found in the N part of building 3, while two other burials of burnt bones were found near building 4 (Ζιώτα 2014a:49).

Kleitos II was first inhabited during the LN I period, when the pottery was characterised by black top pottery. This early phase is probably at least partly contemporary with the phase of Kleitos I.

At Kleitos I and II some remains of the MBA have been preserved, in particular some trenches of the MBA in the area of Kleitos II and artefacts of the LBA in disturbed layers in the N-NE of Kleitos I. At Kleitos II a pit was found which, according to the excavators, are clear remains of ritual activity. The pit contains a female burial in the upper layers and a large number of artefacts, vessels, stone tools, etc. in the lower layers. Of particular note are the 31 bone tools found at the level of the burial level and above. The whole set was studied in Stathopoulou's thesis. They are shaped sheep/goat metatarsals with decorative engravings, probably handles for other tools. From the bone assemblage of the tools of Kleitos, there is also a small sample of the MBA. It cannot be excluded that there was a short-lived settlement of this period in the low outcrop where Kleitos II was developed, which was completely destroyed by cultivation, either by the levelling that followed the draining of the marshes in the area or by a combination of several interventions on the site (Ζιώτα 2014a:60-62).

7.2 Bone tools

This chapter presents the bone assemblage from the area of Kleitos Kozani. The aim is to present the specific categories into which the material under study has been classified. The questions arising from the archaeological classification and the main characteristics of each group are presented. Aggregate data on bone tools, such as the numerical size of the categories and their general distribution are given, followed by a detailed presentation. As for the other sites in this thesis, issues of typology, raw materials used, production techniques, traces of use, and their geographical and temporal distribution in the settlement phases are discussed for each group. The presence or absence of these tools is also compared with other Neolithic bone tools in the wider region of Greece and the Balkans.

A total of 1351 bone objects were collected from all layers and units of the Kleitos I and Kleitos II excavations (table 35). A total of 1202 objects were found in the deposits of Kleitos I and 94 objects in the deposits of Kleitos II (table 36). 55 objects were found outside the settlement trenches and 2 were recovered. The ornaments is studied by Chondrogianni A. and the category of bone handles has been studied by Stathopoulou P. They are therefore not included in the material. However, some objects of the material after the study were included in the ornaments, so they were studied. In addition, the zooarchaeological material has been studied by V. Tzevelekidi, so we do not expect the picture of bone assemblages to change. As discussed below, a high concentration of bone tools was found in trenches Kleitos I: ΙΓ5, ΙΓ6, ΙΓ7, ΙΓ8, ΙΓ9, ΙΓ10, ΙΔ4, ΙΔ5, ΙΔ6, ΙΔ7, ΙΔ8, ΙΔ9, ΙΔ10, ΙΔ11, ΙΕ6, ΙΕ7, ΙΕ8, ΙΕ9, ΙΕ10, ΙΖ5, ΙΖ6, ΙΖ7, ΙΖ8, ΙΖ10, ΙΣΤ6, ΙΣΤ7, ΙΣΤ8, ΙΣΤ9 and Kleitos II: Ι16, ΙΑ16, Η16. We find bone tools outside the settlement. This could be an indication of work done outside the settlement.

The bone assemblage from the two Kleitos sites is very well preserved. It preserves intact tools and several processing debris that help to reconstruct the chain operatoire. As we will see below, all the tool types that appear in the Neolithic are also present in the Kleitos area. As we will see below, there is a significant difference from the other sites we are studying. Kleitos has different and more types of tools than Revenia, Kato Agiannis and Paliambela.

In Kleitos I found a total of 53,3% pointed tools, from which 0,2% projectile points, 0,5% double points, 44,9% awls, 6,6% perforators/pointed tools unidentified, 0,2% needles, 0,3% arrows, 0,8% harpoons, 0,1% fishhook. Edged tools 16,1% from which 8,0% chisels, 4,9% spatulas, 1,3% edged tools/unidentified, 0,5% polishers, 0,1% polishers- chisels, 0,7% axes, 0,2% polishers- spatulas, 0,2% axe-chisels, 0,2% sleeve-axe. And the other categories such as sleeves 1,9%, waste 3,7%, rings 1,0%, cousoirs 0,1%, parts 2,7%, flute 0,1%, unidentified 9,9% (table 45).

In Kleitos II were found a total of 4,4 % pointed tools, from which, 3,6% awls, 0,4% perforators/pointed tools unidentified, 0,1% needles, 0,1% arrows, 0,1% harpoons, 0,1% fishhook. Edged tools 0,9% from which 0,6% chisels, 0,1% spatulas, 0,1% edged tools/unidentified, 0,1% axes. And the other categories such as sleeves 0,7%, waste 0,2%, flute 0,1%, comb 0,1%, unidentified 9,9% (table 45).

The material from Kleitos is very well preserved and comes from the entire excavation. A first observation is that the material is very similar to the bone assemblage from Dispilio (Kastoria) Agioi Anarghiri (Florina) and the Balkan bone assemblages of the same period. One question that arises is whether there are differences between the different periods of the Neolithic in the development of bone tools, or whether the differences are more geographical.

Kleitos I/II

7.2.1 Pointed Tools

The most common category of tools in Kleitos is pointed tools. As with all the material, this category is very well preserved. Even though the Kleitos assemblage is not numerically the largest material studied in this thesis (the Revenia assemblage is numerically the largest material), the majority of the objects are intact and provide a great deal of information. At Kleitos, pointed tools make up 53,3% of the total material (table 34). Pointed tools are elongated objects made of bone, antler or teeth, their configuration can be partial or total, their lengths vary, the active edge consists of a more or less sharp point, sometimes blunt or reshaped, and the proximal part can be shaped or not. (Camps - Fabrer, H., Ramseyer, D., Stordeur 1990). Pointed tools are defined by a pointed tip that is the working end as indicated by use wear, sometimes the proximal part is also worked. This category includes any object that has a sharp point. Depending on the degree of processing, there are many types of pointed tools (Leroi-Gourhan 1988:883). In Kleitos we find this variety of pointed tools that we do not find anywhere else. The pointed tools are made of bone as well as teeth and antlers. Thus, this category includes several classes of pointed tools, such as needles, awls, projectile points, double-pointed tools, etc. Most points are produced on the bones of sheep/goats, cattle, red deer and roe deer. In terms of raw materials, the pointed tools of Kleitos were mainly made from the bones of sheep, goats and cattle. However, in Kleitos, the presence of wild animals is strong in all categories of tools. This fact allows us to argue for more intensive hunting, but also for the environment of the area. As detailed below, there is a strong presence of red - fallow deer, carnivores, bears and wild animals in general. However, the birds are completely absent. The very good preservation of the material and the large

presence of processing waste give us important information about the construction techniques.

7.2.1.1 Awls

Among the pointed tools, awls are the most common category with 50% (676) (table 34). Most awls are slightly corroded (low=409, none=17 medium=149), while only a few are severely corroded (high=101) (table 39).

Regarding the raw material, most awls are made from long bones (49,3%), while only 0,6% are made from flat bones and 0,1% are made from antler. In awls, were possible to identify ribs, metatarsals, metacarpals, metapodials, tibia, fibula, ulna and radius and the majority are long unidentified bones (table 42). Most are from sheep/goat sized bones with only a very small sample from cattle sized animals and small size animals. Several of these could not be identified to any animal size (table 40). The animal families that could be identified were sheep/goats, cattle, red – fallow deer, roe deer, hare, dog, and pig. A large proportion were of unknown family (table 41).

In contrast to the other sites we examined, the majority of awls are intact, followed by a similar number of fragments, and then almost intact objects (table 37). A total of 288 items are intact, 12 identified only the shaft and convergent lines ending in a point, 147 items salvage part/half of a tool from the active end to the proximal part, 156 items salvage only the active end and shaft, 12 items salvage the shaft and proximal part, and 4 item salvage minimal part of the proximal part (table 38). In order to classify a tool in terms of typology and to identify the part of the tool that is preserved, manufacturing techniques are also taken into account. If an object preserves the converging lines ending in an active end, it is classified in the appropriate category according to the active end. However, many unidentified tools could belong to the awl category. It was considered appropriate to consider the active end and the typology without hypothetically assigning objects to categories. The fact that in all the assemblages examined, sometimes more, sometimes less, by-products of the extraction of bone tools were found helps us to understand that some may have been in second use. In Kleitos like Revenia there are examples of chisels being used as awls in their second use.

Where possible, the cross section was measured at the active end, however in some cases where the active end was missing, the cross section was measured in the millimeters preserved above the active end, as this is the part that most often preserves traces of use. Studying the cross-section helps to understand the movement that make the tool during the use and, more importantly, how much it was used. The cross sections of the active end observed in awls are especially circular and elliptical. The highest percentage is elliptical.

Almost every known construction technique can be found in awls. These include abrasion, cross-cutting, grinding, scraping, longitudinal sawing and combinations of these. The most common combination is abrasion, longitudinal sawing and scraping (table 43). In Kleitos there are not many awls made by splinters. Both Kleitos I and Kleitos II seem to have taken particular care in the construction of their tools. The raw material plays an important role in the technique to be applied to an object. The physiology of each bone is very specific and "guides" the craftsman in the choice of manufacturing techniques, so each bone may undergo different manufacturing techniques to produce a tool. A second factor that determines the choice of techniques is the future use of the tool.

Although there are several tibia awls in the materials we studied (Revenia, Paliambela) there are only 16 tibia awls in the assemblage of Kleitos. The tibia bone awls found in both Kleitos I and Kleitos II are heavily worked. Both epiphyses have been removed or smoothed to a very high degree (fig.7.1, fig.7.2). Only a few retain hight part of the proximal part (fig.7.3, draw 7.1e). Some may belong to this category, but unfortunately, they do not preserve any distinctive features (fig.7.4). The bone was cut first transversely and then longitudinally; The transverse section was made either by percussion or by grooving. After longitudinal sectioning, it was possible to obtain 4 pieces of bone. These were reworked by abrasion to create the active end and smooth the proximal part. Its treatment is so intense that the cross-sections we observe are mainly circular (draw 7.1 d,e,f). The active end is highly polished, another sign of the tool's heavy use. The length of the awl from the tibia is preserved from 4 cm upwards. Mostly they survive from 4 to 6 cm; only a few survive a very long length from 8 to 15 cm. Those that survive long enough are even more elaborate, resembling needles but without a hole (fig.7.2). Such tools will be analyzed later, they are mainly from long bones and may represent the evolution of projectile points; half of the tool shows strong traces of use, fading towards the proximal part, and the latter may have been in a handle. Almost all the tibia are from sheep/goats, with only one from cattle and one from an unidentified animal.

There is only one bone awl from a fibula (fig.7.5). It is an elongated pointed object taken from a pig fibula and has preserved a part of the epiphysis (proximal or distal) at the proximal end. it seems that the proximal part is not preserved intact due to taphonomic issues. The active end and the shaft are heavily treated and only the proximal part shows the type of bone. It is preserved to a great length of more than 8 cm. Its cross-section is circular over the entire length of the tool, except for the last two centimetres, where part of the epiphysis is retained.

There are only 3 ulna bone tools (fig.7.6). One is intact, the second preserves the active end and part of the shaft and the third preserves the half part of the tool (active end – shaft – proximal part). Their tip is massive with an elliptical cross-section. The one that survives intact retains the epiphysis. The intact ulna awl is from hare (fig.7.6b). The choice of the ulna as a pointed tool was mainly because the active end was easy to shape and that the proximal part did not need to be worked to make a good handle. The rounded projection at the tip, with its flat sides without any bumps or ridges, is perfectly adapted to the width of the hand. There is no better handle for a tool. Unfortunately, with the exception of the hare's ulna, the proximal part in the other two tools, which are from sheep/goat sized animals, has not been preserved intact, so it is not possible to know if and to what extent it has been shaped or worked. It is easy to separate from the radius. However, it does not appear as a raw material to any great extent in the Neolithic and Bronze Age, which may have something to do with its resistance to the tasks for which bone tools were used. The technique applied to these very lightly worked objects is the same as that described for all bones. The first step is to separate the ulna from the radius. The angular fracture of the distal part retained as a point is usually followed by very deep scraping and even abrasion, resulting in very sharp points. The proximal part may be left rough or partially sawed and then ground. Traces of use are observed only a few millimetres from the tip of the active point, indicating that the tool was not used along its entire length.

The most commonly raw material to produce awls is metapodial. The awls from metapodial are 317 in total, 41 metacarpals and 106 metatarsals. The rest were difficult to identify as either metacarpals or metatarsals. The variations of the tools obtained from the metapodials are several and are aimed at different uses of the tool. There are no awls from unsplit metatarsals that preserve the entire epiphysis (distal or proximal) in the Kleitos assemblage. Even though the metapodial of sheep and goats are mainly used in this category of tools, there is a great variety in the family of animals used. We observe in the material that metatarsals are used more than metacarpals, while cattle are only found in the metacarpals category. This may be a deliberate choice of raw material management. In general, metapodials have been used from deer, sheep, goats, rabbits, dogs, cattle and only one from pig.

Each bone was treated differently. Metapodials, whether metatarsal or metacarpal from sheep/ goats, roe deer and canine, were processed as follows: one epiphysis was removed by percussion, then the surface of the bone was normalised by abrasion and then the bone was cut lengthwise (fig.7.7a, draw 7.1b). The proximal part, where it survives, is either machined on both sides or left rough with the natural pulley intact (fig.7.8, draw 7.1c). In

most cases, the cross-sections at the shaft are either elliptical or circular (draw 7.1). Cattle and pig metapodia are highly processed, making it very difficult to identify the animal from which they come (fig.7.9); many of the unknown families on this category may belong to the cattle or pig families. Their cross-sections are only circular, and the tools are very polished. These are long tools, symmetrical in length, with two parallel lines converging at a pointed end. Like sheep/goats, they probably cut notches and then by abrasion and longitudinal dissection created the tool; no part of the spongy tissue or the medullary cavity is preserved at all. The metatarsals of the hare (fig.7.10) have little treatment and it seems that their use is limited to the few millimetres of the active end. Mostly they survive from 4 to 6 cm; only a few survive a very long length from 8 to 15 cm and 0 to 4 cm. The long ones (<10 cm) are those from cattle-size animals. In this category, due to the large number, many objects are preserved intact (221). Several preserved part of the half tool, active end - shaft - proximal part (74). While 13 preserve the active end, the rest, as shown in the table, preserve the shaft and the proximal part, but all preserve the two converging lines that form the active end.

In addition to split metapodial, we also have metapodial quartets. The bone is broken into four pieces and bisected on both sides (anterior and posterior). The metatarsal quarters are mainly found in the proximal part of the bone because it is easier to re-bisect. Their cross-section is elliptical, in some tools where the pointed tip is not preserved, the cross section is planoconvex.

There are 2 awls from the radius (fig.7.11). One is intact and the other saves the active end, shaft, and part of the proximal part. One is made from the radius of a sheep/goat and the other from a hare. They have a circular cross section and are between 4 and 8 cm long. One recognises longitudinal cut and abrasion, the other only abrasion.

There are only 8 awls from the ribs (fig.7.12). Three are intact, 1 saves the active end, shaft, and part of the proximal end and the rest saves part of shaft and active end. Six are unidentified, one is made from the rib of a cattle and the other from a pig. They have a elliptical cross section and are between 1 and <15 cm long. In the category of awls, we note only split ribs, as opposed to other tool categories such as spatulas, which we will discuss below. The by-products present in the material from Kleitos help us to reconstruct the stages in the processing of the ribs. The process is the same as in all periods of the Neolithic. The bone is sliced crosswise and then the lateral rims are removed; the bone is then sawed lengthwise, and the spongy tissue is smoothed out.

There are two awls from antlers (fig. 7.13). One is intact and the other saves part of the shaft and the proximal part. Both came from red – fallow deer. Their cross-sections are only circular, and the tools are very polished. These are long tools, symmetrical in length,

with two parallel lines converging at a pointed end. These are heavily worked tools; the spongy tissue is not preserved at all. These tools belong to the category mentioned above and could be part of a larger tool. The proximal part shows more pronounced traces of processing, while the active end shows intense polishing and traces of use. The direction of the wear suggests that the tool was used in a circular motion to penetrate some material. They are very similar to the tools found in abundance at the Dispilio site. At Kleitos many of these tools are not made from antler, whereas at Dispilio chert predominates, but this has to do with the raw material available in the area. More than 8 and up to 15 cm in length.

The most numerous categories of awls are that of unidentified long bones (327 objects) (fig.7.14, 7.15). 1 is from hare, 130 from sheepgoats, 7 from cattle and 189 from unidentified animals. 53 are whole, 10 preserve only the shaft, 68 the active end, part of the shaft and proximal part, 136 the active end and part of the shaft, 55 only the active end and 1 part of the proximal part. Most tools survive from 1 to 15 cm in length; most have an elliptical and circular cross-section at the active end. In the few millimeters above the active end, most cross-sections follow the physiology of the bone and are planoconvex. The majority of the undiagnosed bones have been subjected to abrasion and longitudinal sawing (284), 34 can only be identified by abrasion, in all the rest a combination of grinding-scraping, longitudinal sawing, sawing-scraping, abrasion-grinding techniques is observed. The manufacturing techniques have been recorded based on the image seen in the bone, with the stereoscopical analysis. More than those we can identify in the stereoscope could have been used.

A total of 606 awls were found in Kleitos I and 49 in Kleitos II, while 20 were found outside the settlement. Awls were found in all trenches. A high concentration was found in the trench IΓ9, IΔ4, IΔ5, IΔ6, IΔ8, IΔ9, IE6, IE7, IE10, IZ6, IZ7, IZ8, IΣT6, IΣT7, IΣT8, IΣT9. No awls were found in the trenches IΣT 12, IH9, IH5, IΔ14, IΓ12, IB10, IA17, IA11, IA12, IA9, H10 (table 44,45).

7.2.1.2 Needles

Kleitos needles vary in shape depending on their raw material. Needles from long bones have a thin body and a hole, an “eye”. This hole has been made by rotation and appears to be drilled on both sides. There are a total of five needles 0,4% in the Kleitos bone material (table 34). Three of them are intact and one saves part of the diaphysis and the distal part with the hole (fig.7.16). Two of them are severely eroded and the rest of them are slightly eroded (table 38,39). Two are from wild boar and pig teeth (table 42). On these bones only traces of use and possibly a small abrasion near the hole can be observed. The body of these tools is not thin and long but follows the physiology of the tooth and only abrasion can be detected.

In addition, the hole on the inside and the millimeters next to it are highly polished. It should be noted that these objects could be ornaments, even though there are traces of use. In other words, they have a double use. The two needles from long bones of an unidentified animal are so heavily worked that it is not even possible to determine the size of the animal; the metatarsal needle is also heavily worked but preserves the two grooves of the metatarsal. We can identify the longitudinal sawing and the abrasion. All have a circular cross-section and the teeth are elliptical. Their length ranges from 2 cm to 15 cm.

Three needles were found in Kleitos I and 2 in the fills of Kleitos 2. They found in the trenches IA15, IA16, IE5, IE7, IE8. Two of the needles were found in deposits where MBA pottery was found; perhaps this is the evolution of Neolithic needles. It is a fact that in Neolithic sites we do not find so many refined needles, which could be related to the development of other tasks such as weaving, basketry, etc. (table 44,45).

7.2.1.3 – Pointed tools/Unidentified

It is usually an elongated object, the proximal part blunt, pointed rarely sharp, with a smooth axis and the proximal end tapering to a nose. It does not create as acute an angle as an awl, but its active end can be angled from 10o to 40o. There are 97 bone perforators (7,2%) in the Kleitos I and II bone assemblage (table 34). The majority are fairly eroded, (56) 26 have better traces of use and treatment, and 15 have a severely eroded surface (table 39). The majority are preserved in fragments (51), only 16 are almost intact and 30 are intact (table 37). They preserve the active end 11 tools, only 2 preserves parts of the shaft and the creation of the active end and part of the shaft and proximal part, only the active end and shaft 31, and part of the active end, shaft and part of the proximal part 21, only 3 preserves only the proximal part (table 38).

As for the raw material similar to awls, it was possible to identify several anatomical features and animal species. Four unidentified bones from unidentified animals, 2 cattle radius (fig.7.17), 1 sheep ulna (fig.7.18),14 ribs from unidentified animals (fig.7.19), cattle and pig, 1 scapula and 1 femur from unidentified animal, 3 tooths from wild boar and pig (fig.7.20), 4 red fallow deer antlers, metacarpals, metatarsals, metapodials and tibia from sheep/goats and cattle (fig.7.21), 40 long bones from unidentified animals, sheep/goats, cattle and carnivores (fig.7.22) (table 40,41,42).

The cross sections are circular, elliptical, and planoconvex. The length of the pointed tools in this category reaches more than 15 cm, mainly in the ribs and long unidentified bones. They are the longest of all the Kleitos bone objects. There is a wide variation in the length of the perforators, from 2 cm up to 15 cm.

In the case of pointed tools, the use of all processing techniques and their combination is observed (table 43). The long bones and unidentified long bones have been subjected to abrasion, transverse cutting - grinding-scraping, longitudinal sawing, sawing on longitudinal axis-scraping, abrasion-grinding, scraping, abrasion-sawing on longitudinal axis-scraping, abrasion-sawing on longitudinal axis-scraping, abrasion-sawing on longitudinal axis and splinters. The ribs were cut in half in the manner mentioned above and sawed, sawed-scraped, abraded-sawed-scraped and splinted, the shafts sawed-scraped-abraded, abraded-sawed and splinted, the ulna abraded and scraped, the humerus sawed-scraped-abraded, the metapodial abraded-transverse cut, abraded-grinded-scraped-transverse cut, and the unidentified bones abraded and abraded-grinded. The antlers are also heavily treated. While the teeth are only abraded and the traces of their processing are indistinguishable, the tooth itself bears several traces of its use by the animal itself. It is a tool used by the animal to cut, grind, and drill, all of which leave their mark on the bone. Pointed tools made from splinters have been included in this category of tools. However, the Kleitos assemblage does not have a very large number of fragments, similar to other LN and FN sites. Long bone splinters have non-symmetrical shapes because they are only worked on the active end, which is different from the rest of the body, similar to the other positions we are discussing.

This class of tool is not as homogeneous as other classes, e.g. awls. Sizes, manufacturing techniques and use vary greatly from tool to tool. It has been observed that on bone side tools the traces of use do not exceed a few millimetres from the active edge, whereas on long bone point tools, the traces of use can cover almost the entire surface of the tool.

As the second most numerous category in the pointed tools, are also widely dispersed in the archaeological context. However, there is no great concentration in any particular trench. 89 found in the deposits of Kleitos II and 5 in the deposits of Kleitos II in trenches: I16, H12, IA16, IB9, IB10, IΓ6, IΓ7, IΓ8, IΓ9, IΔ4, IΔ5, IΔ6, IΔ7, IΔ8, H15, IΔ9, IΔ10, IΔ11, IΔ12, IΔ13, IE5, H16, IE6, IE8, IE9, IE11, IZ5, IZ6, IZ7, IZ8, IZ9, IZ10, IZ11, IΣT6, IΣT7, IΣT8, IΣT11, IΣT13, Θ12. 3 pointed tools found in the deposits out of the settlements (table 44, 45).

7.2.1.4 Double points

In Kleitos bone assemblage, there are a total of 7 double points, 0.5% from long/unidentifiable bones and one metapodial (table 34,42) (fig.7.23). The extensive use and treatment of these tools makes it difficult to identify the bone they are made of. Three came from cattle size animals, 1 from an unidentified size animal, and 3 from sheep/goat size

animals (table 40) (draw 7.1 j, k, l). These objects are taken from the thickness of a bone diaphysis. They have the shape of a rod with two opposite points, which may or may not be symmetrical; they are shaped by scraping, abrasion, and sometimes slight retouching (Camps-Fabrer, H. 1990). Their cross-section at the three points of the tool (tip-middle-tip) is circular and rarely elliptical. Their point varies between 5 and 20 degrees. Double points could be used in basketry, but they could also be hooks for the big fish.

Six of these are intact and one preserves part of the active end, the shaft and part of the proximal part. As mentioned above, many of the fragments could fall into this category. The length is between 2 and 9 cm.

All found in the deposits of Kleitos I in the sections IΓ8, IΔ6, IΔ7, IΔ10, IE10, IΣT7, IΣT8. The double points of Kleitos are very similar to those found in the settlement of Dispilio from the same period. The fact that we do not find them in the FN deposits may indicate that this type of tool was discontinued or replaced by another (table 44, 45).

7.2.1.5 Projectile points

The bone assemblage of Kleitos contains a small number of projectile points (6,4%) (table 34) (fig.7.24, draw 7.1 g, h, i). Although some of the pointed tools or the other categories such as awls can be used as projectile tools. The shape of projectile points differs from that of awls and other points. They are shorter and there is a standardization of shape and length. All projectile points are made from long bones of cattle-sized animals (table 40). The tool has two distinct zones. The first is the active end, which is usually very polished and has thin, irregular stripes. On the half of the tool and towards the distal part, the rough striations of the working process can be observed. All projectile points are preserved intact (table 37). Note that many of the fragments present in the material that belong to the pointed tool category could belong to the projectile point or double point category, etc. Their cross section is usually elliptical or circular. Several times there is a transverse cut in the middle of the tool, at the point where the two zones are distinguished. It seems that the distal part was attached to a handle (probably wooden), so that this part of the tool has clearly preserved the treatment surface, which was not in contact with hand lipids or the environment. These artefacts were probably used as arrows for hunting or even war (Choyke, A., Bartosiewicz, L. 2004). This category could include the awls mentioned above, which have a symmetrical shape but do not have the characteristics of projectile points (clear punching due to traces of the active and proximal part of the tool). In addition, the length of the projectile points does not exceed 6 cm, while the awls mentioned above reach up to 15 cm; the projectile points have a mainly elliptical cross-section, while the awls have a mainly circular cross-section.

They were found only in the deposits of Kleitos I and specifically in sections IE9, IE10. Like the double points, the projectile points from Kleitos are very similar to those found in the settlement of Dispilio from the same period. The fact that we do not find them in the FN deposits may indicate that this type of tool was discontinued or replaced by another (table 44, 45).

7.2.1.6 Arrow

The number of objects identified as arrows is 11 (0,8%) (table 34) (fig.7.25). However, many of the pointed tools or fragments could belong to this category. Of these, five are intact, two are almost intact and four are fragments but retain the typological characteristics of an arrow (shaft - active end, active end – shaft – proximal part) (table 37,38). Two are highly eroded, 4 are moderately and 5 are slightly corroded (table 39).

Eight are from unidentified long bones and three from antlers (table 42). Nine are from cattle size animals, one from sheep/goat size animal and one from an unidentified animal (table 40). The families of the animals that can be identified are red fallow deer, deer, sheep/goat and cattle (table 41). The manufacturing techniques identified are longitudinal sawing, abrasion, scraping and transverse cutting (table 43). Their length ranges from 2 to 8 cm.

Four arrows were found in the deposits of Kleitos I, 1 on the deposits of Kleitos II and 6 outside of the settlement. Specifically in trenches IA9, IA10, H12, IB11, H13, IΓ8, IΔ5, IE4, IE2. There is no typological difference between the different contexts in which the arrows were found. Considering other parameters, such as the raw material, where wild predominates in the LN deposits, the higher concentration of arrows in Kleitos I and outside the settlement may indicate the most intense hunting activity in this period (table 44, 45).

7.2.1.7 Harpoon

The tools identified as harpoons make up a total of 12, 0.9% of the material (table 34) (fig.7.26). These are harpoon heads. Unfortunately, most of them are fragments (6), three save parts of the hole (nearly intact) (draw 7.2a) and three save parts of the distal part (intact) (table 37). In this way, we don't have a complete object without a missing piece. Three are heavily corroded and the rest are lightly or not at all corroded (table 39). Most are deer antlers and only two are long bones (table 42). The antlers have been identified as belonging to red and fallow deer, while the long bones are from a large animal without being able to identify the family.

Similar to the assemblages from Agioi Anargiroi (Arabatzis, C. 2019:165) the harpoon heads are formed on tine segments, and all belong to the same morphological type,

with some small variations. The first step was for the manufacturer to select the appropriate tine and extract the desired part from it by percussion and/or sawing. The next step was to shape the base of the proximal part of the tine segment by hammering almost in the center of the blank, then sawing and grinding the proximal part longitudinally to give a flat internal surface and a plano-convex cross-section. In one case, the grinding was not limited to the internal surface of the proximal part but was also applied to its lateral sides. The line hole was drilled in the anterior part of the tine segment. For all types, the rope would have been tied into the wooden shaft to prevent the antler head from being lost after an unsuccessful shot or to pull the harpoon head and fish out of the water. The active end of the proximal part was shaped by abrasion and grinding, and their cross section is circular. The length of the tools, regardless of their state of preservation, ranges from 4 cm to 15 cm. All but one of the distal tips are unmodified and retain their natural shape, and only in one case has the tip been shaped by grinding and polishing. Antler harpoons show no morphological differences, while bone harpoons show traces of grinding and polishing on the tip.

Eleven harpoons were found in the Kleitos I deposits and 1 in the Kleitos II deposits. Specifically in the sections I13, I16, IΓ8, IΔ5, IΔ8, IE6, IZ6, IΣT6 (table 44, 45). Similar harpoon heads have been found in other nearby Neolithic settlements and it seems that this type of harpoon head type is so far only found in the Western Balkans. This type is very different from other tine harpoon heads from the Eastern Balkans, especially those found at Pietrele (Hansen 2013). Although they look almost the same, only the Eastern Balkan harpoon heads can be characterized as toggle harpoons as they have line holes on two opposite sides (anterior/posterior or medial/lateral) and they seem to have a small tang whose role was to force the prey to suffer damage when it penetrated the skin. On the other hand, Western Balkan harpoon heads have a large proximal part that was attached to a wooden shaft and couldn't penetrate the prey's skin (Arabatzis, C. 2019:169).

7.2.1.8 Fishhook

Hooks in the bone assemblage of the Kleitos cover only 0.2% (3 objects) (table 34) (fig.7.25). Their erosion is moderate (1) and low (2) (table 39). Two are from unidentified bones and one from long bone (table 42). The species and size of the animal could not be identified (table 40,41). Two are preserved in fragments, one is intact (table 37). One preserving the active end, shaft and proximal part, one is being preserved in worse preservation and preserving only the shaft and the proximal part and the last one preserves all the parts of the tool (table 38). The cross-section of the active ends in all three is elliptical. The manufacturing techniques identified are in one abrasion, sawing on the longitudinal axis and

transverse cutting, and the other two processed by abrasion and sawing on the longitudinal axis.

One fishhook is found in the Kleitos I deposits and 2 in the Kleitos II deposits. Specifically in the sections IA6, IΓ6, IZ6 (table 44, 45).

7.2.1.9 Conclusions on pointed tools.

According to the study and the statistics obtained, the pointed tools are the most numerous category in the Kleitos I and Kleitos II bone assemblage, accounting for 53,3% of the total material. It is one of the most important tool categories in all Neolithic bone assemblages. In contrast to the other materials we have examined, the pointed tools of Kleitos show heterogeneity in terms of type; we can identify more than five different types of bone points, the shape of which is clearly determined by the raw material. In the Kleitos material we find awls so small that they are reminiscent of their Paliambella and Revenia counterparts, longer awls with more detailed construction and sharper points. We find all possible pointed types in large quantities, such as projectile points, double points, pointed tools made from splinters. The very good preservation of the material gives us a very good picture of both the raw material and the construction of the tools. Among the perforating tools, awls have the highest percentage of 50%, followed by the other categories such as perforators, projectile points, needles, double points, arrows, hooks and fishhooks. In the general category of pointed tools, there is little erosion and enough sedimentation to help us with the taphonomic approach.

There is a great variety of raw material. Almost all long bones are represented by a sample in the pointed tools. Long unidentified bones predominate, followed by metacarpals, metacarpals, metapodials, tibiae, radius, ulna, fibula. Bones such as ribs, scapulae, antlers and teeth are represented in much smaller quantities. Antlers in some categories, which will be examined below, and harpoons are in the majority. The large number and good preservation have helped to identify different families of animals. Domestic animals such as sheep, goats, cattle, pig, and wild animals such as red deer, fallow deer, roe deer, wild boar, bears, carnivores, hares and canines have been identified. Roe deer mainly use the bone rather than the antler, which shows evidence of hunting in the area. Compared to the other areas we are investigating at Kleitos, the presence of wildlife and hunting tools such as harpoons and arrows is intense. Additional arrows were found on fill outside the settlement, possibly indicating activity outside the settlement boundaries. The length of the tools varies from 2 to 3 cm to more than 15 cm. The cross-sections are mainly circular and elliptical. Elliptical cross-sections are mainly found on projectile points. As with the other materials we have examined, traces of use are observed in the first few millimeters from the active end of the tool; there are tools, such as symmetrical ones like projectile points and some awls, where the

traces of use extend up to half of the tool and the other half is clearly the traces of processing. These tools appear to have been attached to a handle, either wooden or antler.

All construction techniques were identified in Kleitos pointed tools. Sawing on the longitudinal axis, abrasion, cross-cutting and scraping are the working techniques that can be recognized in the assemblage of Kleitos.

The Kleitos I has many more tools in total, which is reflected in the pointed tools. In Kleitos I there are 606 awls, 89 pointed tools, 3 needles, 4 arrows, 11 harpoons, 3 projectile points, 7 double points and 1 single hook. In Kleitos II, the total number of tools is much lower, with projectile points and double points completely absent. Awls total 49, pointed tools 5, needles 2, 1 arrow, 1 harpoon and 2 hooks.

7.2.2 Edged Tools

Like the other assemblages in this thesis, edged tools are tools of simple form, made from bone or antler, whole or cut, with the active part formed into a single edge or double bevel. In the case of antlers, the proximal edge is usually worked and polished. In the case of long bones, the proximal part may be worked to make it easier to hold, or it may have retained the natural articulation of the bone and remain rough. All bones are used as raw material for the specific type of tool, depending on the use of the final tool. Long bones, ribs, antlers, and flat bones such as scapulas are used. Antlers are usually worked by direct hammering, slotting or cross-cutting. Bevelling is done by scraping and abrading, notching and then trimming by polishing or abrading. Grooves are produced by grooving or notching. For long bones, the epiphysis is removed by fracture or sawing. Longitudinal removal by fracture (direct or indirect) or sawing along the longitudinal axis of the bone. The active limb is treated by oblique fracture of one of the two limbs, followed by shaping by abrasion.

Sharp tools account for 18% of the total material. Note that some tools, as shown in the table, are classified into two tool categories based on their use and typology, e.g., polishers - chisels. Sometimes it is quite difficult to classify a tool into a single category based on traces of use and the final product in hand. Tools, as a living part of the work of prehistoric people, could have had more than one use, or a second use and a second modification.

7.2.2.1 Chisel

Chisels are the second largest category of Kleitos assemblage (119 8,8%) (table 34). Most of them are slightly (67) or moderately (34) corroded, while only 18 objects are heavily corroded (table 39). Due to the small size of one object, it is not possible to determine the degree of corrosion with certainty, one object saws traces of no corrosion and one is so

heavily corroded that we can recognize only the shape of the active end. There are 23 objects that are intact (no fracture), 19 objects that are almost intact and 126 objects that are fragmented (table 37). In 26 tools almost the whole tool is preserved except for a few fragments, in 11 tools only the active end is preserved, in 25 objects part of the active end, shaft and proximal part is preserved, in 55 objects the active end and part of the shaft is preserved, in 1 object part of the shaft and proximal part is preserved and in 1 object only the shaft is preserved (table 38). Unlike Revenia and Paliabella, we do not have objects that are joined together. This gives us a more accurate count of the material.

As shown in the table 40, the raw material used was sheep-goat size (70) and cattle size (48) (fig.7.28, 7.29), for 1 item the size of the animal could not be identified. There were 56 objects from the sheep-goat family, 1 from goats, 8 from sheep, 2 from roe deer, 10 from fallow deer (fig.7.30), 1 from unidentified deer, 12 from cattle, 3 from pig and 26 unidentified. Flat bones are represented by 4 objects (table 41). The most common bones are long bones, 102, and only one is unidentified. Ribs are 2 objects, unidentified long bones are 32 objects, tibia 52, femur 2, radius 5, metapodials 9 (metatarsals and metacarpals), humerus 1, fibula 1, ulna 1, mandible 1, scapula 1 and antlers 12 (table 42).

The cross-section recorded on all objects varies, as does the shape and size of the edge. The cross sections observed are circular, elliptical, planoconvex, and unidentified. The shape of the edge, where it could be measured, is predominantly convex (31) and straight (53), double bevel (7), while unidentified, which could belong to more than one category, is 28. Several objects preserve less than one centimeter of edge length, the rest preserve from 1-2 cm 88 objects, more than 2 cm 6 objects, unknown lengths 25 objects. The total length of the chisel's ranges from 1 to more than 10 cm. The longest length is preserved by objects with tibia and antler as raw material. This leads to the assumption that this category of finds, the majority of which were made from tibia, used the entire width and length of the bone. It is a tool category that preserves some of the best-preserved length and erosion-preserved objects like the similar categories of other assemblages of this thesis.

The manufacturing techniques used in the chisels that have been identified also vary. They were identified as: scraping - transverse cutting (1), longitudinal sawing - scraping (1), longitudinal sawing (2), unidentified (1), abrasion – longitudinal sawing (95), abrasion - sawing on longitudinal axis - transverse cut (2), abrasion (12), scraping (1) (table 43).

In this category there are also two objects listed in the table as polishers - chisels. These are two fragments of objects that could belong to more than one category, and because of their small size we cannot place them confidently in either category. Both have very little erosion and their active end and part of the diaphysis are preserved; one is a long bone of an

unidentified animal and the other is a metatarsal of a cattle; their edge is concave and only abrasion and longitudinal fragmentation has been identified; their edge ranges from 0 to 4 cm; one is 5.3 cm and the other 6.2 cm long.

The Kleitos I has many more chisels than Kleitos II. In Kleitos I there are 108 chisels and Kleitos II has only 8. The two tools described as polishing chisels were found on Kleito I. The tools found specifically in units I16, I17, IA12, IA15, IA16, IB9, IB10, IB11, IΓ5, IΓ6, IΓ7, IΓ8, IΓ9, IΔ4, IΔ5, IΔ6, IΔ7, IΔ8, H15, IΔ9, IΔ10, IΔ11, IΔ12, IE4, H16, IE6, IE7, IE8, IE10, IZ5, IZ6, IZ7, IZ8, IZ9, IZ10, IZ11, IH5, IΣT6, IΣT7, Θ12, IΣT8 (table 44, 45).

7.2.2.2 Sharp Tools/ Unidentified

Unidentified edged tools are those which, due to fragmentation or corrosion, cannot be assigned to any other category of edged tool (table 34). They make up a small percentage of the total material, 1,3%. Most of them show little (12) or medium (4) corrosion, while only 2 show a fairly high degree of corrosion (table 39). Only 7 object is intact (showing no breakage), and 11 objects are fragmentary (table 37). In other words, 7 retain a large percentage of the entire tool intact (over 90%), 3 retain part of the active edge and 8 retain the active edge and part of the diaphysis (table 38).

As can be seen from the table, the raw material used was sheepgoat size (4) and cattle size (14) (table 40) (fig.7.31). Of these, 1 is from the sheepgoat family, 4 are from cattle, 2 are from wild boar, 1 from red deer, 2 from red fallow deer, 1 from pig and 7 are unidentified (table 41). There are 11 long bones in total. From ribs there is 1 tool, from unidentified long bones there are 8 objects, from ulna there are 3 objects, from antlers 3 and from tooth 3. The 3 ulna and the rib are from cattle, the 3 teeth are from wild boar and pig. The 3 antlers are from red and red-fallow deer and the long bones are from sheep/goats and unidentified animals (table 42).

The cross-section recorded on all objects varies, as does the shape and size of the edge. The cross sections observed are planoconvex, rectangular, and unidentified. The shape of the edge, where it could be measured, is predominantly straight (7), double bevel (3) and convex (2), while 5 are unidentified and could belong to more than one category. All objects save less than one centimeters of edge length. The total length of sharp tools/unknown ranges from 1 to more than 15 cm. The longest length was recorded for an object from antler. This is a category that could belong to more than one sharp object category.

The manufacturing techniques used on the unidentified edged tools that have been identified vary. They have been identified: abrasion - transverse cutting (1), sawing on longitudinal axis (1), abrasion (6), unidentified (1), abrasion - sawing on longitudinal axis (9) (table 43). With both teeth and antlers, it is quite difficult to see signs of use, as the animal

itself leaves marks on the bone from its movements. Deer scratch their antlers on surfaces as they itch and shed them annually, while the teeth of pigs and boars are used as cutting, piercing and slicing tools. The need for comparative material and the assistance of an archaeozoologist was essential to identify traces of use that did not come from the animal. However, a caveat remains, as there is no visible trace such as a hole; the material from Kleitos contained several wild boar teeth, but these had not been treated.

The Kleitos I has many more sharp tools than Kleitos II. In Kleitos I there are 17 sharp tools and Kleitos II has only 1. The tools found specifically in units IΓ6, IΓ7, IΔ7, IE5, IE6, IE7, IZ5, IZ7, IΣT10, Θ16 (table 44, 45).

7.2.2.3 Polishers

Polishers make up only 0,5% of the Kleitos bone assemblage (table 34). A polisher is defined as an object that appears to have been used on both sides of the object. Most of them show little (5) or none (2) corrosion (table 39). Only 1 object is intact (showing no breakage), 1 almost intact and 5 objects are fragmentary (table 37). In other words, 1 preserves a large percentage of the entire tool intact, 1 preserves part of the active end, 3 preserve the active end and part of the shaft, 1 only the shaft and one part of the shaft and proximal part (table 38).

As shown in the table, the raw material used was sheepgoat size (1) and cattle size (6). Of these, 4 are from pig and 3 are unidentified. Long bones are in total 11. From ribs of unidentified animal family are 2 tools, 4 came from teeth of pig and 1 from mandible of unidentified animal family (table 40,41,42) (fig. 87.32).

The cross-section recorded on all objects varies, as the raw material is really different. Ribs have an elliptical cross section while teeth are more rectangular. The shape of the edge, where it could be measured, is convex. These tools are long, with the sides reaching more than 15 cm, while most are between 4 and 6 cm, show signs of use and are fairly polished along the entire length of the tool.

The recognised manufacturing techniques are abrasion on the teeth and longitudinal cutting on the ribs. The teeth do not have a lot of treatment (table 43).

This tool was only found in Kleitos I, and in particular in trenches IΔ8, IZ6, IZ10, IZ12, IΣT7, IΣT9 (table 44, 45).

7.2.2.4 Spatula

The spatulas in the Kleitos bone assemblage, as summarized in the table 34, represent 5,0% (67 objects) of the total material. Most of them (40) are slightly or not at all corroded, 14 are highly corroded and 13 are moderately corroded (table 39). In general, they belong to the

category of relatively well-preserved tools. Fifteen are intact, 16 are almost intact and 36 are fragmentary (table 37). In other words, 17 spatulas are intact, 16 preserve part of the active end, 14 preserve part of the active end and part of the shaft, 16 preserve part of the active end, part of the shaft and part of the proximal part, 3 preserve part of the shaft and part of the proximal part and only one preserves part of the proximal part (table 38). This category also includes polishers - spatulas, which were difficult to categorize. There are three artefacts with little erosion; two of them preserve only part of the active end and one part of the active end, of the shaft and the proximal part; they are from cattle-sized animals; two are ribs from a large animal and one is a long bone. The ribs are bisected and worked by longitudinal sawing and abrasion, while the long bone shows only abrasion; one is long and over 10 cm long, while the other two are 4 to 6 cm long.

As shown in the table, animals of the size of a sheep/goat (2) and cattle (65) were used as raw material (table 40). As far as family 50 is concerned, these are unidentified animals, 1 is red-fallow deer, 3 red deer, 2 sheep/goats, 10 cattle and 1 pig (table 41). As far as specific bone, 1 is unidentified bone, 3 mandibles from unidentified animal, sheep/goat and pig, 52 ribs from unidentified animals and cattle, 1 scapula from sheepgoat, 4 antlers from red-fallow and red deer and 6 long bones from unidentified animals and cattle (table 42).

The cross-section recorded on all objects varies, as does the shape and size of the edge. The cross sections observed are specifically elliptical, planoconvex and unidentified. The shape of the edge, where this could be measured, is predominantly 4 convex and 5 straights, while unidentified, which could fall into two categories, is 58. Seven tools that survives from 0-2 cm of the edge, 3 tools that survives from 2-4 cm of the edge and 56 was difficult to measure the exact length. The total length of the spatulas ranges from 1 to more than 15 cm. 3 are longer than 15 cm, 7 are from 10 – 15 cm, 10 from 8 – 10 cm, 21 from 6 to 8 cm, 19 from 4 to 6 cm., 4 from 2 to 4 cm., 3 from 0 to 2 cm.

The manufacturing techniques that have been used in spatulas and have been identified also vary (table 43). They have been identified: abrasion (4), sawing on longitudinal axis – scraping - abrasion (1), sawing on longitudinal axis - abrasion (54), sawing on the longitudinal axis (1), scraping (1), unidentified (2), abrasion - sawing on longitudinal axis - transverse cut (4). In the ribs, we observe both bisected ribs and whole ribs. The majority are bisected. The sequence used for the processing of ribs is similar to that used for the other categories of tools. The bone is sawed transversely to give the desired length, the lips are removed by percussion if necessary and then the angle is created by

abrasion. The spongy tissue of the bone on the divided ribs can be ground with abrasion or without abrasion.

The spatulas from the Kleitos site, similar to other Neolithic sites, also show decoration. In Kleitos we find three different types of spatulas. All three are represented by more than one tool; the first type is the "simple" spatula; the body of this type of tool is simple, usually made of bisected ribs; the ribs are cut crosswise, and the craftsman obtains the desired length. It is then cut lengthwise to form the active and distal edges (fig. 7.33). In the case of Kleitos spatulas, there are no ribs where the spongy tissue has not been worked. The spongy tissue is smoothened. The edge of these tools is usually straight with rounded angles. The second type of spatula is the one with a distinct proximal part - the handle (fig. 7.34, 7.35, 7.36). In this type we find both ribs and antlers, as well as long bones; these are tools whose active end resembles a spoon, it is curved, and in the genesis of the back end the surface becomes smaller, forming a distinctive handle. The third type is the "decorated" one (fig. 7.37), which we find in all the Neolithic periods, but mainly in NN and FN; the raw material is usually ribs and antlers; similarly, to the previous type, the active end is shaped like a flattened spoon and then the characteristic handle begins, which is not two symmetrical straight lines, but has notches. However, as mentioned above and in the chapter on the study of the Revenia assemblage, we cannot exclude the possibility that these notches may have had a utilitarian value, such as tying the spatula with a rope. The traces of use detected under the stereoscope are not entirely visible.

Except from one tool which is found in fills of Kleitos II, all the other spatulas found in Kleitos I deposits. Specifically in trenches IB8, IB9, IB10, IΓ8, IΓ9, IΓ10, IΔ5, IΔ6, IΔ7, IΔ8, IΔ9, IΔ10, IΔ11, IE5, H16, IE6, IE7, IE9, IE10, IE12, IZ6, IZ7, IZ8, IZ10, IΣT6, IΣT8, IΣT11. A high concentration of this type of tool was found in section IΔ8, with a total of 14 spatulas. The objects defined as polisher spatulas were found in Kleitos I and in particular in the trenches IΔ7, IΔ8 and IΣT9 (table 44, 45).

7.2.2.5 Axe (Axe sleeve- Axe chisel)

The axes in the Kleitos bone assemblage, as summarized in the table 34, represent 0,7% (10 objects) of the total material. The objects that cannot be identified with a single category are represented by a very small number of axe sleeves 0.2% (3) and axe chisels 0.2% (3). Six of them are slightly or not at all corroded, 4 are highly corroded and 6 are moderately corroded (table 39). In general, they belong to the category of relatively well-preserved tools. 5 are intact, 6 are almost intact and 5 are fragmentary (table 37). In other words, 5 axes are intact, 2 preserve part of the active edge, 3 preserve part of the active edge and part of the shaft, 6 preserve part of the active edge, part of the shaft and part of the proximal part (table 38).

As shown in the table, only cattle size animals were used as raw material (table 40). As far as family 3 is concerned, these are unidentified animals, 8 is red-fallow deer, 4 red deer, 1 cattle (table 41) (fig.7.38, fig.7.39). As far as specific bone, 1 is unidentified bone, 10 antlers, 2 long bones and 1 metatarsal (table 42). The cross-section recorded on all objects varies, as does the shape and size of the edge. The cross sections observed are specifically elliptical, planoconvex and unidentified. The shape of the edge, where this could be measured, is predominantly 1 convex and 7 straight, 2 double beveled while unidentified, which could fall into two categories, is 6. 6 tools that survives from 0-2 cm of the edge, 1 tool that survive from 2-4 cm of the edge, 1 tool survive 4 to 7 cm, 1 8 to 10 cm., 1 up to 10 cm., and 6 was difficult to measure the exact length. The total length of the spatulas varies from 1 to more than 15 cm., 4 between 10 and 15 cm, 1 between 8 and 10 cm, 3 between 6 and 8 cm, 2 between 4 and 6 cm, 2 between 2 and 4 cm.

The manufacturing techniques used and identified on the axes also vary (Table 43). They were identified as: sawing on longitudinal axis - abrasion (5), scraping (1), abrasion - scraping- transverse cut (2), transverse cut – abrasion (2). Each bone was treated differently. One of the axes, from a long bone, has a hole and possible decoration (fig.7.38d). It is small but a very carefully worked tool. The long bones are halved lengthwise, and the bone has been abraded around the circumference. The antlers are worked on the active end. Usually, the beam of the antler is used instead of the tines. The axes on the tine have drilled shaft holes and beveled edge. The hole is close to the basal part of the tine, which is formed by unidirectional bow drilling. The active end is blunt and very worn due to heavy use, probably for woodcutting.

The second type of the axis are the beam axis. Their manufacture was a time-consuming process that required a great deal of effort, physical strength, technical skill and in-depth knowledge of the physical properties of antler. The beam axes comprise a rather interesting typological assemblage. They make up the largest part of the assemblage and their morphology shows the desire and ability of the inhabitants of the settlements to work with this hard material, investing a lot of effort and time to create strong and robust tools that could help them in their daily needs (Arabatzis 2019:147). According to the typology of Agioi Anargiroi there are 4 subcategories in beam axis. In Kleitos we recognize 3 subcategories. The first is the split beam axe with the active end on the burr, where the maker would cut off the antlers in the middle of the beam segment and keep the part with the basal part (fig.7.38a, fig.7.39b, c). The next manufacturing step was the removal of the tines (first and second), usually by percussion and bending. In this subtype, the manufacturer didn't grind the raw material, but chose to split it in half lengthwise, a very difficult and

time-consuming operation. This was done in great detail and with great success using sawing and splitting techniques. The reasons for this choice could be stylistic or economic. By splitting the raw material in two, the manufacturer could have two blanks that could be shaped according to his needs (Arabatzis 2019:147). The next manufacturing steps are related to the shaping of the shaft hole and the of the base. The few data available provide limited information about the shaft hole and the base of the axe. and the basal part of the axe. In one case the shaft hole was shaped by percussion and bow drilling close to the and bow drilling close to the basal part of the axe, which was left unshaped. The active end was also in the basal part of the antler. It has a broad cutting edge and a plano-convex cross section. cross section.

The second sub-category is the split beam axe with active end on upped beam. The raw material has been successfully split in half by sawing. The inner surface of the split beam bears some grinding marks, probably from some smoothing or flattening after splitting. The shaft hole has a flat oval cross-section and was formed by percussion and bow drilling (Arabatzis 2019:151).

The third one is the handheld beam axe on junction. is a unique hand tool, the shape of which is reminiscent of the T-axes used in many parts of Europe during the Neolithic (fig.7.38a) (Bogucki 2008; Kabaciński et al. 2014; Classon 1983; Elliot 2012,2015; Grygiel and Bogucki 1990; Riedel 2003; Tóth 2012). In this case there are no attempts to shape the shaft hole and the tool shows signs of wear, so it must be that it was used by hand. The raw material, part of the beam segment and the was removed from the remainder of the beam, mainly by percussion and bending fractures. The third tine was removed by percussion. The active end has probably been scraping, and it's quite damaged and worn (Arabatzis 2019:152).

Except from one tool which is found in fills of Kleitos II, all the other axes found in Kleitos I deposits. Specifically in trenches IΓ6, IΓ9, IΓ12, H15, IΔ5, IΔ9, IE7, IE10, IΣT6, IΣT7, IZ8 (table 44, 45).

7.2.2.6 Conclusion on edged tools

Sharp tools account for 18% of the total. As mentioned above, some tools are divided into two tool categories based on their use and typology, e.g. polishers - chisels. Sometimes it is quite difficult to classify a tool into a single category based on traces of use and the final product in hand. Tools, as a living part of the work of prehistoric people, could have had more than one use, or a second use and a second modification.

At Kleitos, the edged tools show much more variation in typology than at the other sites considered. Many tool types have many different subcategories, such as spatulas.

Chisels are the second largest category of bone tools from Kleitos. The bones used were mainly sheep/goat tibiae. The shape of their edge is convex, straight and double-bevelled, depending on their use. Some of the best double-beveled objects are preserved in the material. For all bones shaped with a chisel, the treatment follows the same pattern. First, an epiphysis is cut by percussion and then the active end and the middle part of the tool are formed by abrasion.

Unidentified edged tools are not very common in the Kleitos material. More come from large animals and unidentified long bones; where a good percentage of the edge has survived it has been possible to identify straight, double bevel and convex edges.

The category of polishers contains a very small number of objects. These are objects that show signs of use over almost the entire surface of the bone. Maintain great length.

Spatulas are a very well preserved category. They are usually made from the ribs of large animals. The first type is the "simple" spatula; the body of this type of tool is simple, usually made from halved ribs. The second type of spatula is the one with a distinct distal part - the handle. The third type is the "decorated" spatula, with notches on the handle.

Axes are included in the category of edged tools. Only large animals are included in this category. Most are made from deer antlers. They are very well preserved objects found in parallel at many sites in Europe, the Balkans and Greece of the same period.

Edged tools are found in all sections of the Kleitos I and II excavations. A very small number are found in the deposits outside the settlements.

7.2.3 Rings

The use of this category of objects is controversial. On the one hand, the literature refers to them as ornament (Υφαντίδης 2006), and on the other hand, they bear a strong resemblance to the thumb rings of the Florina area (Arabatzis 2019,2024). Perhaps its use as a protector during a task such as hunting is more likely, as the hole is large enough to be used as a ring. If we assume that it was used as jewellery, it is more likely to be used as a necklace. The rings in the Kleitos bone assemblage, as summarised in the table 34, represent 1,0% (13 objects) of the total material. 8 of them are slightly or not at all corroded, 2 are highly corroded and 3 are moderately corroded (table 39). Two are intact, 3 are almost intact and 9 are fragmentary.

As shown in the table, 12 tools came from cattle size animals and 1 from sheep/goat size animal (table 40) (fig.7.40). As far as family 2 is concerned, these are unidentified animals, 8 are red-fallow deer, 2 are cattle, and 1 deer (table 41). They have managed to gain recognition 1 femur, 9 antlers and 3 long bones (table 42). The cross sections observed in all objects are circular. The total length of the rings ranges from 1 to 4 cm. 11 range from 2 to 4 cm and 2 range from 0 to 2 cm.

So far, archery thumb rings have only been found in the Neolithic settlement of Dispilio (Υφαντίδης 2006, 2018) and in Anarghiri IXb (Arabatzis 2019). It seems that it's a local tradition that appears in northwestern Greece in the Late Neolithic and continued in the Final Neolithic. The assemblages of these sites are unique in the area, and they are the oldest manifestations of the use of antler thumb ring archery in the Neolithic Balkans.

The thumb rings were probably formed on beam and tine segments and on long bones. First the desired part was sawn out. Then one of the sides was ground. The final shape of the ring, together with the shape of the hole, was the result of many techniques such as sawing, bow drilling, grinding and polishing. In some cases, the spongy tissue of the antler is still visible beneath the polishing marks.

At Kleitos the bone rings have a large diameter hole and therefore could not be included in the category of ornament without implying that it was not a clothing accessory (draw 7.3a). It has been suggested, however, that they were archery rings. Their rather large inner diameter suggests that most of them were placed on the thumb. Similar morphological thumb rings are known from later periods, known as 'archer's thumb rings' (Payne-Galloway 1995 [1903]). They are made of many different materials (including antler) and are used in archery both to stabilize the arrow for a better shot and to protect the thumb. In some cases, a piece of leather is added between the finger and the ring to improve protection (Dias-Meirinho 2011).

The ring could be used in two ways. The traces of use show that in most cases the ring was indeed used on both sides, with the end facing inwards or outwards. Some traces, such as colour changes in a particular shape, can also confirm the additional use of a piece of leather and/or thread. What both the literature and the many contemporary archers and makers of such rings emphasise as their main characteristic is that these objects work more efficiently (in terms of achieving a good shot and protecting the wearer) when they are made specifically for the particular user/archer; when they are therefore completely 'personal' objects, directly linked to specific bodies/persons (Υφαντίδης 2018:136-137).

All rings found in the deposits of Kleitos I and specifically in trenches IB10, IE4, IE6, IE7, IE9, IE11, IZ6, IZ7, IZ10, IΣT7, IΣT9 (table 44, 45).

7.2.4 Sleeve

The sleeves in the Kleitos bone assemblage, as summarised in the tabl 34, represent 2,6% (35 objects) of the total material. Of these, 14 are slightly or not at all corroded, 11 are heavily corroded and 8 are moderately corroded (table 39). In general, they belong to the category of relatively well-preserved tools. 18 are intact, 8 are almost intact and 9 are fragmentary (table 37).

As shown in the table 41, 33 tools were from deers. As far as family 3 is concerned, these are unidentified animals, 13 are red-fallow deer, 11 are red deer, 9 deer. All use as raw material antlers (table 42). The cross sections observed in all objects are circular. The total length of the sleeves ranges from 1 to more than 15 cm. 5 are longer than 15 cm, 10 are from 10 – 15 cm, 5 from 8 – 10 cm, 5 from 6 to 8 cm, 6 from 4 to 6 cm., 4 from 2 to 4 cm.

All manufacturing techniques were used to produce the sleeves (table 43). These are tools moulded on segments or tines, that were intermediate parts of composite tools consisting of three parts: the stone tool, the antler part and the wooden handle. The antler parts were used as the stone tool sockets of composite axes or adzes to absorb the shock of shock during use and to prevent the wooden handle from breaking (Winiger 1981). Their main characteristic is the presence of a socket that was used for the insertion of a stone tool and also the existence (or the absence) of a shaft hole for the wooden handle. The majority of intermediate tools were formed on segments and tines but the most well preserved tools were formed on basal part.

According to the Agioi Anarghiri typology there are 4 types of sleeves (Arabatzis 2019). In the bone assemblage of Kleitos we recognise 3 types. The first one is the sleeve on the basal part with a shaft hole. The tools of this type were formed on basal parts of the antler and they have a shaft hole for the insertion of the wooden handle and a socket for the insertion of a stone tool (fig.7.41a, c). All of them were made on basal parts of red - fallow deer antlers. It seems that the small basal part of the deer antler wasn't considered strong and compact enough by the manufacturers for their needs and wasn't used at all in this kind of tools. There also seems to be a clear diachronic preference for shed antlers, as only three sleeves were formed on unshed antlers. This choice could have been based on symbolic reasons that are unknown to us today, as well as practical reasons (Arabatzis 2019:72). The large number of shed antlers shows that the inhabitants of the settlement were aware of antler casting and could collect them without having to wait for a successful deer hunt to obtain the raw material. This is true for all the sites we are investigating and for the Neolithic period in general.

The production sequence of these tools consists of the following steps: first the raw material is procured, then the first or the first two tines are removed from the antler, then the basal part of the antler is continuously separated from the rest of the antler by percussion to the desired length of the tool, and finally the optional removal of the crown and the forming of the shaft hole and the socket. The socket hole on the proximal part of the tool was formed mainly by percussion and hollowing. The percussion technique was used to separate the basal part from the rest of the antler. It was usually used in the area where the socket was formed.

The use of sawing to separate the basal part and to form the percussion is rarely attested. The final shape of the socket was achieved by hollowing. They removed the inner spongy tissue of the antler with a stone tool, probably a borer or a blade and a chisel, and could shape the size and shape of the socket to suit their needs. In some cases, the outer surface of the socket was levelled by grinding. The tine hole was formed in an anterior-posterior direction either between the first tine and the second tine, or at the base of the first tine, or at the base of the second tine, or beyond the second tine. The shaft hole is round or usually oval in cross section. The tine hole was made using three techniques: hammering, drilling and boring, which were mainly used in combination. The manufacturer then had two choices: either to form the shaft hole before forming the socket or after forming the socket. The semi-finished products of Kleitos have shown that manufacturers prefer to form the shaft hole first and then form the socket. This is confirmed by Arabatzi's study of the material of the Agioi Anarghiri, which suggests a common choice. Perhaps this choice for the position of the shaft hole is related to practical reasons that be important during the use of the tool, such as the transmission of the energy of the impact, the absorption of the of the impact or damage to the tool.

The second type of tool found in Kleitos assemblages is the perforated sleeves. These sleeves are formed on tines that were cut off by percussion and sometimes sawing, and later the proximal part of the antler was hollowed out to form the socket into which a ground stone tool was inserted (fig.7.41b, draw 7.3b). In a few cases, the percussion marks from the removal process were smoothed by grinding, perhaps for a better aesthetic result. The difference between the previous categories of sockets and this one is the absence of a shaft hole or hafting socket. The tool was inserted perpendicularly to the longitudinal axis of the wooden handle, with the distal part of the tine located in the back of the wooden handle. The stone tool was placed inside the socket, also vertical to the longitudinal axis of the wooden handle and was used as an axe.

This type of sleeves has also been attested in other lakeside settlements in France and in Switzerland. In France, its use is rather rare with a few items coming from the Middle Neolithic phase of the Clairvaux VII settlement (Maigrot 2005). On the contrary, in Switzerland the Middle Neolithic, and more particularly the Cortaillod and Pfyn Cultures, are characterized by the presences of perforating sleeves (Maytain 2010, Billamboz 1982; Suter 1981, 2000; Gross et al. 1987; Wey 2001). So far the quantity of the perforating sleeves found in Neolithic settlements in Greece and in the rest of the Balkans is very small as this tool type has been found only in Dimini in Thessaly (Moundrea Agrafioti 1987:252, Fig.3.5) and in Divostin in Serbia (Lyneis 1988, Pl.IV.d,e) and in Agioi Anarghiri in Florina (Arabatzis

2019). However, this type is also observed in Dispilio of Kastoria (Explo ERC project) and in the sites of this thesis. From the published material it seems that this type is not very common in Thessaly. But with the new research, it seems to be found in large quantities in Macedonia.

The third are the socheted sleeves. They are formed on beam segments and tines. They are usually opened from one part to the other to attach the stone tool directly to the wooden handle. This is the most common type (fig.7.41e). The manufacturer would cut across the desired section of the tine and then rotate to remove the spongy tissue. He would then either grind the outer surface or leave it rough. These tools do not usually retain much length. It is one of the tools we find in all the sites we look at. This category of sleeves is very well documented in many (lake-dwelling) Neolithic settlements of the 5th and 4th millennia BC in Central Europe. In Switzerland it appears for in the last quarter of the 5th millennium BC in the settlement of Egolzwil 3 (Wyss 1994) and its use continued until the end of the 4th millennium BC in the area of Zurich and Lake Twann (Schibler 1987; Gross-Klee and Schibler 1995:163; Zimmerman 2016) and until the early centuries of the 3rd millennium BC in the area of Lakes Neuchâtel, Bienne and Morat (Region de trois lacs) (Gross-Klee and Schibler 1995:163; Suter 1981, Maytain 2010;). In France, these tools appear around Clairvaux almost in the middle of the 4th mill. BC (Pétrequin 2005; Maigrot 2011) and they are also attested in phases 1-4 of the settlement of Chalain 4, dated to the beginning of the 3rd millennium BC (Maigrot 2003) and in Chalain 3 (Voruz 1997). It is the most common type in the sites we studied and in Macedonia in general.

All types of sleeves are well known from the lake dwellings of Central Europe of the 4th and 3rd millennia BC, and their detailed study over the last 50 years has led to the creation of either simple or very detailed and extensive typologies (Maigrot 2005; Billamboz 1977; Billamboz and Schlichtherle 1982; Suter 1981; Schibler 1987; Voruz 1997; Winiger 1985). The presence of this type of tool in Neolithic settlements in Greece is not so frequent.

In Northern Greece, sleeves have been attested in the Neolithic settlement of Stavroupoli (Χατζούδη 2002:616), in Makrigialos (Tsoraki 2008), in Dikili Tash (Séfériadès 1992, Pl. 141, Pl.195a,b) and in Sitagroi (Elster 2001,365). Similar tools have been reported from the lakeside settlement of Dispilio in lake Orestias (Explo ERC project). In Thessaly, sleeves have been found in the Late Neolithic layers of Dimini (Stratouli 1998, Moundrea-Agrafioti 1981) in the Late Neolithic and Chalcolithic layers of Pefkakia –Magula (Stratouli 1998), in the Chalcolithic phase of Pyrgos (Stratouli 1998) in Argissa (Hanschman and Milojcic 1976) in Pyrassos (Weisshaar 1978) and in the Neolithic levels of the Theopetra Cave (Στρατούλη 2000,326, Fig. 19:1-4).

In Central Greece, antler sleeves have been reported from the Late Neolithic layers in settlement in the Cave of Skotini Tharrounion on the island of Evia. In Southern Greece, a few tools have also been attested in the Neolithic habitation layers of Franchthi Cave (Stroulia 2003). In the islands of the Aegean Sea there have been found in the Late Neolithic settlement in the island of Aghios Petros (Moundrea-Agrafioti 1987), in the settlement of Uğurlu in the island of Gökçeada (Turkey) (Paul 2016; Paul and Erdoğu 2017), in the Late Neolithic layers of the settlement in the Cave of Skotini Tharounion in the island of Euboea (Στρατούλη 1993) and in the Cave of Aghios Georghios in the island of Rhodes (Στρατούλη 1987,509-511,Fig.107-108). In the rest of the Balkans the situation is almost the same. So far only a few settlements there have found antler sleeves and in most of the cases their number is relatively small and doesn't exceed the 5-10 artefacts per settlement. In Serbia, a few antler sleeves have been found in Divostin in Serbia (Lyneis 1988; Vitezović 2011, 2013, 2017), and in Ušće Kameničkog Potoka (Vitezović 2014:128,Fig.12) while in the Republic of Northern Macedonia similar tools have been found in the Late Neolithic layers of settlement Mogila in Senokos (Temelkoski and Mitkoski 2006; Mitkoski 2017,125) and in the settlement Trestena Stena (Mitkoski 2011). Antler sleeves have been also reported from various Neolithic and Early Neolithic settlements in Romania (Beldiman et al. 2012).

In Kleitos I we found 25 sleeves and in Kleitos II 9. Speciffically in trenches Θ17, I16, I17, IA15, IA16, IA17, IΓ7, IΓ8, IΓ10, IΔ4, IΔ5, IΔ6, IΔ7, IΔ8, IΔ9, IΔ10, IΔ14, H16, IE7, IE13, IZ6, IZ7, IΣT7, Θ12 (table 44, 45).

7.2.5 Unidentified objects with a hole (Part)

There is a category of objects that we do not know exactly what their use is. Their use is controversial, but there seems to be a pattern to their construction. This category is found throughout the Balkan region. In the wider region of Albania, it is referred to as ornament. However, we cannot exclude the possibility that they are objects that were "part" of a larger object. They are objects of circular shape with a hole in the center. Any bone, long bones of cattle size animals, antlers, and even turtle boils are used as raw material (fig.7.42, draw 7.3c, d).

The experimental study carried out for the production of the hooks showed a way in which these objects could be used. It was used as a hand protection during the use of a drill to form the hooks (Στρατούλη, Γ. 2008:19). However, this is a category of tools whose use we could not be sure of. In most cases, the outer surface around the perimeter of the bone was left rough; in a few cases, it was treated with abrasion. We can therefore assume that these tools had more than one use.

These objects in the Kleitos bone assemblage, as summarised in the table 34, represent 2,7% (36 objects) of the total material. Most of them (28) are slightly or not at all corroded, 5 are highly corroded and 2 are moderately corroded (table 39). The specific object is also specific in terms of processing. It is usually a piece of bone, either left rough or smoothed at the corners. They all have a hole in the centre, and apart from the fresh fractures caused by taphonomy, they are mostly intact.

All but one of the bones from sheep/goat sized animals are from cattle sized animals. The family of the animal could only be identified in a few objects. Thirteen could not be identified, 1 was from a wild animal, 1 from a human skull, 4 from a red deer, 1 sheep/goat, 16 cattle. Specifically, 3 radius (unidentified family και cattle), 1 human skull, 7 cattle femurs, 4 antlers, 17 long bones (11 unidentified family and 6 cattle), 4 humerus (1 wild animal, 1 sheep/goat, 2 cattle) (table 40,41,42).

The length of these tools varies from 2 to over 8m, but there is a standardisation in type. There are two types of such tools. The first is more carefully worked, with the rough surfaces abraded by abrasion; the craftsman would take a piece of bone, either by percussion or by cutting along the longitudinal axis, and then work around the periphery of the bone surface. We do not know whether the hole was made gradually, as mentioned above, or whether the design of the tool required a hole to be made from the outset. The second type was treated similarly to the first, but its sides were not smoothed (fig.7.42). However, it was observed in all objects that the hole was only made by rotation. Perhaps this confirms the use suggested by Statouli at Dispilio.

It may be a single object that is part of a larger tool, as mentioned above. It could have been a hunting accessory, it could have been tied to the ends of ropes and thrown out to bind the legs of animals, or it could have been a weight for nets; all these hypotheses are possible, but from the traces of use we do not know for sure the use of these tools. The fact that a human skull was found may indeed suggest that these were objects of some ritual value. However, we cannot say for sure because the skull was also found in the trench of the NN, has not been found in a context that would indicate its use as a ritual.

All objects found in the deposits of Kleitos I and specifically in trenches IB9, IΔ6, IΔ8, IΔ9, IΔ10, IΔ11, IE6, IE7, IE9, IE12, IZ5, IZ6, IZ7, IZ10, IΣT6, IΣT7, IΣT8, IΣT12, IΣT13 (table 44, 45).

7.2.6 Cousoir

There are two unique tools in Kleitos; one in Kleitos I in trench IE6 and the other in trench IA12 in the square outside the LN ditch (table 44, 45) (fig.7.43, draw 7.4 a,b). The one is slightly corroded, and the other is moderately corroded (table 39). Both are intact. Both are

teeth, specifically canine from bears. Their cross section is elliptical, and both show signs of abrasion. One reaches 9 cm and the other 7 cm. One of them has a hole in it.

It is a type of tool that is very early in the excavations and has been a mystery to researchers as to its use. It was first discovered in 1907 by A. Favraud in the deposits of the Pont-Neuf cave in France (Favraud, 1907, p. 420, Fig. 183). It was a lion canine. The term "cousoir" was later used for the treated canines of large carnivores; its use was essentially identified with compressors for piercing and sewing leather.

Similar objects have been found in several European excavations. In the Vogelherd excavation, G. Riek found a bear canine tooth with fine parallel ridges on its root, without commenting on its use. In 1956, Canon P. Mouton published four canines from the Les Rois excavation that corresponded to a defined type of tool and were not improvised. They were extremely durable tools that could have been used for sewing (Mouton, 1956, p. 757). In 1995, D. Buisson found two canines with possible traces of use in the Ferrassie collections. They are referred to in the literature under many different names, such as "cousoir" (Mouton, 1956), "billot", "poussoir", "compressors", "touchers", "retouchoir".

No parallel examples have been found in the Balkans, nor in Macedonia. They are not heavily worked objects; one of the two at Kleitos has a hole made by rotation, the hole has a very strong polish, indicating that it was in contact with organic material, perhaps leather or vegetable fibre.

7.2.7 Comb

There are two tools in Kleitos referring to combs; one in Kleitos II in trench IΓ6 and the other in trench IA12 in the square outside the LN ditch (table 44, 45). Both are slightly corroded (table 39) (fig.7.44). One is almost intact, and the other is a fragment although both save part of the active end, part of the shaft and part of the proximal part. Large animal bones were used in both, the family was only identifiable in one and that was cattle. One is a long bone, and the other is a scapula. One shows traces of longitudinal cutting and abrasion, the other traces of transverse cutting and abrasion (table 43). One reaches 11 cm and the other 12,4 cm.

The combs are two unique objects with no similarity in typology. One looks like a modern "fork" and the other is more like a ceramic decoration tool (fig.7.44a, draw 7.4 c). The long bone ('fork') has been cut lengthwise and worked by abrasion. Notches resembling teeth have been made along its length (3), the length is quite long, although they have not survived intact and do not exceed 2 cm. The other comb has a completely different shape. It is made from a scapula, cut across the pineal gland, and polished all over; it has teeth only on one long side, which do not exceed a few millimetres (fig.7.44b, draw 7.4d).

A comb was also found at Kleitos, which was not included in the material because it is Bronze Age or later. It is more suggestive of Bronze Age combs.

7.2.8 Flute

There are two tools in Kleitos referring to flute (fig.7.45); one in Kleitos I in trench I16 and the other in Kleitos II in trench IΓ8 (table 44, 45). One is slightly corroded and the other is moderately corroded (table 39). One is almost intact and the other is a fragment, saving only part of the middle of the tool (table 37,38). Large animal bones and sheep/goat size animal were used, the family was only identifiable in one and that was pig (table 40,41). One is a tibia and the other is a humerus (table 42). One shows traces of abrasion, and the other traces of transverse cutting and abrasion. One reaches 5,8 cm and the other 6 cm.

Both objects have a hole in them. One has a through hole from one end of the bone to the other. The second has two holes at different points on either side of the bone. Unfortunately, the centre of the tool is preserved, and we do not have an image of the complete object; all the holes have been made by rotation. In both cases the marrow tissue has disappeared.

7.2.9 Unidentified objects

A very large percentage of the material is classified as unidentified tools/objects (fragments of worked bones with traces of use). They account for 11,5% of the material (table 34). Most of the corrosion is minor (80 tools), medium (36 tools) and severe (6 tools) (table 39). Most of these are from cattle size animals (102), 35 from sheep/goat 7 from small animals and 11 from unidentified animals (table 40). The following animal families could be identified: carnivore (1), cattle (7), deer (11), red/fallow deer (31), sheep/goat (19), pig (11), canine (1) and unidentified (62) (table 41). Long bones identified tibia (10), ulna (2), femur (3), humerus (2), radius (3), MP (1), mandible (1), tooth (9), rib (13), metacarpal (2), metatarsal (3), antler (54), unidentified (4) and long bone/unidentified (47) (table 42).

There are 17 tools that are intact, 12 that are almost intact and 126 that are fragments (table 37). Twelve retain only the active edge, 27 the active edge and part of the diaphysis, 54 parts of the diaphysis, 10 the active limb, part of the diaphysis and part of the distal, 18 part of the diaphysis and part of the distal and finally 17 only part of the distal (table 38). All manufacturing techniques were used in this category of tools (table 43).

The assemblage includes some antler artefacts that can't be clearly assigned to any of the above categories, or any other. Their state of preservation and manufacture does not allow for any definite conclusions to be drawn, so we can only speculate about their possible use. These are similar tine points with flattened bases. All these points have been extracted from

the rest of the tine by percussion and/or sawing, and their base has been flattened by grinding (fig.7.46). The length is quite similar to all these objects, ranging from 2 to 8 cm, and the diameter of the base from 1 to 3 cm. As no other objects were found from this part of the tine, we can't be sure if these objects were used as they were found or if they are semi-finished ornaments like the pendants made from tine tips in the Swiss lake dwellings of Arbon Bleiche 3, Twann and Sutz-Lattrigen (Deschler-Erb et al.2002; Suter 1981; Hafner and Suter 2000). In Greece, similar objects have been found throughout the Neolithic site of Agioi Anargyroi (Arabatzis 2019:195).

Similar objects have been found, also made from deer antlers. There are also similar tine points with bases in the form of small points. All of these points were extracted from the rest of the tine by percussion and/or sawing, and their bases were worked by grooving in all directions around the diameter of the bone. This created an uneven surface with points. We have no parallel in the published material from Macedonia. However, one hypothesis is that it may have served as a stamp for pottery decoration.

A small bone fragment with clear traces of decoration was found; we cannot identify the individual characteristics of the raw material. Draw parallel lines equidistant from each other. The grooves it bears are reminiscent of the grooves on the handles of Bronze Age goat and sheep metapods at Kleitos, studied by Stathopoulou. In these objects it is reported that there is a tendency to make the decorations near the distal end, and in only one object does the decoration cover a very large part of the diaphysis (Stathopoulou 2015: 37-38). However, the fragment in our hands cannot be identified with certainty with this particular type of tool.

At Kleitos I, 134 unidentified objects were found and 9 at Kleitos II, 11 objects were found outside the settlement and only 1 was recovered. As shown in the table, unidentified bone objects were found in almost all sections of the excavation (table 44, 45).

7.2.10 Waste and semi – finished objects

The number of waste items collected is high, as the 60 items represent 4.4% of the total assemblage studied (table 34) (fig.7.47 a, b, c, d, e, f, g, h). This situation is not unique, as the same one can be attested in other prehistoric settlements in Central Europe, where the quantity of waste material is very high and sometimes of waste material is very high and sometimes exceeds the number of finished items (Deschler-Erb et al. 2002; Kotai 2010; Maigrot 2003; Suter 1981, 2000; Voruz 1997).

This category includes items that cannot be transformed into finished products, either because they were rejected during the manufacturing process or because they are fragments of tools that cannot be repaired or recycled. This view, of course, reflects our own current

views and not those of the prehistoric inhabitants of the settlement, who could have used this material for any other task or for the creation of other artefacts (Arabatzis 2019:204).

Most of the waste was found within the settlement, indicating that at least the majority of bone tool processing took place within the settlement. It also suggests that this waste was not completely disposed of by the producer or owner of the raw material in landfills or other areas outside the settlement. This hypothesis is supported by the high presence of raw materials within the settlement. It is worth mentioning here that, based on the zooarchaeological remains from all the sites of LN and FN, but also on the data we have from the sites where the bone tools are found, their processing probably starts with the slaughter of the animal.

For a researcher, the presence of waste and half-finished objects is very important: it allows us to reconstruct the chain of operations and to talk about the processing of bone tools in a much better way. It is easier to know if a technique has been chosen and if it can be modified within the different periods of the Neolithic. Compared to the other sites in this thesis, Kleitos has a good amount of waste and unfinished items. The corrosion of these objects follows the same pattern as the others. Most are lightly and moderately corroded, while fewer are severely corroded. Most of the bones were from cattle-sized animals (34), with only 5 from sheep/goats and 1 unidentified. the animal families that could be identified were as follows 3 unidentified, 7 red - fallow deer, 19 red deer, 1 red deer, 1 roe deer, 2 sheep/goat, 1 sheep, 10 cattle, 17 deer. Only one bone was unidentified, while the rest could be identified. One ulna, one rib, 42 antlers, 6 long bones, 3 metacarpals, 3 metatarsals, 1 metapodal, 1 tibia and 1 humerus. The largest percentage is covered by the antlers. This is observed at all sites where there is an abundance of antler tools, such as in Central Europe, in Greece at Aghios Anargyros and Dispilio; where there is a greater abundance of bone tools rather than antlers, the waste is more difficult to identify. 50 wastes were found in Kleitos I, 3 in Kleitos II and 7 in deposits outside the settlement. Specifically in trenches IE6, IE9, H13, Θ12, IA11, IA12, IA13, IA15, IA16, IB8, IΓ12, IΓ5, IΓ9, IΔ4, IΔ5, IΔ6, IΔ7, IΔ8, IΔ9, IE12, IE7, IZ10, IZ6, IZ7, IZ9, IΣT6, IΣT8 (table 44, 45).

As we can see in the images, the waste has both transverse and longitudinal fractures. In the case of the antlers, we can reconstruct the entire chain operation. In the case of the sheep/goat metatarsals, the technique of first abrading and then cutting longitudinally seems to have been used. On the other hand, the bones of large animals seem to have been cut transversely or percussion was used.

7.2.11 Ornaments

The bone ornaments from Kleitos are being studied by A. Chondrogianni. However, some objects embedded in the bone tools could belong to the ornaments. Two of the categories have been analysed above (Cousoir, part). These two categories could also have been used as ornaments. A single antler artefact was found at Kleitos, which is mentioned in the literature as ornament in a second use (table 35) (fig.7.48).

The first use of this type seems to have been in harpoons. The main characteristic of this type is that the distal part of the tine is decorated with alternating parts of notches and protrusions with round cross sections. The once rounded or pointed tip of the tine has been levelled to become a flat surface with a round cross section. It seems that when the active end of the harpoon head became blunt, its user decided to recycle the raw material and turn the harpoon head into an ornament. The line hole of the harpoon head was used as a peg hole for the ornament, the blunt tip was transformed into a flat distal part and the once curled part of the prong behind the tip became the base for the gradual transformation of the harpoon head into an ornament with notches and protrusions (Arabatzis 2019:190).

7.3 Temporal and spatial distribution of the bone implements of Kleitos

At Kleitos I, the remains of 10 buildings have been uncovered (Ζιώτα 2014α) (see Map 9). The buildings were named: building A, B, Γ, Δ, E, Z, H, Θ, I, ΣΤ. Of the ten buildings of Kleitos I, the remains of three are very fragmentary, making it impossible to identify the bone tools in them and to draw any substantial conclusions. These are buildings B (near the centre of the settlement), Z (in the middle of the southern boundary of the settlement) and I (on the north-western edge of the site) (Χονδρού 2018).

Building A

Building A had a total of 3 construction phases. The remains of the later phase are very close to the plough and some within the disturbed surface layer. The floor of the later phase was formed from the remains of the earlier phase, incorporated into a solid layer of pieces of dried clay, parts of clay structures, pottery and artifacts. Lower down, at the level of the earliest phase, there was an ordinary thin burnt layer, and when the remains of the house first appeared, just below the surface disturbed layer, a section of floorboards covered with clay flooring survived. If this is not a floor, it represents a third Late Roman phase, destroyed by cultivation (Ζιώτα 2013, 2014α).

A total of 32 bone tools were found in building A (see Map 11). This is quite a large number within a single building. There were awls, parts, unidentified bone tools, chisels, spatulas, sleeves, axes and waste. 7 of these were found near or on top of a clay structure based on the excavators. The fact that we have waste within the houses, as we will see below, suggests that the production of bone tools may have taken place within the houses, perhaps at the time of food preparation.

Building B

Building B is quite heavily excavated and there are several signs of heavy disturbance. These disturbances include late Roman burials, work to install a ΔΕΗ pylon, and many animal holes. Possible levelling and landscaping work following the destruction and abandonment of the building may also have contributed to the severe deterioration of the remains. In fact, the excavated picture consists more of spaces of damaged building material than of single extended layers. The existence of two phases of the house has been established, the earlier of which has been disturbed by a later pit. Due to the very fragmentary nature of the building, it is not possible to speak of a distribution of finds across the site (Ζιώτα 2014α, Χονδρού 2019). However, a total of 17 bone tools were found in the blocks thought to contain the

house (see Map 11). Awls, pointed tools, spatulas, unidentified bone tools, chisels and a sleeve were found.

Building Z (G)

Building Z is in a fragmentary state of preservation, which is clearly reflected in the sporadic distribution of its building material. The distribution of the bone tools as all the other artifacts inside the building is uncertain. For the sake of accuracy, we cannot define any tool contained within the possible walls of the building. This is largely due to the fact that the coordinates of many of them were not recorded during the excavation of section IZ9, where the house is located. No precise coordinates could be obtained for the tools found in units where more or less of the building material was broken. As can be seen from the statistics in general, section IZ9, which includes building Z, has a very small number of bone tools (see Map 11).

Building I (J)

Building I is located very close to the area occupied by a much later stone-built building (see Map 12). It survives not only in fragments, but in the smallest area of all the other buildings. The presence of pieces of building material adhering to the surfaces of the objects or traces of burning are indications in this direction, but not definite evidence (Χονδρού 2019). Within the sections defined as buildings only 3 tools were found, 2 awls and an unidentified bone tool, all three of which have a large amount of sediment and are preserved in fragments.

Building Γ(C)

Building C consists of two successive construction phases, the oldest of which survives in a limited area. Numerous later pits were excavated over the structural elements of the building, disturbing them (see Map 12). Nevertheless, the internal earthen structures, especially of the later phase in the northern part of the building, are in very good condition and most of them are in situ (Χονδρού 2019). The walls were founded on ditches which are indistinguishable and can be traced and identified by the rubbled clay, but no postholes are visible within them; the surfaces of the walls and floors were frequently renewed and had overlapping layers of clay. Building C has been described as having storage compartments, a hearth and a fragmentary surviving circular thermal structure on a substrate of clay and pebbles concentrated in the northern part of the building (Ζιώτα 2013).

A total of 16 bone tools were found in and around Building C. In this building the tools, although fewer in number, are more varied. Awls, rings, sleeves, chisels, polishers and sharp unidentified tools were found. Inside the building, several structures have been

preserved in good condition and the bones have been found near or on them, making it relatively certain that the tools are part of the household equipment.

Building Δ (D)

Building Δ had at least two building phases. Its remains appear very high up in the arable layer and the upper part has been destroyed (Ζιώτα 2014α). However, the perimeter of the house can be defined with relative certainty (see Map 12). It was in and around Building D that the most bone tools were found in a single house. A total of 37 bone tools were found, including awls, parts, chisels, antler rings, waste, spatulas, pointed tools and unidentified bone tools. In the vast majority of them, the tools are intact or almost intact. They have very little corrosion and relatively little sediment. The largest quantity of bone tools was found in Building D.

Building E(E)

Building E has no more than three construction phases (see Map 13). Both the first and second phases were pile dwellings that were destroyed by fire. Many pieces of clay, which had been used to clad the frame of the house, preserve the impressions of wooden structural elements; some also preserve grooved decoration with linear patterns. The finds included pottery, stone tools, ornaments, etc. Based on the typology of the pottery, the early phase of carving belongs to the LN (Ζιώτα 2014α, 2014β, 2013). In the thin layer of fill between them, two vessels were found, perhaps the contents of a pit, one anthropomorphic. The remains of the structure were later subjected to several deliberate interventions and disturbances, with the opening of a pit in the eastern part and the construction of two circular thermal structures in the western part (Χονδρού 2019).

A total of 12 tools, awls, axes and sleeves were found in building E. There are some decent tools among them, but most of them are fragments.

Building H(H)

Building H has one construction phase. located at the southern end of the area occupied by the dwellings, may have been made of small trees, as a thick layer of charred wood was found beneath the remains of the superstructure (Ζιώτα 2013, 2014α) (see Map 13). A total of 12 bone tools, awls and a chisel were found in building H. Both intact tools and fragments are preserved. One of these was found with the structure in front of Building H.

Building Θ(I)

Building I is in the immediate vicinity of Building D, but was probably built later, as it appears in a higher layer (see Map 13). It had two construction phases, each of which seems to have been sealed with a layer of solid marl after its completion (Ζιώτα 2014, Χονδρού 2019). A possible hearth and a small pit for fixing the storage vessel were found near the eastern boundary of the house. only two pieces of the vessel remained in situ, and the seeds it contained were collected burnt from inside the pit. as in all the houses of the settlement, the level of use of the earliest phase of construction Θ corresponds to a thin ash-black layer, which may have been created by burnt dissolved clay (Ζιώτα 2014).

In and around Building I, only a total of 8 awls and 1 chisel have been found, which have been preserved in a very good state of preservation, almost intact, intact and with little erosion.

Building ΣΤ(F)

Building F has a fairly well-preserved construction phase (see Map 13). Inside, remains of mud constructions have been found in the northern and western parts, as well as at least 4 vessels in situ (Ζιώτα 2014). Only two tools were found in building F, one awl and an unidentified tool. However, 5 tools, spatulas and awls were found in the excavations outside and around the house.

Kleitos II

The picture of Kleitos II is much less clear. According to pottery estimates, it was inhabited during the LN and FN. Kleitos II has up to three occupation phases in its northern and southern parts. Of the total of four buildings identified, the remains of three show fragmentation and boundary ambiguity, preventing the confident attribution of triple tools within them (see Map 10).

Building 1 – 2

Buildings 1 and 2 have a curvilinear plan with a diameter of 4-6m. Thermal clay structures have been found in both of them. Building 2 shows at least 3 phases of occupation. However, due to later activities (e.g. the opening of a narrow long trench over its eastern part), the excavation picture is not particularly clear. The most recent, which includes a python in a pit in the floor, seems to have been destroyed by fire. Many broken vessels were found among the remains. Fragments of pottery indicate the construction of two-storey dwellings in the LN and/or FN (Ζιώτα 2014α,β).

We can safely place the tools within the buildings of Kleitos II. In buildings 1 and 2, 2 and 6 tools were found respectively. The tools include a flute, awls, chisels, and sleeves.

Building 3

Building 3 is located in the SE corner of the settlement and is rectangular in shape, measuring approximately 5 x 11 m. Building 3 had at least three phases of construction, but the two later phases were preserved in a very limited area, mainly in the centre of the house. In building 3, parts of the building had either been destroyed by cultivation or eroded by the stream to the east of it. concentrations of building clay from the later phase were preserved, and below them a small section of flooring with layers of clay overlaid on shells. a few remains of ash, charcoal, burnt clay, seeds and pieces of clay construction were also preserved.

In the second phase, the outer walls of the building were constructed with wood and mud. Inside, 4 postholes were found, two each on the western and eastern boundaries, and a foundation trench; two walls separated two rooms at the northern and southern ends, providing important evidence of the internal organisation of the house; it has a clay floor. Further north, a well-preserved workbench made of solid clay was uncovered. Its surviving length is 1.30 m, width and height 0.30 m and 0.15 m. To the north of the bench, a broken and burnt half of a large pithos was found. In the north-western part of the house, an elliptical hearth or oven was uncovered, with clay walls and an opening to the east. There were other clay structures in Building 3, but these were not found in situ. The importance of Building 3, apart from the unevenly good preservation of its furnishings, lies in the presence of a large quantity of stored retains (seeds etc) when it was destroyed.

A total of 5 awls and 1 sleeve were found in building 3; they are very well preserved and survive intact or almost intact.

Building 4

Building 4 is the northernmost building of the settlement and is located at its highest point. The remains of the building form a layer with a maximum thickness of 0.50 - 0.60 m and an area of about 90 m², consisting mainly of pieces of burnt structural clay. Many of these retain impressions of wood or reed from the frame of the superstructure, as well as thin overlapping layers of clay from repeated maintenance of the surfaces. No postholes were found around the perimeter, only two inside the house and a narrow foundation trench along the eastern boundary; three shallow pits were found below the level of use, containing pottery, animal bones and clay masses; no structures were found in situ, but only fragments of them survive.

A total of 5 awls, 1 sleeve and 1 axe were found in building 4; they are very well preserved and survive intact or almost intact.

Ditches

Most of the settlement is bounded by a 3-4m wide and 1.5m deep ditch, with two other narrower and shallower ditches to the north, east and south-east (see Map 14). Their stratigraphy and construction features suggest that they were built in sections. To the north-west and east-north-east, the ditches are connected by double enclosures of piled fences; the enclosures were founded on narrow ditches and no clay was used in their construction. In addition to the outer ditches, there is an inner moat that divides the settlement into two unequal parts. Most of the houses are to the west of this internal boundary. The remains of five large houses have been found to the east of the village, structures that may have been used occasionally or seasonally, with only clay floors or clay postholes, and without the usual finds of a domestic settlement.

The excavation of the ditches was neither comprehensive nor uniform. In fact, the excavation data itself makes it rather impossible to speak of uniform ditches surrounding the settlement: in places, long sections of ditch were found that seem to have stopped at certain points without following a truly uniform peripheral course. Their dimensions vary, with some sections being wider and others much narrower (e.g. the outer ditch in section ID 14 as opposed to the double inner ditch in section ID 13, or the sections of the same ditch in sections IB 8 and IB 10, where they vary greatly in width) (Χονδρού 2019:359).

Chondrou reports on the basis of the distribution of the grinded tools that we do not currently have precise information on the length, width and depth of the ditches in each of the excavation units, so a more complex analysis of the density of finds can be made. However, we can mention as a hint that the ditch passes through only one square of section IB6, so the low number of finds could be described as expected, while on the other hand the narrow ditches in the northern part of section IB10 turn out to be much richer than the large (wide and deep) ditch that passes through a large part of section IB8. By examining more extensive parts of the ditch system, in a rough division into northern, western and eastern parts (Fig. 16.A.23), we may get a more representative picture. We do not currently have precise information on the length, width and depth of the ditches in each of the excavation units, so a more complex analysis of the density of finds can be made. However, we can mention as a hint that the ditch passes through only one square of section IB6, so the low number of finds could be described as expected, while on the other hand the narrow ditches in the northern part of section IB10 turn out to be much richer than the large (wide and deep) ditch that

passes through a large part of section IB8. By examining more extensive parts of the ditch system, in a rough division into northern, western and eastern parts, we may get a more representative picture (Χονδρού 2019:359). The same pattern is observed in the distribution of bone tools. For example, in sections IB9 and IB10, in the ditch deposits, bone tools are much more numerous than in section IB8, where no tools were found within the ditch.

A total of 39 bone tools were recovered from all the sections that can be defined with relative certainty as trenches. Awls, chisels, pointed tools, sleeves, handles, parts, unidentified bone tools, waste and polishers were found. Not much waste was found in the units of the trench, suggesting that the waste from the bone tools was not discarded, but perhaps used up, and the very small number of bone tools in the trench suggests that these tools were not frequently discarded. We have the same picture from the site of Paliambela, where no large quantity of tools was found in the ditch of MN.

Most of the tools found in the trench were fragments rather than intact tools. The trench also contained the only human bone from the material we are studying. However, objects such as a flute made from human bone and other artifacts made from human bones were found outside the ditch in Kleitos I. According to the excavator, it is necessary to consider other possible strategies for dealing with human skeletal remains (Ζιώτα 2013:47).

The data does not suggest a pattern in the deposition of tools in the ditch. Equal numbers of different types of tools were found in all sections and units covering the ditch. Mostly fragments were found, making the tools non-functional, but there were also intact tools, so we can't just talk about rejection. One hypothesis could be a structured deposition, but this is not supported by any other evidence.

Pits - constructions (working areas)

Between the houses and around the residential area are developed craft, storage and waste disposal areas. Large storage pots in pits, clay-lined pits and about 30 structures, isolated or in small groups, representing laboratory facilities were found; the smallest of these structures survives outside House A and had a vaulted clay roof and an opening to the south. The settlement also contained basin-shaped structures built of a thick layer of clay with sparse horizontal piles inside, not isolated but in two or three successive groups on the N-S axis. Five sets were found. They were roofed, as evidenced by the impressions of vertical wooden elements on their long sides. U shape structures, circular mud structures and octagonal structures, some of which were thermal, have been preserved (Ζιώτα 2013:43-44).

Tools in pits were found only at Kleitos I and in very small quantities in the pits between the two settlements. A total of 57 tools are associated with pit fills, either around the

perimeter of the settlement next to the ditch, or between the houses, or near the buildings. As there are no exact coordinates on the tools, this picture is an approximation based on the excavation squares, sections and excavation diaries. We distinguish between pits associated with settlement boundaries and pits within the settlement core. The second category includes pits within and contemporary with houses, pits in the open air, while a separate group consists of pits dug on top of older building remains, disturbing them (Χονδρού 2019: 363). There are 37 bone tools associated with the constractions or working areas. They were mainly found in the construction area between buildings D, H, I and F. Some were found in the structure within building F and a small number in structures D and SE of building A (see Map 15).

Very few tools were found in the pits around the periphery of the settlement, only 9 in the pit in the south-western part of the settlement and near the surrounding ditch (IZ 6 x L). The pit was not identified in time and was not excavated as such. It is a shallow pit and therefore quite disturbed. The tools do not seem to have been found at the bottom of the pit, but rather in the upper layers of the pit, which makes us cautious about whether the tools were deliberately discarded or left in the pit. The tools found were mainly awls and a spatula, with the exception of 3 which were fragments, the rest were intact tools.

A total of 34 tools were found in pits associated with houses A, C and I. A pit (ID 9 IV L.1) was found to the north/northeast of Building A and is probably contemporary with its earlier phase. It has rather unclear boundaries and is probably large in area and was excavated in sections. It is over half a metre deep and the fill is rich in traces of burning and dissolved clay, pottery, animal bones and antlers, flaked and grinded tools. A total of 8 bone tools were found from the middle and lower parts of the fill. Pit ΙΣΤ 6 VI L. was not found during the excavation of the block, but is probably a small, relatively shallow pit. Its depth coincides with that of ΙΣΤ 6 XVI Λ.1 (in which no bone tools were found), making it probably contemporary with Building C and perhaps with the earlier phase of Building D, to which it is closest. It is an assemblage of building material with a few sherds and bones. In total about 10 tools were found. In the absence of co-ordinates, we cannot be certain that all the tools in this particular block belong to the pit. The tools were of equal integrity and fragments. A pit (ΙΣΤ 8 VII L) is located near building Θ and is probably contemporary with its earlier phase. It is circular in shape and more than 70 cm deep. Its fill, rich in gritty clay, contained limited quantities of sherds and bones, a clay seal and a broken tool with a blade. A total of 3 bone tools were found in the pit, 2 intact and one fragment.

A total of 26 tools were found in the pits of the open areas of the settlement. On the southern boundary of the settlement is IZ 8 XIII L. 2. It is very shallow (its depth was not recorded, but it was excavated in one pass), but it was excavated in a single unit) and was

probably filled in a single episode. It contained broken building material, a lot of pottery and an intact awl. ID 9 III L.1 has a possible rim and is over half a metre deep. The fill appears fairly homogeneous in composition, but there is an increase in volume and density of finds in the upper layers. The pit contained a total of 9 bone tools, awls, chisels, an axe, unidentified bone tools, mainly fragments. A single intact awl was found in pit IZ 8 XII L.1. The pit has an oval contour and is more than 1 m deep. For this reason, its depth is not absolutely certain, nor is it easy to monitor its stratification. From the available data it seems that there were 3 episodes of filling. The entire lower part of the pit and for a depth of 85-95 cm shows a fill poor in finds, with limited amounts of dissolved building material and little pottery, limited traces of burning, a vessel and a fragment of limestone collected as possible raw material. But even within this fill, the density of finds decreases as we move towards the bottom of the pit, with the last 20cm almost barren. Immediately above this thick layer, another episode of pit filling is identified, with clay masses in an oblique arrangement and strong traces of burning. This is followed by a 20-23 cm layer of undifferentiated fill, covered by a concentration of dissolved building material, which probably sealed the pit. Pit IΔ 10 VII contained 4 tools, 2 intact and 2 fragments, 1 double point, 2 awls and 1 unidentified bone tool. An almost intact awl was found in pit IE8 I. The IΣT 7 XII L.1, had at least two episodes of deposition. One large concentration of finds is associated with the base of the pit and a second with the final fill in its upper part. These two large assemblages are separated by a 42-44 cm thick fill with few finds, mainly shells and bones. The contents of the pit include 7 bone tools such as awls and sleeves, intact and fragmented. IZ 5 VII L. is later than the ditch, having been opened in the same area but at a higher level of the embankment. The finds from the interior present a very interesting picture, with strong features of structured deposition, probably the result of a single episode. 3 bone tools were found, 2 awls and a chisel, 2 of which were intact and 1 of which was a fragment.

The area between the two neighbouring settlements is characterised by an intense presence of pits, individually or in groups. However, only 3 tools were found in pits between Kleitos I and II. In pits Th12II and Th12V. In the first pit an intact pointed tool was found and in the second 2 fragments, 1 of an awl and 1 of an unidentified bone tool.

As mentioned above, 37 tools are associated with the existing structures at Kleitos I. West of building A, in the existing structure in section IΔ8VIII, XIV, 12 bone tools were found. A variety of bone tools were found, such as spatulas, awls, unidentified bone tools, polishers, wastes, and one of the few pottery tools with an edge shaped with small points ('stamp'). There were 14 tools found in the structure SE of building A, including spatulas, awls, unidentified bone tools, waste. An awl was found in the construction inside building F.

A total of 10 tools were found in the structures between buildings A, D, H, I and F, including awls, chisels and unidentified bone tools.

A total of 10 tools, including awls, wastes, unidentified bone tools, chisels and one of the two tools we have defined as 'cousoir', were found in the non-settlement deposits. A total of 9 tools were found on surfaces designated as floors, mostly awls and unidentified.

There are two large bone concentrations in the settlement, which also contain bone tools. One is located in the W boundary outside the wall of building D, where only awls and fragments were found intact. The second concentration is located in section IΓ5XIV near the Neolithic burials, where 19 bone tools were found, including awls, chisels, unidentified bone tools, and pointed tools. A significant concentration of waste was found here, namely 5, perhaps indicating a site for the processing of bone objects.

At Kleitos I there is a concentration of bone tools throughout the western side of the settlement, with the highest concentration on the south-western side (see Map 16). At Kleitos II, on the other hand, the greatest concentration appears to be in the area between the buildings in the center of the settlement (see Map 17). There is a general pattern which shows that the bone tools are concentrated in the areas around the houses and especially to the west of them. This is not surprising as these could be the forecourts of the houses where work was carried out.

In trench IΔ9, where building A is located, and in trench IΔ8, to the west of the building with its many structures, 114 tools were collected. Of these, 12 are waste, while all tool types are included. Many bone tools were also found in IΔ6, 56 in total, where there is part of the ditch and a more recent building of historic date. Based on the typology of the tools, there does not seem to be a strong disturbance and we are talking about Neolithic tools. In IΔ6, as mentioned above, a large concentration of animal bones was found, but without much waste of bone tools. So we can assume that this is a place where bones are processed, but we can't say for sure.

Large quantities of bones were also found in sections IE6 and IE7, a total of 113 bone tools. Building E and its courtyard are located in sections IE7 and IE6. Again, there is no pattern in the tool typology. All tool types were found in these sections.

The next large concentration is found in trenches IΣT6 and IΣT7, where a total of 122 bone tools were found. in trench IΣT7 is building D and to the west of it is trench IΣT6. similar to the other trenches we are examining, almost all tool types were found and there is no pattern.

The next trenches show the highest concentration observed in the settlement. These are trenches IZ6, IZ7 and IZ8. A total of 217 tools recovered from in these sections, which

include Buildings C and H and their western outbuildings. They are located at the extreme SW end of the settlement and again there is no pattern to the tools recovered. Awls, chisels, wands, unidentified tools, axes and harpoons are included in these sections.

Kleitos II shows a greater concentration in the centre of the settlement, where almost half of the tools are concentrated. A total of 43 tools were found in sections I16, I17, IA16 and includedd spatulas, awls, harpoons, polishers and sleeves. The next largest assemblage at Kleitos II is located to the north of the settlement in section H16, where 24 tools were recovered.

For a few categories of tools we can say that there is a pattern in their distribution inside or outside the settlement. For example, awls appear to be evenly distributed throughout the settlement. Clearly, where there is a greater concentration of tools, there is likely to be a greater concentration of awls. For certain tool categories such as axes there may be a pattern emerging, but we cannot be sure. 3 out of 10 axes are found in section IΔ9, but section IΔ9 concentrates a large number of tools anyway, so we cannot be sure that they were found there for any reason. There are 11 arrows in total, and all but two (sections IΣT6 and IZ8) are found in fills outside or very close to, but outside, the settlement. In contrast, the harpoons and fishhooks are found in fills inside the settlement.

In general, the assemblage appears to be concentrated along the western side of Kleitos I and in the centre of the settlement at Kleitos II. The sites where bone tools were found are mainly open or covered open spaces, areas defined as work surfaces and, to a lesser extent, pits and waste areas such as the ditch. Bone tools were found in all of the buildings of Kleitos I and Kleitos II, with the exception of Building Z. These included awls, chisels or sharp tools, spatulas or polishers, waste and unidentified tools. The aforementioned rings, harpoons and arrows seem to be present only in Kleitos I, in the southwest of the settlement, and more specifically in buildings Γ and Δ. Another noteworthy observation is that the processing waste, apart from its presence within the buildings, does not seem to follow any pattern so we can conclude with some reservation that each group living within the settlement made its own tools.

Chapter 8 - Results, conclusions and future research

8.1 Results of the four Neolithic sites Revenia Korinos, Paliambela Kolindros, Kato Agiannis and Kleitos

The overall findings from the study of the bone-tool assemblage of Revenia Korinos settlement, including ornaments and their distribution at the site, indicate that there were no significant differences between the beginning and the end of the Early Neolithic. None of the tools disappeared, and no new elements were added to the assemblage.

Contrary to the Paliambela bone assemblage, also found in Pieria and dating from the same period, the predominant tool type is the edged tool. This predominance could be attributed to factors such as preference, work intensity, tool durability, lower recycling rates, or more frequent disposal of materials. However, it should be noted that the high fragmentation of the material contributes to an incomplete picture of the assemblage.

Pointed tools in the assemblage primarily originate from long bones (metapodials, tibiae and unidentified long bones) and, to a lesser extent, from ribs. The finest examples come from metatarsals and long bones, demonstrating standardization in shape, size, and technique. Pointed tools constitute 25.3% of the assemblage, with awls representing 18.7% of these. The erosion of these tools is generally low. In contrast to other Neolithic bone industries in Macedonia, edged tools are more prevalent in this assemblage, with spatulas being the most common category (10.2%), followed by chisels. The choice of raw material varies by tool type; spatulas are typically made from ribs, while chisels are predominantly made from long bones and mainly tibiae. The Revenia bone assemblage also includes other tool categories. Notably, by-products are an important component of the assemblage, as they provide valuable insights into the chaîne opératoire, revealing aspects of the production process that are usually concealed.

At Revenia, it appears that bone blanks were obtained either from butchery or from breaking bones to extract marrow, and then processed into tools, a conclusion supported by the zooarchaeological study. During the Early and Middle Neolithic, deliberate fragmentation of animal bones seems to have been a common practice among early farmers, aimed at extracting nutrients, especially during a period when animal husbandry was not intensive and the ratio of farmed animals to humans was low. This widespread fragmentation before final disposal, evident in early pits at Paliambela, Kolindros, and Revenia, is interpreted by scholars as an effort to homogenize the parts of the animal's body from which fat and marrow could be extracted and distributed among those participating in collective consumption. In contrast, data from later Neolithic phases and beyond suggest that the deposition of various animal parts reflects a management strategy designed to highlight diversity and inequalities among participants in such collective activities (Halstead and Isaakidou, 2013).

In general, despite the omnipresence of domesticated species, wild animals, including large ones, are sparsely represented in the osteological assemblages of open Early Neolithic sites in Greece. Although wild animals were available and early farmers were capable of hunting them, as evidenced by data from the preceding Mesolithic period, they are represented by only a few specimens. Conversely, the presence of large wild animals increases in late Neolithic and particularly Bronze Age sites in mainland Greece. The situation for small wild animals is different, as their presence remains relatively stable between the Neolithic and the Bronze Age, despite limitations in data completeness (Halstead and Isaakidou 2013: 135-136). This pattern may reflect early Neolithic negotiations and contrasts related to private versus collective needs, internal versus external concerns, cooked versus raw foods, and domesticated versus wild animals (Hodder 1998: 87-88). Halstead (1999: 84-86) suggests that the rising proportion of wild animals in later Neolithic and Bronze Age zooarchaeological data indicates a shift towards the physical and symbolic isolation of households, where the obligation to share goods was replaced by the right to store them. This trend towards increased hunting in the later Neolithic is also evident in the current study of materials from Revenia, Paliambela, and Kleitos, with Kleitos (LN and FN) showing a particularly high number of wild animals.

Several bones, particularly tibiae and metapodial bones, were observed to be unfused, suggesting they were processed while still young. The selection of metapodial quarters or distal tibiae for tool production indicates a deliberate choice to utilize available raw materials fully or to showcase the craftsman's skill and adherence to traditional methods. It appears that the residents of Revenia made extensive use of their raw materials. Notably, spatulas represent an exception in the material culture. The predominance of spatulas and their meticulous craftsmanship may reflect the specific expertise of Revenia's inhabitants, though this remains a hypothesis.

The spatial distribution of tools appears to be relatively uniform across all pits; however, some pits designated as bone pits, such as Pit 18 (see Map 4), exhibit a higher concentration of bone tools. According to Chapman, the practice of structured foundation deposits in Neolithic settlement areas—such as in pits, under house floors, and within postholes and wall foundation grooves of pegged dwellings—is intended to link the living with the dead. This practice is aimed at ensuring stability and celebrating the inception of a new life cycle in the settlement area (Chapman 2000: 66-69).

The study of bone tools and other materials, particularly pottery, reveals significant similarities between Western and Central Macedonia and Thessaly, evident from the beginning of the Early Neolithic and continuing through the Early and Middle Neolithic

periods. Similar types of bone tools have been identified across Neolithic sites throughout the Balkan region (Russell 1985; 1990), Northern Greece (Christidou 1999), Thessaly (Moundrea 1981), and the Eastern Mediterranean (Russell, 2016). A comparative analysis with northern Thessaly, based on available published data (Moundrea 1981), indicates that similar manufacturing techniques and tool types were used. The bone tools from Thessaly, like those from Revenia and Paliambela, display a simplicity and austerity in design. However, Thessalian tools tend to be preserved in longer lengths, possibly due to more frequent discarding or lower labor intensity. In contrast, the inhabitants of Revenia and Paliambela appear to have maximized the use of their tools through intensive use and reworking.

The study of tools, ornaments, and their spatial distribution at Paliambela Kolindros revealed no significant differences between the various Neolithic periods. None of the tools disappeared, nor were any new elements added. Furthermore, there was no observed difference in preference for bone type or animal family across the periods. While deer are primarily found in the Middle Neolithic (MN) and Late Neolithic (LN), the small sample size precludes firm conclusions.

Nevertheless, there are isolated tool types, such as hooks identified in the EN deposits and a fishbone awl in the MN deposits, which are unique to these periods and represented by single specimens. The rarity of the fishbone awl may result from either a scarcity of suitable raw material or a specific cultural preference of the Neolithic inhabitants. Conversely, the infrequency of hooks cannot be attributed to a lack of raw material, as they are fabricated from long bones, which are consistently available across the assemblage. Bone hooks are prevalent throughout the Neolithic at various sites in Macedonia, the Balkans, and the Eastern Mediterranean. Thus, it is not conclusive to assert that this tool type vanished from Paliambela Kolindros in later Neolithic phases. A plausible explanation for the absence of similar tools could be the inherent fragility of this specific tool type, leading to potential destruction during excavation or prolonged burial.

Pointed tools, such as awls, are the most prevalent tool type found at the site. This prevalence may be attributed to cultural preference, the intensity and nature of the work, the durability of the tools, reduced recycling, or more frequent disposal of the material. Bone pointed tools have been consistently found across all periods and sites of the Neolithic era. These tools are primarily derived from long bones (metapodials, tibiae, splinters, and unidentified long bones), with rib-derived examples being rarer. The best-preserved pointed tools are from long-bone metapodials and splinters, showing a standardization in shape, size, and technique. The predominance of pointed tools at Paliambela Kolindros is not unique; similar tools have been found at most Neolithic sites across the Balkans (Russell 1985 1990),

Northern Greece (Christidou 1999), Thessaly (Moundrea 1981), and the Eastern Mediterranean (Russell 2016). Pointed tools served various functions, including piercing tree bark, working leather, and decorating pottery.

Edged tools constitute the second most common category in the Paliambela material. Among these, bone tools such as scrapers are some of the earliest to appear in Europe, with the earliest examples identified at the Saltzgitter-Lebenstedt site in Germany, where mammoth ribs were modified by percussion and scratching into irregular shapes, possibly for leatherworking (Soressi et al. 2013:14186). At Paliambela, long bones, ribs, and scapulae served as raw materials for tools with cutting edges, such as scrapers. Although several worked scapulae were found, their active edges were not preserved. Generally, scapulae are a less common raw material for bone tool production. Studies from various regions have suggested that scapula tools might have been used as stirrers for food preparation (Russell 1990; Chistidou 1999; Russell 2016). The discovery of shoulder blades within the houses of the MN period at Paliambela Kolindrou supports this hypothesis. Tools with a wide active edge could have had multiple functions, including leather scraping and clay working (e.g., polishers). Like pointed tools, edged tools exhibit minimal variation in shape, size, and processing techniques. However, they do include several types, such as convex, double-edged, and double bevel, likely determined by their intended use.

The combs from the settlement are notably well preserved, exhibiting a range of sizes and shapes. The Neolithic inhabitants evidently devoted considerable effort to the manufacture of these tools, using exclusively ribs from large mammals, either whole or split. A smaller number of tools, such as rings and separators, are also present. Rings were made from long bones, while separators came from ribs. Separators could serve dual purposes as both tools and ornaments. Tools made from deer antlers are few, and their physical structure required minimal processing. Antler handles for stone tools are intricately worked. However, due to the fragility of the raw material, these antler tools lack discernible traces of processing and use.

The ornaments from the site are quite limited in number and lack variety in shapes or decorative elements. They are simple objects, with no greater care in their treatment compared to the tools. Almost all the ornaments have a hole in them. The manufacturing techniques for both tools and ornaments are consistent. Most have been cut lengthwise and transversely, possibly created by either direct and indirect percussion or sawing. Grinding was achieved through abrasion. For those objects with holes, the perforation was typically made by circular motion from one side of the object to the other, likely using a perforating tool, possibly made of bone.

The raw material for producing bone artifacts in the settlement of Paliambela predominantly comes from medium-sized mammals such as goats and sheep, with fewer instances of larger mammals like cattle, pigs, and deer, as well as small animals. It is noteworthy that both tools and ornaments lack teeth as a raw material, despite its use for ornaments in other bone traditions of the same period.

Most of the objects consist of fragments that cannot be easily classified into specific categories or individual types of either tools or ornaments. However, the objects selected and included in the material have been categorized based on their shape (e.g., worked metatarsal and tibial epiphyses) or showed traces of treatment and use (e.g., long bone diaphysis). Additionally, a significant amount of sediment on the surface of the artifacts was observed, complicating the identification of treatment and use traces. Notably, there was no evidence of burning on the bones.

Overall, the study of the assemblage from Paliambela reveals no significant variation in the techniques of crafting and using bone objects over the extended period under consideration. Tools do not disappear, nor do new types or construction techniques emerge. There are no major changes in tool categories, nor are there variations in shape or size over time. Regarding ornaments, while they are present in deposits throughout the Neolithic period, the small number of finds limits the ability to determine the persistence or disappearance of specific types or categories. Consequently, there is a general consistency and standardization in the production of tools throughout the period.

All types of tools, particularly the most prevalent ones, are present in deposits ranging from the Early Neolithic (EN) to the Final Neolithic (FN). The artifacts from the EN and Middle Neolithic (MN) benefit from more extensive study and better stratigraphic consistency, allowing for more confident dating. The primary criterion for dating these objects is the settlement pottery, which aligns with the C14 dating results (Μανιάτης et al. 2011). When comparing the bone material from Paliambela with other bone traditions from the surrounding region, both similarities and differences emerge. Although the bone artifacts from Paliambela have evidently been integral to the daily life of the Neolithic inhabitants, and no tool type has become extinct across the Neolithic periods at this site, the assemblage is characterized by a notable simplicity and austerity in comparison to those from other contemporary settlements. Despite this general trend towards simplicity, certain tools, such as specific scrapers, awls, rings, and edge tools, are prevalent across most Neolithic sites, reflecting their utility in daily tasks. Conversely, tools like combs, hooks, and separators are notably less common and are not found at all Neolithic sites. This variation underscores the

distinctiveness of the Paliambela assemblage within the broader context of Neolithic bone tool traditions.

In an initial comparative analysis with the Northern Thessaly region, based on the published material (Moundrea 1981), it is evident that Paliambela's bone tools exhibit similarities in construction techniques and tool types with those from Thessaly. Both regions demonstrate a notable consistency in the simplicity and austerity of their bone tools, favoring straightforward shapes and functions.

The bone tools from Thessaly are frequently preserved in longer lengths compared to those from Paliambela. This difference in preservation could indicate either a higher rate of discarding tools in Thessaly or a lower intensity of use, leading to longer-lasting artifacts. In contrast, the evidence from Paliambela suggests that inhabitants used their tools more intensively and reworked them extensively, resulting in more fragmentary remains. Moreover, similar to Revenia, Paliambela does not feature decorated bone tools. However, Paliambela exhibits a greater use of scapulae for tool-making, which are notably absent at Revenia. This suggests a regional variation in raw material preferences and potential tool functions. When compared to other Macedonian bone traditions, Paliambela and Thessalian assemblages stand out for their simplicity. In contrast, sites like Dispilio in Kastoria display greater variety and complexity, particularly in terms of decoration, highlighting the diversity in Neolithic bone tool practices across the Macedonian region.

The comparative study reveals that tools from Paliambela Kolindros exhibit a little similarities with those from the southern and central Balkans. Notably, a preserved a hammer from Paliambela resembles tools found in Selevaće, Serbia. This indicates a shared tool tradition across the region. However, bone objects in the Balkans show greater variety in shape and decoration compared to those from Paliambela. In the broader Balkan context, bone tools encompass a wider range of forms, including awls, rounded hooves, needles, and other pointed and edged tools. The use of antlers and teeth as raw materials is more prevalent here than in Macedonia and Thessaly, where bone tools predominantly utilize long bones and ribs. Antlers, either used alone or combined with beams, are particularly common in the Balkans for making digging tools. Ornaments in the Balkan region also display greater material diversity and complexity compared to Paliambela's simpler and less varied assemblage. Overall, these observations underscore the greater diversity and better preservation of bone tools and ornaments in the Balkans compared to the material from Paliambela. This correlation extends to the pottery traditions of the regions, aligning with findings from studies of pottery in Macedonia, Thessaly, and the Balkans (Παπαδάκου 2011; Παπαϊωάννου 2011; Perlès 2001).

The bone assemblages from the Eastern Mediterranean, as discussed by Le Dosseur (2016) and Russell (2016), exhibit similarities to those from Paliambela, Macedonian sites, and the Balkans, particularly in terms of construction techniques. However, these assemblages are notably more diverse and elaborate in terms of form and decoration. In the Eastern Mediterranean, bone tools and ornaments show a richness in variety and complexity. The assemblages from this region include a broader range of forms and more elaborate decorative motifs compared to the relatively simpler and more austere materials found in Paliambela and the surrounding areas. This includes not only functional tools but also a wide array of ornamental items such as rings, pendants, figurines, and intricate motifs that embellish both tools and decorative objects. This contrast highlights a broader spectrum of craftsmanship and aesthetic practices in the Eastern Mediterranean compared to the more utilitarian and less varied bone tools and ornaments found in Paliambela and similar Neolithic sites in Macedonia and the Balkans.

The bone assemblages from Paliambela exhibit notable simplicity in both shape and form, distinguishing them from other contemporaneous bone traditions. This simplicity is particularly evident in the minimalistic approach to ornaments, which are sparse and lack elaborate decoration. Despite these differences, the fundamental manufacturing techniques—percussion, sawing, and abrasion—are consistent across various bone traditions. This indicates a shared technological foundation among different regions, though the specific application and variation of these techniques can differ. The absence of certain technological or morphological elements in Paliambela's assemblage does not necessarily suggest a lack of knowledge but may reflect a deliberate choice or cultural preference. According to Lemonnier (1986), such choices within a "chain" of technological decisions provide insights into the cognitive frameworks of the societies producing these artifacts. These decisions reveal how societies navigate tradition and innovation, reflecting broader processes of change and differentiation. Similarly, Dobres and Hoffmann (1994) emphasize that the study of material culture offers a valuable perspective on human agency, illustrating how material production intersects with abstract concepts, goals, and interests. In summary, while Paliambela's bone tools and ornaments may appear less complex compared to other regions, the consistency in manufacturing techniques and the deliberate nature of material choices provide a rich context for understanding the technological and cultural practices of Neolithic societies.

At this stage, the similarities and differences with other bones (Macedonia, Thessaly, the Balkans and the Eastern Mediterranean) are highlighted. However, we could not attempt to interpret this comparison. Certainly, as social networks expand, human groups interact,

including skills, preferences and habits that relate to different aspects of their identity. This has two important implications. First, traditions of techniques may include elements of multiple origins, some of which may be transmitted between people belonging to the same social group, while others may be borrowed from people belonging to different social groups. Second, all cultural elements may necessarily evolve in the same way (Gosselain 2000: 209).

The bone assemblage at Kato Agiannis is small, rather fragmented and eroded. The general categories found at the site are those present from the Neolithic and continue into the Bronze Age. The most diverse category is that of chisels. However, the single deer antler spoon found at the site indicates the change that occurs in the FN and the transition to Bronze Age tool making. Such tools are not found in the EN, MN and LN deposits, except at some sites such as Dispilio, where the raw material is clay.

In contrast to the other sites in Pieria that we examined (Revenia, Paliambela), Kato Agiannis has more processed deer antlers, which may support the view that hunting is increasing in FN compared to MN. However, this is a hypothesis as the sample of material we are examining is quite small and no zooarchaeological study has been carried out at the site.

Based on the excavators, the original use of the ditch is not for rejection but for fortification. As observed in the Paliambela ditches, few bone tools are found in them, indicating little or no rejection of bone tools. This is reinforced by the animal bones, which are few and in a poor state of preservation (very fragile). There are mainly bones, a few teeth and a few antlers.

The excavation of Kleitos has yielded a very rich assemblage of bone tools. Both the good preservation of the material and the good picture of the excavation allow us to reconstruct the bone tool production and its distribution around the settlements of Kleitos I and II to a very good degree. Although there are several unidentifiable tools, it is possible to distinguish several categories of finds. It is noteworthy that in several categories of findings we can distinguish subcategories such as awls and spatulas. Furthermore, the majority of the material is fragmented, almost as many have survived intact or almost intact.

In terms of raw material, we have a wide variety of domestic and wild animals that is not found in the other sites we study. The largest proportion of bones comes from sheep and goats, followed by cattle and deer and, to a much lesser extent, pigs. In general, pigs are not widely used for tool production. Within each tool category there is a corresponding preference for raw material, e.g. long bones of goats and sheep and larger animals are used for pointed tools, while flat bones are used for sharp tools. This is logical in all the sets we are considering, as the bone itself has a specific physiology that guides the craftsman in how

to work it to achieve a particular result. Long bones are used in the majority of cases, followed by antlers and flat bones. The bone assemblage at Kleitos contains a very large amount of deer antler, preserved in very good condition. In this category, too, much processing waste has been found, which helps to reconstruct the processing process. Even though the wild species are much less numerous than the domesticated ones, there is a great variety. Bears, wild boars, dogs, hares, and carnivores were found in the settlement. This reinforces our data, mentioned in Chapter 5, that we have an increase in hunting in the LN and FN periods compared to earlier periods. Metapodials predominated in the long bones, but the sample is represented by all long bones; in the case of bears, boars and wild animals in general, it seems that teeth were used predominantly. The antlers came from large deer such as red deer, while the majority of deer bones came from smaller deer such as roe deer.

In general, the hunting equipment such as antler (thumb) rings, harpoons, the presence of many antler tools, and the presence of processed teeth of bears and boars give us information about the activities outside the settlement and around the lakes that, according to the excavators, surrounded the area in these prehistoric times (Ζιώτα 2014b: 327). It seems that hunting must have played an important role in the economy of the settlement, as in other Neolithic settlements in the area (Megalo Nisi Galanis: Fowler and Greenfield 2005 Agioi Anarghiroi: Αραμπατζής 2019). As opposed to the EN and MN positions considered in this thesis.

Pointed tools account for the largest percentage of total tools at 53.3%, followed to a much lesser extent by edged tools at 18%. However, in Kleitos there are too many categories such as combs, rings, axes, sleeves (with subcategories), harpoons, arrows, fishhooks etc. In addition, there are several bone tools grouped together without being able to identify their use (antler artefacts, parts). It is important to have processing fragments (wastes) that allow us to understand the processing of certain bones. It appears that large, long bones were cut transversely by percussion and then grooved longitudinally to extract one or two bone pointed tools. The most common bone for pointed tools is the metapodial of sheep and goats, which, unlike other sites, appears to have been first softened by abrasion and then cut longitudinally. At Kleitos, while metapodial quarters are quite common at other sites, they are present, but it was more common for the bone to retain its length. There is no great depletion of these tools as there is at the sites of EN Revenia and Paliambela. The waste also gives us important information about the treatment of the antlers. Both the beam and the tines were used to make bone tools; the beam was used to make tools such as axes, while the tines were used as a binder between the wood and the tool. All possible construction techniques and their combinations have been identified in the material of Kleitos.

The results of the Kleitos excavation and the study of bone assemblage are particularly important because they allow us to address many of the issues that concern Neolithic research. One of these concerns the way in which human activities and community relations are reflected in the landscape and the changes that social space underwent over time. The settlement of Kleitos I is clearly delimited, both artificially and naturally, and is organized along the axis of centre - periphery - boundaries, with stability and differentiation in the use of each section; its area is relatively small and, as regards the organization of the internal space, it seems to combine elements that characterize both mound and flat settlements, without fully corresponding to either model. An important parameter that needs to be clarified is the duration of occupation, and one possibility that cannot be excluded is the destruction of anthropogenic deposits by cultivation, given that the surviving ecostructural remains appear just below the arable layer. However, the tendency to artificially delimit settlements, regardless of their type, is characteristic of the whole of south-eastern Europe during the Late and Final Neolithic, with features as far north as Greece. Examples in northern Greek are the Makrigialos I, Avgi Kastorias sites (Ζιωτα 2014a:51).

The settlement of Kleitos II is much smaller, is more compact in form, with smaller houses, with limited open spaces, with thermal structures and storage vessels in the interior; the settlement is developed vertically, with relative stability in the position of the houses, which have undergone several reconstructions; the settlement area is delimited by the natural stream and separated from the area of development of crops and other non-residential uses.

The data derived from the study of bone tools in terms of distribution are important enough to understand the use of these tools. There is no pattern in terms of distribution, i.e. a large quantity in particular structures or in a particular building. However, there is a greater concentration of tools to the west of the settlement and in the trenches to the west of the houses in potentially open areas. A much smaller quantity of bone tools is found inside the houses, with no absence except in building G. It is assumed that the objects found inside the houses, together with the other finds, constituted the toolbox of the individual household, while those found in common areas were the tools used for tasks in which the whole community participated. Based on the excavator's observations, all evidence suggests that the open-air structures were used for economic practices that affected the whole community rather than individual social units. There is a concentration of structures around the centre of the settlement, but they were not all in use at the same time and their association with specific phases of occupation is being investigated (Ζιώτα 2014b:324). Structures in open spaces are not connected and the frequency of each type exceeds or falls short of the number of houses; it is likely that they were used for productive activities at a collective level, or at least for

activities that were not strictly private in nature, which is implied by their location in areas that were probably communal. Furthermore, there does not appear to have been much tool disposal at the sites, either deliberate or due to cessation or end of use. No abundance of tools was found within the burials or pits.

Finally, it is worth noting that at Kleitos human bones are used, albeit in very small quantities, in the present material, even for objects whose ideological significance we are not sure of. Other possible strategies for dealing with human skeletal remains should probably be considered.

From the study of the assemblages in this thesis and from the literature review carried out as part of this research, it appears that the LN and FN Kleitos seems to 'look' towards the Balkans and Central Europe in a similar way to the other sites studied in the region in terms of typology, distribution and tool use.

8.2 Conclusions

8.2.1 The bone industry of Neolithic Macedonia in the European context

The present analysis provides us with useful information about bone tool and antler industry in the Neolithic period of Northern Greece, concerning the raw material selection, manufacturing processes, and utilization, based on typological classification. Additionally, an attempt was made to investigate the spatial and temporal distribution of bone tools across the sites to correlate these artifacts with social practices related to their production, consumption, and deposition. A statistical analysis compares specific variables derived from the archaeological material.

By studying the bone assemblages from the sites covered in this thesis in relation to other bone traditions in the surrounding area, we can identify both similarities and differences. Neolithic bone tools, while not the most abundant material remains at Neolithic sites, definitely played a significant role in the daily lives of Neolithic people. The fact that they are not the most abundant does not diminish their importance, as they consist of organic material that is more easily transportable than other inorganic materials. It's essential to note that drawing generalized conclusions about distribution or exchange networks, or even traditions, based solely on the study of one material from one site would be inappropriate. However, we can initiate a comparative study using our statistical data.

As previously noted, the study of bone tools has not received the same level of detailed investigation as other archaeological materials, and available information remains limited. Research has increasingly shifted focus from merely cataloging the morphological diversity of tools to understanding the human activities and behaviors associated with their production and use. Consequently, the type of data available varies across different tool assemblages. Currently, the study of bone tools is structured around three primary axes: the selection and processing of raw materials, the manufacturing techniques employed, and the utilization of the finished products (Χρηστίδου 2006). This framework allows for a comprehensive examination of how bone tools were crafted and used, highlighting not only the technological aspects but also the socio-cultural practices embedded in their production and application (Χρηστίδου 2006).

A comparative study of the published sites of Macedonia shows that there are two different traditions in the regions, although this does not mean that each settlement does not have its own individual characteristics. One region extends from Central Macedonia eastwards, encompassing part of Thessaly, while the other extends from Western Macedonia towards the Balkans and neighboring Albania. Clearly, all the bone assemblages share

similarities, primarily in terms of construction. As mentioned earlier, the physiology of the bone significantly influences its suitability for construction. The published material studied together with the material of this thesis covers all subperiods of the Neolithic and more specifically: Vasilika (LN-FN), Thermi B (LN-FN), Stavroupoli (LN-FN) (Χρηστίδου 2006), Megalo Nisi Galanis(LN-FN), Sitagroi (MN-FN), Dikili Tash (LN-FN), Arcadiko (LN) (Christidou 1999), Dispilio (LN-FN) (Explo ERC project, Στρατούλη 2008; Υφαντίδης 2006), Nea Nicomedia (EN), Servia (EN-LN) (Stratouli 1998) Anarghiri IXb (LN) (Arampatzis 2019); 2. Thessaly: Argissa Magoula (LN-FN), Ojaki Magoula (EN-FN), Prodromos (EN-MN), Agia Sophia Magoula (LN), Pyrgos (FN) (Stratouli 1998), Sesklo (EN-MN), Agios Petros (MN-LN), Magoula Karamourlar (LN) (Moundrea 1981), Dimini (MN) (Stratouli 1998; Moundrea 1981). Balkans: Starčevo- , Körös–Criş (Vitezović 2016b; Tóth 2008), Grivac, Selevaće (Russel 1990), Aniste, Bresnica, Vinča (Vitezović 2017).

8.2.2 Raw material preferences over space and time

In the Neolithic era, the primary raw material for crafting bone tools in the regions under study was primarily the bones of domesticated animals commonly consumed in settlements, such as sheep, goats, pigs, and cattle (Choyke and Schibler 2007). An exception was the use of deer antlers, obtained through collection or hunting. However, some settlements, like Kleitos, also utilized bones of wild animals, such as roe deer tibias and boar and bear teeth, though to a lesser extent. This pattern is consistent in Western Macedonia and the Balkans generally. The procurement of skeletal bones for tools is closely linked to animal dissection, food preparation techniques, and the management of remains. Specific techniques varied depending on the species and size of the animal, local traditions, and consumption practices (Χρηστίδου, 2006). For example, metapodials, which serve as blanks, are often detached during skinning. If long bones are broken to extract marrow, intact bones must be selected beforehand. Alternatively, fragments from the breaking process can be repurposed for tool making. In the settlement of Revenia, archaeozoological studies revealed that bones were often broken for marrow extraction. Metapodials, used less frequently for tool production (70 objects), were less common than tibias (208 objects), indicating selective use based on the condition and suitability of the bones.

Often, it is challenging to match bone tools to their anatomical positions, species, and the sizes of the animals from which they originated, especially when the objects are fragmentary or lack diagnostic features. The degree of processing also affects the preservation of these characteristics. In Central and Western Macedonia, Thessaly, and the Balkans, long bones were primarily used for tool-making, with ribs, antlers, and teeth being

secondary materials (Stratouli 1998; Χρηστίδου 2006; Vitezović 2017; 2018; Korkuti, Hauptmann, and Schrickel 1995; Arampatzis 2023; Vitezović and Bulatović 2013; Rajković and Vitezović 2020; Morgenstern 2011; Markova 2019). Metapodials from sheep and goats were primarily used for making awls, while tibias were often crafted into chisels. At sites like Paliambela, Revenia, and Thessaly, the proximal part of the shaft typically remained rough, though it was occasionally smoothed. In contrast, at Kleitos, Dispilio, and Selevac, the proximal part was either smoothed or absent. Scapulae were rarely used across these regions, though Paliambela saw more frequent use of scapulae compared to other Central and Western Macedonian and Thessalian settlements. For example, only one scapula-based tool has been found at Vasilika (Χρηστίδου, 2006) and Revenia, seven at Kleitos, and very few at sites in Thessaly (Moundrea-Agrafioti, 1981). In Western Macedonia and the Balkans, shoulder blades were generally not significant raw materials for tool production. In Paliambela, Middle Neolithic tools made from shoulder blades were found within household contexts, suggesting they were intended for specific domestic uses rather than communal activities. This unique choice of raw material implies a specialized preference among the Neolithic inhabitants of Paliambela that differed from other bone-working traditions in the region.

Similarly, it could be asserted that in certain locations there was a specialization in different types of tools. For example, the Kleitos settlement focused on metapodials from sheep/goats and antlers, while Revenia specialized in using ribs. In Kleitos, the production of metapodial awls was quite homogeneous, with the tools being long and finely crafted, suggesting a possible specialization. Quartered metapodials are relatively uncommon in northern Greek Neolithic settlements, reported only in a few Middle Neolithic sites in eastern Macedonia and Thrace, but these tools have been documented in Neolithic settlements in Serbia, Slovenia, and Hungary (Arabatzis, 2013; Christidou, 2005; Choyke, Toth, and Zsuzsanna 2013; Russell, 1990). In contrast, at the site of Revenia, the majority of tools consisted of spatulas crafted from the ribs of large mammals, with some ribs even split lengthwise. The bisection of ribs involves a specific technical process, as detailed in the preceding chapters. Experimental studies indicate that not all ribs of large animals are suitable for producing the wide and thin tools found in archaeological material. Cattle ribs, due to their regular shape, are particularly suitable for producing these tools. It has been confirmed that the ribs should be fresh and not separated in time from the dismemberment of the animal to ensure successful crafting. One method of preserving and storing bones until they are ready to be cut is by smoking the rib cage or selected ribs, allowing the processing to be deferred for approximately four months. Although there is no excavation evidence for these technical solutions, it is plausible that rib dissection was integrated into the process of

consuming the carcass. Slaughtering a large animal requires expertise, as does rib dissection, and it is conceivable that both tasks were carried out by the same individuals (Χρηστίδου 2006).

There are notable differences in the raw materials used for bone tool assemblages across the studied settlements. In Kleitos, red deer antlers are significantly more prevalent compared to other settlements, with long bones primarily comprising sheep/goat metapodia. Paliambela exhibits the highest percentage of long bones, mainly sheep/goat metapodia. In Revenia, cattle ribs are predominant, followed by unidentified long bones. Kato Agiannis, despite having a small sample, shows no presence of metapodia, with antlers and long bones sharing the same percentage.

On a smaller scale, other bones are used in tool making across the settlements. The ulna and radius are primarily used for awls, the mandible for edged tools, and the femur and humerus for both awls and edged tools. Some bones are found in very small percentages but are unique to specific settlements. For example, a human skull was found in Kleitos, a spine and a fish bone in Paliambela, and a fibula from a carnivore in Revenia. Teeth were present in all settlements, with Kleitos having the highest percentage. Paliambela and Kato Agiannis each had one instance of teeth being used. In Kleitos, the numerous teeth mainly come from the tusks of male wild boars. Bone tools from domesticated pigs are not observed in large proportions at any site; those that are present include humerus and femur bones, but no other long bones.

Regarding deer antlers, neither their collection nor use appears to have been systematic in the settlements of Central Macedonia and Thessaly, outside the Drama plain. However, in Western Macedonia and the Balkans, there was a particular specialization in using deer antlers, as evidenced by the published material. In the Balkans, both red deer and roe deer were abundant, though there were quantitative differences among the settlements. Some had more bones and antlers from deer, while others had fewer, reflecting regional differences in economic practices (Vitezović 2016:126; Vitezović and Antonović 2020; Vitezović 2017; 2018; 2013; Rajković and Vitezović 2020; Vitezović 2010; Korkuti, Hauptmann, and Schrickel 1995; Russell 1990).

In some sites in Western Macedonia, such as Kleitos and Dispilio, human bones that have been used for bone tools are observed. At both sites, human-modified bones have been identified, categorized as both (unidentified objects with a hole) "part" and "flute". We do not have similar examples from other sites in Greece where an archaeozoological study has been carried out. Similarly, in the Balkans, no human bone has been observed, but we cannot be sure if the bone tools have not been subjected to a detailed archaeozoological study.

Generally, the use of human bones as raw materials for tool production is noted in prehistory (Verna and d'Errico 2011), but this practice is not commonly observed during the Neolithic period.

In conclusion, the availability of raw materials for bone tool production is influenced by the local environment, the practices of craftsmen, and traditions in animal husbandry. The nature of the raw materials significantly impacts the resulting objects, determining their use and processing methods. A consistent trend across sites in the Balkan region, extending northwards and including Greece, reveals a prevalent use of specific bone types for crafting tools (Choyke 2014). Sheep and goat bones, particularly tibia and metatarsals, are the most frequently utilized, with red deer antlers and ribs from large animals also playing a significant role. While bones from wild animals are less commonly represented, variations exist among settlements, as seen in the Drama plain (Christidou 1999). Pig bones, mainly femur and humerus, make up a minimal percentage across all sites, similar to the presence of bones from wild animals. This pattern is likely linked to the methods of animal slaughter and the preferences of the craftsmen.

8.2.3 Typologies through space

The two central categories observed in all periods studied for bone tool production are pointed and edged tools. These categories are further subdivided into sub-categories such as awls, projectile points, spatulas, and chisels. Throughout the material, there is a particularly high proportion of unidentified tools, which could potentially affect statistical analysis. However, based on the available data, the overall picture reveals variations in manufacturing techniques and tool types. Almost all tool categories are present in the materials under study, with a higher percentage of pointed and edged tools, as noted. Revenia, in particular, shows a higher percentage of edged tools, predominantly spatulas and chisels. Additionally, although the sample size is small, Kato Agiannis includes two spoons not found at other sites, which bear similarities to Bronze Age spoons. These variations highlight the diversity in tool production and use across different settlements.

The awls in Kleitos appear to have been initially smoothed through abrasion and subsequently cut along their length, as evidenced by the waste material, which allows for the reconstruction of the operational sequence. This technique aligns with practices observed in other Western Macedonian settlements, such as Dispilio, and various locations in the Balkans. In Thessaly and Central Macedonia, a similar technique is identified, but it primarily involves first cutting along the length and then refining the tool through abrasion. In Kleitos and other sites in Western Macedonia and the Balkans, a broader array of pointed tools is evident,

including double points, projectile points, and fishhooks. In contrast, the settlements of Central Macedonia predominantly feature tools limited to awls and round points (in the text perforators). With regard to edged tools, Revenia has a notable prevalence. There is no significant distinction in the treatment of bones, particularly tibiae and ribs, as previously outlined. However, there is variation in the shapes of objects at Kleitos; for instance, spatulas exhibit four distinct categories with different decorations and proximal parts, whereas spatulas at other sites tend to share a uniform pattern. Decoration on the proximal part of spatulas is also prevalent in the Balkans, such as in Divostin (Vitezović 2016a). This variation extends to other categories of objects, such as combs. In Kleitos, the variety of combs exceeds those found in Paliambela, although the combs from Paliambela are notably meticulous in their construction.

In all studied locations, unique objects are present that are not found elsewhere. In Paliambela, for instance, the material includes pointed objects made from both split and unsplit ribs, which are unique to this site and not found in Macedonia, the Balkans, or Thessaly. Kleitos features a variety of objects, some of which remain uncertain in their use (unidentified objects with a hole). Similar objects are abundant at sites in the Balkans, Albania, and Dispilio, and they do not originate from a specific bone category. These objects could be fashioned from the blank long bones of large animals, antlers, or even a human skull. In Dispilio, it is theorized that these objects served as hand protectors for craftsmen when drilling holes or working with a drill (Στρατούλη 2008). In Albania, the literature refers to these tools as jewelry (Korkuti, Hauptmann, and Schrickel 1995). Conversely, in various Balkan regions including Golokut, Bastine, Starčevo-Grad, Grivac (Vitezović 2016b), Koros (Tóth 2008), and across Serbia, they are cataloged as unidentified objects. This classification is based on comparative photographs from Balkan museums compiled by the author. The theory suggesting a protective function is plausible, given the waste materials found at both Kleitos and Dispilio, indicating the initiation of a hole in the bone. However, certainty regarding the use of these tools remains elusive. The objects identified as cousoirs in Kleitos are also found in Balkan sites, including Golokut, Bastine, Starčevo-Grad, and Grivac (Vitezović 2016b).

Another significant category of bone tools includes antler implements, which are further classified into various sub-categories such as axes, sleeves, digging tools, handles, beveled tools, and rings. These tools are utilized across distinct regions, with notable prevalence in Western Macedonia, Albania, and the Balkans. In these regions, ceramic tools are also commonly found, with sites like Dispilio, Megalo Nisi Galanis, Anarghiri IXa, and Anarghiri IXb in Western Macedonia reporting their presence (Arampatzis 2019; 2023). With

the exception of one case (Stavroupoli Thessaloniki) (Χατζούδη 2002), the examined antler assemblages from Central Macedonia lack significant information about antler use. This limitation stems from their limited quantity, as highlighted by Christidou in 1997 and 1999, and the absence of comparable data. However, as mentioned earlier, antler implements are present in all sites, with variations in both quantity and typology. In the eastern part of Macedonia, the most extensive comparable assemblages come from the settlements of Dikili Tash and Sitagroi (Christidou 1999). The Balkans, including Albania and Western Macedonia, feature a variety of antler objects such as harpoons, axes, and sleeves (Russel 1990; Vitezović 2013; 2017; Rajković and Vitezović 2020; Vitezović 2010; 2016a; Tóth 2008). Objects like sleeves, rings, and harpoons are notably absent in the literature for Central Macedonia and Thessaly but are found in large quantities in the Balkans. Thumb rings, for instance, are referred to as jewelry in Dispilio and Albania (Υφαντίδης 2006; Korkuti, Hauptmann, and Schrickel 1995), while in Anarghiri IXb, they are described as hand rings for archery protection (Arampatzis 2019). In Central Macedonia, a type of ring tool is found in Revenia, Paliambela, Thermi, Limenaria, and Stavroupoli. These rings differ in processing techniques, form, and raw materials compared to those in the Balkans and Western Macedonia. The latter predominantly use deer antlers as blanks, whereas Central Macedonian rings are mostly crafted from long bones of large mammals. According to Christidou, these rings were likely used as tool holders or for holding fiber bundles during the manufacture of knitted objects. Additionally, handles or sheaths for attaching stone tools are noted from Stavroupoli (Χρηστίδου 2006).

8.2.4 Distribution of bone tools thought time and space

Based on the research and statistical analysis presented in this thesis, several conclusions can be drawn regarding the temporal and spatial distribution of bone tools across the studied settlements. Excluding Paliambela, which has a continuous occupation from the Early Neolithic (EN) to the Final Neolithic (FN), the remaining sites show more distinct and closed temporal phases: Kleitos I corresponds to the Late Neolithic (LN), Kleitos II to the FN, Revenia to the EN, and Kato Agianis to the FN. It is important to emphasize that universal conclusions about societies based solely on the study of bone tools are not feasible. The objective here is to provide insights into how bone tools were utilized within these settlements and to determine whether there are discernible differences in the objects across various periods.

An essential factor in understanding the connection between tool use and the daily life of Neolithic inhabitants is determining whether these tools were found in enclosed or open

spaces. Tools discovered in enclosed spaces likely indicate activities conducted within the household, such as food preparation or seed processing. Conversely, tools found in open spaces may suggest community-level activities, such as leatherworking, clay or bark processing, or basket making. This distinction can vary depending on the specific period under examination.

Throughout the Neolithic, bone tools are predominantly found in communal areas across all studied settlements. However, distinct differences emerge between periods. From the Early Neolithic (EN) to the Final Neolithic (FN), there is a gradual shift, though not dramatic, towards the use of bone tools within enclosed spaces. Scholars suggest that by the later phases of the Neolithic, well-defined settlement units begin to appear (Kotsakis 2014: 9-10). In the EN, activities involving bone tools seem to occur in open spaces accessible to the entire community. By the FN, however, bone tools are increasingly found within enclosed spaces or around the perimeter of houses. This shift reflects a transition from communal to individual contexts, corresponding with the decreasing communal nature of settlements and the rise of more enclosed households (Kotsakis 2014: 12). This evolution aligns with the socio-economic changes of each period, as settlement units in Northern Greece gradually transition from open communal areas in the Early Neolithic to more autonomous, 'closed' units by the Middle Neolithic and Final Neolithic periods.

Across all studied sites except Kato Agianis, bone tools are consistently linked to food production and consumption. These tools, made from the remains of animals used by the inhabitants, facilitate processing food, leather, and other animal by-products. In the Early Neolithic, food preparation and consumption likely occurred in shared communal spaces. By the Middle Neolithic (MN), there is a notable shift towards the establishment of socially and economically autonomous households (Halstead 1999). This period marks a transition in Northern Greece that leads to the more robust, defined settlement units of the Bronze Age (Kotsakis 2014: 13). In all settlements, bone tools are predominantly found in areas associated with food preparation. For example, in Kleitos I, while bone tools are found in the west, there is a significant concentration in the center and areas with numerous zoological remains. This suggests that bone tools were closely tied to locations where carcasses or food were processed, supported by experimental studies indicating that these tools are primarily made from fresh bones. Similarly, in Revenia, bone tools are concentrated in bone-rich pits such as 18, 24, 42, and 38. At Paliambela, bone tools like combs, rings, scrapers, and awls are found in both pits and open spaces, suggesting areas where these tools were both crafted and used (AEX 1302, 517, trench 13 deposits).

The placement of bone tools in open spaces throughout the Neolithic period can be attributed to the nature of the tasks for which they were used. These tasks, such as tanning, which produces strong odors and requires ample space, were likely impractical to perform within the confined areas of Middle Neolithic (MN), Late Neolithic (LN), or Final Neolithic (FN) houses. The evidence supports the notion that such activities were carried out in open areas adjacent to or between houses. In sites like Paliambela (MN, LN, FN), the cobblestones in front of and between houses, as well as open spaces within and around the settlement, were likely utilized for these tasks. Similarly, in Kleitos I (LN), the central area of the settlement and open spaces within houses might have been used for such work. In Kleitos II (FN), the 'courtyards' of the houses could have served as workspaces. These open areas would accommodate the large-scale and messy nature of tasks such as leatherworking, which was not suitable for enclosed, domestic spaces. Moreover, these activities may not have been conducted solely by individuals but could have involved groups of people working together, regardless of familial relationships. This communal or collaborative approach further supports the idea that such tasks were suited to open, shared spaces rather than confined interiors.

The distribution of bone tools in the ditch systems of the studied Neolithic settlements provides key insights into their usage and disposal practices. Except for Kleitos II (seems to be partially formed by natural features, with two streams bordering the settlement from the north/northwest and east, and possibly a third stream from the southwest), all the examined sites are surrounded by ditches where bone tools have been found. This suggests that ditches may have functioned as part of the settlement's waste management system or as areas for tool disposal. At Kleitos I, a total of 39 bone tools were discovered, which is relatively modest given the amount of excavation waste. This may indicate that bone tools were not frequently discarded in the ditches, or their disposal might have been managed in a way that prevented significant accumulation in these areas (Ziota et al. 2013: 58-59). In Revenia, only three bone tools were found within grave contexts, highlighting that ditches might not have been a primary location for tool disposal at this site. Paliambela, on the other hand, yielded 55 bone tools from its ditches. The higher number can be attributed to the extended period of ditch usage from the Middle Neolithic (MN) to the Late Neolithic (LN), suggesting a longer period of tool usage and disposal. In contrast, Kato Agianis, with 22 bone tools found in the ditch, also reflects a relatively small number, similar to other sites. This indicates that, like the other settlements, ditches were not major disposal sites for bone tools at Kato Agianis either. Research on prehistoric refuse, such as that by Goutas et al. (2016), suggests that tools were used until they were worn out. This pattern of usage may explain the low number of tools

found in ditch deposits. Tools that had reached the end of their functional life might have been discarded in less prominent locations or managed in a manner that did not result in significant accumulation in the ditches. Overall, the modest number of bone tools found in ditch systems suggests that these areas were not the primary disposal sites for such items. The low counts at various sites may reflect different practices in tool use, maintenance, and disposal. The variation in tool numbers across the sites indicates that the practices related to tool management and disposal were likely influenced by local customs and the specific operational contexts of each settlement.

The types of bone tools found across the Neolithic settlements exhibit notable variation, reflecting differences in both tool use and site organization. At Kleitos, the distinction between Kleitos I and Kleitos II highlights how tool types and their distribution differ within the same settlement. Specifically, tools such as spatulas, axes, antler rings, cousoirs, harpoons, parts, double points, and arrows are predominantly or exclusively found in Kleitos I. This indicates that these tools may have been more commonly used or produced in the earlier phase of the settlement. Kleitos II, on the other hand, encompasses a broader array of these components, suggesting a continuation or expansion of tool types into this later phase. At Paliambela, the distribution of bone tools varies significantly across different periods. In the Middle Neolithic (MN), the site features a majority of antler artifacts, harpoons, and combs. This concentration reflects the prominence of these tools during this period. In contrast, the Early Neolithic (EN) is marked by the presence of hooks, while the Late Neolithic (LN) is characterized by the discovery of a single needle. This temporal variation in tool types at Paliambela suggests changes in tool use and technology over time, as well as shifts in the types of activities and crafts practiced within the settlement. Overall, these differences underscore the dynamic nature of tool use and production in Neolithic settlements. The variation in bone tools across periods and sites indicates not only changes in technology and material preferences but also reflects broader shifts in settlement organization and daily life activities.

The research presented in this thesis in comparison with the literature reveals the presence of two distinct Neolithic traditions based on the geographical and cultural influences observed in the studied settlements (see Map 18). The first tradition is associated with Western Macedonia, aligning with influences from the Balkans, while the other tradition is linked to Central Macedonia, looking towards Thessaly. Several objective factors have played a significant role in shaping these traditions. Primarily, the physical environment holds great importance, influencing both the availability of raw materials and the inherent need to create objects that would facilitate life for the inhabitants. For instance, Kleitos, Megalo Nisi

Galanis, Dispilio, Anarghiri IXb and the prehistoric settlements in the Balkans mentioned in the paper (most of them) during the period studied were lake settlements and surrounded by dense forest (Morales-Molino et al. 2024). This is evident in their toolmaking, characterized by the abundance of harpoons, fish-hooks, double points (which can also function as hooks), etc. It is crucial to acknowledge that the context directly influences the choices made in tool production (Sillar and Tite 2000). Additionally, the production of bone objects is significantly influenced by both the initial raw materials and the craftsman's envisioned future use for the tool. Moreover, the economic conditions of a settlement play a crucial role in shaping specific parameters. As Silar and Tite highlight, the technological decisions within a chaîne opératoire, such as the production of bone tools in this instance, are not only a result of economic factors but also contribute to the formation and perpetuation of the social context (Sillar and Tite 2000). The perspective of two distinct traditions is bolstered by examples from pottery. For instance, Papaioanou's examination of pottery from two Revenia pits reveals significant differences between the pottery of the Starčevo culture and that of the Revenian. Interestingly, similarities are observed with the pottery of the advanced EN and early MN in Thessaly (Παπαϊωάννου 2011:146). Similarly, Papadakou's research on the Early Neolithic pottery of Paliambela highlights that “further north in Greece, the pottery traditions exhibit variances, both in terms of chronology and technological-stylistic attributes” (Παπαδάκου 2011:20-21).

Upon examining the literature and conducting a comparative analysis of the materials from this thesis with those from neighboring regions, a notable pattern emerges in the transition from the late 6th millennium to the 5th millennium BCE. This period is characterized by significant changes and innovations that reflect a dynamic and progressive evolution rather than a mere adherence to local traditions. One of the key innovations from this period is the introduction of sleeves, which were designed to protect both the wooden shaft and the tool itself—such as an axe—from vibrations. The concept of sleeves is potentially inspired by similar practices observed in Central Europe. This development highlights an important late Neolithic advancement in toolmaking, as sleeves provided a means to enhance the functionality and durability of tools by mitigating the impact of vibrations during use. Similarly, another notable innovation is represented by objects such as "the part," as discussed in this thesis. Stratoulis' hypothesis suggests that these objects served a protective role for the craftsman's hand during drilling activities. The use of such protective implements signifies a sophisticated understanding of tool use and ergonomics, reflecting an advanced approach to addressing the challenges faced during tool-making and material processing. These innovations underscore a broader trend of technological and functional

advancements that characterized the late Neolithic period. Rather than a simple continuation of established practices, the introduction of new tool types and protective measures indicates a period of experimentation and adaptation. This progression is evident in both the material culture and the technological innovations of the time, marking a significant shift towards more specialized and effective tool-making practices.

Boivin argues that the pace of human evolution accelerated with the development of new tools, which not only influenced the physical evolution of human anatomy but also contributed to significant socio-cultural changes (Boivin 2010:193-196). This perspective underscores the dynamic nature of tool evolution, which continues to be a crucial field of study even today. Despite their seemingly "primitive" nature, the tools from the era under examination exhibit discernible differences and innovations that reflect human responses to evolving needs. In analyzing the various bone tool traditions, several notable differences emerge, highlighting the complexity and diversity of toolmaking practices. The absence of specific technological or morphological elements should not be interpreted as a lack of knowledge but rather as a deliberate choice within a broader "chain" of technological decisions. This chain offers archaeologists insights into the cognitive processes and cultural decisions of the societies that produced these tools, revealing aspects of tradition and innovation (Lemonnier 1986). Recognizing human action in both tangible materials and abstract concepts is essential for understanding how material culture evolves. As Dobres and Hoffmann (1994) suggest, the production of material culture serves as a fertile ground for negotiating human goals and interests. Tools are shaped not only by material needs but also by ideological and cultural factors, reflecting a complex interplay between human labor and evolving requirements. The evolution of tools in response to specific geographical needs illustrates how human creativity and labor drive technological advancement. Tools do not evolve autonomously; instead, they are developed and refined through human effort to address various needs, whether material (such as functional tools) or ideological (such as ornamental objects). This process results in a non-linear growth of specialization, driven by the increasing complexity of human requirements. An illustrative example of this specialization can be seen in the practice of animal husbandry. As Halstead (1996: 25) notes, the gradual domestication of animals leads to more specialized pastoral economies, characterized by larger herds, specific feeding requirements, and advanced animal handling techniques. The demands of animal husbandry necessitate more labor and specialization, reflecting broader trends in technological and socio-economic evolution. Overall, the study of tool evolution reveals a dynamic interplay between technological innovation, human needs, and socio-cultural factors. By examining these aspects, researchers can gain deeper insights

into the cognitive and cultural contexts that shaped the development of material culture throughout history.

8.3 Epilogue and Future Research

The in-depth analysis of the bone tool assemblages from Kleitos I and II, Paliambela Kolindros, Revenia Korinos, and Kato Agianis has provided valuable insights into the raw material preferences, typologies, and their distribution across different time periods and locations. By situating these findings within the broader literature, the study has highlighted both the unique and shared technological characteristics across these regions.

The research focused on the intricate processes of bone tool usage, offering a comprehensive view of how craftsmen selected and utilized raw materials, and how these materials were processed and adapted over time. This exploration has revealed the significant role of bone tools in prehistoric societies, demonstrating their utility alongside stone tools and underscoring their enduring importance.

The study began by defining the primary research issues and establishing a robust theoretical and methodological framework. This framework emphasized the importance of a biographical approach to bone tools, moving beyond static typological and morphometric analyses to consider the entire life cycle of these objects.

Overall, this study has deepened our understanding of bone toolmaking in prehistoric times, illustrating the complex interplay between technology, environment, and social practices. It highlights the significance of bone tools as not only functional artifacts but also as reflections of the cultural and technological developments of ancient societies.

There are several promising directions for future research on bone toolmaking in Macedonia that could significantly deepen our understanding of these artifacts and their broader context. This study has tried to provide valuable insights into tool-making techniques, potential uses, and the disposal of tools, but it has not included an experimental approach to bone tool analysis. An experimental study, which would involve replicating tools and comparing these replicas with archaeological specimens, could offer a deeper understanding of the techniques employed in their creation and provide more detailed insights into their practical applications. In addition to experimental research, further chemical analyses could be employed to better determine the specific functions of these tools. By analyzing residues or other chemical markers on the bone tools, researchers could gain a clearer picture of how these implements were used in prehistoric times. Future research should also explore the connections between archaeozoological practices and bone tool production. Understanding how animal processing and other related activities influenced toolmaking could shed light on the relationships between human activities, resource use, and technological development. Moreover, expanding the geographical scope of the study to include a broader range of traditions could provide a more comprehensive view of bone

toolmaking practices. Comparing and contrasting bone tool traditions across different regions and time periods would enhance our understanding of the diverse cultural influences and technological innovations that shaped these practices. By pursuing these avenues, researchers can gain a more nuanced understanding of the interactions between human behavior, animal resources, and cultural traditions, offering new insights into the complexities of prehistoric toolmaking.

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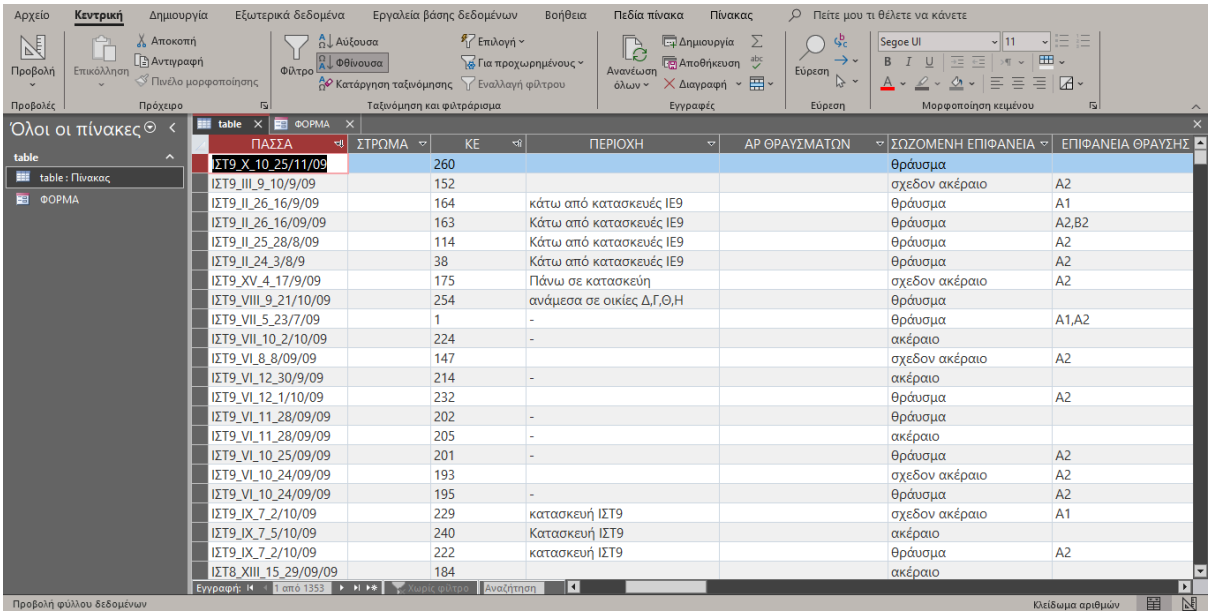

ΠΑΣΣΑ	ΣΤΡΩΜΑ	ΚΕ	ΠΕΡΙΟΧΗ	ΑΡ ΘΡΑΥΣΜΑΤΩΝ	ΣΩΖΟΜΕΝΗ ΕΠΙΦΑΝΕΙΑ	ΕΠΙΦΑΝΕΙΑ ΘΡΑΥΣΗΣ
ΙΣΤ9_Χ_10_25/11/09		260			θράυσμα	
ΙΣΤ9_ΙΙΙ_9_10/9/09		152			σχεδον ακέραιο	Α2
ΙΣΤ9_ΙΙ_26_16/9/09		164	κάτω από κατασκευές ΙΕ9		θράυσμα	Α1
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ΙΣΤ9_VII_5_23/7/09		1	-		θράυσμα	Α1,Α2
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ΙΣΤ9_VI_8_8/09/09		147			σχεδον ακέραιο	Α2
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ΙΣΤ9_VI_12_1/10/09		232			θράυσμα	Α2
ΙΣΤ9_VI_11_28/09/09		202	-		θράυσμα	
ΙΣΤ9_VI_11_28/09/09		205	-		ακέραιο	
ΙΣΤ9_VI_10_25/09/09		201	-		θράυσμα	Α2
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ΙΣΤ9_ΙΧ_7_2/10/09		222	κατασκευή ΙΣΤ9		θράυσμα	Α2
ΙΣΤ8_XIII_15_29/09/09		184			ακέραιο	

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Figure 4.2 : Revenia - awls made from fibula raw material

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Figure 4.4 : Revenia - awls made from ulna raw material

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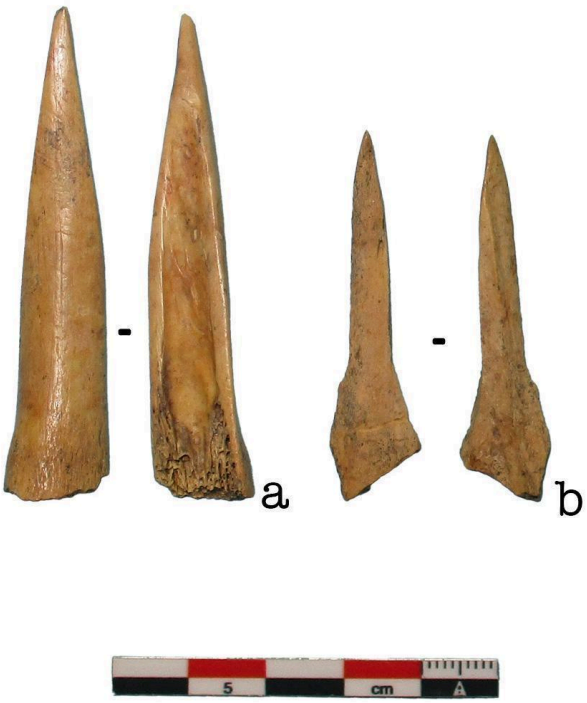

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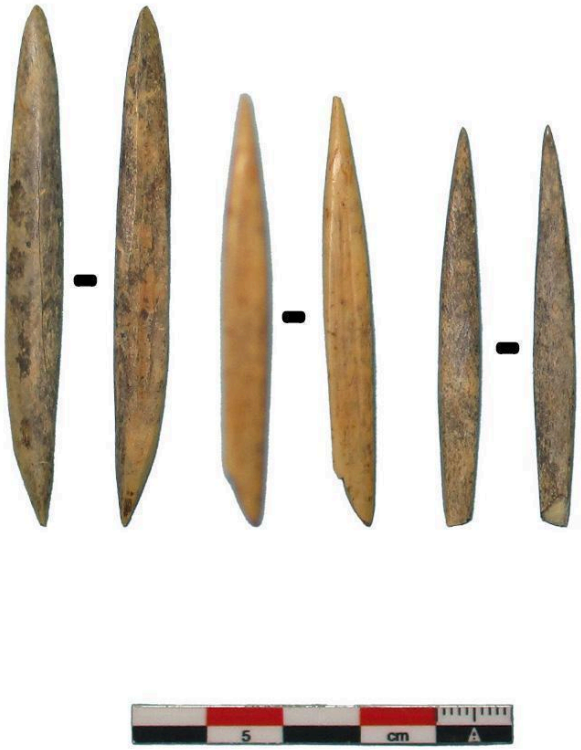

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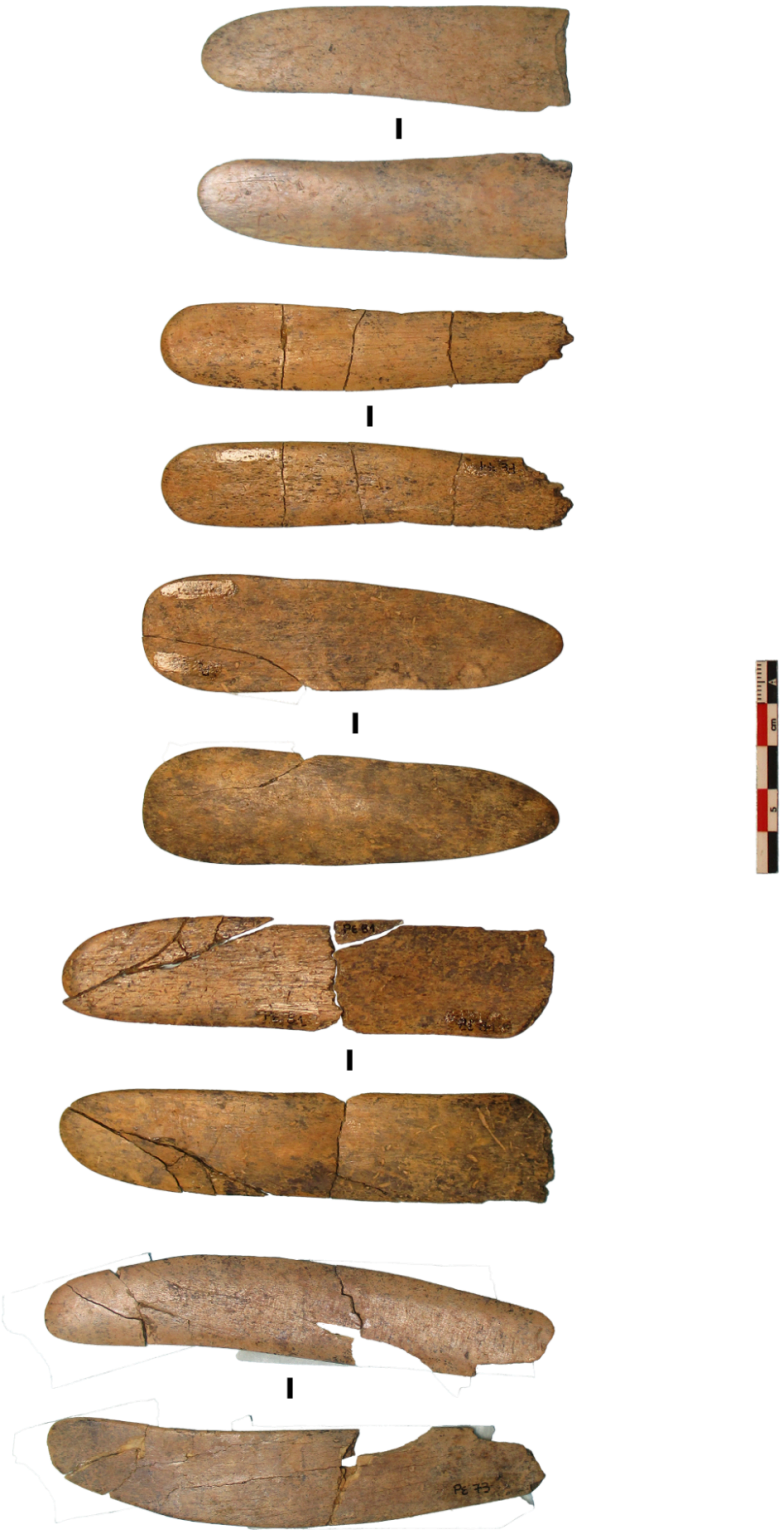

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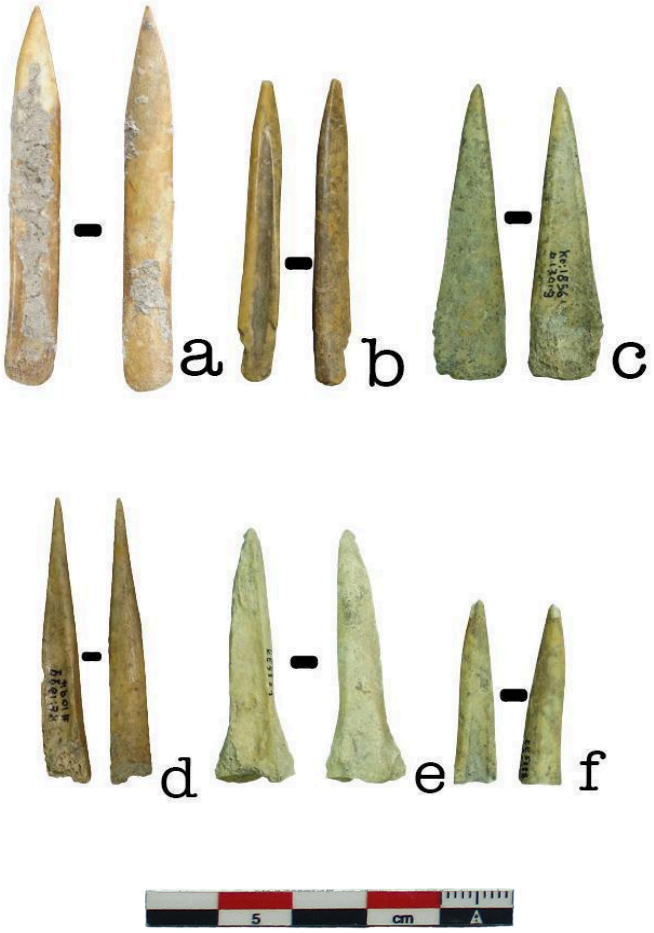

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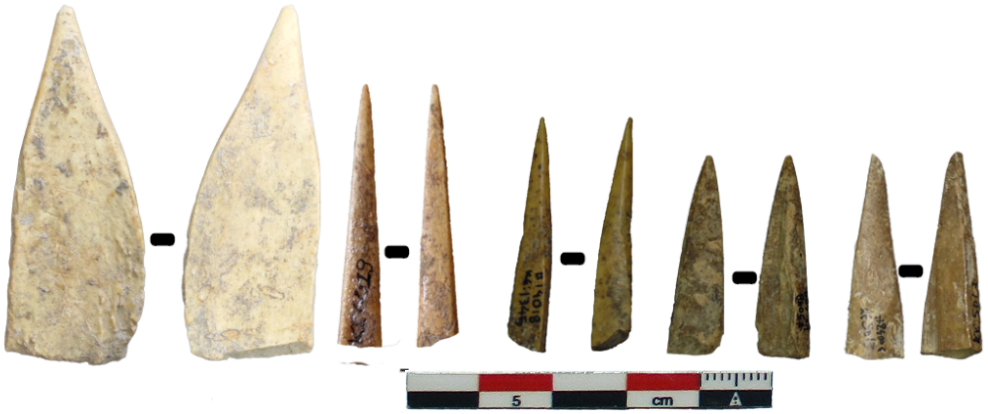

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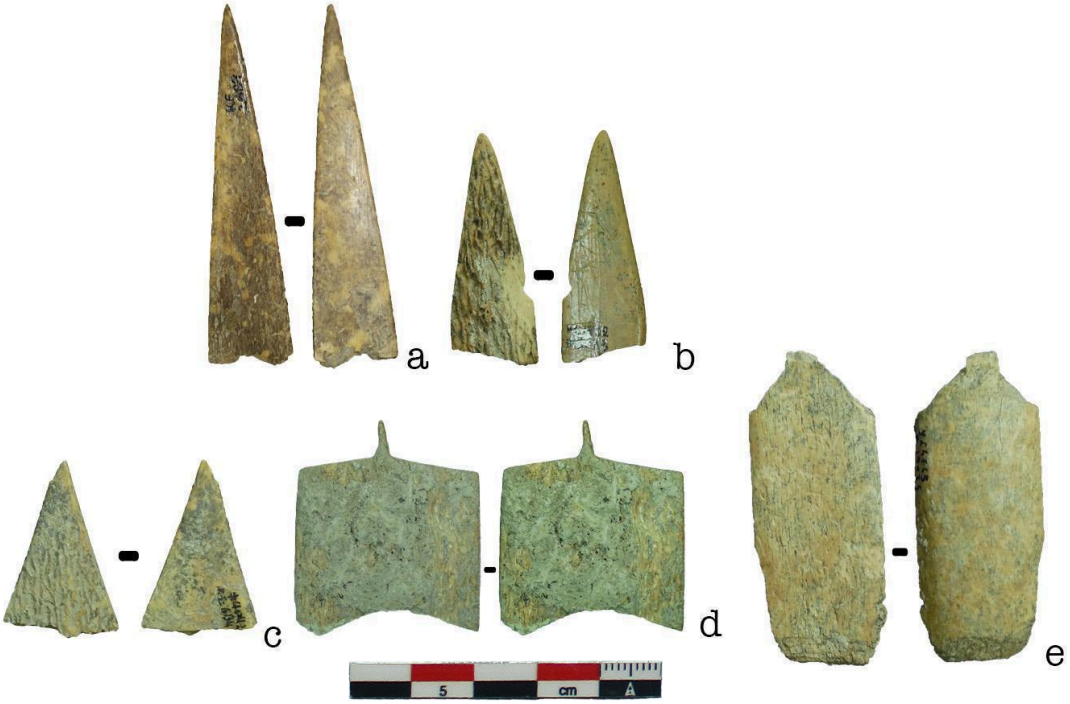

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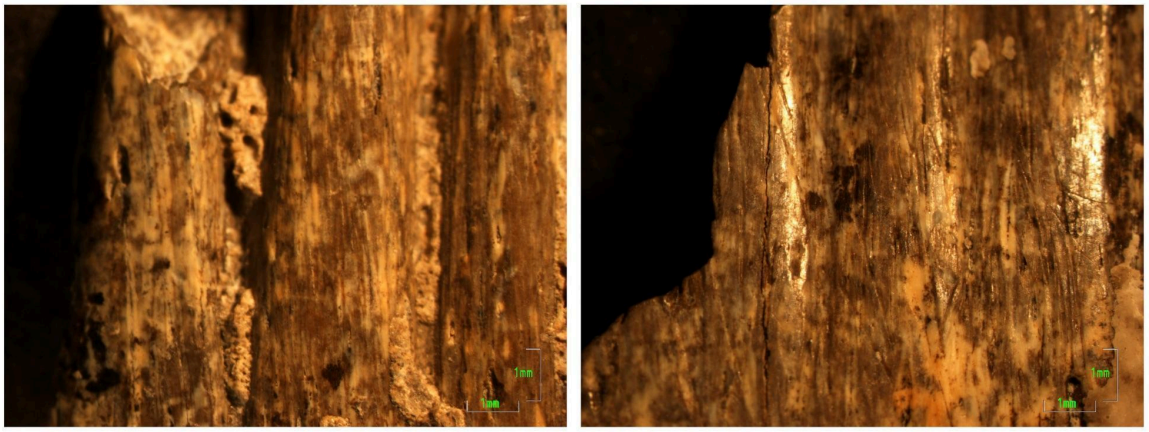

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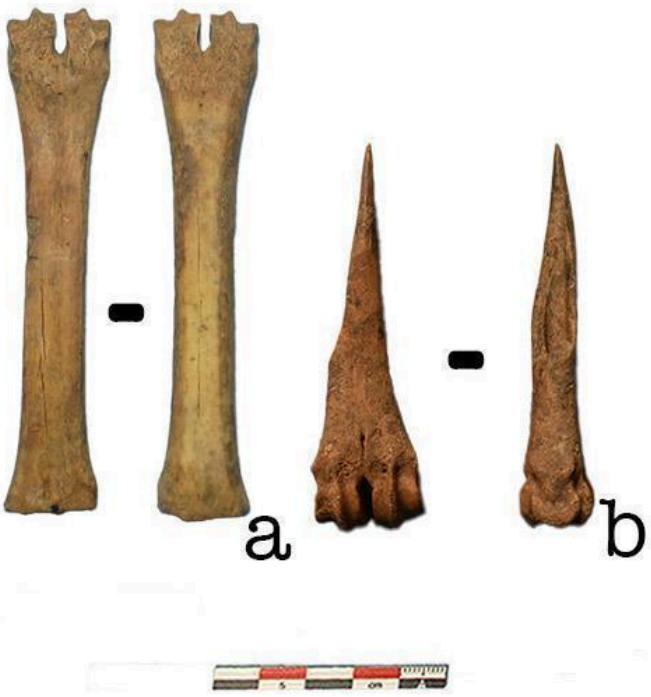

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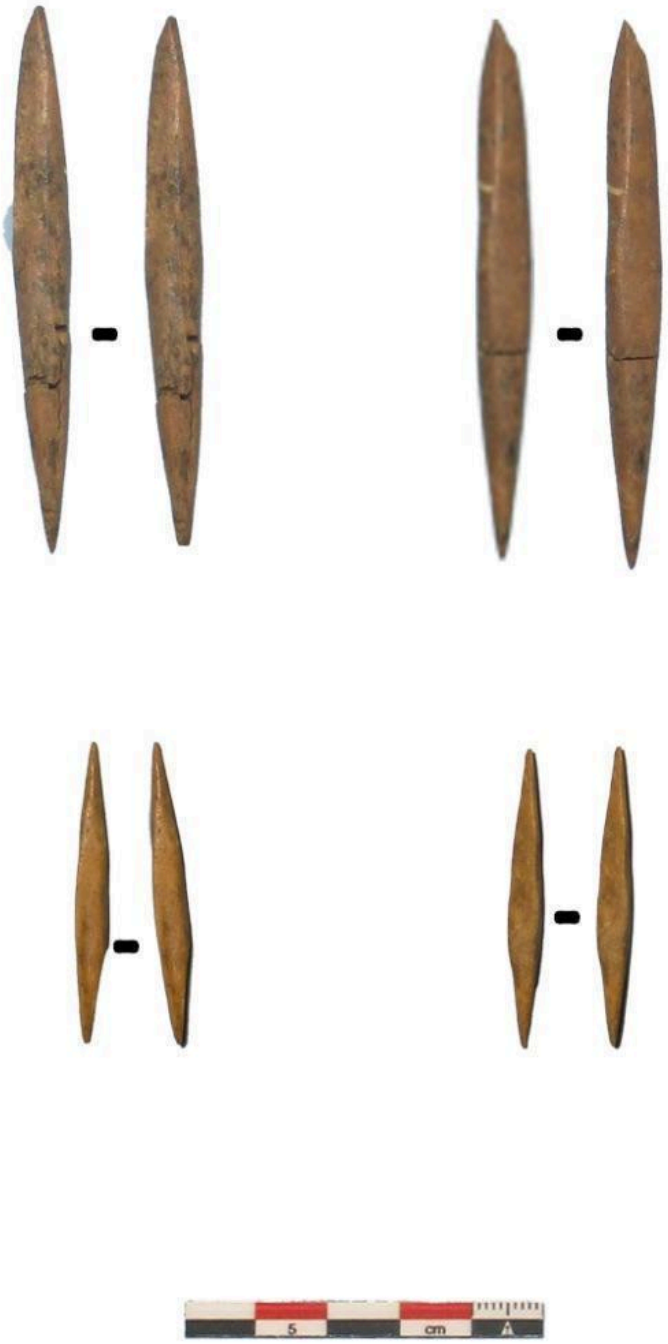

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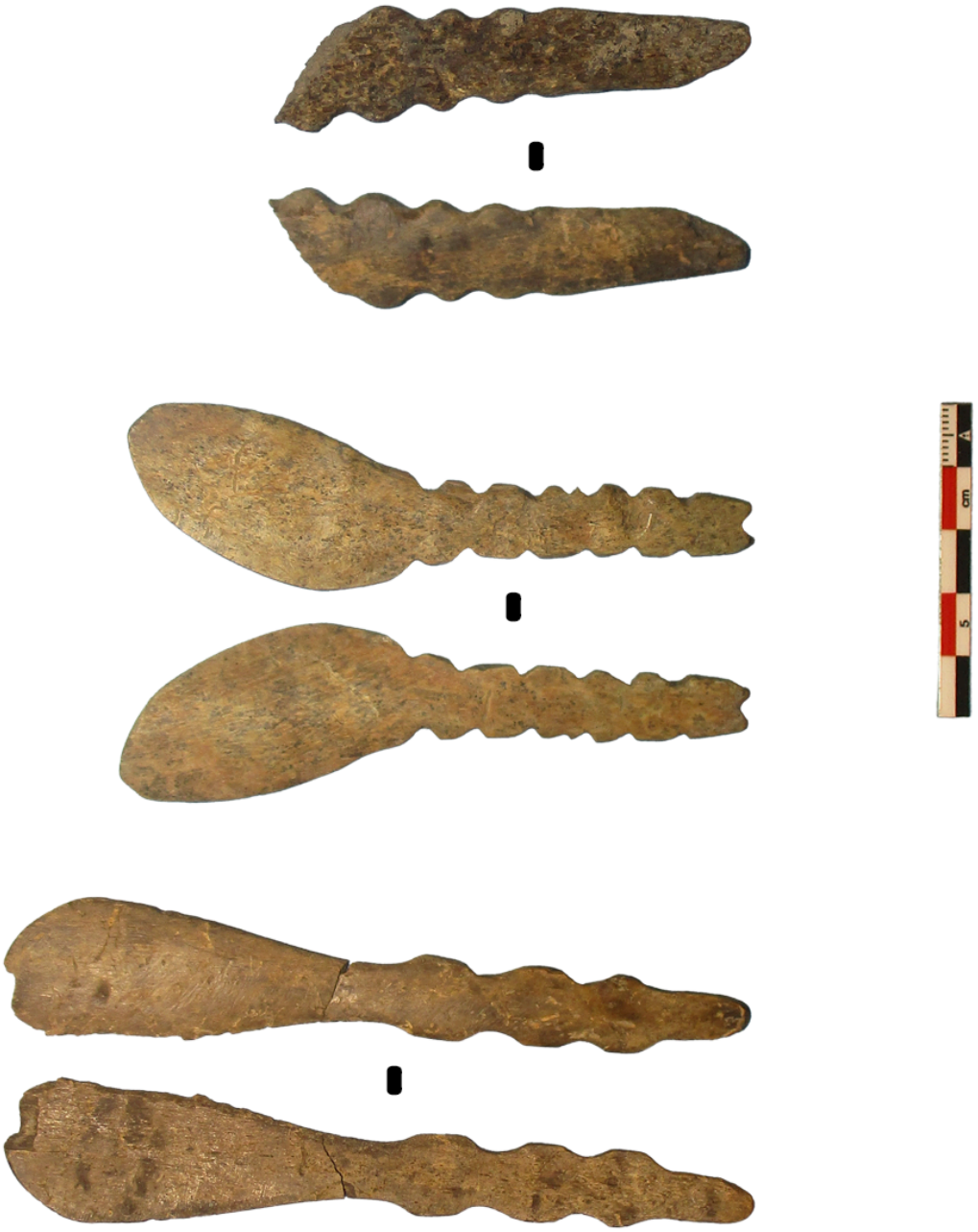

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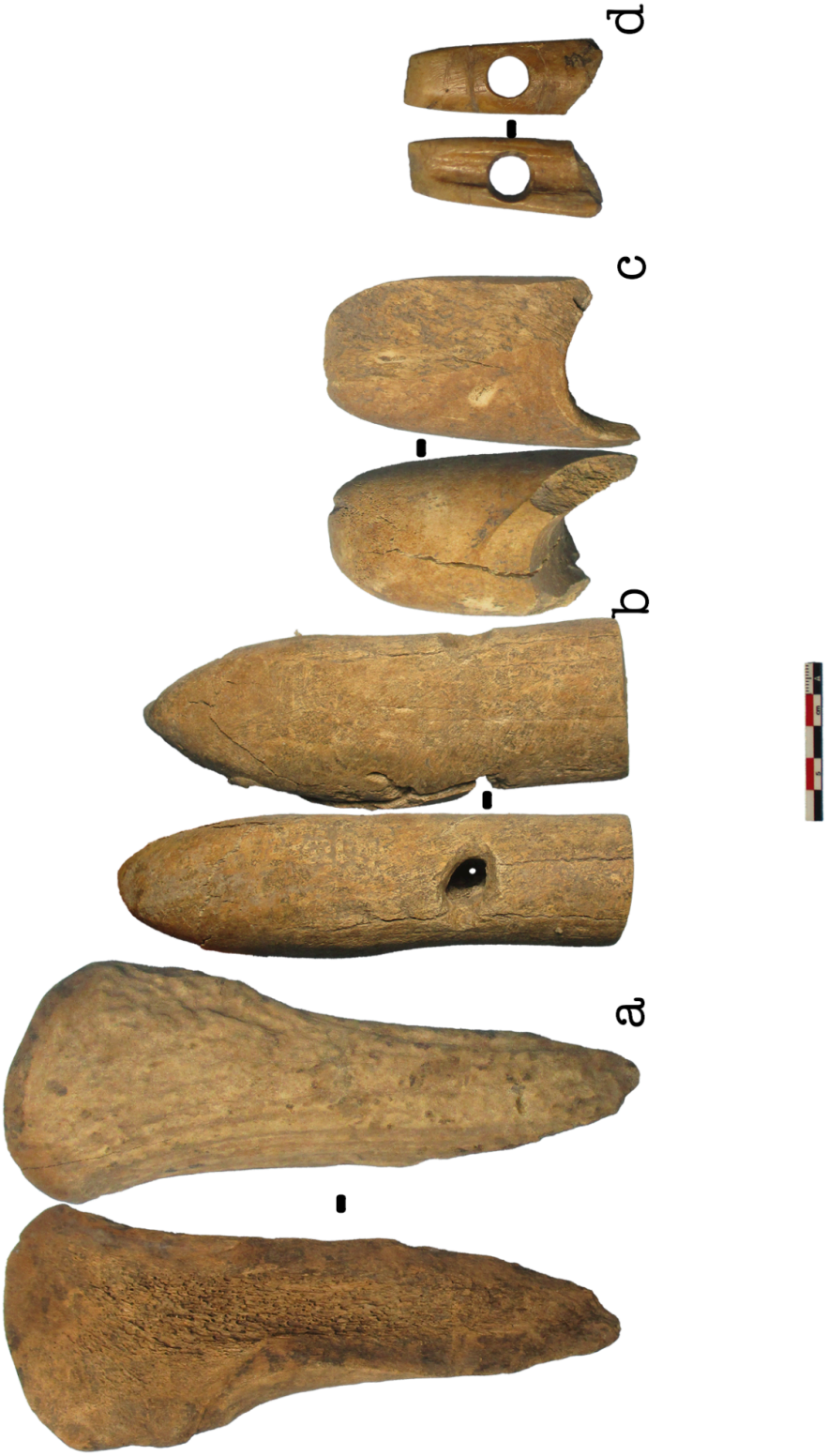

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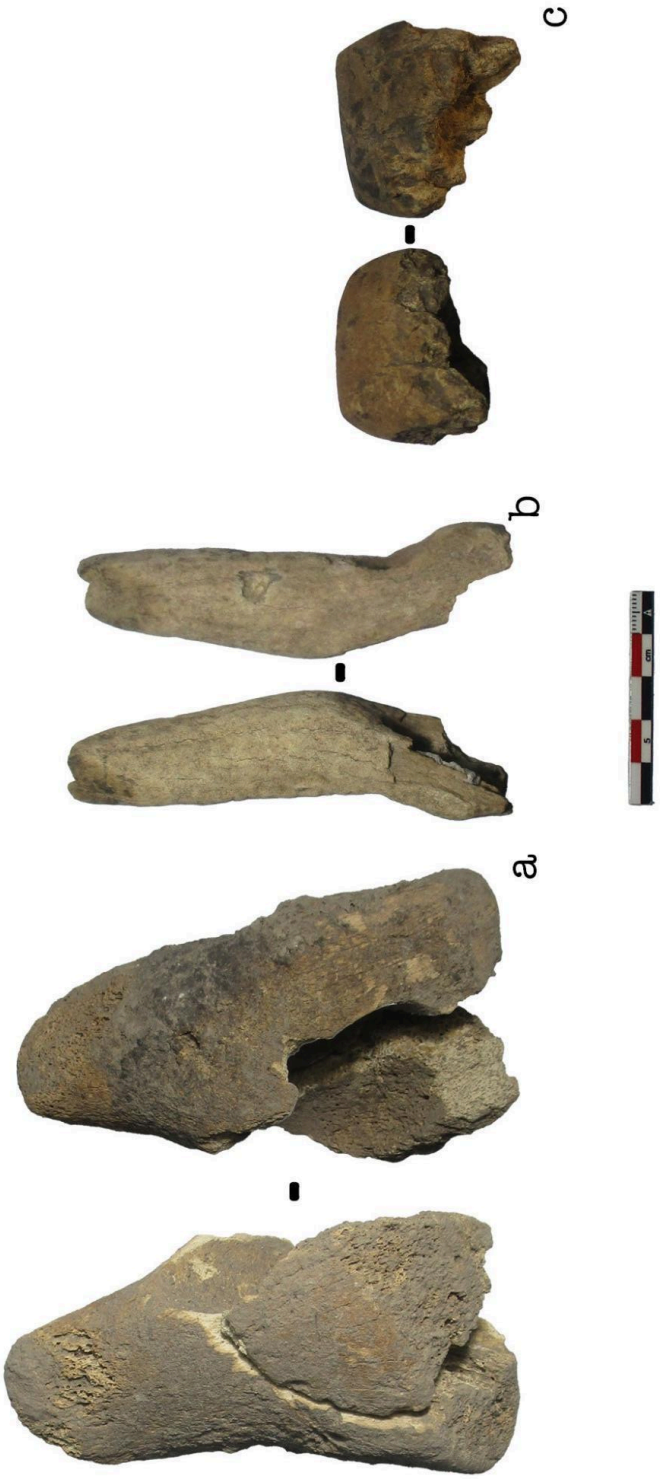

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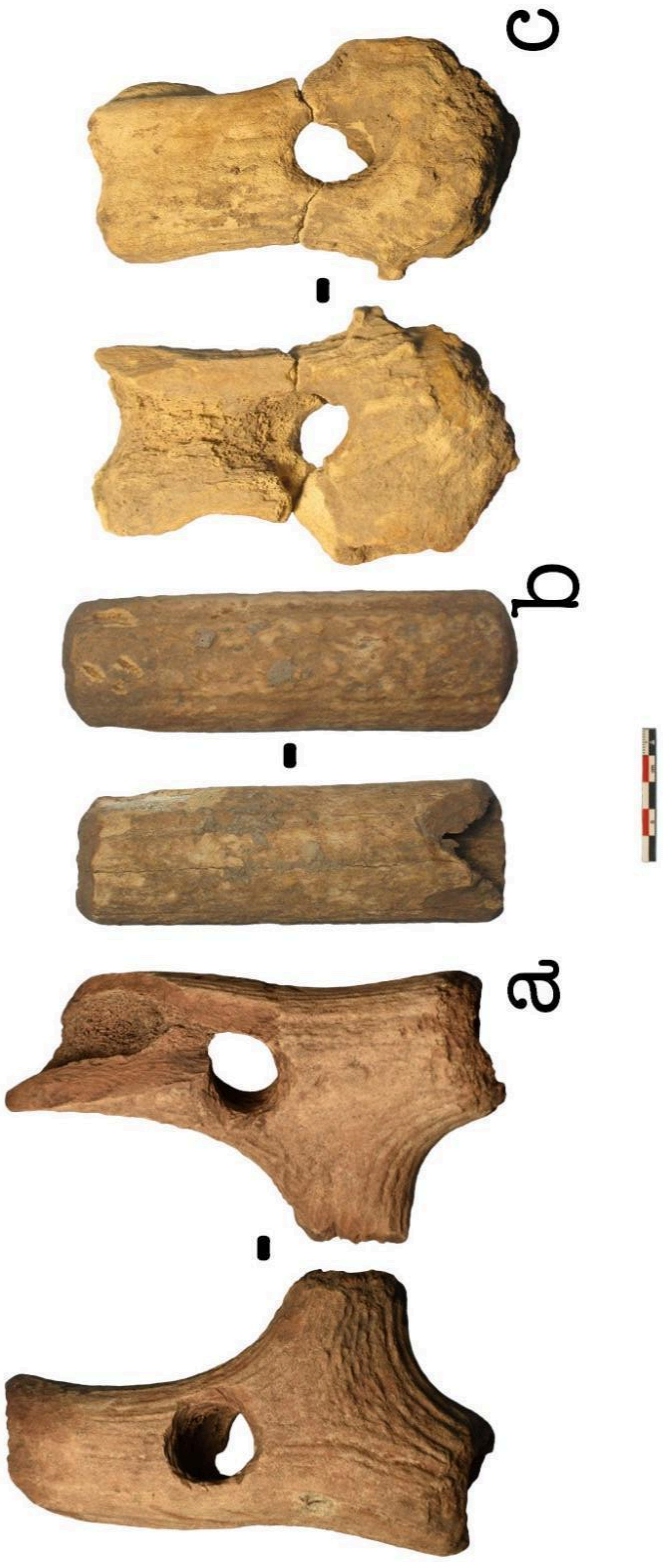

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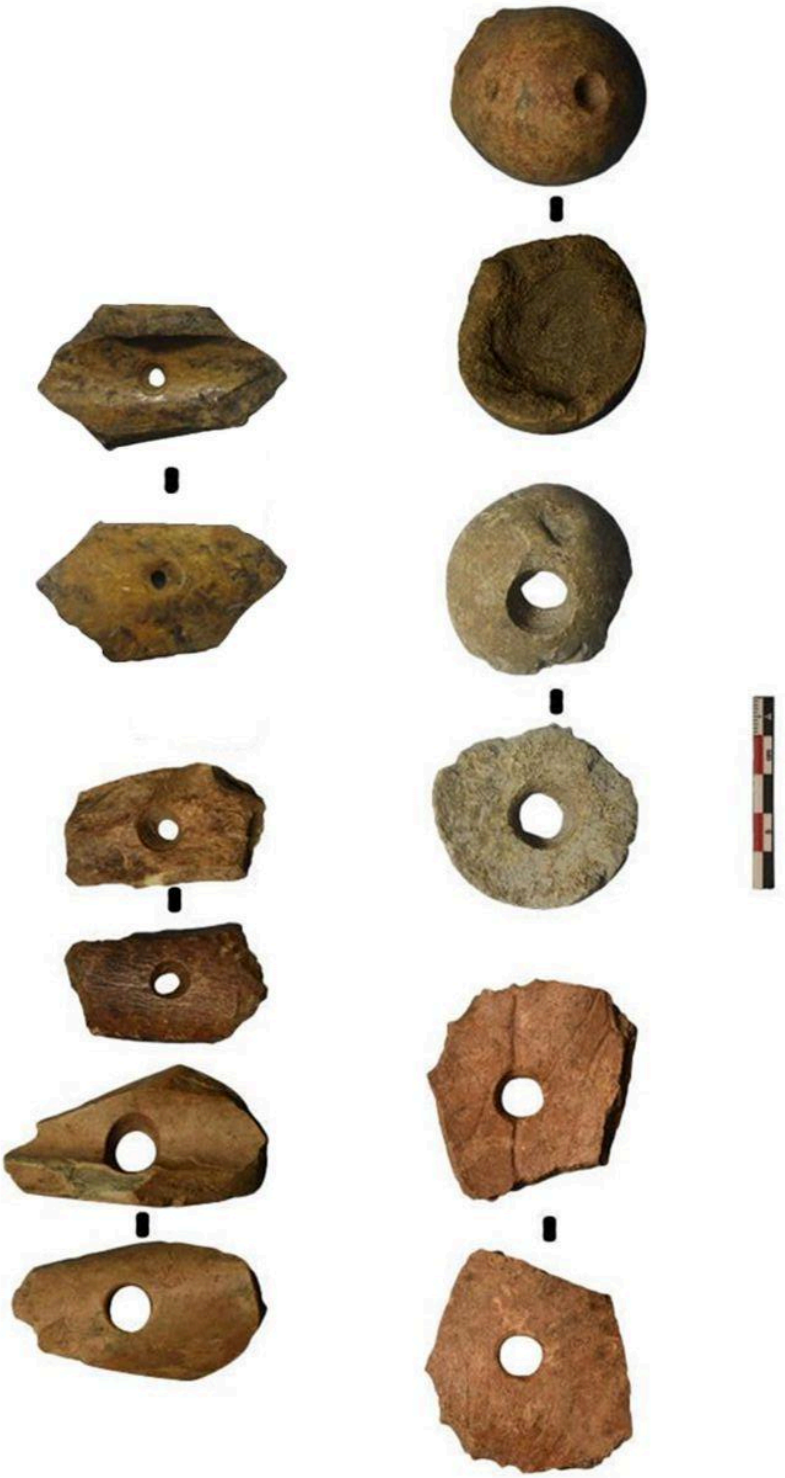

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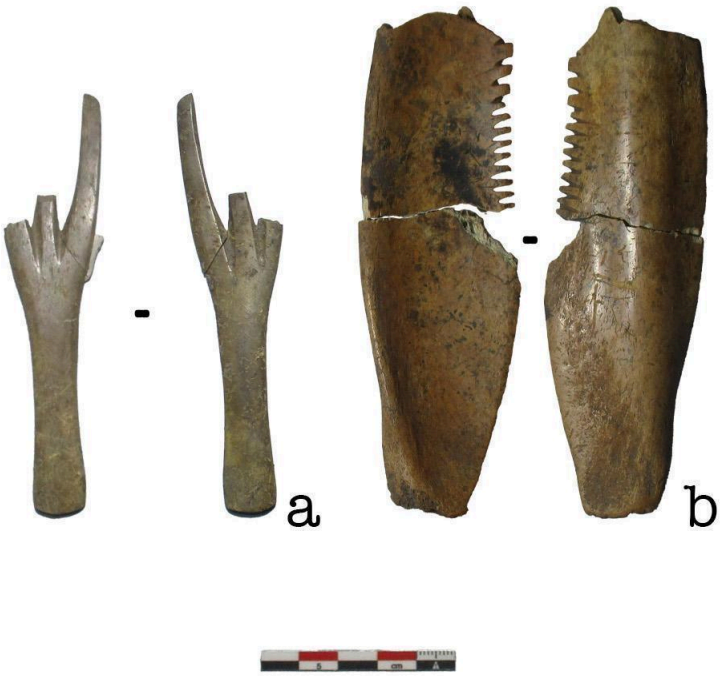

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Artifact				
	Frequency	Percent	Valid Percent	Cumulative Percent
tool	1097	95,6	95,6	95,6
ornament	4	,3	,3	96,0
waste	39	3,4	3,4	99,4
unidentified object	7	,6	,6	100,0
Total	1147	100,0	100,0	

Table 1 Percentage of artefacts in the settlement of Revenia

Categorization of Artifact					
		Frequency	Percent	Valid Percent	Cumulative Percent
	needles	3	,3	,3	,3
	spatulas	117	10,2	10,2	10,5
	sleeve	1	,1	,1	10,6
	fishook	3	,3	,3	10,8
	axe	1	,1	,1	10,9
	awls	215	18,7	18,8	29,7
	arrow	3	,3	,3	30,0
	part	1	,1	,1	30,1
	unidentified object	473	41,2	41,4	71,5
	waste	37	3,2	3,2	74,7
	perforators	61	5,3	5,3	80,1
	double points	5	,4	,4	80,5
	sharp tool	26	2,3	2,3	82,8
	scraper	4	,3	,3	83,1
	chisel	192	16,7	16,8	99,9
	polisher	1	,1	,1	100,0
	Total	1143	99,7	100,0	
Missing	ornament	4	,3		
Total		1147	100,0		

Table 2 Revenia - Category of artifact (Typology)

The distribution of bone objects in space					
		Frequency	Percent	Valid Percent	Cumulative Percent
		2	,2	,2	,2
	Unidentified Fill	220	19,2	19,2	19,4
	surface	46	4,0	4,0	23,4
	pit1	1	,1	,1	23,5
	pit2	43	3,7	3,7	27,2
	pit3	7	,6	,6	27,8
	pit4	13	1,1	1,1	28,9
	pit5	37	3,2	3,2	32,2
	pit6	24	2,1	2,1	34,3
	pit7	64	5,6	5,6	39,8
	pit8	2	,2	,2	40,0
	pit9	1	,1	,1	40,1
	pit cleaning	15	1,3	1,3	41,4
	pit10	5	,4	,4	41,8
	pit11	16	1,4	1,4	43,2
	pit13	1	,1	,1	43,3
	pit17	1	,1	,1	43,4
	pit18	80	7,0	7,0	50,4
	pit19	2	,2	,2	50,6
	pit20	25	2,2	2,2	52,7
	pit21	3	,3	,3	53,0
	pit23	2	,2	,2	53,2
	E. Balk	40	3,5	3,5	56,7
	pit24	48	4,2	4,2	60,9
	pit25	12	1,0	1,0	61,9
	pit26	12	1,0	1,0	62,9
	pit27	4	,3	,3	63,3
	pit28	4	,3	,3	63,6
	pit29	14	1,2	1,2	64,9
	pit30	1	,1	,1	65,0
	pit32	4	,3	,3	65,3
	pit33	7	,6	,6	65,9
	pit34	13	1,1	1,1	67,0
	N. Balk	64	5,6	5,6	72,6
	pit36	5	,4	,4	73,1
	pit37	1	,1	,1	73,1
	pit39	9	,8	,8	73,9
	pit40	3	,3	,3	74,2
	pit41	13	1,1	1,1	75,3
	pit42	35	3,1	3,1	78,4
	pit43	10	,9	,9	79,3
	pit44	22	1,9	1,9	81,2
	pit45	9	,8	,8	82,0
	pit46	12	1,0	1,0	83,0
	N. Area	2	,2	,2	83,2
	pit47	13	1,1	1,1	84,3
	pit48	8	,7	,7	85,0
	pit49	5	,4	,4	85,4
	pit50	8	,7	,7	86,1
	pit51	38	3,3	3,3	89,5
	pit53	5	,4	,4	89,9
	pit56	9	,8	,8	90,7
	pit58	6	,5	,5	91,2
	pit59	2	,2	,2	91,4
	pit62	1	,1	,1	91,5
	NW area	1	,1	,1	91,5
	pit66	3	,3	,3	91,8
	pit67	6	,5	,5	92,3

	pit69	1	,1	,1	92,4
	pit71	2	,2	,2	92,6
	pit72	6	,5	,5	93,1
	pit74	3	,3	,3	93,4
	pit78	1	,1	,1	93,5
	pit84	1	,1	,1	93,5
	pit1b	1	,1	,1	93,6
	pit23a	2	,2	,2	93,8
	SE. Area	3	,3	,3	94,1
	pit24a	4	,3	,3	94,4
	pit29a	1	,1	,1	94,5
	pit29b	1	,1	,1	94,6
	pit29e	1	,1	,1	94,7
	pit29g	8	,7	,7	95,4
	pit46b	1	,1	,1	95,5
	pit46d	1	,1	,1	95,6
	pit48a	2	,2	,2	95,7
	SW. Area	1	,1	,1	95,8
	48b	1	,1	,1	95,9
	48g	9	,8	,8	96,7
	pit5b	17	1,5	1,5	98,2
	pit5g	9	,8	,8	99,0
	pit81	2	,2	,2	99,1
	ditch 1α+1β	3	,3	,3	99,4
	ταφές	1	,1	,1	99,5
	Wall cleanouts	1	,1	,1	99,6
	cobble	2	,2	,2	99,7
	pit15	1	,1	,1	99,8
	Central Area	1	,1	,1	99,9
	pit76	1	,1	,1	100,0
	Total	1147	100,0	100,0	

Table 3 Revenia - Spatial distribution of bone artifacts

Erosion degree							
		Erosion					Total
		high	medium	low	none	unrecordable	
tool	needls	0	1	2	0	0	3
	spatula	16	60	41	0	0	117
	sleeve	0	0	1	0	0	1
	fishook	0	2	1	0	0	3
	axe	0	1	0	0	0	1
	awls	20	93	101	0	1	215
	arrow	0	1	2	0	0	3
	part	0	1	0	0	0	1
	unidentified	49	184	231	4	5	473
	waste	5	14	18	0	0	37
	perforators	7	34	20	0	0	61
	double points	0	1	4	0	0	5
	sharp tool	5	10	11	0	0	26
	scraper	1	2	1	0	0	4
	chisel	10	65	116	0	1	192
	polisher	0	1	0	0	0	1
Total		113	470	549	4	7	1143

Table 4 Revenia - Erosion degree of tools

Table 5 Revenia - Raw Material (General Bone Category)

Tool - General bone category									
									Total
			flat bone	long bone	tooth	antler	fishbone	unidentified	
tool	needles	Count	0	3	0	0	0	0	3
		% within tol	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,0%	0,4%	0,0%	0,0%	0,0%	0,0%	0,3%
		% of Total	0,0%	0,3%	0,0%	0,0%	0,0%	0,0%	0,3%
	spatula	Count	112	1	0	0	0	4	117
		% within tol	95,7%	0,9%	0,0%	0,0%	0,0%	3,4%	100,0%
		% within gb	34,5%	0,1%	0,0%	0,0%	0,0%	6,2%	10,2%
		% of Total	9,8%	0,1%	0,0%	0,0%	0,0%	0,3%	10,2%
	sleeve	Count	0	1	0	0	0	0	1
		% within tol	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,0%	0,1%	0,0%	0,0%	0,0%	0,0%	0,1%
		% of Total	0,0%	0,1%	0,0%	0,0%	0,0%	0,0%	0,1%
	fishook	Count	3	0	0	0	0	0	3
		% within tol	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,9%	0,0%	0,0%	0,0%	0,0%	0,0%	0,3%
		% of Total	0,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,3%
	axe	Count	0	1	0	0	0	0	1
		% within tol	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,0%	0,1%	0,0%	0,0%	0,0%	0,0%	0,1%
		% of Total	0,0%	0,1%	0,0%	0,0%	0,0%	0,0%	0,1%
	awls	Count	7	190	0	0	1	17	215
		% within tol	3,3%	88,4%	0,0%	0,0%	0,5%	7,9%	100,0%
		% within gb	2,2%	25,5%	0,0%	0,0%	100,0%	26,2%	18,8%
		% of Total	0,6%	16,6%	0,0%	0,0%	0,1%	1,5%	18,8%
	arrow	Count	0	2	0	0	0	1	3
		% within tol	0,0%	66,7%	0,0%	0,0%	0,0%	33,3%	100,0%
		% within gb	0,0%	0,3%	0,0%	0,0%	0,0%	1,5%	0,3%
		% of Total	0,0%	0,2%	0,0%	0,0%	0,0%	0,1%	0,3%
	part	Count	1	0	0	0	0	0	1
		% within tol	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
		% of Total	0,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
	unidentified	Count	150	279	5	2	0	37	473
		% within	31,7%	59,0%	1,1%	0,4%	0,0%	7,8%	100,0

		tol						%
		% within gb	46,2%	37,4%	100,0%	100,0%	0,0%	56,9%	41,4%
		% of Total	13,1%	24,4%	0,4%	0,2%	0,0%	3,2%	41,4%
	waste	Count	19	17	0	0	0	1	37
		% within tol	51,4%	45,9%	0,0%	0,0%	0,0%	2,7%	100,0%
		% within gb	5,8%	2,3%	0,0%	0,0%	0,0%	1,5%	3,2%
		% of Total	1,7%	1,5%	0,0%	0,0%	0,0%	0,1%	3,2%
	perforators	Count	8	52	0	0	0	1	61
		% within tol	13,1%	85,2%	0,0%	0,0%	0,0%	1,6%	100,0%
		% within gb	2,5%	7,0%	0,0%	0,0%	0,0%	1,5%	5,3%
		% of Total	0,7%	4,5%	0,0%	0,0%	0,0%	0,1%	5,3%
	double points	Count	0	5	0	0	0	0	5
		% within tol	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,0%	0,7%	0,0%	0,0%	0,0%	0,0%	0,4%
		% of Total	0,0%	0,4%	0,0%	0,0%	0,0%	0,0%	0,4%
	sharp tool	Count	17	9	0	0	0	0	26
		% within tol	65,4%	34,6%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	5,2%	1,2%	0,0%	0,0%	0,0%	0,0%	2,3%
		% of Total	1,5%	0,8%	0,0%	0,0%	0,0%	0,0%	2,3%
	scraper	Count	1	3	0	0	0	0	4
		% within tol	25,0%	75,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,3%	0,4%	0,0%	0,0%	0,0%	0,0%	0,3%
		% of Total	0,1%	0,3%	0,0%	0,0%	0,0%	0,0%	0,3%
	chisel	Count	6	182	0	0	0	4	192
		% within tol	3,1%	94,8%	0,0%	0,0%	0,0%	2,1%	100,0%
		% within gb	1,8%	24,4%	0,0%	0,0%	0,0%	6,2%	16,8%
		% of Total	0,5%	15,9%	0,0%	0,0%	0,0%	0,3%	16,8%
	polisher	Count	1	0	0	0	0	0	1
		% within tol	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within gb	0,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
		% of Total	0,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
Total		Count	325	745	5	2	1	65	1143
		% within tol	28,4%	65,2%	0,4%	0,2%	0,1%	5,7%	100,0%
		% within gb	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	28,4%	65,2%	0,4%	0,2%	0,1%	5,7%	100,0%

	Specific Bone Category																
	needls	**spatula**	**handle**	**fishook**	**axe**	**awls**	**arrow**	**part**	**unidentified**	**waste**	**perforators**	**double points**	**sharp tool**	**scraper**	**chisel**	**polisher**	**Total**
mandible	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
long bone	3	2	0	0	1	134	2	0	156	5	34	4	7	0	68	0	416
rib	0	109	0	3	0	6	0	1	145	19	8	0	17	1	6	1	316
scapula	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
antler	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
tooth	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
unidentified	0	5	0	0	0	18	1	0	42	1	1	0	0	0	4	0	72
blank	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1

tibia	0	0	1	0	0	13	0	0	82	3	12	1	0	2	94	0	208
tibia/mp	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
ulna	0	0	0	0	0	2	0	0	2	1	3	0	2	0	0	0	10
femur	0	0	0	0	0	2	0	0	5	1	0	0	0	1	4	0	13
humerus	0	0	0	0	0	0	0	0	2	0	1	0	0	0	1	0	4
radius	0	0	0	0	0	1	0	0	8	3	0	0	0	0	7	0	19
metapodial	0	0	0	0	0	36	0	0	21	4	2	0	0	0	7	0	70
fibula	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2
Total	3	117	1	3	1	215	3	1	473	37	61	5	26	4	192	1	1143

Table 6 Revenia - Raw Material (Specific Bone Category)

Animal size						
						Total
		small size	sheep/goat size	cattle size	unidentifed	
Tool	needles	0	2	0	1	3
	spatula	0	5	111	1	117
	sleeve	0	1	0	0	1
	fishook	0	1	2	0	3
	axe	0	0	1	0	1
	awls	6	165	9	35	215
	arrow	0	1	1	1	3
	part	0	0	1	0	1
	unidentified object	11	245	173	44	473
	waste	1	13	22	1	37
	perforators	1	35	24	1	61
	double points	0	3	1	1	5
	sharp tool	0	6	17	3	26
	scraper	0	1	3	0	4
	chisel	0	163	19	10	192
	polisher	0	0	1	0	1
Total		19	641	385	98	1143

Table 7 Revenia - Raw Material (animal size that can be identified in the material)

Animal Family																		
		needles	spatula	handle	fishook	axe	awls	arrow	part	unkn	blank/ byproduct	perforators	double points	sharp tool/unkn	scraper	chisel	polisher	Total
sheep /goat	Count	1	1	1	0	0	125	0	0	196	12	28	3	3	1	141	0	512
	% within AF	0,2%	0,2%	0,2%	0,0%	0,0%	24,4%	0,0%	0,0%	38,3%	2,3%	5,5%	0,6%	0,6%	0,2%	27,5%	0,0%	100,0%
	% within tol	33,3%	0,9%	100,0%	0,0%	0,0%	58,1%	0,0%	0,0%	41,4%	32,4%	45,9%	60,0%	11,5%	25,0%	73,4%	0,0%	44,8%
goat	Count	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	4
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	25,0%	0,0%	0,0%	0,0%	0,0%	0,0%	75,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	1,6%	0,0%	0,3%
sheep	Count	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	50,0%	0,0%	0,0%	0,0%	0,0%	0,0%	50,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,2%
fish	Count	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%

hare	**Count**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
fox	**Count**	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	50,0%	0,0%	0,0%	0,0%	0,0%	50,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,0%	0,0%	0,0%	1,6%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%
dog	**Count**	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	50,0%	0,0%	0,0%	50,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%
carnivore	**Count**	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	50,0%	0,0%	0,0%	50,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%
bird	**Count**	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	66,7%	33,3%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,4%	2,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,3%
unidentified	**Count**	2	116	0	3	1	84	3	1	253	21	29	2	23	1	39	1	579

	% within AF	0,3%	20,0%	0,0%	0,5%	0,2%	14,5%	0,5%	0,2%	43,7%	3,6%	5,0%	0,3%	4,0%	0,2%	6,7%	0,2%	100,0%
	% within tol	66,7%	99,1%	0,0%	100,0%	100,0%	39,1%	100,0%	100,0%	53,5%	56,8%	47,5%	40,0%	88,5%	25,0%	20,3%	100,0%	50,7%
Cattle	Count	0	0	0	0	0	0	0	0	5	3	1	0	0	1	1	0	11
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	45,5%	27,3%	9,1%	0,0%	0,0%	9,1%	9,1%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1,1%	8,1%	1,6%	0,0%	0,0%	25,0%	0,5%	0,0%	1,0%
wild cattle	Count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,1%
pig	Count	0	0	0	0	0	2	0	0	6	0	1	0	0	1	3	0	13
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	15,4%	0,0%	0,0%	46,2%	0,0%	7,7%	0,0%	0,0%	7,7%	23,1%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,9%	0,0%	0,0%	1,3%	0,0%	1,6%	0,0%	0,0%	25,0%	1,6%	0,0%	1,1%
boar	Count	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
deer	Count	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%

	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%
red/fallow deer	Count	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,4%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%
roe deer	Count	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	3
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	33,3%	0,0%	33,3%	0,0%	0,0%	0,0%	33,3%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	1,6%	0,0%	0,0%	0,0%	0,5%	0,0%	0,3%
goat/roe deer	Count	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	3
	% within AF	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	33,3%	0,0%	0,0%	0,0%	0,0%	0,0%	66,7%	0,0%	100,0%
	% within tol	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,0%	0,0%	0,0%	1,0%	0,0%	0,3%
Total	Count	3	117	1	3	1	215	3	1	473	37	61	5	26	4	192	1	1143
	% within AF	0,3%	10,2%	0,1%	0,3%	0,1%	18,8%	0,3%	0,1%	41,4%	3,2%	5,3%	0,4%	2,3%	0,3%	16,8%	0,1%	100,0%
	% within tol	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Table 8 Revenia - Raw Material (Animal Family that can be identified in the material)

Tool preservation									
		intact	shaft	proximal part	unidentified	active end/shaft/proximal part	active end/shaft	shaft/proximal part	
Tool	needles	0	0	0	0	3	0	0	3
	spatula	41	13	2	0	15	39	7	117
	handle	1	0	0	0	0	0	0	1
	fishook	1	0	0	0	2	0	0	3
	axe	0	0	0	0	0	1	0	1
	awls	119	6	0	1	16	64	8	214
	arrow	0	0	0	0	3	0	0	3
	part	1	0	0	0	0	0	0	1
	unidentified	17	334	49	6	5	11	50	472
	waste	14	0	0	0	0	0	0	14
	perforators	30	0	0	0	5	26	0	61
	double points	5	0	0	0	0	0	0	5
	sharp tool	15	1	0	0	2	7	1	26
	scraper	2	0	0	0	0	2	0	4
	chisel	73	5	0	0	20	90	4	192
	polisher	0	1	0	0	0	0	0	1
Total		311	367	51	7	71	241	70	1118

Table 9 Revenia - Tool preservation

Processing Techniques																	
	Tool																Total
	needles	spatula	sleeve	fishook	axe	awls	arrow	part	unidentified object	waste	perforators	double points	sharp tool	scraper	chisel	polisher	
abrasion	0	0	0	0	0	15	0	0	68	5	4	0	1	0	6	0	99
abrasion-scraping-transverse	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	4
abrasion-transverse	0	1	0	0	0	2	0	0	6	1	1	0	1	0	2	0	14
grinding-sawing-scraping	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	5
grinding-scraping	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	3
grinding-scraping-transverse	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	3
perforation-sawing-scraping	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
sawing on longitudinal axis	0	1	0	0	0	5	0	0	9	9	2	0	1	0	3	0	30
sawing-scraping	0	7	0	0	1	9	0	0	18	2	3	0	5	0	1	0	46
sawing-transverse	0	0	0	0	0	0	0	1	1	5	0	0	0	0	0	0	7
abrasion-grinding	0	1	0	0	0	5	1	0	39	0	2	0	0	0	9	0	57
scraping	0	0	0	0	0	3	0	0	21	3	3	0	0	0	1	0	31
trasverse cutting	0	0	0	0	0	0	0	0	8	6	0	0	0	0	0	0	14
splinders	0	0	0	0	0	23	0	0	7	2	12	0	0	2	8	0	54
unidentified	0	1	0	0	0	0	0	0	13	0	0	0	2	1	1	0	18
abrasion-sawing-scraping	2	83	0	1	0	114	2	0	158	2	22	5	11	1	101	0	502
abrasion-grinding-sawing-scraping	0	0	0	0	0	3	0	0	3	0	0	0	1	0	4	0	11
abrasion-grinding-scraping-transverse	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1

	abrasion-perforation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	abrasion-perforation-sawing-scraping	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
	abrasion-perforation-sawing-scraping	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	abrasion-sawing	0	9	0	1	0	34	0	0	102	1	10	0	3	0	53	1	214
	abrasion-sawing-scraping-transverse	0	9	0	0	0	0	0	0	10	1	0	0	0	0	2	0	22
Total		3	117	1	3	1	215	3	1	473	37	61	5	26	4	192	1	1143

Table 10 Revenia - processing techniques recognised on the tools

Tool - Distribution																	
	sleeve	needles	spatula	fishook	axe	awls	arrow	part	uniden tified	waste	perfora tors	double points	sharp tool	scraper	chisel	polishe r	Total
	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
unidentifie d layer	0	1	26	1	0	46	1	0	88	8	12	0	4	0	32	0	219
surface	0	0	3	0	1	4	0	0	20	3	1	1	0	1	12	0	46
pit1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
pit 2	0	0	3	0	0	12	0	0	17	0	2	0	2	0	7	0	43
pit 3	0	0	2	0	0	1	0	0	2	0	0	0	1	0	1	0	7
pit 4	0	0	0	0	0	1	0	0	5	1	0	0	2	0	4	0	13
pit 5	0	0	4	0	0	10	0	0	8	2	6	0	0	0	7	0	37
pit 6	0	0	5	0	0	5	0	0	8	1	1	1	0	0	3	0	24
pit 7	1	0	13	2	0	9	0	0	27	0	4	0	1	1	6	0	64
pit 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
pit 9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
pit cleaning	0	0	2	0	0	3	0	0	5	0	2	0	0	0	3	0	15
pit 10	0	0	0	0	0	2	0	0	0	0	2	0	1	0	0	0	5
pit 11	0	0	0	0	0	3	0	0	5	2	0	0	2	0	4	0	16
pit 13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
pit 17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 18	0	0	14	0	0	17	0	1	32	3	2	0	1	0	9	1	80
pit 19	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
pit 20	0	0	1	0	0	2	0	0	20	0	2	0	0	0	0	0	25
pit 21	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	3
pit 23	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2

E. Balk	0	0	3	0	0	14	0	0	11	3	1	0	0	0	8	0	**40**
pit 24	0	0	6	0	0	4	1	0	15	2	3	1	2	2	12	0	**48**
pit 25	0	0	1	0	0	2	0	0	8	0	1	0	0	0	0	0	**12**
pit 26	0	0	1	0	0	0	0	0	6	1	1	0	1	0	2	0	**12**
pit 27	0	0	2	0	0	0	0	0	1	0	0	0	0	0	1	0	4
pit 28	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	4
pit 29	0	0	2	0	0	5	0	0	3	1	1	1	0	0	1	0	**14**
pit 30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
pit 32	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0	4
pit 33	0	0	1	0	0	0	0	0	4	1	0	0	0	0	1	0	7
pit 34	0	0	0	0	0	0	1	0	8	1	0	0	0	0	3	0	13
N. Balk	0	1	5	0	0	19	0	0	22	3	3	0	3	0	7	0	**63**
pit 36	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	0	5
pit 37	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 39	0	0	1	0	0	2	0	0	2	0	2	0	0	0	2	0	9
pit 40	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
pit 41	0	0	2	0	0	2	0	0	8	0	1	0	0	0	0	0	13
pit 42	0	0	1	0	0	11	0	0	13	0	1	0	0	0	8	0	**34**
pit 43	0	0	0	0	0	2	0	0	4	0	1	0	0	0	3	0	10
pit 44	0	0	2	0	0	2	0	0	14	0	0	0	1	0	3	0	22
pit 45	0	0	1	0	0	1	0	0	4	0	1	0	1	0	1	0	9
pit 46	0	0	0	0	0	0	0	0	6	1	0	0	1	0	4	0	12
N. Area	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
pit 47	0	0	1	0	0	1	0	0	6	0	0	0	1	0	4	0	13
pit 48	0	0	0	0	0	1	0	0	6	0	0	0	0	0	1	0	8

pit 49	0	0	0	0	0	0	0	0	2	0	1	0	1	0	1	0	5
pit 50	0	0	1	0	0	0	0	0	7	0	0	0	0	0	0	0	8
pit 51	0	0	2	0	0	6	0	0	17	1	2	0	0	0	10	0	**38**
pit 53	0	0	1	0	0	1	0	0	2	0	0	0	0	0	1	0	5
pit 56	0	0	0	0	0	1	0	0	4	1	0	0	0	0	3	0	9
pit 58	0	0	0	0	0	1	0	0	2	0	0	0	0	0	3	0	6
pit 59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
pit 62	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
NW. Area	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
pit 66	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	3
pit 67	0	0	2	0	0	1	0	0	3	0	0	0	0	0	0	0	6
pit 69	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 71	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2
pit 72	0	0	0	0	0	1	0	0	3	0	0	1	1	0	0	0	6
pit 74	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	3
pit 78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
pit 84	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit1b	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 23a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
SE. Area	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
pit 24a	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
pit 29a	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 29b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
pit 29e	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
pit 29g	0	1	0	0	0	2	0	0	2	1	0	0	0	0	2	0	8

pit 46b	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
pit 46d	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 48a	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
SW. Area	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
pit 48b	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
pit 48g	0	0	0	0	0	1	0	0	7	0	1	0	0	0	0	0	9
pit 5b	0	0	2	0	0	8	0	0	4	0	0	0	0	0	2	0	**16**
pit 5g	0	0	2	0	0	1	0	0	3	0	1	0	0	0	2	0	9
pit 81	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
ditch 1α+1β	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	3
burials	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Wall Cleanouts	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
cobble yard	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
pit 15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Central Area	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
pit 76	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	1	3	117	3	1	215	3	1	473	37	61	5	26	4	192	1	1143

Table 11 Revenia – Spatial distribution of tools (category of artefacts)

Tool					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	perforators	31	8,2	8,6	8,6
	harpoon	4	1,1	1,1	9,7
	sleeve	7	1,9	1,9	11,6
	awls	115	30,4	31,8	43,4
	digging tool	4	1,1	1,1	44,5
	spatula	10	2,6	2,8	47,2
	comb	9	2,4	2,5	49,7
	spatula, polisher	2	0,5	0,6	50,3
	fishhook	1	0,3	0,3	50,6
	object	92	24,3	25,4	76,0
	sharp tool	10	2,6	2,8	78,7
	chisel	34	9,0	9,4	88,1
	dagger	9	2,4	2,5	90,6
	polisher	4	1,1	1,1	91,7
	needle	30	7,9	8,3	100,0
	Total	362	95,8	100,0	
Missing	blank	16	4,2		
Total		378	100,0		

Table 12 Paliambela - Category of artefacts

Artifact					
		Frequency	Percent	Valid Percent	Cumulative Percent
	tool	358	94,7	94,7	94,7
	ornament	17	4,5	4,5	99,2
	unidentified artifact	3	,8	,8	100,0
	Total	378	100,0	100,0	

Table 13 Paliambela - Percentage of artefacts

The distribution of bone tools														
		surface	uniden tified	house 20	House 23	CY H25	close space	cobble yard	ditch	small ditch	open space	pit	possibl e CS	
tool	perforators	2	15	2	0	1	0	1	6	0	9	4	0	40
	harpoon	0	2	0	0	0	0	0	1	0	1	0	0	4
	handle	0	3	0	0	0	1	0	0	0	0	0	0	4
	awls	2	45	3	3	9	9	5	19	3	27	7	2	134
	digging tool	0	2	0	0	0	0	0	1	0	1	0	0	4
	spatula	0	2	0	0	0	1	1	1	0	3	2	0	10
	comb	0	4	0	1	0	0	0	1	0	3	0	0	9
	spatula, polisher	0	1	0	0	0	0	0	0	0	0	1	0	2
	fishhook	0	0	0	0	0	0	0	0	0	1	0	0	1
	unidentified	1	34	2	0	4	3	4	12	0	19	11	2	92
	sharp tool	0	4	0	0	0	0	0	2	0	2	2	0	10
	chisel	1	15	0	0	1	0	0	6	1	7	3	0	34
	dagger	0	4	0	0	2	0	0	0	0	0	3	0	9
	polisher	0	1	0	0	1	0	0	2	0	0	0	0	4
	needle	0	0	0	0	0	0	0	0	0	1	0	0	1
	ring	0	2	0	0	0	0	0	0	0	1	0	0	3
Total		6	134	7	4	18	14	11	51	4	75	33	4	361

Table 14 Paliambela - Spatial distribution of bone artefacts

Tool - Preservation					
					Total
		intact	almost intact	fragment	
tool	perforators	3	4	33	40
	harpoon	0	3	1	4
	sleeve	0	3	1	4
	awls	17	18	99	134
	digging tool	0	1	3	4
	spatula	1	3	6	10
	comb	0	7	2	9
	spatula, polisher	0	0	2	2
	fishhook	1	0	0	1
	unidentified artifact	1	2	89	92
	sharp tool	1	2	7	10
	chisel	2	11	21	34
	dagger	0	1	8	9
	polisher	0	1	3	4
	needle	1	0	0	1
	ring	0	1	2	3
Total		27	57	277	361

Table 15 Paliambela - Tool preservation

Object erosion degree							
							Total
		Unrecognizable	High	Low	Medium	None	
tool	perforators	3	0	5	28	4	40
	harpoon	0	0	2	2	0	4
	sleeve	0	2	0	2	0	4
	awls	18	0	7	106	3	134
	digging tool	0	2	1	1	0	4
	spatula	1	0	1	8	0	10
	comb	1	0	2	6	0	9
	spatula, polisher	0	0	0	2	0	2
	fishhook	0	0	0	1	0	1
	unidentified artifact	9	1	4	76	2	92
	sharp tool	0	1	0	9	0	10
	chisel	1	3	5	23	2	34
	dagger	2	0	1	6	0	9
	polisher	0	0	0	4	0	4
	needle	0	0	0	1	0	1
	ring	0	0	0	3	0	3
		35	9	28	278	11	361

Table 16 Paliambela - Erosion degree of the tools

Salvage tool surface										
		blank	shaft	shaft/active end	shaft/active end/proximal part	shaft/proximal/part	active end	intact	proximal part	
tool	perforators	0	7	17	1	2	9	4	0	40
	harpoon	0	0	4	0	0	0	0	0	4
	sleeve	0	1	0	1	2	0	0	0	4
	awls	1	12	59	4	12	27	18	1	134
	digging tool	0	0	0	0	1	2	1	0	4
	spatula	0	1	4	1	2	1	1	0	10
	comb	1	0	2	0	0	0	6	0	9
	spatula, polisher	0	0	1	0	0	1	0	0	2
	fishhook	0	0	0	0	0	0	1	0	1
	unidentified artifact	0	57	2	0	13	1	3	16	92
	sharp tool	0	0	6	0	0	3	1	0	10
	chisel	0	3	9	2	1	14	5	0	34
	dagger	0	1	4	0	0	4	0	0	9
	polisher	0	1	2	1	0	0	0	0	4
	needle	0	0	0	0	0	0	1	0	1
	ring	0	0	0	2	0	0	1	0	3
Total		2	83	110	12	33	62	42	17	361

Table 17 Paliambela - Tool preservation

Tool - Processing techniques														
		unknown	longitudinal section, scraping, abrasion	longitudinal section, abrasion	scraping, abrasion	abrasion	cross section, longitudinal section	cross section, longitudinal section, rubbing, scraping,	cross section, longitudinal section, rubbing	cross section, abrasion, scraping	cross section, abrasion	longitudinal section	longitudinal section, scraping,	
tool	perforators	0	1	23	1	6	0	0	0	0	1	8	0	40
	harpoon	0	0	0	0	3	0	0	0	0	0	1	0	4
	sleeve	0	0	0	0	3	0	0	0	0	1	0	0	4
	awls	2	1	84	2	21	0	0	1	0	0	23	0	134
	digging tool	1	0	0	0	2	0	0	0	0	0	1	0	4
	spatula	0	0	7	0	0	1	0	0	0	1	1	0	10
	comb	0	1	6	0	0	0	1	1	0	0	0	0	9
	spatula, polisher	0	0	2	0	0	0	0	0	0	0	0	0	2
	fishhook	0	0	0	0	0	0	0	0	0	1	0	0	1
	unidentified artifact	2	1	48	0	23	1	0	2	1	1	13	0	92
	sharp tool	0	0	5	0	3	0	0	0	0	0	2	0	10
	chisel	0	2	27	1	2	0	0	0	0	0	1	1	34
	dagger	0	0	7	0	0	0	0	1	0	1	0	0	9
	polisher	0	0	0	1	1	0	0	0	0	1	1	0	4
	needle	0	0	1	0	0	0	0	0	0	0	0	0	1
	ring	0	0	0	0	2	0	0	0	0	1	0	0	3
Total		5	6	210	5	66	2	1	5	1	8	51	1	361

Table 18 Paliambela - Processing Techniques recognised on the tools

Raw Material (Specific Bone Category)																		
		unknown	femur	radius	ulna	humerus	spine	fishbone	scapula	metacarpal	metatarsal	tooth	antler	tibia	long bone /unknown	metapodium	rib	
tool	perforators	1	0	0	0	0	0	0	0	0	0	0	1	2	19	1	2	23
	harpoon	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
	sleeve	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0	4
	awls	1	0	2	3	1	0	1	0	9	15	0	0	4	48	12	9	105
	digging tool	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	4
	spatula	0	0	0	0	0	0	0	5	0	0	0	0	2	0	0	2	9
	comb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9
	spatula, polisher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
	fishhook	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	unidentified artifact	6	0	0	1	0	0	0	1	5	6	1	0	10	22	3	21	76
	sharp tool	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	6	9
	chisel	2	1	1	0	0	0	0	0	1	2	0	2	15	7	0	1	32
	dagger	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	6	9
	polisher	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	4
	needle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	ring	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3
Total		11	2	3	5	1	1	1	7	15	23	1	13	36	98	16	61	295

Table 19 Paliambela - Raw Material (Specific Bone Category that can be identified in the material)

Raw Material (Animal Size)						
						Total
		unidentified	cattle size	sheep/goat size	small size	
tool	perforators	2	4	33	1	40
	harpoon	0	4	0	0	4
	sleeve	0	4	0	0	4
	awls	13	12	104	5	134
	digging tool	0	4	0	0	4
	spatula	0	6	4	0	10
	comb	0	9	0	0	9
	spatula, polisher	0	2	0	0	2
	fishhook	0	0	1	0	1
	unidentified artifact	6	30	53	3	92
	sharp tool	0	4	6	0	10
	chisel	0	9	25	0	34
	dagger	0	6	3	0	9
	polisher	0	3	1	0	4
	needle	0	0	1	0	1
	ring	1	2	0	0	3
Total		22	99	231	9	361

Table 20 Paliambela - Raw Material (Animal Size that can be identified in the material)

Animal Family														
		unknown	fish	row deer	red deer	goat	sheep/goat	sheep	bovid	deer	hare	dog	pig	
tool	perforators	22	0	0	0	0	15	0	2	1	0	0	0	40
	harpoon	0	0	0	0	0	0	0	0	4	0	0	0	4
	sleeve	0	0	0	0	0	0	0	2	2	0	0	0	4
	awls	66	1	0	1	3	50	5	3	3	1	0	1	134
	digging tool	0	0	0	4	0	0	0	0	0	0	0	0	4
	spatula	0	0	0	0	0	4	0	4	0	0	0	2	10
	comb	1	0	0	0	0	0	0	8	0	0	0	0	9
	spatula, polisher	2	0	0	0	0	0	0	0	0	0	0	0	2
	fishhook	0	0	0	0	0	1	0	0	0	0	0	0	1
	unidentified artifact	35	0	3	0	0	34	5	8	2	0	1	4	92
	sharp tool	4	0	0	0	1	5	0	0	0	0	0	0	10
	chisel	2	0	0	1	2	21	1	3	3	0	0	1	34
	dagger	6	0	0	0	0	1	0	2	0	0	0	0	9
	polisher	2	0	0	0	0	1	0	1	0	0	0	0	4
	needle	0	0	0	0	0	1	0	0	0	0	0	0	1
	ring	1	0	0	0	0	0	0	1	1	0	0	0	3
Total		141	1	3	6	6	133	11	34	16	1	1	8	361

Table 21 Paliambela - Raw Material (Animal Family that can be identified in the material)

Chronological distribution of bone tools										
		disturbed layers	EN	EN,MN	MN	MN,LN	LN	FN	UNIDENTIFIED	
tool	perforators	2	5	1	15	3	5	1	8	40
	harpoon	0	0	0	3	1	0	0	0	4
	sleeve	0	0	0	0	0	0	0	4	4
	awls	2	12	1	52	9	20	7	31	134
	digging tool	0	0	0	1	0	0	1	2	4
	spatula	0	3	0	2	1	1	0	3	10
	comb	0	0	0	2	1	0	0	6	9
	spatula, polisher	0	1	0	1	0	0	0	0	2
	fishhook	0	1	0	0	0	0	0	0	1
	unidentified artifact	1	10	2	28	11	9	4	27	92
	sharp tool	0	2	0	4	0	0	2	2	10
	chisel	1	3	0	8	4	7	1	10	34
	dagger	0	3	1	2	0	0	0	3	9
	polisher	0	0	0	1	0	0	2	1	4
	needle	0	0	0	0	0	1	0	0	1
	ring	0	0	0	1	0	1	0	1	3
Total		6	40	5	120	30	44	18	98	361

Table 22 Paliambela - Chronological distribution of bone tools

Chronological distribution of ornaments								
		Chronology						Total
		disturbed layers	EN	MN	LN	FN	UNIDENTIFIED	
ornaments	segregator	0	0	2	0	0	0	2
	earring	0	0	1	2	0	1	4
	pendant	0	2	1	1	0	4	8
	bead	1	0	1	0	1	3	6
Total		1	2	5	3	1	8	20

Table 23 Paliambela - Chronological Distribution of ornaments

Distribution of ornaments								
								Total
		surface	unidentified	CY H25	ditch	open space	pit	
ornaments	segregator	0	0	0	2	0	0	2
	earring	0	2	1	0	1	0	4
	pendant	0	5	0	0	1	2	8
	bead	1	2	0	2	1	0	6
Total		1	9	1	4	3	2	20

Table 24 Paliambela - Spatial Distribution of ornaments

Tool				
	Frequency	Percent	Valid Percent	Cumulative Percent
unidentified	7	31,8	31,8	31,8
pointed tool	1	4,5	4,5	36,4
awl	3	13,6	13,6	50,0
spatula	2	9,1	9,1	59,1
spoon	2	9,1	9,1	68,2
chisel	7	31,8	31,8	100,0
Total	22	100,0	100,0	

Table 25 Kato Agiannis - Tool Category (Typology)

Raw Material (Animal Size)					
					Total
		cattle size	sheep/goat size	unidentified	
tool	unidentified	5	1	1	7
	pointed tool	1	0	0	1
	awl	0	3	0	3
	spatula	2	0	0	2
	spoon	2	0	0	2
	chisel	4	2	1	7
Total		14	6	2	22

Table 26 Kato Agiannis - Raw Material (Animal Size that can be identified in the material)

Raw Material (Animal Family)								
								Total
		cattle	deer	sus	red deer	sheep/goat	unidentified	
tool	unidentified	0	1	1	3	1	1	7
	pointed tool	1	0	0	0	0	0	1
	awl	0	0	0	0	2	1	3
	spatula	0	0	0	0	0	2	2
	spoon	0	0	0	1	0	1	2
	chisel	0	0	0	2	1	4	7
Total		1	1	1	6	4	9	22

Table 27 Kato Agiannis - Raw Material (Animal Family that can be identified in the material)

Raw Material (Specific Bone Category)									
		antler	long bone/ unidentified	radius	rib	tibia	tooth	unidentified	
tool	unidentified	4	0	1	0	0	1	1	7
	pointed tool	0	0	0	0	1	0	0	1
	awl	0	3	0	0	0	0	0	3
	spatula	0	0	0	2	0	0	0	2
	spoon	1	1	0	0	0	0	0	2
	chisel	2	3	1	0	0	0	1	7
Total		7	7	2	2	1	1	2	22

Table 28 Kato Agiannis - Raw Material (Specific Bone Category)

Tool Preservation				
				Total
		intact	fragment	
tool	unidentified	0	7	7
	pointed tool	0	1	1
	awl	0	3	3
	spatula	0	2	2
	spoon	1	1	2
	chisel	0	7	7
Total		1	21	22

Table 29 Kato Agiannis - Tool Preservation

Tool Preservation							
							Total
		active end	active end-shaft	active end - shaft - proximal part	shaft	unidentified	
tool	unidentified	0	0	0	5	2	7
	pointed tool	1	0	0	0	0	1
	awl	2	1	0	0	0	3
	spatula	0	0	0	2	0	2
	spoon	0	0	1	1	0	2
	chisel	7	0	0	0	0	7
Total		10	1	1	8	2	22

Table 30 Kato Agiannis - Tool Preservation

Erosion Degree					
					Total
		high	medium	low	
tool	unidentified	3	3	1	7
	pointed tool	0	1	0	1
	awl	0	3	0	3
	spatula	0	2	0	2
	spoon	1	1	0	2
	chisel	3	4	0	7
Total		7	14	1	22

Table 31 Kato Agiannis - Erosion Degree

Tool - Processing techniques						
						Total
		sawing on longitudinal axis/abrasion	abrasion	sawing on longitudinal axis	unidentified	
tool	unidentified	2	1	1	3	7
	pointed tool	0	1	0	0	1
	awl	3	0	0	0	3
	spatula	2	0	0	0	2
	spoon	2	0	0	0	2
	chisel	6	1	0	0	7
Total		15	3	1	3	22

Table 32 Kato Agiannis - Processing Techniques that can be identified in the material

The distribution of bone tools						
						Total
		A balk/ditch 1	B balk/ditch 1	ditch 1	stone wall/ditch 1	
tool	unidentified	0	0	5	2	7
	pointed tool	0	0	1	0	1
	awl	1	0	2	0	3
	spatula	0	0	2	0	2
	spoon	0	1	1	0	2
	chisel	2	0	4	1	7
Total		3	1	15	3	22

Table 33 Kato Agiannis - Spatial distribution of bones tools

Artifact					
		Frequency	Percent	Valid Percent	Cumulative Percent
	unidentified	155	11,5	11,5	11,5
	chisel	119	8,8	8,8	20,3
	spatula	67	5,0	5,0	25,2
	sharp tool	18	1,3	1,3	26,6
	polisher	7	,5	,5	27,1
	polisher - chisel	2	,1	,1	27,2
	axe	10	,7	,7	28,0
	polisher spatula	3	,2	,2	28,2
	sleeve	35	2,6	2,6	30,8
	sleeve -axe	3	,2	,2	31,0
	axe - chisel,	3	,2	,2	31,2
	byproduct/waste	60	4,4	4,4	35,7
	ring	13	1,0	1,0	36,6
	cousoir	2	,1	,1	36,8
	part	36	2,7	2,7	39,5
	flute	2	,1	,1	39,6
	comb	2	,1	,1	39,7
	projectile point	3	,2	,2	40,0
	double point	7	,5	,5	40,5
	awl	676	50,0	50,0	90,5
	pointed tool	97	7,2	7,2	97,7
	needle	5	,4	,4	98,1
	arrow	11	,8	,8	98,9
	harpoon	12	,9	,9	99,8
	fishook	3	,2	,2	100,0
	Total	1351	99,9	100,0	
Missing	notool	2	,1		
Total		1353	100,0		

Table 34 Kleitos - Category of Bone Tools (Typology)

Artifact					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tool	1331	98,4	98,4	98,4
	Ornament	20	1,5	1,5	99,9
	Unknown	1	,1	,1	100,0
	Total	1353	100,0	100,0	

Table 35 Kleitos - Percentage of artefacts

Percentage of bone artefacts in Kleitos I and II					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kleitos I	1202	88,8	88,8	88,8
	Kleitos II	94	6,9	6,9	95,8
	Unidentified Layers	2	,1	,1	95,9
	Outside the settlement	55	4,1	4,1	100,0
	Total	1353	100,0	100,0	

Table 36 Percentage of bone artefacts in Kleitos I and II

Tool preservation					
					Total
		intact	almost intact	fragment	
Tool	unidentified	17	12	126	155
	chisel	23	19	77	119
	spatula	15	16	36	67
	sharp tool	7	0	11	18
	polisher	1	1	5	7
	polisher - chisel	0	0	2	2
	axe	4	3	3	10
	polisher spatula	0	1	2	3
	sleeve	18	8	9	35
	sleeve -axe	1	2	0	3
	axe - chisel,	0	1	2	3
	byproduct/waste	60	0	0	60
	ring	2	3	8	13
	cousoir	2	0	0	2
	part	21	3	12	36
	flute	1	0	1	2
	comb	0	1	1	2
	projectile point	3	0	0	3
	double point	6	0	1	7
	awl	282	121	273	676
	pointed tool	30	16	51	97
	needle	4	0	1	5
	arrow	5	2	4	11
	harpoon	3	3	6	12
	fishook	1	0	2	3
Total		474	216	661	1351

Table 37 Kleitos - Preservation of bone artefacts

Salvage tool surface									
									Total
		intact	active end	shaft/active end	shaft	active end /shaft /proximal part	shaft/proximal part	proximal part	
Tool	unidentified	17	12	27	54	10	18	17	155
	chisel	26	11	55	1	25	0	1	119
	spatula	17	16	14	0	16	3	1	67
	sharp tool	7	3	8	0	0	0	0	18
	polisher	1	1	3	1	1	0	0	7
	polisher - chisel	0	0	2	0	0	0	0	2
	axe	4	1	2	0	3	0	0	10
	polisher spatula	0	2	0	0	1	0	0	3
	sleeve	19	1	1	1	9	4	0	35
	sleeve -axe	1	0	0	0	2	0	0	3
	axe - chisel,	0	1	1	0	1	0	0	3
	byproduct/waste	60	0	0	0	0	0	0	60
	ring	3	0	0	6	4	0	0	13
	cousoir	2	0	0	0	0	0	0	2
	part	23	1	2	3	7	0	0	36
	flute	1	0	0	1	0	0	0	2
	comb	0	0	0	0	2	0	0	2
	projectile point	3	0	0	0	0	0	0	3
	double point	6	0	0	0	1	0	0	7
	awl	288	57	156	12	147	12	4	676
	pointed tool	29	11	31	1	21	1	3	97
	needle	4	0	0	0	0	1	0	5
	arrow	5	0	1	0	5	0	0	11
	harpoon	3	0	4	0	4	1	0	12
	fishook	1	0	0	0	1	1	0	3
Total		487	117	311	98	268	44	26	1351

Table 38 Kleitos - Tool preservation

Artifact erosion degree								
								Total
		high	medium	low	none	unrecognisable	unidentified	
Tool	unidentified	33	36	80	0	3	3	155
	chisel	16	34	66	1	1	1	119
	spatula	14	13	39	1	0	0	67
	sharp tool	2	4	12	0	0	0	18
	polisher	0	0	5	2	0	0	7
	polisher - chisel	0	0	2	0	0	0	2
	axe	3	4	3	0	0	0	10
	polisher spatula	0	0	3	0	0	0	3
	sleeve	11	8	14	0	2	0	35
	sleeve -axe	0	1	1	0	1	0	3
	axe - chisel,	1	2	0	0	0	0	3
	byproduct/waste	19	20	20	0	1	0	60
	ring	2	3	7	1	0	0	13
	cousoir	0	1	1	0	0	0	2
	part	5	2	28	1	0	0	36
	flute	0	1	1	0	0	0	2
	comb	0	0	2	0	0	0	2
	projectile point	0	1	2	0	0	0	3
	double point	2	2	3	0	0	0	7
	awl	91	149	409	17	5	5	676
	pointed tool	15	26	56	0	0	0	97
	needle	2	0	3	0	0	0	5
	arrow	2	4	5	0	0	0	11
	harpoon	3	1	7	1	0	0	12
	fishook	0	1	2	0	0	0	3
Total		221	313	771	24	13	9	1351

Table 39 Kleitos - Erosion Degree

Animal size						
						Total
		unidentified	cattle size	sheep/goat size	small size	
Tool	unidentified	11	102	35	7	155
	chisel	1	48	70	0	119
	spatula	0	65	2	0	67
	sharp tool	0	14	4	0	18
	polisher	0	6	1	0	7
	polisher - chisel	1	1	0	0	2
	axe	0	10	0	0	10
	polisher spatula	0	3	0	0	3
	sleeve	0	33	1	1	35
	sleeve -axe	0	3	0	0	3
	axe - chisel,	0	3	0	0	3
	byproduct/waste	1	54	5	0	60
	ring	0	12	1	0	13
	cousoir	0	2	0	0	2
	part	0	35	1	0	36
	flute	0	1	1	0	2
	comb	0	2	0	0	2
	projectile point	0	3	0	0	3
	double point	1	3	3	0	7
	awl	22	99	545	10	676
	pointed tool	5	55	37	0	97
	needle	2	2	1	0	5
	arrow	1	9	1	0	11
	harpoon	0	12	0	0	12
	fishook	2	0	1	0	3
Total		47	577	709	18	1351

Table 40 Kleitos - Raw Material (Animal Size that can be identified in the material)

		Animal Family																	
		unidentified	bear	wild animal	human	carnivore	red - fallow deer	red deer	row deer	wild boar	sheep/goat	goat	sheep	cattle	deer	hare	canine	sus	
Tool	unidentified	62	0	0	0	1	31	12	0	0	19	0	0	7	11	0	1	11	155
	chisel	26	0	0	0	0	7	3	2	0	56	1	8	12	1	0	0	3	119
	spatula	50	0	0	0	0	1	3	0	0	2	0	0	10	0	0	0	1	67
	sharp tool	7	0	0	0	0	2	1	0	2	1	0	0	4	0	0	0	1	18
	polisher	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7
	polisher - chisel	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
	axe	3	0	0	0	0	4	3	0	0	0	0	0	0	0	0	0	0	10
	polisher spatula	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	sleeve	1	0	0	0	0	13	11	0	0	0	0	0	0	9	0	1	0	35
	sleeve -axe	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
	axe - chisel,	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	3
	byproduct/waste	3	0	0	0	0	7	19	1	0	2	0	1	10	17	0	0	0	60
	ring	2	0	0	0	0	8	0	0	0	0	0	0	2	1	0	0	0	13
	cousoir	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	part	13	0	1	1	0	4	0	0	0	1	0	0	16	0	0	0	0	36

	flute	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
	comb	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
	projectile point	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3
	double point	5	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	7
	awl	202	0	0	0	0	1	1	2	0	432	2	15	10	0	7	1	3	676
	pointed tool	47	0	0	0	1	2	0	0	1	23	1	2	16	2	0	0	2	97
	needle	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	5
	arrow	6	0	0	0	0	1	0	0	0	1	0	0	1	2	0	0	0	11
	harpoon	2	0	0	0	0	5	2	0	0	0	0	0	0	3	0	0	0	12
	fishook	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Total		445	2	1	1	2	90	56	5	4	541	4	26	91	46	7	4	26	1351

Table 41 Kleitos - Raw Material (Animal Family that can be identified in the material)

Raw Material (General bone category)										
										Total
			unidentified	mandible	human skull	tooth	antler	long bone	flat bone	
Tool	unidentified	Count	4	1	0	9	54	73	14	155
		% of Total	0,3%	0,1%	0,0%	0,7%	4,0%	5,4%	1,0%	11,5%
	chisel	Count	2	0	0	0	12	102	3	119
		% of Total	0,1%	0,0%	0,0%	0,0%	0,9%	7,5%	0,2%	8,8%
	spatula	Count	1	1	0	0	4	4	57	67
		% of Total	0,1%	0,1%	0,0%	0,0%	0,3%	0,3%	4,2%	5,0%
	sharp tool	Count	0	0	0	3	3	11	1	18
		% of Total	0,0%	0,0%	0,0%	0,2%	0,2%	0,8%	0,1%	1,3%
	polisher	Count	1	0	0	4	0	0	2	7
		% of Total	0,1%	0,0%	0,0%	0,3%	0,0%	0,0%	0,1%	0,5%
	polisher - chisel	Count	0	0	0	0	0	1	1	2
		% of Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,1%
	axe	Count	1	0	0	0	7	2	0	10

		% of Total	0,1%	0,0%	0,0%	0,0%	0,5%	0,1%	0,0%	0,7%
	polisher spatula	Count	0	0	0	0	0	1	2	3
		% of Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,2%
	sleeve	Count	0	0	0	0	33	2	0	35
		% of Total	0,0%	0,0%	0,0%	0,0%	2,4%	0,1%	0,0%	2,6%
	sleeve -axe	Count	0	0	0	0	3	0	0	3
		% of Total	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,0%	0,2%
	axe - chisel,	Count	0	0	0	0	2	1	0	3
		% of Total	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,0%	0,2%
	byproduct/waste	Count	1	0	0	0	42	16	1	60
		% of Total	0,1%	0,0%	0,0%	0,0%	3,1%	1,2%	0,1%	4,4%
	ring	Count	0	0	0	0	9	4	0	13
		% of Total	0,0%	0,0%	0,0%	0,0%	0,7%	0,3%	0,0%	1,0%
	cousoir	Count	0	0	0	2	0	0	0	2
		% of Total	0,0%	0,0%	0,0%	0,1%	0,0%	0,0%	0,0%	0,1%
	part	Count	0	0	1	0	4	30	1	36
		% of Total	0,0%	0,0%	0,1%	0,0%	0,3%	2,2%	0,1%	2,7%
	flute	Count	0	0	0	0	0	2	0	2
		% of Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,0%	0,1%
	comb	Count	0	0	0	0	0	1	1	2
		% of Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,1%
	projectile point	Count	0	0	0	0	0	3	0	3
		% of Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,2%	0,0%	0,2%
	double point	Count	0	0	0	0	0	7	0	7
		% of Total	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%	0,0%	0,5%
	awl	Count	0	0	0	0	2	666	8	676
		% of Total	0,0%	0,0%	0,0%	0,0%	0,1%	49,3%	0,6%	50,0%
	pointed tool	Count	4	0	0	3	4	70	16	97
		% of Total	0,3%	0,0%	0,0%	0,2%	0,3%	5,2%	1,2%	7,2%
	needle	Count	0	0	0	2	0	3	0	5
		% of Total	0,0%	0,0%	0,0%	0,1%	0,0%	0,2%	0,0%	0,4%
	arrow	Count	0	0	0	0	3	8	0	11
		% of Total	0,0%	0,0%	0,0%	0,0%	0,2%	0,6%	0,0%	0,8%
	harpoon	Count	0	0	0	0	10	2	0	12
		% of Total	0,0%	0,0%	0,0%	0,0%	0,7%	0,1%	0,0%	0,9%
	fishook	Count	2	0	0	0	0	1	0	3
		% of Total	0,1%	0,0%	0,0%	0,0%	0,0%	0,1%	0,0%	0,2%
Total		Count	16	2	1	23	192	1010	107	1351
		% of Total	1,2%	0,1%	0,1%	1,7%	14,2%	74,8%	7,9%	100,0%

Table 42 Kleitos - Raw Material (General Bone Category that can be identified in the material)

Processing Techniques																	
		entified	tudinal sawing	ng - scr	g - scr - abr	ng - abr	craping	r - abr	abrasion	nsverse cutting	nsverse utting - tudinal sawing	s- long - cr - abr	- long - abr	an - scr	n - scr - abr	an - abr	
	unidentified	18	7	0	0	42	3	2	52	10	1	1	2	1	4	12	55
	chisel	1	2	0	1	95	1	0	12	0	0	0	2	1	0	4	19
	spatula	2	1	0	1	54	1	0	4	0	0	0	4	0	0	0	67
	sharp tool	1	1	0	0	9	0	0	6	0	0	0	0	0	0	1	18
	polisher	0	0	0	0	1	0	0	6	0	0	0	0	0	0	0	7
	polisher - chisel	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
	axe	0	0	0	0	5	1	0	0	0	0	0	0	0	2	2	10
	polisher spatula	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	3
	sleeve	2	1	1	0	2	4	1	2	6	0	0	0	6	1	9	35
	sleeve -axe	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	3
	axe - chisel,	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	3
	byproduct/waste	5	5	2	2	1	5	0	11	13	0	1	1	7	0	7	60
	ring	0	1	0	0	1	0	0	1	3	0	0	0	0	0	7	13
	cousoir	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
	part	13	1	0	0	1	1	1	11	1	2	0	2	0	0	3	36
	flute	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2
	comb	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2

projectile point	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	3
double point	0	0	0	0	3	0	0	4	0	0	0	0	0	0	0	7
awl	1	6	0	2	613	0	0	45	1	0	0	4	0	0	4	76
pointed tool	0	3	0	0	70	0	0	20	1	0	0	1	0	1	1	97
needle	1	0	0	0	2	0	0	2	0	0	0	0	0	0	0	5
arrow	0	0	0	0	7	0	0	0	0	0	0	4	0	0	0	11
harpoon	1	0	0	0	4	0	0	4	1	0	0	0	0	1	1	12
fishook	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	3
Total	46	28	3	6	918	16	5	188	36	3	2	21	16	9	54	351

Table 43 Kleitos - Processing Techniques that can be identified in the material

Tool - Distribution						
						Total
		Kleitos I	Kleitos II	Unidentified	Out of the settlement	
Tool	unidentified	134	9	1	11	155
	chisel	108	8	0	3	119
	spatula	66	1	0	0	67
	sharp tool	17	1	0	0	18
	polisher	7	0	0	0	7
	polisher - chisel	2	0	0	0	2
	axe	9	1	0	0	10
	polisher spatula	3	0	0	0	3
	sleeve	25	9	0	1	35
	sleeve -axe	3	0	0	0	3
	axe - chisel,	3	0	0	0	3
	byproduct/waste	50	3	0	7	60
	ring	13	0	0	0	13
	cousoir	1	0	0	1	2
	part	36	0	0	0	36

	flute	1	1	0	0	2
	comb	0	1	0	1	2
	projectile point	3	0	0	0	3
	double point	7	0	0	0	7
	awl	606	49	1	20	676
	pointed tool	89	5	0	3	97
	needle	3	2	0	0	5
	arrow	4	1	0	6	11
	harpoon	11	1	0	0	12
	fishook	1	2	0	0	3
Total		1202	94	2	53	1351

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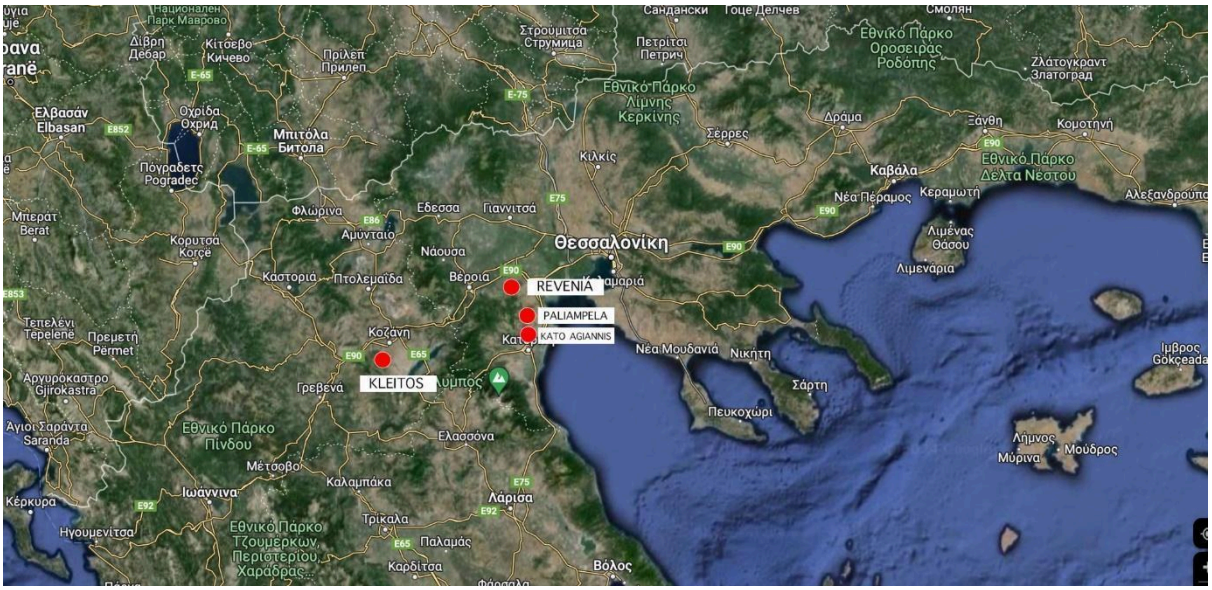
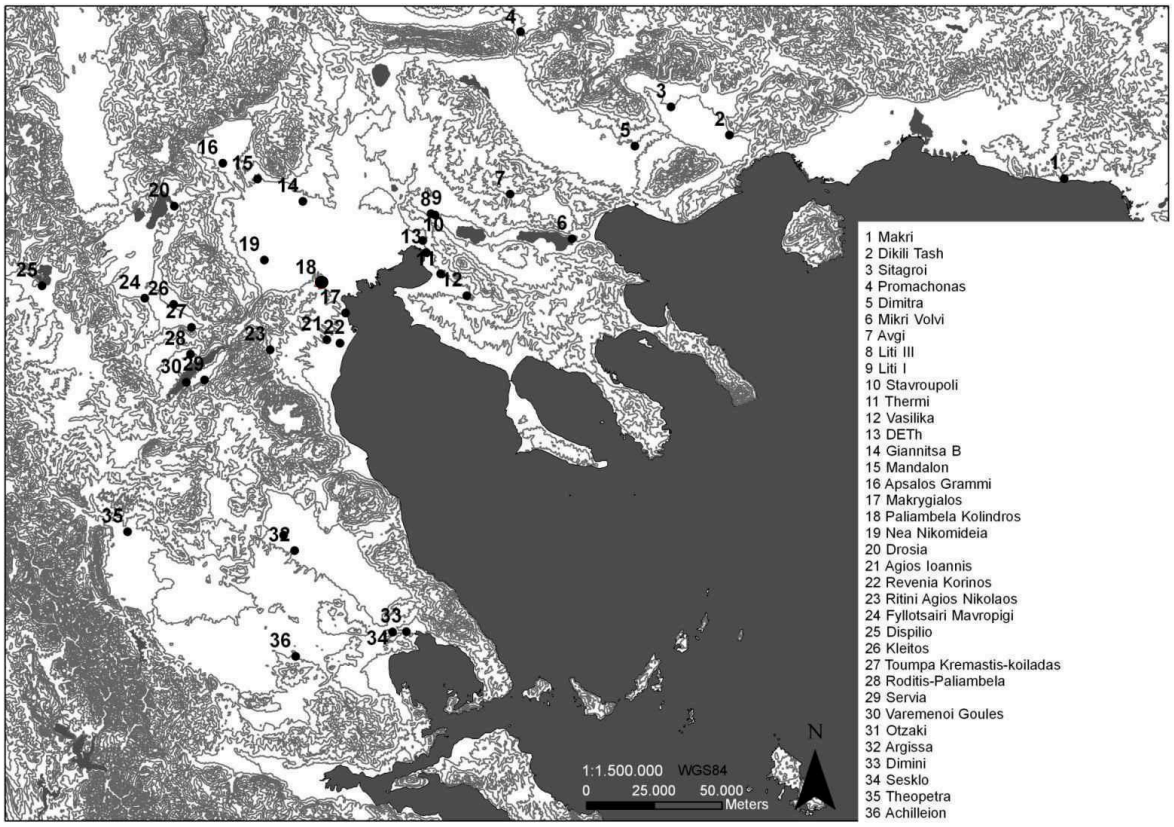
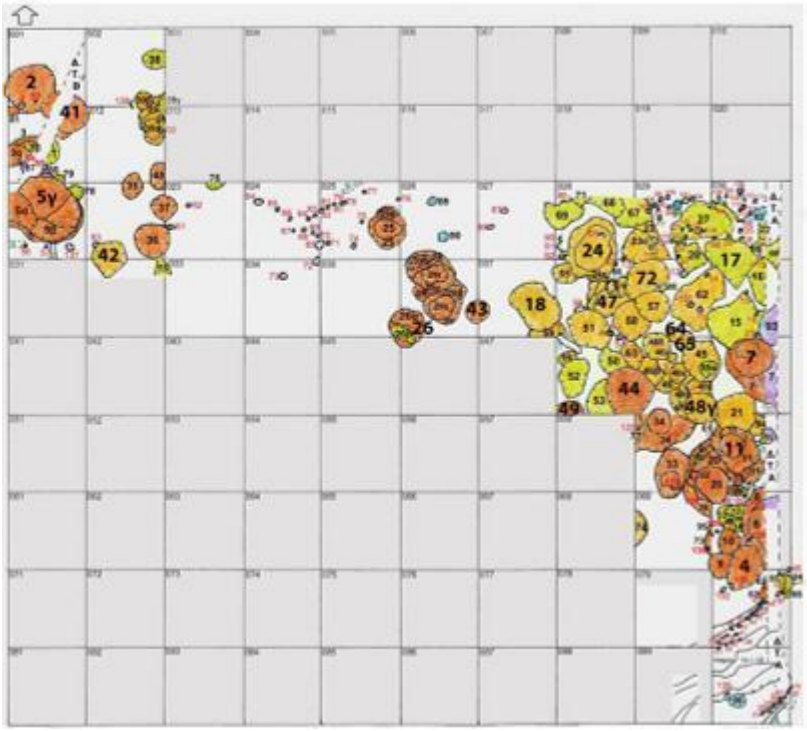


Map 1: Sites of the thesis



Map 2: Neolithic sites of Greece (after Kotsakis, K., Kaukoula, K., Nanoglou, S. και Astreinidou, P. (2007), Paliambela Kolindros Management Plan)



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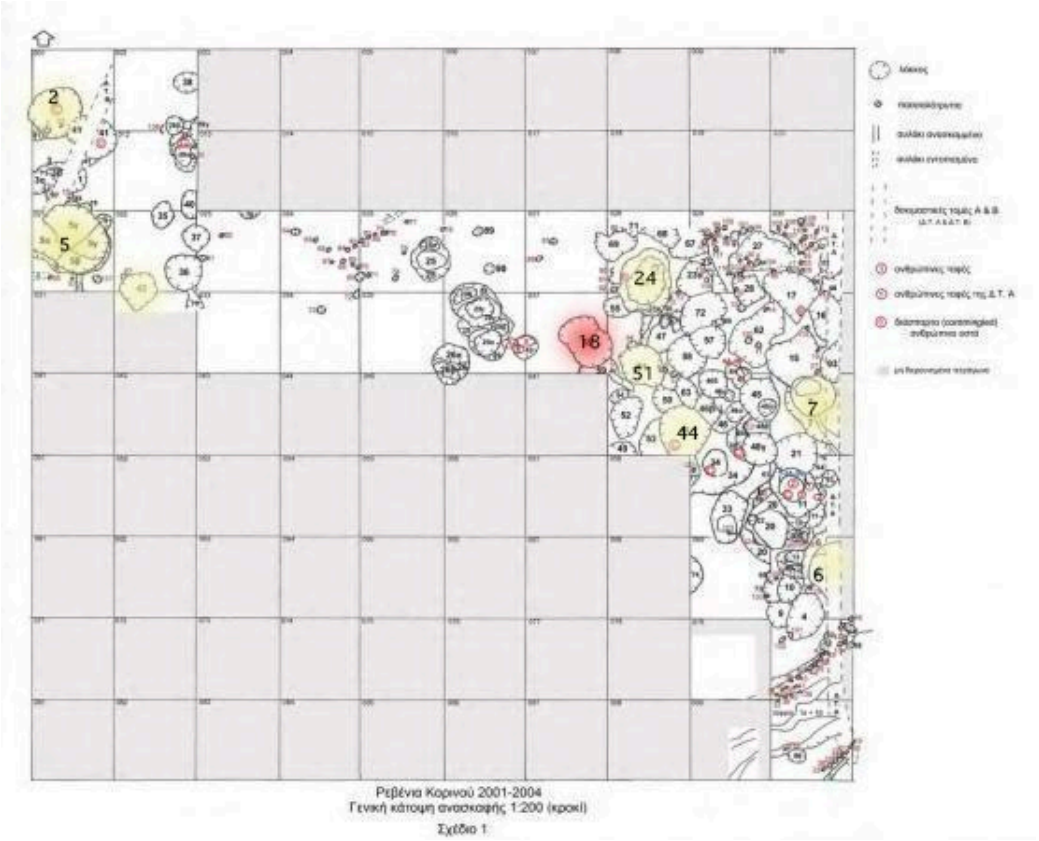

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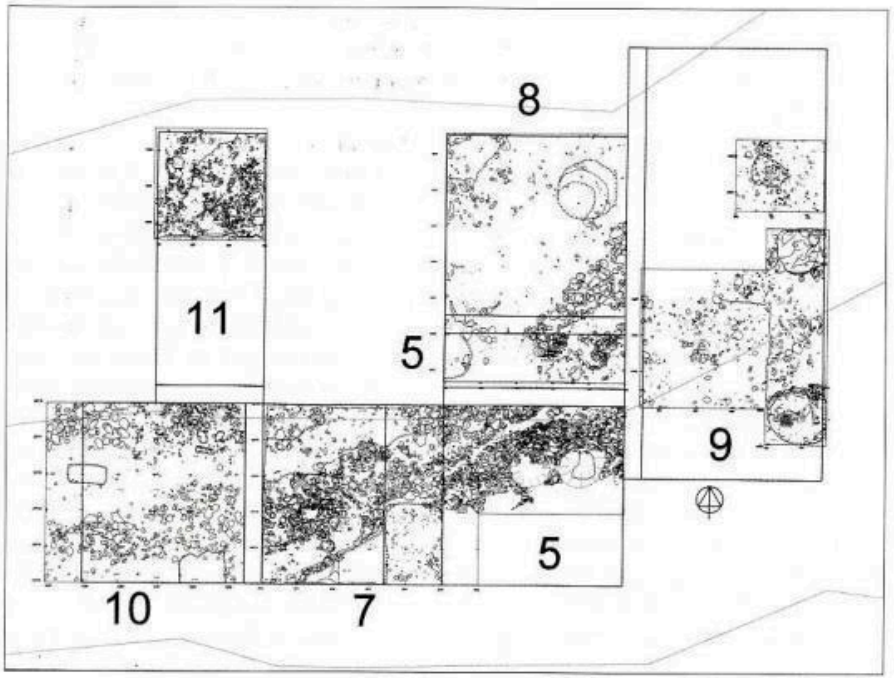
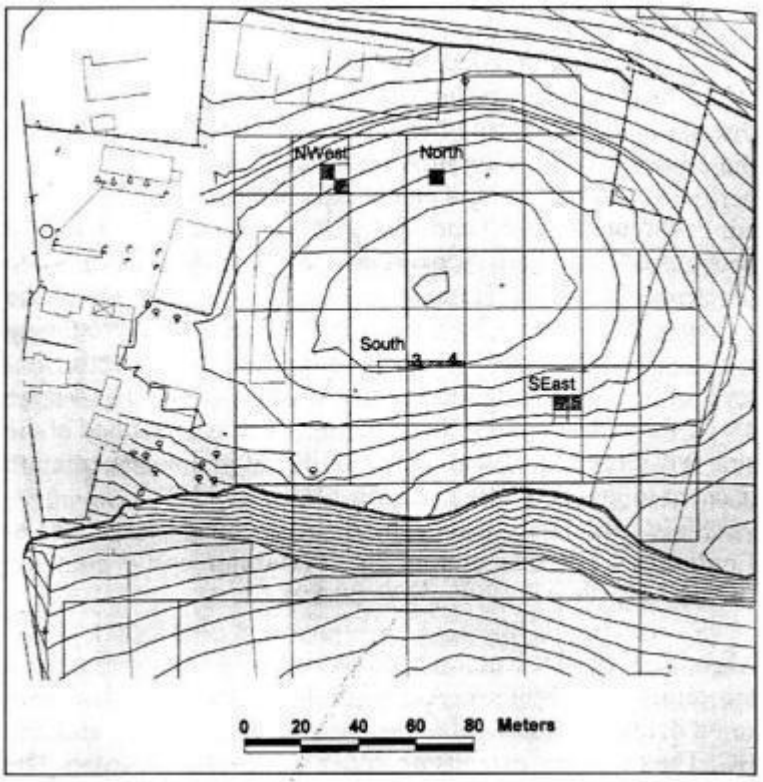
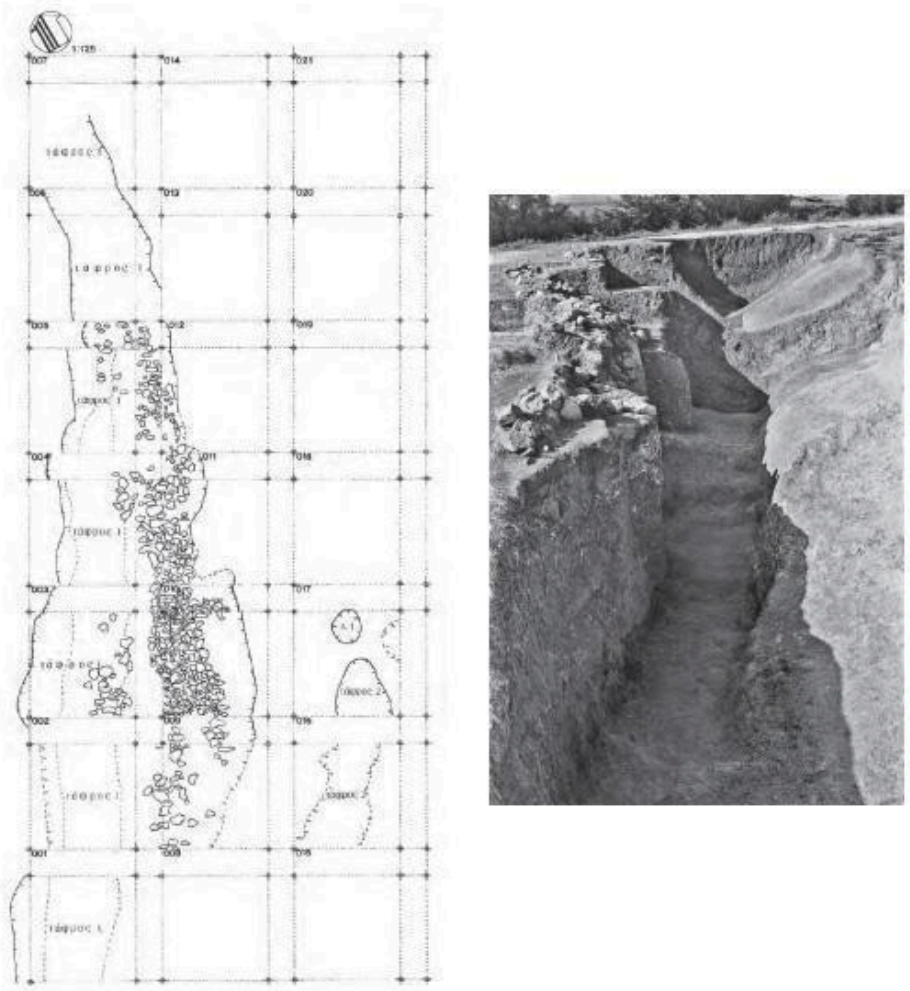


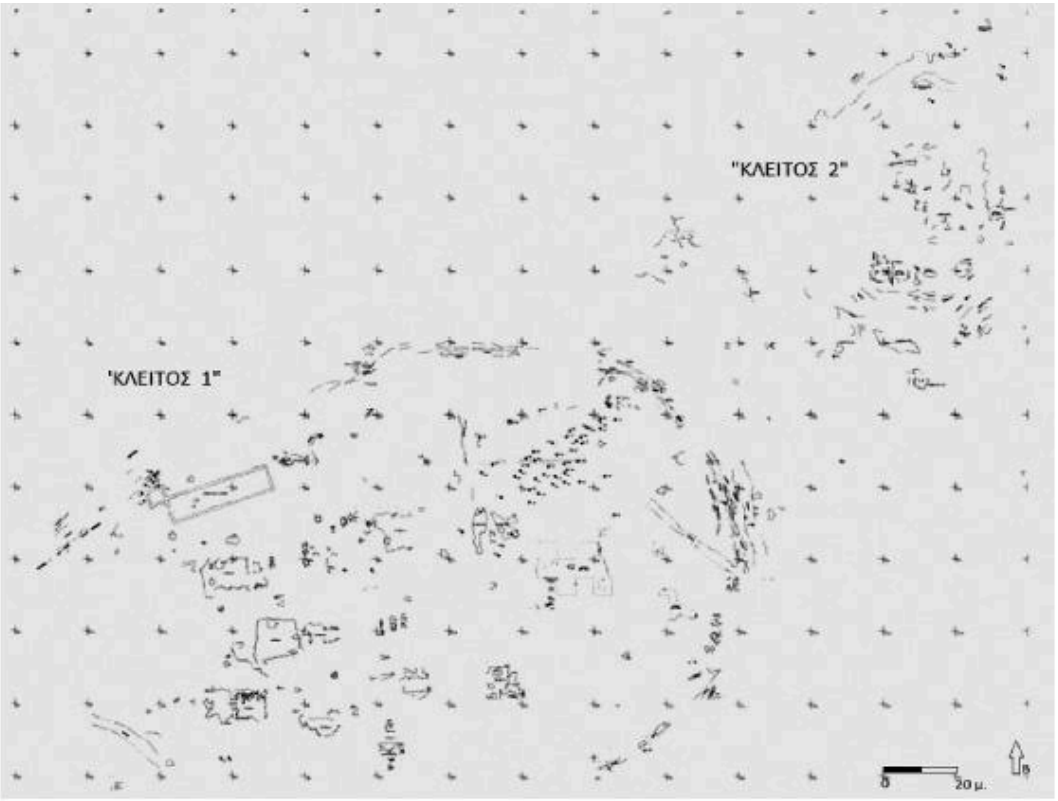
Map 5: Site of Paliambela (after Kotsakis, K. and Halstead, P. 2002. "Ανασκαφή Στα Νεολιθικά Παλιάμπελα Κολινδρού." In AEMTh16, 407–15)



Map 6: Site of Paliambela (after Kotsakis, K. and Halstead, P. 2002. "Ανασκαφή Στα Νεολιθικά Παλιάμπελα Κολινδρού." In AEMTh16, 407–15)



Map 7: Site of Kato Agiannis Pieria (after Μπέσιος, Μ., Αδακτύλου, Φ. 2008. "Τάφρος Της Τελικής Νεολιθικής Στον Κάτω Αγιάννη Πιερίας." In Το Αρχαιολογικό Έργο Στη Μακεδονία Και Στη Θράκη 22. Θεσσαλονίκη. https://www.ptonline.com/articles/how-to-get-better-mfi-results.)



Map 8: Archaeological sites of Kleitos I & II (after Ζιώτα, Χ. 2014a. "Η Ανασκαφή Στον Κλείτο Κοζάνης Το 2010." In ΤΟ ΑΡΧΑΙΟΛΟΓΙΚΟ ΕΡΓΟ ΣΤΗ ΜΑΚΕΔΟΝΙΑ ΚΑΙ ΣΤΗ ΘΡΑΚΗ 24,2010, 53–62. Θεσσαλονίκη: Εκδόσεις Ζήτη. https://www.ptonline.com/articles/how-to-get-better-mfi-results.)

Map 9: Site of Kleitos I (after Ζιώτα, Χ. 2014a.)

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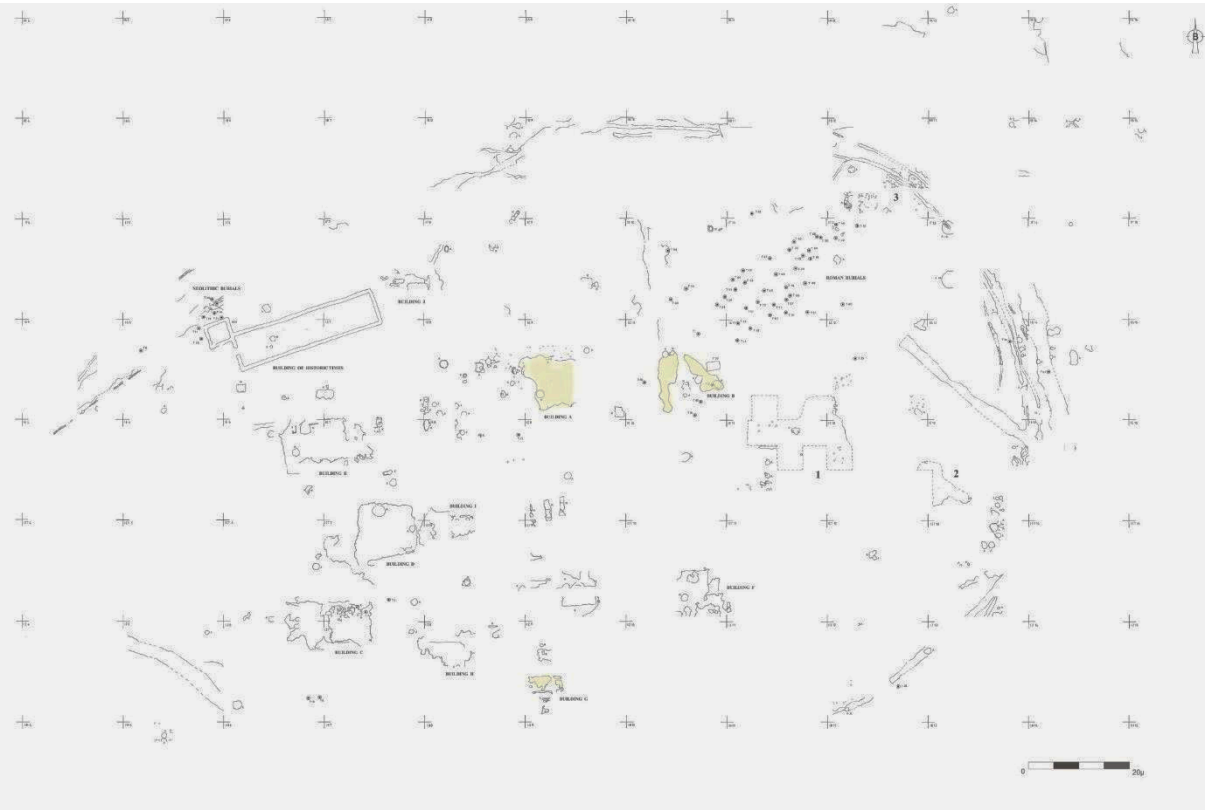

Map 11: Concentration of bone artefacts in buildings A, B, G (after Ζιώτα, Χ. 2014a. edited by Eleni Koutsopoulou)

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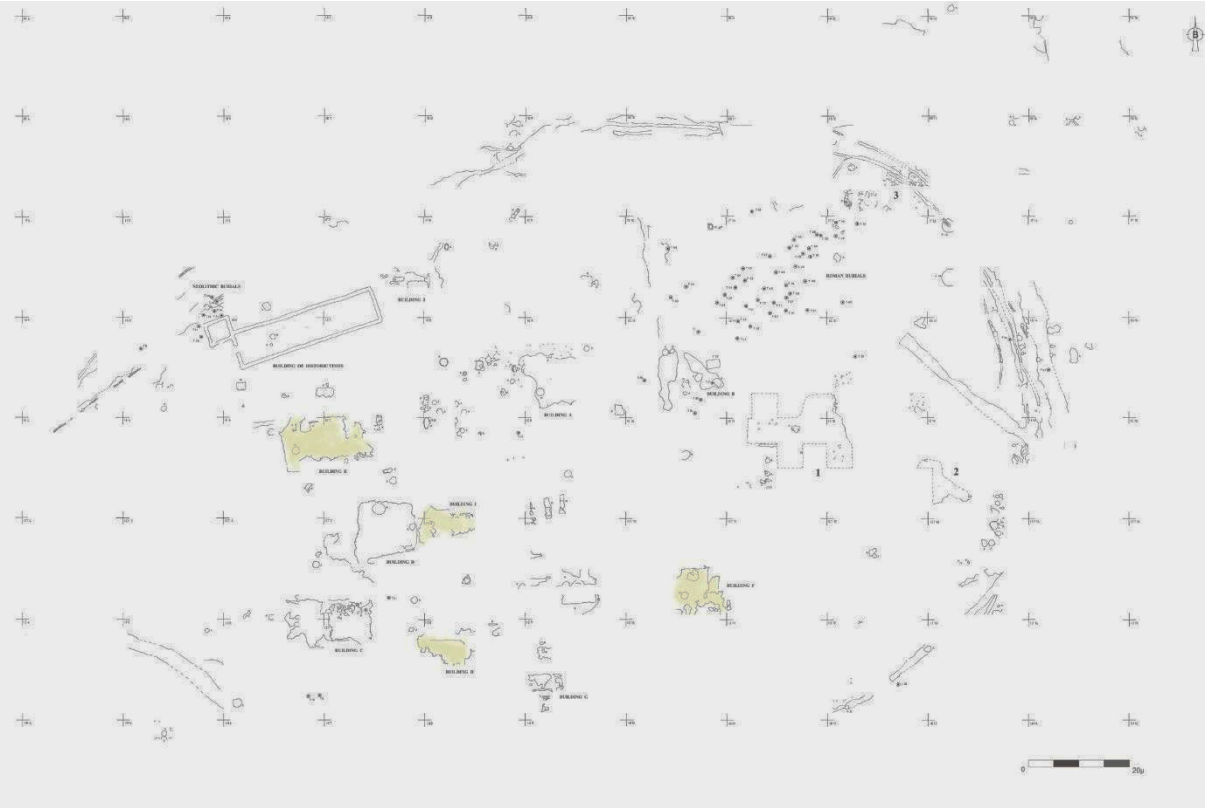

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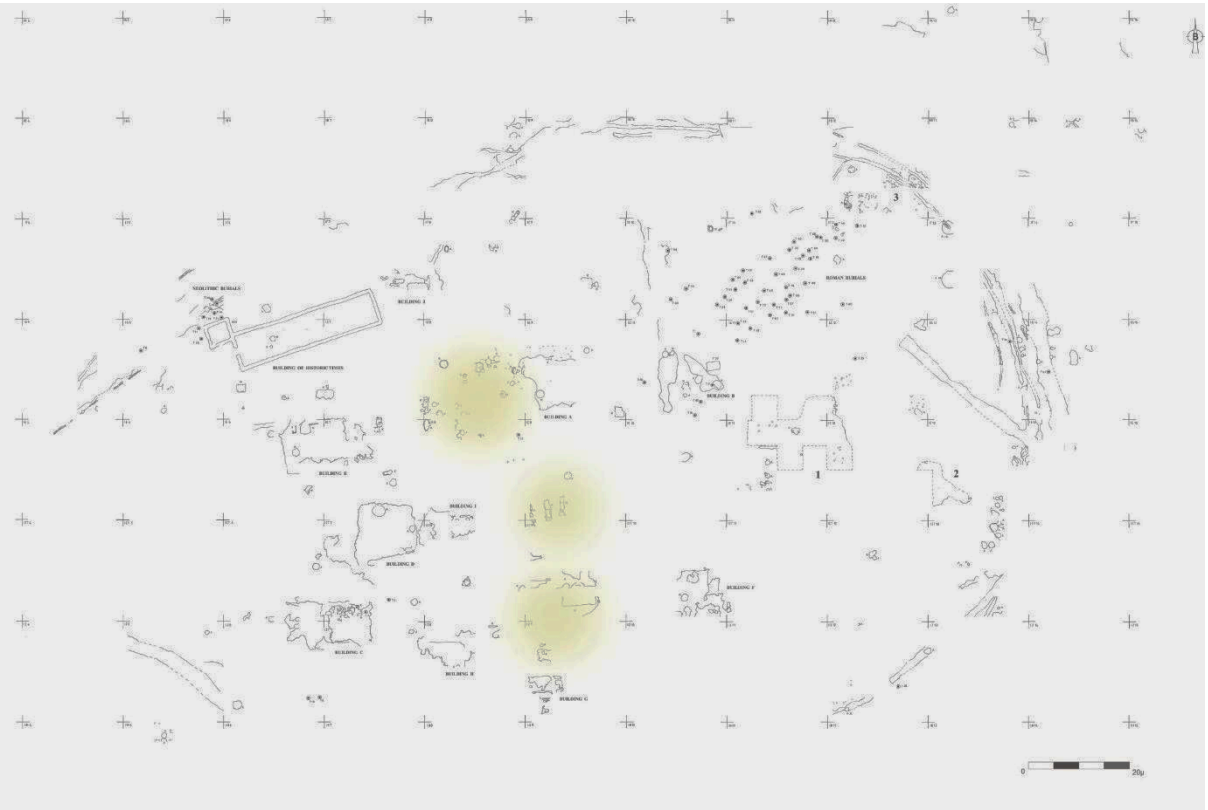

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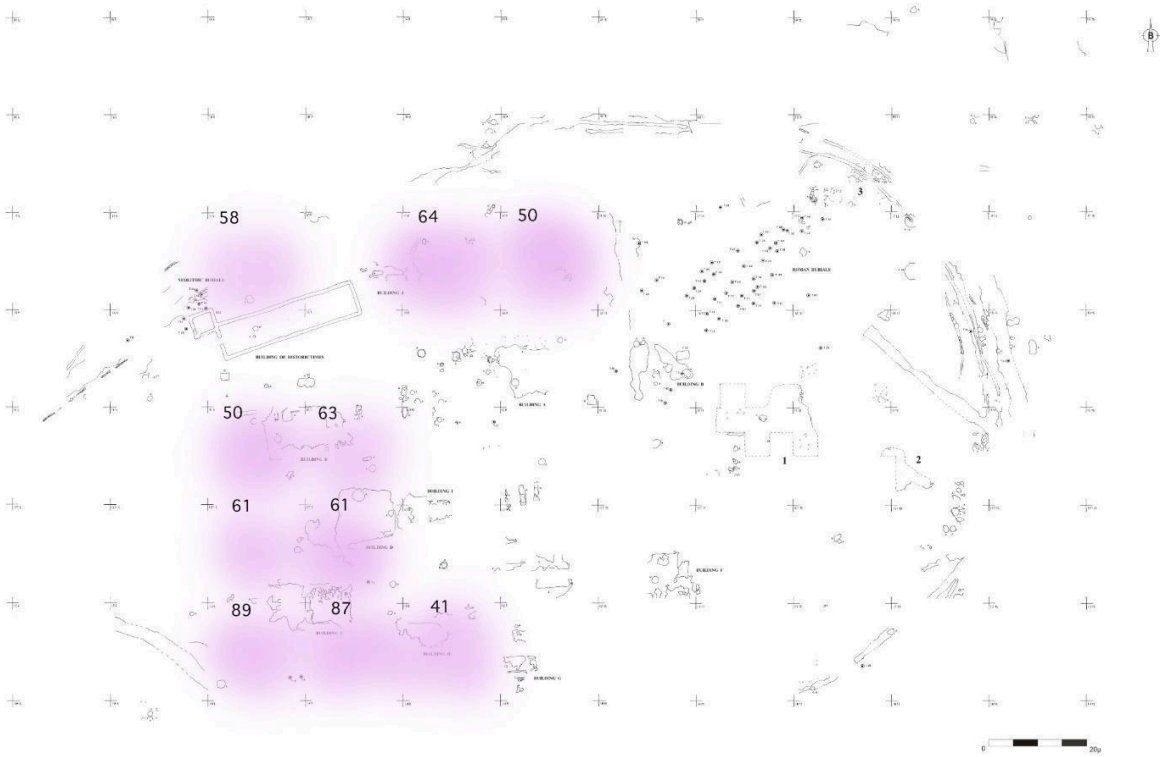

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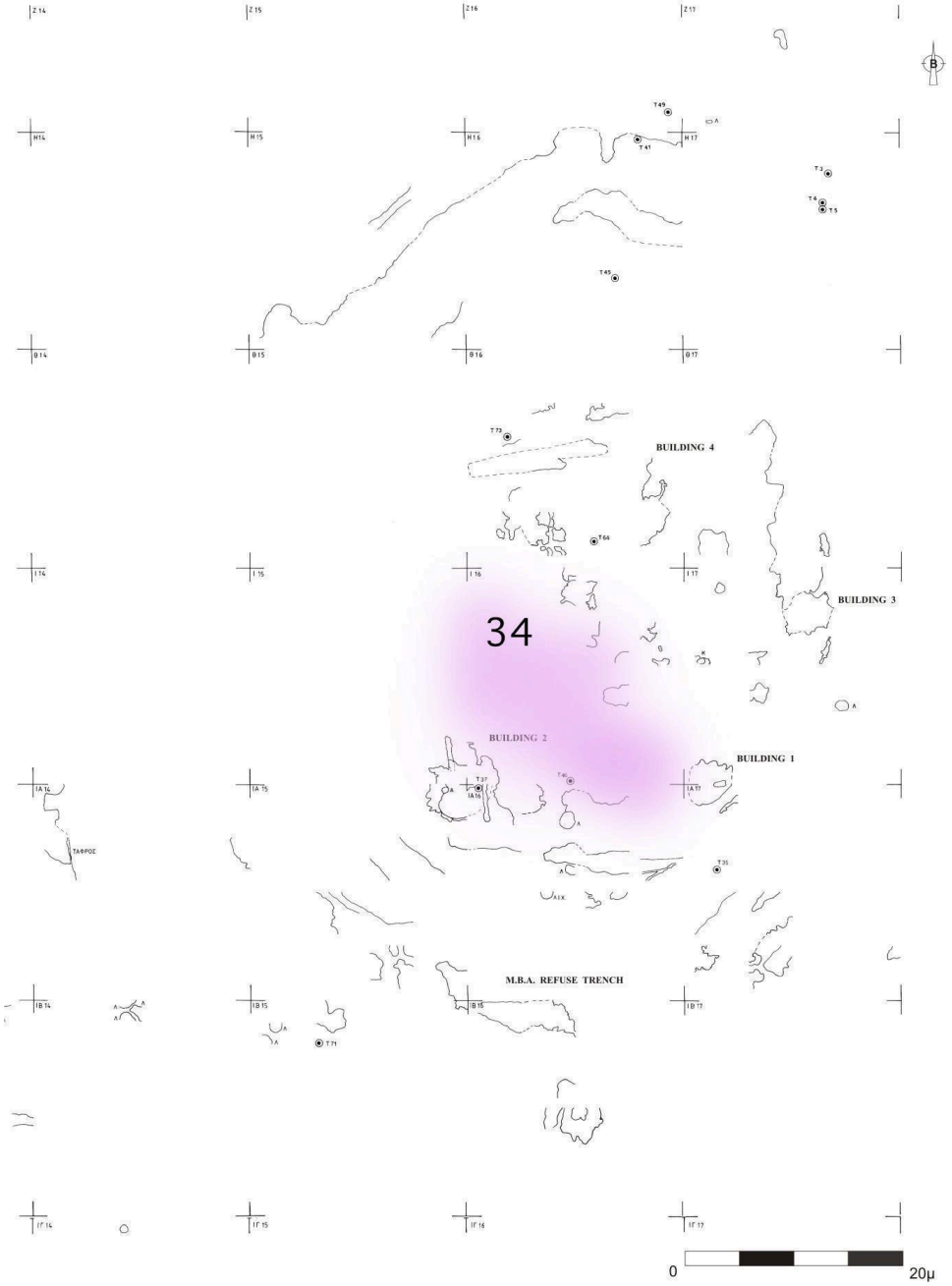

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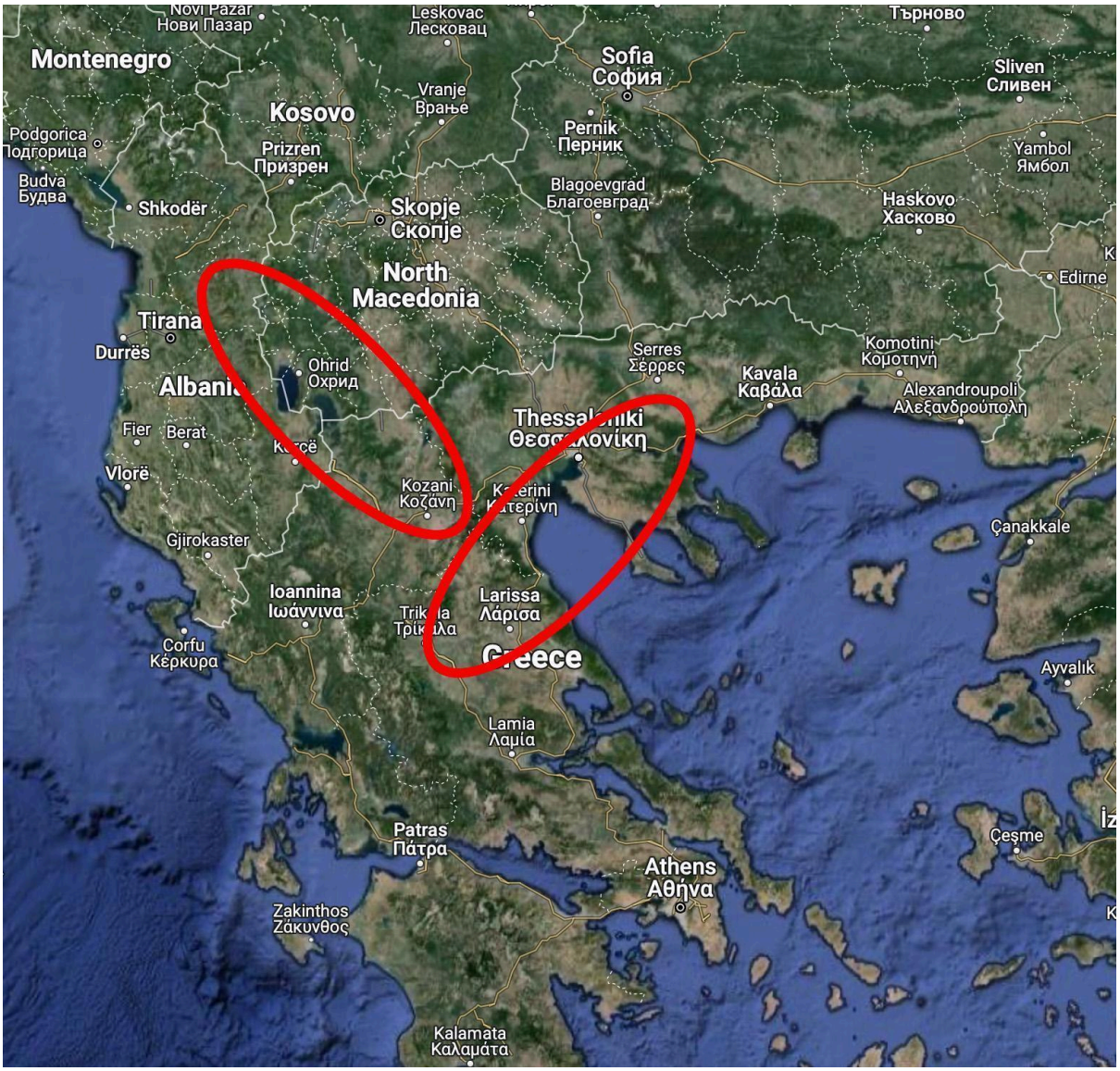

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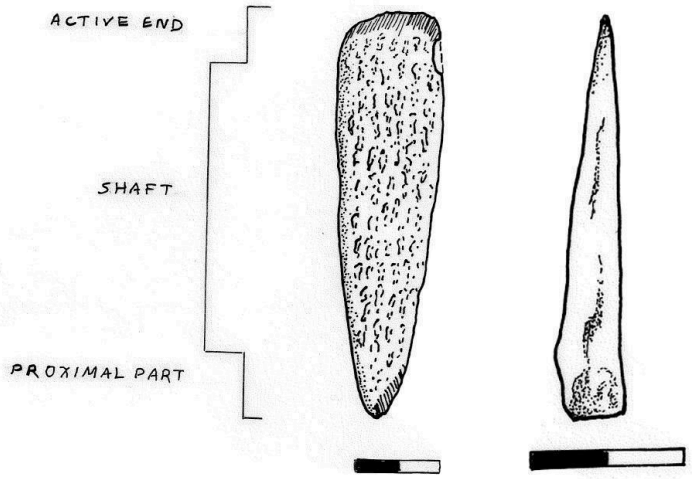

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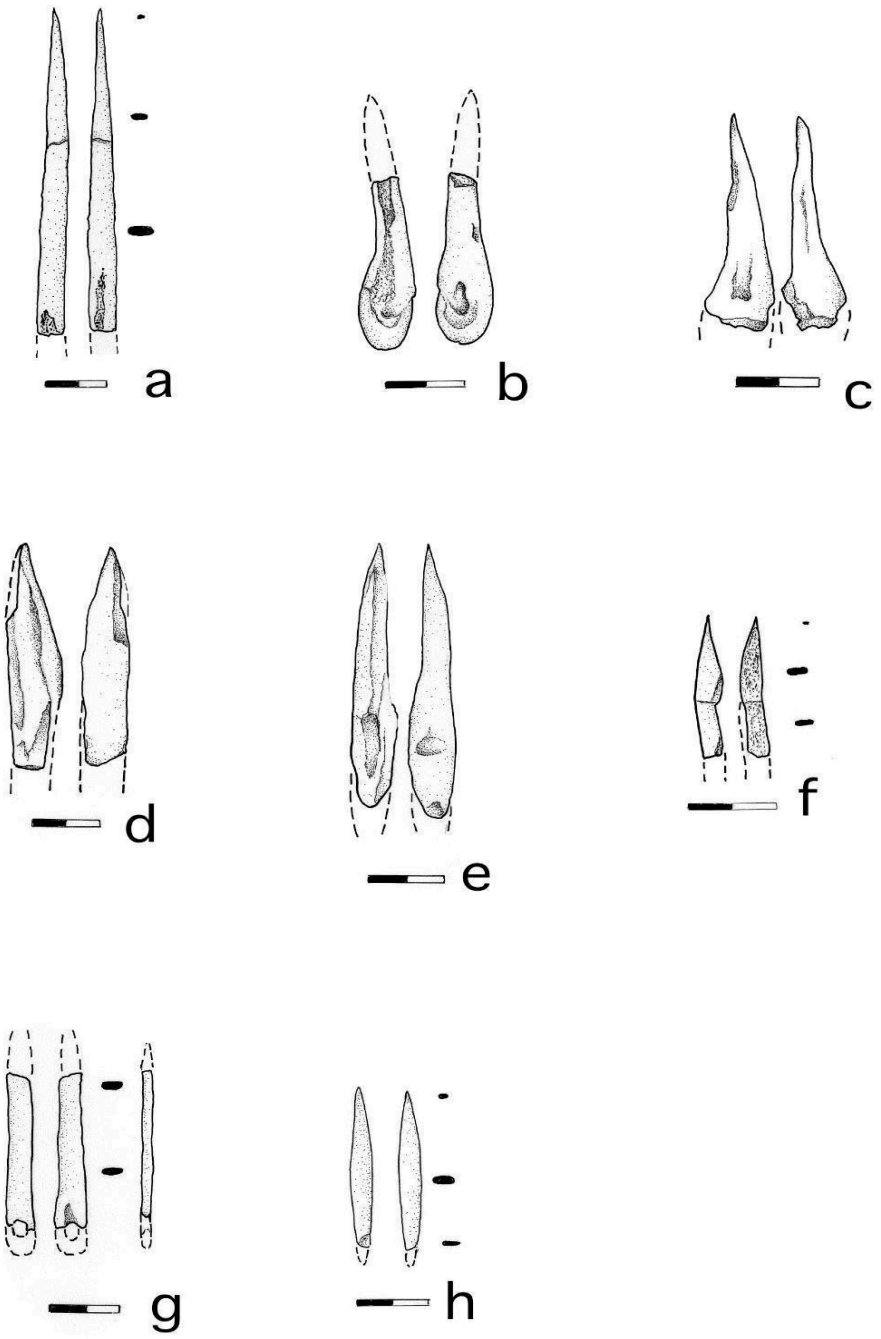

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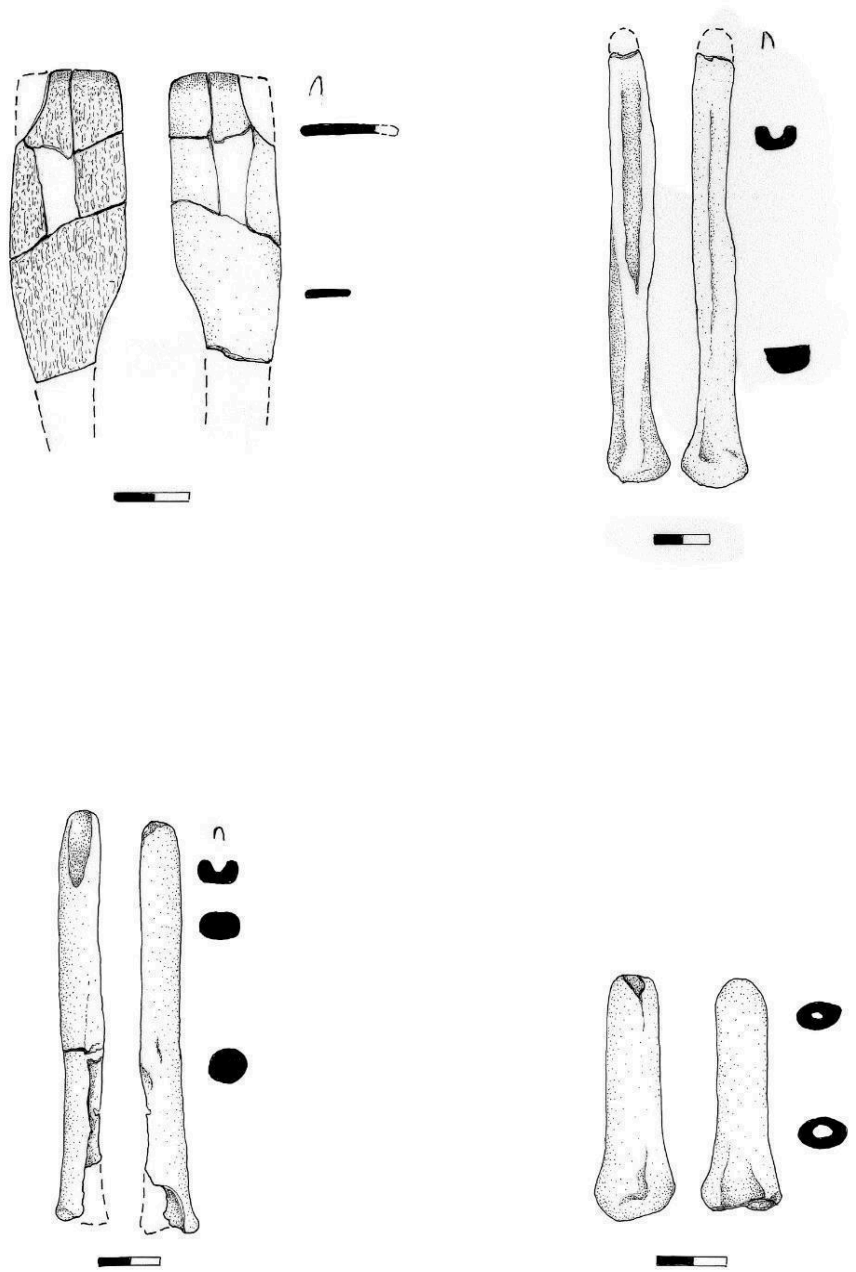

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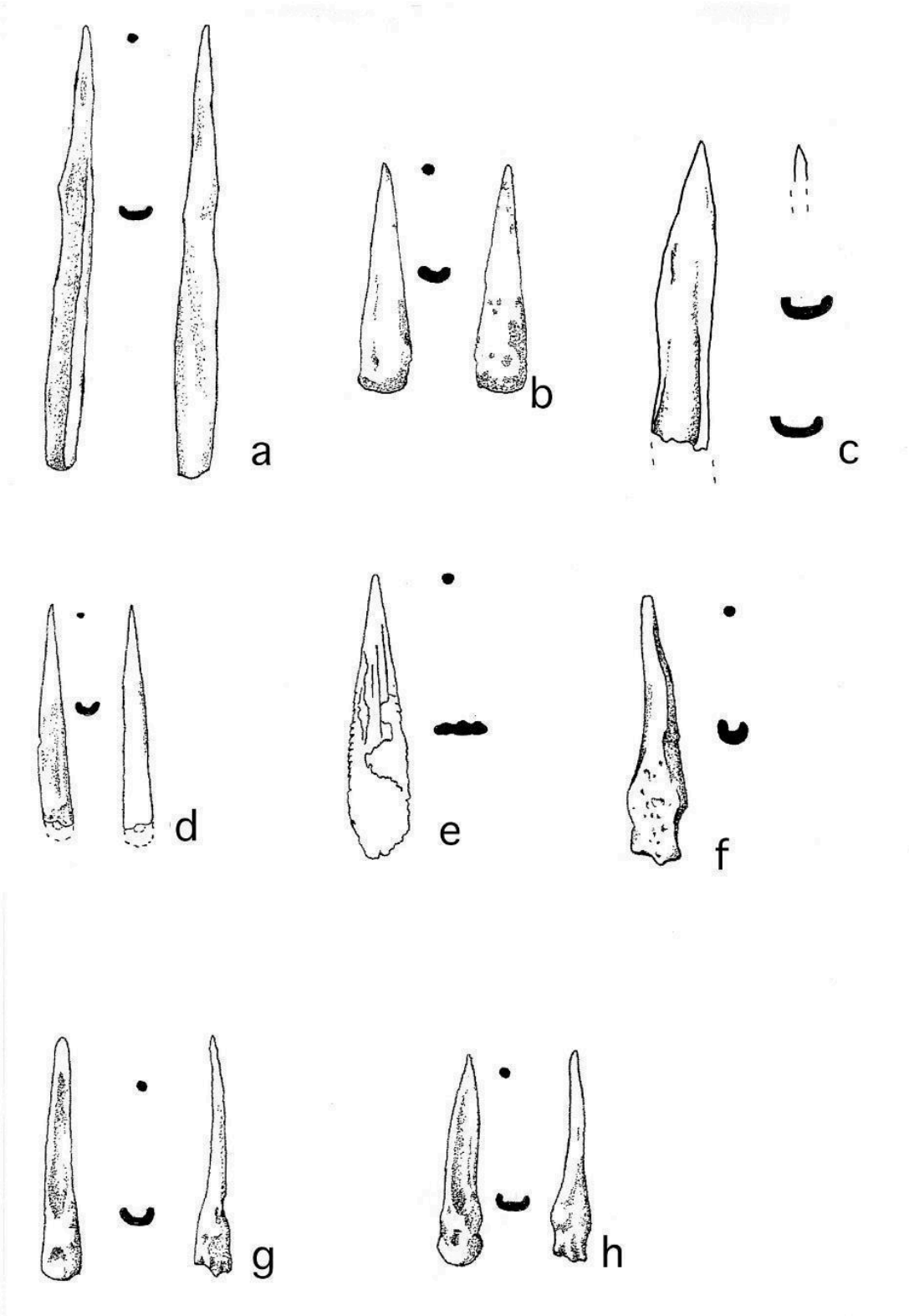

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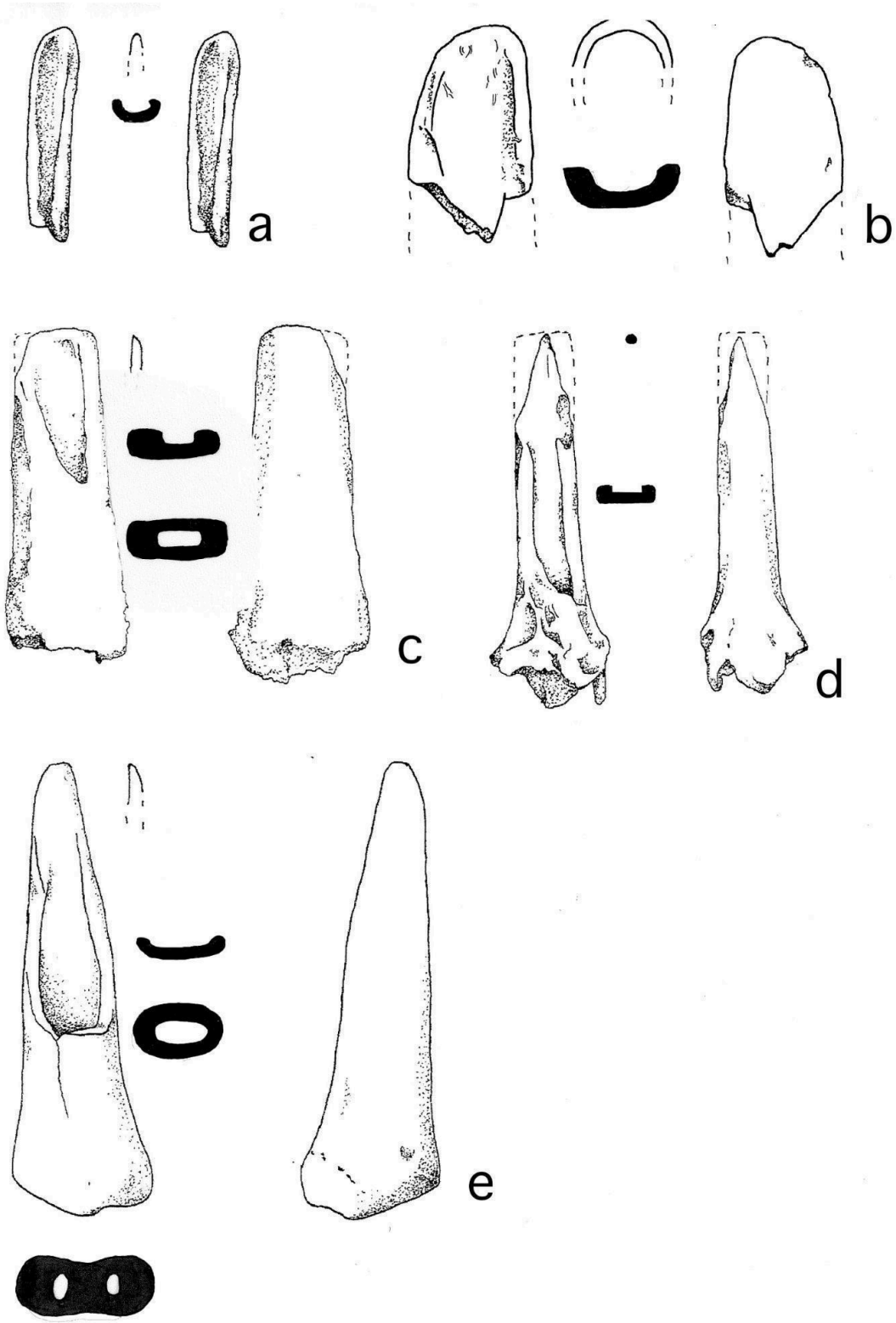

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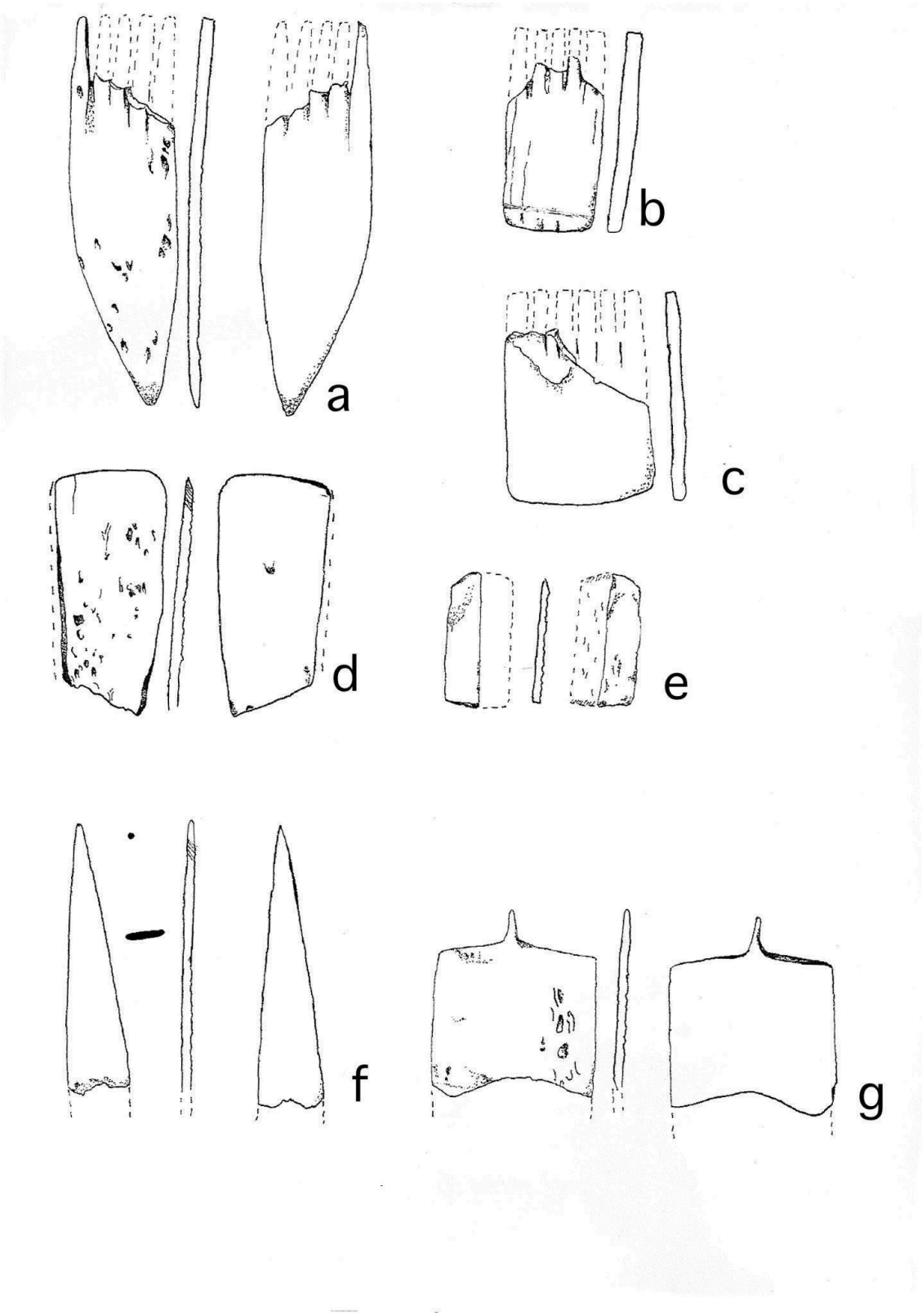

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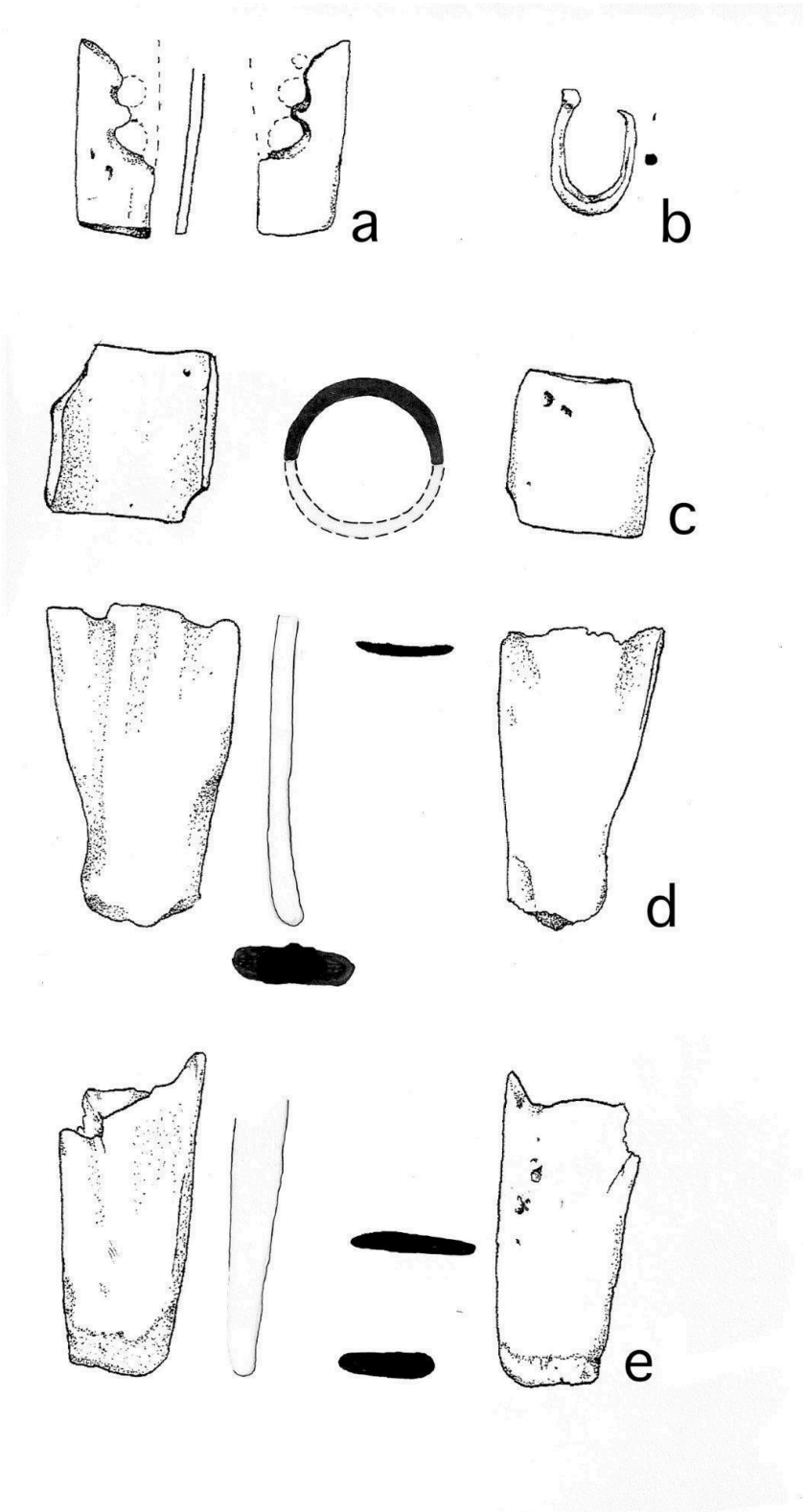

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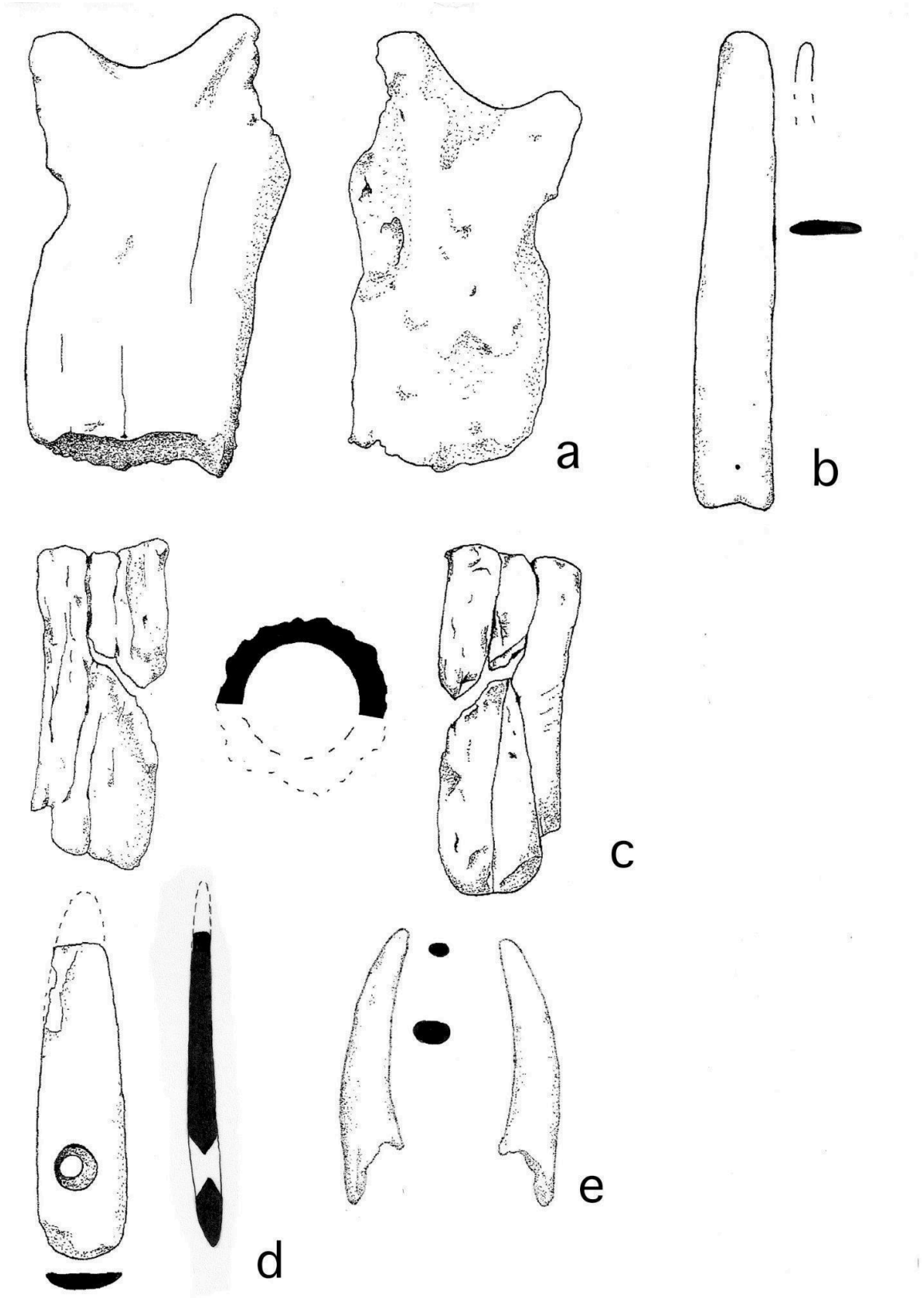

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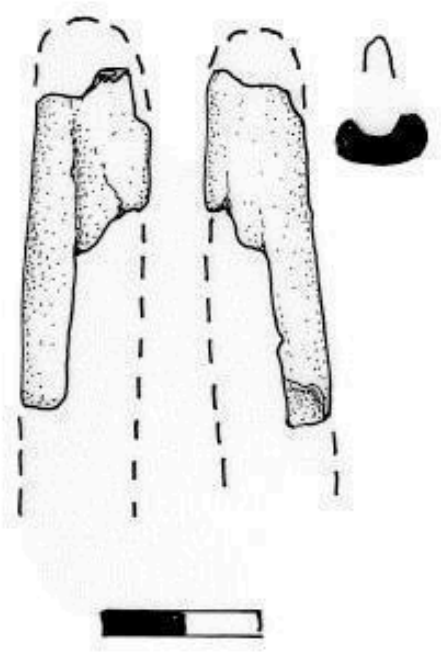

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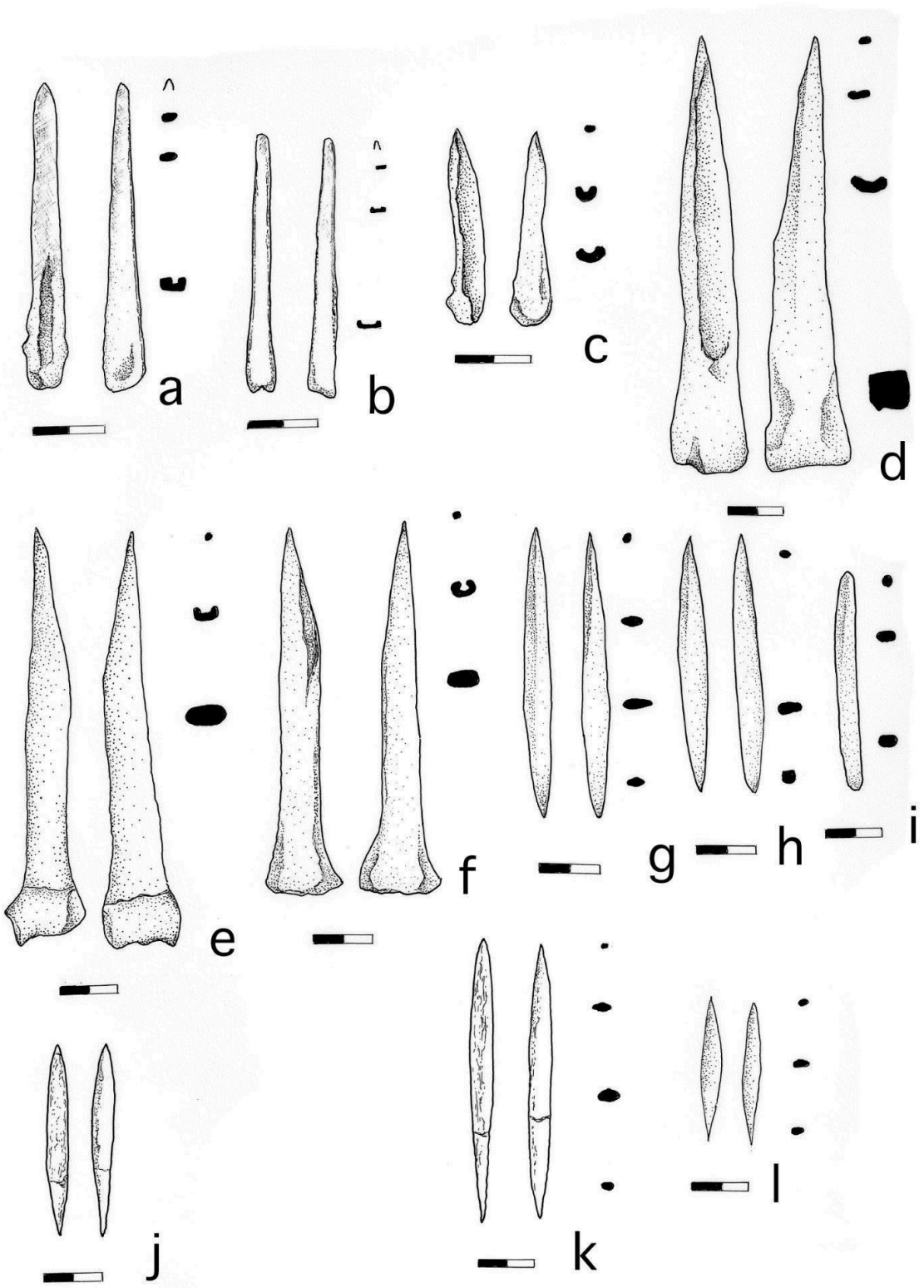

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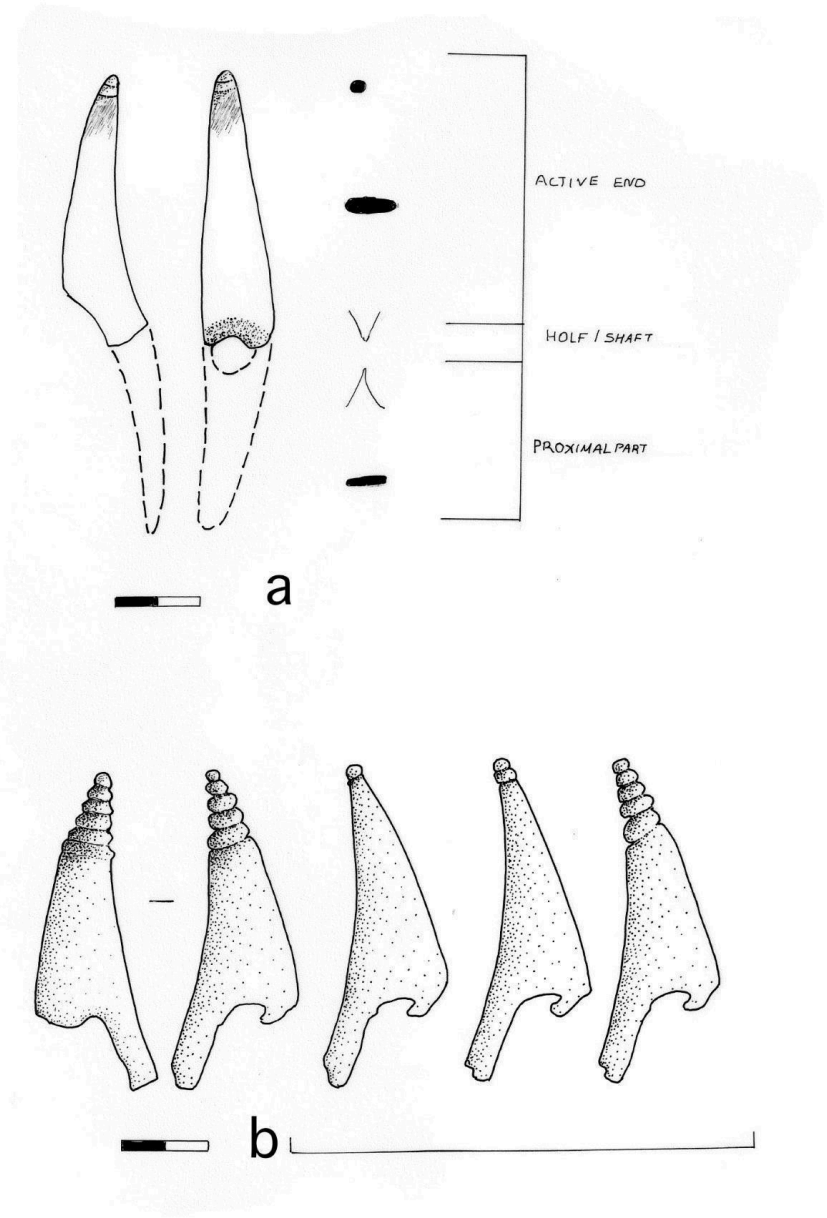

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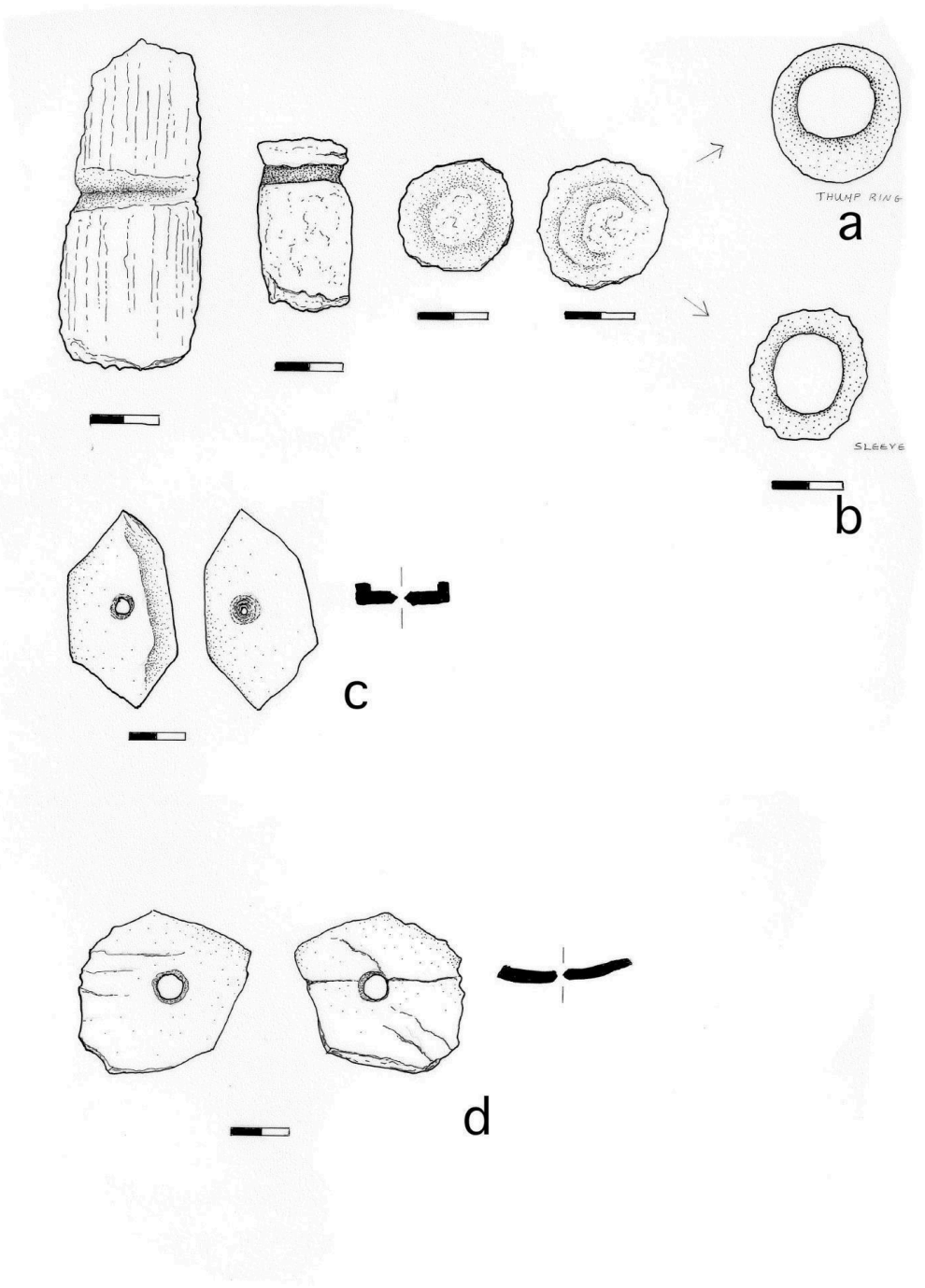

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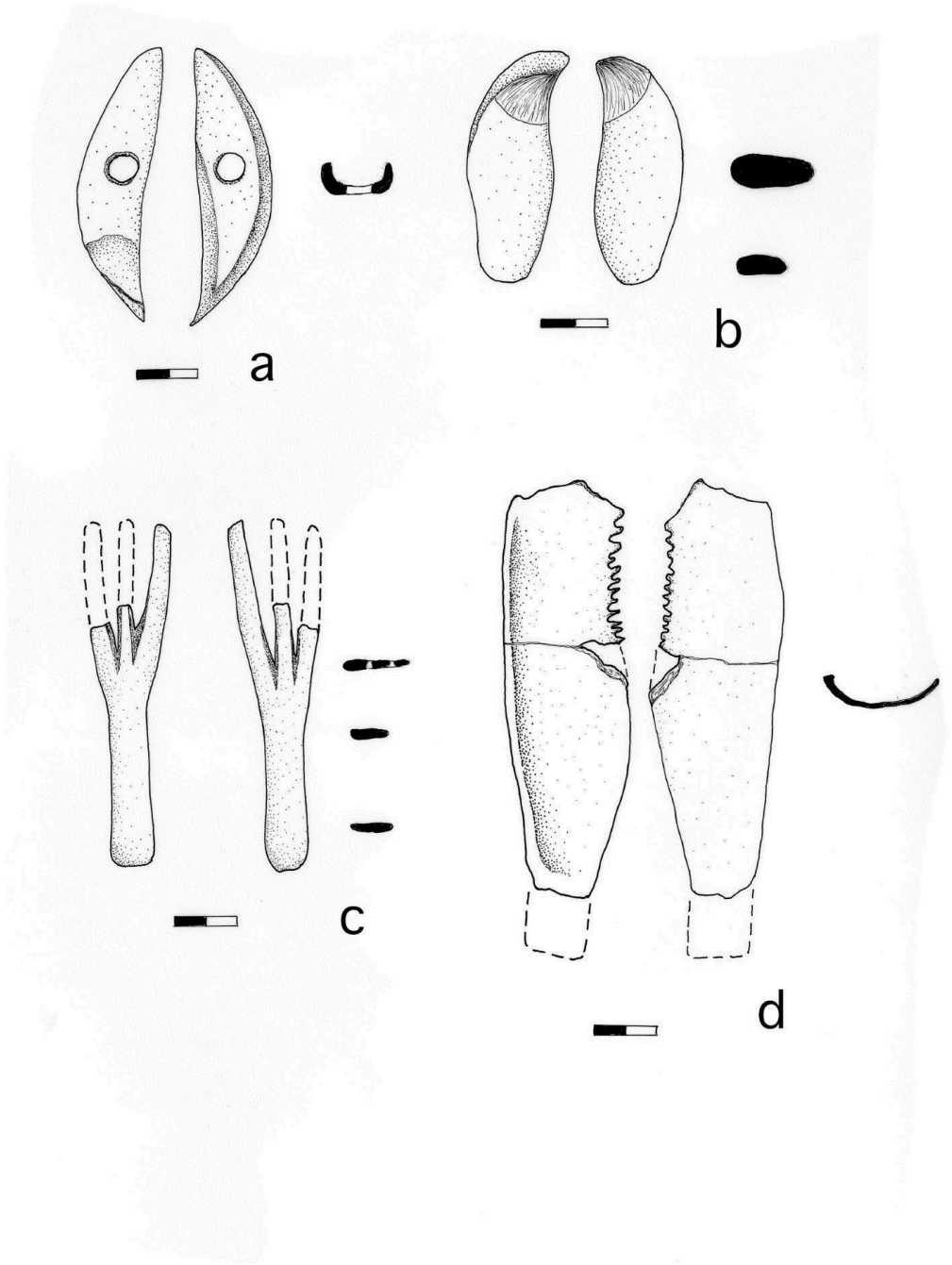

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