CHIPPED STONE INDUSTRIES FROM WESTERN MACEDONIA, GREECE.

THE CASE OF THE NEOLITHIC LAKESIDE SETTLEMENT

ANARGHIRI IXb

Volume I: Text

Inauguraldissertation

an der Philosophisch-historischen Fakultät der Universität Bern

zur Erlangung der Doktorwürde

vorgelegt von

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Promotionsdatum: **27 Februar 2020**

eingereicht bei

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To my parents,

Lazaros and Eleni

Acknowledgements

The present Ph.D. thesis is the result of personal effort, but would never have been accomplished without the contribution of many people, who supported and encouraged me during the last years.

First of all I would like to thank my supervisor, Prof. Dr. Albert Hafner of the University of Bern. I am grateful for his willingness to take over my Ph.D. study at the University of Bern, but also for his academic advice and suggestions.

I would like to express my gratitude to Prof. Dr. Nikos Efstratiou of the Aristotle University of Thessaloniki for accepting to co-supervise my Ph.D. thesis. During the first years of my studies at the Aristotle University of Thessaloniki as undergraduate student, but also throughout my postgraduate studies, Prof. Efstratiou has been always supportive, offering his valuable advice and constructive comments. I am indebted to him for all the inspiring conversations, his guidance and encouragement during my Ph.D. research.

I would also like to thank Prof. emeritus Kostas Kotsakis of the Aristotle University of Thessaloniki for his well-aimed recommendations and discussions during the annual Ph.D. progress meetings.

The present Ph.D. study was motivated by a discussion with Dr. Panikos Chrysostomou, of the Archaeological Service of Florina, the time I was working at the rescue excavations in the Amindeon region. I am grateful to him for providing the permission to study the material from the rescue excavation of Anarghiri IXb, but also for his support and assistance to practical issues. I would also like to express my gratitude to Dr. Christina Ziota, Head of the Archaeological Service of Florina. She has always been supportive and provided her help and advice every time I asked for it. Additionally, I would like to thank Dr. Elpiniki Naoum, of the Archaeological Service of Florina. The last months of recording the lithic material from Anarghiri IXb she offered a comfortable environment at the facilities of the archaeological site of Petres, in order to save time among working at the site and recording the material of my Ph.D. research.

My gratitude goes also to Dr. Joséphine de Karman Foundation of Faculty of Humanities, University of Bern, and to Dr. Christian Hesse, Professor at the Institute of History, University of Bern and Foundation’s Committee president, who accepted my application and offered me a sixmonth grant. The financial support at the last stage of writing my thesis was decisive, in order to focus on my work and complete my thesis on-time.

I am grateful to Prof. Dr. Paolo Biagi of Ca’ Foscari University of Venice (Department of Asian and North African Studies) and Dr. Elisabetta Starnini for their help in the identification of raw materials from the Anarghiri IXb assemblage, but also the interesting discussions and their help in bibliography. I would also like to express my gratitude to Dr. Lia Karimali. Her willingness to discuss issues concerning the lithic material of Anarghiri IXb and her help in providing necessary bibliography on lithics were valuable. I am also grateful to Dr. Niels Andreasen, lithic specialist and good friend, who read my text thoroughly, providing effective improvements and well-aimed suggestions. I owe many thanks to Prof. Dr. Vasilis Melfos of the Geology Department of the Aristotle University of Thessaloniki, who has always been willing to help me with discussions regarding the raw materials and especially obsidian. Even though the characterization of obsidian artefacts from Anarghiri IXb was not carried out in the framework of my Ph.D. due to time restrictions, I hope to a future analytical work on this interesting material.

I would like to thank Dr. Katerina Skourtopoulou, who has always been helpful, already from my postgraduate studies. I deeply appreciate all the inspiring discussions and her eagerness to share her knowledge and experience on the chipped stone industries of northern Greece. I am thankful to Dr. Chrysa Tsagkouli for her kind response and help with bibliography on Neolithic projectile points. I am also grateful to Odysseas Metaxas, lithic specialist and friend, for his work on the drawings of the Anarghiri IXb lithics.

Every journey is better when you have good company. And for this long and many times hard road, I am happy that I had the chance to share it with two fellow colleagues and above all, good friends. Dr. Christopher Arampatzis and Dr. Tryfon Giagkoulis were also working on their Ph.D. research with material from the settlement of Anarghiri IXb. During the last years we had the chance to work on common projects and have a lot of discussions regarding the settlement of Anarghiri IXb, sharing our enthusiasm, but also the difficulties of our research. Their help and constant support was valuable, especially during the last year of writing my thesis and I am grateful to both of them.

I owe a lot to my friends Elena Ainali, Yula Tsilogianni and Maria Tryfinopoulou, who have been very supportive during the last years, encouraging me, but also providing all the necessary ‘distractions’ in order to bring me back to reality every time I was lost in ‘my world’. Friends that are so close, no matter how far… Eleni Koutalou, Savvas Lostoridis, Panagiotis Chasiotis, Koula Borboudaki and Evita Kalogiropoulou were there for me -especially during the final stage of writing my thesis- and I am grateful to them. I am also thankful to Panagiotis Panagiotidis for his encouragement during the last years, making easier my stay back at my homeland, the time I was working in Florina and recording the lithic material of Anarghiri IXb.

Last but not least, I would like to express my deepest gratitude to my family. My brother Charalampos and his wife Iliana were there for me, showing all this time their love and caring. Among the special ones is my little niece Elena, who always managed -in her own sweet way- to make me forget the difficulties and keep smiling! Finally, I would like to express all of my love and gratefulness to my parents, Lazaros and Eleni. They were always supportive to every decision I have made and they never stopped believing in me. Their love, understanding and constant encouragement is one of the reasons that I have made it. The least I can do is to dedicate them my Ph.D. thesis.

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Chapter 1.

Introduction

1.1 Introduction and research aims

The study of chipped stone industries deriving from prehistoric sites in northern Greece has opened a new area of exploration for prehistoric research in the last decades. Together with many other aspects of material culture, lithic artefacts have been part of specialized studies and therefore are included in recent publications. Thus, lithic studies have focused on raw material exploitation and exchange networks, technological and typological analysis, functional analysis, spatial and contextual approaches (see Chapter 3). Previous research has demonstrated different patterns of raw material exploitation between northern and southern Greece during the Neolithic period. The lithic industries of southern Greece and eastern Thessaly are characterized by the use of imported materials, like obsidian and flint. On the other hand, the study of lithic materials from central, eastern Macedonia and Thrace shows that the prehistoric communities of northern Greece relied on local and regional materials for tool production, demonstrating regional patterns related to the distribution of raw materials (Dimitriadis & Skourtopoulou 2001; Kakavakis 2011; Kourtessi-Philippakis 2009; Skourtopoulou 2013).

Despite these noticeable advances in lithic studies, a serious gap in our knowledge for the area of western Macedonia, Greece, is noticed. A few preliminary reports are the only sources of information concerning the use of raw materials and tool production during the Late Neolithic period in the region. Therefore, comparison studies with lithic assemblages from other areas of Greece and the Balkans are lacking.

The study of the material unearthed from the prehistoric lakeside settlement of Anarghiri IXb in the Amindeon basin, western Macedonia, Greece, counting thousands of lithic artefacts aims to shed light on the chipped stone industries of western Macedonia, providing therefore a comparable material and enriching our knowledge regarding the lithic production during the Late Neolithic period in the region. An additional interest in the material of Anarghiri IXb is related to the limited information on the Final Neolithic industries of northern Greece (Elster 2003; Sériadès 1992). The settlement of Anarghiri IXb demonstrates an almost uninterrupted occupation from 5400/5300 cal BC to approx. 4200 cal BC, providing the opportunity to investigate the organization of lithic production during the early phase of the Final Neolithic period (4600/4500-4300/4200 cal BC).

Research aims

The present study focuses on the prehistoric chipped stone industries of western Macedonia using as a case study the lithic material from the Late and the Final Neolithic settlement of Anarghiri IXb in the Amindeon basin. The primary aim of the research is to explore the organization of chipped stone production of the settlement, to demonstrate the strategies employed by the prehistoric inhabitants of the community and investigate the factors that affected their choices. More specifically, the main objectives of the study are:

- To explore the strategies of raw material acquisition and exploitation for the production of tools.
- To examine the technical skills and the technological choices related to stone tool manufacturing.
- To provide a representative typology of the chipped stone tools and approach the activities related to their use.
- To discuss the changes that occurred during the lifetime of the settlement between the two distinct chronological periods. The comparison concerning the lithic material of the Late and the Final Neolithic period demonstrates the chronological variation in the organization of tool production, which could reflect changes in the socioeconomic level of the settlement.
- To investigate the inter-site communication in the region of western Macedonia and explore the exchange networks that the settlement of Anarghiri IXb was participating.
- To integrate the chipped stone industry of Anarghiri IXb to the geographical, chronological and cultural context of the adjacent Greek and Balkan regions.

1.2 Organization of the thesis

The thesis comprises three volumes. The first volume contains the text, which is organized in eight chapters. The first chapter corresponds to the present introduction and the general aims of the research (Chapter 1). The second chapter (Chapter 2) refers to the region of western Macedonia providing information regarding the geographical, geological and environmental background of the study area, as well as the chronological context of Neolithic in northern Greece. A brief overview of the research history in the region of western Macedonia is also presented to draw the outline of the prehistoric investigation in the broader study area. In the final section of this chapter, the settlement of Anarghiri IXb is introduced with information concerning the excavation of the site and the finds, the stratigraphic sequence and the chronological framework of the settlement.

The next chapter (Chapter 3) refers to the history of lithic studies conducted in Greece. A review of the first attempts and the developments on lithic analysis is presented, highlighting the theoretical and methodological trends that affected the study of knapped stone, as well as the recent directions of research in the domain of chipped stone analysis.

Chapter 4 consists the main part of the thesis focused on the analysis of the lithic material derived from the Anarghiri IXb settlement. At first, the material under study is introduced with information concerning the sample selection and the limitations of the present research, while the methodological framework followed in the analysis of the lithic material is described. In a second place, the analysis of the studied material is presented, divided into three main sections including the examination of the raw materials, the technology and tool typology of the lithic material, accompanied by statistical data. Each part examines separately the material of the Late and the Final Neolithic period.

The synthesis of the examined material follows at the next chapter (Chapter 5), which consists of several sections. Each section discusses issues originated by the evaluation and synthesis of the studied material. The reconstruction of the *chaîne opératoire* and the technological analysis demonstrate aspects of raw material preferences and acquisition strategies, but also provide information on the technological choices and the technical skills of the prehistoric knappers. In addition, the typological analysis focuses on the characteristics of tools, their potential use and management. All the above issues are examined diachronically to show the chronological variability of the lithic material.

At the following chapter (Chapter 6), the incorporation of the material from Anarghiri IXb to the chronological and geographical framework of northern Greece and southern Balkans is accomplished by a comparative study of the chipped stone industries from selected contemporary settlements. Using the information derived from the analysis of the Anarghiri IXb material, but also from the above-mentioned comparison, a discussion regarding the communication and exchange networks related to the settlement of Anarghiri IXb follows at Chapter 7.

The last chapter of the thesis (Chapter 8) presents the final conclusions of the research including a summary of the study results and some considerations for future investigation.

In the second volume of the thesis (Volume II), visual depiction of the analyzed data is provided in the form of maps, charts, tables and plans. Volume III includes a number of plates presenting the photographic documentation and graphic representation of selected artefacts from the Anarghiri IXb assemblage. The artefacts depicted are indicative of the technological and typological categories encountered at the studied material representing both chronological periods (Late and Final Neolithic).

Chapter 2.

The region of western Macedonia and the settlement of Anarghiri IXb

2.1 Geographical, geological and environmental setting of western Macedonia

2.1.1 The geography

The region of western Macedonia is located at the northwestern part of Greece, bordering with Albania and the Republic of North Macedonia to the north, Thessaly to the south, central Macedonia to the East and Epirus to its West. It comprises the Prefectures of Kastoria, Grevena, Kozani and Florina, covering an area of almost 9.451 km^2. The region is mainly mountainous with basins and lakes to dominate the landscape (Fig. 2.1). Its west border is the Pindus mountain range and the mountains Grammos (2.520 m), Smolikas (2.637 m) and Tymfi (2.497 m). The eastern borders of the region are marked by the mountains Voras (2.524 m) and Vermion (1.769 m), which separate western from central Macedonia. At its southern part, the region is separated by Thessaly with the Pieria range (Chasia, Antichasia and Kamvounia mountains). High mountainous ranges cut through the middle part of western Macedonia including the mountains Varnoundas (2.334 m in Greek territory), Vernon (2.126 m), Askion (2.111 m) and Vourinos (1.866 m) (Kotoulas 1987).

Among the mountainous terrain, several basins were formed, while lakes and rivers also characterize the landscape of the region. The longest river is Aliakmon (310 km), which originates in the Pindus Mountains (Vernon, Grammos and Voion) crosses Grevena, Kastoria and Kozani Prefectures, as well as Imathia and Pieria and flows into the Thermaic Gulf. The basins that are formed in the mountain ranges of western Macedonia include the Kastoria basin with the Orestias Lake (28 km^2), the Upper Aliakmon basin covering part of the Grevena and Kastoria Prefectures, the basin of Ptolemais with the drained Kitrini Limni (Yellow Lake) in the Kozani Prefecture and also the middle Aliakmon valley with the Servia basin and the artificial lake of Polyfitos. At the northern part of the Florina Prefecture lies the basin of Pelagonia, part of which belongs to the Republic of North Macedonia. The Prespes lakes are in the northern part of Florina, Great Prespa Lake (270 km^2) located at the Greek, Albanian and North Macedonian borders and Small Prespa Lake (48 km^2) at the Greek-Albanian borders. At the southern part of Florina Prefecture, there is also the Amindeon basin, with Zazari (2 km^2), Chimaditis (11 km^2), Vegoritis (72.5 km^2) and Petron (14 km^2) Lakes (Kotoulas 2004).

2.1.2 The geology

The region of western Macedonia is part of the Internal Hellenides zones, characterized by Mesozoic, Paleozoic and older metamorphic rocks, as well as ophiolites. The Internal Hellenides are subdivided into several metamorphic zones that include (from east to west) the Rhodope Massif, the Serbo-Macedonian Massif, the Vardar/Axios Zone and the Pelagonian Zone (Fig. 2.2). Western Macedonia belongs to the Pelagonian geotectonic zone, which forms an elongate nappe pile of continental origin extending from the Republic of North Macedonia to the south through the central Greek mainland and Evvoia into the Cyclades (Attico-Cycladic Massif). The Pelagonian Zone is oriented from north-northwest to south-southeast and lies between the Pindus ophiolitic belt at the west and the Vardar/Axios ophiolitic belt at the east (Mountrakis 1986, 336).

The lithostratigraphy of the Pelagonian Zone in northern Greece comprises, from top to bottom: i) the formations of later alluvial depositions of Upper Pleistocene and Holocene, ii) meta-alpine formations including the Molasic sediments of the Mesohellenic Trough and the Pleistocene deposits of the basins, iii) Triassic-Jurassic recrystallized carbonate sediments and marbles with the emplacement of Tethyan ophiolites on top. The ophiolitic compounds derive from the Vardar/Axios zone and the Sub-pelagonian zone and are embedded on the two calcite covers. Among the sediments that accompany the ophiolites are radiolarian hornstones and calcareous cherts. iv) A Permo-Triassic low grade metamorphic volcano-sedimentary unit and v) a Paleozoic and older polymetamorphosed crystalline basement consisting of gneisses, schists and Late Paleozoic granitic intrusions (Kilias et al. 2010, 8; Mountrakis 1986, 336-338) (Fig. 2.3).

More specifically, parts of the basins of western Macedonia are covered by the Neocene quaternary sediments that were formed during the Holocene and are characterized by alluvial deposits of sand, clays and conglomerates, but also by lacustrine deposits with interbedded lignites in the area of Amindeon, Ptolemais and Kozani. The larger part of the basins of Florina and Kozani, but also Grevena and Kastoria are also characterized by Miocene and Upper Pliocene sediments, well documented at the riverine and lacustrine deposits. The basins were formed when a major tectonic graben extended between the Pelagonian Plain and the Aliakmon River in the south during the Upper Miocene and Lower Pliocene. Moreover, the larger part of the Kastoria and Grevena region is covered by the Miocene sediments of the Molasic Mesohellenic Through, a southeast-east trending massive basin formation, which spreads from southeastern Albania to Thessaly. It was formed and filled with marls, sandstones and conglomerates, which derive from materials corroded and laid at the basins from the ranges of the Pindus and the surrounding Pelagonian area during the latter stages of the Alpine orogeny (Brunn 1956; Metaxas et al. 2007).

Regarding the alpine formations, at the eastern part of the Pelagonian Zone, Voras Mountain consists of narrow belts of schists, gneisses, granitoids, Paleozoic and Mesozoic meta-sedimentary rocks, Tethyan ophiolites and Middle to Late Jurassic radiolaritic-ophiolitic mélanges. The succession on the top of the obducted ophiolites consists of Late Jurassic to Early Cretaceous clastic sediments, shallow-water limestones and flysch (Kilias et al. 2010, 9). The Vermion range includes the crystalline basement, marbles of Triassic-Jurassic age, the ophiolitic mélange of Jurassic age with serpentines and volcanic rocks, Upper Cretaceous limestones or limestone conglomerates and flysch consisting of clay schists and clays (Brunn et al. 2004; Photiades et al. 2018). In the middle of the pelagonian zone, the mountains of Vernon and Varnoundas consist of Late Paleozoic granites, gneiss and schists. Small ophiolitic compounds are also present. In the west part of the pelagonian zone, a series of Triassic and Jurassic recrystallized limestones with layers of chert and bauxites, as well as small areas with ophiolitic compounds are present. The Grevena region is also part of the pelagonian zone with marble, plutonics, gneiss, amphibolites, schist, etc., but also by the ophiolitic complex of mount Vourinos, comprising deep-sea rocks, like gabbro, diorite and basalt, Jurassic and Cretaceous carbonate stones, which include ophiolitic layers and radiolarian chert crops (Carras et al. 2004; Chiari et al. 2003; Photiades et al. 2018). Finally, at the western boundaries of western Macedonia lies part of the Pindus geotectonic zone, which is characterized by Mesozoic layers and ophiolites. The presence of the latter usually combines with pelagic sediments (over the pillow lavas) composed of hornstones, small layers of schist, limestones and radiolarites (Nirta et al. 2010).

2.1.3 The climatic conditions and the paleoenvironment

The climate conditions in western Macedonia are temperate continental with generally dry and cool summers, as well as cold winters. The average annual precipitation amounts to 516.7 mm and the mean annual air temperature is 12.3 °C, while the mean monthly air temperatures for January and July are 2.6 and 22 °C, respectively (Gassner et al. 2019). The climate in the area of western Macedonia during the 5th millennium BC was slightly different than today, with the temperature to have been up to 4 ^{o}C warmer during summers. However, it seems that a minor climatic change during the Neolithic resulted in increased rains and gradually turned the climate into colder and more humid conditions, especially after 2500 BC, approximating the present conditions (Andreou et al. 1996, 562; Bottema 1974, 154).

Regarding past vegetation, pollen diagrams and charcoal analysis demonstrate that during the Neolithic the environment of western Macedonia was characterized by the presence of open forests of mixed deciduous oak woodland with lime, elm, hazel, fir and ash among the species (Bottema 1982; Kouli 2002; Ntinou 2008). At low altitudes, dense deciduous forests and oaks were present, while conifers covered higher altitudes. The lowlands and the areas close to water sources were covered by coastal halophytic and open vegetation. This is evident by the pollen diagrams of Lake Orestias, Chimaditis and Zazari, but also by the charcoal analysis of samples from the Neolithic settlements of Dispilio, Avgi and Kleitos (Bottema 1974; Gassner et al. 2019; Karkanas et al. 2011; Kouli 2002; Marinova & Ntinou 2018; Ntinou 2008; 2010; 2014).

The physical environment and the vegetation of western Macedonia favored the establishment of many prehistoric settlements in the area, already from the Early Neolithic period, as is evidenced by the archaeological record (see Chapter 2.3). The settlements were clustered in the riverine zone of Aliakmon River and the lakeshores, which would provide fertile arable land for cultivation. Certain crops would probably be vulnerable to frequent flooding in the extensive and active floodplains. Certain pastoral activities, mainly cattle keeping, were dependent on proximity to water and damp meadows (Gassner et al. 2019; Gkouma & Karkanas 2018).

It is generally argued that human presence did not influence the environment to a significant degree in the Neolithic period. However, a change is recorded around 3100-3300 BC, when a decrease of forests and mainly oaks is observed. The human impact on the environment in the form of forest clearings, vertical transhumance and intensive land use might have resulted in slope erosion and deposition of sediments along the peripheries of valleys (Andreou et al. 1996, 562; Bottema 1974, 274-277).

2.2 Chronological framework

For many decades, the chronological system of the Neolithic period in Greece followed the trends of Thessalian chronology, which was based on relative chronology according to the cultural affinities to the Thessalian Neolithic sites. Christos Tsountas with his excavations at Sesklo and Dimini (1908) was the first to define two separate stratigraphic periods according to the differences observed among the two settlements (Tsountas 1908). Later, the publication of Weinberg established a tripartite chronological system, which separated the Neolithic into an Early, Middle and Late phase (Weinberg 1947). In the mid-1950s the systematic excavations in Thessaly conducted by Milojčić and Theocharis revealed many Neolithic settlements, where the excavators used relative chronology for dating. Milojčić proposed the division of the Early Neolithic into three sub-phases and introduced the Chalcolithic period, which corresponds to the phase preceding the Early Bronze Age (Milojčić 1950/51; Milojčić 1959, 24; 1960). This system was for a long time used mainly in the Neolithic of Thessaly, but also at other areas with similar ceramics.

The introduction of absolute dating techniques in the late 1950s, especially radiocarbon dating, contributed greatly to the chronology of archaeological material. However, the different cultural expressions of the Neolithic in the wider Greek area, but also the unclear limits between the chronological periods slowed down the application of a complete chronological sequence for the whole Neolithic Greece. Thus, many chronological schemes have been proposed based on regional sequences that focus on Thessaly, Aegean, or Greece as a whole. Widely accepted and used by researchers are the chronologies proposed for the Greek Neolithic by Démoulé and Perlès (1993), Papadimitriou (2010, 20-21), Andreou, Kotsakis and Fotiadis for northern Greece (1996, 538) and Reingruber (2017), as well as Gallis (1996) for Thessaly.

According to radiocarbon dating, the Neolithic period lasts from the mid-7th millennium to the Late 4th BC. The Early Neolithic period dates from 6700/6500 to 5800/5600 cal BC, while the so-called aceramic phase is not identified in northern Greece. The Middle Neolithic lasts approx. 500 years (5800/5600-5400/5300 cal BC). The Late Neolithic corresponds to a much longer chronological phase, which divides into Late Neolithic I (5400/5300-4900/4800 BC), Late Neolithic II (4900/4800-4500 cal BC) and Final Neolithic or Chalcolithic (4700/4500–3300/3100 cal BC).

The chronology used in the present study follows the generally accepted chronological sequences (see Andreou et al. 1996; Gallis 1996; Papadimitriou 2010; Reingruber et al. 2017), which are based on the recent radiocarbon dates from Neolithic settlements in northern Greece (Fig. 2.4).

2.3 The history of the prehistoric research in western Macedonia

The prehistoric research in Macedonia was delayed for many decades in comparison to southern Greece. Until the beginning of the 20th century, the archaeological research in northern Greece was limited to visits of historians and travelers in the region. At the same time, incorporation of Macedonia in the Greek state in 1913 opened the road for more systematic work in the region. The Russian Archaeological Institute of Istanbul conducted the first investigation in the area of western Macedonia from 1898-1899. At Ag. Panteleimon, a village at the shores of Vegoritis Lake in Florina, the remains of an Early Iron Age cemetery were excavated revealing hundreds of tombs (Akamati & Veleni 1987, 105; Chrysostomou et al. 2015, 26-27; Chrysostomou & Giagkoulis 2016, 7; Heurtley 1939, 100-105). Early investigations in the region of Macedonia were also conducted by Wace and Thompson involving surface surveys, which were focused on the identification of correlations among the Thessalian and Macedonian prehistoric cultures (Wace & Thompson 1912).

More systematic investigations in the area of Macedonia and Thrace begun during World War I by the allied British and French army forces (British Salonika Force and Archaeological Service of the French Armée d'Orient). In the framework of military expeditions and defensive works, several archaeologists, topographers and architects conducted topographic surveys, surface collections and small-scale excavations to unveil the past of Macedonia. The results of their investigations were published in the journals of the British and French Archaeological Schools in Athens (BSA, BCH) (Adam-Veleni 2015, 127-128; Akrivopoulou 2015; Rhomiopoulou 2014, 34). Among the essential contributors was Leon Ray, who excavated trial trenches at prehistoric settlements in central Macedonia. His publication of the results of the French investigations at prehistoric mounds in Macedonia included maps, topographic representations and stratigraphic observations (Rey 1921). Another important work of this period was the research of Casson, a member of the British archaeological school, who investigated the Tsaousitsa site in western Macedonia (Casson 1919-21). In 1926, he published a monograph entitled 'Macedonia, Thrace and Illyria' on the antiquities of Macedonia and Albania (Casson 1926).

The main research interest of this period was focused in central and eastern Macedonia. During the interwar period, the prehistoric settlement of Dikili Tash was excavated by the French Archaeological School, under the direction of Louis Renaudin. The investigation was limited to a few trial trenches, but it was the first time that Neolithic layers were identified at the settlement (Renaudin 1920; 1921; 1922). In the same period, the American School of Classical Studies started the excavation at ancient Olynthus in central Macedonia by the direction of Robinson, where a Neolithic settlement was also located and excavated (Mylonas 1929).

In the 1930s, the work of W.A. Heurtley focused on the prehistoric research of western and central Macedonia. His research included systematic surface surveys and excavation at prehistoric sites across Macedonia. Among the investigations conducted by Heurtley was the excavation at Servia, already known by 1911 (Wace 1913-1914) and the excavation at Armenochori in Florina, where remains of an Early Bronze Age settlement were revealed. In 1939, Heurtley published the monograph 'Prehistoric Macedonia', concentrating the results of the prehistoric investigations conducted by him or other researchers of the time (Heurtley 1939). At that period, the research interest of Antonis Keramopoulos in western Macedonia included surface surveys and small-scale excavation projects. One of the essential contributions was the excavation at the Neolithic lakeside settlement of Dispilio in Kastoria, a settlement type that was documented for the first time in Greece (Keramopoulos 1938; 1940).

After the early investigations conducted during the first decades in Macedonia, limited research was carried out for the next 30 years, mainly due to political and historical reasons. However, during the 1960s D. French published the results of surface surveys conducted in Macedonia and Thrace, presenting already known, but also new prehistoric sites. Additionally, his research in western Macedonia provided information on the Neolithic settlements of Kitrini Limni, at the Ptolemais basin (French 1966; 1970).

It was only at the beginning of the 1960s when the systematic excavation at Nea Nikomedeia in central Macedonia started. The excavation project carried out by the Universities of Cambridge and Harvard combined the new methodological trends with the participation of various disciplines (Bintliff 1976; Rodden 1962; 1964; 1965). In the next two decades, excavations were also conducted at the prehistoric settlements of Sitagroi (Elster & Renfrew 2003; Renfrew et al. 1986), Dikili Tash (Deshayes 1970; 1973; Treuil 1992; 2004), Dimitra and Vasilika (Grammenos 1991; 1997a). In the region of western Macedonia, the rescue excavation of the prehistoric settlement of Servia was carried out (1971-1973), directed by the British School at Athens and the Archaeological Service (Riddle & Wardle 1979).

Since the decade of 1980s, an increase in the interest of prehistoric excavations has been on the rise, which has changed the landscape of prehistoric research in northern Greece significantly. The construction of great public works was a key factor for finding new archaeological sites and excavating extended prehistoric settlements throughout Macedonia. Large-scale rescue excavations also contributed to the identification of the flat-extended settlement type providing new methodological and interpretative directions. Furthermore, the Archaeological Service, except for the collaborations with foreign archaeological schools, gained a leading role at the excavations by more organized and staffed services. The Aristotle University of Thessaloniki offered courses in prehistory of northern Greece already from the mid-1970s, with the important contribution of Dimitris Theocharis and Giorgos Chourmouziadis. The University directed excavations in many regions of northern Greece (Mandalo, Archontiko, Paliambela, Toumba, Makri, Arkadikos, Dispilio, etc.), some of which have continued until today. The Annual Meeting of the Archaeological Work in Macedonia and Thrace (AEMTH) organized by the Aristotle University of Thessaloniki and the Archaeological Museum of Thessaloniki since 1987 enabled the preliminary presentation and the publication of excavation results (Adam-Veleni 2015, 128-129; Andreou et al. 1996, 562; Papaefthimiou-Papanthimou 2014).

In this framework, the excavations at western Macedonia increased in number and many old but also new settlements were investigated (Fig. 2.5). In the region of Kastoria, the systematic excavation of the Neolithic lakeside settlement of Dispilio started in 1992 by the Aristotle University of Thessaloniki under the direction of Chourmouziadis and continues until today under the supervision of Prof. em. Kostas Kotsakis. It is the first discovered lakeside settlement that was excavated in Greece and dates from the Middle Neolithic to the end of the Final Neolithic period, as well as the Bronze Age (Facorellis et al. 2014). Hundreds of wooden structural elements, architectural remains, thermal structures, tools and other finds were unearthed during the excavations. The first results of the excavation were published in 2002 with preliminary reports on the material culture of the settlement. Additionally, a project of the reconstruction of the Neolithic lakeside settlement was also carried out, resulting in the first eco-museum in Greece (Chourmouziadis 2002).

Another systematic excavation in the area of Kastoria, not far from Dispilio, was conducted by the Archaeological Service from 2002 until 2008 at the Neolithic settlement of Avgi. According to radiocarbon dates, the settlement was inhabited from the later phases of the Middle Neolithic to the Late Neolithic II, demonstrating three occupation phases (Avgi I-III). The excavation revealed many free-standing rectangular buildings and open areas, thermal structures, storage and disposal pits, as well as many bone and stone artefacts and pottery (Stratouli 2010; 2011; 2013; 2019).

Small-scale rescue excavations also supplemented the documentation of prehistoric occupation in Kastoria. At the beginning of 2000, the rescue excavation at Kolokynthou revealed a Neolithic settlement close to the Aliakmon riverbed. According to the pottery, two occupation phases have been distinguished, a late Middle Neolithic/early Late Neolithic phase and a Final Neolithic phase. The investigation revealed the remains of rectangular post-framed houses and disposal pits (Tsouggaris et al. 2004).

The rescue excavation at Trita Koromilias, a Late Neolithic settlement located close to the Aliakmon River, was conducted by the Archaeological Service during 2013-2015. The excavation revealed pits, thermal structures, stone tools and pottery. The pits were probably used as activity areas. The excavator suggests that the settlement had a distinctive character with seasonal use (Stratouli 2017).

The excavation at Piges Koromilias Cave, close to the Neolithic settlements of Dispilio and Avgi, revealed layers of Middle and Late Neolithic occupation. The cave had a pastoral use, mainly during the Late Neolithic, but its use continued until the 20th century. The presence of clay floors and post-holes demonstrate a rudimentary spatial organization in the cave. Many ceramics, but also few chipped and ground stone tools, osseous artefacts and spindle whorls were found in the cave deposits (Trantalidou et al. 2007; 2011; Trantalidou & Andreasen 2015).

In the Grevena region, a survey undertaken by Carleton College, directed by Wilkie at the 1980s, documented almost 400 sites dating from the Early Neolithic to modern times. At least 15 small sites are attributed to the Early Neolithic and located in flat terraces close to streams (Wilkie 1993; 1999; Wilkie & Savina 1997). Recent investigations increased the number of Early Neolithic sites to 19 (Karamitrou-Mentessidi 2014). In 1993, Toufexis excavated the settlement of Kremastos. The small excavation revealed an extensive destruction layer, the architectural remains of a wattle and daub dwelling and a storage pit. The pottery indicates that the settlement was occupied during the later phases of the Early Neolithic and during the Late Neolithic period (Toufexis 1998). Another Early Neolithic settlement excavated in 2005 is Matsouka Rachi, close to the Kremastos site. The settlement was occupied during the latter phase of the Early Neolithic and during the Middle Neolithic. The excavation revealed two destruction layers, architectural remains, three ditches and storage pits (Karamitrou-Mentessidi 2007a, 544-548). A survey has been conducted during the last decades at the highland area of Grevena, near Samarina by the Aristotle University of Thessaloniki, to investigate the human presence during the early prehistory. The project was focused on the identification of open-air Middle Paleolithic sites, but also documented the presence of Late Neolithic stone tools and located a Bronze Age site, demonstrating the seasonal exploitation of the highland area earlier than previously thought (Late Neolithic) (Biagi & Efstratiou 2013; Efstratiou et al. 2006).

Rich evidence of prehistoric occupation comes from the Prefecture of Kozani. One of the systematic surveys started at the mid-1980s at the Kitrini Limni basin to identify, record and excavate prehistoric settlements after the drainage of Kitrini Limni (Yellow Lake) during the 1950s due to mining activity in the area (Fotiadis 1988; 1991; Fotiadis & Hondroyianni-Metoki 1997; Fotiadis et al. 2000; Karamitrou-Mentessidi 1987; Ziota et al. 1993). The Kitrini Limni project brought to light many prehistoric settlements from the Early Neolithic period to the Bronze Age. The earliest occupation was confirmed at the site of Ag. Dimitrios, while nine Middle Neolithic and 13 Late Neolithic sites were also discovered. Additionally, the occupation during the Bronze Age is attested by 11 sites of the Early Bronze Age and two of the Late Bronze Age period. The settlements were either forming low mounts or were established at flat land. The project also included a survey in the mountainous hinterland (Vermion), where a cave with possible use during the Early Neolithic period was found (Andreou et al. 1996, 568-569). In the last decades, the number of prehistoric settlements has increased to more than 45 (Karamitrou-Mentessidi 2014).

In the framework of this project, a systematic surface survey was conducted at Megalo Nisi Galanis, Mikro Nisi Akrinis and Toumba Pontokomis. The excavation at Megalo Nisi Galanis during 1987-1989 and 1993-1994 revealed architectural remains of dwellings, which were probably built in a pisé technique, pottery, as well as large quantities of chipped and ground stone tools, shells and clay figurines. The settlement was first settled in the Early Neolithic period and was intensively occupied until the early phases of the Final Neolithic period and probably during the Bronze Age (Fotiadis 1988; 1991; Fotiadis & Hondroyianni-Metoki 1997; Fotiadis et al. 2019; Ziota et al. 1993). A few years later, the Late Neolithic site of Toumba Kremastis Koiladas was also excavated (1996, 1998-1999). The excavation revealed 462 pits, five ditches and 23 burials at the marginal zone of the Neolithic settlement. The material was studied by Hondroyianni-Metoki in the framework of her Ph.D. research, discussing the non-domestic uses of space at the Neolithic settlement (Hondroyianni-Metoki 2009a).

In the last decade, the expansion of the coal mining zone of the Public Power Corporation S.A. Hellas in the area of Kitrini Limni motivated the Archaeological Service to organize a rescue program for the documentation of prehistoric settlements in the area. Many small-scale rescue excavations were conducted, providing useful information on the prehistoric occupation of the region. One of the important documented site is Kleitos, a flat-extended Late Neolithic settlement that was first located in 1995 and was systematically excavated a decade later (2006-2010). Kleitos I was occupied during the Late Neolithic I period, while Kleitos II refers to a neighboring habitation with a horizontal movement during the Late Neolithic II and the Final Neolithic period. The excavation at Kleitos I revealed architectural remains of widely spaced buildings and open areas with thermal structures. The settlement was probably encircled by a system of ditches and post-framed enclosures. Kleitos II was more restricted in size with small open spaces. The investigation is significant as the entire settlement was excavated, providing useful information regarding the spatial organization and the distribution of indoor and outdoor activities (Ziota 2014a; 2014b; Ziota et al. 2013a; 2013b).

The rescue excavation of the Early Neolithic settlement at Mavropigi-Filotsairi should also be mentioned. The excavation conducted during 2005-2006 uncovered the whole settlement providing rich information about the first agricultural communities in the region. The settlement was founded at about 6600 cal BC and abandoned at 5900 cal BC, demonstrating three occupation phases. The excavation revealed a central pit house, irregular rectangular pile dwellings, storage pits and indoor thermal structures, 15 burials and many chipped stone tools (Kaczanowska & Kozlowski 2015), as well as many other portable finds (clay figurines, ornaments, stamp seals, etc.) (Karamitrou-Mentessidi 2007b, 523-534; Karamitrou-Mentessidi et al. 2015).

Apart from the Kitrini Limni project, a second important endeavor in the Kozani region is the Middle Aliakmon survey project that started in 1985. The construction of the Polyfitos Dam at the Aliakmon River and the formation of the artificial lake during the 1970s changed the landscape of the area. It exposed many prehistoric settlements to erosion and other detrimental effects. The Archaeological Service of Kozani decided to investigate the shores and the terraces near the Polyfitos Lake and the middle zone of Aliakmon River, to survey and conduct rescue excavations at the prehistoric settlements of the area (Andreou et al. 1996, 565-566; Hondroyianni-Metoki 1993; 1995; Ziota & Hondroyianni 1997).

The investigation revealed 124 prehistoric sites and resulted in the formation of a catalog including all known prehistoric settlements in the area. A total of 47 Neolithic (13 EN, 15 MN, 22 LN, 33 FN), 69 Bronze Age (24 EBA, 10 MBA, 42 LBA) and nine Iron Age settlements were located. At the same time, 28 prehistoric cemeteries had also been investigated. Excavations were conducted at Kriovrisi, Kranidia, Varemenoi Goulon, Vasilara Rachi, Paliambela Roditi and a few other settlements. The surveys and excavations mentioned above evidenced the extensively settled riverine zone of Aliakmon already from the Early Neolithic period and the number of prehistoric settlements to increase during the Late and the Final Neolithic period. During the Early and the Middle Neolithic, many settlements were established at flat land and low mounds, while there is a tendency for settlements in the Late and Final Neolithic to be situated on higher ground (Hondroyianni-Metoki 2009b).

During the 1980s, a survey at the region of western Macedonia was carried out by Kokkinidou and Trantalidou, to document the prehistoric occupation of the area. The research was based on previous field studies (Kastoria and Ptolemais basins, Aliakmon valley), but also on fieldwork and identification of new sites (basins of Florina, Mikri Prespa Lake, Vegoritis Lake, Giannitsa and Almopia plain). This work resulted in the identification of 96 prehistoric sites. Settlement location is characterized by diversification, involving sites close to water bodies (rivers and lakes), as well as fertile soils for agricultural exploitation and natural lines of communication. The settlement types include tall tells, low mounds, flat settlements, elongated tables and naturally defensible locations. The settlements seem to increase in number during the Late Neolithic and the Early Bronze Age. In contrast, a decline and an interruption of occupation is recorded during the Late Bronze Age (Kokkinidou & Trantalidou 1991).

In Florina Prefecture, the survey mentioned above located 23 settlements in the Florina basin and 29 in the Amindeon basin. In the Florina basin, most of the settlements belong to the Bronze Age, with only two sites dating to the Neolithic period. The Amindeon basin revealed nine Neolithic settlements (already occupied from the Middle Neolithic) located at the shores of the four lakes (Petron, Vegoritis, Chimaditis and Zazari) and a number of Early Bronze Age and Iron Age sites, also documented by the presence of cemeteries (Trantalidou 1989). However, the research did not identify any Early Neolithic settlements. It was during the rescue excavation at Filotas, a village close to the Amindeon area, where an Early Neolithic settlement was located and excavated in 1996. The excavation revealed a large pit in the bedrock with partially preserved features (clay floor, stone and clay structures) and pottery of the Early and probably of the Middle Neolithic period (Ziota & Moschakis 1999).

During the 1990s, the prehistoric investigation at the Florina Prefecture was limited to the re-excavation of the mound of Armenochori (1996-1997) by Chrysostomou, which confirmed the earlier occupation of the settlement during the Final Neolithic until the Middle Bronze Age. The excavation revealed destruction layers and architectural remains, providing information regarding building techniques, storage, dietary practices and economy of the Bronze Age in the area (Chrysostomou 1998). The finds of the excavation are exhibited at the Archaeological Museum of Florina.

In 2001, the excavation of the Iron Age Necropolis of tombs at Ag. Panteleimon was resumed under the direction of Chrysostomou and continues until today. The excavation revealed hundreds of graves organized in 18 tombs. A variety of grave types and grave goods were unearthed, providing information concerning the burial customs of this period in the region (Chrysostomou et al 2015, 26-27; Chrysostomou & Giagkoulis 2016, 7).

During the last 15 years, the Archaeological Service of Florina in the framework of rescue excavations investigated the Amindeon basin and the area of the four lakes (Petron, Vegoritis, Chimaditis and Zazari). The results of this research enriched the archaeological map of the region with 54 new well documented sites, covering a chronological period from the Early Neolithic to late historical times. The search for the diachronic occupation of the area - and more specifically for sites found along the shores of the four lakes and in the Amindeon Coal Mining Zone - shed light on a well-defined prehistoric sequence informally named the 'Culture of Four Lakes.' The 'Culture of Four Lakes' is represented by several Neolithic and Bronze Age settlements. Many of the settlements appear to have been occupied uninterrupted from the Neolithic to the Early and Middle Bronze Age. More specifically, the initial occupation of the area is represented by 11 Early Neolithic settlements, while in the following periods (Middle and Late Neolithic), the number of sites increases to 15. The Final Neolithic is represented by 12 sites showing a small decline in numbers. The subsequent Early and Middle Bronze Ages are characterized by a rise in the number of settlements and the founding of new ones. The occupation patterns so far show a preference for the lakeside areas along with those in the form of shallow mounds and flat land. The foundation of settlements is related to factors such as the proximity to water and fertile soils for early agricultural exploitation. Their architecture is characterized by post-framed and subterranean circular dwellings, while some settlements are surrounded by a system of concentric ditches (Chrysostomou et al. 2015, 26; Chrysostomou & Giagkoulis 2016, 6-7).

As regards the settlements located at the boundaries of the Amindeon Coal Mining Zone, the Archaeological Service of Florina carried out the rescue excavations project, to record and excavate the sites that were threatened due to the expansion of the coal mine. Special attention was given to settlements with preserved waterlogged material. Eight pile-dwellings and 19 lakeshore settlements have been recorded, most of which are located at the north shore of Chimaditis Lake (Chrysostomou et al. 2015, 27-28; Chrysostomou & Giagkoulis 2016, 7) (Fig. 2.6).

The earliest recorded traces of wetland habitation are at Limnochori II, a settlement that was occupied during the Middle, Late and Final Neolithic (5500-3300/3200 BC). Several wooden construction elements were unearthed, belonging to pile-dwellings raised on platforms in clusters or as individual units. The settlement of Anarghiri III was established during the Late Neolithic period (5300-4000 BC) and the excavation revealed two burnt layers and a wooden floor of a pile-dwelling. The settlement of Limnochori III was occupied during the Final Neolithic period (4500-4000 BC). The excavated wooden structures were organized in rows on a single raised platform to enable traffic between the dwellings. The settlement of Anarghiri IV was inhabited from the early 4th millennium until the Byzantine period, but limited research was carried out. The excavation of the Anarghiri I site unearthed a large Bronze Age settlement in the Chimaditis Lake. The settlement was destroyed by fire at approx. 2000 BC and its ruins were flooded in the Lake (Chrysostomou et al. 2015, 28-29; Chrysostomou & Giagkoulis 2016, 7-8).

Apart from the abovementioned cases, three further settlements established just before the early 5th millennium were also excavated, located on a low mound in the marshy area of Chimaditis Lake (Anarghiri IXa and IXb), as well as in another marshy environment situated 2 km to the north (Rodonas II). At Anarghiri IXa, the remains of a two-story pile-dwelling were unearthed, but also an oval wooden palisade of the Bronze Age (Chrysostomou & Giagkoulis 2018). Similarly, the excavation at Anarghiri IXb, located close to the previous settlement, revealed extensive destruction layers and remains of dwellings that were built on platforms or raised on piles. The three wooden trackways that were found during the excavation provide unique information regarding local infrastructure in this early period. The settlement of Rodonas II was established in the same period and its excavation revealed a rich organic layer containing pottery, tools and other archaeological materials (Chrysostomou et al. 2015, 29; Chrysostomou & Giagkoulis 2016, 8).

The excavations at the prehistoric lakeside settlements on the shores of Chimaditis Lake provided important information and enriched our knowledge regarding this settlement type, not only due to the excellent preservation of wooden structures, but also to the rich material culture that was unearthed. It seems that the settlements of Limnochori II, Anarghiri III and Anarghiri IXb during their final occupation phases (Final Neolithic) became dry-land sites due to continuous anthropogenic deposition. Important information derives from the excavations concerning the spatial organization and arrangement of household activities, according to the presence and density of domestic structures at the interior and exterior areas of the dwellings. The presence of hearths and ovens, clay structures, pottery and other portable finds enable the reconstruction of everyday activities of the prehistoric occupants (Chrysostomou et al. 2015, 28-30).

Information on the organization of the settlements' space, the enclosures and infrastructure elements of the settlements is also valuable. Concentric ditches surrounding the settlements are present at the dry-land settlement Anarghiri XI, already inhabited from the Early Neolithic, as well as the Neolithic settlements Anarghiri XIII and Anarghiri XIIIa. Apart from the ditches, the presence of timber palisades is attested at the settlement of Anarghiri IXb during the Late Neolithic, but also at the settlement Anarghiri IXa during the Bronze Age. The wooden trackways recovered at the periphery of the Anarghiri IXb settlement and the long trackway that connected the settlement with its synchronous neighboring settlement Anarghiri XI, provide information concerning the off-site activities and the connection between neighboring settlements, triggering discussions on the practical, social and possible symbolic role of the structures (Chrysostomou & Giagkoulis 2018).

2.4 The Neolithic lakeside settlement of Anarghiri IXb

2.4.1 The excavation of the site

The prehistoric lakeside settlement of Anarghiri IXb is located at the north-eastern marshy area of Chimaditis Lake, close to the prehistoric settlements of Anarghiri IXa, Anarghiri XI and Sotiras V, in the boundaries of the Amindeon Coal mining zone of the Public Power Corporation S.A. Hellas. The excavation of the settlement was part of the large-scale rescue excavations project conducted by the Archaeological Service of Florina. The prehistoric occupation covers an area of almost 2.8ha and has an oval shape orientated from north-east to south-west (Chrysostomou et al. 2015, 29; Chrysostomou & Giagkoulis 2016, 8) (Fig. 2.7). The excavation area is diagonally divided by a drainage canal created during the 1960s to manage the lake. The area east of the canal covers the more substantial part of the settlement. It includes the north, east and southern periphery, as well as the central area of the prehistoric occupation, while a small part of the settlement involves the area west of the canal. The preliminary examination of the stratigraphy indicates that the anthropogenic deposits of the periphery are 2.7m thick while moving to the center of the occupation area, their thickness rises to almost 3.8m (Giagkoulis 2019, 21).

The early investigation of the site started with few trial trenches in 2012, while in the following three years, a systematic excavation was conducted (2013-2016). The total excavated area covered almost 17.410 m^2. The excavation at the periphery of the settlement involved all the anthropogenic deposits until the natural bedrock, while at the central area of the settlement the excavation covered only the upper anthropogenic layers (Fig. 2.8). The unstable working terrain located close to the mining zone brought the excavation to an end in 2017 (see also Arampatzis 2019, 47; Giagkoulis 2019, 21-22).

2.4.2 The stratigraphy

A preliminary analysis of the settlement's stratigraphy is based on the collaborative work of the author, Dr. Christophoros Arampatzis and Dr. Tryfon Giagkoulis, members of the archaeological team of the Anarghiri IXb excavation and also former Ph.D. candidates at the Institute of Archaeological Sciences of the University of Bern (see also Arampatzis 2019, 47-48; Giagkoulis 2019, 22-25). The stratigraphic analysis of the excavated area proved to be a challenging endeavor, due to the lack of studies of archaeological materials that could contribute to the understanding of the settlement's stratigraphy (pottery, architectural remains, etc.), but also because of the partially excavated central area of the settlement. Consequently, the preliminary reconstruction of the settlement's stratigraphy was based on the available information, including the analytical study of the excavation records and the photographic documentation of the trench profiles.

Because of the large excavated area, it was decided to concentrate on particular parts of the excavation and select specific trenches for the stratigraphic analysis. The focus was laid on trenches from the north (574a,b,c), central (717a,b,d) and southern area (832d, 833c,d) of the excavation, which represent the central occupation area and the periphery of the settlement (Fig. 2.9). The selected trenches were carefully excavated and fully documented, providing a good overview of the stratigraphy. Moreover, the radiocarbon dates derived from the trenches provide secure information regarding the chronological periods and occupation phases of the settlement.

The preliminary stratigraphic analysis resulted in the identification of five main layers (Fig. 2.10a-b). Layer I (0.20-0.50m thickness) refers to the topsoil that contains superficial and disturbed material. It is not present in the whole excavation area since modern activities have partially removed it. The second layer (Layer II) (0.30-0.50m thickness) is a very dark brown soil, with small roots and pebbles that contains fragments of clay and pottery. There are also some later disturbances that can be seen mainly in the form of pits at the north and central parts of the settlement. Layer III (0.20-0.50m thickness) is light grayish and contains small fragments of clay and charcoal. It is characterized by large quantities of pottery and other materials (animals' bones, bone and stone tools, etc.), while in almost all cases, fragments of clay features are recorded, probably belonging to architectural remains and structures. The successive layer IV (0.40-0.80m thickness) has a brownish color, containing many clay fragments and charcoals, but also large quantities of pottery, bones, stone tools, etc. In this layer, remains of clay structures are also recorded. At the profiles of the southern trenches some disturbances and interventions from the upper layer (Layer III) are observed. Finally, layer V (0.50-1.20m thickness) is dark brown/dark grayish brown and is characterized by increased humidity, traces of organic materials and preserved wooden elements. It contains pottery, bone and stone tools, clay finds, etc. This layer is completely excavated at the trenches of the southern sector, partially revealed at the trenches of northern sector, but it has not been investigated at most of the central excavated area (for a detailed presentation of the layers of the southern sector, see Giagkoulis 2019, 23-24; Vol. III, 1, Plan 1).

The preliminary identification of the stratigraphic sequence of the settlement and its general outline has highlighted some differences among the excavated areas. The thickness of the deposits and the differences at their elevations demonstrate a layers' sloping, which is greater at the north and south excavated area, as well as the eastern part of the settlement. Thus, the layers of the north-eastern trenches appear with inclinations from south to the north and west to the east. Similarly, the trenches of southern sector are inclined from west to east. This is a characteristic mainly of the upper deposits, while the two lower layers show small differences in elevation. The two latter are interpreted as evidence of wetland occupation, which later (layers I-III) turned into dry land and formed a low mound (see also Giagkoulis 2019, 24-25).

2.4.3 The chronology

One of the important goals of the excavation was to determine a chronology for the settlement of Anarghiri IXb. For this reason, many samples were submitted for AMS analysis to the Laboratory for the Analysis of Radiocarbon of the University of Bern. A total of 79 samples were selected, including 34 pieces of charcoal and 45 fragments of wooden posts.

The results of the radiocarbon dating of the Anarghiri IXb settlement indicate activity during the Late and the Final Neolithic period (Fig. 2.11a-b). The first occupation at the settlement dates to the transitional phase of the Middle Neolithic to the Late Neolithic (5500–5400 cal BC), which is attested by two posts and a charcoal sample from the south excavated area. The following chronological period corresponds to the Late Neolithic I period (5400/5300–4900/4800 cal BC) evidenced by many samples of charcoal and structural wood derived from a large part of the excavated area. There are also four ^{14}C dates attesting the existence of a subsequent Late Neolithic II phase (4900/4800–4600/4500 cal BC), which, however, is sporadically evidenced at the north sector, as well as the south-western area. The poor documentation of the Late Neolithic II period could be the result of a possible hiatus at the occupation of the settlement during this period, or the concentration of activities to specific areas. Of course, a potential sampling lapse should not be excluded. The successive Final Neolithic period (4600/4500–4300/4200 cal BC) is well documented at most of the excavated area and confirmed by charcoal and post samples, especially at the north and central area of the excavation. The latest provided ^{14}C date to approx. 4200 cal BC possibly signifies the end of the occupation at the settlement. However, three vertical wooden posts attest to the existence of activity during the Early Bronze Age (2800-2500 cal BC).

Based on field observations and ^{14}C dates, the interpretation of the stratigraphic sequence is as follows (see also Arampatzis 2019, 48; Giagkoulis 2019, 25-27):

i) The uppermost layer includes disturbed Neolithic and later material. However, apart from three vertical posts that date to the Early Bronze Age, no other chronological correlation can be attributed to this period for the moment.

ii) The ^{14}C dates of the Final Neolithic period (4600/4500–4300/4200 cal BC) derive from layers II and III of the excavated deposits. The characteristics of the deposits and the preservation of the finds from this period indicate that the settlement was on dry land close to the lake shore.

iii) Layers IV and V are attributed to the Late Neolithic period (5400/5300–4600/4500 cal BC). The secure dating to the Late Neolithic I period is well documented for both layers. In contrast, the scarce evidence of the Late Neolithic II period did not allow for a tight correlation to the settlement's stratigraphic sequence. According to the observations of the excavated deposits and the preserved wooden elements and structures, it seems possible that during the Late Neolithic the pile-dwellings were built in a humid ground, probably in the lake's water.

iv) The few early ^{14}C dates of the end of the Middle Neolithic and the beginning of the Late Neolithic period (Middle Neolithic/Late Neolithic I, c. 5500–5400 cal BC) are not correlated to a specific archaeological layer. They are only confirmed by dates from two posts and a charcoal sample from the south excavated area. However, the dates attest to the initial human presence at the site, with no further occupation or other correlated evidence for the moment.

2.4.4 The finds

The excavation of the settlement brought to light many architectural features, as well as large quantities of portable finds. Extensive architectural remains of houses and destruction layers, open areas with thermal structures and other clay features are reported at the excavation records, related to the north, central and south-west part of the excavated area.

Of the most exceptional finds for the southern Balkan prehistoric research are the well-preserved wooden structures that were unearthed mainly at the south-east and north-east periphery of the settlement (Chrysostomou et al. 2015, 29; Chrysostomou & Giagkoulis 2016, 8).

The specialized study of the wooden structures was carried out by Giagkoulis at his recent Ph.D. research (2019). The study included the analytical description and categorization of the material, the identification of the accessing and enclosing wooden structures, as well as their stratigraphic and horizontal distribution. Focus was also laid on the reconstruction of their potential form and function. Many ^{14}C dates derived from post samples demonstrate the chronological sequence of the structures' construction, related to the chronological framework of the settlement. The chronological diversification among some trackways and fences indicates changes at the outline of the settlement during its lifespan, which could signify a possible shift in the spatial organization and a rearrangement of the habitation space during the Late Neolithic II/Final Neolithic period (Giagkoulis 2019, 176-179).

The portable finds include all categories of material culture, like large quantities of plain and decorated pottery, bone and antler tools (Arampatzis 2019), chipped stone artefacts (Papadopoulou 2018a; 2018b) and ground stone tools, well preserved wooden artefacts, clay human and animal figurines, clay stamps, ornaments of bone, stone and shell, etc.

A preliminary study of the rich osseous assemblage demonstrates the use of bones, antler and teeth of both domesticated and wild animals for the manufacture of a variety of artefacts including tools, ornaments, projectile points, fishhooks, whistles, etc. (Arampatzis 2019, pers. communication). Arampatzis has also conducted a specialized study on the antler artefacts in his recently published Ph.D. (2019). The antler artefacts derived from the excavation of Anarghiri IXb is so far the largest assemblage in Greece, offering an important comparative material of the Late and the Final Neolithic period. The antler artefacts were mainly shaped on red deer antler and manufactured on-site, according to the presence of blanks, waste and many semi-manufactured specimens. Antler was primarily used for the production of tools for a variety of everyday activities (woodworking, leatherworking, agriculture, stone tool manufacture, etc.), the manufacture of hunting equipment (thumb rings, harpoons, harpoon heads, projectile points, mace heads, fish hooks), but also of ornaments bearing symbolic meanings (pendants, rings) (Arampatzis 2019).

Chapter 3.

Lithic studies in Greece: Research review, theoretical trends and recent directions

The early history of chipped stone studies

Although stone tools are one of the most abundant and long-lasting finds of material culture of the past societies, the attention of researchers and the systematic study of the artefacts had a long road to run until the mid of 20th century (Elefanti et al. 2016; Fotiadis 2016; Kakavakis 2015; Kourtessi-Philippakis 2014a; 2014b; Runnels 2016). Chipped stone tools were for a long time considered as the result of natural processes. Until the 16th and 17th centuries, lithic artefacts were characterized as thunderbolts, shaped by the lightning struck, with healing or talismanic powers (Fotiadis 2016, 93; Goodrum 2002). It was during the Renaissance that the first recognition of stone tools as the creation of man was stated by Mercati, a curator of the Vatican collections (Kourtessi-Philippakis 2014b, 113). The development of the three-age system during the 19th century attributed a chronological dimension to stone tools. At the same time, the important discoveries of early hominids and paintings at the caves of France and Spain, but also the theories of Darwin for the human evolution, contributed to the identification of an early period of man's history setting the foundations for the study of prehistoric archaeology (Ibid., 114).

The European interest on prehistoric stone tools had already been established by 1830-1840 with the work of Boucher De Perthes, who developed typologies of stone tools based on morphological criteria, but also commented on their possible functions and their economic and cultural role (Boucher De Perthes 1847). A significant contribution was of Sir John Evans, who focused on exercising flintknapping and experimenting with use wear in order to understand the function of the tools, but also worked on their graphic representation (Runnels 2016, 12). The work of the French prehistorian Gabriel de Mortillet proved also important regarding the developments on the study of Paleolithic material. De Mortillet proposed a typological classification based on morphological criteria, which characterized specific cultural groups. He supported that the differences recorded at the lithic material of various Paleolithic sites was the result of the action of different cultural groups (De Mortillet 1869).

Along with the developments in France, an increased interest in stone tools is also observed at the rest of Europe and other parts of the world. In North America, the emphasis on typological classification and a basic description of stone tools was enriched by the contribution of William Holmes. Holmes conducted excavations and surveys at quarries and also concentrated to refitting and experimental flintknapping in order to understand the knapping stages that are followed for the production of stone tools (Runnels 2016, 12). He also stressed the importance of stone tools in chronology, as well as the evolution of their form and function through time (Andrefsky 1998, 3). Most of the studies mentioned above were focused on Paleolithic material, but the first steps of a more holistic view of the chipped stone study had just begun.

In contrast to the developments in West Europe and North America, the interest in lithic studies in Greece was not as intense during the 19th century. The work of the Archeological Service and the foreign archaeological schools was mainly concentrated on the classical antiquities in order to attract the attention of the Europeans regarding the classical past of Greece (Elefanti et al. 2016, 1). However, many Greeks and foreign scholars carried private stone tool collections, which sometimes were part of economic exchange since they bought and sold various artefacts and stone tools (Fotiadis 2016, 95-96). From 1870 stone tools were recognized as part of the Greek history of a preceding era, which was earlier than the classical period. George Finlay, a British historian and collector of antiquities in Greece, owned a large collection of flint and obsidian weapons and stone tools, some of them collected at the Tumulus of Marathon. Finley supported that the stone tools belonged to the prehistoric period, based on similarities to material from recently discovered sites in Europe and excavated pile-dwellings in Switzerland that he visited while traveling (Finley 1839; Fotiadis 2016, 105; Karadimas 2013, 128-129). At the same period, the French geologist Ferdinand Fouqué made some interesting observations regarding the material derived from Akrotiri and Therasia. The volcanic eruptions at Santorini motivated research and excavations at the island, where Fouqué had the chance to collect prehistoric artefacts and document the lithic material. He noted that obsidian is exotic, suggesting early maritime in the Aegean and exchange among other areas (Fotiadis 2016, 101-103; Fouqué 1867; Tzachili 2005, 247). Lithic material from private collections was also published during that period by the French archaeologists Francois Lenormant and Albert Dumond. According to similarities with lithic materials from Europe, they supported that the tools belonged at the stone and bronze age (Elefanti et al. 2016, 2; Kourtessi-Philippakis 2014a, 21-22).

At the end of the 19th century, the excavations conducted at Mycenae, Tiryns and Orchomenos contributed to the identification of the prehistoric period in Greece. At the excavations of Mycenae and Tiryns, Heinrich Schliemann reported the presence of obsidian tools and arrowheads comparable to the material from Marathon. He also commented on the distribution of the obsidian at other settlements pointing Melos as the possible source of the material and suggested that it was part of early trade. However, Schliemann's interest in the Mycenaean period and the spectacular finds of the Royal Tombs and Palaces shadowed the importance of the earlier stone tools, a fact also observed in the case of the obsidian tools and arrowheads found at Knossos by Sir Arthur Evans (Fotiadis 2016, 112-113; Runnels 2016, 13). However, Robert Bosanquet was the first to discuss widely and describe the obsidian artefacts analytically. The excavation at the Bronze Age settlement at Phylakopi in Melos Island and his increased interest in the obsidian circulation in the Mediterranean led him to observations regarding the quarrying of obsidian, the possible use of the artefacts, but also their role in the funerary contexts in Cyclades (Bosanquet 1904; Elefanti et al. 2016, 2).

At the end of the 19th century and the beginning of the 20th century, an increased interest in prehistoric research in Greece is recorded, partially due to the incorporation of Thessaly, Macedonia, Epirus and eastern Thrace in the Greek state. Extensive surveys and small-scale excavations were focused on the stratigraphic documentation and chronology of the prehistoric settlements, mainly in the region of Thessaly, but also in Macedonia and Thrace (Elefanti et al. 2016, 2; Rhomiopoulou 2014). One of the most important contributors of this period was Christos Tsountas, who located many prehistoric settlements in Thessaly and conducted excavations at the Neolithic settlements of Sesklo and Dimini. At his publication (1908), the chipped stone tools were placed among the 'miscellaneous finds' and were rudimentary commented. However, the distinction of basic types like arrowheads, knives and cores in relation to the stratigraphic and chronological information and his comments on the raw materials and their possible sources was important for that period (Tsountas 1908, 327-328). The treatment of chipped stone tools as 'miscellaneous objects' continued for an extended period and is also observed at the work of other researchers like Wace and Thompson in 'Prehistoric Thessaly' (1912), as well as the work of Hansen 'Early civilization in Thessaly' (1933). In the region of Macedonia, the French archaeologist Leon Ray used more analytical descriptions for chipped stone tools and made comparisons to similar material from other areas (Ray 1921, 240-241). Nevertheless, it is obvious that at the first decades of the 20th century, the chipped stone tools were not considered important finds and were only shortly commented in publications of prehistoric sites of Greece.

The Greek archaeologist George Mylonas commented for the first time the raw materials used at the Neolithic settlement excavated at Olynthus in Central Macedonia. His brief but interesting description of raw materials focused on their categorization according to color, while he also identified the quartz artefacts (Mylonas 1929, 63-75). Similarly, the archaeologist Antonis Keramopoulos during his excavations at Dispilio in western Macedonia commented the presence of stone tools made of various raw materials of different colors, as well as the presence of obsidian. Keramopoulos also proposed different sources of the raw materials and supported that part of the tools were manufactured on-site (Keramopoulos 1937). The research of Heurtley during this period in central and western Macedonia offered him the opportunity to compare materials from different areas and chronological periods. His analytical descriptions of the chipped stone assemblage focused on the identification of raw materials and the classification of basic tool types (Heurtley 1939, 200-201). Heurtley's work on the chipped stone artefacts demonstrated the diachronic use of stone in tool manufacturing from the Early Neolithic to the Iron Age and stressed the importance of the lithic material in understanding the everyday activities of the prehistoric inhabitants (Kourtessi-Philippakis 2014b, 115).

In addition to the references above on chipped stone assemblages, the work of the German archaeologist Wilhelm Dörpfeld at the Ionian Islands provided information regarding the chipped stone material from Chirospilia in Lefkada, a cave occupied during the Neolithic and the Bronze Age period. Dörpfeld recorded the chipped stone artefacts, identified the raw materials used for the tools' production and commented on their technological characteristics. He supported that the tools were manufactured on-site, except for obsidian suggesting its Melian origin (Dörpfeld 1927; Kourtessi-Philippakis 2008a).

The history of the study of stone tools in Greece is not irrelevant to the general course and progress of the theoretical approaches developed in prehistoric archaeology. From the beginning of the century, the treatment of chipped stone tools was based on the historical-cultural approach, according to which tools were typologically classified on morphological criteria and considered as markers of chrono-cultural changes. However, this perspective failed to explain the cultural changes that were usually interpreted based on diffusion theory. In regard to lithics, the variation observed among different materials was considered the result of the action of different cultural or ethnic groups, according to Francois Bordes, who mainly supported this theory. In the middle of the 20th century, the famous typology of Bordes continued to express the historical and cultural interpretation of stone tools. However, the classification of different tool types in order to distinguish different cultural groups in space and time enabled the more systematic recording and documentation of lithic materials. The classification of tool types, including also technological criteria and analytical recording of the retouched types, facilitated the statistical and comparative analysis. This work based on Paleolithic material is still in use and also affected the classification and analysis of lithics from other periods, as well as domains like experimental archaeology and functional analysis (Bordes 1967; Kourtessi-Philippakis 2014b, 116; Runnels 2016, 12-13).

The influence of the New Archaeology and the concept of 'Chaîne opératoire'

During the 60's the New Archaeology emerged with a critical view pointing to a more anthropological and scientific orientation of the prehistoric archaeology. The contribution of natural sciences in the field of archaeology inspired the belief that many dimensions of human activity could be approached since they were shaped by universal and measurable physical laws. The attention of researchers was turned to the relationship of prehistoric humans with the environment and the economic and social factors that would interpret their behavior. Thus, the interest was oriented to the economic dimensions of technology, the quantitative and statistical analysis of the information. The new trends in archaeology affected the treatment of chipped stone assemblages and highlighted the significance of lithic studies. The previous system based on morphological criteria for the classification of the chipped stone tools resulted in the lack of approaches and interpretations regarding human behavior. Now, the focus was laid on recording the variation of tool types using objective classification criteria. Emphasis was given to the interpretation of lithic variability in terms of tools' function and different activities that the tools were involved (Binford & Binford 1966; Edmonds 1995, 9-19).

This period the developments on archaeological experimentation and ethnoarchaeology, as well as the approach of reduction sequence played a significant role in the domain of lithic studies. A vital work to this direction was Semenov's approach on microwear analysis that was translated in 1964 (Semenov 1964). His work turned the interest to the functional analysis of lithic artefacts, demonstrating the various uses of the chipped stone tools and proving that the morphology of tools is not always related to their use (Andrefsky 1998, 4). This development became popular and started affecting the way chipped stone tools were analyzed. Similarly, the growth of experimentation on the manufacturing of lithic artefacts proved to be an essential component of the new approaches. Replication and experimental flint knapping had already been practiced in Western Europe and North America from the 19th century (Runnels 2016, 12-13). However, the systematic work of Bordes and Don Crabtree turned the interest of many researchers in lithic replication and tool refitting. The experimental manufacture of lithic tools enabled the understanding of the techniques used for tool production, the stages that are followed and the factors that may affect the whole procedure. In this way, not only the finished products were at the focus of the study, but also the whole process of manufacturing, taking into account the fraction mechanisms and the physical and mechanical properties of the raw materials. The work of George Frisson (1968) was also inspiring, who claimed that the shape and morphology of tools could also change during their use. These changes are visible to the final form of the tool and can be observed by the researcher. This realization proved to be important since archaeologists started to regard chipped stone tools as dynamic materials, which change through their use in space and time (Andrefsky 1998, 3-4).

One of the most critical contributors of this period was Leroi-Gourhan, a French anthropologist who focused on the study of technical, social and symbolic patterns of behavior. Inspired by the work of the French ethnologist Marcel Mauss at the 1930s, he introduced the concept of *Chaîne opératoire* in the study of artefacts (Leroi-Gourhan 1964), which refers to all the successive processes that are followed, from the acquisition of raw materials to the final discard of the artefact. The *Chaîne opératoire* is a methodological tool that can be applied to all kind of material evidence (pottery, bone and stone tools, etc.), describing the whole procedure that an artefact goes through, from the raw material procurement, manufacture, use, maintenance and discard, in order to approach and interpret the human behavior (Audouze 2002; Inizan et al. 1999, 14). The next decades the concept of *Chaîne opératoire* constituted the basic methodological and interpretative tool, used in various approaches for the reconstruction of artefacts' manufacture and use, but also the understanding of the social character of technology. Furthermore, the technological approach given by Jacques Tixier proved also determinant in the future research of lithic analysis. Tixier demonstrated that the technological analysis using the concept of *Chaîne opératoire* can approach and identify not only the technical actions of the manufacturers (techniques and methods), but also the choices, the constraints and the preferences of the producers, which are linked to their psychomotor functions, their cognitive capacities, their skills and knowledge (Edmonds 1990; Inizan et al. 1999, 15-16).

Following the developments of cognitive archaeology, which focused on the interpretation of human behavior through the study of material culture, prehistoric technology proved to be ideal for the investigation of prehistoric human intelligent and cognitive functions. The technological actions are connected to conceptual schemas and psychomotor functions (Inizan et al. 1999, 100; Pelegrin 1990, Roux 1990). By analyzing the reduction sequence of tool production, we can approach the technical skills of the producers, which are connected to mental abilities and learning processes, but also the cognitive intents, their choices and strategies (Perlès 1992a). It was a renewed emphasis on the reconstruction of the sequences of choices, options and decisions of prehistoric people within a specific time and spatial framework, involving the mental operations and the technical gestures, which became the primary methodological tool in the study of the chipped stone assemblages (Ibid.). Soon the interpretation of human behavior, which could be captured by the technological products, would turn the interest into maters like technical skills, knowledge, practical experience and specialization (Pelegrin 1990), in order to understand and interpret the variability in tool production and the activities of the prehistoric communities.

Moreover, the principals of the *Chaîne opératoire* were also applied in behavioral archaeology with Schiffer as the primary representative (Schiffer 1972). This approach tried to explain the variability in human behavior by focusing on the study of the relationship between humans and artefacts. Considering the stages that the objects go through from raw material acquisition to discard, but also the post-depositional factors, an emphasis was given to the biography of artefacts, in order to approach their life history; thus, all the stages of their manufacture, use and discard, but also, the social processes that the artefacts were part of and the meanings that they carried until the time the researchers find them (Andrefsky 1998, 29-37; LaMotta & Schiffer 2001, 21-24).

The use of natural sciences and economic theories in the domain of prehistoric archaeology had a significant impact in the lithic studies in Greece. The New Archaeology influenced the research of chipped stone studies, which focused on the relation of prehistoric people with the natural environment and the exploitation of natural sources. The economic view was applied in theories regarding the distribution and exchange of raw materials, with obsidian at the focal point. Additionally, the use of archaeometric methods facilitated the characterization of the two obsidian sources in Melos (Aspinall et al. 1972; Renfrew et al. 1965). This period the work of Renfrew and Torrence was focused on the distribution of Melian obsidian and the systems of trade. The use of scientific tools and diagrams in order to perceive the distribution of the material resulted in the 'down the line' model by Renfrew, with main parameters of analysis the quantity of the material and its distance from the source (Renfrew 1984; Renfrew et al. 1965; 1968). Torrence attempted to demonstrate the efficiency of obsidian production using notions like time, energy and specialization (Torrence 1982; 1984; 1989). The identification of obsidian sources in Melos triggered the discussion among a variety of issues regarding trade, circulation, exchange and specialization that could be approached through the study of chipped stone tools. Moreover, the recovery of obsidian assemblages from early layers of Franchthi Cave indicated the material as a marker of early trade (Perlès 1979).

Soon it was demonstrated that obsidian was the dominant material for tool production in Neolithic settlements of southern Greece and played an essential role in the industries of eastern

Thessaly. During the next decades, many researchers proposed various models attempting to reconstruct the obsidian circulation and approach the exchange networks, using technological, economic and social parameters. The work of Perlès and Moundrea-Agrafioti was of the first systematic classification and quantitative studies following technological and cognitive approaches (Moundrea-Agrafioti 1981; Perlès 1973; 1990; 1992a; 1994). Additionally, the study of the chipped stone industries from Thessalian Neolithic settlements produced new models and distribution patterns regarding the raw materials' exchange networks. The research of Karimali on the production and exchange patterns in Neolithic Thessaly demonstrated the parallel existence of multiple exchange networks, stressing the importance of the social context of space and contact among the prehistoric communities (Karimali 1994) (For a brief overview of exchange networks in Greek prehistory see also Chapter 7.1).

In northern Greece, the first systematic excavations began at this period, involving the prehistoric settlements of Nea Nikomedeia in central Macedonia, Dikili Tash and Sitagroi in eastern Macedonia. The chipped stone material was recorded analytically, based on typology and raw material identification (Rodden 1962, 276-278; Sefériadès 1992; Tringham 2003). In the case of Sitagroi, the classification of the chipped stone assemblage according to raw materials and tool types was accompanied by functional analysis. At the same time, comments on the technological characteristics of the artefacts attempted to approach the choices of prehistoric knappers (Tringham 2003). At the end of the 1970s the excavation at the prehistoric settlement of Dimitra in eastern Macedonia yielded a significant number of chipped stone artefacts. The innovative methodology of the excavation included the use of flotation and dry-sieving for the total excavated deposits. This method facilitated the collection of a significant number of lithic finds of various dimensions, involving fragments and waste that enabled the reconstruction of the reduction sequences and the technological study of the material (Kourtessi-Philippakis 1997).

At the same time, lithic studies also focused on economic choices and the relationship between people and the natural environment. Motivated by the variation of raw materials used for tool production by different Neolithic settlements in northern Greece, territorial issues related to unequal access at raw material sources, control of the sources and exploitation, etc. were also proposed (Fotiadis 1985, 290-291; Grammenos 1997b, 293-297).

During the 1980s, a shift in the interest of raw material studies is recorded with researches focusing on raw material provenance and exploitation. In northern Greece, several surveys carried out in central and eastern Macedonia brought to light outcrops (Vasilika, Mount Kerdyllia) which had been exploited during prehistoric times supplying the settlements with raw materials (Grammenos 1991, 119-120; Kourtessi-Philippakis et al. 1993). Similarly, surveys in the area of Rhodope (Thrace) led to the location of the prehistoric chert quarry at Petrota (Fotiadis et al. 2003). In the same context, the identification of Carpathian obsidian from the prehistoric settlement of Mandalo in central Macedonia indicated the existence of more complex exchange networks as far as the Balkans and central Europe (Kilikoglou et al. 1996).

In the 1990s, a significant number of excavations in northern Greece is recorded, which brought to light many flat-extended prehistoric settlements in central Macedonia and Pieria (Stavroupoli, Thermi, Vasilika, Makriyalos). Several analytical publications and studies of lithic materials followed (Kyriakidou 1991; Skourtopoulou 1990; 1992; 1993; 1999; 2002) including functional (Skourtopoulou 2004) and experimental approaches (Skourtopoulou & Dimitriadis 1996). The increased number of lithic studies, in addition to the material already studied from eastern Macedonia, demonstrated regional patterns that had developed in different areas of northern Greece during the Neolithic. The patterns of distribution of local material and site hierarchy sequences had been proposed by Skourtopoulou concerning some of the flat sites in central Macedonia (Thermi, Vasilika). In general, the identification of raw material sourcing became one of the most important issues regarding the chipped stone studies, reinforced by the use of chemical and petrographic characterization (Dimitriadis & Skourtopoulou 2001; 2003; Garnaud 2000; Kambouroglou & Peristeri 2006; 2008). The developments in the lithic studies of northern Greece, mainly focused on raw material exploitation patterns, revealed the importance of the knowledge of different areas' geology. Moreover, these studies underlined the diversification of the lithic industries, not only in the local and regional scale, but also by the apparent contradiction between northern and southern Greece (Kourtessi-Philippakis 2009, 305-306; 2014b, 118).

Recent directions in lithic studies

Already from the 1980s the approaches of post-processual archaeology criticized many of the theories that had been expressed during the previous period. The generalization and dogmatic functional approaches did not let room for the subjective character of human behavior, as well as the symbolic expressions. The material culture cannot be seen and quantified by using objective measurements, because meanings, ideas and behaviors are developed among people and objects. The contextual approach set forward the role of the historical content of the past, but also underlined the cultural present of the researcher, both of which affect the archaeological interpretation (Hodder and Hutson 2003, 166-172).

In this framework, researchers turn to the understanding of human behavior, ideology and social organization through the study of technology. Recent approaches view technology as a social practice that demonstrates the relationship between humans and materials experienced in social and cultural contexts. Technology is full of meanings, a socially embedded and physical experience of production and reproduction (Dobres 2000, 96-108; Edmonds 1995, 14-17). The artefacts bear social and symbolic meanings and constitute the materialization of people's ideas and symbols (Lemonnier 1993). Recent directions in lithic analysis use the methodology of *Chaîne opératoire* and the technological approach in order to understand and interpret the social structures and meanings that lay behind the artefacts, which now have gained an active and dynamic role. The analysis of chipped stone assemblages moves to more interpretative approaches, considering the symbolic aspects of the lithic material and the way it is embedded in the actions and choices of prehistoric people. Since technology is a dynamic phenomenon embedded in social interaction and reproduction, the past social relationships can be approached by reconstructing the technological networks (Dobres and Hoffman 1994).

Under these principals, the new directions of lithic technology are focused on issues related to gender, identity, sex, status, specialization and social organization, which can be approached by the study of the lithic material in its historical and social context. In the last two decades, lithic studies in Greece focus on the spatial and contextual distribution of the artefacts to recognize specific areas of manufacture, use and discard of tools. In this framework, the excavation of many flat settlements, mainly in northern Greece, enabled the study of the organization of the domestic space. The use of lithic reduction sequence in a contextual approach proves to be important, providing information regarding the function of specific areas in a settlement. Additionally, it can demonstrate patterns of structured deposition and symbolic expression, acts of structuring memory and social identity (Skourtopoulou 2006; Stratouli & Metaxas 2009; 2018). The approaches of chipped stone assemblages related to the circulation of raw materials and tools are also directed to the identification of social networks and the interaction of prehistoric communities in a social and symbolic framework identified, among others, by the presence of expressive material culture (Kakavakis 2011; 2014; 2017).

As has been demonstrated the developments in the study of chipped stone tools in Greece were delayed in comparison to Europe and North America. Apart from the political and historical conditions that affected the development of prehistoric research in Greece (see Chapter 2.3), the neglect of the lithic material by early researchers and excavators is characteristic. As Runnels has well-aimed stated, Greek stone tools are characterized by a history of neglect. The reasons for this delay in the research of lithics can be traced to the focus of western European archaeologists and Greek researchers on classical antiquity and the general orientation of Greek archaeology from the beginning of the 20th century. However, an interruption of the developments in lithic studies has also been recorded in Europe in the first half of the 20th century, although experimental flintknapping developed from 1860 already (Runnels 2016, 13). The approaches of the New Archaeology and the introduction of innovative techniques gave a shift in the study of chipped stone artefacts, which started to be treated as important components of the archaeological record for the understanding of prehistoric societies. The use of the *Chaîne opératoire* and the technological approach in the study of the chipped stone materials have been widely applied and remain the main methodological and interpretative tools for lithic analysis. Chipped stone tools gained their dynamic role contributing to the understanding and interpretation of prehistoric communities through a wide range of approaches that developed and improved through time. At the same time, the new directions of research require the participation of lithic studies in the new perspectives of archaeological interpretation.

In the last decade, several prehistoric archaeologists and researchers are specialized in the study of chipped stone artefacts in order to unveil the multifaceted role of tool production in the prehistoric communities. However, much work has yet to be done. Some of the disciplines like the application of use-wear studies and experimental replication, are very rare in Greece (Elefanti et al. 2016, 5). Moreover, raw material characterization studies proved to be very important in lithic analysis. They should continue to provide vital information, especially for raw materials other than obsidian (flint, chert, chalcedony, etc.). Finally, the results of the studies should be published and involve more synthetic works, in order to provide a comparative corpus of lithic assemblages among different regions, but also in correlation to other archaeological materials for a more holistic approach of the prehistoric communities.

Chapter 4.

The chipped stone industry of the Anarghiri IXb settlement and the analysis of the material

4.1 Introduction

The present chapter focuses on the analysis of the chipped stone material derived from the Neolithic lakeside settlement of Anarghiri IXb. The analysis consists of three main parts, including the raw materials, the technological and the typological examination of the artefacts. The studied material is ascribed to two different chronological periods, the Late and the Final Neolithic. Thus, the analysis of each assemblage will be presented separately, to demonstrate the similarities and the differences of the chipped stone production among the two periods.

4.1.1 The material under study

The excavation at the settlement of Anarghiri IXb brought to light a sizeable chipped stone assemblage. A total of 10953 artefacts have been recovered from all the excavated deposits during the excavation seasons 2013-2016. However, during 2017 the final stage of the removal of anthropogenic deposits by mechanical means at the settlement yielded 3229 chipped stone artefacts. Consequently, the total number of chipped stone artefacts derived from the settlement of Anarghiri IXb is 14182. Additionally, a large number of micro-refuse has resulted from the electro-sieving method that was applied during the excavation of four trenches (trenches 645, 715, 830, 854). The procedure involved the washing of the excavated deposits using electric sieves and the residues produced almost 8820 small pieces of chipped stone debitage, which rises the total number of the material at 23002 pieces (Fig. 4.1).

Sample selection

Due to the large quantity of the chipped stone artefacts from Anarghiri IXb, the necessity to select a part of the material for the needs of the present study emerged. A large number of the material would require considerable time for recording all the artefacts, but would also prove more difficult for the organization, analysis and management of the bulk of the data and its characteristics. In the process of choosing the representative sample for the study, the following criteria were decided:

- The material should derive from what were considered by the excavators as stratified deposits, to be assigned to the different chronological periods/phases of the settlement.

- The selection to focus on excavated areas at the central part of the prehistoric settlement; this could ensure that the material under study was representative of the main occupation/domestic areas.
- The material to come from deposits that have been excavated using the same methodology, avoiding, therefore, any confusion regarding the qualitative or statistical representation of the sample.

Considering the criteria mentioned above, it is apparent that the material from the 2017 season had to be excluded from the study, since it derives from unstratified deposits. Additionally, it was decided not to include the material from the western sector of the excavated area (west of the modern canal). This area covers only a small part of the prehistoric settlement, close to the western periphery with few architectural remains. In accordance with the excavation records and stratigraphic observations, the material that derives from some layers of this area comes from disturbance trenches and it was decided to be excluded from the study (n:1355). Moreover, the material obtained from the four trenches where the electro-sieving method was applied (trenches 645, 715, 830, 854) was also excluded from the study, since this could cause problems in the qualitative representation and statistical analysis of the data. These trenches due to the extensive use of water-sieving of the excavated deposits show a significantly increased number of chipped stone artefacts and most importantly, waste material. All four trenches yielded a total number of 2277 artefacts (almost 20% of the total excavated material), while the quantity of micro-refuse is rather large (n:8820). However, this material should be treated separately and it could contribute greatly with information on the production of tools and the evidence related to waste products.

The material that was finally selected derives from the eastern sector of the excavation (Fig. 4.2). It covers a significant part of the prehistoric settlement, involving the central area of the Neolithic occupation and a large part of the eastern, northern and southern periphery. The chipped stone artefacts of 121 trenches are included in the study. However, also, in this case, the material coming from the upper layer (topsoil including superficial and disturbed material) and the unstratified artefacts were not included in the study (n:1731).

Consequently, the material selected for the study refers to the two distinct chronological periods (according to the chronology and the stratigraphy of the settlement), namely, the Late and the Final Neolithic. The chipped stone assemblage analyzed in the present study consists of a total of 5590 artefacts with the material from the Late Neolithic deposits (Layers IV and V) to include 1625 artefacts (29%), while the material from the Final Neolithic layers (Layer II: 752, layer III: 3213) involves 3965 artefacts (71%) (Fig. 4.3, 4.4).

4.1.2 Limitations of the research

The detailed study of the chipped stone artefacts from Anarghiri IXb was not an easy task, not only because of the large number of the material itself, but also due to difficulties and restrictions related to the excavation process of the settlement, for which the author was not responsible.

Numerous chipped stone artefacts were found during the excavation of the settlement. Ideally, it would have been essential to analyze the total lithic assemblage and acquire the entire picture of the lithic production of the prehistoric settlement. However, in the context of a Ph.D. study, time and practical restrictions made such an effort almost impossible. Nevertheless, the criteria followed in the selection of the material and its analysis provide an indicative picture of the settlement's lithic industry.

A second restriction is relevant to the excavated area of the settlement. As it has already been underlined in a previous chapter (see Chapter 2.4), only the periphery of the Anarghiri IXb settlement was fully excavated to the natural bedrock. On the contrary, a large part of the central area of the site was partially excavated, covering the deposits of the Final Neolithic period. Consequently, the evidence of the Late Neolithic deposits deriving from the central area of the settlement is missing.

Moreover, even though the dry-sieving of the excavated deposits was applied at all trenches during the excavation seasons 2013-2016, the amounts of debris are smaller than expected, probably due to practical reasons (small size). This observation is based on the presence of larger quantities of micro-refuse at the trenches where the electro-sieving method was applied, by washing the total deposits and using three sieves of decreasing mesh size. Therefore, the number of debris that is included to the study should not be considered indicative, since increased percentages would be expected.

Another important limitation of the research is the fact that the study of the settlement's spatial organization has not been completed yet. Apart from the apparent restrictions related to the sketchy picture of the Late Neolithic settlement, the recovery of the horizontal organization of space of the Final Neolithic period, which is rich in architectural remains, is not available at the current stage of research. Consequently, the interpretation of the horizontal distribution of the artefacts and any contextual reference is not possible for the moment. Similarly, the lack of studies of other archaeological material from Anarghiri IXb (except for the wooden structures and the antler tools) sets also some restrictions. The analytical study of architecture, pottery and other portable finds would contribute to a more synthetic discussion on the socioeconomic character of the settlement and could shed light on the diachronic changes during its lifespan, the exchange and communication networks, etc., strengthening the suggestions that are based on the study of the lithic material.

An additional restriction in the study is related to the lack of research on raw material sources in the region of western Macedonia. Identification of raw material sources is critical in order to investigate the strategies of raw material procurement of the community and the choices on the use of certain raw materials for tool production. Furthermore, the macroscopic examination of the lithic material from Anarghiri IXb and the lack of petrographic description of the lithic artefacts resulted in a general classification of the raw materials according to certain criteria (see Chapter 4.1.3). In order to overcome the obvious restrictions, the macroscopic identification of raw materials and their possible sources was based on the geology of western Macedonia, the limited data from research in northern Greece and the macroscopic observations of researchers in the recent literature (see Chapter 4.2.2).

Finally, the limited information on the lithic industries from western Macedonia does not allow for substantial correlations to the neighboring settlements. Thus, the comparison of the material from Anarghiri IXb with contemporary settlements of western Macedonia is based only on the available preliminary reports.

4.1.3 Methodology

The study of the lithic material was carried out during three seasons (2016-2018) at the Ag. Panteleimon facilities of the Archaeological Service of Florina, where the material is stored.

Since the primary goal of the study is focused on the comparison of the assemblage of the Late and the Final Neolithic period, the attribution of the material to two distinct chronological periods was necessary. The examination of the settlement's stratigraphy and the correlation of the excavated layers with the available ^{14}C dates was teamwork carried out in three selected areas of the settlement corresponding to the northern, central and southern part of the excavation (see

Chapter 2.4.2 and 2.4.3). In the case of chipped stone artefacts, which are represented to almost all excavated deposits, the stratigraphic distribution is of crucial importance. Consequently, the stratigraphic examination of all trenches included in the present study was necessary to achieve the chronological attribution of the material. Based on the preliminary stratigraphic analysis, a broadened stratigraphic examination of the rest excavation trenches was carried out by the author. This process included the analytical study and observation of all the available information related to each trench, deriving from the excavation records and the photographic documentation, as well as their incorporation to the basic stratigraphic trenches. Finally, this work resulted in the stratigraphic integration of all the trenches involved in the study from the eastern sector.

The present study of the lithic material is based on the techno-morphological analysis of the artefacts following the *chaîne opératoire* methodology. The identification of raw materials used, the technical characteristics of the artefacts and the tool typology constitute the main parts of the analysis. The macroscopic identification and recording of a series of attributes concerning the raw materials resulted in their categorization. Additionally, through macroscopic observation, a systematic recording of the technological and typological characteristics of the chipped stone artefacts was carried out in order to reconstruct the *chaîne opératoire* and identify the tool types. To record the attributes of the artefacts and process the data, a Filemaker computer program was created, with a variety of fields for the classification of different variables. The fields included in the data-base cover all the available information required for the technological and typological analysis of the artefacts, as well as the macroscopic characterization of raw materials (based on Andrefsky 1998 and Inizan et al. 1999). The information recorded refers to the following fields:

- *Recording data:* The unique number of each artefact according to the general recording catalog of the site and the recording date (e.g. A9b.AE5464).
- *Excavation data:* Information regarding the excavation date and the location of the artefact (trench, square, excavation unit, feature and layer).
- *Chronology:* The chronology of the archaeological layer according to the stratigraphy and the absolute chronology (Late Neolithic, Final Neolithic).
- *Coordinates:* The coordinates of the artefact according to the X, Y, Z axis, or in case they are missing, its derivation from dry-sieving, electro-sieving, surface layer, or sorting.

- *Integrity of the artefact:* Information regarding the preservation of the artefact (complete, almost complete, fragment, fragment/proximal part, fragment/mesial part, fragment/distal part, indeterminate).
- *Dimensions:* The maximum length, maximum width and thickness according to the technological axis of the artefact.
- *Raw material:* This part provides information regarding the raw material of the artefact. It includes a general categorization of the raw materials (flint, radiolarite, obsidian, chert, quartz, quartzite, chalcedony, other, burnt, patinated, indeterminate) and a more detailed categorization of flints based on color (gray, pale brown, reddish brown, yellowish brown, black and olive). Other attributes that were recorded for each artefact include the color (according to Munsel Soil Color Charts 2000), the texture (thin, medium, medium to coarse, slightly coarse, coarse), the homogeneity (high, medium, low), the translucency (transparent, translucent, semi-translucent, opaque, opaque with translucent edges) and the luster (shiny, medium, dull). Additionally, the knapping quality of the raw material has been evaluated (fine, medium, low) based on the characteristics mentioned above.
- *Surface characteristics:* This part examines the presence of cortex or patina on the surface of the artefact and its percentage (25%, 50%, 75%, 100%), as well as the characteristics of thermal alteration (change of color, fissures and conchoidal cupules).
- *Technological category:* This field records the technological category of the artefact according to its stage at the *chaîne opératoire* (raw nodule, core, knapping product, technical product, debris, indeterminate), while a more detailed categorization for the knapping products (flake, blade-flake, blade, microblade), the technical products (crested blade, rejuvenation flake, core platform rejuvenation flake, core tablet, cortical flake, plunging blade, hinged artefact) and debris (chips, angular shatter) is offered.

It should be noted that in the present study blade-flakes are defined as elongated flakes, whose length is almost double of their width. Additionally, microblades are defined as blades whose width does not exceed 1cm.

- *Section and profile:* It examines attributes of the blanks, like section (triangular, trapezoidal, polyhedral, mixed, other), axiality (fine, medium, not axial), profile curvature (arch-shaped, curved, slightly curved, flat, other) and profile symmetry (symmetrical, medium, asymmetrical, twisted).

Mixed section refers to the parallel presence of triangular and trapezoidal section at the same artefact that is encountered at some blanks.

- *Proximal part and lower face:* This part refers to the characteristics of the proximal part and the lower face of the artefact and includes the butt dimensions (max. length and max. width), the butt type (cortical, flat, dihedral, facetted, linear, punctiform, winged, pecked, spur, retouched, convex, concave, indeterminate), the flaking angle (abrupt, semi-abrupt, low), the overhang (abrasion, pressure, unretouched, indeterminate), the bulb (extreme, extending, slightly extending, flat, double, broken, absent, indeterminate) and the waves of percussion (intense, slightly intense, diffuse, smooth).
- *Distal part and upper face:* This part refers to the characteristics of the distal part and the upper face of the artefact including information concerning the distal edges (convergent, divergent, parallel, other), the presence of prismatic face (prismatic, medium, not prismatic), the number of negatives at the upper face of the artefact and their direction (single, opposite, different, vertical, other).
- *Knapping techniques:* The evaluation of the artefacts' technological characteristics at the lower and upper face, as well as their proximal and distal part, led to the proposed knapping technique for the artefacts' production (direct percussion-hard hammer, direct percussion-soft hammer, indirect percussion, pressure technique).
- *Retouch:* A separate set of fields for the right and left edge, as well as the proximal and distal part of the artefact was recorded. The type of retouch involves its position (direct, inverse, alternate, alternating, crossed, bifacial), localization (distal, mesial, proximal, right, left, basal), distribution (continuous, discontinuous, partial), delineation (straight, concave , convex, notched, denticulated, shouldered, tongue, tang, long narrow tang, regular, irregular), extent (short, long, invasive, covering), angle (abrupt, crossed-abrupt, semi-abrupt, low) and morphology (scaled, stepped, parallel, sub-parallel).
- *Sickle gloss:* A separate set of fields for the right and left edge was recorded. The information includes its localization (proximal, mesial, distal, proximal & mesial part, mesial & distal, entire edge), intensity (high, medium, low) and direction (parallel, oblique, vertical).
- *Use retouch:* In cases of unretouched blanks, the possible presence of use retouch is recorded and refers to its localization (right, left, both edges, proximal, distal) and type (use removals, use stripes, rounding, smoothing).
- *Tool typology:* According to the techno-morphological criteria and the presence of sickle gloss or use retouch the tools were classified in the following types: sickle blade/sickle element, retouched sickle blade/sickle element, end-scraper, double end-scraper, side-scraper, perforating

tool, blade with lateral/bilateral retouch, notch, denticulated tool, truncation, backed tool, projectile point, geometric, splintered piece, burin, composite tool, blank with use retouch.

- *Tool treatment:* The evaluation of the tools' characteristics that demonstrate the resharpening, recycling, or possible discard of the tool.

In the case of cores, some more attributes were recorded:

- *Core shape:* pyramidal, flat, polyhedral, circular, semi-circular, globular, amorphous, indeterminate.
- *Striking platform:* Number of core striking platforms and types of striking platform (plain, cortical, prepared, mixed, other). In the cases that several striking platforms are present at the core, they are recorded as mixed when they refer to different types (e.g., prepared and plain, or plain and cortical).
- *Debitage surface:* Number and type of negative products (flakes, blades, microblades, flakes & blades, blades & microblades), direction of negatives (single, opposite, multiple, other), dimensions of negatives (max. and min. width and length).
- *Core exploitation:* It examines the knapping stage of the core (raw material testing**,** early knapping stage, covered by negatives, exhausted).
- *Core treatment:* Recycling or discard of the core.

The documentation of the chipped stone assemblage also includes the photographic depiction and graphic representation of selected artefacts carried out by the author. The graphic representation followed the general principles according to Inizan et al. (1999, 101-123) and Addington (1986). Further processing of the original drawings was carried out by Odysseas Metaxas (inking and digital processing).

The completion of the recording of the artefacts' characteristics, led us to the next step of the study, which involved the processing of the recorded data. At this stage, the statistical analysis and the evaluation of the information allowed the classification of the material according to the raw materials used, the technological characteristics and tool types. The synthesis of the information that derived from the analysis of the material enabled the reconstruction of the *chaîne opératoire* and facilitated the exploration and discussion of issues related to raw material acquisition, tool production, use and treatment of the chipped stone artefacts. Moreover, the examination of the lithic material according to the chronological periods demonstrated the similarities and differences in the organization of tool production between the Late and the Final Neolithic period.

The comparison of the studied material to the lithic industries of contemporary settlements from northern Greece and southern Balkans was considered necessary to integrate the settlement of Anarghiri IXb in the broader chronological, geographical and cultural context. Emphasis was given to the evaluation of all the information derived from the analysis of the material from Anarghiri IXb in combination to the contemporary lithic industries of western Macedonia, which demonstrated the regional patterns of chipped stone production and contributed to the discussion on the exchange networks that were operating in the region during the Late and the Final Neolithic period. The above comparisons and discussions contributed to the final results of the research, demonstrating the character of the lithic production at the settlement of Anarghiri IXb during the Late and the Final Neolithic in the general framework of the Neolithic industries of northern Greece.

4.2 The raw materials

4.2.1 Introduction to raw materials

A variety of raw materials was used to produce chipped stone tools by the prehistoric inhabitants of the Anarghiri IXb settlement, which include flint, radiolarite, obsidian, chalcedony, quartz, quartzite and chert. Flint is the dominant raw material, while radiolarite, obsidian, chalcedony and chert are less common in the tool industry. Similarly, quartz and quartzite were rarely used for tool production. Additionally, several artefacts are burnt and some pieces are recorded with the presence of patina. Finally, few artefacts (less than a dozen) are made of other coarse-grained raw materials (Fig. 4.5).

The above-mentioned raw materials are generally prevalent in the lithic industries of many prehistoric settlements of northern Greece, although in different representations (Kakavakis 2011, 76-78). Each of them shows various characteristics and offer different potentials when it comes to knapping.

Quartz is an essential raw material since rocks and minerals are mainly composed of this material. Chert, flint and chalcedony are microcrystalline or cryptocrystalline varieties of quartz. Macrocrystalline quartz is a chemical compound consisting of one part silicon and two parts oxygen. It is highly resistant to both mechanical and chemical weathering. It can be translucent or even transparent, usually in a milky-white, yellowish white or grayish white color. Its hardness in Mohs scale is 7, while its fracture is not conchoidal (Dimitriadis 2008, 102; Luedtke 1992, 80).

Chert or flint is a variety of microcrystalline or cryptocrystalline quartz. It occurs as nodules and concretionary masses, as well as layered depositions. It breaks consistently with a conchoidal fracture and its hardness in Mohs scale is 7. It appears in a great variety of colors, homogeneity, texture and luster (Goffer 2007, 94). Chert usually is an opaque and dull variety of sedimentary rocks that sometimes has an almost conchoidal fracture (Luedtke 1992, 24). In comparison to flint, chert is often of lower knapping quality, due to its partially irregular fracture (Dimitriadis 2008, 107-108). Usually, chert and flint are used to describe the same raw material. However, in the present study, chert refers to the opaque, medium to coarse-grained materials of medium and low knapping quality, with less regular fracture.

Radiolarian chert is a rather hard, fine-grained and homogeneous sedimentary rock that is composed predominantly of the microscopic remains of radiolarians (silica-secreting organisms)

(Luedtke 1992, 42). Its color varies, but dark reddish brown, reddish brown and yellowish brown are the most usual categories. It is an opaque material, sometimes with translucent edges and a conchoidal fracture, but occasionally irregular fracturing (Dimitriadis & Skourtopoulou 2001, 783). In the literature of Greek chipped stone assemblages, this material is mentioned by researchers as radiolarian chert or jasper. An extremely fine-grained variety often called 'chocolate flint', 'Thessalian radiolarite' or 'dark reddish radiolarian chert' is mainly attested at the industries of western Thessaly. The origin of the latter is considered at the Pindus range (Karimali 1994, 269, 348; Moundrea-Agrafioti 1981, 43; Perlès 2001, 202; Tsagkouli 2002, 149).

Chalcedony is also a microcrystalline form of quartz. It is translucent to transparent, usually fine-grained with conchoidal fracture. It appears in light grayish or white color with reddish, yellowish, grayish, or brownish bands. Its hardness on Mohs scale is 6.5 to 7 (Dimitriadis 2008, 103; Luedtke 1992, 23-24; Rapp 2009, 80).

Obsidian is an igneous rock with a conchoidal fracture and is usually characterized as natural glass. Obsidian's hardness on Mohs scale is 5.5, a fact that makes it relatively easy to carve, but also to break. Its color varies from gray and dark gray to greenish gray and black. It is opaque, semi-translucent or translucent, with shiny luster (Goffer 2007, 99; Rapp 2009, 85-88). Sometimes it contains grayish bands or white inclusions (spherulites) (Georgiadis 2008, 105).

Quartzite is a non-foliated metamorphic rock composed almost entirely of quartz. Quartzite is usually white to gray. Some rock units that are stained by iron can be pink, red, or purple. Other impurities can cause quartzite to be yellow, orange, brown, green, or blue. The quartz content of quartzite provides a hardness of about 7 on the Mohs hardness scale. Its fracture is almost conchoidal (Dimitriadis 2008, 108; Rapp 2009, 82-83).

4.2.2 Raw material provenance

As it has already been mentioned, the chipped stone industry of Anarghiri IXb comprises of artefacts made of a variety of raw materials like flint, radiolarite, obsidian, chert, quartz, quartzite and chalcedony. The provenance of the raw materials is an important parameter in lithic analysis since it can demonstrate a wide range of strategies engaged by the prehistoric inhabitants to acquire raw materials for the tool production and contribute to the discussion regarding the factors that could be related to their choices by using specific materials. Thus, the information provided is not only restricted to the economic organization of a settlement and the use of natural resources, but also the social and sometimes symbolic implications of such choices.

At this point, it should be mentioned that there is a significant scarcity of petrographic/geochemical analysis of lithic materials, as well as identification of raw material sources in northern Greece and especially in the area of western Macedonia. However, during the 1990s a project for the raw material characterization of samples derived from Neolithic settlements of northern Greece was carried out (Dimitriadis & Skourtopoulou 2001, 779-789). A series of chipped stone artefacts were analyzed by scanning electron microscopy. The samples examined included material from the prehistoric settlements of Dispilio and Megalo Nisi Galanis (western Macedonia), Makriyalos (Pieria), Stavroupoli and Thermi (central Macedonia), Sitagroi (eastern Macedonia) and Makri (Evros). A geological map of northern Greece was divided into four zones according to the geological formations related to the different samples (Fig. 4.6). The samples of western Macedonia (Zone I) proved to be connected to radiolarian cherts, silicified carbonates and ultrabasic rocks. The samples from central Macedonia (Zone II) were abundant in ultrabasic rocks and voluminous hydrothermal quartz segregations. Eastern Macedonia (Zone III) is generally characterized by the absence of raw materials, with few concretions of quartz and acid volcanics. However, the samples analyzed were mainly characterized by acid volcanics and silica, including parts of plant tissues. In Zone IV (Thrace), silicified carbonates and acid volcanics are dominant. The research results demonstrated that the raw materials used for tool production in each area were compatible with the rock types that occur in each geographical/geological zone to a high degree. Consequently, the use of local or regional raw materials (distances smaller than 100 km) proved to be the usual pattern in the Neolithic settlements of northern Greece, with few exceptions (Makriyalos and Sitagroi) (Dimitriadis & Skourtopoulou 2001, 785).

Unlike western Macedonia, more research was carried out at the central and eastern parts of northern Greece. In the region of central Macedonia, the most common material in tool production is quartz and a variety of jasper (siliceous limonite). Outcrops of the latter have been identified close to two Neolithic settlements (Vasilika and Thermi) that explored, used and circulated this material, while both have been characterized as workshops (Grammenos 1991, 119-120; 1997b, 296-297; Skourtopoulou 2002, 545, 546; 2004, 401-402). Additionally, recent research of the geological material from Vasilika quarry was also focused on its petrographic and geochemical analysis (Karageorgiou et al. 2016, 1859-1866).

In the area of eastern Macedonia, primary sources of opalite/chalcedony are located at the north slope of Kerdyllia Mountain at the Serres region (Kourtessi-Philippakis et al. 1993). The archaeological material from the Neolithic settlement of Dikili Tash was identified with these sources. The examination of archaeological samples by thin sections and infrared spectroscopy revealed the presence of various flints, chalcedonies, jasper, quartzite and obsidian (Garnaud 2000, 35-37). In the same region, use of these sources was also attested by analysis of many samples from other prehistoric settlements of the area with the XRD method (X-ray diffraction). The comparison with the geological samples indicates the local origin of the raw materials with increased use of opalite and quartz (Kambouroglou & Peristeri 2006; 2008). Additionally, the location of a quarry at Petrota in Thrace region revealed sources of flint that were extensively used during the prehistory from the Middle Paleolithic until the Neolithic period (Efstratiou & Fotiadis 2000; Fotiadis et al. 2003).

According to the limited research undertaken in northern Greece, the geology and lithology of each area and the empirical macroscopic observations of researchers in the recent literature, possible sources of raw materials used for chipped stone production have been proposed.

Radiolarites are present in the geological background of western Macedonia, while this material was used by the prehistoric inhabitants of many settlements in the area (Dimitriadis & Skourtopoulou 2001, 785). Moreover, radiolarites could originate from about 30-40 km from the settlement of Anarghiri IXb deriving from the Voras mountain range comprising in part of Mesozoic limestones (Kaczanowska & Kozłowski 2015, 72). However, a lower quality material usually appears in the form of pebbles and its derivation is considered from secondary sources (river gravels), like the Aliakmon River which is also rich in radiolarite deposits (Ziota et al. 1993, 95). On the other hand, the fine-grained variety often called “chocolate flint” or “Thessalian radiolarite” or ‘dark reddish radiolarian chert’ is mainly present at the industries of western Thessaly and originates from the Pindus range (Elster 1994, 170-171; Karimali 1994, 269, 348; Karimali & Karabatsoli 2010, 322; Moundrea-Agrafioti 1981, 43; Perlès 2001, 202; Tsagkouli 2002, 149; Ziota et al. 1993, 95). This material could be imported to the settlements of western Macedonia through regional exchange networks, possibly with the settlements of western Thessaly. Nevertheless, the procurement from the mountains of northern Pindus in the western part of western Macedonia is also possible.

Flint is the most abundant material in the lithic industries of both chronological periods at the Anarghiri IXb settlement, including a variety of colors (gray, pale brown, reddish brown, black and olive flint), while in most cases is of excellent knapping quality. The origin of the material could be located at the Pindus Mountains, while its presence is also confirmed at other settlements of western Macedonia, like Dispilio, Avgi and Megalo Nisi Galanis (Andreasen 2008; 2011; Doulkeridou 2009, 31-32; Tsagkouli 2002, 148-149; Ziota et al. 1993, 95). Moreover, a surface research carried out for the identification of Middle Paleolithic sites in the Grevena area (Pindus range) located primary sources of chert, including some good quality gray flint, a fact that at least confirms the presence of primary sources of good quality flints at the mountain masses (Biagi & Efstratiou 2013; Biagi et al. 2015, 8-9; Efstratiou et al. 2006, 416, 421, 430).

Silicified carbonates are abundant at the geology of western Macedonia (Dimitriadis & Skourtopoulou 2001, 785), while according to the geological maps, layers of flints can be found at the Triassic and Jurassic limestones of the mountain masses of the area (see Chapter 2.1.2). Additionally, the presence of macroscopically similar materials that are abundant at the industries of the settlements in the area could indicate the presence of primary raw material sources in the region (Skourtopoulou 2002, 548; 2004, 403). Moreover, a survey conducted close to Dispilio at the riverbed of Aliakmon confirmed the presence of numerous nodules of jaspers and honey flint (Galanidou 2010, 2-3). Similar research at the shores of the Aliakmon River in the area of Kozani and Servia yielded nodules of various raw materials, including flints, which probably derived from the mountain masses of the area (Hondroyianni-Metoki 1993, 105-120).

As regards yellow/yellowish brown flint, there is an open discussion for the origin of this raw material, which is characterized by many researchers as 'silex blond' or 'honey flint.' Although its presence has been identified at many prehistoric settlements (already from the Early Neolithic period) at southern (Franchthi), central (Thessaly) and northern Greece (Dispilio, Megalo Nisi Galanis, Makriyalos, Stavroupoli, Sitagroi, Dikili Tash, Makri, etc.), sources of this fine quality material have not been identified in Greece yet. In almost all cases, the material is present in the form of tools or unretouched blanks, a fact that demonstrates the production of these tools away from the settlements. A variety of yellowish brown flint, the so-called 'Balkan flint', is reported to originate from sources of the Pre-Balkan platform (central Bulgaria: Sredna Gora, southern Bulgaria: Izbekli, northern Bulgaria: Dobrutza area). It is an excellent quality material containing white inclusions. Many researchers support that 'Balkan flint' was a material circulated through the Balkans in the form of formal tools (including long blades) from the Early Neolithic period (Gurova 2008; 2011; 2012; Gurova & Nachev 2008; Kozlowski et al. 1996, 337; Manolakakis 2005, 32-36; Tringham 2003, 84). On the other hand, recent research in northeastern Greece demonstrates the existence of some possible sources of this material at the western range of the Rhodope Mountains. However, researchers claimed that its mineralogical composition differentiates this local material from the one originates in Bulgaria (Dimitriadis & Skourtopoulou 2001, 782, 785; 2003, 85; Manolakakis 2005, 34). A different suggestion regarding the origin of yellowish brown flint has been proposed for the western coast of Greece or the territory of present-day Albania (Kaczanowska & Kozłowski 2015, 71; Kourtessi-Philippakis & Astruc 2002, 76; Perlès 2001, 78, 202; 2004, 10).

The obsidian of the Anarghiri IXb settlement, probably of Melian origin, is an exotic material that is present in northern Greece in small percentages, in contrast to eastern Thessaly and southern Greece. Obsidian is more frequent during the Late and the Final Neolithic and is mainly reported at the settlements of central and western Macedonia. This material is related to exchange networks that were well organized during this period in Thessaly and northern Greece. The distance of Melos from the study area is almost 450-500 km. Possible routes for the circulation of obsidian could be through Thessaly. However, another route for the exchange and indirect procurement of this material could be related to the coastal settlements of central Macedonia (e.g., Stavroupoli, Makriyalos).

The island of Melos is not the only source of obsidian in the Aegean since sources have also been located to the island of Antiparos in the Cyclades and the island of Yali in the Dodecanese. However, the small size of nodules in the first case proved to be restricting for the further use of this material in blade production. Additionally, the Yali obsidian is characterized by white or pink spots (spherulites), which cause an irregular fracture. Nevertheless, the latter was used at many prehistoric settlements across the Dodecanese and is found in small quantities in Crete (Georgiadis 2008, 106-110). A different origin of obsidian -apart from the island of Melos in the Aegean- could also be considered the Carpathian area since Carpathian obsidian has been documented at two Neolithic settlements of northern Greece, Mandalo and Dispilio (Kilikoglou et al. 2006; Milić 2014, 288; 2016, 219-221). Future analysis could investigate the assumption that the settlement of

Anarghiri IXb was also part of a network related to the circulation of Carpathian obsidian. In any case, taking into consideration the macroscopic characteristics of the Anarghiri IXb obsidian, it is supported that it derived from the island of Melos.

Chalcedonies are abundant in eastern Macedonia, where local sources have been located (Kourtessi-Philippakis 2008b, 118-119). However, the medium quality chalcedony that is present in the Anarghiri IXb material could hardly derive from distant sources and a possible local or regional origin seems more plausible. On the contrary, the high quality yellowish red material documented at the Final Neolithic layers in the form of few retouched tools can be considered of distant origin and it was imported to the settlement probably through exchange.

Most cherts are considered of local origin. The medium quality of the material and the smooth surfaces of some cores point to possible secondary sources not far from the settlement of Anarghiri IXb. As regards quartz, its presence at the lithic industries of central and eastern Macedonia is significant. In fact, at some settlements quartz is the dominant raw material, due to its abundance at the geological background of the area (Palli 2014, 608-610). Similarly, quartz and quartzite are considered local materials in the case of Anarghiri IXb settlement, though underrepresented. West Macedonia is also rich in quartz and deposits have been located at the Vermion Mountain range (Dimitriadis & Skourtopoulou 2001, 785; Ziota et al. 1993, 95). The prehistoric inhabitants could easily have access to these materials, which were mainly in the form of pebbles and could derive from secondary deposits.

Due to the lack of raw material identification and specialized analysis, the possible provenance of raw materials in many cases is based on macroscopic observations. Consequently, since the location of raw material sources in western Macedonia is an open issue, we should be skeptical regarding this matter in cases that laboratory analysis has not been carried out. It should be also underlined that the different terms used for describing raw materials prove to be sometimes problematic. The different terminology used by geologists and the variety of terms and descriptions used in the archaeological literature can be confusing to compare raw materials from various assemblages.

4.2.3 The lithic assemblage of the Late Neolithic layers

During the Late Neolithic period, the commonest raw material used for tool production is flint (70.1%). Radiolarite and obsidian follow in lower percentages (5.9% and 4.4% each), while chert (3.3%), quartz (2.1%), chalcedony (2%) and quartzite (0.6%) are underrepresented. Several artefacts are characterized burnt (10%), while some pieces with the presence of patina are recorded (1.5%). The last two cases are separated by the rest of the material since the identification of the raw material category in most cases was not possible due to the chemical and mechanical changes that the materials went through. In two cases, the raw material was not identified (0.1%) (Fig. 4.7, 4.8). The categories of the raw materials in the chipped stone industry of the Late Neolithic period are presented analytically in the following pages.

i) Flint (70.1%, n:1137)

Flint is the dominant raw material in the Late Neolithic layers. It is separated into basic categories in respect to color, texture, homogeneity, luster and translucency (Fig. 4.9, 4.10). The main categories, according to the criteria, are the following:

Gray flint (67.8%, n:772; 48% of the total material).

Gray flint is the most numerous flint category during this period. Three different qualities have been recorded. The first one prevails, covering almost 1/3 of the category (70.9% of the gray category, n:549). It is high-quality material, with thin texture, high homogeneity, translucent or semi-translucent and medium to shiny luster. Its color varies from light gray and gray to light brownish gray and grayish brown (7.5YR 6/1, 7.5YR 5/1, 2.5Y 7/1, 2.5Y 5/2, 10YR 7/1, 10YR 7/2, 10YR 5/2, 10YR 6/1). In some cases, it contains small impurities (white spots), while on the other hand, some clear and almost transparent dark gray material is also attested (GLAY1 5/N, 5Y 3/1).

A medium quality gray flint has been differentiated (28.3% of the gray category, n:219) of gray, grayish brown, brownish gray and light gray color (10YR 5/2, 10YR 6/2, 7.5YR 5/2, 2.5YR 5/1). The texture is thin, the homogeneity of the material is in some cases medium and some artefacts contain inclusions. The luster is usually of medium degree and the material is semi-translucent to opaque.

The last category of gray flint (0.6% of the gray category, n:5) refers to low-quality material of dark gray to gray color (GLAY1 4/N, 2.5Y 5/1, 10YR 5/1). It is of medium texture, medium homogeneity and semi-translucent, containing many inclusions.

Pale brown flint (17.4%, n:198; 12% of the total material)

It is the second most numerous category of flint and includes artefacts of pale brown to brown color (10YR 7/3, 10YR 6/3, 5YR 5/2, 7.5YR 6/3, 7.5YR 4/3). A fine-quality material is present (63% of the pale brown category (n:126), of thin texture and high homogeneity, semi-translucent to translucent, with a medium to shiny luster. The lower quality (37% of the pale brown category, n:73) refers mostly to semi-translucent material with some inclusions and dull to medium luster.

Reddish brown flint (3.1%, n:35; 2% of the total material).

This material is differentiated by the chocolate radiolarized jasper because of the differences observed in texture and translucency. The former is a semi-translucent to translucent material, of high homogeneity and thin texture. In most cases, it is shiny and sometimes contains small white spots or dark brown/black areas. Its color varies from weak red (7.5R 4/2, 2.5YR 4/2, 10R 4/3, 10R 4/4) to reddish brown (2.5YR 3/4, 4/4, 5YR 4/4), dark reddish brown (2.5YR 3/4- 3/3, 5YR 3/2, 5YR 3/4, 5YR 2.5/2) and dark reddish gray (5YR 4/2, 2.5YR 3/1).

Yellowish brown flint (0.7%, n:8; 0% of the total material)

During the Late Neolithic period, few artefacts of good quality yellowish brown flint have been attested. The texture of the material is thin and its homogeneity medium to high. The material is, in some cases, opaque with translucent edges and white inclusions (n:6), but also semi-translucent to translucent (n:2). Its color varies from very pale brown (10YR 7/4) to light yellowish brown (5Y 6/3) and yellowish brown (10YR 5/6, 10YR 5/4).

Black flint (10%, n:113; 7% of the total material)

This is a high-quality flint, of thin texture and high homogeneity, which in most cases is opaque with translucent edges or semi-translucent. Its luster is medium to shiny. The color of the material is black (GLAY1 2.5/N, 5Y 2.5/1, 2.5Y 2.5/1), while in 14 cases, small areas of dark brown color are recorded. Its presence is observed at the deepest layers of the excavated area (Layer V) and could be related to the initial occupation phase of the settlement.

Olive flint (1%, n:11, 1% of the total material)

In ten cases, the material is of excellent quality, thin texture, high homogeneity, translucent to semi-translucent. Its color varies from light olive gray and light olive to olive and olive brown (5Y 6/2, 2.5Y 5/2, 2.5Y 4/3, 2.5Y 4/4, 5Y 6/2). There is only an artefact of medium homogeneity, opaque to semi-translucent, with medium luster.

ii) Radiolarite/jasper (5.9%, n:96)

Radiolarites have been separated into two categories. The first one refers to a fine quality material well-known as chocolate radiolarized chert/jasper, mainly present at the industries of Thessaly. Almost half of the category (43.6%, n:31) belongs to this good quality material and its color ranges from reddish brown to dark reddish brown and dusky red (2.5YR 3/3, 2.5YR 4/4, 2.5YR 3/2). It is of thin texture and high homogeneity, while it is usually opaque and sometimes translucent at the edges. This material is separated in this study by a lower quality of radiolarian chert/jasper (56.4%, n:40). The latter material is of dusky and weak red to dark reddish brown color (2.5YR 3/2, 10R 3/2, 10R 3/3, 10R 4/4, 5YR 3/2), opaque, of thin texture and medium homogeneity. It is usually present in the form of pebbles, with a smooth external surface.

iii) Obsidian (4.4%, n:71)

Several artefacts are made of obsidian (n:71). Its color varies from very dark gray (GLAY1 3/N) to black (GLAY1 2.5/N) and greenish black (GLAY1 2.5/10Y). Its texture is thin, of high homogeneity and shiny luster. In most cases, the raw material is opaque with translucent edges, while less are the artefacts that are semi-translucent. In 13 cases, grayish bands are observed on the body of the translucent material. Additionally, two artefacts refer to a shiny, almost transparent and black quality of obsidian (5Y 2.5/1, GLAY 1 2.5/N) that vividly resembles glass.

iv) Chert (3.3%, n:54)

The artefacts made of opaque, usually medium or lower quality material are included in the category of cherts. Their color varies from brown to gray and dark gray (10YR 5/3-4/3, GLAY1 3/N, 5Y 3/1, 2.5Y 5/1, 10YR 3/1). A category of olive (GLAY1 4/10Y) and yellowish brown chert (10YR 7/6) are also attested but poorly represented. Most of cherts are of medium or low homogeneity and medium or dull luster.

v) Chalcedony (2%, n:33)

The artefacts made of chalcedony are of medium quality. In 12 cases, the material has a reddish gray-grayish color (7.5R 4/1, 2.5Y 5/1, 10R 4/1, 5YR 5/2) usually with darker reddish bands. It is semi-translucent, of medium homogeneity and a dull luster. However, the majority (n:21) is represented by a reddish material, weak red to reddish brown (2.5YR 4/2, 2.5YR 4/3), translucent to semi-translucent, of thin texture and a dull luster.

vi) Quartz (2.1%, n:34)

In the case of quartz, two main categories have been recorded. The first one refers to good quality material, in white color (White Page N/8.5 and N/9), translucent, of medium homogeneity and medium texture (44%, n:15). The second one belongs to a lower quality of quartz, translucent to semi-translucent, of low homogeneity and, in most cases, coarse texture (56%, n:19). Its color is white-milky white (10YR 8/1, White Page N/8.5 and N/9).

vii) Quartzite (0.6%, n:9)

Nine artefacts are made of quartzite. Their color ranges from weak red (7.5R 4/4) to pale red (7.5R 6/2). The material is characterized by low homogeneity, translucency and medium texture. In some cases (n:5), the material appears with opaque areas or bands.

viii) Burnt (10%, n:164)

Several artefacts have been characterized burnt, due to the thermal effect on their surface. In most cases, the typical characteristics related to thermal effect include fissures, conchoidal cupules and color alteration. Because of these changes at the artefacts, it was decided not to include these materials to the categories mentioned above. Almost half of the material (45.7%, n:75) has been altered to light grayish or white color with many fissures and conchoidal cupules on their surface. The rest of the artefacts have a reddish or grayish color.

ix) Patinated (1.5%, n:25)

A small number of artefacts has developed a white (in most cases) or yellow patina, due to weathering. In six cases, the artefacts are covered by patina (100%), in 13 cases, the percentage of patina at their surface is larger than 75%, while six artefacts show a percentage larger than 50% of their surface.

x) Other (0.1%, n:2)

Two artefacts of undetermined raw material are included in this category. The first one is a coarse-grained, opaque material of low homogeneity and greenish gray color (GLAY1 6/10GY). The second one is black (10YR 2/1), opaque, of medium homogeneity (resembles radiolarite).

4.2.4 The lithic assemblage of the Final Neolithic layers

During the Final Neolithic period, the percentage of flint decreases (60%) but remains the predominant raw material of the lithic industry. The presence of radiolarite, obsidian and chalcedony increase (11%, 6.3% and 5%, respectively), while chert (3.4%) and quartzite (0.7%) do not show any significant changes. On the contrary, the artefacts of quartz decrease in number (1%). The artefacts that are characterized by thermal effect cover 11% of the total material, while patina is observed in a small percentage (1.4%). Finally, the artefacts of other raw materials are few (0.2%) (Fig. 4.11, 4.12). In the following pages, the categories of raw materials from the Final Neolithic deposits are presented.

i) Flint (60%, n:2446)

The basic categories of flint recognized at the material of the Final Neolithic period remain almost the same in comparison to the previous period. Still, some changes are observed regarding their representation (Fig. 4.13, 4.14):

Gray flint (39.6%, n:940; 24% of the total material)

Gray flint remains the most numerous flint category during the Final Neolithic period, although its representation decreases significantly in comparison to the previous period. All three qualities documented at the Late Neolithic deposits are also represented at this period. The high-quality gray flint prevails with 59% of the gray category (n:552). However, there are only a few pieces of clear and almost transparent dark gray quality. The medium quality gray flint counts 40% of this category (n:381). Finally, the lower quality refers to a small number of artefacts (1%, n:8)

Pale brown flint (37.4%, n:890; 23% of the total material)

During the Final Neolithic period, pale brown flint keeps second place among flints, while it increases significantly in number, including both fine and medium quality material. In the first case, the number of the artefacts covers 63% of the pale brown flint category (n:558), while medium quality pale brown flint is represented by 37% (n:332).

Reddish brown flint (4.4%, n:104; 3% of the total material)

The material refers to the fine reddish brown flint encountered at the previous period. However, a small number of artefacts (4.5% of the reddish brown category, n:8) are of a medium quality material, which is translucent, of thin texture and medium homogeneity, in red and reddish brown color.

Yellowish brown flint (15.3%, n:363; 9% of the total material)

During the Final Neolithic period the representation of yellowish brown flint increases. Three categories are recorded regarding the quality of this material. The majority (77% of the yellowish brown category, n:278) refers to a high quality yellow or yellowish brown flint, which is translucent in most cases, of thin texture, high homogeneity and shiny luster. Its color varies from strong brown to light yellowish brown, yellowish brown, brownish yellow, reddish yellow and brown (7.5YR 5/6, 10YR 6/4, 10YR 5/3, 10YR 6/6, 7.5YR 6/6, 7.5YR 5/4). The second variety is also of good quality material (18%, n:65), which is usually opaque with translucent edges and few inclusions (white spots). Its color is very pale brown to light yellowish brown and yellowish brown (10YR 7/3, 10YR 6/4, 10YR 5/4), while its texture is thin and its homogeneity high. Finally, a small number of artefacts (5% of the yellowish brown category, n:20) involves a lower quality material of reddish yellow, brownish yellow and strong brown color (7.5YR 6/6, 10YR 6/6, 7.5YR 5/6), which is opaque to semi-translucent, of thin texture, medium homogeneity and medium to dull luster.

Olive flint (3.3%, n:79; 1% of the total material)

In most cases, olive flint is of fine quality, likewise the previous period (72% of the olive category, n:57). Additionally, during the Final Neolithic period, there is a medium quality olive flint (20% of the olive category, n:19), which is semi-translucent, of medium homogeneity and high texture. Its color varies from olive gray and dark greenish gray to dark and very dark gray (5Y 5/2, GLAY1 4/10Y, 2.5Y 3/1). Few artefacts (8%, n:6) are made of the already mentioned medium quality olive flint, which is also present at the Late Neolithic deposits.

ii) Radiolarite/jasper (11%, n:440)

Fine quality radiolarite covers more than half of the category (63.1%, n:278). The lower quality of radiolarian chert/jasper is represented by 32.7% (144). However, a yellowish brown, strong brown, or reddish yellow (7.5YR 5/6, 7.5YR 6/6, 7.5YR 6/8) opaque radiolarian chert is also present during this period, represented by 18 artefacts (4%). The material is of medium homogeneity, thin texture, medium to dull luster, while in some cases, it contains small inclusions.

iii) Obsidian (6.3%, n:250)

During the Final Neolithic period, the percentage of obsidian artefacts increases to 6.3% (n:250). In most cases, the raw material is opaque with translucent or semi-translucent edges, while smaller is the number of the artefacts that are semi-translucent. In 59 cases (23.6%), grayish bands are observed at semi-translucent to translucent specimens. During this period, two artefacts are related to a shiny, almost translucent and black quality of obsidian that resembles glass.

iv) Chert (3.4%, n:133)

Artefacts made of chert are opaque, of medium or low homogeneity and medium or dull luster. Their color varies from brown to gray and dark gray (7.5YR 5/4, 10YR 5/1, 5Y 4/1), while few pieces belong to a medium quality olive and brown chert (5YR 5/2, 7.5YR 5/3). However, a significant number of cherts (24%) is represented by a medium quality greenish gray material (GLAY1 5/10Y) that is also attested at the previous period.

v) Chalcedony (5%, n:198)

As regards chalcedony, its representation increases during the Final Neolithic period. Almost all the artefacts (98%, n:194) are made of the medium quality material. In 50 cases (25.2%) the material is of reddish gray or grayish color with reddish bands. However, the majority (74.2%, n:144) is represented by the reddish banded material. Moreover, in four cases (2%), a variety of fine quality chalcedony is attested in strong brown, red and yellowish red color (2.5YR 4/6, 7.5YR 5/8, 5YR 4/6). The material is translucent, of thin texture and high homogeneity, while it is recorded only at this period, exclusively in the form of tools.

vi) Quartz (1%, n:40)

The percentage of quartz during the Final Neolithic decreases to half of the earlier period. The better-quality quartz represents 35% of the category (n:14). However, most of the artefacts are made of the lower quality material (65%, n:26). It should be noted that a couple of pieces belong to a yellowish variety (10YR 7/6), which is coarse-grained and translucent, of low homogeneity. This material is present only at the Final Neolithic deposits.

vii) Quartzite (0.7%, n:29)

A small number of artefacts is made of quartzite. The majority is represented by the opaque, weak pale variety (72%, n:21), while the translucent and banded quartzite is rarer (28%, n:8).

viii) Burnt (10.9%, n:434)

The percentage of the burnt artefacts is almost unchanged among the two chronological periods.

ix) Patinated (1.4%, n:56)

A small number of artefacts has developed a patina of white or yellow color due to weathering. In 23 cases, the artefacts are totally covered by a patina; in 18 cases, the percentage of patina at the surface is larger than 75%, while 15 artefacts show a percentage larger than 50%.

x) Other (0.2%, n:9)

Four artefacts are made of schist (green schist), while in five cases, gabbro or similar coarse-grained material of low homogeneity was used.

4.3 The technology

4.3.1 Introduction to technology

Following the production stages of knapping (*chaîne opératoire*), the material under study has been classified into the next technological categories: raw nodules, cores, technical products, knapping products, debris and indeterminate pieces. As raw nodules are considered the unworked materials that have no trace of knapping or have been subjected to raw material testing. Cores, on the other hand, are the raw materials with negatives of detached blanks or preparation at their surface. Technical products include cortical flakes (first flakes), crested blades, rejuvenation flakes (rejuvenation flakes, core platform rejuvenation flakes, core tablets), or pieces that are the result of knapping accidents (hinged artefacts and plunging blades). The category of knapping products refers to flakes, blades, blade-flakes and microblades. The total of knapping products have been analyzed, retouched, or unretouched. The only exception is projectile points, which are examined in the section of tool typology. Finally, debris include chips and angular shatter (Inizan at al. 1999, 32-38, 59-60).

In the following pages a thorough analysis of the technological characteristics of the artefacts is presented according to their classification, in order to achieve the reconstruction of the *chaîne opératoire*. Apart from the identification of the main technological categories that demonstrate the place of each artefact in the production chain, a number of attributes are examined in detail (as they have been described in Chapter 4.1.3) providing information on the technological choices of the prehistoric knappers and the flaking methods used for the production of tools.

As regards the total studied assemblage of both chronological periods, the dominant category is knapping products, which cover 89% (n:4996). The number of technical products is smaller (6%, n:361), while cores, debris, raw nodules and indeterminate pieces are less present. More specifically, blades are dominant (71%, n:3974), while flakes (9%, n:503), microblades (6%, n:323), blade-flakes (3%, n:156) and projectile points (1%, n:40) are less represented at the industry of Anarghiri IXb (Fig. 4.15).

4.3.2 The lithic assemblage of the Late Neolithic layers

The assemblage derived from the Late Neolithic layers is characterized by the dominance of knapping products, that cover 88,2% (n:1431) of the total material (Fig. 4.16). Raw nodules (0.3%, n:6), cores (2%, n:33) and technical products (7.7%, n:125) are less represented. Few pieces involve debris (0.3%), as well as indeterminate artefacts (1.5%, n:25). More specifically, in the case of knapping products blades prevail (69.9%, n:1133) over flakes (10%, n:163), while microblades (5.2%, n:85), blade-flakes (2.4%, n:39) and projectile points (0.7%, n:11) are less represented (Fig. 4.17, 4.18).

i) Raw nodules (0.3%, n:6)

Six raw nodules derive from the Late Neolithic layers (Fig. 4.19). Their shape is either amorphous or globular. Their length ranges from 1.9cm to 8cm (average: 4cm), their width from 1.7cm to 4cm (average: 2.7cm) and their thickness from 1cm to 2.8cm (average: 1.7cm). The nodule of quartz has the largest size (length: 8cm, width: 4cm, thickness: 2.8cm) and the flint nodule the smallest.

Three of the raw nodules are of medium quality dark reddish brown radiolarite (49%), which is opaque and of medium homogeneity. These nodules were probably used for raw material testing, as evidenced by the presence of one or two negatives at their surface. One of the nodules has fissures at its surface that could lead to its discard since it does not seem to be suitable for knapping.

There is also a single nodule of low-quality quartz of coarse texture and low homogeneity (17%). Only one flake negative is observed at its surface and is probably related to raw material testing.

Another case refers to a fragment of dark gray flint of medium homogeneity and thin texture (17%). The smooth external surface covers more than 25% of the nodule. There is one possible flake negative, which could indicate raw material testing.

Finally, a nodule of undetermined black colored material is included in this category (17%). It is opaque and of medium homogeneity, probably a low-quality chert. Its surface is smooth and there are no traces of knapping.

ii) Cores (2%, n:33) (PLATES I, XXXII: a, b)

A significant number of cores that derived from the Late Neolithic deposits are of flint (43%, n:14). The majority is represented by gray flint (28%, n:9) and less of black (9%, n:3) and pale brown flint (6%, n:2). At the same time, radiolarite and chert cores are both represented by 21% of the total number (n:7 for each raw material). In two cases, the cores have undergone thermal alteration and one is patinated. Finally, a single obsidian core is documented during this period.

Cores were mainly formed on a nodule (n:19) and less on a flake (n:8) as a result of secondary treatment of the blank. Gray flint cores are represented by both categories, in contrast to radiolarite and chert that have mainly the form of worked nodules, usually preserving part of the smooth external surface. Most of the cores are complete (n:19), but a significant number is fragmented (n:14).

The basic characteristics of the examined cores are presented in figures 4.20-4.25. In the next pages an analytical presentation of the Late Neolithic cores according to the raw material category follows.

Flint cores

Flint cores are present in the form of a nodule (n:12) or flake in a secondary use (n:2). Their shape varies, since they are flat (n:3), semi-circular (n:3) or circular (n:1), pyramidal (n:1), globular (n:2), polyhedral (n:1) and amorphous (n:1). Their length ranges from 1.7cm to 5cm (average: 3.3cm), their width from 1.3cm to 5cm (average: 3.1cm) and their thickness from 0.5cm to 2.5cm (average: 1.6cm).

Eight cores are complete, one almost complete and five are fragmented. Presence of cortex is attested at four cores (2<25%, 1<50%, 1>50%). The type of striking platform is plain (n:3), prepared (n:8) and cortical (n:1), while in two cases, a prepared and a cortical or a prepared and a plain striking platform coexists.

The negative products include microblades (n:5), flakes (n:3), flakes and blades (n:3), flakes, blades and microblades (n:2), blades and microblades (n:1). At six cores the direction of negatives is single, at five multiple and three opposite. The dimensions of negatives range from 1cm to 4.4cm in length and 0.3cm (in the case of microblades) to 2.6cm in width. Regarding the knapping stage, seven cores are at an early stage of exploitation (2-3 negatives), four are entirely covered by negatives at their surface and three are exhausted.

Concerning raw materials, some interesting observations can be outlined. The exploitation of black flint cores is mainly related to the production of microblades. All three cores are small and covered by negatives (PL.I: d, PL.XXXII: a), while one is exhausted. In one case, part of the white chalky cortex is observed. The striking platform of the cores is mainly prepared. The multiple or opposite direction of the negatives points to intensive exploitation, but also a less controlled reduction. In the case of pale brown flint flake and blade negatives of single direction have been recorded. The striking platform is either prepared or cortical. The cores could have probably been discarded since a fracture is observed in both cases. As regards gray flint, it should be noted that five out of nine cores are of fine quality semi-translucent gray flint (PL.I: a, b). In most cases, the core striking platform is prepared, while the negatives at the debitage surface are of single or opposite direction. The products include flakes, blades and microblades. An early stage of core exploitation is also observed. However, two large flakes of gray flint had been also used as cores to produce microblades.

Radiolarite cores

Seven cores are of reddish brown radiolarite. Three cases refer to the fine quality material and the rest are of medium/low quality. Their length ranges from 2.2cm to 7.5cm (average: 3.5cm), their width from 1.4cm to 4.5cm (average: 2.9cm) and their thickness from 0.6cm to 3.1cm (average: 1.4cm).

As regards the fine quality radiolarite, the first case refers to a flake used as a core, with a microblade negative. The second one includes a globular core with two striking platforms, one cortical and the other prepared. It is covered by blade and microblade negatives of opposite direction (PL.XXXII: b). The third core has a plain striking platform and is covered by small flake and microblade negatives of single direction (almost exhausted). The dimensions of the negatives are 1-3.1cm in length and 0.3-1.5cm in width.

The rest cases involve three nodules and one large flake of medium quality radiolarite. Their shape is globular (n:1) or amorphous (n:2). Two nodules bear few flake negatives at their surface, still at an early reduction stage (PL. I: c). The dimensions of negatives range from 1.3cm to 2.7cm in length and 1.1cm to 1.8cm in width. Finally, the flake fragment used as a core has two negatives (blade and microblade) of a single direction.

In general, it seems that the medium quality radiolarite was used to produce flakes and blades, while fine quality material was preferable for blade and microblade production. It could be suggested that the lower quality material could not correspond to a successive blade or microblade production.

Chert cores

Cores of chert consist of nodules that carry part of the external smooth surface (>50% in five cases), while in two cases, they are formed on a flake. Their shape is polyhedral (n:2), semi-circular (n:1) and globular (n:1). Their length ranges from 3.1cm to 5.8cm (average: 4.2cm), their width from 2.6cm to 7.3cm (average: 4.3cm) and their thickness from 1.3cm to 3.9cm (average: 2.6cm).

The striking platform of three cores is prepared, while the rest have a plain surface. All cores belong to the first stages of reduction bearing 2-3 negatives of flakes and blades, in most cases of multiple directions. The dimensions of negatives vary from 1.1cm to 4cm in length and 1cm to 3.5cm in width. At two cores the negatives of technical accidents are observed at their surface (negatives of a plunging blade and a hinged flake). In fact, in three cases, the nodules seem to have been discarded at an early stage, probably due to low quality of the material or to knapping accidents.

Obsidian core

A single obsidian core derives from the Late Neolithic deposits. It is opaque and shiny, of black color (GLAY1 2.5/N). Its size is 3cm in length, 2.9cm in width and 1.9cm thick and its shape is almost pyramidal. There are two possible striking platforms, but there is no evidence of preparation. The 3-4 negatives at the core's surface belong to flakes of multiple direction. The dimensions of the negatives range from 1.8cm to 2cm in length and 0.8cm to 1.8 cm in width. The core has not careful design and seems that it was left at an early stage.

Quartzite core

A fragment of a quartzite core is recorded. Its size is 3.7cm in length, 2.9cm in width and 1.9cm thick. It has a reddish color (10R 4/6), low homogeneity and medium to coarse texture. Its shape is semi-circular and preserves the smooth external surface of the nodule. A plain striking platform is present and there is only one flake negative (3.4cm in length and 0.8cm in width). The core is at an early reduction stage and seems to have been discarded, probably due to the low knapping quality of the material.

Other (patinated/ burnt)

There is one core on a flake of pale brown-white color with strong patina at its surface (>75%). A single striking platform is recorded, prepared with small removals. There are three single direction flake negatives at its debitage surface. The dimensions of the negatives vary from 1.6cm to 2.2cm in length and 0.7cm to 2cm in width.

Additionally, there are two core fragments on a nodule which are burnt. The first one of white color has fissures at its surface. A couple of blade and flake negatives are observed at its debitage surface. The second core fragment is of reddish brown color (possibly of radiolarite). Its shape is pyramidal and a single prepared striking platform is recorded, while the debitage surface bears four microblade negatives of single direction. The dimensions of negatives range from 1.5cm to 2.9cm in length and 0.7cm to 0.8 cm in width. The core is obviously discarded since its major part is fragmented.

iii) Technical products (7.7%, n:125) (PLATES III-IV, XXXII: c)

Technical products cover 7.7% of the total assemblage of the Late Neolithic deposits (n: 125). There is an almost equal representation of rejuvenation flakes (26%, n:32) and plunging blades (25%, n:31). Crested blades follow (20%, n:25), while smaller percentages are connected to core platform rejuvenation flakes (10%, n:13), cortical flakes (9%, n:11) and hinged pieces (10%, n:12). Finally, there is only one core tablet (Fig. 4.26, 4.27).

As regards the raw material representation, the 3/4 of the total number of technical products are of flint (75%, n:94), with gray flint to be the most common (46%, n:58). Black (14%, n:18) and pale brown flint (12%, n:15) follow in smaller numbers, while only two pieces are of reddish brown flint. Technical products of obsidian (9%, n:11), radiolarite (8%, n:10), chert (3%, n:4) and quartzite (1%, n:1) are less represented. Additionally, few pieces are either burnt (4%, n:5) or patinated (1%, n:1) (Fig. 4.28).

Cortical flakes (PL.III: g, h)

Only 11 cortical (first) flakes have been recorded from the Late Neolithic layers. Five of those are of gray flint, four of black flint, one of radiolarite of medium quality and one of chert. Cortex that covers all the external surface (100%) is recorded at four flakes, while the rest preserve at least 75% of cortex. A white chalky cortex characterizes cortical flakes of gray and black flint. On the contrary, the radiolarian and chert flakes preserve the smooth external surface of the nodule, probably of a pebble.

Most of the flakes are complete (n:8) and the rest fragmented (3 fragments of mesial and distal part). Their length ranges from 2cm to 7.9cm (average: 3.4cm), their width from 1.4cm to3.6cm (average: 2.4cm) and their thickness from 0.3cm to 1.3cm (average: 0.7cm). Gray flint cortical flakes are longer than the rest, while those of black flint have the smallest dimensions.

The butt types of the flakes are mainly flat, cortical, or dihedral. There is only one flake of gray flint with a facetted butt. Their length varies from 0.6cm to 2.2cm (average: 1cm) and their width from 0.3cm to 1.1cm (average: 0.5cm). The flaking angle is semi-abrupt and sometimes low. At almost all flakes, the bulb is extreme or extending and the waves of percussion are intense or slightly intense. The characteristics mentioned above demonstrate the use of direct percussion with a hard hammer in most cases to produce decortication flakes.

Crested blades (PL.III: a-c, XXXII: c)

Most crested blades are of gray flint (n:13), followed by pale brown (n:6), reddish brown (n:1) and black flint (n:1), radiolarite (n:2), quartzite (n:1) and a burnt artefact. The presence of cortex is attested in ten cases, six of which preserve a percentage smaller than 25% and four smaller than 50%.

Almost half of the blades (n:12) are complete, while the rest are fragmented (proximal part: 2, mesial part: 8, distal part: 3). Their length ranges from 3cm to 8cm (average: 4.8cm), their width from 0.9cm to2.2cm (average: 1.5cm) and their thickness from 0.3cm to 1.7cm (average: 0.6cm). Longer are the crested blades of medium quality radiolarite and pale brown flint.

The usual butt types are dihedral (n:4), flat (n:3), facetted (n:3), punctiform (n:1) and cortical (n:1) with a semi-abrupt flaking angle in most cases. The butts' length ranges from 0.3cm to 1.2cm (average: 0.7cm) and their width from 0.2cm to 1.3cm (average: 0.4cm). The bulbs of the blades are mostly extending, slightly extending or extreme and the waves of percussion at the ventral face of the artefacts are intense or slightly intense. It could be supported that crested blades, being part of the first reduction stages, were knapped by using direct percussion with a hard or a soft hammer.

Most crested blades are secondary (n:17) and the rest primary (n:4) and tertiary (n:4). It should be mentioned that primary crested blades are made of gray and pale brown flint. Sixteen blades have a triangular cross-section, six trapezoidal and three mixed. None of the blades has a prismatic face. Most of those (n:16) bear less than four perpendicular negatives for the shaping of the crest and the rest from five to seven negatives. A secondary and a tertiary crested blade have a partial crest shaped at the proximal and mesial part of the blade. Moreover, the ridge of the crested blades is not uniform and straight. On the contrary, it is rather unsophisticated and unequal to both parts of the blade.

Another interesting fact is that some of these technical products were used as tools since they are retouched (n:8) or have traces of sickle gloss (n:4) (PL.III: b). This involves mainly blades of gray flint and less pale brown flint or radiolarite. Among the cases, a crested blade of the second raw of 8,5cm length (A9b.AE8145) made of medium quality dark reddish brown radiolarite bears heavy bilateral retouch at its cutting edges (PL.XXXII: c).

Rejuvenation flakes (PL.IV: g, h)

Flakes that were detached from the core to renew or rejuvenate it's debitage surface are numerous (n:32). Most of these are of gray flint (n:12), black flint (n:5) and obsidian (n:5). The rest raw materials are less represented (chert: 3, radiolarite: 2, pale brown flint: 1, reddish brown flint: 1, burnt: 2, patinated: 1). The presence of cortex is attested at 13 flakes (<25%).

Most of the flakes are complete (n:23) and the remaining are broken (proximal part: 3, mesial and distal part: 6). Their length ranges from 1.8cm to 5.7cm (average: 3.1cm), their width from 1.5cm to 6.3cm (average: 2.8cm) and their thickness from 0.2cm to 1.5cm (average: 0.7cm). Longer products are related to medium quality radiolarite, chert and gray flint.

The flakes' cross-section is polyhedral (n:13), mixed (n:9), triangular (n:7) or trapezoidal (n:3). Most of them have divergent distal edges, are not axial or prismatic. Their butts are mainly flat (n:11), but also cortical (n:3), dihedral (n:3), winged (n:3), or facetted (n:2). The size of the flakes' butts is quite large (average length: 1.4cm, average width: 0.5cm), while the flaking angle is semi-abrupt at most flakes and, in a couple of cases, low. Bulbs are mainly extreme (n:13) or extending (n:9), as well as double or broken in few cases. Likewise, the waves of percussion are either intense (n:15) or slightly intense (n:17). Those characteristics point to the application of direct percussion with a soft and a hard hammer.

Rejuvenation flakes were used to renew the debitage surface of the core, to correct possible errors and accidents and to enable the regular procedure of knapping. Nine flakes bear negatives of more than five previous removals, which were mainly of different (n:19) or opposite direction (n:5). Additionally, four flakes bear the negative of a previous hinged flake, an accident that probably needed to be corrected, to continue knapping.

Four of the flakes (2 obsidian, 1 radiolarite, 1 gray flint) are retouched and were used as tools. More specifically, the obsidian and radiolarite flakes are partially retouched, while the flake of gray flint -apart from lateral retouch- has also traces of sickle gloss.

Core platform rejuvenation flakes (PL. III: d-f)

Thirteen core platform rejuvenation flakes have been recorded. Most of these are of flint (gray: 5, pale brown: 2, black: 1) and less of medium quality radiolarite (n:2), obsidian (n:2), or are burnt (n:1). The presence of cortex is recorded at four flakes (<50%). Most of the flakes are complete (n:10), but three are fragmented (proximal and mesial part:1, mesial and distal part: 2). Their length varies from 2cm to 4cm (average: 2.8cm), their width from 1.5cm to 4.8cm (average: 2cm) and their thickness from 0.3cm to 1.3cm (average: 0.8cm).

The cross-section of the flakes is polyhedral (n:6), triangular (n:5) or trapezoidal (n:2). The butts are flat (n:5), concave (n:2), dihedral (n:1), or cortical (n:1) and only one obsidian flake has a facetted butt. The butts' length ranges from 0.5cm to 1.2cm (average: 0.8cm) and the width from 0.2cm to 0.7cm (average: 3.8cm), while the flaking angle is in all cases semi-abrupt. The bulbs are mainly extending and the waves of percussion are intense or slightly intense.

Core platform rejuvenation flakes provide information regarding the core's striking platform and the products produced. In six cases, the striking platform of the core is prepared, in four is cortical and in three is plain. All the obsidian core rejuvenation platforms point to a prepared core striking platform, including some cases of pale brown and gray flint. Negatives of flakes (n:4) that also include a negative of a hinged flake, blades (n:5) and microblades (n:2) are recorded, as well as two cases of both blade and microblade negatives. In most cases, the negatives have a single direction. It is noteworthy that the blade and microblade negatives are recorded at the core platform rejuvenation flakes of gray and black flint, obsidian, radiolarite and the burnt artefact.

Core tablet

A single core tablet has been recorded from the Late Neolithic layers. It is of good quality gray flint with few inclusions. It is complete, of large dimension (length: 7.1cm, width: 8cm, thickness: 2.5cm) and polyhedral shape. Its periphery preserves negatives of blades and microblades of opposite direction. The butt of the tablet is dihedral and of large size (length: 2.7cm, width: 1.2cm), with a semi-abrupt flaking angle. The bulb is large and intense waves of percussion are observed at the ventral face. The core tablet has been probably knapped with the use of a hard hammer.

Plunging blades (PL.IV: a-c)

Plunging blades are of the numerous categories of technical products (n:31). The dominant raw material is gray flint (n:17). Black (n:7) and pale brown flint (n:3) are less common, while obsidian (n:2), radiolarite (n:1) and burnt artefacts (n:1) are represented by a couple of pieces. Twelve blades preserve a small part of the cortex (<25%) at their distal end or one of the cutting edges.

More than half of the blades are complete (n:17) and the rest are fragmented (13 mesial and distal parts). Their length varies from 2.6cm to 6.2cm (average: 4.6cm), their width from 0.8cm to 3.1cm (average: 1.5cm) and their thickness from 0.3cm to 1cm (average: 0.6cm). The longer blades are of gray and pale brown flint, as well as few cases of black flint that do not exceed 5.1cm.

The cross-section of the blades is mainly polyhedral (n:16) or trapezoidal (n:8) and less mixed (n:5) or triangular (n:2). The blades are not prismatic and have a curved distal part due to plunging. The butts are facetted (n:7), flat (n:5), dihedral (n:4) or retouched (n:1). Their length ranges from 0.4cm to 0.8cm (average: 0.5cm) and their width from 0.1cm to 0.4cm (average: 0.2cm). In most cases, the flaking angle is semi-abrupt (n:10) and less abrupt (n:7). The bulb is slightly extending (n:10) or extending (n:5) and is in one case flat. The waves of percussion are diffuse (n:14), slightly intense (n:12) and intense (n:5).

The distal part of plunging blades provides information regarding the broken/removed part of the core. In most cases, it involves pyramidal cores with negatives of blades and microblades. The majority demonstrate a single core striking platform (n:21) since the negatives are of a single direction. On the contrary, fewer cases point to a core with more striking platforms, where the negatives are of different directions (multiple: 7, opposite: 3).

Despite the accident of plunging, many blades were used as tools. In eight cases, marginal, lateral and bilateral retouch is recorded, sometimes combined with truncation, while there is a case of an end-scraper shaped at the distal part of the blade. Additionally, six blades have traces of sickle gloss, indicating their use as sickle elements (PL.IV: c).

Hinged artefacts (PL.IV: d-f)

Hinged artefacts are of gray (n:5) and pale brown flint (n:3), radiolarite (n:2) and obsidian (n:2). They include four blades, seven flakes (two of obsidian) and a blade-flake (radiolarite). Two artefacts (of gray and pale brown flint) preserve a small part of cortex at their surface.

Almost all artefacts are complete (n:10), but two fragments (mesial and distal pert). Their length varies from 1.6cm to 4cm (average: 2.6cm), their width from 1cm to 3.8cm (average: 1.8cm) and their thickness from 0.2cm to 0.8cm (average: 0.4cm).

The cross-section of the artefacts is triangular (n:6), trapezoidal (n:2), mixed (n:2) or polyhedral (n:1). Half of those are not axial and their profile is asymmetrical. The butts are mainly dihedral (n;5) and less flat (n:2), linear (n:2), or facetted (n:1). Their length ranges from 0.3cm to 1.1cm (average: 0.7cm) and their width from 0.1cm to 0.4cm (average: 0.3cm). The flaking angle is, in most cases, semi-abrupt, but sometimes abrupt or low. The bulbs are mainly extending, slightly extending and, in one case, double. Additionally, the waves of percussion are intense or slightly intense. Two blades of gray and pale brown flint have traces of sickle gloss and were used as sickle elements (PL.IV: d).

iv) Knapping products (88.2%, n:1431)

The technological category of knapping products includes blades, flakes, blade-flakes, microblades and projectile points. Blades dominate covering 79.1% of the total knapping products (n:1133), while flakes (11.4%, n:163), blade-flakes (2.7%, n:39) and microblades (6%, n:85) are less represented. The projectile points have been included in this categorization, but their analysis follows at the section of tool typology. Their representation at the Late Neolithic layers is small (0.8%, n:11) (Fig. 4.29).

In respect to raw material distribution, flint prevails over the rest materials covering almost 3/4 of the total number (71.2%, n:1020). Radiolarite (5%, n: 72), obsidian (4%, n: 58), chert (3%, n:41), chalcedony (2%, n:33), quartz (2%, n:26) and quartzite (0.5%, n:7) are less represented. Several burnt artefacts are also present (10%, n:150), while few pieces are patinated (2%, n:23). Finally, there is only one product of other material (probably a flake of limestone) (Fig. 4.30, 4.31).

Flakes

Flakes correspond to 11.4% of the number of knapping products and 10% of the total material (n:163). Almost half of the flakes are made of flint (49%), while the rest raw material categories are present in smaller quantities. More specifically, quartz is represented by 13% (n:21) of the flakes, chalcedony 9% (n:14), radiolarite 8% (n:13), chert 6% (n:10), obsidian 6% (n:9), quartzite 2% (n:4), burnt 5% (n:8), patinated 1% (n:2) and other 1% (n:1). Concerning the flint categories, gray flint is dominant covering 36% (n:58), while the rest flint categories are less represented (pale brown 5%, n:9; black 5%, n:9; olive 2%, n:3; reddish brown 1%, n:2) (Fig. 4.32). Most flakes have no remains of cortex at their surface (n:132). However, there are 13 flakes where cortex covers less than 50% of their surface, while at 19 flakes, cortex covers less than 25%. The raw materials involved are gray, pale brown, black and olive flint, chalcedony, radiolarite, quartz and quartzite.

Most of the flakes are complete (n:69) or almost complete (n:24) and less are fragmented (proximal part: 33, mesial part: 10, distal part: 27). Their length ranges from 1.3cm to 5.1cm (average: 2.6cm), their width from 1.2cm to 4.8cm (average: 2.2cm) and their thickness from 0.1cm to 1.2cm (average: 0.5cm) (Fig. 4.33). Flakes of quartz are larger in dimensions and thicker in comparison to the other raw materials. On the other hand, flakes of black and reddish brown flint are smaller in size.

The cross-section of the flakes is mainly triangular (45%, n:73) and less trapezoidal (21%, n:35), polyhedral (15%, n:24), mixed (13%, n:21) and other (6%, n:10). Most of the flakes are not axial (50%, n:82), while less are the cases of fine (33%, n:54) or medium (17%, n:27) axiality. Their profiles are mostly symmetrical (40%, n:66), medium (33%, n:54) and asymmetrical (27%, n:41) and two flakes have a twisted profile. As regards the profile curvature of the flakes, it is mainly slightly curved (31%, n:50) and less curved (19%, n:31) and flat (18%, n:30), but there is a significant number of indeterminate cases (32%, n:52).

Most of the flakes preserve their proximal part (n:115). The majority of butts is flat (48%, n:55) and dihedral (19%, n:22), whilst less are cortical (6%, n:7), facetted (6%, n:7), winged (5%, n:6), concave (4%, n:5), pecked (3%, n:3), punctiform (2%, n:2), retouched (2%, n:2), linear (1%, n:1), convex (1%, n:1) or indeterminate (3%, n:4) (Fig. 4.34). Facetted butts are mainly related to flakes of black and gray flint, radiolarite and obsidian. The length of the butts ranges from 0.4cm to 1.8cm (average: 0.9cm) and their width from 0.1cm to 0.9cm (average: 0.4cm) (Fig. 4.35). The butts of gray flint, radiolarite and obsidian are smaller in dimensions. The flaking angle is, in most cases, semi-abrupt (92%, n:106), while in few cases, an abrupt (3%, n:3) or a low angle (5%, n:6) is recorded. The overhang is mainly unretouched (63%, n:72) and sometimes pressure is applied (30%, n:35), while few flakes have an abraded overhang. The bulbs of the flakes are mainly extending (62%, n:71) and less extreme (17%, n:20) or slightly extending (10%, n:12). Few flat, double and broken bulbs are also recorded (Fig. 4.36). At the same time, slightly intense waves of percussion at the ventral face of the flakes are more common (36%, n:59) than intense (34%, n:55) or diffuse (30%, n:39).

Concerning the distal part of the artefacts, the majority has divergent distal edges (64%, n:77), while less are convergent (28%, n:33) or parallel (8%, n:10). Almost all flakes are not prismatic or have a medium prismatic face. However, more regular shapes are observed at radiolarite and obsidian flakes. Additionally, the direction of the negatives at their dorsal face is at half cases single (46%, n:65) and the rest different (41%, n:57) or opposite (13%, n:31).

Considering the characteristics mentioned above, the knapping techniques that have been identified to produce flakes mainly refer to the application of direct percussion with a soft hammer and less with the hard hammer technique.

Blade-flakes

Blade-flakes are poorly represented in the category of knapping products, covering only 2.7% in this category and 2.4% of the total material (n:39). Flint is present in a smaller percentage at the category of blade-flakes (31%) in comparison to the rest knapping categories (flakes, blades, microblades). Once again, gray flint prevails (23%, n:9), while pale brown (5%, n:2) and black flint (3%, n:8) are less represented. At this technological category the representation of chalcedony (20% n:8) and chert (15% n:6) is significant, but radiolarite (8% n:6), quartz (5% n:2), obsidian (3% n:1) and quartzite (3% n:1) are still present in small quantities (Fig. 4.37). The majority of blade-flakes do not bear cortex at their surface (n:28), with the exception of 11 artefacts made of gray and pale brown flint, radiolarite, chert and chalcedony (6 blade-flakes with cortex <50%, 5 blade-flakes with cortex <25% of their surface).

Blade-flakes are mainly complete (n:16) or almost complete (n:10) and less fragmented (proximal part: 7, mesial part: 2, distal part: 4). Their length ranges from 1.9cm to 4.8cm (average: 3.8cm), their width from 1cm to 2.5cm (average: 3.8cm) and their thickness from 0.1cm to 1.1cm (average: 3.8cm) (Fig. 4.38). Once again, quartz products are larger in dimensions, as well as artefacts of chalcedony and pale brown flint. Inversely, black and gray flint, but also radiolarite are smaller in dimensions among blade-flakes.

Triangular cross-section is more frequent among blade-flakes (38%, n:15), than mixed (31%, n:12), trapezoidal (28%, n:11) or polyhedral (3%, n:1). Almost half of the artefacts are of fine axiality (41%, n:16), preferably of obsidian, gray flint and chert. The rest are not axial (39%, n:15), have medium degree of axiality (15%, n:6) or are indeterminate (5%, n:2). Their profile is mainly flat (33%, n:13) or slightly curved (28%, n:11) and less curved (18%, n:7) or indeterminate (21%, n:8). Symmetrical profiles are more usual (46%, n:18), but there are cases of medium degree of symmetry (28%, n:11) or asymmetrical (26%, n:10) profiles too. Flat and asymmetrical profiles are more usual at chert, quartz and chalcedony blade-flakes. Conversely, obsidian blade-flakes are more symmetrical with regular appearance.

Almost all blade-flakes preserve their proximal part (n:32). Likewise flakes, the majority of butts is flat (44%, n:14) and less are dihedral (16%, n:5), facetted (16%, n:5), concave (9%, n:3), winged (6%, n:2), cortical (3%, n:1), linear (3%, n:1) or pecked (3%, n:1) (Fig. 4.39). Facetted butts are more common at the products of obsidian, black and gray flint. The length of the butts varies from 0.5cm to 2.1 (average: 1cm) and the width from 0.2cm to 0.8cm (average: 0.4cm) (Fig. 4.40). The products of obsidian, radiolarite and gray flint have smaller butt dimensions in comparison to the rest raw materials. The flaking angle is in most cases semi-abrupt (78%, n:25), while in few cases, an abrupt (16%, n:5) or low angle (6%, n:2) is observed. The overhang is usually unretouched (78%, n:25), but sometimes pressure is applied (22%, n:7). Concerning the bulbs, the majority are extending (63%, n:20) to slightly extending (22%, n:7), while few are extreme (6%, n:2), flat (3%, n:1), broken (3%, n:1) or retouched (3%, n:1) (Fig. 4.41). Moreover, slightly intense (44%, n:17) and diffuse (33%, n:13) waves of percussion are more common, in contrast to intense (20%, n:8) and smooth (3%, n:1). Extreme bulbs and intense waves of percussion are usually recorded at chert and pale brown flint blade-flakes.

Finally, most blade-flakes have convergent (60%, n:18) distal edges and less are the cases of divergent (23%, n:7) or parallel (17%, n:5). The upper face of the artefacts is generally not prismatic. The direction of previous negatives is mainly single (57%, n:22), but there are also few cases of opposite (13%, n:5), different (15%, n:6) or indeterminate (15%, n:6) direction.

Concerning the knapping techniques applied for the manufacture of blade-flakes, direct percussion with a soft hammer has been applied in most cases, whereas techniques involving indirect percussion and direct percussion with a hard hammer are rare.

Blades (PLATES VII: a-f, XXXIII)

Blades is the most numerous category covering 79.1% of the knapping products and 70% of the total material (n:1133). Once again, blades made of flint are dominant and the rest raw material categories correspond to smaller numbers (radiolarite 5%, n:53; obsidian 3%, n:37; chert 2%, n:21; chalcedony 1%, n:11; quartz and quartzite 0.3%, n:3, n:2; burnt 11%, n:125; patinated 2% , n:21). In the case of flint blades, almost half are made of gray flint (52%, n:585) and less are made of pale brown (14%, n:161), black (6%, n:75), reddish brown (2%, n:23), olive (1%, n:8) and yellowish brown flint (1%, n:8) (Fig. 4.42). Most blades do not bear cortex at their surface (n:962), but 171 artefacts (gray, pale brown, black, reddish brown and olive flint, radiolarite, quartzite and chert) preserve a small part of cortex (< 50-25%).

In comparison to the previous knapping products, blades are mainly fragmented (88%, proximal part: 337, mesial part: 293, distal part: 285) and less complete (n:131) or almost complete (n:87). Their length ranges from 1.6cm to 10.6cm (average: 4.5cm), their width from 1cm to 3.5cm (average: 1.4cm) and their thickness from 0.1cm to 1cm (average: 0.35cm) (Fig. 4.43). There is a small number of blades which length exceeds 8cm and are mainly made of gray flint (n:8), radiolarite (n:2) and chert (n:2). A long unretouched blade of yellowish brown flint is an exception, with 18.6cm length (A9b.AE2944) (PL.XXXIII: c). It consists of four fragments and seems to have been deliberately broken. The blade has been produced by the pressure technique and must have been the result of exchange. It recalls the macroblades that are well-known from the Balkan Chalcolithic industries (Gatsov 2009, 43-45; Gurova et al. 2016; Manolakakis 2008). In general, blades of chert, yellowish brown flint and radiolarite are longer than the products of other raw materials while the few examples of quartz and quartzite blades are smaller in dimensions.

Trapezoidal cross-section prevails at blades (50%, n:566), indicating an advanced knapping stage. Triangular (28%, n:318) and mixed (18%, n:204) cross-sections follow in number, while there are fewest blades with a polyhedral cross-section (4%, n:45) (Fig. 4.44). At the same time, most of the blades have high (63%, n:715) or medium (17%, n:189) degree of axiality, but some artefacts are not axial at all (10%, n:120), or are indeterminate cases (10%, n:109). Almost half of the blades provide information regarding the profile curvature (n:569). Half of the blades have slightly curved profiles (48%, n:284), while less are the cases of curved (37%, n:202) or flat (15%, n:83) profiles. Flat profiles are usually recorded on blades of quartz, chalcedony and chert, but also on a few blades of medium quality radiolarite, gray and pale brown flint. Furthermore, symmetrical profiles are dominant (77%, n:867), although there are some blades with medium (15%, n:175) or low symmetry (7%, n:79) and few with a twisted profile (1%, n:12).

Less than half of the blades maintain their proximal part (n:524). The major number of butts is prepared, with facetted (45%, n:235) and dihedral (23%, n:120) butts to be more numerous. Less represented are cortical (1%, n:5), flat (14%, n:73), winged (5%, n:26), concave (3%, n:18), linear (1%, n:7), punctiform (2%, n:9), retouched (3%, n:13), indeterminate (3%, n:16) and convex (0%, n:2) butts (Fig. 4.45). All flint categories, radiolarite and obsidian have mainly facetted butts, but also dihedral and flat. Blades of chert, quartz, quartzite and chalcedony usually have flat and dihedral butts. The length of butts ranges from 0.3cm to 2.2cm (average: 0.7cm) and their width from 0.1cm to 0.8cm (average: 0.3cm). Smaller butt dimensions are recorded at blades of reddish brown, yellowish brown and black flint, as well as obsidian (Fig. 4.46). The flaking angle is in most cases abrupt (55%, n:290) and less semi-abrupt (44%, n:228), with few indeterminate cases (1%, n:6). The flaking angle of quartz, quartzite and chalcedony blades is exclusively semi-abrupt. The overhang of the blades is mainly unretouched (79%, n:414), in contrast to prepared (13%, n:71), abraded (2%, n:9) (flints, radiolarite, obsidian and chert), or indeterminate (6%, n:30). The bulbs are extending (54%, n:284) to slightly extending (41%, n:213) and sometimes flat, extreme, retouched, or broken (almost 1% each) (Fig. 4.47). Moreover, half of the blades have diffuse waves of percussion at their ventral face (52%, n:584), but also slightly intense (25%, n:283) and smooth (17%, n:195). In some cases, prominent waves of percussions are observed (6%, n:71).

The distal edges of the blades (n:503) are mainly convergent (61%, n:309) and parallel (33%, n:166) than divergent (6%, n:28). More than half of the blades have a medium to fine prismatic face (67%, n:753). The remaining artefacts are fully prismatic (33%, n:380) and are produced from flint, obsidian and fine quality radiolarite. Finally, most of the blades derive from single-platform cores since negatives at their dorsal face have a single direction (88%, n: 992). Less are the cases of opposite (7%, n:82), different (3%, n:38) or indeterminate (2%, n:21) negatives' direction.

As regards the knapping technique that was applied to produce blades, the majority is manufactured using indirect percussion and direct percussion with a soft hammer. Indirect percussion seems to be more usual at flint and radiolarite. A small number of blades made of obsidian, gray, pale brown, reddish brown, black and yellowish brown flint could also be related to the application of pressure technique.

Microblades (PLATES VII: g-j, XXXIII: b)

Microblades cover 6% of the knapping products and 5.2% of the total material (n:85). The majority is made of flint (69%, n:59), while microblades of radiolarite (4%, n:3), obsidian (13%, n:11) and chert (2%, n:2) are less in number and some artefacts are burnt (12%, n:10). Among the flint categories, microblades of gray flint are well represented (44%, n:37), whereas reddish brown (9%, n:8), pale brown (8%, n:7) and black flint (8%, n:7) have smaller percentages (Fig. 4.48). In few cases, a small part of cortex (<25%) remains at the artefacts' surface (n:14), mainly observed at gray, reddish brown, black flint and radiolarite. The rest artefacts do not have any trace of cortex.

Like blades, most microblades are fragmented (proximal part: 36, mesial part: 18, distal part: 10). Complete (n:14) or almost complete (n:7) pieces are less in number. Their length ranges from 2cm to 5.6cm (average: 3.4cm), their width from 0.5cm to 0.9cm (average: 0.8cm) and their thickness from 0.1cm to 0.6cm (average: 0.2cm) (Fig. 4.49). Microblades made of pale brown flint are longer, whereas radiolarite microblades have the smallest dimensions.

Trapezoidal cross-section prevails among microblades (49%, n:42), triangular (33%, n:28) and mixed (17%, n:14) sections follow and there is only a case of polyhedral section (Fig. 4.50). Almost all microblades are axial, with few exceptions of gray and black flint. In 35 cases, slightly curved (46%, n:16) or curved (40%, n:14) profiles prevail, but also few flat (14%, n:5). Most microblades have a symmetrical profile (87%, n:74), while a small number is related to medium (7%, n:6), asymmetrical (4%, n:4) and twisted profiles (1%, n:1).

A large number of microblades preserve their proximal part (n:54). Most butts are prepared, with facetted (44%, n:24), punctiform (16%, n:9) and dihedral (13%, n:7) butts to prevail and are exclusively represented by artefacts made of flint, obsidian and radiolarite. Less are the microblades with concave (7%, n:4), winged (5%, n:3), linear (5%, n:3), flat (4%, n:2), cortical (2%, n:1) and retouched (2%, n:1) butts, where the rest raw materials are also involved (Fig. 4.51). The length of the butts ranges from 0.2cm to 0.8cm (average: 0.5cm) and their width from 0.1cm to 0.4cm (average: 0.2cm). Smaller butts are recorded in the case of chert, radiolarite and gray flint (Fig. 4.52). The flaking angle is in most cases semi-abrupt (74% n:40) and less abrupt (26%, n:14). The overhang is unretouched (83%, n:45) and few microblades of obsidian, gray and reddish brown flint have prepared overhang (16%, n:9). Most of the bulbs are slightly extending (83%, n:45), while some microblades have flat (9%, n:5), extending (6%, n:3) or broken bulbs (2%, n:1) (Fig. 4.53). Additionally, smooth (46%, n:39) and diffuse (41%, n:35) waves of percussion are the rule, with few exceptions of slightly intense (9%, n:8) or intense (4%, n:3) waves of percussion.

At 31 microblades that preserve their distal part, most have convergent distal edges (77%, n:24) and there are only a few examples of parallel (13%, n:4) and divergent (10%, n:3) distal edges. Many microblades of excellent quality flints and obsidian (42%, n:36) have a prismatic dorsal face. However, less prismatic are most of the microblades (58%, n:49), which also refer to fine quality flints, obsidian, radiolarite and chert. Moreover, single direction of negatives at the dorsal face is the rule (88%, n:75), with few exceptions of opposite (7%, n:6) or different (5%, n:4) negatives' direction. In the latter cases, gray and black flint are once again implicated, but there are also a couple of obsidian and radiolarite microblades.

Pressure technique was applied to produce prismatic microblades. The use of this technique is mainly applied on obsidian and some cases of high-quality flints. Indirect percussion is also attested, as are a few cases of direct percussion with using soft hammer technique.

v) Debris (0.3%, n:5)

Only five pieces are characterized as debris. Two of those are made of low-quality quartz (an irregular chunk and a chip). Additionally, there is an irregular chunk of obsidian, a chip of gray chert and a chip of medium quality semi-translucent gray flint (Fig. 4.54). Their average length is 1.2cm, their width 1.1cm and their thickness 0.3cm. These by-products resulted from the knapping activity and were discarded.

vi) Indeterminate pieces (1.5%, n:25)

Pieces that could not be classified in the previous technological categories are characterized as indeterminate. This category involves 25 artefacts, all in fragments. The majority is of gray flint (32%, n:8), while few are those of medium quality radiolarite (16%, n:4), quartz (20%, n:5) and dark gray chert (4%, n:1). Finally, a couple of indeterminate pieces are burnt (28%, n:7) (Fig. 4.55). In five cases, a small part of cortex remains at their surface. The average length of the artefacts is 2cm, their width 1.6cm and their thickness 0.4cm.

4.3.3 The lithic assemblage of the Final Neolithic layers

The dominance of knapping products also characterize the assemblage of the Final Neolithic layers The number of knapping products covers 90% (n:3565) of the total material. Raw materials (0.4%, n:16), cores (1.4%, n:59) and technical products (6.1%, n:236) are less represented. The indeterminate pieces (1.6%, n:71), as well as debris (0.5%, n:18), include only a small number of artefacts (Fig. 4.56). More specifically, in the case of knapping products, blades prevail (71.8%, n:2841) over flakes (8.5%, n:340). In contrast, the categories of microblades (6%, n:238), blade-flakes (3%, n:117) and projectile points (0.7%, n:29) are less common, as in the previous period (Fig. 4.57, 4.58).

i) Raw nodules (0.4%, n:16)

The category of raw nodules includes sixteen cases (0.4%) of unworked material. Eleven of these are of dark reddish brown radiolarite of medium quality (69%), two of medium to low quality quartz (13%), two of quartzite (low quality) (13%) and there is also a nodule of chalcedony (5%) (Fig. 4.59).

Except for five complete nodules, the rest are fragmented. They all preserve a smooth external surface and probably derived from secondary sources. Their length ranges from 1.7cm to 8.5cm (average: 3.8cm), their width from 1.6cm to 6.7cm (average: 3.0cm) and their thickness from 0.7cm to 2.8cm (average: 1.7cm). The nodules of radiolarite have larger dimensions in comparison to the rest.

In seven cases of radiolarite nodules and fragments, one or two flake negatives are recorded at their surface, probably indicating raw material testing. The same can be supported for the chalcedony and the burnt nodule. As concerns the fragmented nodules, they most likely have been discarded, due to the medium knapping quality of the material.

ii) Cores (1.4%, n:59) (PLATE II, XXXII: c)

A total of 59 cores derive from the Final Neolithic layers. The majority is of medium quality dark reddish brown radiolarite (37%, n:22). Gray flint (17%, n:10), chert (10%, n:6) and yellowish brown cores (9%, n:5) follow, while the rest raw materials are represented by few pieces (reddish brown flint 5%, olive flint 5%, pale brown flint 4%, obsidian 3%, quartzite 3%, quartz 2%, chalcedony 2%, burnt 3%) (Fig. 4.60).

Cores are shaped from nodules (n:44) and in some cases from flakes (n:15). The cores of flint, radiolarite and chert are represented by both nodules and flakes. However, yellowish brown flint is an exception since all five cores are flakes that have been used for the further detachment of flakes, blades or microblades. The rest categories are represented by nodules of medium to low quality, most likely of local materials. It is also interesting to note that radiolarite is mainly represented by low quality material of local nodules, deriving probably from secondary deposits.

The main characteristics of the Final Neolithic cores are presented in Figures 4.61-4.65. The analytical presentation of the cores regarding raw material category follows in the next pages.

Flint cores

There are 23 cores of flint, which are of gray flint (n:10), yellowish brown (n:5), reddish brown (n:3), olive (n:3) and pale brown flint (n:2). In ten cases, large flakes or blades have been used as cores (five of yellowish brown flint, four of gray and one of pale brown flint). The presence of cortex is attested at five cores with a percentage smaller than 50% (n:2) or smaller than 25% (n:3), mainly related to gray and olive flint. Almost half of the cores are complete (n:12) and the rest are fragmented. Their length varies from 1.2cm to 4.4cm (average: 2.9cm), their width from 1.2cm to 4.5cm (average: 2.5cm) and their thickness from 0.7cm to 3cm (average: 1.7cm).

Core shape is in most cases pyramidal (n:6), circular (n:3), amorphous (n:1) or indeterminate (n:3). Seven cores have two striking platforms, which are either of opposite (n:2) or multiple (n:5) direction. The striking platform at many cores is either plain (n:12) or prepared (n:10) and there is a core with a cortical and prepared platform (n:1). Core platform preparation is usually connected to gray, pale brown and reddish brown flint. The negative products include flakes (n:7), blades (n:1) and microblades (n:10), but also flakes and blades (n:3), flakes, blades and microblades (n:1) or blades and microblades (n:1). The direction of negatives in many cases is single (n:14), but also multiple (n:6) or opposite (n:3), while their dimensions range from 1.1cm to 3.4cm in length and 0.3cm to 2.4cm in width. In almost half cases, the number of negatives is 2-4, pointing to an early stage of core exploitation, while ten cores are covered by negatives (gray, reddish brown and olive flint) and three are exhausted (pale brown and yellowish brown flint).

It is interesting to note that pyramidal cores are mainly of excellent quality gray and olive flint. Additionally, excellent quality gray, pale brown and yellowish brown flint are more associated to microblade products (PL.II: b, c, XXXII: c).

As regards the cores on a flake or blade blank, the majority bears few negatives at the ventral face of the blank, which include mainly flakes or microblades. The five cores of yellowish brown flint are on large flakes or blades that already bear retouch or gloss. This pattern of using flakes or blades as cores possibly indicates a strategy to economize raw material, especially since the materials used are of excellent quality.

Radiolarite cores

Cores of radiolarite are in most cases of medium quality (n:15) and less of fine quality material (n:7). In five cases, flakes or blades of fine quality material were used as cores. Most of the cores are fragmented (n:15) and few are complete (n:7). On 12 cores, the smooth external surface of the nodule remains in various percentages (at eight cores <50%, at four cores <25%). Their length ranges from 1.4cm to 4.9cm (average: 3.1cm), the width from 1.9cm to 4.8cm (average: 2.7cm) and their thickness from 1.3cm to 3.2cm (average: 1.5cm).

The shape of cores is amorphous (n:9), pyramidal (n:3), polyhedral (n:2), circular or semi-circular (n:2) and flat (n:1). Most cores have a single striking platform, while in two cases two striking platforms coexist with opposite or different direction. The striking platforms are mainly plain (n:11), but also prepared (n:3), cortical (n:1), prepared and cortical (n:1) or indeterminate (n:6). Sixteen cores belong to an early reduction stage with two or three negatives on their surface. In four cases, cores are covered by negatives and another two are exhausted. Regarding the negative products, flakes (n:9), blades (n:2) and microblades (n:6), or flakes and blades (n:3), blades and microblades (n:1), flakes, blades and microblades (n:1) were detached from the cores, with single (n:12), multiple (n:9), or opposite direction (n:1). The negatives' dimensions range from 1cm to 4.2cm in length and 0.7cm to 4.7cm in width. Fine quality radiolarite is mostly connected to pyramidal cores with prepared striking platforms for blade and microblade production.

Two complete and two fragments of large flakes and one complete blade have been also used as cores. All of them are of fine quality radiolarite. These cores were used to produce flakes, but mainly small blades and microblades. As it is expected the negatives' dimensions are smaller than those of the worked nodules (length: 0.8- 2.9cm, width: 0.4- 2.2cm).

Five cores must have been discarded, due to fragmentation. In one case, the core has fissures at its surface and a second one has a broken striking platform, pointing to their discard since the detachment of blanks could not be successful.

Chert cores

Chert cores are poorly represented in the Final Neolithic assemblage (n:6). Three of these are on secondarily used large flakes. They are of medium quality material of dark gray, brown, greenish gray and reddish brown color. Four cores are broken and only two are complete. In two cases, they preserve part of the cortex (<50%). Their length varies from 2.2cm to 7cm (average: 3.8cm), the width from 1.3cm to 6.3cm (average: 3.1cm) and their thickness from 1.2cm to 2.5cm (average: 1.8cm).

Their shape is either amorphous or indeterminate. The striking platform is plain and, in one case, prepared. In most cases, the core bears 2-3 negatives (n:4), while one core is covered by negatives and another is exhausted. The negative products include mainly flakes (n:3) and less flake and blades (n:1) or microblades (n:2), with single (n:4) or multiple (n:2) directions. Their size is 1.1-5.1cm in length and 0.5-1.9cm in width.

Four cores must have been discarded either because of their fragmentation or in another case due to exhaustion.

Obsidian cores

Two complete cores of obsidian have been recovered from the Final Neolithic layers. Their length is 2.9-3.7cm, their width 2.5-3.2cm and their thickness 1.1-2.1cm.

Both cores have an almost pyramidal shape. The first one has a prepared striking platform and is covered by negatives. The negatives' products include microblades of a single direction and their size is 0.8-1.6cm in length and 0.5-0.9cm in width. At the one side of the core, its surface seems to preserve a small part of the cortex (<25%).

The second core (PL.II: a) has two plain striking platforms which have different direction. In this case too, a small part of cortex remains at its surface (<25%). It is covered by negatives of flakes, blades and microblades of multiple direction. Their length is 2.4-3.0cm and their width 0.7-1.8cm. Additionally, one of the striking platforms seems to have been rejuvenated with a flake removal.

Quartz and quartzite cores

There is one complete core of low-quality quartz (length: 3.2cm, width: 3cm, thickness: 2.3cm). Its shape is polyhedral and has a single plain striking platform. Three flake negatives of single direction (length: 2.3-3cm, width: 1.3-1.9cm) are observed at its surface.

Regarding the two quartzite cores, they are both complete (length: 3.2-4cm, width: 3.7-4.7cm, thickness: 2.6-3.5cm) and of low quality. Their shape is amorphous and they have a single striking platform. In one case, the striking platform is plain, while at the second core, it seems to be prepared with small removals. Both cores are at an early stage of reduction with few negatives at their surface. The negatives of flakes in one case and of flakes and blades at the second have single direction and their dimensions are 1.6-2.6cm in length and 1-1.7cm in width.

Chalcedony cores

A complete core of medium quality chalcedony is recorded. Its size is 3.2cm in length, 3.8cm in width and 3.3cm in thickness. Its shape is almost pyramidal. The core has two opposite striking platforms, one prepared and the other plain. It is covered by flake and blade negatives of opposite directions (length: 1.7-3.2cm, width: 1.1-2.3cm).

Burnt cores

Two cores show evidence of thermal alteration, like a change of color and small conchoidal cupules and fissures at their surface. They are both almost complete (length: 2.3-2.7cm, width: 1.4-1.9cm, thickness: 1.1-1.2cm). The first one has a globular shape with a single striking platform. Negatives of small flakes and microblades are present in multiple directions and small dimensions (length: 0.8-1.6cm, width: 0.3-1cm). The core is exhausted and must have been discarded.

The second core has an almost pyramidal shape. There are two opposite striking platforms, both cortical. Negatives of small flakes and microblades of opposite directions cover the core. Their dimensions are 1.1-1.9cm in length and 0.5-0.6cm in width. This core looks also exhausted and was probably discarded.

iii) Technical products (6.1%, n:237) (PLATES V-VI)

Technical products cover 6.1% of the total material of the Final Neolithic layers. The majority is represented by crested blades (30%, n:71), plunging blades (22%, n:53) and rejuvenation flakes

(20%, n:47). Smaller percentages refer to core platform rejuvenation flakes (12%, n:28), cortical flakes (8%, n:20), hinged products (7%, n:16) and a couple of core tablets (1%, n:2) (Fig. 4.66, 4.67).

Most technical products are of gray (26%, n:61) and pale brown flint (20%, n:48). The rest flint categories are less represented (reddish brown 3%, n:8; yellowish brown 4%, n:9; olive 3%, n:7). Radiolarite (15%, n:36) and obsidian (12%, n:27) show a relatively high percentage. On the contrary, chert (3%, n:7), chalcedony (3%, n:7), quartz (1%, n:3) and quartzite (1%, n:2) are represented by few pieces. Burnt and patinated artefacts cover 9% (n:22) of the technical pieces (Fig. 4.68).

Cortical flakes (PL.VI: g)

The number of cortical flakes is rather small. The majority is of radiolarite (n:8), where cortex refers to the smooth external surface of the nodule. The remaining raw materials are represented by few pieces (gray flint: 2, pale brown flint: 2, reddish brown flint: 1, quartz: 3, chert: 1, burnt: 2, patinated: 1). It should be noted that yellowish brown and olive flint are not represented in this technical category. Ten flakes are covered entirely by cortex (100%) and the rest are covered more than 75% of their dorsal face.

Most of the flakes are complete or almost complete (n:13) and the rest are fragmented (proximal part: 3, mesial part: 1, distal part: 4). Their length ranges from 2cm to 5.2cm (average: 3.1cm), their width from 1cm to 4.1cm (average: 2cm) and their thickness from 0.2cm to 1.5cm (average: 0.5cm). Larger dimensions are recorded at flakes of medium quality radiolarite, gray flint and quartz.

Cortical flakes are not prismatic. Their butts are quite big, since their length varies from 0.4cm to 1.7cm (average: 0.95cm) and their width from 0.1cm to 0.6cm (average: 0.35cm). Most butts are flat (n:5) and the rest are winged (n:2) or dihedral (n:2). The flaking angle is mainly semi-abrupt and, in some cases, low, pointing to direct percussion with a soft or a hard hammer. This is also supported by the presence of extending bulbs and intense waves of percussion.

A large cortical blade-flake of medium quality dark reddish brown radiolarite has a denticulated retouch at the proximal and mesial part of its right edge. Another flake of the same material bears marginal retouch at its left edge. Finally, a blade-flake of reddish brown flint (cortex >75%) has traces of sickle gloss at the entire left cutting edge.

Crested blades (PL.V: a-c)

Crested blades are the most numerous category among technical products (n:71). The majority is of gray (n:16) and pale brown flint (n:16), as well as excellent and medium quality radiolarite (n:16). The rest raw materials are represented by few pieces (chalcedony: 4, yellowish brown flint: 3, olive flint: 2, reddish brown flint: 1, chert: 1, burnt: 10, patinated: 2). Most of the blades do not have cortex at their surface (n:62), but in nine cases, the artefacts are partially covered with cortex (in four cases <50%, in five cases <25% of their surface).

The number of complete (n:9) or almost complete pieces (n:6) is rather small, while most of the crested blades are fragmented (proximal part: 18, mesial part: 12, distal part: 26). Their length varies from 1.5 to 8.5cm (average: 4.1cm), their width from 1.0 to 2.8cm (average: 1.6cm) and their thickness from 0.1 to 1.3cm (average: 0.6cm). Six blades are longer than 6cm and are made of fine quality radiolarite, gray and pale brown flint.

The dimensions of the blades' butts are quite big, with length to range from 0.3 to 1.9cm (average: 0.8cm) and width from 0.2 to 0.8cm (average: 0.4cm). Most butts are flat (n:13) and less are facetted (n:5), dihedral (n:4), linear (n:1), retouched (n:1) or cortical (n:1). The bulbs are mainly extending and slightly extending, while extreme bulbs are also recorded in few cases. The waves of percussion at their ventral face are intense or slightly intense (n:36) and diffuse (n:35).

Secondary crested blades are more numerous (n:44) than primary (n:13) and tertiary (n:14). Crested blades of yellowish brown flint are exclusively secondary. Most crested blades have a triangular cross-section (n:46) and less trapezoidal (n:19) mixed (n:5) or polyhedral (n:1), while none of them is prismatic. Almost half of the blades have more than four vertical negatives at their dorsal face and the rest have at least 2-4 negatives for the shaping of the crest. Eight blades have a partial crest shaped that is located either at the distal or at the proximal part of the blank. Moreover, the shaping of the crest at most blades is irregular and the ridge is not straight (rather unsophisticated).

Another important fact is that almost half of the crested blades (n:36) are retouched and were used as tools. All tool types are represented in this technological category, like lateral and bilateral retouch (PL.V: a), perforating tools, end-scrapers (PL.V: c), truncations, etc. Sickle gloss, occasionally in combination with retouch, is recorded on 28 blades.

Rejuvenation flakes (PL.VI: f)

Forty-seven rejuvenation flakes derive from the Final Neolithic deposits. The majority is of gray flint (n:18) and obsidian (n:11). Pale brown flint (n:6), yellowish brown flint (n:2), olive flint (n:1), radiolarite (n:3), quartzite (n:2), chert (n:2) and chalcedony (n:1) are represented by few pieces. There is also one patinated flake. The presence of cortex is recorded at 12 flakes (<25% of the surface).

Most flakes are complete (n:20) or almost complete (n:15), while the rest are fragmented (proximal part: 7, distal part: 5). Their length ranges from 1.5 to 5.3cm (average: 3cm), their width from 1.1cm to 4.8cm (average: 2.8cm) and their thickness from 0.3cm to 2cm (average: 0.8cm).

The cross-section of the artefacts is polyhedral (n:22), triangular (n:14), trapezoidal (n:8) or mixed (n: 3). The majority is asymmetrical and of medium to low axiality. The butts are flat (n:13), facetted (n:5), cortical (n:4), dihedral (n:4), winged (n:3) and in few cases indeterminate. The butts' average length is 1.2cm and the average width 0.6cm. The flaking angle of most flakes is semi-abrupt (n:29) and in four cases low. Moreover, the bulbs are extreme (n:15) or extending (n:14), while few are double (n:3), flat (n:2) or broken (n:2). Most of the blanks have intense waves of percussion at their ventral face (n:39) and few are slightly intense (n:8). At 14 flakes more than 5 negatives are recorded at their dorsal face. Additionally, in most cases (n:38) the direction of negatives is different.

Direct percussion with a hard hammer is the most probable technique that had been applied to produce these flakes, as well as direct percussion with a soft hammer. Moreover, two obsidian flakes bear the negative of a knapping accident at their dorsal face (plunging and hinged negatives). A small number of flakes has been partially retouched (n:4).

Core platform rejuvenation flakes (PL.V: d, e, g)

Core platform rejuvenation flakes are typically of obsidian (n:9) and pale brown flint (n:8). Radiolarite (n:4), reddish brown (n:3), gray (n:2) and yellowish brown flint (n:2) are less common. In three cases a small part of cortex (<25%) remains at the dorsal face of the flake.

Most flakes are complete (n:14) or almost complete (n:4), while the rest of the artefacts are fragmented (proximal part: 3, mesial part: 3, distal part: 4). The length of the flakes ranges from 1.8cm to 4.1cm (average: 2.7cm), their width from 1.1cm to 4.1cm (average: 2.1cm) and their thickness from 0.3cm to 1.5cm (average: 0.6cm). Most of the flakes have a triangular and polyhedral cross-section.

The flakes are not prismatic. Their butts are quite big since their length varies from 0.4cm to 1.4cm (average: 0.8cm) and their width from 0.2cm to 0.6cm (average: 0.35cm). The butts of the flakes are flat (n:3), winged (n:2), dihedral (n:3), facetted (n:2), concave (n:3), cortical (n:1), punctiform (n:1) or linear (n:1). The flaking angle is mainly semi-abrupt and, in few cases, low, pointing to the application of direct percussion with a soft or hard hammer. This observation is supported by the presence of extreme, extending and few double bulbs, as well as intense or slightly intense waves of percussion at the ventral face.

Core platform rejuvenation flakes provide information regarding the core striking platform and the blanks produced. In most cases, the core platform is prepared with small removals (n:20), while a minority of platforms are plain (n:8). In two cases, traces of abrasion of the core's overhang are attested (obsidian). Moreover, most negative products refer mainly to microblades (n:18), than to blades and flakes (n:10). Prepared core striking platforms and microblade negatives are mostly related to obsidian, fine quality flint and radiolarite. Additionally, a core platform rejuvenation flake of fine quality dark reddish brown radiolarite bears lateral retouch at its left cutting edge.

Core tablets (PL.V: f)

Only two core tablets derive from the Final Neolithic layers. They are both complete and of excellent quality gray flint. In one case, a small percentage of white, chalky cortex is recorded (<25%).

The length of the tablets is 3.5cm and 2.8cm, their width 2.6cm and 2.8cm and their thickness 1.1cm. Their cross-section is polyhedral, their bulbs are extreme and extending and the waves of percussion are intense. Direct percussion with a hard hammer is the knapping technique applied in both cases.

Both core tablets point to a prepared core striking platform with small removals. In the one case the core was used to produce blades and microblades and the second to produce microblades.

The one core tablet (A9b.AE5889) (PL.V: f) is retouched at its distal part. Direct, long, continuous and abrupt removals form a convex outline that shapes an end-scraper's working edge.

Plunging blades (Pl.VI: a-c)

The accident of plunging has been recorded on 53 blades. It is frequent in the case of gray flint (n:16), pale brown flint (n:12) and obsidian blades (n:7). The other raw materials are less represented (reddish brown flint: 3, yellowish brown flint: 1, olive flint: 4, radiolarite: 1, chert: 3, chalcedony: 2, burnt: 4). Several blades (n:22) preserve part of the cortex (<50- 25%), which in most cases, is located at the distal part of the blank. Almost half of the plunging blades are complete (n:15) or almost complete (n:11) and the rest preserve their mesial and distal part (n:27). The length of the blades ranges from 1.6cm to 7.1 (average: 4.0cm), their width from 0.7cm to 4.0cm (average: 1.5cm) and their thickness from 0.2cm to 1.6cm (average: 0.6cm).

The most common cross-section of the blades is trapezoidal (n:20), while smaller numbers refer to polyhedral (n:14), triangular (n:9) or mixed (n:10) section. These artefacts have a mainly curved profile (n:40) and in some cases, an arch-shaped profile is documented (n:13). The butts of the blades are flat (n:6), winged (n:1), dihedral (n:4), facetted (n:3), punctiform (n:1), retouched (n:1), pecked (n:1) or linear (n:1). The butt's length ranges from 0.2cm to 0.8cm (average: 0.5cm) and its width from 0.1cm to 0.4cm (average: 0.2cm). The flaking angle of the blades is semi-abrupt and abrupt, the bulbs are slightly extending and the waves of percussions are slightly intense or diffuse/smooth.

Direct percussion with a soft hammer and indirect percussion are documented in the production of blades. The obsidian plunging blades and microblades have a single direction of negatives at their dorsal face pointing to pyramidal cores (PL.VI: c). The same observation can be made for several blades and microblades of gray and pale brown flint.

On 17 plunging blades, retouch is recorded, which in many cases involves lateral or bilateral retouch, or form truncations, denticulations, end-scrapers, etc. Some blades display sickle gloss at one or both cutting edges, demonstrating their use as sickle blades/elements (PL.VI: a).

Hinged artefacts (PL.VI: d, e)

There is a small number of artefacts that are hinged (n:16). Most of them are flakes (n:8) and blades (n:6), but there are also two blade-flakes. Most of the artefacts is of gray flint (n:5), pale brown flint (n:4) and radiolarite (n:4), while one artefact of yellowish brown flint and a couple of burnt or patinated pieces have also been recorded. The presence of cortex is attested in three cases (<50%).

Most of the hinged products are complete or almost complete (n:9) and the rest are fragmented (seven fragments of distal part). The length of the artefacts range from 1.3cm to 4.0 (average: 2.5cm), their width from 0.8cm to 4.4cm (average: 1.8cm) and their thickness from 0.1cm to 1.1cm (average: 4.2cm).

Many of the blanks are asymmetrical and not axial. The butts are flat (n:4), facetted (n:2), winged (n:1), linear (n:1), or cortical (n:1) and the flaking angle is semi-abrupt and in one case low. The bulbs of the products are extreme, extending and slightly extending and the waves of percussion at their ventral face are intense or slightly intense. The application of direct percussion with a soft and a hard hammer was used in the case of hinged artefacts.

A hinged blade of excellent quality gray flint bears lateral retouch and sickle gloss at its right cutting edge. Likewise, a second unretouched blade of excellent quality grayish brown flint has sickle gloss at its right cutting edge.

iv) Knapping products (90%, n:3564)

The technological category of knapping products includes blades, flakes, blade-flakes, microblades and projectile points. Blades dominate covering 79.7% of the total knapping products (n:2841), while flakes (9.5%, n:340), blade-flakes (3.3%, n:117) and microblades (6.7%, n:238) are less represented. The presence of projectile points at the Final Neolithic layers is small (0.8%, n:29) (Fig. 4.69, 4.70).

Regarding raw material distribution, flint prevails over the rest materials, covering more than half of the total number (62%, n:2185). Obsidian (6%, n: 220), radiolarite (10%, n: 362), chert (3%, n:115), chalcedony (5%, n:188), quartz (1%, n:26) and quartzite (1%, n:20) are less represented. Several burnt artefacts are present (11%, n:391), while a few pieces are patinated (1%, n:50). Finally, there are nine products of other raw materials (Fig. 4.71).

Flakes

The category of flakes refers to 9.5% of the knapping products and 8.5% of the total material (n:340). Flakes are mainly made of flint (39%, n:132), with gray flint to prevail (19%, n:66). At the same time, pale brown (15%, n:49), reddish brown (1%, n:4), yellowish brown (3%, n:11) and olive flint (1%, n:2) are present in smaller numbers. A significant number of flakes is made of radiolarite (17%, n:58) and chalcedony (17%, n:56), while chert (8%, n:28), obsidian (5%, n:18), quartz (4%, n:14) and quartzite (1%, n:3) were less used for flake production. Burnt (7%, n:25) and patinated flakes (1%, n:4) are also present, as well as a couple of flakes of other raw material (probable gabbro) (Fig. 4.72). Some flakes preserve part of cortex at their surface (32 flakes with a percentage <25% of cortex, 32 flakes with a percentage <50% of cortex) and are mainly related to gray and pale brown flint, radiolarite, chert and chalcedony.

Most flakes are complete (n:134) or almost complete (n:86), whilst less artefacts are fragmented (proximal part: 53, mesial part: 27, distal part: 40). Their length ranges from 1.3cm to 5.8cm (average: 2.7cm), their width from 0.8cm to 4.4cm (average: 2cm) and their thickness from 0.1cm to 1.5cm (average: 0.5cm) (Fig. 4.73). Flakes of chert, quartz, quartzite and chalcedony are larger when compared to flint, obsidian and radiolarite flakes.

Most of the flakes have a triangular cross-section (53%, n:181) and less have trapezoidal (23%, n:77), mixed (12%, n:42), polyhedral (7%, n:24) or other (5%, n:16) section. At the same time, most pieces have a fine (36%, n:123) or medium axiality (23%, n:79), but the non-axial flakes are also well represented (41%, n:138). Additionally, from a total of 261 flakes that preserve their distal part, the majority has a slightly curved (43%, n:111) or flat profile (35%, n:92) and fewer flakes are curved (22%, n:58). The symmetrical (41%, n:141) or medium symmetrical (31%, n:106) profiles prevail over asymmetrical (26%, n:87) or twisted (2%, n:6) profiles. Obsidian flakes, in most cases, have curved and symmetrical profiles.

Almost 72% of the flakes maintain their proximal part (n:243). The dominant butt type is flat, covering half of the material (53%, n:128). On the other hand, dihedral (12%, n:29), linear (7%, n:16), cortical (6%, n:15), winged (6%, n:14), concave (5%, n:13), facetted (4%, n:10), pecked (2%, n:5), retouched (2%, n:5), punctiform (0%, n:1) and convex (0%, n:1) butts are less represented (Fig. 4.74). Facetted butts are more common at flakes of obsidian, radiolarite, gray and pale brown flint. The length of the butts ranges from 0.4cm to 2.7cm (average: 0.9cm) and their width from 0.1cm to 1.2cm (average: 0.4cm) (Fig. 4.75). However, smaller are the butts of obsidian, radiolarite, yellowish brown, pale brown and olive flint. Concerning the flaking angle of the flakes, semi-abrupt butt angles is the rule (86%, n:210), while in few cases a low (10%, n:23) or an abrupt (4%, n:10) angle is recorded. The overhang is mainly unretouched (77%, n:187), but sometimes pressure is applied (23%, n:56). Half of the bulbs are extending (51%, n:124), whereas there is a number of flakes with slightly extending (20%, n:48) and extreme bulbs (15%, n:38). Few flat (5%, n:12), broken (4%, n:9), double (2%, n:4), absent (2%, n:6) or indeterminate (1%, n:2) bulbs are recorded (Fig. 4.76). Additionally, the waves of percussion at the ventral face of the flakes are either slightly intense (36%, n:121), diffuse (32%, n:109), or intense (29%, n:99) and less smooth (3%, n:11).

The distal part of the artefacts is mainly characterized by divergent edges (56%, n:145), but also a large number refers to convergent (43%, n:107) and few parallel edges (3%, n:9). Almost all flakes have a low degree of prismatic face. The direction of negatives is single (56%, n:192) or, in many cases, different (28%, n:96). Few flakes have opposite or indeterminate direction of negatives at their dorsal surface (8%, n:26 each).

According to the flakes' technological characteristics, the knapping techniques that have been identified for their production is direct percussion with a soft hammer and more rarely direct percussion with a hard hammer.

Blade-flakes

The category of blade-flakes is less represented among knapping products covering only 3.3% and 3% of the total material (n:117). Flint (33%, n:40) and chalcedony (32%, n:38) are the commonest raw materials used for their production. Regarding flint, gray (19%, n:23) and pale brown (11%, n:13) are mainly represented, while few artefacts are of yellowish brown (1%, n:1) and olive flint (2%, n:3). Radiolarite (14%, n:16), quartzite (8%, n:9) and chert (5%, n:6) are less represented and few artefacts are made of quartz (2%, n:2) and obsidian (1%, n:1). A couple of pieces are burnt (n:2), patinated (n:2), or of other raw material (possibly gabbro, n:1) (Fig. 4.77). Almost all blade-flakes do not bear cortex at their surface (n:104), with few exceptions that mainly involve gray and pale brown flint, radiolarite and chalcedony (seven blade-flakes with cortex <50%, six blade-flakes with cortex <25%).

Most of the artefacts are complete (n:44) or almost complete (n:27) and less are fragmented (proximal part: 25, mesial part: 5, distal part: 16). Their length ranges from 2.4cm to 5.5cm (average: 3.6cm), their width from 1cm to 3.3cm (average: 1.8cm) and their thickness from 0.2cm to 1.1cm (average: 0.5cm) (Fig. 4.78). Blade-flakes of quartz, quartzite, chert and pale brown flint are larger in size.

Triangular (46%, n:54) and trapezoidal (31%, n:36) are the most common cross-sections of the blade-flakes, in comparison to mixed (19%, n:22) or polyhedral (4%, n:5). Most of the artefacts are axial (42%, n:49), but there is an important number of non-axial pieces (33%, n:39), or blade-flakes of medium axiality (25%, n:29). The profile curvature at 98 artefacts is mainly flat (51%, n:50) and less are slightly curved (32%, n:31) or curved (17%, n:17). Fine (40%, n:47) and medium (30%, n:35) profile symmetry is recorded at most blade-flake, but few cases also involve asymmetrical (25%, n:29) or twisted profiles (5%, n:6).

The presence of a proximal part is recorded at 90 blade-flakes. The majority of butts is flat (66%, n:59), whilst less represented are dihedral (8%, n:7), winged (8%, n:7), facetted (6%, n:5), concave (4%, n:4), linear (3%, n:3), retouched (2%, n:2), cortical (1%, n:1), punctiform (1%, n:1) and pecked (1%, n:1) butts (Fig. 4.79). The length of butts ranges from 0.3cm to 2.1cm (average: 1cm) and their width from 0.2cm to 0.9cm (average: 0.4cm) (Fig. 4.80). Smaller butts are recorded at yellowish brown and pale brown flint blade-flakes. The flaking angle in most cases is semi-abrupt (83%, n:75), while in few cases an abrupt (10%, n:9), a low (5%, n:4) or indeterminate (2%, n:2) angle is observed. The overhang is mainly unretouched (83%, n:75). The bulbs of the artefacts are extending (56%, n:50) to slightly extending (27%, n:24) and few extreme (6%, n:5), flat (4%, n:4), broken (3%, n:3), double or absent (2%, n:2 each) bulbs are recorded (Fig. 4.81). Moreover, slightly intense (39%, n:46) and intense waves of percussion (38%, n:44) are the most common, but also diffuse waves of percussion (21%, n:25) and few cases of smooth (2%, n:2) ventral faces.

As regards the distal edges of the blade-flakes (98 cases), most of those are convergent (64%, n:63) and less divergent (30%, n:29) or parallel (6%, n:6). Almost all blade-flakes are not prismatic, with a single direction of negatives to be more common (74%, n:86), than opposite, varying (10%, n:12 each) or indeterminate (6%, n:7).

According to the above observations it seems that most blade-flakes were produced by direct percussion with a soft hammer, while less cases point to the application of direct percussion with a hard hammer or indirect percussion.

Blades (PLATES VIII: a-f, XXXIV)

The category of blades is the most numerous among knapping products (79.7%, n:2841), as well as the total material, covering 71.8%. Flint blades prevail in number (66%, n:1849), with the rest raw material categories to be less represented (radiolarite 10%, n:274; obsidian 5%, n:129; chert 3%, n:79; chalcedony 3%, n:93; burnt 11.4%, n:354; patinated 1%, n:41; quartz, quartzite, other: less than 1%). As regards the flint blades, the majority is made of pale brown and gray flint (25% each, n: 707 and n:696), while smaller quantities are connected to yellowish brown (11%, n:306), reddish brown (3%, n:81) and olive flint (2%, n:59) (Fig. 4.82). Most blades do not bear cortex at their surface (n:2559). However, in some cases, cortex is present at flints, radiolarite, quartz, chert and chalcedony (150 blades with cortex <25%, 130 blades with cortex <50%).

Regarding their preservation, most blades are broken (proximal part: 807, mesial part: 905, distal part: 755). On the contrary, complete (n:207) or almost complete blades (n:167) are less in number. Their length ranges from 1.1cm to 12.5cm (average: 4.5cm), their width from 1.6cm to 4.8cm (average: 1.5cm) and their thickness from 0.5cm to 1.1cm (average: 0.4cm) (Fig. 4.83). It is noteworthy that the longer blades are of gray, olive, pale brown and yellowish brown flint, as well as fine quality radiolarite. There are 27 blades longer than 8cm (8-12.5cm), which are made of gray (n:13), yellowish brown (n:4), pale brown (n:3) and olive flint (n:1), but also radiolarite (n:5) and a patinated artefact.

Blades with trapezoidal cross-section cover the half of the material (50%, n:1411). Triangular cross-section is also usual (31%, n:883), while mixed (15%, n:423) and polyhedral sections (4%, n:124) follow in smaller numbers (Fig. 4.84). The examination of 1180 blades demonstrates that most of them are axial (72%, n:850), but there are some with medium (15%, n:174) or low (13%, n:156) degree of axiality. The profiles of 1190 blades are mostly slightly curved (46%, n:549), but also curved (28%, n:326) and flat (26%, n:313). At the same time, symmetrical profiles are dominant (79%, n:2235), although there are some blades characterized by less symmetrical (13%, n:378), asymmetrical (7%, n:196) or twisted (1%, n:32) profiles.

The proximal part is preserved on 1093 blades. Most of the butts are facetted (38%, n:420), dihedral (23%, n:246) and flat (22%, n:239). Less represented are winged (5%, n:54), retouched (4%, n:38), linear (3%, n:33), concave (2%, n:24), punctiform (2%, n:18), cortical (0%, n:5), pecked (0%, n:4) and convex (0%) butts (Fig. 4.85). Facetted butts are recorded at the blades of all flint categories, radiolarite and obsidian. Additionally, obsidian is also related to punctiform, linear and retouched butt types. The length of butts ranges from 0.2cm to 1.8cm (average: 0.8cm) and the width from 0.1cm to 0.9cm (average: 0.3cm) (Fig. 4.86). Smaller are the butts of obsidian and reddish brown blades. In almost half cases, the flaking angle is semi-abrupt (54%, n:593) and the rest blades have an abrupt flaking angle (46%, n:500). The overhang is mainly unretouched (78%, n:854), but there are many cases of preparation with pressure (19%, n:208) or abrasion (3%, n:31). The bulbs of the blades are mainly extending (49%, n:548) to slightly extending (42%, n:477) and sometimes flat (3%, n:34) or extreme (3%, n:30). A small number involves retouched, broken, or absent bulbs (1% each) (Fig. 4.87). Concerning the waves of percussion at the ventral face of the blades, half of the material has diffuse waves of percussion (51%, n:1457). Still, there are also smooth (24%, n:678) and slightly intense (20%, n:553) waves of percussion, whereas intense waves of percussion are rare (5%, n:153).

Convergent distal edges (n: 1190) are the commonest among blades (67%, n:798), but there are also cases of parallel (27%, n:318) and divergent distal edges (6%, n:74). Most products have a medium to good prismatic face (62%, n:1764), but blades with really prismatic characteristics are less in number (38%, n: 1077). Moreover, most of the blades are related to single-platform cores and have negatives of the same direction at their dorsal face (86%, n:2431). Blades with opposite (8%, n:229), different (2%, n:69) or indeterminate (4%, n:112) negatives' direction are less in number.

Finally, the knapping technique applied to produce blades at almost half cases is probably related to indirect percussion, but also direct percussion with a soft hammer was probably used. Additionally, several prismatic blades with parallel edges made of all flint categories, radiolarite and obsidian seem to have been produced by pressure technique.

Microblades (PLATE VIII: g-j, XXXIV)

Microblades cover 6.7% of the knapping products and 6% of the total Final Neolithic material (n:238). The majority is made of flint (66%), with gray (28%, n:67) and pale brown flint (21%, n:50) to be more common. Yellowish brown flint was less used (10%, n:23), while reddish brown and olive flint refer to few pieces (2% and 1%, respectively). A significant number of obsidian microblades is also recorded (30%, n:70), covering almost 1/3 of the category. Few microblades are made of radiolarite (3%, n:8), chert (0%, n:1) or chalcedony (0%, n:1), while burnt (4%, n:9) or patinated (1%, n:2) artefacts are also present, still few (Fig. 4.88). A small percentage of cortex (<25%) is recorded on a few microblades (n:16).

Regarding their preservation, most microblades are fragmented (proximal part: 82, mesial part: 57, distal part: 48), while the complete (n:28) or almost complete (n:23) artefacts are less in number. Their length ranges from 2.1cm to 7.1cm (average: 3.4cm), their width from 0.4cm to 0.9cm (average: 0.7cm) and their thickness from 0.1cm to 0.6cm (average: 0.2cm) (Fig. 4.89). Longer are the microblades made of pale brown and olive flint.

Almost half of the microblades have trapezoidal cross-section (47%, n:112), whereas triangular (29%, n:69), mixed (20%, n:47) and polyhedral section (4%, n:10) is less common (Fig. 4.90). The examination of 95 microblades points to the prevalence of axial artefacts (78%, n:74) over medium (10%, n:10) or low (12%, n:11) axiality. As regards the profile curvature of the microblades (n:108), a significant number has slightly curved profiles (59%, n:64) and fewer products are characterized by curved (24%, n:26) or flat (17%, n:18) profiles. Moreover, from the total number of microblades, the majority has symmetrical profiles (87%, n:206) and the rest have less symmetrical (9%, n:22), asymmetrical (3%, n:7) or twisted (1%, n:3) profiles.

The microblades that maintain their proximal part are 129 in number. Most butts point to the preparation of the core's striking platform. Facetted butts prevail (35%, n:46), while punctiform (22%, n:28), linear (18%, n:24), flat (12%, n:16), dihedral (5%, n:6), winged (4%, n:5) and concave butts (3%, n:4) follow (Fig. 4.91). The length of butts ranges from 0.2cm to 0.8cm (average: 0.5cm) and the width from 0.1cm to 0.4cm (average: 0.17cm) (Fig. 4.92). Microblades of obsidian, radiolarite, chert, gray, reddish brown and olive flint have smaller buts' dimensions. The flaking angle is, in most cases, semi-abrupt (77%, n:99) and less abrupt (23%, n:30). The overhang is mainly unretouched (81%, n:105) with a few exceptions of preparation with pressure (19%, n:24). Moreover, most bulbs are slightly extending (83%, n:107) with some exceptions of flat (7%, n:10) and extending (7%, n:9) or broken, retouched and indeterminate bulbs (1% each) (Fig. 4.93). As for the waves of percussion at the ventral face of the microblades, they are mainly smooth (53%, n:125) and diffuse (36%, n:85). Nevertheless, there is a small number of microblades with slightly intense (10%, n:25) or intense (1%, n:3) waves of percussion, also related to excellent quality flints, obsidian and radiolarite.

Concerning their distal part (n:99), most microblades have convergent edges (65%, n:64) and less parallel (31%, n:31) or divergent (4%, n:4). The dorsal face is primarily prismatic (55%, n:130), but there are also microblades with less prismatic appearance (45%, n:108). Almost all microblades derive from unidirectional cores (93%, n:222), with a few exceptions of opposite (5%, n:11) or varying (2%, n:5) direction of negatives that point to multidirectional cores.

Finally, pressure technique seems to have been applied to produce a significant number of microblades, mainly connected to obsidian, yellowish brown flint and radiolarite, as well as some cases of gray and pale brown flint. The use of indirect percussion is also attested and possibly a few cases of direct percussion with a soft hammer.

v) Debris (0.5%, n:18)

Debris involves a small number of artefacts (0.5%, n:18). Seven of these are of gray flint, three of yellowish brown and two of pale brown flint. Additionally, three pieces are burnt, one is of radiolarite, one of obsidian and one of quartzite (Fig. 4.94). From the total number, only two pieces are classified as angular shatter, while the rest are chips. The average length is 1.1cm, the width 1.3cm and their thickness 0.2cm.

vi) Indeterminate pieces (1.6%, n:71)

All indeterminate pieces are fragmented and many of these are burnt (30%, n:21). Almost all raw materials are represented (gray flint 16%, n:11; pale brown flint 11%, n:8; reddish brown flint 4%, n:3; yellowish brown flint 2%, n:1; radiolarite 11%, n:8; quartz 11%, n:8; chert 7%, n:5; quartzite 4%, n:3; chalcedony 2%, n:1; burnt 30%, n:21; patinated 1%, n:1; other 1%, n:1) (Fig. 4.95). In 24 cases, a small part of cortex remains at their dorsal face. The average length of the indeterminate fragments is 2.3cm, their width 1.8cm and their thickness 0.6cm.

4.4 The tool typology

4.4.1 Introduction to typology

More than half of the documented artefacts are tools that were used for a variety of activities by the prehistoric inhabitants of the Anarghiri IXb settlement. Before the detailed typological analysis of the material under study, some clarifications should be made regarding the criteria followed for their categorization.

Tools are considered all artefacts that bear traces of use or deliberate retouch (Andrefsky 1998, 75; Inizan et al. 1999, 157). The first case refers to *tools a posteriori* that include artefacts with traces of use removals, as well as those bearing sickle gloss at their surface (without retouch) and splintered pieces. All three types are defined as tools since the traces recorded at the artefact imply its use (Moundrea-Agrafioti 1981, 105-106). More specifically, blanks with traces of use involve artefacts that bear use removals, abrasion and sometimes polishing at their edges, pointing to their contact with other materials. However, it should be underlined that at the present study, the examination of the material has been carried out macroscopically; thus, the recognition of use wear at plain blanks is limited to the cases of visible use removals. Artefacts that bear traces of sickle gloss constitute a functional tool type. Sickle gloss refers to the sheen that is developed when an artefact comes in touch with plants rich in silicon (reeds, etc.), which in many cases is visible with the naked eye. In the present study sickle gloss was not identified at the obsidian artefacts, since it is more difficult to be observed by macroscopic examination in comparison to other raw materials. Finally, splintered pieces also constitute a functional tool type, bearing the characteristic traces (bipolar removals) that are caused by the tool's use.

The second group of tools consists of retouched artefacts, which are blanks that were deliberately modified or transformed by retouch. The main categorization is based on their techno-morphological characteristics, which sometimes are also connected to the possible use that the tools imply. The classification of tools follows the traditional typology (Andrefsky 1998, 190-196; Debenath & Dibble 1994; Inizan et al. 1999, 81-87) that is also used in most lithic studies in Greece (Kakavakis 2011, 95-100; Karimali & Karabatsoli 2010, 346-349; Kourtessi-Philippakis 1997; Moundrea-Agrafioti 1981; Perlès 2004; Sériadès 1992; Skourtopoulou 2004). The typological classification of the Anarghiri IXb tools includes the following types:

i) Unretouched sickle blades/elements
ii) Retouched sickle blades/elements
iii) Scrapers
iv) Blades with lateral retouch
v) Perforating tools
vi) Splintered pieces
vii) Burins
viii) Truncations
ix) Denticulated tools
x) Backed pieces
xi) Projectile points
xii) Notches
xiii) Retouched flakes
xiv) Composite tools
xv) Geometrics

In the following analysis, the assemblage of the Late and the Final Neolithic will be separated into the above-mentioned tool types. However, concerning the tools' categorization, we should also note the following:

First, blanks with use removals are not included in the tool group due to the lack of specialized microscopic examination. However, there will be a reference to the cases where use removals might indicate the use of these artefacts.

Secondly, artefacts with sickle gloss characterized as sickle blades and sickle elements are separated into two types, retouched and unretouched. The former includes any type of retouch present on the sickle element or blade. For instance, truncations, denticulations, notches and lateral/bilateral retouch with presence of sickle gloss are included in this tool type. Moreover, scrapers, perforating tools and splintered pieces that bear sickle gloss are analyzed to each tool type separately, since in most cases, the tools resulted from recycling. The same is followed in the case of some burins. Finally, as composite tools have been defined the tools which combine two different tool types, that is, both tool edges could be functional at the same time. In the present study, composite tools combine an end-scraper's working edge and a perforating point.

4.4.2 The lithic assemblage of the Late Neolithic layers

Almost half of the chipped stone artefacts that derive from the Late Neolithic deposits are characterized as tools (56.5%, n:917), either because of the presence of deliberate retouch, or due to the visible sickle gloss or splintering at their active edges (*tools a posteriori*). However, there is a significant number of blanks with traces of use wear, which in most cases is related to visible use removals (31.8%, n:517) (Fig. 4.96).

Before proceeding with the analysis of the tool types as defined above, we will focus for a while to the blanks with use retouch. Use retouch is observed on almost all kinds of blanks, but mostly on blades (n:350) and less on flakes (n:92), microblades (n:52) and blade-flakes (n:18). It should also be mentioned that a small number of blanks with use retouch are technical products that were probably used. These include blades that have resulted from knapping accidents (16 plunging blades, 6 hinged artefacts) or products of the shaping and rejuvenation of the core (10 crested blades, 18 rejuvenation products). The integrity and morphology of the blank, as well as the good quality of the raw material (black, gray and pale brown flint) might have played a role in selecting these artefacts for further use.

In most cases use wear is observed only at one edge of the artefact (right edge: 181, left edge: 147, distal part: 11), while at 178 blanks use wear is observed at both cutting edges. Regarding the raw materials' representation, artefacts of gray flint (n:224) prevail over pale brown flint (n:57), black flint (n:38), radiolarite (n:29) and chert (n:13). An important observation is that the obsidian artefacts belong mainly to this group (47 of the total 63 artefacts), demonstrating their use as unretouched blanks and less as retouched tools. In the case of chalcedony, half of the tools belong to this category (n:14), like reddish brown (n:13) and yellowish brown flint (n:3). Concerning quartz, almost all tools (with one exception) are artefacts with use removals, while similar is the case of quartzite where all six blanks bear use wear (Fig. 4.97).

If we turn to the retouched tools as previously defined, including sickles and splintered pieces, we observe the following:

First, most tools are shaped on blades (89%) and few on retouched flakes (6%), microblades (3%) and blade-flakes (2%) (Fig. 4.98, 4.99).

As regards the raw materials, half of the tools are made of gray flint (53%, n:484), while pale brown (14%, n:128) and black flint (7%, n:61) are less represented. Radiolarite (5%, n:47), chert (3%, n:25), obsidian (2%, n:16), reddish brown flint (2%, n:16) and chalcedony (2%, n:14) are present in smaller percentages. Additionally, tools of olive flint (1%, n:7), yellowish brown flint (1%, n:5) and quartz (0.1%, n:1) are few. Finally, there are also some burnt (10%, n:91) or patinated (2%, n:19) tools (Fig. 4.100).

The most numerous tool types at the Late Neolithic assemblage consist of unretouched sickle blades/sickle elements (26.2%), retouched sickle blades/sickle elements (24.8%) and scrapers (22.5%). Blades with lateral retouch (6.2%), perforating tools (6.1%), splintered pieces (3.2%), burins (3%) and truncations (2%) are the next tool types while projectile points, backed pieces and denticulated tools (1.2% each), notches (1%), retouched flakes (0.9%), composite tools (0.4%) and geometrics (0.1%) are present in small percentages (Fig. 4.101, 4.102).

The analysis of each tool type follows in the next pages, while at figures 4.103- 4.104, the dimensions of tools and the distribution of raw materials by tool type are presented.

i) Unretouched sickle blades/elements (26.2%, n:240) (PLATES IX, X)

The most common tool type are sickle blades/elements, which are characterized as *tools a posteriori*, since they are defined by the presence of sickle gloss at their cutting edges and not by deliberate retouch. It is a functional tool type, due to the characteristic luster that demonstrates the tool's use. In this study, we will use the term 'sickle' as is traditionally used by researchers for describing artefacts bearing sickle gloss (Moundrea-Agrafioti 1981, 111; 1983; Perlès 2001, 205), although the use of these tools is not limited to the activity that their characterization implies (see Chapter 5.5.1).

The artefacts that bear sickle gloss are separated into two categories according to their length: sickle blades and sickle elements (Fig. 4.105). The first category refers to blades that due to their length (>5cm) could be used individually. Sickle elements, on the other hand, are tools that belong to a composite form with many smaller elements (length <5cm) put together in a haft (Moundrea-Agrafioti 1981, 111, 119).

Sickle blades (PL.IX: a, b, PL.X: a-c)

Seventeen blades and a blade-flake are included to the group of sickle blades (length >5cm). Almost all (15 blades) are of gray flint, one of chert, one of pale brown flint and another of chalcedony (blade-flake). Most tools are complete.

The length of complete blades (13 blanks) ranges from 5.0cm to 9.4cm (average: 5.8cm), their width from 1.1cm to 2.5cm (average: 1.6cm) and their thickness from 0.2cm to 0.6cm (average: 0.3cm).

Fifteen out of eighteen blades bear traces of sickle gloss at one cutting edge (right edge: 6, left edge: 9), while the rest three have bilateral sickle gloss. Unilateral sickle gloss of blades has mainly parallel direction (n:11) than oblique (n:4), of low (n:6), medium (n:3) or high (n:6) intensity. It should be mentioned that in all cases of oblique sickle gloss, the mesial and distal part of the blade has been used and not the proximal (n: 5). The remaining unilateral sickle blades have their entire edge covered by sickle gloss.

All blades with bilateral sickle gloss are characterized by an oblique and medium to high intensity gloss at both edges. In these cases, it is obvious that the sickle gloss covers part of the one and part of the opposite cutting edge (proximal/mesial and distal/mesial). All three cases are of gray flint, one of which has a deliberate break at its distal end (Fig. 4.106- 4.108).

*Sickle elements (*PL.X: d)

In comparison to sickle blades, sickle elements are more numerous (222 pieces). The majority is represented by blades (n:201), while microblades (n:11), flakes (n:5) and blade-flakes (n:5) are few. Among these artefacts, four technical pieces (two plunging and two hinged blades) bear sickle gloss and have been used as tools.

As regards the raw materials, the dominance of gray flint (n:116) is expected, but pale brown (n:35) and black flint (n:22) are also well represented. Few pieces are made of reddish brown (n:6) and olive flint (n:2), chalcedony (n:6), radiolarite (n:6) and chert (n:3). Some burnt (n:24) and patinated blanks (n:2) also bear traces of sickle gloss.

Only 43 artefacts are complete or almost complete, since most sickle elements are fragmented. The length of complete pieces varies from 2.3cm to 4.9cm (average: 3.6cm). The fragmented elements' length ranges from 1.3cm to 4.7cm (average: 2.9cm) and their width and thickness from 0.7cm to 2.5cm (average: 1.3cm) and 0.2cm to 0.8cm (average: 0.3cm) respectively.

The major number of sickle elements bears sickle gloss at only one cutting edge (right edge: 89, left edge: 97). Sickle gloss covers the entire cutting edge at more than half of the blades (n:118) and, in the rest of the cases, the proximal/mesial (n:28) or mesial/distal part of the blade (n:40). Parallel to the length axis is the main direction of gloss (n:124), while an oblique direction is recorded at 62 artefacts. The intensity of gloss is high (n:65), medium (n:84) and low (n:37). At 27 blades simple fracture with a blow is observed at the proximal (n:10), distal (n:16), or both proximal and distal part (n:1), which in few cases forms a diagonal edge.

Bilateral sickle gloss is recorded on 36 tools (35 blades, one microblade). Both cutting edges are entirely covered by sickle gloss in 11 cases, while in 13 cases only the proximal/mesial part of the one edge and the mesial/distal part of the opposite edge are covered, as well as 12 cases where the one edge is entirely covered by gloss, but the opposite edge only partially (distal or proximal part). On 10 tools, the direction of sickle gloss is oblique at both edges, on 22 blades it is parallel, while four blades bear sickle gloss with both oblique and parallel direction at each cutting edge. The intensity of gloss in many cases is at both cutting edges high (n:11), medium (n:5) or low (n:6) or at each edge medium and low (n:3) or medium and high (n:11). In two cases, deliberate fracture at both distal and proximal part of the blade is recorded and in another case, an intentional fracture occurs only at the distal part of the tool. Finally, one sickle element has a strongly blunted edge due to intensive use (Fig. 4.106- 4.108).

According to the characteristics, it is obvious that the direction of sickle gloss at both sickle blades and sickle elements indicates mainly a parallel fit of the elements or the blade to the haft and less a diagonal. Additionally, the presence of some sickle blades and sickle elements with bilateral sickle gloss points to more intensive use of the tools, since when the one edge is not functional anymore (blunted) the opposite edge was used instead. These blades are mainly made of gray, pale brown and black flint. Moreover, simple fracture at one or both narrow ends of the tool is attested, demonstrating an attempt to control its size and enable its hafting.

ii) Retouched sickle blades/ elements (24.8%, n:228) (PLATES X, XI)

The second more numerous tool type includes artefacts that bear sickle gloss at one or both cutting edges and, at the same time, have been retouched. Apart from blades that dominate at this group (n:217), few pieces of microblades (n:5), flakes (n:3) and blade-flakes (n:3) are involved.

Additionally, eight technical products have also been used as tools (four plunging blades, three crested blades and one rejuvenation flake).

At this tool type, the same categorization as in the unretouched sickles will be followed, that is, retouched sickle blades and sickle elements (Fig. 4.109).

Retouched sickle blades (PLATE XI)

There are 33 blades longer than 5cm that are included in this category. Most of the blades are of gray (n:17) and pale brown flint (n:7). One blade is of olive flint, two of chert, five of radiolarite and one burnt.

There are 24 complete or almost complete blades and the rest are fragmented (proximal and mesial part: 2, mesial part: 2, mesial and distal part: 5). The length of complete pieces varies from 5cm to 10.6cm (average: 6.5cm), while the fragmented elements' length ranges from 5.1cm to 8.4cm (average: 6.1cm). The width and thickness of the tools ranges from 1cm to 2.7cm (average: 1.6cm) and 0.2cm to 1cm (average: 0.4cm) respectively. In six cases, the length of the blades exceeds 8cm (two blades of radiolarite, one of chert, three of gray flint) (PL.XI: a). The main characteristics of retouched sickle blades are presented at figures 4.110-4.113.

Unilateral sickle gloss is recorded at 23 blades (right edge: 8, left edge: 15). In 13 cases sickle gloss covers the entire edge of the tool, in six the mesial/distal part and in four the proximal/mesial part. The direction of gloss is either parallel (n:14) or oblique (n:9). On 16 blades, gloss intensity is high and the rest have medium degree of intensity.

Retouch is mainly present at the same cutting edge of the blade that bears sickle gloss (n:10). A second cycle of resharpening can be observed in one case where retouch at one part interrupts the sickle gloss, while at the inverse part retouch is covered by gloss. In two cases, lateral retouch forms denticulations and at another three, it is combined with a truncation at the distal part of the blade. There is only one blade where retouch is located at the opposite edge of the one with the sickle gloss (A9b.AE505) (PL.XI: c). In this case, abrupt retouch forms a backed edge while gloss is present at the opposite cutting edge (active edge). Additionally, five blades have bilateral retouch, which sometimes is combined with a truncation at the distal part (n:3) or both narrow ends (n:1). Heavy retouch is attested at three blades of gray flint, chert and radiolarite. Finally, three blades with unilateral sickle gloss have been truncated at distal (n:2) or proximal part (n:1), while their cutting edges are unretouched.

Bilateral sickle gloss is recorded at 10 blades. The sickle gloss covers both cutting edges of the blade entirely in two cases. In contrast, the most usual localization is at the mesial/distal part of the one edge and the proximal/mesial (n:4) or entire edge (n:4) of the opposite. The direction of sickle gloss is at both cutting edges parallel (n:4) or oblique (n:3), or parallel at one edge and oblique to the opposite cutting edge (n:3). The intensity of gloss is rather high (n:5) or medium (n:2) at both cutting edges, pointing to intensive use of the blades. Few are the cases of high and medium intensity of sickle gloss (n:2) or high and low (n:1) at each edge.

Most blades with bilateral sickle gloss bear also bilateral retouch (n:8), which in four cases form denticulations while at the opposite cutting edge an abrupt or semi- abrupt, straight, continuous and short retouch is present. At five blades a truncation is formed at the distal end and is combined with lateral or bilateral retouch. There is also one blade with bilateral sickle gloss and unretouched cutting edges, but a truncation is shaped at its distal part (probably to reduce its size). In another case of bilateral sickle gloss, only one edge has been retouched, probably due to blunting of the opposite edge. At all these tools (except for the truncated one), sickle gloss is interrupted by the presence of retouch, which in two cases is only sporadically preserved. This fact demonstrates a strategy of resharpening of the tools' cutting edges to become effective again. In general, 29 sickle blades have been resharpened.

Moreover, in three cases of bilateral sickle gloss and retouch, the tool has been heavily retouched, probably indicating an intensive resharpening of the cutting edges (more than two life-cycles of use). The raw materials involved are gray flint, radiolarite and chert.

Retouched sickle elements (PL.X: e-g)

Retouched sickle elements (length <5cm) include 195 tools that correspond to 184 blades, 5 microblades, 3 blade-flakes and 3 flakes. The dominant raw materials are once again gray (n:95), pale brown (n:30) and black flint (n:23). The rest raw materials are less represented (radiolarite: 10, reddish brown flint: 5, olive flint: 2, chert: 3, chalcedony: 2, burnt: 19, patinated: 6).

Only 42 tools are complete or almost complete, while the majority is fragmented. The length of complete pieces varies from 2.9cm to 4.8cm (average: 3.9cm). The fragmented elements' length ranges from 1.3cm to 4.9cm (average: 3.3cm) and their width and thickness from 0.9cm to 2.7cm (average: 1.4cm) and 0.2cm to 0.8cm (average: 0.3cm) respectively. The main characteristics of retouched sickle elements are presented at figures 4.110-4.113.

A total of 137 sickle elements bear traces of sickle gloss at one cutting edge, while 58 bear bilateral sickle gloss.

The direction of sickle gloss at unilateral sickle elements is mainly parallel (n:88) and less oblique (n:49). On 86 blades, sickle gloss covers the entire cutting edge of the tool, at 19 the proximal/mesial part and at 32 the mesial/distal part of the blade. In most cases, sickle gloss intensity is high (n:83), pointing to intensive use and fewer tools have low (n:13) or medium (n:41) degree of intensity.

Lateral retouch (n:79), in most cases, is continuous, semi-abrupt and direct, covering the entire edge of the tool. On 63 blades, retouch coincides with the edge that bears sickle gloss. In some cases, retouch forms denticulations (n:3), but on many blades, it is also combined with a truncation at the distal (n:8) or proximal (n:3) end of the tool. The remaining 16 blades are retouched at the opposite edge of the one with the gloss. In these cases, retouch is usually semi-abrupt, direct and continuous, including few backed and shouldered blades.

Bilateral retouch includes 26 sickle elements. Sometimes it is combined with denticulations at one or both cutting edges (n:3). In two cases, the denticulated cutting edge has a backed edge at the opposite side. On five blades, bilateral retouch is combined with a truncation at the distal (n:3) or proximal end (n:2). In two more cases a shoulder is shaped with abrupt and short retouch at the proximal part of the blade.

Finally, there are 32 blades with unilateral sickle gloss that have unretouched cutting edges, but a truncation is formed at the distal (n:24), proximal (n:6), or both parts (n:2) of the tool.

As regards the sickle elements with bilateral sickle gloss, its direction in most cases is parallel (n:34) while oblique (n:16) or parallel at one edge and oblique at the opposite edge (n:8) is not that usual. Sickle gloss covers the entire cutting edge of both edges at 27 blades. There are also blades where sickle gloss is located on the mesial/distal part of one edge and the proximal/mesial part of the other (n:15), covers the distal part of the one edge and the entire opposite edge (n:5), or the proximal part of the one edge and the entire opposite edge (n:11). The intensity of gloss in most cases is high at both edges (n:26), while medium (n:7) or low (n:5) degree of intensity is less usual. Few are the cases of high and medium intensity of sickle gloss (n:15) or medium and low (n:5) at each edge.

Lateral retouch (n:26), in most cases, covers the one edge of the blade, with continuous short and semi-abrupt removals. In two cases, it forms denticulations and at another two, a shoulder is shaped. Lateral retouch and truncation at distal part is recorded at two blades.

Bilateral retouch is recorded at 25 sickle elements. In some cases, retouch forms denticulations (n:4), or is combined with a distal (n:5) or proximal (n:1) truncation. In two cases, a shoulder is shaped at the proximal part of the blade, probably to enable hafting of the tool. In another case, there is a combination of a backed edge and denticulations at the opposite cutting edge.

Additionally, it should be noted that there are seven sickle elements with bilateral sickle gloss and a truncation located at the distal (n:6) or proximal (n:1) end of the tool.

A simple fracture at the distal or proximal end of the tool is recorded in 12 cases. At another 12 sickle elements, heavy retouch is recorded covering both cutting edges and sometimes the distal or proximal part too. These tools are mainly made of fine quality gray flint, while there are a couple of pale brown flint, black flint and chert artefacts. Finally, resharpening of tool edges is observed on 121 elements, since sickle gloss is interrupted by retouch.

iii) Scrapers (22.5%, n:207) (PLATE XV, XVII)

The category of scrapers includes end-scrapers, double end-scrapers and side-scrapers. The majority is represented by end-scrapers (n:196), while double end-scrapers (n:8) and side-scrapers (n:3) are few (Fig. 4.114).

End-scrapers (PL.XV)

End-scrapers are the most common type among scrapers, which are tools with a scraper's working edge shaped at the distal or proximal part of the blank. End-scrapers are mainly made of flint (gray: 117, pale brown: 20, reddish brown: 3, black: 5, yellowish brown: 1, olive: 1) and less of radiolarite (n:9), chert (n:4) or obsidian (n:2). A small number of end-scrapers is burnt (n:28) or patinated (n:6).

End-scrapers are mostly made on blades (n:179), while flakes (n:11), blade-flakes (n:5) and microblades (n:1) were rarely used. Additionally, two crested blades and a plunging blade have been used as end-scrapers. Flakes and blade-flakes are mainly complete or almost complete. Their length ranges from 1.2cm to 4cm (average: 2.9cm), their width from 1.5cm to 3.2cm (average: 2.2cm) and their thickness from 0.3cm to 1.2cm (average: 0.6cm). End-scrapers on a blade are more frequently fragmented. Their length ranges from 1.2cm to 10.4cm (average: 2.8cm), their width from 0.9cm to 3.4cm (average: 1.6cm) and their thickness from 0.1cm to 0.9cm (average: 0.4cm). A small group of end-scrapers (n:5) includes blades that their length exceeds 6cm (6-10.4cm), all made of gray flint. The blades bear lateral or bilateral retouch and traces of sickle gloss.

Scrapers typically have a working edge at the distal end (n:182) and more rarely at the proximal end. At the latter, the butt of the blank is removed by retouch and sometimes the same happens to the bulb (when it is extending). Retouch is long (n:104) or short (n: 92), in almost all cases abrupt, with parallel (n:79), sub-parallel (n:83), scaled (n:24) or stepped (n:9) removals. The delineation of removals is mainly convex (n:172), with few exceptions of straight (n:21) or denticulated (n:3) working edges.

Most end-scrapers' working edges cover the distal or proximal part together with some part of both cutting edges (Type A)(n:129) (PL.XV: a-g). This type refers to a convex outline. The working edge of flake end-scrapers is exclusively positioned at its distal part and is quite wide. In some cases, the part with the working edge has a curved profile (n:17) or is shaped on wider and thicker blade fragments (n:11). However, there are end-scrapers with their working edge to be restricted to one narrow end (Type B) (n:64) (PL.XV: j). In nine cases, this is recorded on long rectangular blades with narrow end-scrapers' edge. In three cases, the end-scraper's working edge is denticulated (Type C) (PL.XV: h, i) (Fig. 4.115).

Almost half of the end-scrapers have traces of sickle gloss (n:101) at one or both cutting edges, which in most cases is combined with lateral retouch. Presence of lateral, bilateral and marginal retouch at the cutting edges of the blades, but at the same time, some notched, denticulated, or backed blades point to the recycling of the tools. In the case of sickle gloss, this is always interrupted by the removals of the end-scraper's working edge, a fact that demonstrates the second use of the tools (PL.XV: a, b, c, h, i).

Some other end-scrapers are shaped to facilitate use. For instance, an end-scraper is shaped at the distal part of a blade, while at the mesial and proximal part, continuous and abrupt retouch forms an extended tang, probably for hafting. In 16 cases, end-scrapers are combined with a truncation at the opposite side of the active edge (PL.XV: h). Truncations are straight, oblique or triangular and occasionally serve to repair a damaged edge and help to the modification, handling or even hafting of the tool.

Double end-scrapers (PLATE XVII: a-b)

A small number of double end-scrapers has been recovered from the Late Neolithic layers. All eight cases are shaped on a blade. The raw materials include gray (n:3) and pale brown flint (n:1), chert (n:1), a patinated and two burnt artefacts.

Their length ranges from 1.9cm to 3.4cm (average: 2.4cm), their width from 1.3cm to 2.6cm (average: 1.7cm) and their thickness from 0.3cm to 0.5cm (average: 0.4cm).

Two kinds of shaping have been recorded. The first refers to formation of a wider working edge at the distal part and a narrower at the opposite part (proximal) (Type A) (n:2). The second type includes double end-scrapers with similar width of both working edges, which is more usual (Type B) (n:6) (Fig. 4.116).

In general, retouch at both working edges is direct, continuous, abrupt, short (n:5) or long (n:3), with parallel (n:4) or sub-parallel (n:4) removals in a convex delineation. In one case, the edge of the scraper is shaped with direct retouch and the opposite with inverse retouch.

Almost 3/4 of the double end-scrapers are recycled tools. In five cases blades have lateral (n:3) or bilateral (n:2) retouch combined with lateral or bilateral sickle gloss, while in one more case a blade bears traces of sickle gloss at its right edge. In all cases sickle gloss is interrupted by the removals that shape the scraper's working edge. Retouched sickle blades were possibly modified into end-scrapers after being used for cutting plant material.

Side-scrapers

There are only three cases of macroscopically identified side-scrapers, all on flakes and from flints of excellent quality (gray, pale brown flint).

Their length ranges from 2.3cm to 3.9cm (average: 2.9cm), their width from 2.1cm to 2.9cm (average: 2.4cm) and their thickness from 0.6cm to 1.2cm (average: 0.8cm).

This type is characterized by long, continuous, abrupt, or semi-abrupt and parallel retouch at one edge with convex delineation. A side-scraper formed at the right edge of a blade is combined with an abrupt and almost denticulated retouch at its left edge.

iv) Blades with lateral retouch (6.2%, n:57) (PLATE XVIII)

Blades (n:54) and microblades (n:3) with lateral retouch are less represented among tools. In three cases, technical pieces (plunging blades) are involved.

Almost half of this category's tools are of gray flint (n:28), while few pieces are of other raw materials (pale brown flint: 6, black flint: 3, obsidian: 6, radiolarite: 4, chert: 2, chalcedony: 1, burnt: 5, patinated: 2). Two of the microblades are made of gray flint and one is burnt. One plunging blade is of obsidian, a second of gray flint and the third of black flint.

Only 13 blades are complete or almost complete, while the majority is fragmented. The length of complete pieces varies from 3.1cm to 7.3cm (average: 5.3cm). The fragmented blades' length ranges from 0.7cm to 5.5cm (average: 3.2cm) and their width and thickness from 0.8cm to 3.1cm (average: 1.5cm) and 0.1cm to 0.8cm (average: 0.3cm) respectively.

Most of blades bear unilateral retouch (n:38) and the rest have both cutting edges retouched (n:19) (Fig. 4.117). Retouch is usually direct (n:42) and less inverse (n:11) or alternating (n:4). It covers the entire cutting edge on almost half of the blades (n:25), while there are many cases that it's limited to the proximal and mesial or mesial and distal part of the tool (n:32). Retouch is mainly continuous (n:48) and less partial (n:5) or discontinuous (n:4), while its delineation in almost all cases is straight or regular. Most removals are short (n:51) than long (n:6) and their angle is mainly abrupt (n:33) than semi-abrupt (n:22) or low (n:2). Regarding the morphology of retouch, a variety has been observed with parallel (n:32) and scaled (n:18) removals to be more common in comparison to sub-parallel (n:7).

Four blades bear bilateral intense and abrupt retouch, pointing to a possible renewal or resharpening of the cutting edges (PL.XVIII: a). At another four blades, an intentional break is recorded at the proximal and distal part, probably to shorten the tool and control its size. Additionally, in three cases, retouch forms a shoulder at one edge, possibly for enabling the handling of the tool.

v) Perforating tools (6.1%, n:56) (PLATE XX, XXXVII: a)

Perforating tools are pieces with a sharp, active point. The dominant raw materials in this tool type remain gray (n: 31) and pale brown flint (n:10), still few tools are made of other raw materials (black flint: 3, reddish brown flint: 1, radiolarite: 3, chert: 3, chalcedony: 1, burnt:3, patinated: 1).

Perforating tools are formed on all types of blanks, with blades to prevail (n:49) over flakes (n:1), blade-flakes (n:3) and microblades (n:3). Almost half of the tools (n:24) are on complete or almost complete blanks, while the rest are fragmented. Their length varies from 1.5cm to 5.0cm (average: 3.5cm), their width from 0.8cm to 3.5cm (average: 1.3cm) and their thickness from 0.2cm to 1.1cm (average: 0.3cm).

Perforating tools show a techno-morphological variability. In most cases, the active point is shaped at the distal part of the tool, while few are the cases where the proximal part is retouched (n:7) to remove the butt and form a pointed end. The most common shaping includes elongated tools with abrupt or semi-abrupt, direct, bilateral or alternate retouch at the proximal or distal part that shape a pointed end (Type A) (n:27) (PL.XXXVII: a). Equally frequent are blades with continuous lateral or bilateral retouch, where the shaping of the perforating tool is applied with abrupt direct or alternate retouch (Type B) (n:13). A subset of the perforators have active points shaped by a few removals at the proximal or distal extremity (Type C) (n:16) (Fig. 4.118).

A tool that is differentiated by the rest is shaped on a blade of gray flint (A9b.AE8983) (PL.XX: i). Its distal and proximal parts are retouched with direct bilateral short and abrupt removals that form an elongated point at both ends. At one part, the active point is rounded and shows intensive traces of abrasion. At the opposite part, the outline is more triangular. It is probably a double perforating tool.

The active point of the perforating tools is mainly symmetrical to the technological axis of the artefact (n:34), following the symmetry of the blank. However, there are tools with asymmetrical active points. This fact does not seem to be affected by other factors than the morphology of the blank. Regarding the thickness of the active point, it varies from 0.1cm to 0.5cm (average: 0.23cm), but almost half of the active points are 0.2cm thick. The three micro-perforators shaped on microblades have an active point of 0.1cm thickness.

On 30 tools, the active point is rounded and abraded by use, pointing to a rotating move. As regards the part of the tool located opposite of the active point, sometimes the presence of a truncation (n:5), intentional break (n:5) or shoulder (n:1) indicates a better shaping or re-arrangement of the morphology of the blank in order to enable its handling (PL.XX: d, h).

Finally, in 37 cases apart from the active point, the tools bear retouch from other -probably earlier- uses. Lateral, marginal, bilateral retouch, denticulations and notches are recorded, pointing to a possible different first use of the tools. Especially the presence of sickle gloss in 18 cases demonstrates the recycling of the tools since sickle gloss is interrupted by retouch (PL.XX: b-g).

vi) Splintered pieces (3.2%, n:29) (PLATE XXII: a-c)

Splintered pieces are tools defined by elongated bipolar removals at the extremities and/or the edges of the blank caused by use (Moundrea-Agrafioti 1981, 130-131). Some researchers suggest their use as intermediate tools employed with indirect percussion (wedges), while others consider them as exhausted bipolar micro-cores (for the discussion on their use see Chapter 5.5.1). However, in this category are also included tools that have been recycled.

Splintered pieces are recorded at all types of blanks: on blades (n:19), flakes (n:7), blade-flakes (n:1) and two indeterminate knapping products, while one of the blades is a technical product (crested blade). The major number of tools is made of gray flint (n:11), whereas pale brown (n:4), olive (n:3), yellowish brown (n:2) and black flint (n:1) are less frequent. Few pieces are of radiolarite (n:2), obsidian (n:1), chert (n:1), or are burnt (n:4).

Only nine out of 29 tools are complete or almost complete. The percentage of fragmentation is high, probably due to the use of the tools. Their length ranges from 2.0cm to 5.0cm (average: 3.2cm), their width from 1.0cm to 2.8cm (average: 1.7cm) and their thickness from 0.2cm to 0.9cm (average: 0.4cm).

Almost all splintered pieces have a nearly rectangular or square shape. The majority bears traces of bipolar striking at both dorsal and ventral face of the blank. The splintered pieces are mainly first-stage (n:20) and less second-stage (n:9), according to the proposed schema regarding the degree of usage (Moundrea-Agrafioti 1981, 134; Tixier 1963, 147) (Fig. 4.119). Consequently, most tools at Anarghiri IXb during the Late Neolithic were discarded at the first stage of use, where the traces are still restricted to the extremities of both edges. The rest belong to the second stage, where the blank is still recognizable, but the use traces are more intense and cover a more substantial part of its surface.

As splintered pieces were either used unretouched blanks or in many cases already used tools which were recycled. It is interesting to mention that 18 splintered pieces are tools at their second or third cycle of use. Only in eleven cases are splintered tools recorded on an unretouched flake or blade. Conversely, six blades with sickle gloss, eight blades with lateral or bilateral retouch (sometimes with sickle gloss) (PL.XXII: a, b) and an end-scraper (PL.XXII: c) were used as splintered pieces. Moreover, in three cases, splintered pieces are documented as the third use of the tool, since they are on blades with lateral retouch and sickle gloss (1st use), which later were turned into end-scrapers (2nd use) and finally used as splintered pieces (3rd use). The recycling of tools that in the end are turned into splintered pieces (and due to this violent use, the artefacts are destructed) is a fact that could point to a strategy of economizing raw materials.

vii) Burins (3%, n:27) (PLATE XXIII: a-c)

The frequency of burins in the Late Neolithic layers is low. Almost all are shaped on blades (n:24), with a couple of exceptions (one microblade, a flake and a blade-flake). Most of the burins are of gray (n:12), pale brown (n:3) and black flint (n:2), while few tools are represented by the other raw material categories (chalcedony: 2, yellowish brown flint: 1, olive flint: 1, quartz: 1, chert: 1, burnt: 4).

Only seven tools are complete or almost complete, but the majority is fragmented. Their length ranges from 3.0cm to 4.8cm (average: 3.4cm), their width from 1.1cm to 3.3cm (average: 1.5cm) and their thickness from 0.2cm to 0.6cm (average: 0.4cm).

In almost all cases, a simple burin with a single facet is present. Most of them are on an unretouched cutting edge or debitage surface (PL.XXIII: b). There are also three simple burins on a transversal break, one on truncation and six on a retouched cutting edge. A dihedral déjeté burin on a retouched sickle element is also included (PL.XXIII: c). Only two double burins are recorded, one of which is on lateral retouch and a sharpening burin on a transversal break (PL.XXIII: a). In most cases, the burin blow is perpendicular (n:19), while fewer burin blows are slightly angled to the axis of the artefact (n:8). The size of burin facets varies in length from 0.9cm to 2.6cm (average: 1.3cm) and in width from 0.1cm to 0.4cm (average: 0.2cm).

Some other cases of simple burins include a burin facet with the negative of a hinged spall and three burin facets with twisted profiles. Additionally, there are six angle burins on lateral retouch, three of those bearing sickle gloss.

Eight unretouched blades with sickle gloss have received burin blows. Seven blades bear unilateral sickle gloss and one bilateral. In almost all cases, the burin blow is located at the edge with the sickle gloss interrupting it. A possible scenario could be related with a secondary use of the blades, by transforming them into burins.

viii) Truncations (2%, n:18) (PLATE XXIV: b, c)

Truncations include tools with an abrupt retouch at the proximal or distal end of the artefact. This tool type is present at 16 blades, one flake and a blade-flake. They are all knapping products except for the flake, which is an obsidian core rejuvenation flake. Apart from this case, the rest tools are made of gray flint (n:11), pale brown flint (n:5) and a radiolarite blade.

The complete or almost complete pieces are five, while the rest are fragmented. The length of tools ranges from 2.7cm to 4.5cm (average: 4.0cm), their width from 1.0cm to 2.2cm (average: 1.4cm) and their thickness from 0.2cm to 0.6cm (average: 0.3cm).

In most cases truncation is located at the distal (n:15) or the proximal part (n:2), or both at distal and proximal part (n:1) of the artefact. It is shaped with continuous, short and abrupt retouch, which is direct (n:11) or inverse (n:7), mainly straight (n:15), but also convex (n:3). In two cases, truncation at the distal part is combined with shouldered retouch at the opposite side of the blade.

Truncation was mainly used as a technique to reduce the length of the artefact or to facilitate its shaping and rarely consists of the active edge of the tool (judging from techno-morphological criteria and macroscopic examination). It is frequently combined with other types of retouch or tool types (sickle elements, end-scrapers, perforating tools, etc.).

ix) Denticulated tools (1.2%, n:11) (PLATE XXV)

Denticulated tools include artefacts that have an edge which forms denticulations by retouch. Only 11 cases are recorded in the Late Neolithic contexts. They are formed on blades (n:5), flakes (n:5) or blade-flakes (n:1). In one case, a crested specimen is used as tool with denticulated retouch. The raw materials used include gray (n:5), reddish brown (n:1) and pale brown flint (n:1), obsidian (n:2), radiolarite (n:1) and chalcedony (n:1).

Almost half of the tools are complete (n:6) and the rest are fragmented. Their length ranges from 1.9cm to 6.6cm (average: 4.2cm), their width from 1.2cm to 3.1cm (average: 2.0cm) and their thickness from 0.3cm to 1.7cm (average: 0.6cm).

In most cases the right or left cutting edge forms denticulations by direct (n:6), inverse (n:3) or alternating (n:2), short (n:8), long (n:2) or invasive (n:1) and abrupt (n:4), semi-abrupt (n:4) or low (n:3) retouch, which might cover part of the blade (n:4) or the entire edge (n:7). Moreover, retouch is usually continuous (n:8) or partial (n:3), with parallel (n:8) or stepped (n:3) morphology.

There is one flake with denticulated retouch, which is located at its distal end and is shaped by short, low and stepped removals. In another three cases, both cutting edges are retouched. The first has bilateral denticulations. The other two have one denticulated cutting edge and straight, short and abrupt retouch at the opposite side covering the entire edge. As it has already been mentioned, denticulations are mostly present in combination with other tool types, like retouched sickles (PL.XXV: b, c).

x) Backed pieces (1.2%, n:11) (PLATE XXVII: a, b)

This tool type includes artefacts that have abrupt retouch at one of the long edges, while the opposite edge constitutes the sharp and active cutting part of the tool. There is a small number of backed tools, which are shaped on blades (n:7), flakes (n:3) and a microblade (n:1). The majority is made of gray flint (n:7), while the rest are of radiolarite (n:3) and pale brown flint (n:1).

Almost all tools are fragmented (n:10) and only one blade is complete. Their length ranges from 1.7cm to 4.9cm (average: 2.9cm), their width from 0.8cm to 2.5cm (average: 1.6cm) and their thickness from 0.1cm to 0.8cm (average: 0.4cm).

Retouch is recorded at the right or left edge of the artefact, which is direct (n:10) or inverse (n:1), continuous (n:9) or partial (n:2), usually straight (n:7) or convex (n:4), with abrupt (n:11) and short (n:5) or long (n:6) retouch. It covers the entire edge of the tool (n:8) or part of the edge (n:3). The morphology of the retouch is usually parallel or sub-parallel (n:7) and sometimes scaled (n:4).

There is one backed blade with abrupt retouch at its left edge, while its proximal and distal part are truncated (PL.XXVII: a). The right edge is the active cutting edge of this tool. In another two cases, one edge is backed and at the same time short and semi-abrupt retouch is present at the opposite side of the tool (active edge). Finally, a blade combines a backed edge with a truncated distal part and a retouched active edge (opposite edge). Backed tools are usually combined with other tool types like sickles, probably to facilitate hafting (PL.XXVII: b).

xi) Projectile points (1.2%, n:11) (PLATE XXVIII: a, b)

The projectile points that derived from the Late Neolithic layers cover a small percentage among tools (1.2%). Almost half of the tools are made of gray flint (n:6), while pale brown flint (n:2) and chert (n:2) are the rest raw materials used for their production, including a burnt tool. The quality of the raw materials vary, involving high-quality materials, but also medium quality flint and chert.

Eight projectile points are complete or almost complete and the rest are fragmented. Their length varies from 2.3cm to 6.6cm (average: 3.5cm), their width from 1.3cm to 2.6cm (average: 2cm) and their thickness from 0.3cm to 0.7cm (average: 0.46cm).

A variety of techno-morphological types characterizes the projectile points and each piece is almost unique in the typological sense. Five main types have been distinguished according to their morphological characteristics: tanged points, tanged and barbed points, leaf-shaped points, rhomboid points and various.

Tanged points (n:1)

There is one tanged point (A9b.AE7169 – length: 2.4cm, width: 1.5cm, thickness: 0.4cm) which is burnt. It bears lateral retouch at its right edge and a deliberate diagonal break at the opposite edge, forming a triangle. The base is broken, but there are still traces of bilateral, direct, abrupt retouch that shaped the tang of the point.

Tanged and barbed points (n:2)

Two projectile points are included in this group. Both are formed on a blade fragment and the face of the blank remains plain. Their shape is almost triangular and simple, with a small tang at the proximal part and small barbs. In the first case (A9b.AE8981 – length: 2.4cm, width: 1.3cm, thickness: 0.5cm), the shaping of the tool is simple and involves lateral retouch. The base of the point is located at the butt of the blade. The tang is formed by abrupt short retouch at the one side and a simple blow at the opposite, which forms small and asymmetrical barbs. The tip of the point is broken.

The second projectile point (A9b.AE5749 – length: 2.7cm, width: 2.6cm, thickness: 0.5cm) has a small tang formed by an inverse notch at the left part and a simple blow at its right part. A deliberate break shapes the left edge of the point and the tip is damaged. The barbs are small and asymmetrical. This point has been reused since sickle gloss and use retouch are present at its right (cutting) edge.

Leaf-shaped points (n:5)

Five projectile points have an almost leaf-shaped outline, but each case is differentiated. In four cases, their shape is elongated and the base of the point has a roughly triangular outline. However, in one case, the base of the point is simple and linear.

The first point is of fine quality gray flint (A9b.AE9727 - length: 6.6cm, width: 2.1cm, thickness: 0.6cm) (PL.XXVIII: a). It is elongated and its base forms a simple tang of an almost triangular outline, shaped with bifacial retouch. The point is covered by bifacial retouch with long, sub-parallel and low removals, which at the edges are semi-abrupt. Its profile is symmetrical. A small part of the base is broken. This projectile point is of high skilled manufacture, probably produced using pressure technique, indicating the implication of specialized artisans. A similar point is recorded at Kitsos Cave in Attica, also made of flint (Perlès 1981, 214, PL. VIII, n. 15).

Another point is elongated and its base has a simple, almost triangular outline (A9b.AE4447– length: 4.8cm, width: 1.8cm, thickness: 0.7cm). It is made of opaque brown chert and is probably formed on a flake. The point is shaped with bifacial invasive, semi-abrupt and long removals at the main body, while its tip and base are formed by covering semi-abrupt retouch.

A similar case is point A9b.AE9725 of fine quality gray flint shaped on a blade (length: 3.9cm, width: 1.9cm, thickness: 0.5cm). It bears bifacial, short, semi-abrupt retouch at the right edge and inverse retouch at the left one. The base is shaped by covering bifacial retouch with long and semi-abrupt removals in triangular outline. This point could be considered as semi-manufactured, since only its base is shaped, while the rest body of the blade remains plain. However, the pointed end with the tip is broken. An interesting observation is that the projectile has been modified from a sickle element. Its right cutting edge bears traces of sickle gloss, demonstrating a strategy of tool recycling.

An unusual leaf-shaped point is A9b.AE7524 (PL.XXVIII: b). The projectile is made of opaque gray flint, is complete and shaped on a flake (length: 5.9cm, width: 2.4cm, thickness: 0.6cm). It has a more rounded main body, while the pointed part is quite elongated and the base at the opposite side has an almost triangular outline. At the dorsal surface, retouch is covering, long, low and sub-parallel. At the ventral surface, only the mesial/distal part and the base bear short semi-abrupt retouch, while the main body of the projectile is plain. The tip of the point is rounded, a fact that points to a different use of this tool, possibly a perforating tool in secondary use. This suggestion is reinforced by the presence of direct and abrupt retouch at the mesial and distal part of the right edge, which seems to have been applied after the initial shaping of the projectile point. This projectile is differentiated from the rest, due to its shape and retouch type that would probably demand more time and labor investment.

Finally, there is a simple version of leaf-shaped point made of excellent quality pale brown flint (A9b.AE5753 – length: 3cm, width: 2.1cm, thickness: 0.3cm). It is shaped on a flake and the only retouched part is its tip, where short, abrupt and continuous retouch at right edge forms the point. Its base is straight, simple and unretouched, and the body of the projectile is plain.

Rhomboid points (n:1)

One projectile point has a rhomboid shape and is formed on a blade fragment (A9b.AE475 – length: 2.9cm, width: 2.1cm, thickness: 0.4cm). The face of the blank is plain and the point is shaped with simple convergent deliberate blows at the proximal part, while its distal part bears marginal retouch at the left edge and a deliberate break at the right.

Various (n:2)

The last two points cannot be categorized into the types mentioned above, because of their different shape and morphology. The first one of dark gray flint (A9b.AE9726 - length: 2.3cm, width: 2.6cm, thickness: 0.3cm) is shaped by bifacial, short and semi-abrupt removals that cover all the periphery. There is only one barb shaped at the right part and a basic shaping of the tang. This projectile could belong to the category of tanged and barbed points, but it could also be semi-manufactured.

The second case refers to a blade fragment of dark gray chert (A9b.AE9835 - length: 2.4cm, width: 2.3cm, thickness: 0.3cm). The point bears bifacial and bilateral short and semi-abrupt retouch that gives the tool an angular outline. Its base is simple and straight, while the part with the active point is broken.

xii) Notches (1%, n:9) (PLATE XXIX: a-d)

Nine notches have been recorded at the Late Neolithic material (five blades, three flakes, one microblade). Three tools are of gray flint, one of pale brown flint and another of black flint. There is also a piece of obsidian, one of radiolarite, one of chert and a patinated tool.

The size of the tools ranges from 1.8cm to 6.2cm (average: 3.8cm) in length, from 0.9cm to 3.4cm (average: 1.8cm) in width and from 0.2cm to 1.0cm (average: 0.4cm) in thickness.

Notches are shaped by direct (n:5) or inverse (n:4) retouch, which is continuous, short, abrupt (n:4), or semi-abrupt (n:5). In most cases, a notch is located at the long edge of the artefact (n:5) (PL.XXIX: a, b) and less at the proximal (n:3) or distal end (n:1) (PL.XXIX: d).

Notches are sometimes recorded at tools with sickle gloss or are combined with other tool types, like end-scrapers (PL.XXIX: c).

xiii) Retouched flakes (0.9%, n:8)

This tool type includes flakes that bear retouch, but do not belong to any of the above mentioned tool types. Their number is small and are made of obsidian (n:3), gray (n:2) and black flint (n:1), radiolarite (n:1) and chert (n:1). Five out of eight cases are technical products (two cortical flakes, three rejuvenation flakes) that were retouched and used as tools.

Half of the artefacts are complete or almost complete and the rest are fragmented. Their length varies from 2.8cm to 5.7cm (average: 4.3cm), their width from 2.0cm to 5.5cm (average: 3.2cm) and their thickness from 0.4cm to 1.3cm (average: 0.8cm).

Retouch is direct or inverse, partial or continuous, short and abrupt or semi-abrupt. At almost all flakes, retouch is located at one of the cutting edges. Only an obsidian flake bears partial retouch at its proximal and distal end.

xiv) Composite tools (0.4%, n:4) (PLATE XXX: a)

Composite tools are represented by four artefacts that combine two tool types, end-scraper and perforating tool. All four tools are shaped on a blade and are of gray flint (n:2), yellowish brown flint (n:1) and radiolarite of excellent quality (n:1).

The length of the tools varies from 2.2cm to 4.2cm (average: 3.1cm), their width from 1.0cm to 1.4cm (average: 1.2cm) and their thickness from 0.4cm to 0.5cm (average: 0.4cm).

In one case a backed blade with lateral retouch and sickle gloss has been turned into a perforating tool and end-scraper. This modification is the result of reuse, since later retouch is superimposed on sickle gloss and the initial retouch. The formation of the perforating point is made with abrupt retouch at one edge and a small notch at the other. The tool is asymmetrical to the axis of the blade and the thickness of the point is 0.4cm. At the same time, the proximal part is shaped into an end-scraper, with abrupt, convex and parallel retouch.

A similar case includes a blade that bears lateral retouch and sickle gloss at one cutting edge. In a second use-cycle, an end-scraper's working edge is formed at its distal part with convex, long and abrupt retouch, while a perforating point is shaped at the opposite side (proximal end), with abrupt bilateral retouch. The point is symmetrical to the blade's axis (0.4cm thick).

The same type is present to a longer blade that bears bilateral retouch and a simple angle burin on the retouched edge (PL.XXX: a). In a second use, the proximal part of the blade was turned into an end-scraper and the distal part to a perforating point with alternate and abrupt retouch. The pointed end is symmetrical to the blade's axis and is 0.3cm thick.

The last case refers to a blade with bilateral retouch and sickle gloss at one cutting edge. In a second use, an end-scraper's working edge is formed at the proximal part and a perforating point at its distal end. The perforating point is asymmetrical to the blade's axis (0.5cm thick).

According to the above-mentioned cases, composite tools result from re-used tools, in a second life-cycle. It is interesting to note that this tool type is represented by excellent quality flints and radiolarites, probably indicating an attempt to economize the raw material.

xv) Geometrics (0.1%, n:1) (PLATE XXXI: a)

There is only one geometric. It is a blade fragment of gray flint (length: 1.6cm, width: 1.5cm, thickness: 0.4cm). It is a trapeze, with an almost oblique truncation at its distal part and a straight one at the proximal end. The tool has continuous inverse retouch and sickle gloss at its left edge. The sickle gloss is parallel to the blade's long axis and of high intensity. It is interrupted by lateral retouch, probably to resharpen the cutting edge. This tool was possibly used as sickle element.

4.4.3 The lithic assemblage of the Final Neolithic layers

More than half of the chipped stone artefacts that derived from the Final Neolithic layers are characterized as tools (59.4%, n:2355), including retouched blanks, sickles and splintered pieces. However, also in this case, many blanks bear use retouch covering almost 26.7% (n:1061) of the total assemblage (Fig. 4.120).

Most utilized blanks are blades (n:691), while flakes (n:173), microblades (n:139), blade-flakes (n:47) and some indeterminate products (n:11) are less represented. Similarly to the previous chronological period, it seems that several technical products (n:69) were also used as tools. These mainly refer to crested (n:20) and plunging blades (n:21), but also to rejuvenation flakes (n:23) and some hinged pieces (n:5).

The most common raw materials concerning utilized blanks are gray (n:232) and pale brown flint (n:191), obsidian (n:156) and radiolarite (n:107). It is noteworthy that utilized blanks represent 3/4 of the obsidian tools and only 1/4 of the obsidian artefacts are retouched tools. Almost the same could be supported in the case of chalcedony, where half of the artefacts are retouched and the rest involve unretouched blanks. Regarding the rest raw materials, yellowish brown (n:52), reddish brown (n:27) and olive flint (n:12), as well as chert are less represented. As for quartz (n:22) and quartzite (n:15), almost all tools are blanks bearing use wear and only a few pieces are retouched. Finally, there are burnt (n:104) and patinated (n:16) blanks that also bear traces of use wear (Fig. 4.121).

The complete or almost complete artefacts are 254, while the majority are fragmented. The length of complete blades (78 blanks) ranges from 2.1cm to 8.2cm (average: 4.2cm), their width from 1cm to 2.1cm (average: 1.3cm) and their thickness from 0.1cm to 0.9cm (average: 0.4cm). There are also three blades that are longer than 8cm.

As regards the rest tool types, most of them are shaped on blades (90%) and far less is the representation of flakes (5%), microblades (2%) and blade-flakes (3%) among tools (Fig. 4.122, 4.123).

Concerning the raw materials used for tool production, an equal representation of gray (25%, n:596) and pale brown flint (25%, n:592) is observed, covering almost half of the tools. Yellowish brown flint (12%, n:279) and radiolarite (11%, n:249) follow, while chalcedony (4%, n:88), chert (3%, n:68), reddish brown flint (3%, n:62), olive flint (2%, n:54) and obsidian (2%, n:50) are less represented. As for quartz (1%, n:3) and quartzite (1%, n:3), only a few pieces of these materials are recorded. Finally, some tools are burnt (11%, n:273) or patinated (1%, n:35) and the category of other raw materials includes only three tools (0.1%) (Fig. 4.124).

The most numerous tool type during the Final Neolithic remains sickle blades/elements (23.8%), like the previous period. Similar is the representation of scrapers (23.6%) and retouched sickle blades/elements (21.6%). Blades with lateral retouch (9%), perforating tools (6.1%) and splintered pieces (5%) are the next common tool types. Finally, burins (2.8%), backed pieces (2%), truncations (1.8%), projectile points (1.2%), geometrics (0.8%), notches (0.7%), retouched flakes (0.6%), denticulated (0.5%) and composite tools (0.5%) include a small number of tools (Fig. 4.125, 4.126).

The dimensions and the raw material distribution of each tool type are depicted in Figures 4.127 and 4.128. In the following pages, the analytical examination of the Final Neolithic tool types is presented.

i) Unretouched sickle blades/elements (23.8%, n:561) (PLATES IX, XII)

Sickles is one of the most common tool types during the Final Neolithic period. However, sickle blades (blades longer than 5cm) are few (n:34), in comparison to sickle elements (n:527) (Fig. 4.129).

Sickle blades (PL.IX: c)

Thirty-four sickle blades also include three technical pieces (two crested blades and a plunging blade). The raw materials used for their production involve pale brown (n:10) and gray flint (n:10), which are equally represented. There are low counts of yellowish brown (n:5), olive (n:1) and reddish brown flint (n:2), radiolarite (n:3) and chert (n:3).

From the total number of sickle blades only 13 tools are complete or almost complete, with their length ranging from 5cm to 10.6cm (average: 6.4cm), while the length of fragmented sickle blades ranges from 5cm to 7.6cm (average: 5.8cm). Their width varies from 1cm to 2.4cm (average: 1.6cm) and their thickness from 0.3cm to 0.7cm (average: 0.4cm).

Twenty-seven sickle blades bear traces of sickle gloss at one cutting edge (right edge: 14, left edge: 13), while the rest bear bilateral sickle gloss. Unilateral sickle gloss is mainly parallel to the blade's long axis (n:25) than oblique (n:2), covering the entire cutting edge (n:17) and, in few cases, the proximal/mesial (n:4) or mesial/distal (n:6) part of the blade. Most blades have sickle gloss of medium degree (n:14) and fewer have high (n:7) or low (n:6) intensity.

Regarding the blades with bilateral sickle gloss, its direction is parallel (n:4) or oblique at both edges (n:2), or parallel at one edge and oblique at the opposite cutting edge (n:1). On half of the blades, the gloss covers the proximal/mesial part of the one cutting edge and the mesial/distal of the opposite. On one blade, sickle gloss covers both edges entirely, while two other blades have the one cutting edge entirely covered by sickle gloss and the other at its proximal/mesial or mesial/distal part. The intensity of the sickle gloss is high (n:1), medium (n:1), or low (n:1) at both edges, or high and medium (n:2) or medium and low (n:2) at each cutting edge (Fig. 4.130-4.132).

Finally, there are two sickle blades that are intentionally broken at their distal part with a simple fracture.

Sickle elements (PL.XII: a, c, d)

Many tools belong to the type of sickle elements (n:527). The majority refers to blades (n:467), while microblades (n:13), flakes (n:26) and blade-flakes (n:20) are few. There is one indeterminate fragment that also bears traces of sickle gloss. Among the tools, 16 technical products were used as sickle elements (nine crested blades, four plunging blades, two rejuvenation flakes and one hinged blade).

Concerning raw materials, gray (n:152) and pale brown flint (n:120) were used to produce more than half of the sickles. Chalcedony (n:46), yellowish brown flint (n:40) radiolarite (n:38), chert (n:22), reddish brown (n:16) and olive flint (n:11) are less represented and few pieces are made of quartzite (n:2), quartz (n:1) or other (n:1) materials. Additionally, some tools are burnt (n:68) or patinated (n:10).

The major number of tools is fragmented and only 78 pieces are complete or almost complete. The length of complete tools varies from 2.3cm to 4.9cm (average: 3.5cm). The fragmented elements' length ranges from 1.1cm to 4.6cm (average: 3cm) and their width and thickness from 0.8cm to 3.5cm (average: 1.5cm) and 0.1cm to 0.8cm (average: 0.3cm) respectively.

The majority of sickle elements bear sickle gloss at one of the cutting edges (right edge: 203, left edge: 254). On most tools, sickle gloss covers the entire cutting edge (n:323), while fewer artefacts bear sickle gloss only at the proximal/mesial or mesial/distal part. The general direction of sickle gloss is parallel to the long axis of the tool (n:331) and less oblique (n:126). The intensity of gloss is high (n:165), medium (n:143) or low (n:149).

The presence of bilateral sickle gloss is recorded in 70 cases, all blades. In 23 cases, the sickle gloss covers both cutting edges entirely, while in 27 tools sickle gloss is located at the proximal/mesial part of the one cutting edge and the mesial/distal part of the opposite edge. In 20 cases, the one cutting edge is entirely covered by sickle gloss, but the opposite only partially (proximal/mesial part or mesial/distal part). On almost half of the blades (n:34) the direction of sickle gloss at both edges is parallel and oblique in 19 cases. On 17 tools, the sickle gloss is oblique at one cutting edge and parallel at the opposite side of the blade. Finally, the intensity of sickle gloss is frequently on both edges medium (n:27) and less high (n:9) or low (n:8), or at each edge medium and low (n:10) or medium and high (n:16) (Fig. 4.130-4.132).

On 28 sickle elements, a deliberate fracture is recorded at their distal (n:15), proximal (n:7) or both narrow ends (n:6), which sometimes is diagonal.

It is evident from the above observations that the direction of sickle gloss of both sickle blades and sickle elements indicates a parallel fit of the tool to the haft and less a diagonal, while in few cases the tool had been used both ways (parallel at one edge and oblique at the opposite). Additionally, a deliberate distal or proximal fracture is attested on some blades. This technique was used to control the length of the element and perhaps to facilitate its insertion to the haft. The intensity of sickle gloss is mainly of a high or medium degree, pointing to the intensive use of the tools.

ii) Retouched sickle blades/elements (21.6%, n:510) (PLATES XII; XIII; XIV; XXXV)

Retouched artefacts with the presence of sickle gloss include mainly blades (n:483) and few pieces of microblades (n:11), flakes (n:7) and blade-flakes (n:9). In this count, some retouched technical products are also included (ten crested blades, four plunging blades and two hinged artefacts).

In this tool type, all raw materials are represented, except for quartz and quartzite. More specifically, almost half of the tools are of pale brown (n:146) and gray flint (n:127), while yellowish brown flint (n:79) and radiolarite (n:48) are also present in large numbers. Some tools are of chalcedony (n:13), chert (n:10), olive (n:11) and reddish brown flint (n:6), while an obsidian blade possible bears traces of sickle gloss. Finally, 64 tools are burnt and five are patinated.

Most retouched sickles correspond to sickle elements in contrast to less common sickle blades (Fig. 4.133).

Retouched sickle blades (PL.XII: g, XIII, XIV: d, XXXV)

Retouched sickle blades constitute almost 1/5 (n:108) of this tool type. They are made of flint (pale brown flint: 34, gray flint: 24, yellowish brown flint: 17, olive flint: 7, reddish brown flint: 1), radiolarite (n:17) and chert (n:2), but there are also six burnt blades.

There are 41 complete and slightly damaged blades and the rest are fragmented. The length of complete tools varies from 5cm to 12cm (average: 6.7cm), while the fragmented elements' length from 5cm to 10.1cm (average: 6.1cm). The width and thickness of the tools ranges from 1.1cm to 3.4cm (average: 1.7cm) and 0.3cm to 0.9cm (average: 0.5cm) respectively. Fifteen blades are longer than 8cm (six of gray flint, five of radiolarite, three of yellowish brown flint, one of olive flint), as well as a microblade of pale brown flint (length: 7.1cm, width: 0.9cm, thickness: 0.4cm). The main characteristics of retouched sickle blades are presented at figures 4.134- 4.137.

Unilateral sickle gloss is recorded in 73 cases (right edge: 27, left edge: 46). On 37 blades, sickle gloss covers the entire edge of the tool, at 20 the mesial/distal part and at 16 the proximal/mesial part is covered. The direction of sickle gloss is mainly parallel to the blade's long axis (n:59) than oblique (n:14). Moreover, the intensity of gloss in most blades is high (n:37) and medium (n:26), than low (n:10).

Unilateral retouch is recorded at 37 blades. Most of them bear continuous, direct, short and semi-abrupt retouch at the same cutting edge with the sickle gloss (n:30). In all cases, retouch includes straight or regular removals that result in the resharpening of the tool (PL.XII: g). Additionally, nine of the blades combine lateral retouch and truncation at their distal end, while two blades bear lateral denticulated retouch.

The presence of bilateral retouch is recorded on 34 blades. It includes blades with continuous, straight, or regular retouch and sickle gloss at one edge. Denticulated retouch is also recorded at some blades. However, there are few cases where retouch forms a backed edge (n:5) or a shoulder (n:3) at the opposite cutting edge. Moreover, bilateral retouch sometimes is combined with a truncation at the distal end of the blade (n:9) (PL.XIII: d). Finally, two blades with unilateral sickle gloss have been truncated at their distal end while their cutting edges are unretouched.

Bilateral sickle gloss is recorded at 35 blades. The extent of sickle gloss in 22 blades covers both edges entirely and in six cases, the proximal/mesial and mesial/distal part of each edge is only partially covered. On seven tools, sickle gloss is located at the proximal/mesial part of the one edge and the entire opposite cutting edge. The direction of sickle gloss is either at both cutting edges parallel (n:23) or oblique (n:7), or parallel at one edge and oblique at the opposite (n:5). As regards the intensity of sickle gloss, this is high (n:10), medium (n:13), or low (n:2) and, in some cases, high and medium (n:6) or medium and low (n:4) at each cutting edge.

The blades bearing bilateral sickle gloss and have one of their cutting edges retouched are nine. Usually, the cutting edge has continuous, semi-abrupt, or abrupt retouch which interrupts the sickle gloss to resharpen the cutting edge. The opposite cutting edge also bears sickle gloss but is unretouched. Two blades combine lateral retouch and truncation at the distal end of the tool, as well as another blade with a notch formed at the distal part of the retouched sickle blade.

Most blades (n:26) have bilateral retouch, which in most cases, is extending to the entire cutting edges of the blade (n:17). The remaining tools are retouched at the proximal/mesial or mesial/distal part of the one edge and entirely at the opposite edge. Usually, retouch is direct at both edges (there are few blades with alternating or inverse retouch), continuous (n:23), short (n:14) or long (n:12), with abrupt (n:16) or semi-abrupt (n:10) and parallel (n:10), sub-parallel (n:9) or scaled (n:7) removals.

Retouch is usually straight or regular at both cutting edges. However, three blades bear at the same time denticulated retouch at one of their cutting edges. In combination with bilateral retouch, truncation at the distal end is recorded in seven cases, two of them with a shoulder formed at the one edge. Another blade is bilaterally retouched with straight removals that result in pointed ends at the proximal and distal part of the tool (PL.XXXV: a).

Retouch on sickle blades (n:96) is typically applied to resharpen the active edge of the blade, as evidenced by the interruption of sickle gloss by the removals. Additionally, truncation, backed and shouldered edges are sometimes shaped to enable the handling or hafting of the tool. Moreover, 28 sickle blades bear heavy retouch (PL.XIV: d, XXXV: b). In fact, at eight blades, sickle gloss is only sporadically preserved at the dorsal face due to heavy retouch, pointing to many cycles of resharpening and intensive use of the tools. The raw materials involved are pale brown flint (n:9), yellowish brown flint (n:8), gray flint (n:6), excellent quality radiolarite (n:4) and chert (n:1).

Retouched sickle elements (PL.XII: b, e, f, h)

A great number of sickle elements have been recovered from the Final Neolithic deposits (n:402). The majority refers to blades (n:376), while few microblades (n:10), blade-flakes (n:9) and flakes (n:7) are included. The raw materials represented by this tool type are pale brown flint (n:113), gray flint (n:103), yellowish brown flint (n:62), radiolarite (n:31), chalcedony (n:13), chert (n:8), reddish brown (n:5) and olive flint (n:4). Additionally, 58 tools are burnt and five are patinated.

Most of the tools are fragmented and only 54 are complete or almost complete. The length of complete pieces varies from 1.4cm to 4.8cm (average: 3.8cm). The fragmented elements' length ranges from 1.3cm to 4.8cm (average: 3.2cm) and their width and thickness from 0.6cm to 4.4cm (average: 1.5cm) and 0.2cm to 1.1cm (average: 0.4cm) respectively. The main characteristics of retouched sickle elements are presented at figures 4.134- 4.137.

The presence of unilateral gloss on sickle elements is more common (n:280) than gloss at both cutting edges (n:122).

As regards sickle elements with unilateral sickle gloss (right edge: 136, left edge: 144), they have mainly parallel direction of gloss (n:222) and less oblique (n:58). In 182 cases, sickle gloss covers the entire cutting edge of the tool, while 50 tools bear sickle gloss at their proximal/mesial part and 48 at their mesial/distal part. In most cases, the intensity of sickle gloss is high (n:126), pointing to an intensive use of the tools. Medium (n:98) or low (n:56) degree of intensity also covers a significant number of tools.

Lateral retouch is recorded at 155 implements. In almost half the cases, retouch covers the entire cutting edge (n:84), but in many cases, it is extended only partially (proximal/mesial part: 27, distal/mesial part: 39, mesial part: 5). Most of the blades bear continuous, direct, short, abrupt or semi-abrupt retouch, with parallel or scaled removals. Usually, lateral retouch is straight or regular. However, 11 blades form denticulations, while there are also sickle elements with a notch (n:1), a shoulder (n:3) or a backed edge shaped (n:1). It should be noted that the retouched edge coincides with the edge that bears sickle gloss for many of the tools (n:129), except for 26 blades that are retouched at the opposite cutting edge. In the latter case, the retouched edge bears mainly straight and semi-abrupt retouch, while at two blades, a backed edge is shaped. Moreover, 18 blades bear lateral retouch combined with a truncation at the distal or proximal end.

Sickle elements that bear unilateral sickle gloss and bilateral retouch include 121 cases. Most blades are retouched entirely at both cutting edges (n:96), or the one edge is entirely retouched and the other only partially. The rest elements are retouched at their proximal/mesial and distal/mesial or only their mesial part. Retouch is usually direct at both edges, continuous, short, abrupt, or semi-abrupt, with parallel and sub-parallel removals.

In most cases, retouch at both cutting edges is regular or straight. However, on 19 blades, denticulated retouch at one or both edges is also recorded. Additionally, there are blades with straight retouch at the one cutting edge and a notch (n:4), a shoulder (n:5), or a backed edge (n:19) formed at the opposite side of the blade. There are also 13 cases of bilateral retouch, which is combined with truncation at the distal or proximal end of the tool (PL.XII: e). Finally, there are four sickle elements with distal truncation but unretouched cutting edges.

Concerning the sickle elements that bear bilateral sickle gloss (n:122), in almost half cases the sickle gloss covers entirely both cutting edges (n:61). At the rest tools gloss is located at the mesial/distal part of the one cutting edge and the proximal/mesial of the opposite (n:23), or at the distal (n:22) / proximal part (n:16) of the one edge and the entire opposite edge. The direction of sickle gloss is usually parallel at both edges (n:79) than oblique (n:17). Additionally, 26 tools bear parallel sickle gloss at one cutting edge and oblique at the opposite. The degree of intensity of sickle gloss is high (n:43), medium (n:30) or low (n:8) at both edges and sometimes high and medium (n:28) or medium and low (n:13) at each edge.

The presence of lateral retouch at only one cutting edge is recorded in 43 cases (right edge: 21, left edge: 22) and is mainly direct, continuous, short, semi-abrupt, or abrupt, with scaled or parallel and sub-parallel removals. In almost half cases (n:23) retouch covers the entire cutting edge, but there are some tools retouched at their proximal/mesial (n:8) or mesial/distal part (n:12). Retouch is mainly straight (n:33) or regular (n:6). At two blades, it forms denticulations at the one cutting edge, while at another blade, a backed edge is shaped. There is also a combination of lateral retouch and truncation at the distal or proximal end of the tool (n:6) (PL.XII: h).

The presence of bilateral retouch at tools bearing sickle gloss at both edges is the most frequent (n:79). Retouch is mainly continuous, direct, short, semi-abrupt, or abrupt. It usually covers the entire cutting edge (n:36), but in many cases the mesial and distal or mesial and proximal parts are retouched.

Most sickle elements have regular or straight retouch at both edges (n:59). On 14 blades, denticulated retouch is recorded at one or both cutting edges. Additionally, a backed edge is formed at the one edge of a blade and straight lateral retouch is located at the opposite edge (n:4). In three cases, a shoulder is shaped at the proximal part of the blade and another retouched blade has a notch at its distal part. The bilateral retouch at 23 blades is combined with a distal truncation (PL.XII: f).

Of the total number of sickle elements, the resharpening of the active cutting edge is attested in 354 cases, where sickle gloss is interrupted by the presence of retouch. Fifty-six sickle elements show heavy and intense retouch at their cutting edges, the majority of which are bilaterally retouched (made of fine quality gray, pale brown, yellowish brown flint and radiolarite). Intentional fractures have been recorded in 39 cases on the distal or proximal part of the tool.

iii) Scrapers (23.6%, n:556) (PLATES XVI, XVII, XXXV, XXXVI)

A significant number of scrapers have been recovered from the Final Neolithic deposits, the majority of which includes end-scrapers (n:520), while double end-scrapers (n:31) and side-scrapers (n:5) are few (Fig. 4.138).

*End-scrapers (*PL. XVI, XXXVI)

The most common raw materials to produce end-scrapers are gray (n:138) and pale brown flint (n:132). However, yellowish brown flint (n:75) and radiolarite (n:63) cover an important part of the tools. The rest raw materials are underrepresented (reddish brown flint: 21, olive flint: 10, chert: 9, chalcedony: 4, other: 1). Some end-scrapers are burnt (n:57) or patinated (n:10).

Most end-scrapers are made on blades (n: 486), while flakes (n:27) and blade-flakes (n:7) were rarely used. It is interesting to note that seven crested blades, a plunging blade and a core rejuvenation flake have been modified and used as end-scrapers. Flakes and blade-flakes are mainly complete or almost complete. Their length ranges from 1.6cm to 5.5cm (average: 2.8cm), their width from 1.4cm to 3.5cm (average: 2.1cm) and their thickness from 0.3cm to 1.1cm (average: 0.6cm). As regards the end-scrapers on blades, a small number is formed on complete or almost complete pieces (n:68), since the majority refers to broken blanks that have been modified. The length of the blade blanks varies from 2.4cm to 12.5cm (average: 4.5cm), their width from 1.4cm to 4.8cm (average: 1.7cm) and their thickness from 0.2cm to 1.0cm (average: 0.5cm).

The working edge of end-scrapers is frequently located at the distal part of the tool (n:438) and more rarely at its proximal part (n:82). The majority has a convex outline (n:451), but there are also working edges with straight (n:52) or denticulated (n:17) delineation of removals. Retouch is direct (n:517), with only three cases of inverse removals. It is continuous (n:504) and less partial (n:12) or discontinuous (n:4), long (n:358) and short (n:162), with abrupt (n:333), semi-abrupt (n:184) or few low (n:3) removals. The morphology of the retouch is usually sub-parallel (n:265) and parallel (n:179) rather than scaled (n:42) or stepped (n:34).

Most end-scrapers have a broad, convex working edge that covers the distal or proximal part, including a part of both edges (Type A)(n:314). In the case of end-scrapers on a flake or blade-flake blank (n:34), the working edge is always shaped at the distal part and is wide. On the contrary, less are the end-scrapers with narrow working edge (Type B) (n:189). In 40 cases, the edge has a curved profile and in 39 is shaped on thick blade fragments. Moreover, 17 tools have a denticulated end-scraper's working edge (Type C) (Fig. 4.139).

Many end-scrapers bear traces of sickle gloss (n:294) at the one or both cutting edges, which in all cases is interrupted by the formation of the end-scraper's working edge (PL.XVI: b-d; XXXVI: a). At the same time, almost 320 tools bear lateral, marginal, or bilateral retouch at their cutting edges that, in many cases, forms denticulations (n:36), notches (n:7), or a backed edge (n:15). Additionally, 44 end-scrapers are combined with a truncation at the opposite edge of the tool, while in 22 cases continuous retouch forms a shoulder or, in a single case, a V-shaped proximal part (PL.XXXVI: d), probably to make the handling or hafting of the tool easier. An interesting case is tool A9b.AE8000 (PL.XXXVI: c), which has a wide end-scraper's working edge at its proximal part and a truncation at the narrow distal part with abrupt removals. The upper face of the end-scraper is almost entirely covered with retouch, pointing to an extra effort for producing the tool.

A small group of end-scrapers (n:21) includes blades that their length exceeds 6cm and are made of gray (n:7), pale brown (n:3) and yellowish brown flint (n:6), radiolarite (n:4), including a patinated tool. At all blades bilateral retouch is recorded (PL. XIV: c) with the majority to bear traces of sickle gloss.

It seems that most of the tools (n:428) resulted from the recycling of already resharpened and used sickle blades/elements.

Double end-scrapers (PLATES XVII: c-g, XXXV: c)

There are 31 double end-scrapers shaped on blades. They are made of pale brown (n:12), gray (n:9), reddish brown (n:2), yellowish brown (n:2) and olive flint (n:2), radiolarite (n:3) and chert (n:1).

Their length ranges from 1.7cm to 5.8cm (average: 3.2cm), their width from 1.2cm to 3.4cm (average: 1.9cm) and their thickness from 0.3cm to 1.1cm (average: 0.6cm).

Double end-scrapers include a type with a wider working edge at the distal part and a narrower one at the opposite end of the tool (Type A) (n:15), as well as a type where both working edges have similar width and formation (Type B) (n:14) (Fig. 4.140). Retouch at both working edges is direct, continuous, long and convex, with abrupt (n:21) or semi-abrupt (n:8) and parallel (n:20) or sub-parallel (n:9) removals.

Additionally, there are two cases of circular double end-scrapers (Type C) made of pale brown and gray flint (PL.XVII: g, PL.XXXV: c). The first one (A9b.AE4956) bears continuous retouch at all edges shaping a circular outline with direct, abrupt and sub-parallel removals, which at its distal and proximal part are longer than at the sides of the tool. In the second case (A9b.AE8490), both proximal and distal parts bear continuous, convex and long retouch, while the two cutting edges are also retouched and the right one has parallel sickle gloss. The tool is almost circular, a shape that is mainly caused by the formation of the scraper's working edges and is obviously the result of recycling, due to the presence of sickle gloss.

Several double end-scrapers are considered recycled tools (n:26). In five cases, the scraper bears traces of sickle gloss at the one cutting edge, which is interrupted by the formation of the scraper's working edge. Moreover, 13 double end-scrapers bear traces of sickle gloss at one (n:10) or both edges (n:3) in combination with lateral (n:5) or bilateral retouch (n:8). At the same time, nine tools bear lateral or bilateral retouch, which sometimes forms denticulations (n:1) or a backed edge (n:3).

Side-scrapers

Only five side-scrapers have been recorded, four of which are shaped on a blade and one on a flake blank. They are made of gray (n:2) and pale brown flint (n:2), while the flake is of medium quality quartz.

All side-scrapers are broken. Their length ranges from 1.8cm to 3.8cm (average: 2.5cm), their width from 1.4cm to 2.3cm (average: 1.8cm) and their thickness from 0.3cm to 0.7cm (average: 0.4cm).

The retouch is direct and continuous, with short (n:3) or long (n:2), parallel (n:3) or sub-parallel (n:2) abrupt removals. The side-scraper's working edge covers the entire edge (n:3) or part of the edge and the proximal end of the tool and has a convex (n:3) or regular/straight outline (n:2).

Three side-scrapers are combined with a shoulder at the opposite edge. Two of these bear traces of sickle gloss that is interrupted by the side-scraper's retouch, pointing to the recycling of the tool. Finally, one side-scraper shaped on a blade fragment is combined with an end-scraper's working edge bearing long, continuous and semi-abrupt retouch, while a truncation is located at the proximal part of the tool.

iv) Blades with lateral retouch (9%, n:211) (PLATES XIV, XIX)

Blades (n:201) and microblades (n:10) with lateral/bilateral retouch cover 9% of the Final Neolithic tools. Among the tools, 11 retouched technical products are included (seven crested blades and four plunging blades).

There is an almost equal representation of blades made of gray (n:40) and pale brown flint (n:36). Radiolarite (n:29), obsidian (n:27) and yellowish brown flint (n:18) are also well represented, while few artefacts are made of the rest raw materials (olive flint: 6, chert: 5, chalcedony: 3, reddish brown flint: 2, quartz: 1, patinated: 3). Additionally, a significant number of blades are burnt (41).

The complete or almost complete blades are 25 and the majority is fragmented. The length of complete pieces varies from 1.6cm to 7.0cm (average: 4.2cm). The fragmented blades' length ranges from 1.1cm to 7.3cm (average: 3.2cm) and their width and thickness from 0.6cm to 4.0cm (average: 1.4cm) and 0.1cm to 1.6cm (average: 0.4cm) respectively.

Most blades and microblades bear unilateral retouch (n:122) (Fig. 4.141). The entire cutting edge is covered by retouch at 67 tools, while less are the tools bearing retouch at their mesial and distal part (n:29), the mesial part (n:3), or the proximal and mesial part (n:23). Retouch is mainly continuous (n:100) and less partial (n:2) or discontinuous (n:20), while its delineation in almost all cases is straight or regular (n:114) and rarely concave (n:3), convex (n:2) or irregular (n:3). Removals are short (n:108) rather than long (n:14) and their angle is mainly abrupt (n:58) and semi-abrupt (n:60) than low (n:4). Regarding the morphology of the removals, all types are recorded, with parallel prevailing (n:53) over scaled (n:36), sub-parallel (n:26) and stepped (n:7).

In 12 cases, lateral retouch is combined with truncation at the distal (n:10) or proximal end (n:2) of the tool. Additionally, there is a blade of obsidian with direct, long and semi-abrupt retouch that forms a shoulder at the proximal part of the tool.

Bilateral retouch is recorded at 89 tools. At 45 blades bilateral retouch covers the entire cutting edge, at five the proximal and mesial part of both edges, while the rest cases refer to the localization of retouch at the mesial/distal part of the one edge and the proximal/mesial part of the opposite edge (n:40). Retouch is usually direct (n:73) and less inverse (n:2) or alternating (n:1) at both edges, but there are cases of alternating retouch at one edge and direct at the opposite, or inverse and direct, or direct and bifacial. Continuous retouch at both edges is more common (n:77), but also a combination of continuous retouch at the one cutting edge and discontinuous at the other. Almost all blades and microblades have a straight or regular outline of their edges. Similarly, short retouch is the rule, with only 11 blades to bear long retouch. Abrupt retouch at both edges is recorded in 47 cases, semi-abrupt in 17 and the rest refer to a combination of abrupt and semi-abrupt, or semi-abrupt and low removals. The morphology of retouch is parallel (n:38), scaled (n:10) and sub-parallel (n:7) at both edges. Still, many removals have a different morphology at each edge (parallel and scaled or stepped, sub-parallel and parallel or stepped or scaled).

In seven cases, bilateral retouch is combined with truncation at the distal (n:4) or proximal (n:3) end of the blade (PL.XIV: d). Additionally, 19 blades bear heavy bilateral and abrupt retouch. They are mainly made of fine quality flints and radiolarite. These tools are connected to repeated and intensive resharpening of their cutting edges, pointing to more than one cycle of use. Moreover, at five blades, a shoulder is shaped at the one edge and a straight continuous retouch is located at the opposite cutting edge. Another blade bears continuous bilateral retouch, which at the proximal part forms a tang with long covering and inverse removals.

v) Perforating tools (6.1%, n:145) (PLATES XXI, XXXVII: b-d)

Perforating tools are shaped on blades (n:128), flakes (n:3), blade-flakes (n:5) and microblades (n:9). The most common raw materials involved in this tool type include pale brown (n: 48), gray (n:37) and yellowish brown flint (n:21), as well as radiolarite (n:17). Few tools are made of olive (n:5) and reddish brown flint (n:1), chert (n:4) and chalcedony (n:3), while nine artefacts are burnt.

A small number of tools (n:42) are complete or almost complete, while the majority is fragmented. Their length ranges from 2.4cm to 11cm (average: 3.6cm), their width from 0.2cm to 2.1cm (average: 1.3cm) and their thickness from 0.2cm to 0.8cm (average: 0.4cm).

The shaping of perforating tools involves bilateral retouch at the distal or less frequently the proximal part of the tool, which is direct or alternate, continuous, short or long, scaled, or sub-parallel. A significant number of tools (n:70) refers to blades where retouch is not limited to the active edge, but also a part of both cutting edges are retouched to form an elongated point (Type A). An also usual type (n:51) includes blades that bear continuous lateral or bilateral retouch, which shapes a pointed end (Type B). Finally, less usual are the tools that bear retouch only to the active point with few removals (Type C) (n:24) (Fig. 4.142).

Most perforating tools have a symmetrical point according to the technological axis of the artefact (n: 94). Fewer are the tools with an asymmetrical active point. Additionally, the thickness of the active point ranges from 0.1cm to 0.6cm (average: 0.29cm). On 56 tools the active point is rounded with traces of abrasion by use, pointing to a rotating move.

It is noteworthy that 1/3 of the tools bear retouch from other uses. Lateral, marginal, bilateral retouch, denticulations, notches and backed edges demonstrate the parallel use of the tools for several tasks, or the different first use of the tool and its recycling (PL.XXXVII: b-d). Moreover, almost half of the tools (n:75) have traces of sickle gloss at one or both edges, pointing to their first use as sickles (PL.XXI: a, c, e. f, i). Additionally, the presence of truncation (n:20) (PL.XXI: d) or shoulder (n:3) at the opposite side of the active part demonstrates an attempt to improve the shaping of the tool or enable its handling.

vi) Splintered pieces (5%, n:117) (PLATE XXII: d-f, XXXVIII: c)

Splintered pieces are recorded on blades (n:85), flakes (n:23), blade-flakes (n:4), microblades (n:1) and some indeterminate pieces (n:4). Four artefacts are technical products that have been used as tools (one plunging blade, one crested blade, two rejuvenation flakes). The commonest raw materials among splintered pieces are pale brown (n:26), gray (n:23), yellowish brown flint (n:18) and radiolarite (n:20). Reddish brown (n:4) and olive flint (n:1), obsidian (n:3), chert (n:3), chalcedony (n:3) and quartzite (n:1) are few. Moreover, some tools are burnt (n:13) or patinated (n:2).

A small number of tools are complete or almost complete (n:28). Their length ranges from 1.8cm to 6.2cm (average: 3.0cm), their width from 0.8cm to 3.3cm (average: 1.7cm) and their thickness from 0.2cm to 1cm (average: 0.4cm). Most splintered pieces have a rectangular or square outline. Scars of splintering are mainly of the first-stage (n:80) and less of the second-stage (n:37) (Fig. 4.143).

Only 41 of the total number of splintered pieces are on unretouched blanks. The rest tools are the result of recycling. More specifically, 47 tools bear traces of sickle gloss at one or both active edges (17 unretouched) (PL. XXII: d). Additionally, in 57 cases, the tool is retouched at one or both edges and/or at its distal or proximal part (PL.XXII: e). In fact, tools with lateral and bilateral retouch, denticulations, truncations, backed and shouldered artefacts have been used as splintered pieces in a second use-cycle. In 13 cases the tools had been used as splintered pieces in a third life-cycle since their first use was as retouched blades/sickles and then they were turned into end-scrapers. This is evidenced by the scars from splintering that have destroyed part of the end-scrapers' working edge (PL.XXII: f). These tools demonstrate a high degree of recycling and are related to fine quality raw materials.

vii) Burins (2.8%, n:66) (PLATE XXIII: d-f)

A small number of burins are present at the Final Neolithic assemblage. They are formed on blades (n:57), flakes (n:4), blade-flakes (n:4) and a microblade. Among the tools, three technical products are recorded (a plunging blade, a crested blade and a rejuvenation flake). Most of the burins are of pale brown (n:19) and gray flint (n:12), while the rest raw materials are represented by few pieces (yellowish brown flint: 6, obsidian: 6, chalcedony: 6, radiolarite: 6, chert: 5, reddish brown flint: 3, olive flint: 1, burnt: 2).

There are 15 complete or almost complete tools and the rest are fragmented. Their length ranges from 2.1 cm to 9.9cm (average: 3.8cm), their width from 0.8cm to 3.2cm (average: 1.6cm) and their thickness from 0.2cm to 1.3cm (average: 0.4cm). A fragment of a long blade made of pale brown flint (length: 9.9cm) and two complete blades of pale brown (length: 6.9cm) and yellowish brown flint (length: 6.5cm) stand out regarding their size.

Simple burins prevail, including angle burins (n:44), which are more common than transverse (n:11), axial (n:3) or dihedral déjeté (n:3). The majority of simple burins are on an unretouched cutting edge or unretouched debitage surface (n:36) (PL.XXIII: d), while less are formed on a transversal break (n:20), on a retouched surface (n:3) or on truncation (n:2). Moreover, five double burins have been recorded, including angle burins on a simple break (n:2), on a transversal burin facet (n:1), on lateral retouch (n:1) (PL.XXIII: f) and an angle burin on a break with a dihedral déjeté burin.

The burin blow is either slightly angled to the axis of the tool (n:34) or perpendicular (n:32). The size of burin facets varies in length from 0.5cm to 1.7cm (average: 1.2cm) and in width from 0.1cm to 0.5cm (average: 0.2cm). Most burin facets have negatives of primary spalls, but also two negatives of sharpening spalls have been recorded (PL.XXIII: e). Moreover, there are three cases of a twisted facet, two of hinged facet and another one that has produced a plunging spall.

In 19 cases, the tools have sickle gloss at one or both cutting edges. In most cases, the burin blow is located at the cutting edge that bears sickle gloss and seems to interrupt it. Additionally, 17 retouched blades with sickle gloss are also documented.

viii) Truncations (1.8%, n:41) (PLATE XXIV: a, d, e)

Truncated tools are mainly shaped on blades (n:33) and less on microblades (n:6) or flakes (n:2). A couple of blades are technical products, including a plunging blade and a crested blade. Most of the tools are made of gray flint (n:15), while the rest are of pale brown (n:6), yellowish brown (n:4), olive (n:3) and reddish brown flint (n:1), obsidian (n:4), radiolarite (n:3), but also some burnt (n:4) or patinated (n:1) artefacts.

Only six tools are complete or almost complete. The length of the artefacts ranges from 1.6cm to 8.9cm (average: 3.3cm), their width from 0.8cm to 3.1cm (average: 1.4cm) and their thickness from 0.1cm to 0.7cm (average: 0.4cm).

In 33 cases, truncation is located at the distal part of the tool and in six cases at its proximal part. There is only one double truncation at both proximal and distal part of a crested blade. Another truncation covers the right proximal part of the blade. At almost all truncated tools retouch is direct (n:39) and there are only two examples of inverse retouch. The removals are continuous (n:35) or partial (n:6), short (n:30) and less long (n:11), with sub-parallel (n:17), parallel (n:14), scaled (n:7) or stepped (n:3) morphology. In all cases, retouch is abrupt, while its delineation is mainly straight (n:29) and in few cases convex (n:8), concave (n:2), or irregular (n:2).

Finally, there is one tool where a truncation at the distal part is combined with a shoulder at the opposite side of the blade.

It should be mentioned that truncation is usually combined with other tool types like sickles, perforating tools, end-scrapers, etc. (PL.XXIV: a, d).

ix) Denticulated tools (0.5%, n:12) (PLATE XXVI)

There is a small number of denticulated tools at the Final Neolithic deposits. They are formed on blades (n:7), flakes (n:4) and an obsidian microblade. A plunging blade and a rejuvenation flake also bear denticulated retouch. The raw materials include gray (n:3), pale brown (n:2) and yellowish brown flint (n:1), obsidian (n:1), radiolarite (n:2) chert (n:1), chalcedony (n:1) and a patinated specimen.

Only four tools are complete or almost complete. Their length ranges from 2.6cm to 6.5cm (average: 3.9cm), their width from 0.8cm to 4.3cm (average: 2.0cm) and their thickness from 0.2cm to 1.0cm (average: 0.4cm).

Half of the tools bear bilateral retouch. On five blades, the one cutting edge bears straight and short retouch, while at the opposite edge, denticulations are formed with continuous, short and abrupt parallel removals, in most cases covering the entire edge. Another example is a blade with bilateral denticulations. Additionally, five tools bear denticulated retouch at the one cutting edge, which in most cases is continuous, short and semi-abrupt, while one flake bears denticulated retouch at its distal part.

Denticulated tools are more common in combination with other tool types, like sickle blades/elements, burins (PL. XXVI: a-c) and truncations. There is an interesting truncated and denticulated tool of yellowish brown flint that bears heavy bilateral denticulated retouch, while traces of sickle gloss are sporadically preserved at its surface (PL.XXXVIII: b).

x) Backed pieces (2%, n:44) (PLATE XXVII: c-d)

Backed tools cover a small percentage among the tool types of the Final Neolithic assemblage. Most are shaped on blades (n:35, including a crested blade) and less on flakes (n:5) or blade-flakes (n:4). Half of the tools are made of gray and pale brown flint (10 tools each category), while the rest are made of chalcedony (n:7), radiolarite (n:5), reddish brown flint (n:1), yellowish brown flint (n:2) and chert (n:2). Some burnt (n:6) and patinated (n:1) artefacts have also been recorded.

Most of the tools are fragmented (n:34) and only 10 blades are complete or almost complete. Their length ranges from 2.5cm to 5.4cm (average: 3.4cm), their width from 1.1cm to 3.6cm (average: 2.1cm) and their thickness from 0.4cm to 1.1cm (average: 0.7cm).

The backed edge is shaped at the right or left edge of the artefact. The retouch is in most cases direct (n:40) and less inverse (n:4), long (n:27) or short (n:17), continuous (n:44), usually straight (n:33) and less convex (n:7) or irregular (n:4), with abrupt removals (n:44). The backed edge, in most cases, covers the entire side of the tool (n:31) and in a few tools, it is partial (n:13). The morphology of retouch usually involves parallel (n:26) or sub-parallel removals (n:10), but sometimes scaled retouch is also recorded (n:8).

In 25 cases, the tool bears lateral retouch located at the opposite edge of the backed one (PL.XXVII: c). Most blades bear straight, short and semi-abrupt retouch at their active edge. Moreover, five backed blades are combined with distal (n:3) or proximal (n:2) truncation, while in two cases, a shoulder is formed (PL.XXVII: d).

xi) Projectile points (1%, n:29) (PLATES XXVIII: c-d, XXXIX, XL)

Twenty-nine projectile points derive from the Final Neolithic layers. They are made of pale brown (n:6) and gray flint (n:5), radiolarite (n:6), yellowish brown flint (n:4), olive flint (n:2), obsidian (n:2) and chert (n:1). One projectile is burnt, a second is patinated and another is of other raw material (probably green-schist).

Almost all tools are complete or almost complete (n:27) and only two projectiles are fragmented. Their size varies according to their morphology. In general, their length ranges from 2.0cm to 8.1cm (average: 3.5cm), their width from 1.1cm to 2.8cm (average: 1.8cm) and their thickness from 0.3cm to 0.9cm (average: 0.5cm).

According to their techno-morphological characteristics, they are separated in the following types: tanged points, tanged and barbed points, leaf-shaped points, rhomboid points, shouldered points, spearheads and various.

Tanged points (n:5)

The group of tanged points includes five tools. There is one obsidian point (A9b.AE4429 - length: 2.6cm, width: 1.2cm, thickness: 0.4cm) (PL.XL: c) that bears bifacial covering retouch with the tang shaped by semi-abrupt and parallel removals. The tang is elongated and fully developed with convergent edges, the barbs are small, while the head of the projectile forms a small triangular. The point is of high skilled manufacture and was imported into the settlement ready-made, produced probably by specialists using pressure technique. Similar obsidian projectile points have not been reported in northern Greece, but are known from Dimini in Thessaly (Moundrea-Agrafioti 1981, PL. 10, n.9), Kitsos Cave close to Lavrio, Attica (Perlès 1981, 214, PL. VIII, n. 3, 6, 7), Pangali in Aetolia (Dietz & Bangsgaard 2018, 297, Fig. 29.3), Kefala at Keos Island (Coleman 1977, PL. 95, n. 30) and Franchthi Cave (Perlès 1987, PL. 11, n. 5, 4).

Another projectile point is of fine quality yellowish brown flint (A9b.AE4432 - length: 2.1cm, width: 1.3cm, thickness: 0.4cm) (PL.XXXIX: b). The whole head and tang are shaped with bifacial covering long, low and parallel removals. The tang is shaped by bifacial slightly concave or almost oblique retouch and is broken.

The third tanged projectile point is made of dark gray/olive flint of fine quality (A9b.AE4439 - length: 4.5cm, width: 2.8cm, thickness: 0.6cm) (PL.XL: b). Its head is wide and triangular, but with an almost convex outline at the edges. The projectile point is covered by bifacial long sub-parallel and low retouch. The tang is short with a convex outline and shaped by bifacial notches, which, however, are not symmetrical.

The rest two tanged projectile points are simpler as regards their manufacture. The one point is made of pale brown flint on a blade blank (A9b.AE4451 - length: 4.2cm, width: 1.7cm, thickness: 0.6cm). The head of the projectile has an elongated and slightly convex outline and is formed by lateral direct, short and semi-abrupt retouch while the face is plain. The tang is relatively long and shaped by short and abrupt removals. The other case includes a patinated specimen shaped on a blade (A9b.AE4431 - length: 3.8cm, width: 1.6cm, thickness: 0.7cm). The projectile bears direct, short lateral retouch that is alternating at the proximal part to form the tang. The shape of the head is slightly convex and the faces of the tool are plain.

Tanged and barbed points (n:12)

The type of tanged and barbed point is the most numerous among the projectiles, consisting of 12 tools. Two main groups have been separated according to the development of the barbs, which at seven points are fully developed, while at the rest tools, the barbs are small and rudimentary shaped.

Four projectiles (A9b.AE4438, A9b.AE4442, A9b.AE4443, A9b.AE8982) bear bifacial covering retouch, with long and parallel or sub-parallel low removals (PL.XXVIII: c, XL: a). The points are triangular and the tang is long and fully developed. The barbs are also fully developed, shaped with bifacial notches, but in one case, do not seem symmetrical. In another case, the left barb and part of the right one are broken, as well as a small part of the tip, probably a result of impact damage. Additionally, two of the projectiles have part of the tang and tip also broken.

A similar case refers to a projectile point of radiolarite with the distal part of the head to be broken (A9b.AE4630 - length: 3.5cm, width: 2.7cm, thickness: 0.6cm) (PL.XXXIX: c). The point is shaped at the dorsal surface by invasive long and low retouch while the ventral surface remains plain. The tang is long and unretouched. The barbs are formed with bifacial notches and are asymmetrical since the right one is longer and wide open.

A semi-manufactured projectile point of yellowish brown flint on a blade is also interesting (A9b.AE7934 - length: 2.1cm, width: 2.2cm, thickness: 0.4cm). The blade is broken at the mesial/distal part and the point is shaped only at the base. Bifacial covering retouch with long and shorter semi-abrupt and low removals forms the tang, which is short. The barbs are formed by bifacial notches, which are not symmetrical. The rest part of the projectile's face remains plain. The left edge bears short and inverse retouch, but the right is broken. The projectile must have been at the stage of shaping, but it seems that the distal part was broken during the procedure and was probably discarded.

Additionally, there is a tanged and barbed projectile point of gray flint shaped on a blade (A9b.AE4435 - length: 4.2cm, width: 1.6cm, thickness: 0.3cm), where the faces remain plain (PL. XXVIII: d). The head is shaped with bilateral short and abrupt retouch, which is bifacial only at the mesial left edge. The tang is long and formed with short and abrupt retouch (only partially invasive), while the barbs are shaped with bilateral symmetrical notches. At the left edge of the blade, traces of sickle gloss are observed interrupted by lateral retouch. It seems that the blade was first used as a sickle element and later was modified to a projectile. This is also evidenced by the presence of a burin blow at the distal left edge, which also interrupts the sickle gloss and contributes to the formation of the projectile's tip.

Apart from the cases above, there are also five projectile points where the tang or the barbs are small. The first one refers to an obsidian projectile point (A9b.AE4452 - length: 2cm, width: 1.1cm, thickness: 0.4cm) (PL.XL: d). The point is triangular with a broken tang, while the barbs are shaped by small short notches. It is covered by bifacial long and parallel retouch. Similarly to the tanged obsidian projectile, the use of pressure technique and the skilled manufacture of the point indicate its production by specialists and its introduction into the settlement ready-made. Similar obsidian projectile points are attested at Dimini (Moundrea-Agrafioti 1981, PL. 10, n. 7) and Kitsos Cave (Perlès 1981, 214, PL. VIII, n. 8, 12, 14).

Another point is of medium quality grayish brown flint (A9b. AE4440). It is complete and large in size (length: 6.2cm, width: 2.8cm, thickness: 0.5cm). Bifacial retouch covers all the artefact, with long, low and sub-parallel removals. In this case, the central arris has been removed and smoothened by low removals. The tang is shaped by almost oblique or slightly concave retouch resulting in a narrower pointed end, while the barbs are slightly extending.

A projectile point of pale brown flint is shaped on a blade (A9b.AE4598 - length: 2.6cm, width: 1.3cm, thickness: 0.5cm) and bears bifacial and bilateral invasive retouch (semi-abrupt or low) mainly located at the head and its tip. There is a small tang and only one barb shaped by a small notch at its right part. The left part has no barb, but an oblique outline is formed with short and semi-abrupt retouch. At the proximal left edge, few traces of bifacial sickle gloss are recorded, probably indicating the first use of the tool as sickle and its later modification into a projectile.

Another projectile shaped on a blade (A9b.AE4445 - length: 3.1cm, width: 1.4cm, thickness: 0.4cm) is formed by lateral, alternate, short and semi-abrupt retouch, while the face of the blank remains plain. The tang is relatively long and shaped by short and abrupt removals, but the barbs are small and asymmetrical.

A projectile on a flake of excellent quality radiolarite belongs to this category (A9b.AE5509 - length: 3.4cm, width: 2.5cm, thickness: 0.9cm). It is thick and wide enough. The main shaping is observed at its ventral face, where covering and low retouch is recorded. On the contrary, the dorsal surface remains plain with the central arris of the flake to protrude. The tang of the projectile is short and simple, though it seems broken at the back, while the barbs are small, symmetrical and formed with partial alternate and short retouch.

Tanged and barbed projectile points are common at the Late and Final Neolithic settlements in mainland Greece and the Aegean. In northern Greece their presence is reported at Dispilio

(Tsagkouli 2002, 153, Fig. 6, 7; 2017, 4, Fig. 2, 3), Avgi (Andreasen 2008; 2011), Toumba Kremastis Koiladas (Hondroyianni-Metoki 2009a, 382), Stavroupoli (Skourtopoulou 2004, 383-384, 387) and Makriyalos (Besios 2010, 53; Skourtopoulou 1999, 123).

Leaf-shaped points (n:1)

There is one projectile point that has an almost leaf-shaped outline. It is complete, shaped on a blade blank and is made of a coarse-grained material, possible green-schist (A9b.AE4450 length: 5cm, width: 2.3cm, thickness: 0.6cm). The point is elongated, simple in form and shaped by continuous bilateral, short and semi-abrupt retouch. Its base is located at the bulbar part and is straight with no modification. The tip of the point is broken.

Rhomboid points (n:1)

There is one rhomboid point (A9b.AE6106 - length: 2.9cm, width: 1.7cm, thickness: 0.5cm) of fine quality dark reddish brown radiolarite. It is formed by bifacial covering retouch, with long and low removals. The head is wide and the tang sharp and asymmetrical. The point at its dorsal face has fissures and conchoidal cupules that point to thermal effect.

Shouldered points (n:1)

There is one complete projectile point of gray flint shaped on a blade blank (A9b.AE4433 - length: 4.3cm, width: 1.7cm, thickness: 0.6cm). The head of the point is elongated and formed by continuous bilateral short and semi-abrupt retouch. The base is located at the bulbar part of the blank and a shoulder is shaped at its right proximal part, with short and abrupt removals.

Spearheads (n:1)

A spearhead of fine quality yellowish brown flint has been recovered from the Final Neolithic deposits (A9b.AE4428) (PL.XXXIX: a). It is complete, elongated and large in dimensions (length: 8.1cm, width: 2.0cm, thickness: 0.8cm). It is covered by bifacial retouch, with long, semi-abrupt and parallel removals. At both faces, the central area of the spearhead forms an arris, right at the part where the removals meet. The tang has a triangular outline, with almost oblique retouch at both edges that result in the formation of a convex end. The spearhead seems to be intact since no traces of use or impact fractures are recorded (at least macroscopically). The exceptional quality of the material and the skilled manufacture of the spearhead indicates that the tool was produced by specialized knappers and was imported to the settlement probably as a gift or exchange product.

Various (n:8)

Eight projectile points cannot be grouped to the above-mentioned categories, due to the variety in their morphology. All of them are complete or almost complete. They are made of pale brown (n:2), gray (n:2) and yellowish brown flint (n:1), radiolarite (n:1) and chert (n:1), while one artefact is burnt.

A projectile point of fine quality dark reddish brown radiolarite has an interesting morphology (A9b.AE4446 - length: 3.8cm, width: 1.3cm, thickness: 0.5cm). It is an elongated artefact, totally covered by bifacial long and low or semi-abrupt removals. Its edges are convergent forming a pointed end at both distal and proximal part. It resembles the type that is characterized as 'limace' in the industry of Franchthi Cave (Perlès, 1987, Fig. 11.2, n.9-10), or 'slug' at the industry of Saliagos (Evans & Renfrew 1968, Fig. 61, n. 7), which are attributed to perforating tools. A similar tool has been also found at Tharrounia Cave in Evvoia (Sampson 1993, 492, n. 1) and is classified as projectile point.

Two other cases refer to triangular points shaped by bilateral short and semi-abrupt retouch, which is direct at the first (A9b.AE7519 - length: 2.9cm, width: 2.5cm, thickness: 0.8cm) and inverse at the second one (A9b.AE7525 - length: 2.3cm, width: 1.6cm, thickness: 0.5cm). The common fact is a deliberate asymmetrical break at the base of the point, to create a simple angular fracture for the hafting of the tool. The second point bears some traces of sickle gloss, pointing to the recycling of the tool and its secondary use as a point.

There is also an asymmetrical point (A9b.AE4805 - length: 2.1cm, width: 1.5cm, thickness: 0.3cm) on a blade fragment of pale brown flint, which bears lateral retouch at the one edge and sickle gloss at both edges. At a second stage, the blade's butt was modified to a tang by inverse retouch. The tip of the point is formed with a simple oblique fracture at the distal part.

A different case involves a projectile of gray flint shaped on a blade (A9b.AE7219 length: 2.1cm, width: 1.4cm, thickness: 0.4cm). The base of the projectile is located at the butt of the blade. At its mesial and distal part, alternate retouch with long and semi-abrupt removals forms the head of the point. The tang of the point is wide and long and the ventral face bears invasive and low retouch. Similar is another point (A9b.AE4637 - length: 2.8cm, width: 1.3cm, thickness: 0.4cm) shaped on a blade fragment with bilateral alternating, short and semi-abrupt retouch, which at the mesial part forms a wide and long tang.

A simple point is also shaped on a blade (A9b.AE8979 - length: 2.2cm, width: 1.3cm, thickness: 0.3cm). It is triangular, but its base is broken. The head of the point is formed by alternate retouch, which is almost covering at the tip. At its left edge, a notch is present, while an almost notched part is observed at the mesial right part of the head. While the notches are not symmetrically placed, they could still have facilitated hafting.

Finally, there is one more point of medium quality chert on a flake (A9b.AE7652 - length: 2.6cm, width: 2.4cm, thickness: 0.7cm). The head of the projectile is shaped with direct, bilateral, short and abrupt retouch. The butt of the blank is located at the right edge, while the base of the point is formed with short and abrupt retouch, with a slightly convex outline.

xii) Notches (0.7%, n:16) (PLATE XXIX: e, f)

A total of 16 notches have been recorded from the Final Neolithic deposits. The tools are shaped on blades (n:9, among them a plunging blade), flakes (n:3), blade-flakes (n:1), microblades (n:2) or other blanks (n:1). They are mainly made of gray (n:4) and pale brown flint (n:3). There are five notched obsidian tools, while the rest raw materials are represented by a single piece (olive flint: 1, radiolarite: 1, chert: 1, chalcedony: 1).

Almost half of the tools are complete or almost complete. Their length ranges from 2.7cm to 6.2cm (average: 3.4cm), their width from 0.7cm to 3.2cm (average: 1.5cm) and their thickness from 0.2cm to 0.8cm (average: 0.4cm).

In most cases, a notch is located at the mesial part of the artefact (right edge: 8, left edge: 4) and less at its distal end (n:4). Retouch is always continuous and short, with abrupt (n:7) or semi-abrupt (n:9), scaled (n:4), stepped (n:3) or sub-parallel (n:9) removals. The notch is mainly located at the ventral face of the tool (inverse retouch: 10) than at the dorsal (direct retouch: 6).

Among the tools, there is a blade that bears bilateral continuous short and semi-abrupt retouch, which is combined with a notch at its distal part and a straight truncation at the proximal part (PL.XXIX: f). In another two cases, a notch is located at the mesial part of the right edge of the blade, while short, lateral retouch is located at the left cutting edge.

xiii) Retouched flakes (0.6%, n:16)

The number of retouched flakes (n:13) or blade-flakes (n:3) is small. They are made of gray (n:4) and pale brown flint (n:3), but there are also three flakes of radiolarite, one of yellowish brown flint, one of chalcedony, three burnt and one patinated artefact. Four cases involve technical products that were retouched and used as tools (one cortical flake, three rejuvenation flakes).

The tools are mainly fragmented and only five flakes are complete or almost complete. Their length varies from 1.8cm to 5.2cm (average: 2.8cm), their width from 1.3cm to 4.8cm (average: 2cm) and their thickness from 0.2cm to 1.7cm (average: 0.5cm).

Retouch is located at the right (n:6) or left edge (n:5), as well as the distal part of the flake (n:3). However, there is one case of bilateral retouch and another tool bearing retouch at the left edge and the distal part. In another case, retouch forms a shoulder at the right edge of the flake. In general, retouch is continuous (n:12), regular, short in all cases, abrupt (n:11) or semi-abrupt (n:5), with scaled (n:10) or parallel (n:6) morphology.

xiv) Composite tools (0.5%, n:13) (PLATES XXX: b-d, XXXVIII: a)

Composite tools include 12 blades and a microblade that combine an end-scraper's working edge and a perforating point. Most of them are of pale brown flint (n:7) and few pieces are of yellowish brown (n:2), gray (n:1) and reddish brown flint (n:1). Another two tools are burnt.

The length of the tools varies from 1.9cm to 10.1cm (average: 4.1cm), their width from 0.9cm to 2.5cm (average: 1.5cm) and their thickness from 0.2cm to 0.9cm (average: 0.4cm).

As regards the shaping of the tool, the one part forms an end- scraper's working edge with abrupt, long, continuous and convex retouch with parallel or sub-parallel removals. In most cases (n:10), the end-scraper's working edge is formed at the distal part of the tool and the rest at the proximal part. At the same time, at the opposite end of the tool, a pointed end is shaped (perforating tool), usually with bilateral or alternate abrupt and short retouch. In most cases (n:8), the perforating point is symmetrical to the artefact's technological axis. The thickness of the point varies from 0.2cm to 0.6cm (average: 0.3cm). In four cases, the pointed end is rounded by use, while in almost all tools low and short removals are observed at its ventral part.

A general observation regarding this tool type is that almost all cases result from tool recycling. Eight tools bear sickle gloss at the one or both cutting edges, most of the time combined with lateral or bilateral retouch (n:7) (PL.XXX: c, XXXVIII: a). Retouch is mainly continuous, abrupt and short or long, characterized in many cases (n:8) by a high degree of secondary working and resharpening probably during the first use of the tool. The above observations on the re-use and recycling of these tools, as well as the combination of two different tool types in one artefact is probably related to a strategy of economizing raw materials. This is also reinforced by the excellent quality materials used for their production.

xv) Geometrics (0.8%, n:18) (PLATE XXXI: b-f)

A number of 18 geometrics have been recovered from the Final Neolithic layers. Fifteen tools are shaped on a blade, two on microblades and one on a flake. Most of them are made of flint (gray: 5, pale brown: 3, reddish brown: 3, yellowish brown: 1), while radiolarite, obsidian and chert are represented by only one tool each. Additionally, three geometrics are burnt.

All the tools are shaped on the mesial fragment of the blank. Their length varies from 1.2cm to 3.2cm (average: 1.8cm), their width from 0.7cm to 2.3cm (average: 1.4cm) and their thickness from 0.1cm to 0.6cm (average: 0.3cm).

In 14 cases, geometrics are shaped with a double truncation (at the proximal and distal end). In two cases, truncation is located at the proximal part of the tool and a deliberate oblique break is observed at the opposite end. In another two cases, the tool is not truncated at the distal or proximal part but has a deliberate break at both ends. Most geometrics shape a trapeze. There is one case of an almost square outline, while another tool bears bifacial retouch at the distal and proximal part with indeterminate shape. In general, the distal and proximal part of the tools bear abrupt, direct and continuous retouch, of straight to oblique delineation and short, parallel or sub-parallel removals.

The presence of lateral retouch is attested at seven geometrics. One tool has bilateral retouch that forms a backed edge at one side and bears straight, short retouch at the opposite edge. The rest cases refer to continuous, short, regular and semi-abrupt to abrupt retouch at the one cutting edge. One of the tools also has traces of sickle gloss of parallel direction, which is interrupted by lateral retouch (resharpening). Finally, a geometric with unretouched edges bears parallel sickle gloss at its entire right cutting edge.

Chapter 5.

Aspects of lithic production at the settlement of Anarghiri IXb

The previous chapter presented analytically the Late and the Final Neolithic chipped stone assemblage from the settlement of Anarghiri IXb. The following chapter focuses on the synthesis of the analyzed data and the examination of various aspects of lithic production related to the raw materials, the technology and tool typology. Thus, the discussion is concentrated on the preferences and use of raw materials, the strategies of raw material procurement, the technological choices for tool production and the technical skills of the producers. Additionally, various characteristics of the tools, their potential use and treatment are also examined. The following synthesis explores the organization of tool production at the settlement of Anarghiri IXb diachronically in order to follow the changes through time. At the final part of the chapter, a preliminary work on the spatial distribution of the lithic material is also presented.

5.1 The exploitation of raw materials

5.1.1 The diachronic use of raw materials

The examination of the raw materials used at the settlement of Anarghiri IXb demonstrates that the prehistoric community relied majorly on flint for tool production, while radiolarite, obsidian, chert, quartz, quartzite and chalcedony were less preferred. However, some differences between the Late and the Final Neolithic assemblage can be observed regarding the representation of raw materials (Fig. 5.1). A first look at the raw material categories shows a small decrease in the use of flint during the Final Neolithic period. On the contrary, the use of radiolarite, obsidian and chalcedony increases during this period, while at the same time, quartz declines to half of the respective percentage of the Late Neolithic period. The representation of quartzite and chert remains almost unchanged.

Changes in the use of certain raw materials can be better demonstrated when we turn to the flint categories (Fig. 5.2). The dominance of gray flint during the Late Neolithic is replaced by the almost equal representation of pale brown flint during the Final Neolithic. It is interesting to note that the excellent quality gray/dark gray flint that prevails at the Late Neolithic layers (15%) is almost absent during the Final Neolithic (1%). At the latter period, a lower quality gray flint rises at 25% of the gray category in contrast to the Late Neolithic (12%). Moreover, during the Final Neolithic period, olive and reddish brown flint slightly increase in number. In the case of olive flint, a lower quality material is recorded covering almost 20% of the category, while a lower quality reddish brown flint is also documented.

A significant increase of yellowish brown flint is recorded during the Final Neolithic, a material that is represented by a few pieces in the previous period. At the same time, a variety of lower quality is introduced. The fine quality semi-translucent/translucent yellowish brown flint is present almost exclusively at the later phase. During the Late Neolithic, only two artefacts are made of this variety, whereas the rest of this category is represented by the semi-translucent to opaque good quality yellowish brown flint with white inclusions.

Finally, the excellent quality black flint was exclusively used during the Late Neolithic period since not a single artefact is documented at the Final Neolithic layers. Moreover, according to the settlement's stratigraphy, this material derives from the lowest excavation deposits (Layer V), demonstrating its use mainly to the initial occupation of the settlement (Late Neolithic I).

To continue with the other categories of raw materials, there is a small increase of obsidian during the Final Neolithic period. Similarly, chalcedony also increases, while an excellent quality of this material is attested during this period, although it only counts a few pieces in the form of tools. Concerning radiolarite, its percentage also increases during the Final Neolithic, with the fine quality material to be more common in contrast to the lower quality. Another observation is related to the appearance of a yellowish brown radiolarian chert in the form of tools (except for two flakes), which covers 4% of radiolarites. Finally, quartz is less common during the later period since it declines to half of the respective percentage of the Late Neolithic. Nevertheless, medium quality quartz of yellowish color appears for the first time, though in a low percentage (5%).

Qualities of raw materials

When we turn our attention to raw materials quality, the comparison between the two periods of the Neolithic proves to be also interesting. First, gray flint of excellent quality shows a decline during the Final Neolithic (LN: 71%, FN: 59%) and medium quality material is more common. The same observation can be made in the case of fine quality olive flint (LN: 91%, FN: 72%), while a medium quality material appears during the Final Neolithic. In the case of pale brown flint, the percentages of both periods remain unchanged since excellent quality material prevails (63%). Some high quality pale brown varieties are more numerous but they do not affect the general representation of the category. Additionally, in the case of yellowish brown flint a small decrease in the number of high-quality material is observed during the Final Neolithic (LN: 100%, FN: 94%) due to the presence of lower quality at this period.

As regards fine quality radiolarite, its number increases during the Final Neolithic period (LN: 58%, FN: 63%). Conversely, better quality quartz decreases at the latter period (LN: 44%, FN: 35%). Finally, there is a new entry of excellent quality chalcedony, still represented by a few artefacts.

According to the above observations concerning the quality of raw materials, it is of interest to mention that excellent quality materials are dominant during both chronological periods (Fig. 5.3). However, a decline in the number of high-quality materials is recorded during the Final Neolithic (LN: 68%, FN: 59%) and a parallel increase of medium quality materials. This change could be related to the decline of excellent quality gray flint and the absence of black flint at the latter period, as well as the increased number of medium quality chalcedony.

5.1.2 Raw materials and the *chaîne opératoire*

To understand the way the prehistoric inhabitants produced their chipped stone tools and unveil the strategies that they followed from raw material acquisition to tool production, the use of the *chaîne opératoire* proves to be an important methodological tool. The analysis of all the steps that the prehistoric producers followed regarding each raw material will demonstrate their options and choices in each case, comparing the Late and the Final Neolithic material. According to the analysis of the lithic assemblage at the previous chapter, in the following pages the reconstruction of the *chaîne opératoire* will be carried out for each raw material, to detect the stage of its introduction into the settlement and the related products (Fig. 5.4, 5.5).

Gray flint (Fig. 5.6)

Gray flint is the dominant raw material used for the production of tools during the Late Neolithic period (48%). Almost all knapping stages are attested in the settlement. However, the majority is represented by tools (63%) and less by unretouched blades, microblades, flakes and blade-flakes. The presence of a raw nodule, some cores and little waste demonstrates an on-site knapping activity. Moreover, technical products that include crested blades, cortical flakes, rejuvenation flakes and knapping accidents support a hypothesis regarding on-site knapping of the material. A possible scenario is for the material to have arrived at the settlement as prepared or shaped out cores since the products connected to the first stages of reduction (cortical flakes, crested blades) are few.

During the Final Neolithic, the use of gray flint is reduced to almost half compared to the previous period (24%). The production chain is almost complete and only raw nodules are absent. The dominant category is tools that are prominently represented (63%), while blades, flakes, microblades and blade-flakes follow in smaller percentages. As in the Late Neolithic period, the presence of cores, technical products and waste points to on-site knapping of this material. Cortical flakes and crested blades are few, as well as rejuvenation flakes and knapping accidents. It seems that the cores were introduced into the settlement prepared and knapping was taking place on-site.

Pale brown flint (Fig. 5.7)

Pale brown flint covers 12% of the total material of the Late Neolithic deposits. As in the case of gray flint, it is mainly present in the form of tools (65%) and unretouched blanks (blades, flakes, microblades). There are two cores and some technical products that could point to on-site knapping of this material. The presence of the latter in addition to crested blades, rejuvenation flakes and knapping accidents suggests that small-scale knapping was taking place in the settlement. However, we could support that this was quite restricted and the cores were imported prepared.

During the Final Neolithic period, the frequency of pale brown flint increases and it becomes the second most abundant raw material (22.4%). For pale brown flint, almost all production stages are present except for the raw nodules. The majority is represented by tools (67%) and less by unretouched blanks. The presence of two cores, some technical products and little waste points to on-site production. It seems that the cores were brought to the settlement prepared and knapping was taking place, probably to a greater degree than in the previous period.

Reddish brown flint (Fig. 5.8)

Reddish brown flint covers a small percentage of the artefacts during the Late Neolithic period (2%). This material is present in the form of tools (46%), blades and microblades. There is also a secondary crested blade and a rejuvenation flake, but the material should hardly have been knapped on-site. Most likely, the artefacts were introduced into the settlement in the form of unretouched blanks or finished tools. During the Final Neolithic period, the representation of reddish brown flint does not change significantly (3%). More than half of the artefacts are tools (59%), while a significant number includes blades, a few flakes and microblades. There is also a fragment of a raw nodule, three cores and technical products (a cortical flake, a crested blade, some rejuvenation flakes and plunging blades) that point to the exploitation of the material. The material was probably brought to the settlement in the form of prepared cores and knapped on-site, but to a limited extent.

Yellowish brown flint (Fig. 5.9)

Yellowish brown flint is scarce in the Late Neolithic deposits (0.5%). There are only five tools and three unretouched blades. Among the few unretouched blanks, there is a long blade of 18.6cm length of yellowish brown flint. All the artefacts arrived at the settlement in the form of unretouched blanks or finished tools.

During the Final Neolithic period, the representation of yellowish brown flint increases (9%). The majority is represented by tools (77%), while low percentages are related to unretouched blades, flakes and microblades. Five cores have been recorded, but all of them belong to large blanks that were used as cores in a later phase. Additionally, few technical products involve secondary crested blades, core rejuvenation flakes and a couple of technical accidents, as well as few waste and fragments. Both excellent and medium quality materials are represented in all technical categories. Yellowish brown flint was introduced into the settlement in the form of finished tools or blanks. The small quantities of technical products and waste could hardly support a hypothesis of on-site knapping of the material, but in this case, it would be limited. Moreover, the fact that some blanks were re-used as cores to produce tools could indicate an attempt to maximize the use of the raw material. Yellowish brown flint was not easily accessible to the prehistoric occupants of Anarghiri IXb, like many other Neolithic settlements in Greece.

Black flint (Fig. 5.10)

Black flint was used only during the Late Neolithic period. It is the third most frequent material used in this period (7%). There are three cores and some technical products that include cortical flakes, a secondary crested blade, a rejuvenation flake and a core platform rejuvenation flake, as well as plunging blades. Most artefacts are represented by tools (54%) and there are also many unretouched blades, microblades, flakes and a blade-flake. There is strong evidence that the material was knapped on-site and the technical products point to its introduction in the form of prepared or partially shaped out cores. However, the number of artefacts related to the initial shaping and decortication of the cores is too low to securely support the hypothesis that black flint was imported to the settlement in the form of raw nodules.

Olive flint (Fig.5.11)

Olive flint is scarce in the Late Neolithic layers (2%). Only 11 artefacts have been recorded and almost all are tools of excellent quality material (91%). It is obvious that this material was not knapped in the settlement and finished tools were imported. During the Final Neolithic period, the representation of olive flint slightly increases (3%). The majority refers to tools that were mainly made of excellent quality material (68%). The same material is used in the production of some blades and flakes, while there are two crested blades (a primary and a secondary) and a rejuvenation flake. It seems that most of these artefacts were imported to the settlement as unretouched blanks and finished tools. Additionally, the presence of the medium quality olive flint in the form of prepared cores, a plunging blade and some tools could point to the on-site knapping of this variety, although to a small degree.

Radiolarite (Fig. 5.12)

Dark reddish brown radiolarite of both excellent and medium quality is present during the Late Neolithic period (6%). Almost all the production stages are attested among the artefacts. Few raw nodules, cores and technical products are connected to the medium quality material that derives from secondary deposits. However, three cores, a crested blade and some other technical pieces are of excellent quality material. The major number of the artefacts consists of tools (49%), while unretouched flakes, blade-flakes, blades and microblades are less in number. We should also note that most blades and tools are of excellent quality radiolarite. Radiolarite could be imported into the settlement in the form of prepared cores, but several unretouched blanks or finished tools could be also imported.

During the Final Neolithic, radiolarite becomes more common since its percentage is almost the double (11%) from the previous period. Medium quality radiolarite is represented by all reduction stages from raw nodules and technical products to unretouched blanks, tools and waste. Similar is the case of the excellent quality radiolarite, except for raw nodules. There are few cortical flakes and crested blades of both qualities. Regarding the excellent quality material, it seems that some prepared cores were introduced into the settlement and knapped on-site, but to a small degree since the number of technical products is rather small. Flakes, blade-flakes and microblades are less represented in comparison to blades. In fact, blade tools are dominant among the artefacts (57%), with the majority made of excellent quality radiolarite.

Medium quality material was knapped at the settlement, including the first reduction stages. In contrast, excellent quality radiolarite was mainly imported in the form of tools or blanks. Only in a few cases can on-site knapping be supported. Additionally, during the Final Neolithic, there is a yellowish radiolarite present exclusively in the form of a few tools. These were evidently brought to the settlement as finished products.

Obsidian (Fig. 5.13)

Obsidian holds 4.4% of the total number of artefacts during the Late Neolithic. A single core is present along with some technical products, which are mainly connected to the rejuvenation of the core and some knapping accidents (plunging and hinged artefacts), while there are no raw nodules or waste. In contrast, the number of blades (41%) and microblades (16%) make up more than half of the material and also tools are well represented (23%). Flakes and blade-flakes are few in number. The same pattern is observed during the Final Neolithic period, when the presence of obsidian increases (6.3%). Two cores, angular shatter and some technical products (rejuvenation flakes, core platform rejuvenation flakes, plunging blades) are the only indications of knapping activity. The majority of the artefacts includes unretouched blades (36%) and microblades (26%). Additionally, the presence of tools shows a slight decrease (20%) during this period.

These observations make clear that during both chronological periods, obsidian is present mainly in the form of unretouched and retouched tools, which were probably introduced to the settlement ready-made. A couple of cores and technical products (rejuvenation flakes, knapping accidents) indicate a limited exploitation of the material. In fact, the total absence of crested and cortical specimens demonstrates that the few obsidian cores were imported prepared and knapped on-site.

Chert (Fig. 5.14)

The use of chert during the Late Neolithic is rather small (3%). It is mainly present in the form of tools (46%) and some flakes, blade-flakes, blades and a couple of microblades. However, the presence of cores, a cortical flake, some rejuvenation flakes and a few waste products demonstrate the on-site knapping of the material. The cores arrived at the settlement prepared and small-scale knapping was taking place in the settlement. During the Final Neolithic, the representation of chert does not change (3%). Most of the artefacts involve tools (51%), as well as unretouched blades and flakes. The presence of cores, few technical products and fragments points to some on-site reduction. As in the previous period, the cores could have arrived prepared since pieces associated with the initial stages of lithic reduction are almost absent. The material is mostly represented by medium and low qualities, probably easily found in the vicinity of the settlement. However, some better chert qualities have produced fine blades and blade tools, as well as projectile points.

Chalcedony (Fig. 5.15)

The frequency of medium quality chalcedony is low during the Late Neolithic period (2%). The material is exclusively represented by tools (43%) and some unretouched flakes, blade-flakes and blades. There are no traces of on-site knapping and the products must have been imported to the settlement in the form of ready blanks and tools. During the Final Neolithic period, the presence of chalcedony increases (5%), while a raw nodule, a core and few technical products of medium quality are attested. The raw nodule has a smooth external surface and seems to derive from secondary sources. Among the technical pieces, there are some crested blades, a rejuvenation flake and two knapping accidents. It seems that limited knapping of chalcedony took place in the settlement and the raw material could have been imported in the form of nodules or shaped cores. Most chalcedony artefacts are related to unretouched flakes, blade-flakes, blades and a microblade. However, tools are also well represented (44%). An excellent quality chalcedony from the Final Neolithic layers includes only four blade tools. Thus, this excellent quality material is present exclusively in the form of retouched tools that have been imported to the settlement.

Quartz (Fig. 5.16)

Quartz was rarely used during both chronological periods, although it is a local and easily accessible material. During the Late Neolithic, little knapping activity is associated with quartz (2.1%). Most artefacts include unretouched flakes (62%) and a few blade-flakes or blades. A raw nodule, few debris and indeterminate pieces point to on-site knapping of the material. However, technical products are not represented during this period and there is only one tool. During the Final Neolithic period, a decline in the use of quartz is observed (1%). Similarly to the Late Neolithic period, the material is present mainly in the form of unretouched flakes, blade-flakes and few blades, while there are only three tools. The presence of a couple of raw nodules, a core, some cortical flakes and indeterminate fragments indicate the on-site production of quartz artefacts. The latter are connected exclusively to the lower quality quartz, which was most likely available in the immediate environment of the settlement. Conversely, during both periods, the better quality quartz is exclusively present in the form of finished products and few tools, a fact that indicates the exploitation of this material away from the settlement's area.

Quartzite (Fig. 5.17)

Quartzite is represented by a small number of artefacts during the Late and the Final Neolithic period (0.5% & 0.7%, respectively). During the Late Neolithic, the material is mainly present in the form of unretouched flakes, blade-flakes, or blades, while tools are absent. A core and a technical piece point to a restricted knapping activity in the settlement, probably related to the lower quality material. The same information derives from the material of the Final Neolithic layers. Except for a few unretouched flakes, blade-flakes and blades, there are only three tools. Additionally, the presence of a raw nodule, two cores, two rejuvenation flakes and little waste, point to on-site knapping, again related to the lower quality. The better quality quartzite during both periods is represented only by unretouched blanks and tools that were imported to settlement.

In general, the low knapping quality of the material could be a limiting factor for its use in the production of tools. It must be a local material, probably derived from secondary deposits. The low quality quartzite was imported to the settlement in the form of raw nodules or prepared cores and was used only occasionally for the production of blanks, while there is no evidence for knapping activity connected to the better quality material.

Conclusion

According to the analysis of the *chaîne opératoire* for each raw material, some conclusions can be drawn regarding their exploitation. First of all, there are raw materials that are considered of local origin and include quartz, quartzite, chert and probably chalcedony. The majority of the materials are present in the settlement from the first knapping stages. Quartz, quartzite and medium quality chalcedony were imported in the form or raw nodules or in most cases in the form of prepared cores. The production of blanks and tools was taking place at the settlement area, as evidenced by the presence of technical products and little waste. These materials could be accessible in the immediate environment and were probably used as supplementary for the tools' production. A similar case is the medium quality radiolarite since all stages of the production were taking place in the settlement. The raw nodules -broken or not- and the traces of raw material testing, the technical products and waste, as well as the tools and unretouched blanks, point to the on-site exploitation of the material, which is recorded during both chronological periods (Late and Final Neolithic).

Moreover, obsidian is an exotic material that arrived in the settlement by exchange networks. Obsidian products (blades and microblades) were brought in the settlement as finished tools. However, a restricted knapping of the material took place at the settlement, as evidenced by the presence of few cores and technical products. The two obsidian projectiles must be considered imported products since the skills required for their manufacture would be traced to specialized knappers. A similar case concerns yellowish brown flint. During the Final Neolithic, a significant number of finished tools and unretouched blanks was imported to the settlement. A couple of technical pieces do not securely support the on-site exploitation of yellowish brown flint. Moreover, the re-use of large blanks as cores strengthens the suggestion that the material was not easily accessible or available. Finally, the excellent quality chalcedony tools of the Final Neolithic deposits point to their introduction as finished products, probably related to distant sources.

As regards gray, pale brown, black, reddish brown and olive flint it can be supported that knapping was taking place in the settlement area. In almost all cases, there are cores (few), technical products and little waste. Tools and unretouched blanks represent the majority but knapping even in a small-scale was practiced. Most of the raw materials were introduced in the form of prepared cores. The on-site knapping of reddish brown and olive flint attested at the Final Neolithic period was restricted, as well as pale brown flint regarding both chronological periods, while several products could have been imported as finished tools. On the contrary, the exploitation of gray flint was practiced to a greater degree during the Late and the Final Neolithic period, while black flint was also worked on-site from almost the first reduction stages. Finally, in the case of excellent quality radiolarite, it seems that small-scale knapping was taking place on-site, as evidenced by the few prepared cores and technical products. Still, a significant number of artefacts must have arrived in the form of finished blanks and tools.

In conclusion, it seems that tool production relied on excellent quality flints and radiolarite. Some were introduced into the settlement as prepared cores and knapped on-site, while in almost all cases, core shaping was taking place away from the settlement. On the other hand, the introduction of ready products is possible for some flint varieties and excellent quality radiolarite. In any case, these materials covered a great part of the settlement's needs and the production of blade tools. At the same time, local materials probably easily accessible at the vicinity of the settlement were also processed, but to a smaller degree. These were usually brought to the settlement in the form of raw nodules and pebbles or prepared cores, while their products include mainly flakes and blade-flakes, probably due to the restrictions of the physical properties of the material. Finally, exotic materials were introduced into the settlement in the form of ready blanks and tools, with few exceptions of on-site knapping (obsidian). Nevertheless, it can be supported that the settlement's tool production did not rely on their use to any significant degree.

5.2 Strategies of raw material acquisition at the Anarghiri IXb settlement

The raw materials that were used for tool production at the settlement of Anarghiri IXb show a diversification according to their knapping qualities, but also to their provenance. Taking into consideration the available data on the possible sources of the raw materials used for the tools' production in northern Greece (see Chapter 4.2.2), as well as the geomorphology of western Macedonia, a discussion on the raw material procurement strategies is attempted. The prehistoric inhabitants of Anarghiri IXb acquired the raw materials needed for tool production by combining various strategies. Local materials present in close vicinity of the settlement were directly acquired but used to a small degree. On the other hand, the tool production relied mainly on regional raw materials located at longer distances and were accessible to the community directly or indirectly. According to the research conducted by Dimitriadis and Skourtopoulou in northern Greece (2001) the possible sources of raw materials used by the prehistoric settlements usually do not exceed 50-100 km around the site. Finally, long-distance or interregional procurement involved materials derived from longer distances, transported over hundreds of kilometers from a source area and involved organized exchange networks.

A small number of artefacts attest to the use of locally available materials like quartz, quartzite, chert and chalcedony. Most of the raw materials were probably present in the close vicinity of the settlement and were accessible by the prehistoric inhabitants. The majority is present in the form of nodules and pebbles that could have been collected from secondary deposits (streams and riverbeds). However, these raw materials were used to a low degree for tool production. It is possible that their low knapping quality did not allow more intensive use or did not correspond to the manufacture of the desired products (blade tools). In this category, medium quality radiolarite can be also included since the material is present in the form of nodules and could be found within short distances. Some of the nodules show traces of raw material testing, others are fragmented and some are discarded at an early stage of reduction due to low quality.

A second strategy is related to the procurement of raw materials that can be considered regional. These raw materials were not present in the immediate environment of the settlement and were carried from more distant sources. Excellent quality flints and radiolarite constitute most blade tools during both chronological periods. Similar fine quality flints are also reported at the neighboring settlements of western Macedonia (Dispilio, Avgi, Megalo Nisi Galanis, Servia). The location of the settlements in basins close to water sources (e.g., Aliakmon River), as well as the mountain ranges that are not far from the settlements (Voras, Vermion, Varnoundas, etc.)

could indicate possible uses of still unidentified primary or secondary raw material sources (Skourtopoulou 2002, 547-548). Additionally, the mountainous area of Pindus is also a strong possibility since some categories of siliceous raw materials and radiolarites have been located (Biagi et al. 2015; Elster 1994, 169-171). The prehistoric communities of western Macedonia could have direct or indirect access to regional sources. They could either make procurement trips or exchange through regional networks. In most cases, the products were imported as blanks and tools, but also as prepared cores. Moreover, the presence of technical products demonstrates that at least a part of the knapping was taking place in the settlement.

Finally, a third strategy involves materials that can be characterized as interregional or exotic. Obsidian and excellent quality yellowish brown flint are present as blanks and tools, while limited knapping activity is evidenced in the case of obsidian. Both materials were most likely part of exchange networks that included many settlements in a wide area. Indirect procurement of obsidian and yellowish brown flint has also been identified at other contemporary settlements of western Macedonia (Dispilio, Avgi, Kleitos, Megalo Nisi Galanis, Servia) (see Chapter 6.1).

Raw material procurement trough time

Taking into consideration the above observations regarding the raw material procurement at the Anarghiri IXb settlement, some differences can be traced between the two chronological periods (Fig. 5.18). Exotic materials include obsidian, yellowish brown flint and probably the high quality chalcedony. During the Late Neolithic, the percentage of the imported materials covers 6% of the total assemblage. During the following period (Final Neolithic), the presence of exotic materials increases to 18% since obsidian and yellowish brown flint are well represented.

Raw materials considered of regional origin refer to excellent quality flints of all colors (gray, pale brown, black, reddish brown, olive) and excellent quality radiolarite. They are dominant during both chronological periods (LN: 82%, FN: 66%), but their use decreases during the Final Neolithic.

Finally, local materials involve quartz, quartzite, probably chalcedony of medium quality, radiolarite of medium quality and chert. A small increase in their number is recorded during the Final Neolithic period (LN: 12%, FN: 16%).

A general observation for both chronological periods is that most raw materials used for production of tools at the settlement of Anarghiri IXb comprises regional raw materials of good to excellent quality, while local and exotic materials are few. This pattern concerning the use of raw materials for tool production is in accordance with observations at most contemporary settlements in northern Greece (Dimitriadis & Skourtopoulou 2001; Kakavakis 2014, 600-601, Kourtessi-Philippakis 2009). However, it is interesting to note that during the Final Neolithic period a decrease in the representation of regional raw materials is recorded, while the exotic materials, but also the local ones increase in percentage.

Conclusion

A variety of strategies were employed by the prehistoric occupants of the Anarghiri IXb settlement, which involved the exploitation of regional raw materials to a significant degree. In contrast, the use of locally available materials was limited, as well as exotic ones.

The choices of the prehistoric inhabitants of Anarghiri IXb regarding the use of certain raw materials could be the result of many different factors. First of all, the geology of the area is one of the important parameters as has already been proposed (Dimitriadis & Skourtopoulou 2001). The availability of excellent quality material, which was accessible to the community could explain the dependency of the settlement on regional raw materials and not local ones. Local materials are of low knapping quality and most of them unsuitable for blade production and they could have been used only occasionally. On the other hand, regional raw materials of excellent knapping quality could produce the desired products, like prismatic blades and tools that were destined for certain uses. Thus, it seems that the needs for laminar products satisfied by regional materials and at the same time the technical and physical restrictions of the lower quality local materials played an important role in the prevalence of the former in tool production. Regional materials could have been collected during procurement trips, perhaps in combination with other activities. The prehistoric inhabitants of Anarghiri IXb obtained good quality regional flints, which were brought to the settlement in the form of ready blanks and tools, as well as prepared cores. Most likely, the first stages of decortication were taking place in the procurement areas. At the same time, an indirect procurement of regional raw materials (prepared cores and blanks) is also possible considering the distance to the sources (e.g., Pindus Mountains). The presence of similar raw materials in many contemporary settlements of western Macedonia demonstrates similar strategies of raw material procurement and use, but could also point to exchange through regional networks. In any case, the choices of certain raw materials by the prehistoric community point to a good knowledge of close and more distant raw material sources, but also the access to them and obviously, the development of socio-economic relations with the neighboring settlements.

The presence of both obsidian and yellow flint points to more extensive networks and interregional communication. In the case of obsidian, on the one hand the introduction of finished tools (prismatic blades and microblades) into the settlement is attested, while, at the same time, limited knapping activity is related to this material. The few cores found in the settlement indicate that they were brought to the settlement by exchange, probably along with finished tools. The same could be supported for yellowish brown flint, which is also present in the form of finished products, but there is no clear evidence for its on-site exploitation.

The changes in the use of raw materials between the Late and the Final Neolithic are significant and could be caused by various factors. The inhabitants of Anarghiri IXb stopped using black flint for tool production and the use of gray flint decreased, while both materials show clear evidence of on-site production during the Late Neolithic period. This change coincides with the increase of imported raw materials like obsidian and mainly yellowish brown flint, as well as excellent quality radiolarite. It seems that black flint and much of the excellent quality gray flint were no longer accessible, or in the case of indirect procurement, the regional networks were interrupted or supplies were otherwise restricted. It is also possible that a change in the preference of a certain network occurred, one that first provided high quality black and gray flints and later was substituted or restricted by other networks, maybe more distant. During the Final Neolithic period, the settlement of Anarghiri IXb seems to get involved in networks related to excellent quality radiolarite and exotic materials, like obsidian and yellowish brown flint to a greater degree than in the previous period. On the other hand, a possible dependency on more distant sources of better quality materials or the development of new socio-economic relations could also be a possibility. However, to proceed to possible interpretations, the technological and typological characteristics of the Late and the Final Neolithic assemblage should be also examined. Moreover, an important parameter in the discussion would be the possible changes observed at other categories of material culture through time.

5.3 Technological aspects of tool production

5.3.1 Knapping techniques and production of blanks

The analysis of the chipped stone material demonstrates that the prehistoric inhabitants of the settlement were focused on the manufacture of laminar products -mainly blades- to use them unmodified or retouched for their daily activities. However, different strategies have been recorded in blank production, which are related to the raw materials used and the desired products, but also to the knapping abilities and choices of the prehistoric knappers. To follow the technical skills that the tool production of Anarghiri IXb required, we should first turn to the technical characteristics of the artefacts.

The examination of the technical characteristics of the lithic artefacts from the settlement of Anarghiri IXb has pointed to some differences between the material from the Late and the Final Neolithic period. As regards the general technological categories (raw nodules, cores, knapping products, technical products and debris), their representation remains almost unchanged between the examined chronological periods, with slight differences (Fig. 5.19). During the Final Neolithic period, a small decline of the technical products and cores is observed, while a slight increase in the number of knapping products is recorded. A closer observation of knapping products during the Final Neolithic period points to the decrease of flakes and a small rise of blades, blade-flakes and microblades, which could be related to the increased presence of obsidian and chalcedony during this period.

The evidence of the cores, the technical products and waste

The few raw material nodules that were recovered from the Late and the Final Neolithic layers demonstrate the on-site production of medium quality radiolarite, quartz, as well as low quality quartzite and chalcedony. The only flint raw nodule that was found at the Late Neolithic deposits is dark gray and has small dimensions, possibly derived from secondary deposits. Most raw nodules were probably procured from the vicinity of the settlement and reduced within the settlement. Some of the nodules show traces of raw material testing while others are broken, probably due to the low quality of the material.

The analysis of cores from the Late Neolithic layers demonstrates the exploitation of fine quality flints, radiolarite, chert, obsidian and quartzite at the settlement. As regards flints, both excellent and medium quality materials are exploited (gray, pale brown and black flint). On the contrary, most of radiolarite, chert and quartzite derive from nodules of medium to low quality material. At the same time, the single obsidian core, points directly to the introduction of the material in the form of prepared core. During the Final Neolithic cores are mainly represented by medium quality radiolarite and gray flint. However, few cores of almost all raw material categories are recorded. It should be noted that cores of yellowish brown flint are present only in the form of large flakes or blades. Not a single core of this material in a different form has been recorded, indicating the introduction of ready blanks into the settlement, which in this case were re-used as cores. The same observation can be made for some cases of excellent quality radiolarite, gray and pale brown flint, which apart from cores on nodules, also include cores shaped on a flake. This strategy of using flakes or blades as cores probably indicates the attempt to prolong the use of certain blanks or tools, especially when the materials are of fine quality. Finally, as regards obsidian, two cores are recorded at this period introduced into the settlement prepared.

Cortex is usually present at chert and radiolarite cores in the form of an external smooth surface of the nodule (usually <50%). However, at the Late Neolithic material, both pale brown cores and another of black flint preserve a small percentage of cortex. During the Final Neolithic cortex is attested at the same raw materials as in the previous period, but also at quartz, chalcedony of medium quality and olive flint. Concerning their dimensions, chert cores are larger followed by quartzite, gray and pale brown flint, as well as radiolarite. Their size, of course, is related to the degree of exploitation. During both chronological periods, most cores point to an early reduction stage (LN: 61%, FN: 56%), attested by the limited number of negatives at most cores' surface. The raw materials include chert, radiolarite, gray and pale brown flint during the Late Neolithic and almost the same raw materials at the latter period. Fewer are the completely worked cores (LN: 30%, FN: 30%) involving gray flint, black flint, radiolarite and chert, as well as obsidian for the Final Neolithic. Finally, few cores of gray flint, black flint and fine quality radiolarite are exhausted at the Late Neolithic material, while at the Final Neolithic material pale brown flint and yellowish brown flint are also included (LN:9%, FN:14%). In any case, the degree of exploitation points to an early discard mainly of low knapping quality cores.

Amorphous, globular, flat and semi-circular are the usual core shapes during both chronological periods, as well as pyramidal. The representation of amorphous and pyramidal cores is similar for both chronological periods (LN: 25%, FN: 28%). Pyramidal cores are mostly related to obsidian, excellent quality flint and radiolarite, but few are the cases of strictly pyramidal shape. In most cases, the striking platform of the cores is prepared by faceting (mainly at fine quality flints, obsidian and radiolarite) or is plain (half of them are of chert), than mixed or cortical. However, prepared platforms are more common at the Late Neolithic material in comparison to the Final Neolithic (LN: 39%, FN: 26%), where plain platforms are recorded for more than half of the cores (LN: 49%, FN: 54%) and less are prepared. Additionally, most of the cores have one striking platform and less two, especially at the Final Neolithic material, pointing to a more organized and careful reduction. This is also reinforced by the prevalence of single direction negatives over varying or opposite directions. However, all black flint cores of the Late Neolithic period bear negatives of multiple and opposite directions, indicating their extensive exploitation, although such a decision would result in shorter and less controlled products. Not a single blank of black flint exceeds 5.1cm in length -even the technical products- and obviously, this material had the form of small nodules. During the Final Neolithic period, pyramidal cores are mainly connected to gray and olive flint, as well as the two obsidian cores, while their striking platforms are prepared with small removals. Additionally, fine quality gray, olive and reddish brown flint are more associated to blade and microblade production.

Concerning the negative products, the majority of cores during the Late Neolithic were used for the production of both flakes and blades (gray and pale brown flint, chert) (34%), but also flakes (usually made of chert, gray flint, quartz, quartzite) and microblades (gray and black flint, radiolarite) (24% each). There are fewer cores intended to produce blades and microblades (12%) or flakes, blades and microblades (6%). The obsidian core has negatives of flake removals of multiple directions.

During the Final Neolithic, flake cores are numerous and mainly related to medium quality radiolarite (36%). Microblade cores are equally represented (36%), with flint, chert, radiolarite and obsidian to be involved. Cores of both flakes and blades of gray flint, radiolarite, chert, quartzite and chalcedony are also attested (15%). Less is the number of blade cores (5%) and blade/microblade cores (3%), represented by radiolarite and flint (olive and reddish brown). Finally, three cores of olive flint, radiolarite and obsidian have negatives of flakes, blades and microblades at their surface (5%).

Examining the information that derives from the cores, two different strategies of core exploitation seem to be followed. The first is plain with no core preparation or careful design that mainly involves lower quality materials (chert, medium quality radiolarite, quartz, quartzite, chalcedony) and is related to flake or flake and blade production. Conversely, the presence of cores with more geometric shapes, prepared striking platforms and more careful design are related to blade and microblade production of excellent quality material (flints, fine quality radiolarite, few cherts, obsidian). It could be suggested that the lower quality materials would not be suitable for successive blade or microblade production, due to the poor knapping properties. However, not all excellent quality cores show a planned and elegant shaping. The same could be supported for one obsidian core.

Concerning the technical products, the percentage of cortical flakes, core platform rejuvenation flakes and core tablets remain almost unchanged among the two chronological periods. However, during the Final Neolithic period, crested blades increase in number, but a decline is observed at rejuvenation flakes, plunging and hinged blanks. The raw material representation of technical products follows the general tendency of the assemblage of each period. Thus, gray flint is dominant during the Late Neolithic and there is also a good representation of black and pale brown flint, radiolarite and obsidian. However, yellowish brown flint, chalcedony and quartz are not represented. On the other hand, during the Final Neolithic period, gray and pale brown flint are almost equally represented, while there is an increase in radiolarite and obsidian technical products. Additionally, chalcedony, quartz and yellowish brown flint are represented by few pieces.

Decortication of nodules and initial shaping of the cores took place off-site since technical products connected to the first reduction stages (cortical flakes, crested blades) are few. The cores were introduced into the settlement shaped and prepared, with few cases of on-site decortication. During the Late Neolithic period, gray flint, black flint, radiolarite of medium quality and local chert are involved, while during the latter period, few cortical flakes of gray, pale brown, reddish brown flint, chert and quartz are present. The cortical flakes of radiolarite and quartz refer to medium quality material.

Core shaping including guiding crests demonstrates a demanding procedure in order to produce blades of predetermined form. The crested blades of the Late Neolithic period are mainly made of gray and black flint, as well as radiolarite. There are also some cases of pale brown, reddish brown flint and quartzite, which are mostly of the second series, still few. Additionally, the length of some crested blades (8cm) provides some useful information regarding the initial size of the cores. Thus, the presence of some long crested blades of radiolarite and pale brown flint point to larger cores. The core tablet of gray flint also confirms the presence of cores with large dimensions. Similar observations can be made for the Final Neolithic crested blades. In most cases, they belong to the second or third raw of reduction. All flints are represented and mostly gray and pale brown, as well as radiolarite of fine and medium quality, chert and chalcedony. The large size of some products points to the cores' dimensions, which are mostly related to fine and medium quality radiolarite, pale brown and gray flint. It should be noted that crested blades of quartz have not been found, even though the material was worked on-site from the first reduction stages. This is probably due to the simple knapping technique used for the exploitation of quartz, clearly oriented to flake production. Conversely, the absence of obsidian crested blades is related to the importation of fully prepared cores into the settlement.

The rejuvenation of the core to fix errors and provide renewed flaking surfaces was applied to some extent indicating the on-site knapping activity, still limited. The rejuvenation products of the Late Neolithic are mainly connected to gray and black flint and less to radiolarite of medium quality or pale brown flint. During the Final Neolithic period, the repair of cores is attested for all raw materials (except for quartz) and includes rejuvenation flakes, few core platform rejuvenation flakes (flint, radiolarite and obsidian) and two core tablets of gray flint. However, technical products related to the rejuvenation of the core platform (core tablets, core platform rejuvenation flakes) are generally rare, probably due to the decrease of the core's size that would be caused in such a case. Obsidian, though imported, is well represented by rejuvenation products (LN: 9%, FN: 11%). The obsidian cores were introduced prepared, while the presence of rejuvenation flakes and knapping accidents demonstrate on-site flaking during both chronological periods, with a slight increase at the Final Neolithic period.

In general, the effort to continue and ensure the normal procedure of knapping was practiced for excellent quality materials (regional or exotic), a fact that also demonstrates the skills of the knappers to fix the errors during the knapping procedure. Of course, this is not irrelevant to the different technique of core reduction since local materials mainly produced flakes or blade-flakes; thus, core preparation was not applied in the same manner as in most cases of blade and microblade production, which was more demanding including guiding crests and predetermined design.

The on-site knapping of some materials is also attested by the presence of knapping accidents that are recognized by plunging and hinged products. During the Late Neolithic knapping accidents involve plunging and hinged artefacts mainly of gray and black flint and, to a smaller degree, of pale brown flint, radiolarite and obsidian. Plunging blades provide information regarding the cores and, in most cases, they point to pyramidal single platform cores with blade and microblade negatives. On the contrary, few examples demonstrate the presence of more than one striking platforms, with negatives of multiple or opposite directions. The same information derives from the core platform rejuvenation flakes, which in most cases are prepared (with obsidian, gray and pale brown flint to be involved) and the negatives point to single direction cores. During the Final Neolithic, plunging and hinged blanks include almost all raw materials. Gray and pale brown flint are mainly represented, while radiolarite, obsidian, chert, chalcedony, olive, yellowish brown and reddish brown flint are less in number. The plunging blades generally point to pyramidal cores with blade and microblade negatives of single direction.

Another interesting observation is that many of the technical products were also used as tools, especially when the blank's morphology allowed its further use and modification, or the material was of fine quality (obsidian, fine quality flints). The presence of retouch, sickle gloss and splintering are recorded at 22.4% of the technical products from the Late Neolithic deposits and 34.1% from the Final Neolithic layers, including in most cases plunging blades, crested blades and rejuvenation flakes (Fig. 5.20).

Finally, it should be mentioned that waste products include a small number of artefacts that should be not considered indicative. The electro-sieving method has not been applied to the trenches under study and apparently affects the participation of this group, where higher percentages are expected. The representation of raw materials includes gray flint, obsidian and quartz for the Late Neolithic, while pale brown and yellowish brown flint, radiolarite and quartzite are also involved at the Final Neolithic material. Similarly, most of indeterminate pieces refer to fragments of raw materials that were worked on-site, like gray flint, radiolarite, chert and quartz, while the rest raw materials are underrepresented.

The production of blanks

The representation of flakes and blade-flakes does not seem to change significantly between the two chronological periods. During the Late Neolithic period flakes are mainly made of gray flint. However, it's the first time that quartz artefacts are well represented (13%), as well as chalcedony (9%) and chert (6%). On the contrary, during the Final Neolithic the use of quartz is limited (4%) and flakes are mainly represented by gray and pale brown flint, but also by radiolarite (17%), chalcedony (17%) and chert (8%).

The characteristics of flakes point to the application of a simple reduction technique indicating medium knapping skills, or better, less careful knapping activity. The prevalence of large flat and dihedral butts, the medium to low axiality and the absence of prismatic face and symmetrical profiles at many artefacts, are some characteristics that point to a simple reduction with not careful design. The dominance of extending and extreme bulbs, as well as intense or slightly intense waves of percussion, indicate the application of direct percussion with a hard and a soft hammer. This is also reinforced by the divergent distal edges of the products and different or opposite directions of negatives at their dorsal face. Regarding the raw materials, quartz and quartzite produced larger irregular artefacts, due to the lower quality of the material. Obsidian seems to follow the rest raw materials. However, the smaller dimensions, the presence of facetted butts and the more regular shaped blanks point to the application of direct soft hammer percussion and a more careful knapping activity. In general, it seems that in most cases flakes do not correspond to a predetermined debitage production, probably because they were part of the shaping of the core or of expedient production related to low quality local materials (e.g., quartz, quartzite). This observation fits well with the characteristics of flake cores. It demonstrates that not only the lower quality of the material was the reason for less careful manufacture, but also the desired products or the technical choices and skills of the manufacturers.

A comparison among the products of the two chronological periods demonstrates only slight differences, which indicate a less regular shape of the Late Neolithic flakes, according to the increased percentages of not axial products with extending bulbs, convergent distal edges and opposite/different negatives' direction. This difference could be relevant to the increased presence of quartz flakes during the Late Neolithic period.

In the case of blade-flakes, the morphology of the blanks is more regular and controlled in comparison to flakes. Blade-flakes of the Late Neolithic period are mainly made of gray flint (23%) but also chalcedony (20%) and chert (15%). During the Final Neolithic period, chalcedony blade-flakes cover almost 1/3 of the total, while an increase in the frequency of radiolarite (14%), quartzite (8%) and chert (5%) is also recorded. However, the Final Neolithic material includes less axial and symmetrical products in comparison to the previous period. Additionally, more artefacts have divergent distal edges, flat butts, triangular cross-section and flat profiles. The application of direct percussion with a soft hammer is dominant for both chronological periods. Nevertheless, the use of indirect percussion during the Late Neolithic seems to be more frequent. These differences between the Late and the Final Neolithic blade-flakes are probably relevant to the raw materials used since the increased use of chalcedony and quartzite at the latter period might affected the flaking choices, but also the morphology and appearance of the products.

On the other hand, when we turn to blade production things are differentiated. As regards raw materials, the dominance of gray flint during the Late Neolithic is replaced by the equal representation of pale brown flint during the Final Neolithic. The latter period a significant part of the blades are of yellowish brown flint, radiolarite (the majority of fine quality) and obsidian. On the contrary, the Late Neolithic blades apart from gray flint, are also made of pale brown and black flint, with the rest raw materials to be underrepresented.

Blades are characterized by a high degree of fragmentation. In most cases, they are axial, slightly curved, with symmetrical profiles and trapezoidal cross-sections. Butts are in many cases prepared, with extending or slightly extending bulbs and an abrupt or semi-abrupt flaking angle and diffuse waves of percussion, which point to the application of indirect percussion and direct percussion with a soft hammer. Pressure technique is also applied to a small degree, mainly related to obsidian and some excellent quality flints. In this case, the products are more prismatic, with parallel edges and derive from unidirectional pyramidal cores. In general, they are longer and thinner, demonstrating a more regular appearance.

The blades of the Late and the Final Neolithic period show some slight differences regarding their technological characteristics. The blades of the Final Neolithic period are to a greater degree axial, they are less curved and the number of flat profiles is increased. More cases of convergent distal edges are recorded and there is a higher representation of slightly extending bulbs and smooth ventral faces. Additionally, the number of flat butts is increased in comparison to the previous period. These differences could be related to a possible increase in the application of indirect percussion during the Final Neolithic period. At the same time, the increased flat profiles and smooth ventral faces could also point to a possible increase of pressure blades. Concerning their dimensions, there are no significant changes at the mean value of length, width and thickness, while the presence of long blades (>8cm) is attested during both periods involving gray flint, radiolarite and chert at the Late Neolithic material and gray, yellowish brown, pale brown, olive flint and radiolarite at the following period. An exceptional case is the long pressure blade (18.6cm) of yellowish brown flint recovered from the Late Neolithic deposits.

The technological characteristics of the blades point to a more complex and demanding procedure of core preparation, also evidenced at many cores, which involves guiding crests, core platform preparation and good knapping skills to produce regular and prismatic blades. At the same time, some products do not have a regular appearance. Blades made of gray, black and low quality radiolarite, but also quartz and chalcedony, show a less careful production. Even though platform preparation is attested (e.g., in the cases of black and gray flint), the products are sometimes irregular, probably due to the knapping technique or the technical skills of the producers. Consequently, it could be supported that the majority of blades were produced by the application of indirect and sometimes direct percussion with a soft hammer. Moreover, a small number of products bear characteristics that are related to pressure technique, involving mainly obsidian and excellent quality flints.

Finally, the production of microblades seems to be more standardized. During the Late Neolithic period microblades are made of gray flint, obsidian, black, reddish brown and pale brown flint. At the following period, the dominant raw material for microblade production is obsidian (30%), with gray and pale brown flint to follow, as well as yellowish brown flint. The technological characteristics point to the increased application of pressure technique. The main attributes include small butts, which are mainly facetted, dihedral, linear and punctiform, prismatic faces, slightly extending bulbs and diffuse or smooth waves of percussion, convergent and parallel distal edges, single direction negatives, slightly curved and symmetrical profiles. The dimensions of the Final Neolithic microblades are marginally smaller than of the Late Neolithic and the same is observed at the products' butts. Additionally, the Final Neolithic material has a higher degree of axial products, slightly curved profiles and more parallel distal edges in comparison to the previous period. The application of pressure technique seems to be more usual during this period, probably due to the increased number of obsidian and yellowish brown flint products. In general, microblades of obsidian and yellowish brown flint, but also some cases of excellent radiolarite and excellent quality flints, demonstrate a careful and well-designed production. However, there are also many cases of not regularly shaped microblades which could have been produced by indirect or even direct percussion with a soft hammer (gray flint, black flint, obsidian).

Knapping techniques

According to the above observations concerning the technological characteristics of the cores and the knapping products, it can be supported that the techniques used for the tool production include direct percussion with a hard and a soft hammer, mainly recorded in the case of flakes and blade-flakes. The same techniques have also been used for core shaping and repair products. Thus, the exploitation of raw nodules on-site at their first stages was performed by using these techniques. The same could be supported for the technical products, like crested blades, rejuvenation flakes and core platform rejuvenation products.

In the case of blade production, the application of indirect percussion is attested in a high number of the material for both chronological periods. However, there are also blades that show characteristics of the pressure technique. These mainly refer to blades made of obsidian, yellowish brown flint, excellent quality radiolarite and some cases of pale brown, gray, reddish brown and olive flint.

Concerning the microblades, it seems that the use of pressure technique produced a significant number. Again, obsidian and yellowish brown flint are implicated, as well as radiolarite and excellent quality flints. However, there are also some unstandardized products pointing to the application of indirect percussion.

The secondary modification of blanks is equally informative. The retouch that is present in many cases could be applied by direct and indirect percussion, but also by pressure. Especially in some cases of fine covering bifacial retouch evidenced at projectile points, the application of pressure technique can be supported. Additionally, in many cases, the delicate retouch, with parallel and precise removals, could also point to the use of this technique.

Evidence on the manufacturing equipment for stone tool production is provided from antler tools. The study of antler artefacts conducted by Arampatzis (Arampatzis 2019) has testified a small number of retouching tools (hammers) derived from the Final Neolithic layers (n:7), which had been used for the manufacture of chipped stone tools. The tools were made of red deer antler and the majority was carefully manufactured. The microscopic analysis demonstrated that at least two tools were used for retouching by compression while the rest of them by percussion (Arampatzis 2019, 161-163). The future study of other archaeological material (e.g., ground stone tools) could probably provide more information on tools related to the production of chipped stone artefacts.

5.3.2 Technical skills and degree of specialization

The analysis of the technical characteristics of the chipped stone artefacts and the identification of the stages of the *chaîne opératoire* for each raw material allow some comments concerning the character of craft production and the degree of specialization in the tool production of Anarghiri IXb.

The term specialization in the present discussion concerning the chipped stone material is used to describe the degree of the products' standardization. Standardization refers to specific techno-morphological criteria of the artefacts that demonstrate their controlled production (axiality, prismatic face, profile symmetry, profile curvature, the direction of negatives at the dorsal face and the formation of distal part) (Skourtopoulou 1998a, 11; Tixier 1984, 57-70). A production of more regular and controlled tools can be considered the result of agents with developed skilled abilities, who use specialized methods and techniques of knapping and know the raw material sources and the mechanical properties of the materials (Pelegrin 1990, 123-124; Skourtopoulou 1998a, 11-12).

In the case of Anarghiri IXb, the lack of studies regarding the spatial organization of the settlement is an important limiting factor since no evidence of stone knapping areas can be investigated in the current state of research. The contextual distribution of the artefacts could provide information regarding the stone knapping activity and its correlation to specific areas of the settlement could contribute significantly to the discussion. However, this is not possible before the analysis of the settlement's spatial organization is carried out. Additionally, the partially excavated Late Neolithic deposits that are limited to the periphery of the settlement do not allow a complete contextual analysis for the lithic material of this chronological period.

With these things in mind, the discussion will focus on the characteristics of the artefacts themselves, with no other correlations. It has been demonstrated that the local materials were used to a low degree and mainly in an expedient way. Quartz, quartzite, most of the local cherts and medium quality radiolarite were brought to the settlement in the form of raw nodules or, in the case of chert, in the form of shaped/prepared cores and worked on-site to a small degree. As it has been argued, in most cases, the raw materials are of low knapping quality. The cores rarely follow any geometrical stereotype and do not seem to have a predetermined design. The products include mainly flakes, blade-flakes and few blades, knapped by direct percussion with the use of a hard and a soft hammer. Their general appearance points to a not delicate or sophisticated production.

A second clear category is related to yellowish brown flint and obsidian, both imported materials. In the first case, the total absence -with few exceptions in the Final Neolithic assemblage- of evidence of on-site production demonstrates a different pattern. The majority of the material is tools -to a great degree blades- which have been introduced into the site in a finished form. A significant part of the products shows a more careful and sophisticated design and were produced by indirect percussion and, in some cases, by pressure technique. This production seems to be the outcome of different manufacturers, more specialized in the production of blade tools and apparently in the use of pressure technique. However, the small number of technical products at the settlement and the re-use of some tools as cores for further production might indicate partially the involvement of local knappers.

A similar pattern can be observed in the case of obsidian. The products of obsidian, mainly blades and microblades, follow a specific and careful design. A significant number has been produced by pressure technique. However, the three cores that are present at the settlement do not show a standardized design and shaping. Even though almost pyramidal in shape, the negative products point to the production of flakes, blades and some microblades. Moreover, the technical products do not include crested blades or cortical flakes, indicating that the cores arrived prepared at the settlement. On the other hand, the rejuvenation products demonstrate the effort of the knappers to maintain the normal state of the knapping activity and exploit the material to the fullest. The characteristics of many plunging blades point to conical microblade cores. There are also several blades and few microblades that are not as standardized as others. Some products are not axial, some are not prismatic and some cases point to the application of direct percussion with a soft hammer, where the products have extending bulbs and intense waves of percussion. Consequently, it could be suggested that a significant part of obsidian tools was imported in the form of finished products made by specialists who used the pressure technique. At the same time, the on-site knapping could be related to other manufacturers, maybe locals, which were not skilled and familiar with the production by pressure technique, as evidenced by the technological characteristics of some products. However, the attempts to repair the damages caused by knapping accidents show a degree of skills, but still cannot explain this differentiation among the products.

This pattern regarding the obsidian products has been also recorded at some Neolithic settlements of northern Greece. In her study of obsidian artefacts from settlements in northern Greece, Milić refers that in Makriyalos, most of the material is prismatic blades but does not seem to be products of standardized production (Milić 2016, 194-195). In the case of Paliambela, she refers that the irregularity of the edges of most blades could suggest the use of the percussion technique, concluding that both Adamas and Demenegaki obsidian were introduced into the settlement as prepared cores and were knapped by local or visiting artisans (ibid., 195). In Thermi, Milić argues that obsidian was either acquired as finished products or the cores were brought to the settlement, knapped and then taken to another community, where they were further used for blade manufacture (ibid., 196). In the case of Dispilio, she claims that obsidian was imported to the site in the form of finished products, which, however, in most cases, are not of skilful manufacture (ibid., 221). Milić finally argues that either local or itinerant artisans performed the knapping of a core that could have arrived from another village and then passed on to the next place for further use. In some cases, obsidian might have also circulated as ready blanks and tools, particularly artefacts of Demenegaki source (Ibid., 202).

Apart from the above-mentioned raw materials, the excellent quality flints and radiolarite show similar characteristics. Excellent quality flints have been produced by indirect and direct percussion with a soft hammer to a great degree, but it seems that a small number was also produced by pressure. The majority of products, blades and microblades, demonstrate fine knapping skills and regular forms of the products. However, the products of black flint during the Late Neolithic period are usually less standardized or have less regular forms, while intensive on-site exploitation is attested. The same could be supported for a number of gray flint tools. On the contrary, excellent quality radiolarite, pale brown, reddish brown and olive flint point to better shaped products. We could assume that the main part of the flints and radiolarite was manufactured by skilled knappers who could work on core preparation and produce more regular artefacts. At the same time, small-scale exploitation of these materials could take place at the settlement by locals.

It has been argued that the chipped stone industries of Neolithic Greece are characterized by low skilled technologies from low quality materials that coexist with the skilled blade production from high quality materials produced outside the communities and exchange at inter-communal level (Démoulé & Perlès 1993, 396; Perlès 1990, 28-34; 1992b, 137). This suggestion fits well with the case of Anarghiri IXb settlement, as regards the local unspecialized production and the specialized products of exotic materials, like obsidian and yellowish brown flint. However, it has been demonstrated that in the case of blade production of regional excellent quality materials, the participation of regional artisans with specialized skills or 'itinerant knappers' could be possible (Skourtopoulou 1998a). At the settlement of Anarghiri IXb, apart from the introduction of ready-made exotic tools (obsidian and yellowish brown flint), other regional flints of excellent quality seem to have been worked by skilled manufacturers, which were exercised in blade and microblade production, the core preparation and the production of standardized blade tools. Similarly, at the settlements of Avgi and Megalo Nisi Galanis in western Macedonia, it seems that part of the artefacts made of excellent quality flints were produced by skilled knappers and were imported ready-made into the settlements (Andreasen 2011, Fotiadis et al. 2019, 30). These toolmakers could work in the region of western Macedonia, exploiting, circulating and exchanging raw materials and tools and participating in the regional networks among the settlements (see also Chapter 7.2). Nevertheless, the lack of research on raw material sources in the region on the one hand and the limited evidence that derive from the Neolithic settlements of the area on the other, do not allow more specific suggestions. However, according to Skourtopoulou, since so far the on-site production in a workshop level has not yet been proved, the hypothesis of a network of itinerant knappers cannot be excluded (Skourtopoulou 2002, 548, 550).

On the other hand, the exploitation of excellent quality materials, like gray flint, black flint and the rare cases of excellent quality radiolarite and other flints, indicates that the locals were implicated in this procedure to some degree, but produced tools of lower knapping skills. An interesting fact in this direction is the presence of some projectile points that are of excellent quality materials but show a low degree of symmetry. For instance, the bifacial tanged and barbed projectiles of radiolarite with asymmetrical characteristics are obviously contrasted to the highly skilled manufacture of other radiolarite bifaces, the obsidian projectiles, but also to the excellent yellowish brown spearhead. Additionally, few semi-manufactured projectile points of yellowish brown flint and radiolarite indicate the possible implication and attempt of the locals to produce tools of more demanding skills. Similarly, the presence of some long blades made of chert and gray flint is obviously of lower standardization when they compared to the fine produced long blades of yellowish brown flint or other excellent quality materials. Thus, some degree of specialization or higher knapping skills could also be related to the locals.

Skourtopoulou has supported that the model of 'itinerant knappers' proposed for Thessaly and southern Greece by Perlès (Perlès 1990,1992b) could also be applied for Macedonia and Thrace although in a more restricted scale (Skourtopoulou 1998a; 1999, 125-126; 2002, 548-551; 2004, 404-406). In her study of the chipped stone material from the Late Neolithic settlements of central Macedonia (Thermi, Makriyalos, Stavroupoli) (see Chapter 6.1) she concluded that Thermi and Vasilika were settlements with the character of a 'workshop', producing artefacts of a local jasper (siliceous limonite) that was distributed to other settlements, like Makriyalos and Stavroupoli. The existence of a possible network of itinerant knappers working in a peripheral scale for this material is proposed, a hypothesis strengthened by the technical skills recognized at the artefacts, which also demonstrate the communication at a technical level (Ibid. 2002, 550). Skourtopoulou suggests two possible exchange mechanisms for central Macedonia and Pieria, one related to free-lance trading with or without middlemen and the second based on the presence of a central place of redistribution (Thermi and Vasilika). The recipient settlements could either import ready tools or have on-site production by the specialized artisans who carried the prepared cores (Ibid. 2004, 402). The participation of specialized knappers is also reinforced by the similarities observed among the industries of the settlements by specific tool types (sickles, projectile points). Similarly, the secondary treatment of the tools could also suggest that the knappers were probably visiting the settlements in order to maintain and recycle the tools (ibid., 405-406).

The recent research of Kakavakis on the Neolithic chipped stone industries in northern Greece demonstrates that, in most cases, there is an obvious difference between flake production and more skilled blade production. The Neolithic industries of northern Greece indicate a domestic character with some degree of specialization, as evidenced by the standardized production of blades from local or regional materials. However, in the case of obsidian and Balkan flint, there seems to be a higher degree of specialized production (Kakavakis 2011, 202).

To conclude, in the case of the Anarghiri IXb settlement the presence of two different production systems is recorded, one specialized with products of skilled craftsmanship related to the imported exotic materials and a domestic production covering the everyday needs, with unstandardized tools of low technical skills, probably realized by the locals. However, the skilled parallel production of standardized tools made of regional materials (prismatic blades, microblades, bifacial projectile points) with evidence of on-site production could on the one hand point to the action of regional artisans or even itinerant knappers working in the area, or at the other hand to local knappers who developed some degree of specialized skills and technical abilities.

5.4 The lithic toolkit of the Anarghiri IXb settlement

5.4.1 Tool typology through time

The chipped stone tools from Anarghiri IXb cover more than half of the total assemblage during both chronological periods (LN: 56.5%, FN: 59.4%). The typological analysis indicated some slight differences concerning the representation of tool types between the Late and the Final Neolithic (Fig. 5.21). A small decline at Final Neolithic sickles (retouched and unretouched) is recorded and a slight increase of scrapers, although sickles cover almost half of the toolkit during both chronological periods. Blades with lateral retouch increase during the Final Neolithic, as well as splintered pieces. The rest tool types show slight and insignificant differences between the Late and the Final Neolithic, while the representation of projectile points and perforating tools remain unchanged.

More specifically, during the Late and the Final Neolithic, sickles (retouched and unretouched) are mainly represented by sickle elements, according to their dimensions, since there is only a small number of long blades that could be used individually and show a slight increase at the Final Neolithic assemblage (LN: 11%, FN: 13%). As regards the retouched sickles, several modifications are recorded, which in many cases result in the renewal or resharpening of the active edge. The presence of lateral/bilateral retouch at sickle blades/elements in most cases interrupts the sickle gloss, indicating the resharpening of the active edge. Sometimes, retouch is so intense that the sickle gloss is only sporadically preserved. Additionally, the presence of truncations located at the proximal or distal part of the sickles probably demonstrates a strategy to control their size, which is also achieved by a deliberate fracture at one or both ends of the tool. The formation of a backed edge or a shoulder is probably applied to enable handling or hafting of the tool.

The increased percentage of scrapers during both periods is noteworthy and majorly of end-scrapers, that are shaped on blades or blade fragments to a high degree. During the Final Neolithic, the presence of circular double end-scrapers is attested (although there are only two tools), a type that is absent from the material of the previous period. Additionally, a small increase in the number of double end-scrapers is observed (LN: 4 %, FN: 6%), with a slight decline of end-scrapers (LN: 95%, FN: 93%). The basic shaping during both chronological periods does not seem to change. End-scrapers' working edge covers the distal or proximal part of the tool (or both in the case of double end-scrapers) with long and sometimes short sub-parallel and abrupt/semi-abrupt removals. The most usual type of end-scrapers is Type A, followed by type B. The representation of the types does not change significantly between the Late and the Final Neolithic period (LN: 66%, FN: 61% and LN: 33%, FN: 36%, respectively). Additionally, the long blades with an end-scraper's working edge shaped at their distal part slightly increases during the latter period (LN: 2.5%, FN: 4%).

Similarly, perforating tools do not show many differences according to the formation of their active point. However, it is noteworthy that Type B is more frequent during the Final Neolithic (LN: 23%, FN: 35%), while the presence of Type C declines (LN: 29%, FN: 17%). During the Final Neolithic, the percentage of perforating tools with a rounded point due to use is smaller (LN: 54%, FN: 39%). There is only one double perforating tool at the Late Neolithic material, a type that is not represented in the later period.

The projectile points are either of specialized and skilled production or simply manufactured. They show a large techno-morphological variety and almost every tool is unique. During the Late Neolithic period, the projectile points are mainly of simple manufacture that involves few modifications of the blank. The only skillfully manufactured tools that are shaped by bifacial covering retouch are the two leaf-shaped projectiles. On the other hand, the tools of the Final Neolithic show a greater variety of types and raw materials used, while more careful manufacture is recorded at almost half of the artefacts. During the Final Neolithic, the presence of bifacial covering retouch is attested at many tanged and barbed projectiles. This type is well known from other settlements of the Late and the Final Neolithic period in Greece. On the contrary, not a single characteristic triangle is recorded from the Final Neolithic layers at the settlement of Anarghiri IXb. At the same time, the presence of the two obsidian projectile points and the exceptional yellowish brown spearhead indicate their introduction into the settlement as ready tools. The exotic material, the careful design and the use of pressure technique for their production would require specialized knapping skills. The presence of these artefacts demonstrates the implication of the Anarghiri IXb settlement in a wide exchange network operated in the south (for obsidian) since similar tools have not been recorded in northern Greece, at least for the moment. Nevertheless, apart from the simply manufactured projectile points, which are also numerous at the Final Neolithic period, some semi-manufactured tools demonstrate the effort for on-site production of more skill demanding projectiles, but it is obvious that they are of lower quality as regards their manufacture (asymmetrical barbs, not elegant shaping, etc.). Additionally, it is important to note that in some cases the projectiles are the result of tool recycling, where the tools with lower manufacturing quality are mainly implicated.

Few differences are observed regarding the shaping of the rest tool types between the two periods. One could note the increased presence of bilaterally retouched blades during the Final Neolithic period (LN: 33%, FN: 42%). The splintered pieces are mainly first-stage during both periods, with scars of splintering at the extremities of the tool. Concerning the notches, the denticulations, the backed and truncated tools, only slight changes are recorded in their representation. Additionally, the use of simple burins and geometrics in the shape of trapeze, retouched flakes and composite tools continues, while their shaping remains unchanged during both chronological periods. The only changes are related to the raw materials' representation at each tool type.

Finally, it should be noted that the absence of some tool types, such as the circular double end-scraper, the double perforating tool and some projectile types from one of the two chronological periods, should not necessarily be considered the result of changes in tool typology through time, but could be caused by excavation bias (mainly regarding the deposits of the Late Neolithic period).

5.4.2 Raw materials and tool types

The chipped stone tools of the Anarghiri IXb settlement have been produced by a variety of raw materials. The examination of the tools demonstrates some changes concerning the representation of raw materials used for tool production between the two chronological periods (Fig. 5.22). During the Late Neolithic, tools made of gray flint cover more than half of the total number of tools (53%), while there is a significant decrease during the following period (25%). On the contrary, during the Final Neolithic, the representation of pale brown flint increases at least 10%. Both raw materials cover 50% of the tools at the Final Neolithic deposits. Additionally, excellent quality yellowish brown flint becomes more common among tools (12%). As for olive and reddish brown flint, their percentage shows a small rise during the Final Neolithic, while black flint is absent.

Concerning the rest raw materials, the frequency of tools made of radiolarite rises during the Final Neolithic period from 5% to 11%, with the majority of excellent quality. Tools of chalcedony also increase (LN: 1%, FN: 4%), including a few retouched tools made of excellent quality material. The representation of obsidian and chert among tools remains unchanged between the two periods. As for quartz and quartzite, their presence is scarce during both chronological periods.

The correlation between the raw materials used and specific tool types can provide useful information on the choices of the prehistoric knappers. Apart from the physical and mechanical constraints of each raw material for producing certain tool types, many other factors could be related to the preferences of the prehistoric artisans. In the next pages further exploration of the raw material choices will be attempted concerning the production of specific tool types (Fig. 5.23, 5.24).

Gray flint

The most abundant raw material during the Late Neolithic is gray flint, including a large percentage of tools (63% of gray flint artefacts) and a variety of tool types. However, the majority of tools correspond to sickle blades/elements (28%) and retouched sickle blades/elements (23%), while scrapers are also numerous (25%). Blades with lateral retouch (6%), perforating tools (6%), burins (3%) and splintered pieces (3%) are represented by smaller numbers. There are also some truncated and backed pieces, denticulations and notches, geometrics, projectiles, retouched flakes and composite tools in low percentages (<2%). During the Final Neolithic, the representation of tools made of gray flint does not change much (64% of gray flint artefacts) and all the above-mentioned tool types are present almost in the same percentages. There is a small increase in the number of blades with lateral retouch (7%), splintered pieces (4%) and truncations (3%), while a decrease at burins is recorded (1%). The rest tools show a small deviation between the two periods.

Pale brown flint

During the Late Neolithic period, tools made of pale brown flint include mostly sickle blades/elements (28%) and retouched sickle blades/elements (30%). The number of scrapers (17%), perforating tools (8%) and blades with lateral retouch (6%) is smaller. There are also few cases of truncated (4%) and splintered pieces (3%), denticulated and notched artefacts, burins and backed pieces, as well as a couple of projectile points (all <2%). In the following period, the use of pale brown flint increases and so are the tools made of this material (69% of the pale brown flint artefacts). All tool types are present, with the prevalence of sickle blades/elements (23%) and retouched sickle blades/elements (26%). Interestingly, the number of scrapers approaches these two main categories during this period (25%). Additionally, the number of splintered pieces slightly increases (4%), while the rest tool groups do not show any critical change.

Reddish brown flint

Reddish brown flint is present in small numbers during both chronological periods. However, a high percentage of artefacts made of this material are tools (46%). During the Late Neolithic, the dominant tool type are sickle blades/elements (retouched 38%, unretouched 31%), scrapers follow in smaller numbers (19%) and there is a perforating tool and a denticulated artefact (6% each). During the Final Neolithic, the representation of tools of reddish brown flint rises to 60%. This period the dominant tool type are scrapers (37%), followed by unretouched sickle blades/elements (31%). The number of retouched sickle blades/elements is lower than in the previous period (11%), as well as perforating tools (2%). There are no denticulated tools, but on the contrary, new tool types are included like splintered pieces (6%), geometrics (5%), blades with lateral retouch (3%), few truncated (2%) and backed blades (2%), as well as composite tools (2%).

Yellowish brown flint

Yellowish brown flint is represented by few tools during the Late Neolithic period, which, however, cover 63% of the material. The majority of tools include splintered pieces (40%), while there is an equal representation of scrapers, retouched sickle blades/elements and composite tools (20% each). The number of tools changes significantly during the Final Neolithic period

(78%). A variety of tool types are present mainly referring to retouched sickle blades/elements (30%) and scrapers (27%). Unretouched sickle blades/elements (17%), perforating tools (8%) and blades with lateral retouch follow in smaller percentages (7%). There is also a noticeable decline in the presence of splintered pieces (6%). In contrast, few pieces refer to denticulated and truncated blades, burins, retouched flakes, geometrics, composite tools, backed blades and projectiles (all <1%).

Black flint

Black flint is present only at the Late Neolithic deposits and tools represent almost half of the material (54%). Black flint was mostly used for the production of sickle elements (retouched 38%, unretouched 36%). There is a small number of scrapers (8%), perforating tools (5%) and blades with lateral retouch (5%). Finally, some burins (3%), splintered pieces, notches and retouched flakes were also produced (2% each).

Olive flint

Olive flint is almost exclusively represented by tools during the Late Neolithic period (91%). The most common tool type is retouched sickle blades/elements (40%) and splintered pieces (30%). Fewer are the unretouched sickle elements (20%) and scrapers (10%). During the Final Neolithic period, the representation of tools made of olive flint decreases (68%), but a variety of tool types is included. Unretouched sickle blades/elements and scrapers are the most numerous tool types (22% each), followed by retouched sickle blades/elements (20%). The blades with lateral retouch (11%), perforating tools (9%), truncated tools (6%) and projectiles (4%) are well represented, though in small numbers. Finally, a couple of notches, burins and splintered pieces were also made of olive flint (2% each).

Radiolarite

During the Late Neolithic almost half of the material corresponds to tools (49%), with 2/3 to be made of excellent quality radiolarite. The majority of tools are represented by retouched sickle blades/elements (32%), while scrapers (19%) and unretouched sickle blades/elements (13%) follow in number. Blades with lateral retouch (9%), perforating tools (7%), backed pieces (6%) and splintered pieces (4%) are less represented. Moreover, there are also few notches and denticulations, truncated pieces, retouched flakes and composite tools (2% each). It should be noted that composite tools, splintered pieces, notched, truncated and perforating tools, as well as blades with lateral retouch are only represented by the excellent quality radiolarite. During the

Final Neolithic period, the number of tools increases (57%) and almost all the previous types are present, except for composite tools. The dominant tool type at this period is scrapers (27%) followed by retouched (20%) and unretouched sickles (17%). The number of blades with lateral retouch increases (12%), as well as splintered pieces (8%). Perforating tools remain almost unchanged (7%), as most of the rest categories. Backed pieces are also an exception since their number decreases (2%). It should also be mentioned that during this chronological period, 75% of the tools are made of the excellent quality radiolarite. Almost all tool types are implicated in both qualities, except for projectiles, geometrics and denticulated tools that are made of excellent quality radiolarite.

Obsidian

The presence of tools made of obsidian is quite low in comparison to flint and radiolarite. During the Late Neolithic, only 23% of the artefacts correspond to retouched tools. The distribution of tools is mainly related to blades with lateral retouch (37%) and retouched flakes (19%). A couple of cases include scrapers and denticulated tools (13% each), while few truncated, notched, or splintered pieces are also present (6% each). During the Final Neolithic period, the retouched tools made of obsidian show a small decline (20%). Blades with lateral retouch cover half of the tools (54%), while burins (12%), notched (10%) and truncated tools (8%) follow. There are also few splintered pieces (6%), two fine produced projectile points (4%), a geometric, a denticulated tool and a retouched sickle element (2% each). However, it should be noted that obsidian is majorly represented by unretouched blanks that bear use traces during both chronological periods. A second clarification is that the absence of microscopic examination hasn't allowed the identification of possible sickle gloss at the obsidian blades.

Chert

During the Late Neolithic period, almost half of the chert artefacts are tools (46%). The primary tool type is scrapers and retouched sickle blades/elements (20% each). Unretouched sickle blades/elements (16%) and perforating tools (12%) follow in number, as well as blades with lateral retouch and projectile points (8% each). The rest tool types include burins, notches, splintered pieces and retouched flakes (4% each). During the Final Neolithic period, chert tools have a similar representation among the artefacts (49%), but a significant change is documented. The largest number of tools are unretouched sickle blades/elements (38%). Smaller percentages correspond to retouched sickle blades/elements and scrapers (16% and 15%, respectively). The number of perforating tools decreases significantly (6%), as well as projectile points (2%). The other tool groups show small changes in their representation. There are also new tool types represented by chert during this period, including a few geometrics, denticulated and backed pieces.

Chalcedony

Few artefacts of chalcedony are present at the Late Neolithic deposits and almost half of them are tools (43%). Unretouched sickle elements are the dominant tool type (50%), while retouched sickle elements (15%) and burins (14%) follow in number. Blades with lateral retouch, perforating tools and denticulated tools are less common (7%). During the Final Neolithic period, the percentage of tools among chalcedony artefacts remain unchanged (44%) with a variety of types. More than half of the tools are unretouched sickle elements (53%) and retouched sickle elements (17%). Backed pieces (8%), scrapers (5%) and burins (5%) are also well represented. Finally, small percentages of blades with lateral retouch, perforating tools, notched and denticulated tools, splintered pieces and retouched flakes are documented (less than 3% each).

Quartz

Quartz is another raw material that was used unmodified. At the Late Neolithic layers, there is only one burin of the better quality material. During the Final Neolithic, the tool percentage of quartz is still low (8%) and there is an equal representation of unretouched sickle elements, retouched blades and scrapers, but they refer to only a few pieces (almost 33.3% each). In this case, the tools are also made of better quality material.

Quartzite

The few artefacts of quartzite during the Late Neolithic were used unretouched. However, during the Final Neolithic, there are some tools (8% of the total quartzite artefacts) that include a couple of unretouched sickle elements (67%) and a splintered piece (33%).

Other

This raw material category includes only a few pieces during both chronological periods. There are few tools at the Final Neolithic material that involve a sickle-blade of green-schist, an end-scraper of a coarse-grained material (gabbro?) and a projectile point possibly of green-schist.

Conclusion

The above analysis demonstrates that there was a preference for specific raw materials to producing certain tools. Most tools are made of flints, which are well represented in almost all tool types and especially sickles, whether retouched or unretouched, but also at scrapers, blades with lateral retouch and perforating tools. However, gray, pale brown flint and radiolarite seem to participate in more tool types, than the rest raw materials during the Late Neolithic. On the contrary, yellowish brown flint is mainly represented by splintered pieces. This material is present in small quantities during this period and the high percentage of splintered pieces probably reflects its intensive use until it was exhausted. Additionally, the increased representation of composite tools also demonstrates an effort to prolong the use-life of the tools. Another compelling case is obsidian, which participates mainly in the type of retouched blades, but also retouched flakes. It seems that obsidian flakes -mostly technical products- were appropriate to get retouched and used due to their thickness. There are few tools related to quartz and quartzite, which mainly refer to sickle elements and a burin, while chalcedony is majorly represented by sickles.

During the Final Neolithic period, almost all the raw materials are used in a wider variety of tool types. Raw materials like yellowish brown flint, olive, reddish brown flint and chert are represented by more tool types. Yellowish brown and olive flints are now preferred for sickles and scrapers and less for splintered pieces. It is also interesting that during this period, many raw material categories are represented by scrapers and, in some cases, to a higher degree when compared to sickles, like reddish brown flint and radiolarite.

Some raw material categories were extensively retouched and modified to specific tool types, while others were mainly used as unretouched blanks. The distribution of blanks with use retouch in comparison to retouched tools and tools a posteriori (as have been defined in the previous chapter), provides some useful information (Fig. 5.25, 5.26). It is clear that in the case of obsidian, quartz and quartzite, the majority of the artefacts include utilized blanks. Chalcedony has an equal representation among retouched and utilized blanks during both periods. In the case of flints, radiolarite and chert retouched tools are dominant in comparison to utilized blanks during the Late and the Final Neolithic with a small deviation. However, it should be mentioned that reddish brown flint is better represented by retouched tools during the Final Neolithic, as well as yellowish brown flint. In the case of olive flint, retouched tools are dominant, covering almost the total of the artefacts, while during the Final Neolithic, this percentage is lower since utilized blanks increase.

The above observations on the preferences of raw materials in relation to tool types could be connected to the nature of each raw material. For instance, the already sharp and fragile obsidian was mainly used unmodified. However, in the case of thick flakes, it seems that they were further modified. Quartz and quartzite were rarely retouched, probably due to the quality of the material and their expedient use. On the contrary, flints (mainly of excellent quality), radiolarite of excellent quality and chert are easier to be knapped and get retouched for the desired tool types. Raw materials that were not abundant during the Late Neolithic, like olive flint and yellowish brown flint, were used more intensely, probably to economize the raw material. Another reason might be related to the blanks that each raw material produced. For instance, quartz and quartzite produced mostly flakes and blade-flakes, which were not that suitable for sickles or sickle elements, or to apply modifications as in the case of projectiles, etc. Conversely, flint, chert and radiolarite produced longer and thinner blanks, probably easier to get retouched, but also to get repaired intensively due to their size.

5.4.3 Other characteristics of tools

Blanks used for further modification

An important parameter of tool analysis is related to the morphology of the preferred blanks for tool production. The blanks used for tools are largely represented by blades during both chronological periods (LN: 89%, FN: 90%). On the contrary, a small number of tools were shaped on flakes (LN: 5%, FN: 6%), microblades (LN: 3%, FN: 2%) and blade-flakes (LN: 2%, FN: 3%).

Blades were used for the shaping of almost all tool types, except for retouched flakes during both chronological periods (Fig. 5.27, 5.28). During the Late Neolithic, the highest representation of blades is documented at retouched (95.2%) and unretouched (90.8%) sickle elements, blades with lateral retouch (95%), scrapers (90.3%), perforating tools (88.8%) and burins (87.5%). Blades were less preferred in the cases of splintered (65.5%) and backed pieces (63.6%), truncated (55.5%) and denticulated tools (45.4%), as well as notches (55.5%) and projectile points (54.5%). However, geometrics and composite tools are exclusively shaped on blade blanks.

The presence of flakes and blade-flakes in the tool groups are well represented at denticulated tools (almost 54%), notches (33.3%), splintered (27%) and backed pieces (27.3%), as well as projectile points (27.2%). They were less used for truncated tools (11.1%), scrapers (9.1%), burins (8.3%) and perforating tools (7.1%), while few cases are connected to retouched (2.5%) and unretouched (4.5%) sickle elements. Of course, there is also the type of retouched flakes, which covers 0.9% of the total number of tools. As for microblades, they are mainly related to notched (11.1%) and backed pieces (9%), perforating tools (5.3%), lateral retouch (5.2%), burins (4.1%), retouched (2.1%) and unretouched (4.5%) sickle elements and few end-scrapers (0.4%).

During the Final Neolithic blades were used mainly for retouched (94.5%) and unretouched (89.2%) sickle elements, blades with lateral retouch (95.2%), scrapers (93.7%), perforating tools (88.2%) and burins (82.7%). At the same time, an increase of blade blanks is observed at splintered (72.6%) and backed pieces (79.5%), as well as truncated (80.4%) and notched tools (56.25%). The representation of blades at denticulated tools remain small (45.4%), while at geometrics (83.3%), composite tools (92.3%) and projectile points (35%) decreases.

Flakes and blade-flakes were also used as blanks in the production of denticulated tools (almost 33.3%), notches (25%), splintered (23%) and backed pieces (20.4%), but are less represented in comparison to the previous period. A decline in the use of flakes and blade-flakes is also observed at scrapers (6.2%), truncated (4.8%) and perforating tools (5.5%). On the contrary, projectile points (65%), burins (17.2%) and retouched (3.2%) /unretouched (8.2%) sickle elements on flakes seem to increase. Additionally, the type of retouched flakes slightly declines (0.6%).

Microblades are well represented in the categories of notched (12.5%) and backed pieces (9%) perforating tools (6.2%), lateral retouch (4.7%), burins (4.1%), retouched (2.2%) and unretouched (2.2%) sickle elements. However, during the Final Neolithic period microblades are also used at more tool types like truncated tools (14.6%), geometrics (11.1%), denticulated (8.3%) and composite tools (7.6%), as well as splintered pieces (0.8%).

The dimensions of tools

The dimensions of chipped stone tools seem to be relevant to the desired tool types, while the raw material used at each case also plays an important role. Tools are longer in the case of laminar products. For example, blades with lateral retouch, sickle blades (retouched and unretouched) and sickle elements that are destined for specific activities need to have a particular size for their hafting. Between the two chronological periods, some differences are recorded regarding the dimensions of tools. The examination of each raw material in comparison to the tool's dimensions could shed some light on these differences (Fig. 5.29-5.34, see also Fig. 4.103, 4.127).

The unretouched and retouched sickle blades are the tools with the largest dimensions, as they have been defined in this study (longer than 5cm). During the Late Neolithic, their size varies from 5.8-9.4cm (average 5.8cm) and 5-10.6cm (average 6.5cm), respectively, while during the Final Neolithic, sickle blades range from 5-10.6cm (average 6.4cm) and retouched sickle blades from 5.1-12cm (average 6.7cm). The length of the Final Neolithic blades is slightly larger than in the previous period. The main raw materials for their production during the first period are chert, radiolarite and gray flint, while during the Final Neolithic larger dimensions are attested mostly at blades of gray and yellowish brown flint, as well as pale brown flint. The width and thickness of the tools do not vary a lot; however, the retouched sickle blades of the Final Neolithic are a bit thicker (0.1-0.2cm).

In the case of sickle elements, there are no significant changes between the two periods, but the Late Neolithic blades seem to be narrower. Pale brown and reddish brown flint produced longer tools during the Late Neolithic, while at the later period, yellowish brown flint is differentiated in size when compared to the rest materials. Similarly, retouched sickle elements have almost the same dimensions between the Late and the Final Neolithic. The larger tools are made of chert and pale brown flint at the Late Neolithic material, as well as quartzite and olive flint for the Final Neolithic assemblage.

As regards scrapers, radiolarite, gray and yellowish brown flint produced larger tools at the Final Neolithic period. The cases of end-scrapers at long blades are recorded for gray flint in the Late Neolithic material and gray flint, radiolarite, yellowish brown flint and pale brown flint for the Final Neolithic.

The type of blades with lateral retouch of the Late Neolithic represents longer products, mainly connected to chert, gray and black flint. During the Final Neolithic gray and pale brown flint, as well as radiolarite, produced longer blades.

The dimensions of perforating tools do not show any significant differences. Chert and pale brown flint for the Late Neolithic, as well as radiolarite, yellowish brown and olive flint for the Final Neolithic, represent the longer tools. Concerning the thickness of the active point, we observe that this is slightly thicker at the Final Neolithic tools (average: 0.29cm) in comparison to the previous period (average: 0.23cm).

As for truncated, notched and denticulated tools, they are longer at the Late Neolithic period with gray flint to produce larger in size tools and obsidian to stand out for denticulated tools. Among the Final Neolithic tools pale brown flint artefacts have the larger dimensions.

Backed tools and burins are larger during the Final Neolithic with yellowish brown and gray flint to produce longer tools, as well as pale brown flint for burins. Burins of chert and olive flint also have large dimensions during the Late Neolithic period.

The only geometric of the Late Neolithic material is smaller in size in comparison to the Final Neolithic tools, where geometrics of radiolarite and chocolate flint are larger in length.

Splintered pieces show no significant period-specific differences. However, the size of the tools depends not only on the initial size of the blank, but also the degree of use and damage of the tool. Splintered pieces of olive flint during the Late Neolithic and yellowish brown flint during the Final Neolithic involved larger tools.

The retouched flakes of the Late Neolithic are larger than in the later period, mainly due to radiolarite and gray flint while flakes of yellowish brown flint and chalcedony of the Final Neolithic material are also larger.

Finally, in the case of composite tools, the dimensions of the Final Neolithic tools are slightly larger, with tools of pale brown flint to be longer and wider.

In general, it seems that during the Late Neolithic period, the tool types that are longer in comparison to the Final Neolithic material include blades with lateral retouch, truncated, notched and denticulated tools as well as retouched flakes. On the contrary, retouched and unretouched sickle blades, scrapers, backed tools, burins, geometrics and composite tools have larger dimensions during the Final Neolithic. Finally, almost similar dimensions at both periods are recorded in the case of sickle elements (retouched and unretouched), perforating tools and splintered pieces. Additionally, tools with large thickness are related to denticulated, splintered pieces, retouched flakes and composite tools, but also some cases of backed pieces, perforating tools and scrapers. As for the width of the tools, retouched flakes, but also splintered pieces, notched, denticulated and backed tools, as well as some cases of scrapers and sickle blades have greater values. Between the two chronological periods, the deviation of width and thickness varies, while some tool types have a similar size.

If we turn to the raw materials involved in each case, we observe that during the Late Neolithic tools of gray flint and chert have longer dimensions in most tool types, but also radiolarite in some cases. The Final Neolithic yellowish brown flint stands out with larger sizes in many tool types, but so does pale brown flint. These materials are represented by almost all tool types and mainly laminar tools. On the other hand, the products of quartz, quartzite and chalcedony, but also some cases of chert and radiolarite are thicker and wider than those made of flint.

The above observations on the dimensions of retouched tools seem to be similar when the unretouched blanks are examined. Thus, it is not surprising that during the Late Neolithic, gray, olive, yellowish brown and pale brown flint, radiolarite and chert produced longer blade blanks. Similarly, blanks of yellowish brown flint, olive flint, radiolarite, gray and pale brown flint have larger dimensions in comparison to the rest raw materials during the Final Neolithic. On the other hand, black flint of the Late Neolithic period never exceeds 5.1cm in length and the material must have derived from small cores, which were intensively exploited. The same small dimensions are also recorded in most cases of reddish brown flint and obsidian blanks with few exceptions. The case of quartz and quartzite is differentiated, first because these materials produced shorter blanks, which are more thick and wide, but also because they are mainly related to flake and blade-flake products used to a limited degree.

At the same time, the initial size of the raw nodules demonstrates larger dimensions for radiolarite and quartz, while the size of some crested blades of radiolarite, pale brown and gray flint also point to this direction for these raw materials. Additionally, the production of specific blanks depending on the raw material properties affected the initial size of the products. For instance, even though quartz raw nodules are large, the properties of the raw material and its quality do not permit the extraction of long and laminar products. Moreover, the knapping techniques used and the skills of the manufacturers to produce but also to modify blanks of specific dimensions is another important factor (Perlès 1992a, 233-234; Tringham 2003, 91). Standardization in the size of sickle elements is observed to a great degree and is probably connected to the insertion of the tools to the hafts, which probably required specific dimensions. Likewise, the end-scrapers, in most cases, must have wide and thick working edges to achieve their function. As for the rest tool types, on the one hand, the initial retouch and modification, but also the degree of use, the intensive resharpening and their recycling can change their size. For instance, the systematic renewal of end-scrapers' working edge can reduce the tool's length, or similarly, the resharpening of blades can decrease their width.

These observations indicate that the nature of the raw materials affected the size of the tools and that the desired tool products resulted in specific raw material choices. The availability of excellent quality regional raw materials in the case of the Anarghiri IXb settlement allowed the knappers to choose the best raw material quality for producing certain tool types that would be used for specific activities. Consequently, the uses that the tools were designed for, but also the technical skills and the knowledge of the producers, would probably be important factors in selecting the proper raw material for producing specific tool types.

Patterns of controlling size

To control the size and achieve the desired dimensions of the tools, the prehistoric knappers used a variety of strategies. Production of blanks with the appropriate size during the core reduction is perhaps the most straightforward method, but additional techniques were applied to achieve the required tool size (Perlès 1992a, 235-236; Tringham 2003, 91-97).

The deliberate fracturing of one end of the blank (proximal or distal) or both ends could easily give the desired dimension to the product. However, this method was applied to a limited degree during both chronological periods (LN: 6%, FN: 5%). Deliberate fracture is recorded at almost all tool types but mainly in the case of sickle elements and blades with lateral retouch. On scrapers and perforating tools, the fracture is sometimes recorded at the opposite end of the active part of the tool. Deliberate fracturing has also been documented on utilized blades with use removals. Between the two chronological periods, sickle elements (retouched and unretouched) are mainly implicated, covering more than 50% of the cases (Fig. 5.35). However, during the Final Neolithic, deliberate fracture is more usual at retouched sickles, blades with lateral retouch and scrapers. In contrast, perforating tools, notches and burins are more implicated during the Late Neolithic.

Truncation is another way to reduce the size of a tool and is a technique used on various types of tools. Although this is identified and recorded as a specific tool type (sometimes with a certain use), in the material of Anarghiri IXb, truncation seems to have been applied in many cases to shorten the ends of a blade or flake. However, the degree of truncated tools is also small during both periods (LN: 2%, FN: 1.8%). Truncation is common at sickles and retouched blades, as well as other tool types like end-scrapers, perforating tools, denticulated and backed artefacts. Double truncation is the kind of retouch applied in the shaping of geometrics. It is also recorded in a small number of artefacts as the only modification, where the active edge bears traces of use removals and could be used not for tool shaping but as the active part of the tool. During the Late Neolithic, truncation is mainly recorded at retouched sickle blades/elements covering almost 2/3 of the cases. Conversely, truncated sickle blades/elements during the Final Neolithic correspond only to 35%, while scrapers, lateral retouch, perforating tools, backed and splintered pieces are more represented than in the previous period (Fig. 5.36).

According to the above observations, it seems that the prehistoric knappers produced their tool blanks in the desired dimensions during the initial flaking. Small percentages are related to later interventions to control their sizes, like truncations and deliberate fracture. This could possibly be related to the technical choices and skills of the manufacturers to prepare the core and produce the desired products.

5.5 The use and treatment of chipped stone tools

5.5.1 The use of chipped stone tools

The prehistoric inhabitants used chipped stone tools for a variety of daily activities. The contribution of use-wear analysis and experimental research has provided useful information in this direction. In many cases, chipped stone analysis has evidenced that prehistoric tools were multifunctional and that the form and function of a tool are not necessarily connected (Andrefsky 1998, 189). In Greece, few functional analyses on prehistoric chipped stone tools have been carried out in the last decades, including Franchthi, Lerna, Sitagroi and Stavroupoli (Kozlowski et al. 1996; Skourtopoulou 2004; Tringham 2003; Vaughan 1990).

Although the present study is based on a macroscopic examination, possible uses of the tools can be proposed according to already existent schemas related to their morphological criteria and the visible traces of use. The first case refers to the recording of retouch types, the characteristics of which can imply possible tool types, therefore, possible uses of the tool. In the latter case, focus is on visible traces of use that include the presence of silica gloss and splintering (Skourtopoulou 2004, 363-365). Utilized blanks with use removals have also been recorded. Still, there is a low percentage of accuracy in a macroscopic examination and thus, there is only a small reference for this category. In the following pages, an attempt to highlight some of the potential uses of the chipped stone tools from Anarghiri IXb will be made, in relation to published studies of similar materials.

Cutting tools

Tools used for cutting involve mainly blades with lateral retouch, sickle blades/elements (retouched and unretouched), denticulated tools, retouched flakes, backed tools and sometimes truncated and notched tools. Blades with lateral or bilateral retouch and blades with denticulations refer to tools whose cutting edge/edges sometimes bear denticulations or notches. Retouch is mainly continuous, short, semi-abrupt, or low with straight or regular delineation. These tools were used for cutting hard or soft materials, like wood, bone, hide, or meat (Kozlowski et al. 1996, 307, 310, 324; Perlès 2001, 205), while the presence of retouch at their active edge usually points to their resharpening. Backed tools are also included in this category since the backed edge does not correspond to the active part of the tool, which is related to the opposite sharp cutting edge, usually retouched. The same can be supported in the case of truncations since they were mostly used for shaping the tool, while the cutting edges constitute the active part of the tool. Nevertheless, it seems that truncations were also used as the active part of the tool related to other activities, like planning wood (Kozlowski et al. 1996, 310).

The most characteristic tool type related to cutting activities are sickles (retouched or unretouched). The tools are strictly defined by the presence of sickle gloss at the one or both cutting edges. Experiments indicate that the use of these tools is connected to the processing of plants since gloss is developed when the tool comes into contact with plants rich in silicon (Kozlowski et al. 1996, 307, 324; Perlès 2001, 205). Thus, the tools were probably used for horticultural activities (harvesting, field clearance, etc.). Nevertheless, use-wear examination and experimental work have also demonstrated that sickles could serve some other activities as basketry working, reed and rush work, skin or clay working that could produce a macroscopically similar gloss (Perlès 2001, 205).

Similar uses have been also proposed for retouched blades that do not have sickle gloss. The similarities observed at some cases to the sickles could demonstrate their use for the same activities, where the sickle gloss has not been developed yet or is macroscopically invisible (Skourtopoulou 2004, 368). Furthermore, the utilized blanks that bear visible use retouch might have been involved in cutting activities of hard or soft materials (cutting tools *a posteriori*) (Ibid.). As has been demonstrated in the present study, this group is highly represented in the Anarghiri IXb industry and sometimes, their number overcomes the retouched tools (depending to raw material). They mostly include blades and less often microblades, flakes, or blade-flakes.

In general, cutting tools represent the majority of tools during both the Late and the Final Neolithic. In the Late Neolithic cutting tools make up 63% of the total number of tools, while 51% have traces of sickle gloss. During the Final Neolithic period, the percentage of cutting tools decreases to 59% and a small reduction of tools with sickle gloss is also observed (45%). If we include in the category of cutting tools the unretouched blanks with use removals (cutting tools *a posteriori*), then the representation of cutting tools is much higher (LN: 77%, FN: 72%), with sickles to correspond to almost 1/3 of the tools.

Scraping tools

End-scrapers, side-scrapers and double end-scrapers are included in this category. They are typologically defined by the formation of an abrupt or semi-abrupt working edge at one or both ends of the tool or at one or both side edges. The angle of the active part is usually between 70-90^{o} allowing the edge to scrape, while it is not acute enough for cutting (Andrefsky 1998, 193).

Scrapers were mainly used for animal skin working, but also for wood (Kozlowski 1996, 306) and clay working (Skourtopoulou 2004, 370). Other researchers suggest that they were used for cutting or engraving (Andrefsky 1998, 194). A tentative conclusion is, that differences in the morphology and shaping of the end-scrapers working edge might be related to the different functions or the different materials that the tool came into contact.

The presence of scrapers in the Anarghiri IXb assemblage during both chronological periods covers almost 1/4 of the total number of tools (LN: 23%, FN: 24%).

Perforating tools

Tools with an active pointed end are related to boring of soft or hard materials, like bone, antler, shells and even stone, but are also implicated in activities as basketry and hide working (Karimali & Karabatsoli 2010, 348; Kozlowski et al. 1996, 323-324; Perlès 2004, 151-152; Skourtopoulou 2004, 369). Additionally, perforating tools with an active wide point are suggested to have been used in the making of mending holes and making the perforation on sherd spindle whorls (Perlès 2001, 205).

The number of perforating tools in the Anarghiri IXb settlement is low (6%) and remains unchanged between the Late and the Final Neolithic period.

Splintered pieces

The identification of splintered pieces is mainly connected to the traces of use that are present at the blank's extremities, described as elongated removals created by direct percussion. Usually, these tools are referred to as intermediate tools (wedges) used in indirect percussion to produce wooden or bone tools (Andrefsky 1998, 119-120; Kozlowski et al. 1996, 310; Moundrea-Agrafioti 1981, 130-131; Perlès 2001, 205). Some other researchers consider splintered pieces as cores' remnants that were probably discarded or had a primary use as bipolar micro-cores and later were used as wedges (Conolly 2008, 78). Additionally, other interpretations propose their use as tinder-flints for striking fire (Kardulias & Runnels 1995, 82; Kyriakidou 1991, 51; Manolakakis 2005, 28).

Most splintered pieces from Anarghiri IXb bear traces of the first or second stage. They represent 3% of the tools during the Late Neolithic period and their number increases during the Final Neolithic (5%). In most cases, they are the result of tool recycling, sometimes after two or more different uses of the tool. The macroscopic traces of use point to irregular bipolar scars that do not show any structured reduction. The most possible interpretation for the use of splintered pieces is that they served as intermediate tools (wedges) for working hard or soft materials, a hypothesis that should be tested by use-wear analysis.

Engraving tools

Burins are usually connected to the engraving of soft and hard materials, as bone and antler (Andrefsky 1998, 155; Karimali 2005a, 198; Kozłowski et al. 1996, 324). The same uses have also been proposed for perforating tools, truncations and geometrics (Andrefsky 1998, 194-196; Tringham 2003, 104).

The presence of burins at the Late Neolithic layers represents only 3% of the tools and remains almost unchanged during the following period (2.8%).

Hunting/fishing tools

Projectile points are simple or more sophisticated manufactured (bifaces) elements that were hafted on a spear or arrow. Their use is mainly connected to hunting activities or warfare (Runnels 1985, 381). However, other uses have been proposed, including cutting, scraping, boring and engraving (Andrefsky 1998, 191-192; Karimali & Karabatsoli 2010, 346; Skourtopoulou 2004, 369-370). Another suggested use is fishing, as it has been proposed in the case of the Neolithic lakeside settlement of Dispilio, but also at the Neolithic settlement of Saliagos (Almatzi 2002, 139; Evans & Renfrew 1968, 78). Similar activities are connected to geometrics, which were used as inserts for projectiles, but also for many other activities (Andrefsky 1998, 194-195; Perlès 2001, 205; Tsagkouli 2002, 152-153).

In the case of the Anarghiri IXb material, the number of projectile points and geometrics is rather small during both chronological periods, covering 1% for the Late Neolithic and 2% for the Final Neolithic period. As regards their use, cutting activities can be connected to a few projectiles with deliberate fracture and/or presence of sickle gloss, like some of the geometrics. Additionally, a leaf-shaped projectile of the Late Neolithic layers with traces of abrasion at its active point might indicate its secondary use as a borer. In most of these cases, a different function can be supported, related to a second life-cycle of the tool, but it also seems that some projectile points come from the modification of sickles.

On the other hand, although the use of some projectiles is evidenced by the fracture of the tip or other parts of the tool, there are few cases that the projectile point seems to be intact, probably because it was not used. This is the case of the large spearhead of yellowish brown flint of the Final Neolithic period. Additionally, the one obsidian projectile point also does not seem to bear any trace of use, while the second one is broken at its base and slightly on its tip. It could be supported that some tools were not related to a practical use, but could have a symbolic value. The excellent quality material, which is exotic, the superior quality of manufacture and the high skills required for the production of the above-mentioned projectiles, could indicate that they were part of goods' exchange or gifts bearing special meanings (e.g., status items). The symbolic meaning of some unique arrowheads of highly skilled craftsmanship has already been supported in some cases for the Late Neolithic period, as well as the triangular spearheads of the Final Neolithic (Perlès 1992b, 143). Similarly, in the case of the Late Neolithic Drakaina Cave in Kephalonia Island (Ionian sea), the numerous arrowheads that were found were interpreted into symbolic and communal events related to hunting (Stratouli & Metaxas 2009, 322-323; 2018, 308-309), as well as at Skoteini Cave (Tharrounia, Evvoia), where the arrowheads were not used and regarded to participate in rituals (Sampson 1993, 71).

Composite tools

In the present study, composite tools refer to a tool type that combines an end-scraper's working edge at one narrow end and a pointed end at the opposite. The tools morphologically imply their use for more than one task that, in this case, engage both scraping and perforating. However, their percentage among tools is small (LN: 0.4%, FN: 0.5%).

Patterns of tools' hafting

Although this study is based on macroscopic observation, the hafting of tools can be proposed in some cases, taking into consideration the visible traces (e.g., sickle gloss) or some morphology of retouch that could imply the possible hafting of the tool (Perlès 1992a, 236).

The case of sickle blades/elements is the most characteristic evidence of tool hafting. The surface of the tool that was in contact with the material bears the characteristic sickle gloss, in contrast to the part that was put in the haft. It is one of the cases that the macroscopic observation coincides with the microscopic examination (Tringham 2003, 121). In the case of Anarghiri IXb, sickles are the most numerous tool type -whether retouched or unretouched- bearing visible silica gloss (51% of the Late Neolithic tools, 45.4% of the Final Neolithic tools). The detailed recording of the tools' characteristics demonstrates that most sickles were put in a parallel direction to the haft. Less are the cases of sickles that were hafted diagonally, as is well-known from the Chalcolithic Bulgarian sites (Karanovo sickles, Gurova 2016, 159-162). However, there are some cases where both ways of hafting were recognized at the tool. Additionally, an increase in the number of sickles with parallel direction of sickle gloss is recorded during the Final Neolithic (LN: 63%, FN: 72%). As for the intensity of sickle gloss, it is mostly of medium and high degree pointing to a relatively intense use of the tools, with a small decrease during the Final Neolithic (LN: 83%, FN: 75%). As regards the haft, it could be suggested that at the Anarghiri IXb settlement, it was probably made of wood. Preliminary work on bone tools and the analytical study of antler tools has not provided a single bone/antler haft for sickles (Arampatzis, pers. communication). The same is suggested for other lithic industries in Greece since there is no evidence of antler or bone haft that could be related to sickle hafting (Karimali & Karabatsoli 2010, 347; Moundrea-Agrafioti 1981, 112).

The other cases where a possible hafting of the tools could be supported include backed and shouldered tools (Andrefsky 1998, 163-167). The first case refers to the shaping of a backed edge at the one side of the tool with abrupt continuous removals, to facilitate use of the opposite active edge. Microware analysis has demonstrated that the backed edge didn't have an active function (Kozlowski et al. 1996, 324). Probably it was a way to make an edge dull and enable the handling of the tool by bare hands or by hafting. The shaping of a backed edge is recorded to a small number of tools in the Anarghiri IXb material (LN: 3%, FN: 6%). In the case of sickles, a backed edge at the opposite side of the one with the sickle gloss points directly to the hafting of this area. However, the shaping of a backed edge is also encountered at many other tool types, or it is the only modification of the tool. It is also present to some recycled tools as the primary tool modification (e.g., recycled end-scrapers, perforating tools, splintered pieces, etc.). The majority of backed tools during the Late Neolithic are related to sickle blades/elements covering almost 39%. Backed tools with no further modification represent 36%, while end-scrapers (19%), perforating and composite tools (3% each) are less represented. During the Final Neolithic, the shaping of a backed edge continues to be more common at sickle blades/elements (44%), as well as backed tools with no other modification (33%). The participation of end-scrapers decreases (14%), while perforating tools slightly increase (4%). There are also some new categories implicated that include splintered pieces (3%), denticulated tools and geometrics (1% each) (Fig. 5.37).

A similar case of possible tool hafting refers to the formation of a shoulder by retouch, present in many tool categories, but again in small percentages (LN: 2%, FN: 3%). The formation of a shoulder is mainly recorded at retouched sickle blades/elements and blades with lateral retouch, while it is also present at recycled tools (end-scrapers, perforating tools, splintered pieces, composite tools). In a few cases, there is a combination of a shoulder and a truncation. The formation of a shoulder usually enables the handling or the hafting of the tool. During the Late Neolithic, half of the shouldered tools are sickle elements, while the rest tool types are less represented (lateral retouch 14%, end-scrapers 9%, truncations 9%, perforating tools 4%, backed 5%, splintered pieces 5%, composite tools 5%). On the contrary, during the Final Neolithic shouldered sickle blades/elements decline in number (44%) and a significant increase is recorded at end-scrapers (33%). The number of blades with lateral retouch also increases (11%) and the rest tool types participate to a limited degree (Fig. 5.38).

Projectile points and geometrics were also hafted. The morphology, the shaping and the proposed use of these tools point directly to their insertion into a haft. Additionally, the morphology of the base of the projectile points demonstrates, in most cases, the way that the tool was hafted.

Taking into consideration the above categorization regarding the potential uses of tools at the Anarghiri IXb settlement, it is obvious that the majority of chipped stone tools were used for cutting activities of soft or hard materials during both chronological periods. The preparation of food, the wood and bone working, the clearance of fields are some of the related activities. A large part of the cutting tools seems to be connected to horticultural activities since they bear traces of sickle gloss, demonstrating the agricultural character of the settlement's economy. Animal skin working was another important activity of the settlement's occupants, also attested by the presence of antler tools for leatherworking (Arampatzis 2019, 216). The participation of chipped stone tools in the production of other tools or artefacts can also be supported indirectly. For example, perforating tools can be related to the manufacture of ornaments, beads of various materials (stone, shell, bone), the opening of holes for wooden and bone/antler tools. Likewise, splintered pieces could be used for the manufacture of wooden or bone/antler tools, while burins at the engraving and decoration of antler pendants (Ibid., 188) or other materials. Finally, a small number of tools is related to activities like hunting and possibly fishing since the exploitation of the lake's resources and hunting around the woods could be another part of the economy of the settlement. These activities are also evidenced by the presence of an interesting hunting and fishing equipment made of antler, like thumb rings, harpoons, harpoon heads and projectile points, mace heads and fish hooks (Ibid., 164-185, 216).

An observation regarding the activities reflected at the chipped stone tools through time is that there is not any significant change in the representation of tool types and the related activities between the Late and the Final Neolithic period. One could only mention a small decrease of cutting tools (sickles) during the Final Neolithic and the slight increase of scrapers, splintered pieces and hunting equipment (Fig. 5.39).

The proposed uses of the tools are merely based on morphological criteria and macroscopic examination. The application of use-wear analysis could provide specific information regarding the activities that the tools were implicated. Another important aspect that could provide information on the uses of chipped stone tools would be the areas that the tools were found and the activities that could take place in the domestic space. However, the lack of information concerning the settlement's spatial organization cannot contribute to this topic, at least for the moment.

5.5.2 The treatment of chipped stone tools

The treatment of chipped stone tools refers to the way the prehistoric inhabitants were managing with chipped stone tools after their production and during their use. The use of tools in various activities could result in the damage of the active part of the tool, which was either discarded or maintained and recycled. The concept of maintenance of chipped stone tools refers to the strategies of the prehistoric people to maximize the utility of a tool and prolong its use-life. However, tool maintenance is not characterizing all chipped stone industries, or all raw materials involved in tool production (Andrefsky 2009, 71; Odell 1996, 54-62; Perlès 1992a, 239; Tringham 2003, 113-115). The archaeological record can provide information on how prehistoric tool-makers/users maintained their toolkit and prolonged the use-life of tools, as well as the factors that could affect these choices, like raw material economy, technical possibilities of transformation, symbolic value of the artefacts, etc. (Perlès 1992a, 239-241). The information deriving from the chipped stone tools regarding these strategies includes the resharpening of the active edge, the multiple utilization of a tool for the same or different activities, or recycling. Use-wear analysis could contribute significantly, but as already mentioned, the macroscopic examination of the present assemblage can only allow some observations and comments.

The strategy of chipped stone tools' maintenance at the material of Anarghiri IXb can be easily detected in the case of sickles. Sickle blades/elements with lateral retouch point to the resharpening of the sickle to make its cutting edge sharp and functional again, when the latter is blunted. During the Late Neolithic period, the number of resharpened sickles comprises 150 implements, that is, 16.4% of the total number of tools and 32% of the total number of sickles. The respective number of Final Neolithic retouched sickles is 450 tools and covers 19% of the total number of tools and 42% of the sickles. In most cases, lateral retouch interrupts the sickle gloss, demonstrating that the blade was used in touch with plants and then its edge or edges were retouched to get renewed. Retouch is usually continuous, short and semi-abrupt. However, there are sickle blades/elements where sickle gloss is developed again on the retouched edge, pointing to many successive use-cycles or renewals of the tool's active edge. In the same schema, we could consider that blades with lateral semi-abrupt or low retouch could respond to a similar strategy of maintenance since their active edges were resharpened by removals.

The resharpening of the active cutting edge/edges is also attested at other tool types, like recycled tools involving scrapers, perforating tools, etc., where the sickle gloss of the probable primary use of the tool is again interrupted by lateral retouch. The total percentage of resharpened tools, including sickles, reaches 25% for the Late Neolithic and 36% for the Final Neolithic period (Fig. 5.40).

As regards the raw materials that the tools were made of, they include blades of almost all raw material categories with gray flint, pale brown flint, black flint and radiolarite to be the most common during the Late Neolithic, while in the later period the participation of yellowish brown flint is also significant (Fig. 5.41).

In the case of heavily retouched tools, we could also assume a strategy of resharpening, probably in many repeated cycles, since intensive retouch usually results in the formation of almost abrupt edges. The application of heavy and intense retouch is recorded at 8% of the tools of the Late Neolithic period and 15% at the Final Neolithic period. The commonest tool types for both chronological periods include scrapers, while perforating tools, retouched sickle blades/elements and blades with lateral retouch follow in number. In almost all cases, the tools bear bilateral retouch with continuous and abrupt removals, while sometimes sporadically preserved sickle gloss is recorded. Few are the cases that involve backed, denticulated, notched and splintered pieces, as well as geometrics. However, the majority is represented by recycled tools (Fig. 5.42). Regarding the raw materials transformed by heavy retouch, gray flint covers almost half of the tools during the Late Neolithic. Pale brown flint, chert and radiolarite are also well represented, while there are few tools of black and yellowish brown flint. During the following period, the majority of tools are represented by pale brown and yellowish brown flint, with gray flint and radiolarite to follow. Few pieces refer to obsidian, chert and excellent quality chalcedony. In general, most of the above-mentioned raw materials are of excellent quality (Fig. 5.43).

Another case that demonstrates the maximization of tool use is related to blades that have both their cutting edges used. Since this study is based on macroscopic examination, this could be better observed at tools like blades with bilateral retouch, sickle blades/elements with bilateral retouch, but also in the cases of unretouched sickles that bear bilateral sickle gloss. In all these cases, the use of tools is not restricted to the one cutting edge, but the use of the opposite cutting edge is also attested, as evidenced by the presence of retouch and/or sickle gloss (Fig. 5.44). The blades bearing bilateral sickle gloss cover a small number among the sickle blades during both chronological periods (LN:16%, FN: 14%). In the case of retouched sickles with bilateral sickle gloss or presence of bilateral retouch, the percentages are higher, covering 30% of the retouched sickles at both the Late Neolithic and the Final Neolithic. Finally, the percentage of bilateral use at retouched blades that do not bear sickle gloss corresponds to 33% during the Late Neolithic and 42% during the Final Neolithic. In general, the percentages recorded for the two chronological periods do not show any significant changes, apart from the increased number of blades with bilateral retouch during the Final Neolithic period.

Moreover, composite tools constitute a tool type that demonstrates a strategy of tool economy and maximization of a blank's use. This is not related to maintenance or recycling of the tool, but the combination of two or more tool types in only one artefact. This is a certain way to optimize the use of a tool. In the present study, composite tools combine an end-scraper's working edge and a perforating point at the same tool. Their number is small and does not seem to change between the Late and the Final Neolithic period (LN: 0.4%, FN: 0.5%). They are made of excellent quality flints and radiolarite, including yellowish brown flint during both periods (LN: 25%, FN: 15%), while in most cases, they result from already recycled tools.

Another strategy for prolonging the use-life of a tool is recycling, which is the modification of the initial tool in a second different form that implies a different function. The most usual tool types that are the result of recycling include scrapers and perforating tools. However, splintered pieces are also represented, while few cases refer to burins, composite tools, geometrics, or projectile points (Fig. 5.45). Recycling is recorded at 25% of the Late Neolithic tools and 28% of Final Neolithic tools.

More precisely, during the Late Neolithic scrapers cover 72% of the recycled tools, followed by perforating tools (14%) and splintered pieces (9%). A small number refers to burins and projectile points. Almost half of the end-scrapers bear traces of sickle gloss at one or both cutting edges, which in most cases is combined with lateral/bilateral retouch, denticulations, or notches. The combination of end-scrapers with other kinds of retouch might possibly characterize them as composite tools. However, when sickle gloss is present, it is always interrupted by the removals for the shaping of the end-scraper's working edge, a fact that probably points to the second use of the artefact. The same is also recorded in many perforating tools. Splintered pieces is also a tool type with a high percentage of recycling (LN: 73%, FN: 75%). Most cases refer to blanks with lateral retouch and/or sickle gloss that were used secondarily as splintered tools. Additionally, a small number demonstrates that splintered pieces resulted from the third use of the tool (primary use as retouched sickle blade, second use as end-scraper). The few examples of burins include blades with sickle gloss that have a burin blow, which interrupts the polish of the cutting edge. In the case of projectiles, there are few tools with sickle gloss at one edge, which is interrupted by the removals for the projectile's shaping. The same has been recorded in the case of composite tools. During the Final Neolithic, the percentage of recycled scrapers is a bit lower (69%), while there is an increase at recycled splintered pieces (13%). The projectiles and burins are few, as well as composite tools.

If we turn to the raw materials related to recycled tools, it is obvious that during the Late Neolithic gray flint is mainly represented, followed by pale brown flint and radiolarite. During the Final Neolithic, the major raw materials include gray and pale brown flint, while an increase of yellowish brown flint and radiolarite is recorded (Fig. 5.46).

To conclude, some strategies in the tool management of the Anarghiri IXb material demonstrate the effort to prolong the use-life of some tools. The resharpening of sickle blades/elements and blades with lateral retouch, the application of heavy retouch, the use of both cutting edges of blades, the combination of two tool types at one blank are some of these. Additionally, the recycling covering almost 1/4 of the total number of tools points to an effort to maximize the use-life of the tools. These patterns are not irrelevant to the raw materials of the tools. As has been demonstrated, resharpening and recycling are mainly related to tools of excellent quality flints and radiolarite. Additionally, the blanks produced by these materials were usually longer, allowing several cycles of use and resharpening, as well as recycling. It is out of the question that quartz, quartzite and chalcedony of medium quality do not have this treatment. We should keep in mind that the latter raw materials were not usually retouched, probably due to their physical properties or even the type of blanks that they produced (mostly flakes and blade-flakes) and the activities that they were engaged. They were briefly used and then probably discarded with only a few cases of modifications. On the other hand, if we turn to obsidian tools, it is apparent that the material was used primarily in the form of unretouched blanks and less with further modification. This case is differentiated by the other excellent quality materials, possibly due to the physical properties of obsidian (easy to break) and the nature of the blanks. Obsidian blades and microblades were light and sharp, and not much modification could be applied (Perlès 1992a, 241). In the cases that obsidian resharpening or recycling is documented, this is mainly connected to thick flakes and larger blades, wider than usual.

In general, it can be argued that the strategies of tools' maintenance and recycling could be connected to an effort to economize the raw materials and prolong their use-life, with the further treatment of excellent quality materials. This suggestion is also reinforced by the increased number of technical pieces that were retouched and used as tools (LN: 22.4%, FN: 34.1%). In this case, the morphology of the blanks, as well as the raw materials involved, played a role in their choice. For instance, long crested blades or plunging blades were used retouched or unretouched, especially those of excellent quality materials.

Finally, as regards the patterns of tools' discard, this cannot be detected at this stage of research. The contribution of use-wear analysis could provide useful information to this subject. Additionally, the lack of evidence concerning the settlement's spatial organization is an important obstacle since a contextual analysis of the material is not possible to detect areas of discard, while the contribution of other archaeological material is also critical for supporting and demonstrating the rejection strategies.

5.6 Comments on the spatial distribution of the chipped stone artefacts

The large extent of the excavation at the Anarghiri IXb site covers horizontally almost all the area of the prehistoric settlement, offering the opportunity to investigate the occupation space and explore the areas of everyday activities in the settlement demonstrating the intra-site variation, at least for the Final Neolithic period which is adequately documented. However, since the analysis of the spatial organization of the settlement has not been completed yet, it is not possible to examine the spatial distribution of the chipped stone material and interpret its frequency and concentration in regard to household units, open areas or yards, refuse areas, etc.

For the moment, the only information concerning the organization of habitation space at the settlement of Anarghiri IXb derives from the study of wooden structures situated at the periphery of the settlement. These features involve the wooden trackways and fences located at the northeast and southeast periphery of the excavated area. According to the study of the material, it seems that the outline of the settlement at least to the northeast and southeast is defined by wooden fences. The chronology of two fences (Fence 3 and 8) located at the southeastern part of the periphery at the early Final Neolithic demonstrates a possible shift of the habitation space to the west-northwest in comparison to the previous chronological period (Giagkoulis 2019, 179; Vol.III, 29, Plan 29).

Despite the lack of any other available information related to the habitation space, a preliminary spatial distribution analysis of the lithic material in regard to the excavated area is attempted, to comment on the density and the horizontal variation of the material. Additionally, since the deposits of the Late Neolithic layers have only partially been excavated, the discussion will be limited to the material derived from the Final Neolithic deposits.

The studied lithic material of the Final Neolithic layers consists of 3965 artefacts derived from 107 trenches (10X10m^2) located east of the modern canal. Almost all the excavated trenches yielded chipped stone artefacts, varying in number from a single artefact to larger quantities, reaching 118 artefacts. On the contrary, few are the trenches that have not yielded any lithic material. For the present investigation, excavated trenches have been grouped into five categories according to the density of the lithic artefacts. Thus, there are trenches that produced 1-20 artefacts, 21-40 artefacts, 41-60 artefacts, 61-80 artefacts and these that yielded larger quantities containing more than 80 artefacts (maximum number 118) (Fig. 5.47).

According to the horizontal distribution of the lithic material, it is obvious that the higher density of artefacts appear as two clusters in trenches located in the northeast and central part of the excavated area (11 trenches). Significant quantities of lithic material (61-80 artefacts) are also recorded at many trenches covering mainly the central and south-southwest part of the excavation (18 trenches). A medium density of lithic material (41-60 artefacts) is observed at the central east and south-southwest area, with a couple of exceptions at the northern part (23 trenches). The trenches that yielded smaller quantities (21-40 artefacts) are less in number (8 trenches) and are dispersed at the north and central periphery. Finally, a small concentration of artefacts (1-20) derived from 46 trenches located at the periphery of the excavated area, mainly at the northeast and central excavation area and less at the south.

The above observations indicate that the major concentrations of the lithic artefacts are mainly recorded at the north-northeast and central part of the excavated area, with few cases at the south-southwest, oriented from northeast to southwest. Additionally, the density of the material declines as we move to the periphery with a couple of exceptions in the south part.

The picture of the horizontal dispersal is the same when tools are examined (Fig. 5.48). Similarly, the excavated trenches have been grouped according to the number of tools into six groups that comprise trenches containing 1-10 tools, 11-20 tools, 21-30 tools, 31-40 tools and 41-50 tools, while the last group includes trenches that yielded more than 50 tools (maximum number 71). The higher density of tools coincides to a great degree to the trenches showing larger concentrations of artefacts, located at the northeast and central-east part of the excavated area, as well as few isolated trenches at north and south (12 trenches). High concentrations of tools (41-50 artefacts) are also recorded at 11 trenches located at the north, central and southernmost part of the excavation. Additionally, 15 trenches yielded a medium number of tools (31-40), mainly located at the central and south-southwest part. Lower concentrations of tools (21-30 tools) are recorded at 15 trenches at the northeast and central part, as well as some isolated trenches at the south. Concentrations of 11-20 tools are documented at eight trenches close to the central periphery, but also a couple of cases in north and south. Finally, the trenches located at the northeast and central periphery of the excavation area show the lowest density of tools (1-10).

The above-mentioned data demonstrate the concentration of tools at the north-east, central and southwest excavated areas, with a northeast-southwest direction, while the density of tools at the periphery is low. Additionally, the trenches showing larger concentrations of tools are again located in the northeast and central parts, but also in the southeast part. Following the outline of the settlement as is rudimentary drawn by Fences 3 and 8 during the Final Neolithic period (see Giagkoulis 2019, Vol. III, 29, Plan 29) we could support that the higher concentrations of lithic material almost coincide with the area defined by the fences, while the density of the material declines significantly to the trenches located outside of the fences, at the southeast.

At this early stage of investigation regarding the spatial distribution of the chipped stone artefacts, some more observations could also be made regarding the distribution of the raw materials, the technological categories and the tool types of the Final Neolithic material. However, due to the lack of any other information related to the organization of space, it was decided to explore the general tendencies of the lithic material, setting some considerations for future investigation.

To demonstrate the horizontal variation of the raw materials, the technological categories and the tool types, the excavated area was separated in three main zones, including trenches at the north, central and south part, almost equally represented by the excavated trenches (33-39 trenches at each zone). For the raw materials, some variations regarding the density of different raw material categories are observed (Fig. 5.49). First of all, we should remind that during the Final Neolithic period, gray and pale brown flint represent almost half of the lithic material, thus their presence is high in nearly all trenches. When examining the representation of the raw materials, we observe that most of them are highly concentrated at the central part of the excavated area. More precisely, gray, pale brown and reddish brown flint, radiolarite, obsidian, quartzite and chert are present in higher quantities at the central part of the excavated area and less at the south and north area. In the case of chalcedony, its representation at the central and south part of the excavation is almost the same, while less material is concentrated at the north part. On the contrary, yellowish brown flint, olive flint and quartz are present in higher quantities at the south part of the excavation and less at the central and north.

Similarly, when we turn to the technological categories, the distribution of the lithic material provides some more information (Fig. 5.50). Blades are well represented in almost all cases, but they are mainly present at the central part of the excavated area. All debitage categories are mostly represented in the central part, in comparison to the rest excavated area, followed by the south part and less by the north excavated area. However, the concentrations of debris and projectile points are mainly recorded at the central and north part of the excavation (Fig. 5.51).

Moreover, the representation of specific tool types also varies at the defined excavated areas (Fig. 5.52). Unretouched sickles, scrapers, projectile points, notches and backed tools are more numerous at the trenches of the central excavated area. Additionally, the majority of retouched sickles, blades with lateral retouch, splintered pieces and retouched flakes derive from the southern part of the excavation. On the contrary, denticulated tools, burins and composite tools are more numerous in the north part. In the case of perforating tools and truncations, there is almost the same representation at the three defined areas, while geometrics are equally dispersed. (Fig. 5.53).

The tendencies observed at the representation of the Final Neolithic material regarding the distribution of raw materials, technical categories and tools point to some variations in the habitation space, which need further investigation. It should be stressed once again that the present examination is preliminary and based only on general comparisons among the excavated area with limited interpretative value for the moment. More specific and enlightening information could result from the study of the lithic material in the micro-scale of each trench and, of course, from the reconstruction of the spatial organization at the habitation area and the separation of house units, open spaces, etc. In this framework the differences recorded would contribute to the discussion regarding the use of space and the possible division of everyday activities practiced in the habitation area, like the identification of areas of tool manufacture, use and discard, but also to reveal potential variations among households or other areas of the settlement. Additionally, the contextual analysis of knapped stone combined with other archaeological material could also demonstrate the possible non-utilitarian character of some lithics indicating symbolic or social practices (Skourtopoulou 2006).

Chapter 6.

Chipped stone industries from northern Greece and southern Balkans. A comparative study

The lithic industry of the Anarghiri IXb settlement provides a comparative material of the Late and the Final Neolithic period from western Macedonia. To integrate the studied material with the general chronological and cultural framework of northern Greece and southern Balkans, the comparison to the lithic industries of contemporary prehistoric settlements is necessary. The correlations to the broader area can shed light on the strategies and the choices made by the prehistoric inhabitants of the Anarghiri IXb settlement, the communication and exchange networks, but could also contribute to the understanding of the changes that are documented in the lithic record between the two chronological periods of the settlement. In the following pages, published information of the chipped stone industries from northern Greece and southern Balkans will be discussed and compared to the material under study.

The first part focuses on the area of northern Greece, including settlements of western, central, eastern Macedonia and Thrace. Even though Thessaly is not part of northern Greece, the contribution of this area in the discussion is considered valuable due to the proximity to the area under study. Thus, some Thessalian settlements of the Late Neolithic period are also included. In the second part, information on lithic industries from the southern Balkans will be focused on the area of modern-day Albania, the Republic of North Macedonia and Bulgaria. However, the scarcity of lithic studies in the first two regions is problematic, while in the case of Bulgaria, a large number of lithic publications is available.

The criteria for choosing the settlements under comparison to the material of Anarghiri IXb are relevant to the geographical proximity to the study area and the chronological framework of the settlements (Late and Final Neolithic) (Fig. 6.1). The discussion will be based on information regarding the raw materials, the technological and typological characteristics, where available.

6.1 Chipped stone industries from northern Greece

In the last decades, an increase in the study of chipped stone from prehistoric settlements in north Greece is observed. Several excavated prehistoric settlements have produced a bulk of lithic assemblages and a shift in the specialized study of lithic materials is recorded. Apart from chipped stone reports and publications focusing on single sites, several synthetic works have also been carried out. A recent study conducted by Kakavakis is thoroughly referred to the chipped stone industries of Neolithic settlements of northern Greece, to investigate and interpret the diversification of the assemblages, which is recorded among the settlements during the Neolithic period (Kakavakis 2011). The recent work of Milić regarding the obsidian sampling and characterization should be also mentioned, part of which provides new information concerning the circulation of this raw material in the outer zone of northern Greece (Milić 2016). Another synthetic work has been conducted by Skourtopoulou on the lithic industries of central Macedonia, after the detailed study of the chipped stone material from the Neolithic settlements of Stavroupoli, Thermi B and Makriyalos (Skourtopoulou 2013).

Similarly, the examination of the lithic material from the Neolithic settlements of Dimitra, Dikili Tash and Promachon-Topolniča by Kourtessi-Philippakis, also provides interesting information for the region of eastern Macedonia (Kourtessi-Philippakis 2008b; 2009). In the region of Thessaly, the research of Moundrea-Agrafioti (1981), Perlès (1990; 1994) and Karimali (1994) have outlined the character of the lithic industries from this area. The next pages will provide an overview of the available information regarding the chipped stone industries from northern Greece and Thessaly.

i) Western Macedonia

In western Macedonia, there is a small number of studies or published lithic materials. Consequently, the reference to lithic industries of the region is limited to a few preliminary published reports. Before the examination of the broader region of western Macedonia, it should also be mentioned that many contemporary settlements were occupied during this period in the Amindeon basin. However, the chipped stone material derived from the excavations has not been studied yet, but similarities on the raw materials used and the tool typology of such closely located settlements can be expected (Papadopoulou, personal observation).

In the broader area of western Macedonia, an important Neolithic site is the lakeside settlement of Dispilio, located at the coast of Lake Orestias, in the Kastoria region. The ^{14}C chronology from the settlement demonstrated uninterrupted occupation from the Middle Neolithic to the Final Neolithic period, while a later occupation is also recorded during the Early Bronze Age and in the historical periods (Facorellis & Maniatis 2002; Facorellis et al. 2014; Karkanas et al. 2011). The chipped stone industry has been only preliminary reported (Doulkeridou 2009; Tsagkouli 2002) and studied in an unpublished MA thesis (Doulkeridou 2012).

The total number of chipped stone material counts more than 10.000 artefacts (until the excavation of 2008). The preliminary report provide information regarding the chipped stone artefacts from the Late Neolithic I occupation phase (Trench 4b, 82 artefacts) (Doulkeridou 2009, 27-36). The raw materials used for the production of chipped stone tools include good quality yellowish brown, brown and yellow flint (32.9%), dark reddish brown flint that resembles jasper (23.2%), black and gray flints of excellent quality (15.85%), various gray flints (15.85%) and finally flints of various qualities and colors (12.2%) (Ibid., 31). The petrographic examination of 49 samples indicates the exclusive use of radiolarian cherts (44%) and silicified carbonates (56%), materials that are present in the geological background of the region. However, siliceous limonite was not used and only a few pieces of quartz are present, even though the materials are abundant in the vicinity of the settlement (Dimitriadis & Skourtopoulou 2001, 784-785; Tsagkouli 2002, 148-149). Obsidian occur only in small quantities (approx. 2%). The analysis conducted by Milić included 58 obsidian samples from the Late and the Final Neolithic deposits, which were examined by the use of p-XRF. Eighty-one percent of the samples indicate a Melian provenance (Adamas source: 41%, Demenegaki source: 40%), while there is also a small percentage (19%) of Carpathian obsidian (Milić 2016, 198-199, 220-221).

Most of the material is derived from secondary sources, probably the Aliakmon River, close to the settlement. However, some excellent quality flints could derive from the mountains of western Macedonia and the Pindus range (Tsagkouli 2002, 149). Regarding the technological categories of the material, the products include mainly microblades and flakes, while blades are less represented. The first reduction stages took place away from the settlement, probably at the sources of the raw materials and the cores were imported prepared, or in some cases, only finished products were brought to the settlement. The tools were produced by the use of indirect percussion and direct percussion with a soft hammer. Almost half of the products were retouched (48.7%) with the most common tool types being blades with lateral retouch, sickle elements, perforating tools, end-scrapers and composite tools (Doulkeridou 2009, 32-33). Geometrics, as well as projectile points, are also reported (36 artifacts made of flint), including some cases of tanged-and-barbed projectiles with fine bifacial covering retouch (Tsagkouli 2002, 152-153, Fig. 6-7; 2017, 4, Fig. 2-3). Additionally, the resharpening of the blades and the recycling of the tools is also reported. The artefacts of Melian obsidian include finished products like blades, but also few waste and rejuvenation flakes. No cores of this material were found and the products were introduced into the settlement as finished tools, with a small number to be retouched (retouched blades, end-scraper). The Carpathian obsidian is represented by flakes, debris and two prismatic blades, which are considered imported with no on-site flaking to have taken part (Milić 2016, 221).

Close to the settlement of Dispilio, about 10 km southwest of the lake Orestias, the Neolithic settlement of Avgi is located. It is a flat-extended settlement which is represented by three occupation phases (Avgi I-III). The radiocarbon dates demonstrate that the settlement was first inhabited during the MN period (5700-5300 cal BC) and the occupation continued to the LNI (5300-4800 cal BC) and the LNII (4800-4500 cal BC) periods (Stratouli 2013; 2019, 110-114).

The study of the chipped stone artefacts from Avgi is still in progress. However, some preliminary reports have been published (Andreasen 2008; 2011). A total of 1567 artefacts has so far been analyzed deriving from specific areas of the settlement (Area 5 and open areas East and North of Area 5) focused on the securely stratified deposits (n:963), while another 1442 chips have been recovered from the flotation of soil samples. The raw materials used for the chipped stone production are characterized by the dominance of chert, which is present in the form of pebbles or tabular cores in a variety of colors, textures and qualities. Pale brown, brown, black, gray and dark gray flint are present. Additionally, there is a tiny percentage of a material that macroscopically resembles obsidian (< 0.9%). A small survey conducted in the nearby Aliakmon riverbed demonstrated the presence of quartzite, re-silicified limestone and radiolarian cherts, but of poor knapping quality, while no chert pebbles were found (ibid.).

The few cores (3.1%) and cortical flakes (7.8%), as well as secondary crested blades (0.4%), indicate that small-scale knapping was taking place at the settlement. The products are mainly represented by blades and bladelets (55.8%) and less by flakes (32.7%). Part of the bladelets was manufactured by local producers, but with limited technical investment. On the contrary, it seems that the occupants of the settlement were mainly importing finished tools and prepared prismatic cores by producers outside the valley. The majority of products includes prismatic tool blades with prepared butts, demonstrating a degree of technical skills (ibid.).

The tools cover almost 1/3 of the Avgi industry (n:245), while a significant number of unretouched products was also used since they bear macroscopically visible use wear (30%). The majority of tools were made on blade blanks (80-90%) and involve sickle elements (23.4%), retouched blades (12.6%), truncations (13%), perforating tools (10.6%), notches (2.8%) and end-scrapers (1.6%). Flakes were retouched to a smaller degree and modified mainly as perforating tools or scrapers. There are also some projectile points made on blades or flakes (2%), some of which are covered with fine bifacial retouch applied by pressure technique. They are symmetrical and stemmed, but also tanged-and-barbed. A general emphasis on the production of sickle elements is recorded, which in many cases were truncated or deliberately broken to be hafted. Few are the longer blades that could be used individually. A preliminary observation of the researcher regarding the chronological periods is that the material from Layer 2 (LNI) does not involve truncated and notched flakes, flake borers, end-scrapers and splintered pieces. However, this is a preliminary observation that has to be tested by the material from the remaining areas of the settlement (ibid).

In the region of Kastoria, the excavation at the Piges Koromilias Cave, very close to the settlements of Dispilio and Avgi, revealed deposits of the Middle and the Late Neolithic period. The chipped stone assemblage consists of 16 artefacts made of chert (n:6) and quartz (n:10). The flint is of excellent quality, light brown and gray. The material shows no evidence of on-site production since cores, technical products and waste are absent. The residents of the cave probably carried the tools to the site during seasonal visits. The majority is represented by prismatic blades produced by indirect percussion. Some blades and few flakes are retouched, pointing to activities like cutting, scraping and drilling (Trantalidou & Andreasen 2015).

The prehistoric site of Kleitos in Kozani Prefecture is a flat-extended settlement in the northern part of Kitrini Limni. The settlement has two main occupation phases, Kleitos I that dates to the LNI and Kleitos II that dates to the LNII and FN period (Ziota 2014b; Ziota et al. 2013a; 2013b, 58-59). The chipped stone material is under study and there are no preliminary published data for the moment. However, the obsidian artefacts have been part of Milić's study; thus, this will be the only reference to the material of the settlement.

A significant number of obsidian artefacts have been recovered from the excavation of the settlement (200 artefacts), which comprises almost 3% of the total number of the chipped stone material. However, only 60 obsidian artefacts were examined, which originate from the Adamas (87%) and Demenegaki (12%) sources on Melos Island, but also another piece of unknown provenance. The artefacts from the Adamas source include few cores (n:3), rejuvenation products, debris and finished blades. Cortical artefacts are rare and the cores were introduced into the settlement prepared. The blades were produced with the pressure technique and were used unretouched since there is only a single end-scraper. On the other hand, the few artefacts from the Demenegaki source include five blades and two flakes, which were imported as finished products (Milić 2016, 196-197).

In the area of Kitrini Limni, the settlement of Toumba Kremastis Koiladas was inhabited during the Late Neolithic period (5340-4930 cal BC) (Hondroyianni-Metoki 2009a, 148). The excavated area does not correspond to the residential area of the prehistoric settlement, but to an area at its margins, where hundreds of pits, five ditches and 23 burials were revealed. The chipped stone material that derived from the excavation has not been studied so far, but some preliminary information is provided from the research conducted by Hondroyianni-Metoki in the framework of her Ph.D.

A total of 1037 artefacts are reported, including raw material nodules (5%), cores (5%), debitage (28%) and tools (62%). The raw materials used for tool production involve flint and chert (48.7%), quartz (49.5%) and various coarse-grained materials, as well as marble (0.2%). The presence of obsidian is minimal. Flint and cherts are represented by multiple colors and textures, mainly of light gray and pale brown color, but also of reddish brown and chocolate. Additionally, there is a small number of olive, black, orange, brown and gray-blue flints, most of which are opaque. Most raw materials are considered local and/or regional since they are present in the broader area of Kitrini Limni, in the riverbeds of Aliakmon or at the mountain ranges of Vourinos and Pindus. Quartz includes a fine-grained and coarse-grained quality (Hondroyianni-Metoki 2009a, 380-381). Its origin is local and sources of the material are reported at the Vermion Mountain (Ziota et al. 1993, 95).

The majority of flint and chert artefacts correspond to tools (79.4%), debitage (17.3%) and cores (3.1%). Blades are dominant, while the number of flakes is rather small. The tool inventory includes retouched blades, few denticulated and perforating tools, but also six projectile points. The presence of cores, cortical flakes and waste demonstrates that part of the tools' manufacture was taking place on-site. Artefacts of quartz are characterized by a smaller representation of tools (42.6%), while the number of debitage (39.4%), raw nodules (10.8%) and cores (7%) is more frequent, indicating on-site production of the material. The presence of quartz blades is minimal, due to the low quality of the material. Most flake tools have various shapes, including some perforating and notched tools (Hondroyianni-Metoki 2009a, 383).

Another Neolithic site in the lowest part of Kitrini Limni is the tell-type settlement of Megalo Nisi Galanis. According to ^{14}C dates the occupation at the settlement started at the Early Neolithic period (approx. 6300 cal BC) and went on until the Final Neolithic period (second half of the fifth millennium BC) (Fotiadis et al. 2019, 10-13). The total number of the lithic material is unknown so far since the only information on the chipped stone industry of the settlement is limited to a few preliminary comments. The raw materials used for the tool production include mainly reddish brown radiolarite, as well as gray and yellowish brown flint, light-colored brown-gray flint and an opaque yellow-yellowish red flint. The use of quartz is minimal, while obsidian is present in small quantities. The chocolate-colored flint (radiolarite) is the most common raw material. The researchers mention that a lower quality of this material is present in the vicinity of the settlement, deriving from secondary deposits at a distance of approx. 2 km from the settlement. However, most products were made of excellent quality material, probably derived from longer distances (Fotiadis 1988, 59-60; Fotiadis et al. 2019, 29-30; Ziota et al. 1993, 95-97). The analysis of 21 samples under the polarizing microscope demonstrates that silicified carbonates (64%) and radiolarian chert (30%) were mainly used for tool production, as well as a little quartz (6%). Similarly to Dispilio, the ultrabasic rocks that are present in the vicinity of the settlement were rarely used since better quality materials were accessible to the community (Dimitriadis & Skourtopoulou 2001, 784-785).

Flakes and blades from fine quality flints were produced by experienced knappers and in most cases the products were imported into the settlement in advanced stages of reduction and rarely as cores by intermediaries. A possible direct procurement of the raw materials is considered unlikely due to the distance to the sources. Pressure blades of obsidian were also imported probably by the expert craftsmen themselves. A substantial number of all types of products (even technical ones) were used as tools. There are tools of inferior raw material quality, which were intensively used. Another observation is related to the low use rate of obsidian blades, in contrast to the general tendency of intensive use of the rest materials (Fotiadis et al. 2019, 30; Ziota et al. 1993, 95-97).

The prehistoric settlement of Servia, located at the opposite side of the Aliakmon River (south of the Kitrini Limni basin) is a tell-type settlement with a long duration of occupation from the Early Neolithic to the Early Bronze Age (Ridley & Wardle 1979). The chipped stone tools were preliminarily examined by Watson (1983). The raw materials used for the production of flakes are mainly of medium quality red-brown radiolarite, available at adjacent secondary deposits (Aliakmon River). The presence of cores demonstrates the on-site knapping of this material, mainly by the use of percussion with a hard hammer. On the contrary, blades were manufactured of excellent quality materials, like chocolate and yellow flint. No traces of on-site production of the latter materials are recorded and it seems that the tools were imported ready-made into the settlement. Moreover, few artefacts were also made of quartzite, including a fine-grained quality. The obsidian artefacts include blades, flakes, chips and a small flake core, which, however, derives from unstratified deposits (Watson 1983, 123). The neutron activation analysis of nine artefacts from the Late Neolithic layers confirmed the presence of both Adamas and Demenegaki obsidian from the Island of Melos (Ridley & Wardle 1979, 229; Watson 1983, 123).

Regarding the tool typology, Watson refers to three arrowheads made of chert (a tanged and two transverse), eight retouched flakes, three blades with lateral retouch, a notched and a truncated blade (Ibid., 123, Table 2 & 3).

ii) Central Macedonia

Moving to the area of central Macedonia, some more information on the chipped stone industries derives from Neolithic settlements of the Late and the Final Neolithic period. Apart from the settlements of Mandalo in Pella and Paliambela in Pieria, other chipped stone materials have been part of specialized studies. The flat-extended settlements of Thermi B, Vasilika C, Stavroupoli and Makriyalos located close to the coast of the Thermaic Gulf provide rich comparative materials.

The prehistoric tell-type settlement of Mandalo is located 20 km west of Pella. Three main occupation phases have been defined according to ^{14}C dates: Phase Ia-Ib and Phase II which date between 4600-4000 BC (Final Neolithic period), while Phase III corresponds to the Early Bronze Age (2950-2200 BC) (Andreou et al. 1996, 571; Kotsakis et al. 1989; Papaefthimiou-Papanthimou & Pilali-Papasteriou 1990; 1997, 143). The analytical study of the chipped stone tools has not been conducted yet. However, 12 obsidian artefacts (ten from the FN layers and two from the EBA layers) that derived from the excavation were examined by instrumental neutron activation analyzer and all proved to be of Carpathian origin, except one EBA sample that originates from Melos (Demenegaki source) (Kilikoglou et al. 1996, 347). Milić, in her recent study, re-examined the samples from Mandalo with the p-XRF method, confirming the Carpathian origin of the material (Carpathian 1 source). She also provides some information on the technological characteristics of the obsidian artefacts. A core fragment, flakes, preparation and rejuvenation products and four fragments of blades are reported from the FN deposits. Although on-site exploitation of the material could be supported, Milić argues that a possible scenario is that the artefacts were imported in this form and not knapped at the settlement since a higher number of products would be expected in the latter case (Milić 2016, 220). She finally suggests that, as in the case of Dispilio, the use of Carpathian obsidian was not connected to the cutting properties of the tool but was probably related to its symbolic meanings or as a marker of the connection and exchange of other artefacts (Ibid., 225).

The prehistoric settlement of Paliambela is located in Pieria, close to the Thermaic Gulf. It is a tell-type settlement with a long duration of occupation from the Early Neolithic (end of 7th millennium) to the Middle (5800-5200 BC) and the Late Neolithic period (5200-4500 BC). Some traces of the Bronze Age, as well as the historical times, are also reported (Halstead & Kotsakis 2002; Kotsakis & Halstead 2004).

The study of the chipped stone industry of the settlement is in progress, but there is no published information. However, Paliambela is another site that Milić included in her study; thus, there will be a brief reference only to the obsidian artefacts. The total number of obsidian artefacts is 177, constituting almost 10% of the assemblage. The analysis of 64 pieces from the MN and the LN layers demonstrate their Melian origin from both known sources (Adamas 80%, Demenegaki 20%). In technological terms, the Adamas material includes a core fragment, flakes and rejuvenation products, as well as prismatic blades and some retouched pieces. In contrast, the material from the Demenegaki source is only represented by finished products. In any case, the on-site production of obsidian artefacts is a possibility, with the introduction of prepared cores into the settlement, which could have been knapped by local or visiting craftsmen (Milić 2016, 195).

The site of Makriyalos in Pieria is located very close to the Thermaic Gulf and is a flat-extended settlement with two main occupation phases, Makriyalos I covering the LNI period (5200-4900

BC) and Makriyalos II that corresponds to the LNII period (4900-4500 BC) (Pappa & Besios 1999; Pappa et al. 2013).

A preliminary report from the analysis conducted by Skourtopoulou (1999) refers that the total number of chipped stone artefacts is almost 10.000 pieces. The main information derives from the material of Makriyalos II, which prevails with 62% in comparison to the earlier phase. The raw materials used for the production of chipped stone tools include quartz of both medium and high quality (38%), chocolate radiolarized jasper (28%), jasper (siliceous limonite) (17%) and flint (17%) that involves opaque, but also excellent quality semi-transparent materials (Skourtopoulou 1999, 122). The petrographic examination of 87 samples demonstrates the use of acid volcanics and silica including parts of plant tissues (43%), radiolarian cherts (23%), quartz (14%) and siliceous limonite (15%), as well as small amounts of silicified carbonates (5%). (Dimitriadis & Skourtopoulou 2001, 784-785; Skourtopoulou 1999, 122). The examination of the material indicates that a significant number of raw materials derived from distant sources since volcanic rocks are very well represented. However, a closer source located at the Pieria Mountain range cannot be excluded. As regards quartz, ultrabasic cherts and jaspers, they are all available in the geological background of the area. Radiolarites could be supplied in the form of river pebbles (Peneios River), but also from the mountain ranges of northwestern Greece. As for the volcanic rocks and the materials that derived from silicified forests, they could probably originate from the Rhodope mountain ranges but also potentially of local sources (Pappa et al. 2013, 82-83; Skourtopoulou 1999, 122). Apart from the above-mentioned raw materials, there is also a small number of obsidian artefacts, quartzite and chalcedony. Concerning obsidian, its presence is rather small (less than 5%, according to Skourtopoulou) and the chemical and NAA analysis conducted demonstrates its Melian origin (Ibid, 122-123). The analysis of 27 artefacts (total obsidian artefacts: 39, 0.4%, according to Milić) by Milić confirmed the Melian origin of the obsidian from both Melian sources (Adamas 70%, Demenegaki 30%) (Milić 2016, 194-195).

Two different strategies of tool production have been identified at Makriyalos. First, the on-site exploitation of local material like quartz, low-quality cherts and jaspers, which mainly produced flakes with the application of direct hard or soft percussion, as well as bipolar percussion in the case of quartz products. Blades were produced by indirect percussion. The second strategy refers to excellent quality flints of gray, yellow or blue color and the 'Thessalian' type jasper (chocolate radiolarian chert), which are present in the form of finished products and are not related to on-site production (Pappa et al. 2013, 82-83; Skourtopoulou 1999, 123).

Concerning obsidian, the technological analysis by Milić pointed to the possible on-site exploitation of the Adamas material since a core fragment, a rejuvenation product, a chunk and blades are present. On the other hand, the material from the Demenegaki source involves only finished products. Consequently, there seems to be a different treatment of the material derived from the two sources at the settlement (Milić 2016, 194-195).

The products of the Makriyalos industry include retouched blades (38%) and flakes (30%) with the most prevalent tool types being linear retouch, end-scrapers, notches, sickle blades, backed tools, scrapers on flakes, perforating tools and splintered pieces. There are also a few projectile points of fine quality flints produced by pressure, as well as some atypical tanged points (Besios 2010, 53). The presence of sickle gloss is attested at 17% of the blades and 0.5% of the flakes. The high percentage of sickle elements with traces of resharpening (62%), but also the edge damage observed at 40% of the blades and the recycling of some tools, demonstrates an intensive use of blades, mainly related to raw materials of excellent quality and siliceous limonite (Skourtopoulou 1999, 123-124).

The settlement of Stavroupoli is located in the area of Thessaloniki close to the Thermaic Gulf and dates from the Middle Neolithic (Stavroupoli Ia) to the Late Neolithic (Stavroupoli Ib, II) (Grammenos & Kotsos 2004, 16–17, 20–21). The chipped stone material from the settlement includes almost 1000 pieces, while a sample of 408 artefacts deriving from both periods was studied by Skourtopoulou (Stavroupoli I: 44.5%, Stavroupoli II: 55.5%) (2002; 2004). The primary raw materials used for tool production include quartz, jasper (siliceous limonite), flint, obsidian and radiolarite. A minimal number of artefacts made of quartzite, chalcedony and schist are also reported. At the first occupation phase, jasper prevails (35.5%), followed by flint (31%) and quartz (21%), while obsidian (8%) and radiolarite (4%) are less represented. In the second phase, quartz covers more than half of the material (55.5%), jasper and flint decrease in number (20% and 18% respectively), as well as obsidian (3.5%) and radiolarite (2%). (Skourtopoulou 2004, 390). The petrographic examination of 21 samples demonstrates the prevalence of quartz (51%), siliceous limonite (30%), radiolarian chert (14%) and silicified carbonates in smaller percentage (5%). Consequently, the majority of the material is represented by locally available materials, even though of low quality (Dimitriadis & Skourtopoulou 2001, 785).

On-site knapping of quartz is attested by the presence of cores (2%), rejuvenation products (6%) and debris (12%). The majority of products are related to flakes (43%) and few blades (13%) or microblades (14%). Siliceous limonite was probably knapped on-site but in a smaller degree producing mainly blades. On the other hand, artefacts of flint (gray, gray-green, gray-brown, blue and yellowish brown), radiolarite and chalcedony are mainly represented by microblades, flakes and blades, which were imported to the settlement as finished products. Finally, obsidian is majorly represented by flakes and microblades. On-site production can be supported due to the presence of a core and few rejuvenation flakes, which, however, belong to the first occupation phase (Skourtopoulou 2004, 389).

Tools cover 57% of the material and are made on flakes (61%) and less frequently on blades (35%). Nevertheless, a sharp decrease of retouched tools is attested at Stavroupoli II (36.4% from 70.5% of the previous period). The tool categories include cutting tools that prevail during both periods (Phase I: 48%, Phase II: 44%), followed by perforating tools (Phase I: 15%, Phase II: 23%), composite tools (both periods: 17%), projectile points (Phase I: 17%, Phase II: 7%) and few scrapers (Phase I: 3%, Phase II: 9%). The use of quartz is related to perforating tools and projectile points, while flint and jasper were preferred for the production of cutting tools. On the other hand, obsidian was used unretouched. Likewise, Makriyalos, several sickle elements were resharpened (10%) or recycled (9%), in most cases related to artefacts of flint and jasper (Ibid., 392-393).

The Neolithic settlement of Thermi B is also located close to the Thermaic Gulf, in the area of Thessaloniki. Three occupation phases have been separated, covering a period from the Middle Neolithic to the Late Neolithic I and II (Grammenos 1991; Grammenos et al. 1990; 1992). The studied chipped stone material of Thermi B consists of 6140 artefacts deriving from all excavated deposits**.** The material is dominated by the use of siliceous limonite (62%) and quartz (35%). Very low percentages are connected to flint, obsidian, chalcedony and radiolarite (Skourtopoulou 1990; 1993, 68-73). The petrographic analysis of 20 samples confirms the local origin of the raw materials. The majority of the samples are of siliceous limonite (63%) and quartz (32%) and less of radiolarian chert (5%) (Dimitriadis & Skourtopoulou 2001, 785). Additionally, the analysis of the obsidian artefacts that cover almost 2.5% of the total material (106 pieces) points to its Melian origin from both sources, Adamas (71%) and Demenegaki (29%) (Milić 2016, 196).

All the production stages are represented in the cases of siliceous limonite and quartz, from raw material nodules (1%), cores (8%), rejuvenation products (2%), to flakes (65%), blades (13%), microblades (2%) and waste (2%). Flakes were produced by direct percussion, while blades by indirect percussion. Heat treatment has been suggested for a significant number of flakes (25%) made of siliceous limonite (Skourtopoulou & Dimitriadis 1996). Some better quality materials might have produced blades and microblades by the use of pressure technique. There is no evidence for the on-site exploitation of the remaining raw materials (Skourtopoulou 1990). As regards obsidian, blades and flakes from the Adamas source prevail and there is only one rejuvenation product. The material from the Demenegaki source is represented mainly by prismatic blades, few waste flakes and a rejuvenation product. Milić concludes that either the products were imported as finished tools or they were knapped on-site and then the cores were used to other settlements (Milić 2016, 196).

A variety of tool types are made of siliceous limonite (23%), most of which are shaped on flakes (77%). The majority is represented by scrapers (26%) and splintered pieces (24%), followed by composite tools (12%), flakes with lateral retouch (11%) and perforating tools (7.3%). Smaller is the number of sickle elements, blades with lateral retouch, notches, truncations, denticulated and backed tools, projectile points and burins (less than 4%) (Skourtopoulou 1993, 89-101).

The settlement of Vasilika C is located at the southeast of Thermi B and is dated to the Middle and the Late Neolithic I (second half of the 6th-millennium cal BC), while the Late Neolithic II period is represented by the phases III-IV (Grammenos 1991). The chipped stone material includes 3000 pieces, while 637 artefacts of the phases III-IV have been studied by Kyriakidou (1991). Siliceous limonite and quartz are the dominant raw materials used for tool production (65% and 35%, respectively). Both materials are represented by almost all reduction stages, from cores, cortical and rejuvenation products to fragments and waste. Sources of siliceous limonite have been located in a small distance from the settlement and it has been supported that Vasilika was a settlement that produced and circulated tools of this material in the region of central Macedonia (Skourtopoulou 2002, 545-546; 2004, 401-402). Cores (12%) and indeterminate pieces (17%) are well represented, while there is a small number of technical products (3%). The production of flakes (52%) dominates at both materials, manufactured by using direct percussion, while less is the number of blades (15%) and microblades (1%) produced by indirect percussion. Almost half of the artefacts were used as tools (49%), with siliceous limonite to prevail (67%) over quartz (33%). The main tool categories include products with lateral retouch (22%), splintered pieces (18%), artefacts with use removals (13%), notches (10%), end-scrapers and perforating tools (8% each), denticulations (6%), sickle elements (5%), truncated and backed pieces (4%), geometrics, burins and projectile points (less than 1%) (Kyriakidou 1991, 24-26, 33-44, 48-81).

The settlements of Thermi B and Vasilika C are characterized as specialized workshops for the production and circulation of siliceous limonite. The location of a local source of the material in a distance of almost 3 km from the settlement of Vasilika (Grammenos 1991, 119-120; Skourtopoulou 1992, 407), as well as the strong evidence of on-site production with all knapping stages represented, indicates the intensive exploitation of both materials (siliceous limonite and quartz) and the production of blades and blade-flake tools on-site. This is also supported by the intra-site organization of the settlements and the contextual analysis of the material. At the same time, the parallel existence of finished products made of siliceous limonite at close settlements like Stavroupoli and Makriyalos suggested to Skourtopoulou the circulation of finished tools or prepared cores in a regional network involving these settlements (Skourtopoulou 2002, 545-546; 2004, 401-402; 2013, 11).

East of Thessaloniki, the Neolithic settlement of Kavallari, is located in the Langadas basin. The rescue excavation has revealed an occupation of the LNII period (Kakavakis 2011, 71; 2017, 436). The chipped stone tools were studied by Kakavakis in the framework of his Ph.D. research (2011, 122-136). The material comprises 171 artefacts. Almost half of the artefacts are made of jasper (51%), while flint (23%) and quartz (19%) also cover an essential part of the industry. Chalcedony (6%) and other raw materials (2%) are less frequent. Jasper and quartz were worked in the settlement but in small-scale production. However, the decortication of the raw nodules must have taken place away from the occupation area. The products consist of flakes (38%), blades (40%) and microblades (4%), while cores (2%) and technical products (7%) are present in small quantities. Flakes were produced by direct percussion, whereas blade production was performed either by direct percussion with a soft hammer or by indirect percussion (Kakavakis 2011, 122-125).

Flint is represented by a variety of colors that include yellowish brown, gray-green, blue, gray, white and chocolate. Flint is exclusively represented by finished products and there is also a long blade made of Balkan flint (7.2cm). The majority of flint products include blades (54%) followed by flakes (23%), microblades (8%), technical pieces (5%), or indeterminate fragments (10%). Blades were produced by direct soft percussion or indirect percussion, but few cases also point to the application of pressure technique. The chalcedony products also include finished blades and flakes, produced by soft hammer percussion (Ibid., 125-130).

The tools make up more than half of the lithic material (56%). Typical types are retouched sickle elements (16.6%), end-scrapers and double end-scrapers (14.6%), as well as blades with use removals (9.4%). Retouched blades, perforating tools, truncations, denticulations, splintered pieces, composite tools and blades with a natural back are less represented (4-6%). Finally, there are a few cases of notches, burins, unretouched sickle elements and flakes with sickle gloss (less than 3%). The resharpening of sickle blades appear to be common (58%), while evidence of recycling is less frequent (3%) (Ibid., 130-135).

iii) Eastern Macedonia and Thrace

In the area of eastern Macedonia and Thrace, several Neolithic settlements provide useful information regarding the chipped stone industries of the Late and the Final Neolithic period. The prehistoric settlement of Sitagroi is located in the Drama plain and is a tell-type settlement. It has a long duration of occupation from the Middle Neolithic to the Bronze Age corresponding to Phases I-V (MN, LNI, LNII, BA) (Elster & Renfrew 2003; Renfrew et al. 1986).

A total of 5290 artefacts have been recovered from all the excavated deposits. However, the most substantial part of the material (80%) derives from the Late and the Final Neolithic layers (Sitagroi II and Sitagroi III, respectively). The most prevalent raw materials used for tool production include yellowish brown flint (Phase II: 73.3%, Phase III: 54%), followed by chalcedony (Phase II: 9.2%, Phase III: 16.7%) and other flints of black, gray and brown color (Phase II: 7%, Phase III: 9%). The presence of quartz and rock crystal is also small (Phase II: 7.7%, Phase III: 4.5%), while obsidian appears with only 13 pieces, one from Phase I and the rest from Phase IV (Tringham 2003, 83, 85, Table 3.2). The petrographic examination of 25 samples demonstrates the dominance of recrystallized acid volcanics and silica including parts of plant tissues (84%), as well as silicified carbonates (12%) and a small percentage of radiolarian cherts (4%). Since the general absence of locally available materials characterizes the area, the exploitation of volcanic sources from the Rhodope mountains (50 km) directly or by exchange with settlements of Thrace is possible (Dimitriadis & Skourtopoulou 2001, 785; 2003, 129). The decortication of the raw nodules was taking place away from the settlement. Cores, technical pieces and debris are present of almost all raw materials (apart from obsidian and radiolarite). The technological categorization of the material includes cores (3%), blanks (28%) and waste (69%). The rather high percentage of waste products resulted from the systematic dry sieving of the excavated deposits. The primary production is related to blades, by the use of indirect percussion with a soft hammer, but there are also some cases where pressure was applied. Blades of Balkan flint are larger in dimensions and were produced by pressure technique (Tringham 2003, 90-91).

According to Tringham, tools represent 11.2% during Phase II and 9.3% during Phase III of the total material. The most common tool types are sickle blades/elements (Phase II: 37.2%, Phase III: 36.2%), end-scrapers (Phase II: 25%, Phase III: 29.9%) and truncations (Phase II: 20.3%, Phase III: 21%). Blades with lateral retouch (Phase II: 10.8%, Phase III: 5.2%) and perforating tools (Phase II: 2.7%, Phase III: 2.9%) are less frequent. During phases, II and III denticulated tools and projectile points are not reported. Tringham identifies only the type of Fiera points (Phase II: 2.7%, Phase III: 3.3%) and few double end-scrapers (Phase II: 1.4%, Phase III: 1.5%) (Tringham 2003, 104, 116-121). Few differences characterize the typological study of Manolakakis and Kakavakis. Tools represent 25-31% of each studied material and are mainly shaped on blade blanks. The tool types, apart from the already mentioned, also include few burins, splintered pieces, geometrics and notches deriving from the material of Phase III (Kakavakis 2011, 151-153; Manolakakis 2005, 197-200). The microwear analysis of the material demonstrates the prevalence of cutting tools (67%) followed by scraping tools (24%) while perforating (8%) and engraving tools are less represented (1%) (Tringham 2003, 98-101). Sickle blades cover almost 1/3 of the blade tools. Several strategies for prolonging the use life of tools are attested by multiple uses of all the edges of tools, resharpening and recycling. Resharpening of sickle blades is only attested at 3.2% of the blades, while composite or recycled tools cover 7% of the tools, mainly made of honey-brown flint (Ibid, 113-115).

In the same region, the tell-type settlement of Dimitra located in the Drama basin was inhabited from the Middle to the Late Neolithic II (Grammenos 1997a). The chipped stone material comprises 2300 artefacts and was studied by Kourtessi-Philippakis. The material from Dimitra II (LN) counts 1846 artefacts (80% of the total). The raw materials used for tool production include chalcedony (40%), yellowish brown flint (26.49%), quartz (21.95%), rock crystal (2%) and jasper (1.5%), while obsidian is underrepresented (0.2%) (Kourtessi-Philippakis 1997, 212-214; 2008b, 122).

There is a very high percentage of waste (51.3%) due to the systematic dry sieving of the excavated deposits. However, the number of cores (2%) and technical pieces (0.6%) is rather small. The products (32%) include mainly flakes and blades that were produced by direct percussion with a soft hammer and, in a few cases, by pressure technique. Only 14% of the material has been characterized as tools (n:259). The most common tool categories correspond to unretouched sickle blades/elements (19.3%), retouched sickle blades/elements (13.8%), end-scrapers (13.5%) and blades with lateral retouch (13.5%), while less frequent are composite tools

(9.2%), notches and denticulations (6.5%), backed tools (5.7%), perforating tools (5%), splintered pieces (4.2%), retouched flakes (3.4%), truncations (3%), burins (1.1%), geometrics (0.4%) or artefacts with bifacial covering retouch (0.4%). Finally, an intensive use of sickle blades is reported (Kourtessi-Philippakis 1997, 214-216).

Another Neolithic settlement located in the Drama plain is Dikili Tash. Two main occupation phases are reported, Dikili Tash I that corresponds to the Late Neolithic I (5300-4800BC) and Dikili Tash II that is attributed to the Final Neolithic period. The settlement's last occupation was destroyed by fire at approx. 4300/4260BC (Koukouli-Chrysanthaki & Treuil 2008; Treuil 1992; 2004; Tsirtsoni et al. 2018). A significant number of volcanic rocks are present (gray, black, brown, blue, white, yellow and reddish), while only two obsidian artefacts were found. Regarding the material of Dikili Tash I, according to Kourtessi-Philippakis the raw materials used include chalcedony (47%), flint (15.5%), quartz (8%), rock crystal (<2.5%), jasper (<1.5%) and obsidian (<0.5%). Limestone and marble were less used (<3%), while burnt and indeterminate pieces cover 22% of the total material (Kourtessi-Philippakis 2008b, 116-117; 2009, 306-307). In contrast to the first occupation phase, the raw materials of the assemblage of Dikili Tash II are completely made of yellowish brown flint (Séfériadès 1992, 75).

Except for yellowish brown flint, the remaining raw materials were knapped on-site. Cores, technical pieces, waste, but also flakes and blades are present in most cases. The first stages of reduction (decortication) took place away from the settlement. Chalcedony produced mainly flakes (50%) and fewer blades (9%). Quartz was also used for the production of flakes. As for rock crystal, the presence of cores is evidenced, along with blades, flakes and microblades manufactured by pressure technique within the settlement (Tardy et al. 2016, 216-218). Jasper is present in the form of small pebbles for blade and flake production, while obsidian is only represented by unretouched pressure microblades. Moreover, it seems that most flint varieties are of local origin, with the exception of honey- Balkan flint. The latter is exclusively present in the form of imported ready blades, tools and chips resulting from the resharpening of tools. The blades of Balkan flint have parallel edges and trapezoidal section. Their width ranges from 1.1cm to 1.2cm and their thickness from 0.3cm to 0.5cm (Kourtessi-Philippakis 2008b, 118-120; 2009, 306-307).

According to Séfériadès, the material of Dikili Tash I is represented by cores (6%), technical products (3%), flakes (51%), blades (17%), microblades (10%) and waste (13%). On the contrary, the material of Dikili Tash II is characterized by the dominance of blades (95%), few microblades

(4%) and technical products (1%). Blades were produced by direct or indirect percussion. However, blades of yellowish brown flint (Balkan flint) seem to have been produced by pressure technique (Sériadès 1992, 60-75). Almost 40% of the material was turned into tools, with a preference for blade blanks. During the first phase (Dikili Tash I), the most common tool types are end-scrapers (37%) and retouched sickle blades/elements (27%). Less represented are blades with lateral retouch (6%), backed tools (6%), denticulated tools (5%), notches (5%), side-scrapers (4%), perforating tools (3%), sickle elements (1%), truncations (1%), burins (1%), composite tools (1%), geometrics (1%) and splintered pieces (1%). Tools from the second phase (Dikili Tash II) are mainly represented by end-scrapers (46%), retouched sickle blades/elements (18%), denticulated tools (16%) and blades with lateral retouch (10%). Truncations (4%), burins (2%), perforating tools (2%), backed tools and composite tools (1% each) are less frequent (Séfériadès 1992, 65-81).

The site of Promachon-Topolniča is a flat-extended settlement located at the Greek-Bulgarian borders west of the Strymon River. The site was inhabited during the Late Neolithic period showing four occupation phases (Phase I-IV) (Koukouli-Chrysanthaki et al. 1997; 2000; 2001; 2007). A number of 313 chipped stone artefacts deriving from phase III (LNI) were studied by Kourtessi-Philippakis (2008b; 2009). The majority of the artefacts are made of flint (64%) with blue and yellowish brown flint to prevail (23% and 15%, respectively). Chalcedony (20%) and quartz (15%) are less represented in the industry, while rock crystal, jasper and obsidian are rare (1%) (Kourtessi-Philippakis 2008b, 123). Most of the cores (3.5%) have small dimensions and are exhausted. The blanks cover almost half of the artefacts (52%) and are mainly represented by blades. The on-site production is attested in the case of blue flint for the production of flakes and blades, as well as rock crystal that is present in the form of a blade core and microblades (Tardy et al. 2016, 215-218). Likewise, the exploitation of quartz and jasper was taking place at the settlement area. On the contrary, blades of yellowish brown flint were probably imported as finished tools since there is no evidence of on-site production. Tools cover 43% of the total material and are mainly represented by end-scrapers (37%) and sickle blades/elements (32%). Blades with lateral retouch (10%) are less common, whereas perforating tools and burins cover a tiny percentage (Koukouli-Chrysanthaki et al. 2001, 114-115).

Moving to Thrace, information on the prehistoric chipped stone industries derives from the Neolithic tell-type settlement of Proskinites, located 23 km southeast of Komotini. The settlement was inhabited during the 6th and 5th millennium, from the Middle to the Final Neolithic period (Efstratiou 1996, 569-571). The chipped stone analysis included 573 chipped stone artefacts. The raw materials used are characterized by a variety of colors and textures. The most common raw material category includes excellent quality opaque flints of gray, brown and pale brown color (66%). A medium quality material, semi-translucent, with bands and sometimes inclusions, refers to black, dark gray, grayish brown and reddish brown flints (23%). Finally, an almost translucent excellent quality flint is also present (11%). The use of quartz is also attested at the settlement, but in small percentages, while three obsidian artefacts are also reported. The raw materials are considered of local origin, except for obsidian which possibly originates from the Island of Melos (Papadopoulou 2007, 38-39).

The tool production is characterized by the dominance of flakes (67%), while blades (17%), microblades (5%) and blade-flakes (3%) are less represented. The presence of a few cores (2%) and indeterminate fragments (6%) demonstrates that part of knapping was taking place at the settlement's area. Direct percussion with a soft hammer was used for the production of most flakes and some blades. Indirect percussion was mainly used for the production of blades, while pressure technique is only attested in the case of the obsidian artefacts. More than half of the material (57%) was modified by retouch and tool types include lateral retouch (32%), perforating tools (18%), end-scrapers (12%), denticulations and notches (11% each), composite tools (9%), burins (2%), truncated tools (2%), backed tools (1%) and a single sickle element (Ibid., 40-50, 54).

Finally, the Neolithic settlement of Makri should also be mentioned. Makri is a coastal tell-type site located 10 km west of Alexandroupolis. The settlement was inhabited from the Middle to the Late Neolithic I period (Makri I and Makri II, respectively) (Efstratiou et al. 1998, 11-62). A preliminary study of the chipped stone material was carried out by Skourtopoulou (1998b). A variety of raw materials were used for tool production. Flint predominates in various colors like gray, yellowish brown, blue, gray-green, yellowish red, dark gray and black. The presence of chalcedony, quartz, obsidian and radiolarite is also attested, still in small quantities (Ibid., 41). The petrographic analysis of 17 samples demonstrates the dominance of acid volcanics (76%) that probably originate from the region close to the settlement (< 30 km) and less of silicified carbonates (24%). It seems that the lower quality raw materials were ignored due to the superior quality of locally available recrystallized volcanics (Dimitriadis & Skourtopoulou 2001, 785).

On-site knapping is attested in almost all cases (except for obsidian), producing flakes and blades by direct and indirect percussion. Pressure technique is related to obsidian blades and microblades, but also some cases of excellent quality transparent flints and radiolarite. The percentage of retouched tools is rather low (14.6%) and is mainly related to blades and bladelets.

The most usual tool types involve flake and blade end-scrapers, perforating tools, sickle blades/elements, splintered pieces, denticulations, notches, truncations, backed pieces and few triangular pressure points. It should be noted that splintered pieces are well represented (15.2%). In contrast, the presence of sickle gloss is only attested in a limited number of blades and bladelets (3.4%), many of which were resharpened (1/3 of the sickle blades) (Skourtopoulou 1998b, 42-43).

iv) Thessaly

In the region of Thessaly, many published studies of chipped stone industries are available covering the chronological period of the Late Neolithic. To demonstrate the characteristics of chipped stone production, five settlements were chosen as indicative of the coastal and inland Thessalian region. These include the settlement of Dimini located very close to the Aegean coast, Ag. Sofia at the east Thessalian plain close to Larisa, while others are located at the central and western part of the plain, like Plateia Magoula Zarkou, Magoula Orgozinos and Theopetra Cave.

Neolithic Dimini is a tell-type settlement (magoula) located at the Pagasitic Gulf. The first excavations were carried out at the beginning of the 20th century (Tsountas 1908), while systematic excavations were conducted by Chourmouziadis during 1974-1976 (1993). The occupation of the settlement covers the Late Neolithic II period (4800-4500 BC). The chipped stone artefacts studied by Moundrea-Agrafioti in the framework of her Ph.D. research (1981) consist of 237 pieces. The dominant raw material used for the chipped stone production is obsidian (84.4%), while the presence of chocolate/brown flint (8.5%), yellowish brown flint (6.3%) or other materials (0.8%) is rather small (Ibid., 51, Table 1).

Cores (2.9%), technical pieces (10.5%) and debris (0.8%) cover almost 15% of the total material. The cores are of obsidian and the majority are pyramidal in shape. The products include mainly blades (73.2%) and few flakes (21.1%) or some indeterminate pieces (5.7%) (Ibid., 61, Table 2; 65, Table 3; 78, Table 6). The butts of the blades are mainly facetted and dihedral and the preparation of cores is connected to pressure and indirect percussion. Thus, blades were produced by indirect percussion and in some cases, pressure technique was applied for the obsidian artefacts. The on-site knapping is attested in most cases, with the exception of yellowish brown flint, which was imported in the form of finished tools (Ibid., 99).

The number of tools (including splintered pieces and unretouched sickle blades) reaches 42.8% of the total material. The majority of the tools are made of obsidian (65.3%) and less of flint (34.6%). The most common tool categories include notches, denticulations and other retouched artefacts (45.5%), sickle elements (17.8%), perforating tools (10.9%), projectiles (7.9%), end-scrapers (6.9%), splintered pieces (5.9%) and truncations (5%) (Ibid., 108, Table 10).

The Late Neolithic tell-type settlement of Agia Sofia is located in the eastern part of the Thessalian plain, close to the city of Larisa (Milojčić et al. 1976). The total number of chipped stone material is 364 artefacts. The dominant raw material for tool production is obsidian (86%), while chocolate/brown flint is less represented (14%). The obsidian pressure cores were introduced into the settlement prepared, where pressure blades and microblades were produced. The local dark/light brown chert was mainly used in an expedient way for flake production. Finally, the presence of a few other raw materials (fine grayish or olive green flint) was probably brought to the settlement in the form of finished products (Karimali 1994, 348-354). More than half of the material (57.3%) was turned into tools, which were mainly made of obsidian (60%) and chocolate/brown flint (34%). Blades and microblades with lateral retouch is the commonest tool type (48.8%) followed by retouched flakes and blade-flakes (20%). The rest tool categories include splintered pieces (9.4%), perforating tools (5%), notches (5%), sickles (4.4%), truncations (3.8%), end-scrapers (3.3%), composite tools (2.2%), arrowheads (0.5%) and geometrics (0.5%) (Ibid., 482, Table D1).

Another Late Neolithic tell-type settlement is Plateia Magoula Zarkou, located at the central/western part of the Thessalian plain. The settlement was inhabited from the end of Early Neolithic until the Late Neolithic I, while a later occupation phase is attested at the Early Bronze Age (Gallis 1996, 23-37). The studied lithic material of the Late Neolithic period comprises 231 pieces. The majority of the chipped stone artefacts is of red and brown jaspers (73%), while obsidian (13%), gray chert (6%), gray jasper (4%) and other materials (4.5%) are less represented (Elster 1994, 172, Chart 2). All production stages are attested in the case of red and brown jasper, including cores, technical products, flakes, blades and microblades (Karimali 1994, 286, Table 6.6). The tools (n:33) are mainly made of red/brown/chocolate flint (84%), while there is only one splintered piece of obsidian. The tool inventory includes retouched flakes and blade-flakes (33%), splintered pieces (18%), sickles (18%), perforating tools (15.1%), composite tools (9%), retouched blades (6%) and end-scrapers (6%) (Ibid., 484, Table D3).

In the west part of the Thessalian plain, Theopetra Cave is located almost 3 km from the city of Kalambaka. The cave is situated at an altitude of 300 m above the sea level and adjacent to the Pindus range. The excavations revealed an undisturbed occupation from the Upper Pleistocene to the Neolithic period (Facorellis et al. 2002; Kyparissi-Apostolika 2000; 2018). The chipped stone material of the Neolithic layers corresponds to almost 1115 artefacts and was examined by Skourtopoulou (2000). The raw materials used for the production of tools are mainly represented by an excellent quality chocolate/brown flint (77.6%), while there is also a lower quality brown material (4.7%). Opaque cherts (3%), quartz (2.7%), obsidian (3.4%), high-quality flints (gray-green semi-transparent) (1.3%) and siliceous limonite (1.3%) are also reported in small quantities, as well as few pieces of yellowish brown flint. The chocolate/ brown flint was worked on-site, as evidenced by the presence of cores, technical pieces and a significant number of flakes and few blades. Almost 30% of the material is retouched (flakes 49% and blades 20.5%) and involves usual tool types like end-scrapers (30.7%), perforating tools (13.9%), composite tools (13.9%), pieces with marginal retouch (12.5%) and less cases of side-scrapers, backed pieces, denticulations, projectile points, notches, truncations and burins. The number of sickle blades/elements and splintered pieces (2.86%) is minimal in comparison to other Neolithic Thessalian settlements. Additionally, there are several retouched technical pieces (4.9%), a fact that is probably related to the intensive use of the lithic material (Ibid., 273-274). As regards the rest raw materials, flints were used as complementary material for blade production, represented by the usual tool types, while quartz is more related to flake production. The presence of obsidian is limited to microblades and blades, sometimes bearing lateral retouch. Finally, the on-site production of siliceous limonite is attested, although very restricted (Ibid., 275).

The Late Neolithic tell-type settlement of Magoula Orgozinos is also located in the western part of Thessaly and it was occupied during the pre-Dimini period (Nikolaou et al. 2008, 387-398). The chipped stone industry of the site consists of 398 artefacts. The majority of the material is of fine-grained flint (chocolate, mat brown and other brown qualities) (84.9%), while small percentages are connected to chert (8.29%), chalcedony (3.26%), obsidian (2.01%), schist (0.5%), quartz (0.25%) and other materials (3.51%). Chocolate and mat brown flint derived from the Pindus Mountains and were imported to the settlement in the form of pebbles or cortical nodules and knapped on-site. All reduction stages are attested, from decortication to rejuvenation and tool production. Both flint qualities were used for the production of blades and microblades, but mat brown flint was mainly used for wide pressure blades. In contrast, the few obsidian artefacts were brought to the settlement in the form of finished products. The tools were made of fine quality flints and chalcedony. The most usual types include end-scrapers shaped on blades of mat brown flint, truncated and perforating tools, as well as sickle elements of chocolate flint (Ibid., 389-390).

It is apparent from the above cases that the industries of Thessaly are characterized by the presence of two main raw materials: obsidian and chocolate/brown flint. It has been argued that at the eastern part of Thessaly obsidian was mainly used for tool production, in fact, in substantial percentages (>85%). The proximity to the coast probably allowed the more accessible supply of this material, which was used by many settlements of the region. The cores were introduced prepared or shaped and were knapped for the production of pressure blades and microblades. Thus, the pattern of raw materials used at the eastern Thessalian settlements recalls the settlements of Southern Greece, even though the representation of obsidian in Thessaly is a little lower. In contrast, the settlements at the central and western parts of Thessaly rely on obsidian to a lesser degree and have developed different systems of raw material acquisition for the production of their tools. Western Thessalian settlements, instead of obsidian, use an excellent quality chocolate flint (radiolarite or jasper) that is considered of local origin from the Pindus Mountains. The presence of obsidian at the settlements is limited and conversely proportional to the presence of chocolate flint. The on-site production of tools made of chocolate flint is attested with cores, technical products, blades and microblades detached by indirect percussion and by pressure technique. Additionally, some other raw materials were used, but in limited quantities, like gray/olive flint, yellow (or honey) flint, quartz, chalcedony, etc. At the same time, the small presence of chocolate flint blades in the form of finished tools is recorded at the eastern Thessalian settlements. Consequently, two parallel and supplementary distribution networks co-existed in Thessaly (Karimali 2001; 2009).

6.2 Chipped stone industries from southern Balkans

In an attempt to make broader correlations to the lithic material from Anarghiri IXb, our attention is turned to the southern Balkans. As a starting point, present-day Albania and the Republic of North Macedonia are the closest regions in the study area. However, a significant problem that arises in both cases is the lack of publications regarding the chipped stone industries of contemporary settlements. Consequently, the discussion for these regions will be limited to the general information and the few available studies on lithic industries. In contrast, the publications on chipped stone artefacts from Bulgaria are numerous. However, due to the distance of the region from the study area, only some general characteristics will be presented regarding raw materials, technology and tool typology.

i) Albania

Excavations and research in Albania have systematically been conducted during the last three decades. However, few specialized studies on chipped stone tools are available or published from the Albanian region. The large archaeological projects of the last decades produced several publications mainly documenting the Paleolithic and Mesolithic presence and their relative industries, like the German-Albanian Paleolithic program (Gjipali & Richter 2013; Hauck et al. 2017), the Albanian-American project at Konispol Cave (Korkuti et al. 1996) and the Mallakastra Regional Archaeological Project (Runnels et al. 2009), or investigated the neolithization process, as in the case of Southern Albanian Neolithic Archaeological project (Allen & Gjipali 2014; Gjipali 2017). One of the best documented areas regarding prehistoric occupation is the Korçë basin in southeast Albania. This area was densely inhabited during the Late Neolithic and the Bronze Age (Oberweiler et al. 2018). Keeping in mind the scarce documentation of the Neolithic chipped stone industries, preliminary information from the Neolithic settlements of Kallamas and Maliq in Korçë basin, as well as studies on obsidian analysis and chert sourcing will contribute to this discussion.

One of the recently excavated sites is the lakeside settlement of Kallamas located at the western shore of Greater Prespa Lake in southeast Albania (Lera et al. 2009; 2010; 2015; Oberweiler et al. 2018). The settlement has been excavated since 2008 and two main sequences of occupation have been documented. According to recent ^{14}C dates synchronized to the Aegean chronology, the first occupation corresponds to the Late Neolithic I (5400–5200 BC) and the second to the Late Neolithic II period (4800–4500 cal BC) (Oberweiler et al. 2018). The site is characterized as a sizeable specialized workshop for the production of polished stone tools since all the production stages are attested, from the preparation of raw materials to the production of tools and recycling (Lera et al. 2008, 897; 2009, 707).

Information concerning the chipped stone material of the settlement derives from the excavation reports and a brief preliminary summary[1] (Lera et al. 2009, 707; 2010, 629; Ruka 2014, 10). More than 500 artefacts have been recovered from the excavations of 2008-2011, including a large number of surface finds. However, the preliminary information does not attribute the material to the related chronological periods. The most frequent raw materials for tool production include a chocolate-colored opaque flint, which resembles radiolarite and sometimes combines black or green shades. This material is considered of local origin since outcrops have been located a few km from the site (zone de Qafa e Zvezdës). Chipped stone tools were also manufactured of honey flint, a material with light brown color, which is semi-translucent with some inclusions and is characterized as exotic. This material must derive from the southwest part of Albania, demonstrating the connection of the Korçë basin with the Adriatic coast. The rest raw materials appear in tiny quantities. Among the assemblage, a chip of obsidian is recorded, which is of Melian origin according to p-XRF analysis (Ruka et al. 2019, 43). The manufacture of chipped stone tools was partially taking place on-site, as evidenced by the presence of some cortical and technical pieces (rejuvenation products, knapping accidents). The cores are almost exhausted, pointing to intensive exploitation of raw materials, while the production was focused on lamellar products. The products include unmodified blades, complete or almost complete, with the majority bearing traces of sickle gloss. Additionally, unretouched fragments of blades and microblades intentionally broken were also recovered, some with traces of sickle gloss. Finally, the third category involves retouched blades and microblades that, in some cases, are intentionally broken. This category includes a variety of tools like end-scrapers on a blade, perforating tools, retouched blades with sickle gloss and composite tools.

Another prehistoric lakeside settlement in the Korçë basin is Maliq, which was excavated by Prendi during the 1960s. The Neolithic habitation at the settlement corresponds to a later phase of Late Neolithic (Maliq Ia-b) and the Final Neolithic or Eneolithic (Chalcolithic) period (Maliq IIa-

[1] http://www.sovjan-archeologie.net/kallamas/outillage_lithique_taille.html

b; 4651–4055 cal BC). Additionally, successive occupation phases of the settlement cover the Bronze (Maliq IIIa-c) and the Early Iron Age (Maliq IV) (Prendi 2018, 179).

The chipped stone artefacts of the settlement have not been analytically studied and the limited available information derives from the excavation reports and a few references in the very recent publication of the settlement's excavation (Prendi 2018). The raw materials used for tool production are generally of good quality with a variety of colors, including gray, brown and honey flint. They are considered to derive from the local environment of the Korçë area and were worked near the settlement according to the presence of cores and waste. For the first phase (Maliq I), the only information refers to some flint blades that are either retouched or unretouched, scrapers, or other tools (Ibid., 185). Additionally, a bilaterally retouched obsidian blade derives from the Late Neolithic layers. Its Melian origin has been confirmed by p-XRF analysis (Ruka et al. 2019, 42). The subsequent period (Maliq II) is characterized by larger quantities of flint tools, which include long and narrow unretouched blades with use traces or light retouch. The retouched tools involve scrapers, perforators and denticulated sickle elements. Additionally, many arrowheads manufactured by lateral and bifacial retouch are reported. They have various shapes and sizes, including triangular points with a straight, convex, or concave base, also known by other chalcolithic settlements in the Balkans (Karanovo VI, Gumelnica, Thessaly, etc.), but also leaf-shaped projectile points (Prendi 2018, 203).

In the last decade, surface surveys in the west and southern part of Albania have documented the prehistoric habitation of the Albanian coastal area. A survey conducted at the western lowland revealed a large number of surface lithic material (Ruka et al. 2014). The investigation resulted in the identification of many Paleolithic, Mesolithic and Neolithic sites located in the area of Vjosa River, a hilly landscape with ridges close to the shores. Two sites, Putanja and Dalani i Vogël, were investigated along with three more sites (Portonov I and II and Kepi i Dajlanit) during the research conducted in the area at 2011-2012. A large number of lithic material (n:1244) and pottery was collected. Many of these belong to the Middle and Upper Paleolithic period, according to some diagnostic tools. Few artefacts could be assigned to the Neolithic or latter periods. Among the finds, a piece of obsidian pressure blade is reported. The obsidian analysis points to its origin from Lipari, Italy, which was probably directly imported to the region (Ibid., 97).

Regarding the raw materials used for tool production, the survey demonstrated the use of materials that derive from secondary geological sources, most probably from the alluvial deposits of the Vjosa River. There is a significant presence of excellent quality honey-brown flint among the artefacts. At the same time, the discovery of a tabular flint intentionally brought to the area points toward other sources of this material. The closest primary geological sources of flint would have been at least some 10 km away, as indicated by the successful production of gunflints in the area during the mid-19th and early 20th century. The researchers suggest that the significant quantity of the locally available honey-brown flint at the hill ridge has been traded during the Neolithic (Ibid., 102). Many scholars have already pointed the Albanian region as a possible area with sources of the well-known honey-colored flint that might have been imported to Greece (Kaczanowska & Kozłowski 2015, 71; Kourtessi- Philippakis & Astruc 2002, 76; Perlès 2001, 78, 202; 2004, 10). Its presence in archaeological contexts in Greece raises the possibility that sites along the Albanian coast served as transshipment points for honey flint and other products being moved south to Greece (Ruka et al. 2014, 101-102).

An archaeometric research was also conducted with samples from the western lowland of Albania, to identify the river gravels as potential sources of raw material in prehistoric stone tool production. The research resulted in the identification of chert sources to almost all examined watercourses. The majority include pebbles of reddish radiolarites, or less common black and greenish, but of medium to low quality. As for cherts, pebbles of gray chert have been found, but also of deficient quality. The only exception is a black colored chert located both at an outcrop and in the form of river pebbles (Perhoč & Ruka 2017).

It is surprising that a small number of obsidian artefacts is reported. Only 16 known artefacts from Albania are characterized as obsidian. A very recent study on eight obsidian artefacts that derive from the Albanian region (excavations and surveys) examines the origin of the material with p-XRF analysis (Ruka and Galaty 2017; Ruka et al. 2019). The samples included one blade fragment from Putanja, which is probably dated to the Neolithic period, a chip from the Late Neolithic Kallamas, a retouched blade from the Late Neolithic Maliq, three artefacts (crested blade, blade, flake) from the Late Neolithic Kamnik, a microblade core fragment from the Late Neolithic-Bronze Age Dalani i Vogël and a secondary flake from the Late Neolithic-Bronze Age Bishti i Pallës.

The examination of the material points to a Melian origin from the Adamas source of almost all samples, except for the sample from Putanja that was provenanced to Lipari in Italy. First of all, the presence of Lipari obsidian in a settlement which is located at the eastern Adriatic coast would be expected since the area of Vlora is close to southern Italy. The researcher proposes direct contact between Vlora and Apulia, where many settlements could have served as intermediaries to connect Putanja with the opposite coast and Lipari during the Neolithic period (Ruka et al. 2014, 97; 2019, 45). On the other hand, the obsidian from Melos must have been traded during the Late Neolithic period since the circulation of this material increases during this period in northern Greece. In contrast to other regions like Bosnia and Croatia that were importing Lipari obsidian, Albania and more specifically, the inland area of Korçë basin in southeastern Albania (Maliq, Kamnik, Kallamas) imported obsidian from Melos. It seems that these settlements communicated with the settlements of northern Greece, as evidenced by the presence of Melian obsidian. Ruka suggests that the eastern Adriatic coast of Albania could import Melian obsidian from the Ionian Islands and southwestern Greece (Ruka et al. 2019, 43-45). However, a possible route for the obsidian artefacts could also be through western Macedonia since the presence of this material is attested at many Neolithic settlements of the region.

Discussing the scarcity of obsidian in Albania, Ruka concludes that this is not the result of sampling bias since many types of research and excavations have been undertaken in the last decades. The general absence of obsidian can be explained either due to the abundance and access to excellent quality local flints of the prehistoric occupants in Albania, or to different social practices that were related to obsidian circulation, mainly during the Bronze Age and the mortuary practices applied in the Aegean (Ruka et al. 2019, 45-46).

ii) Republic of North Macedonia

The state of research regarding the chipped stone industries from Neolithic settlements of the Republic of North Macedonia is similar to the Albanian case. A couple of publications concentrated in the area of the Ovčepole Valley in the northeast part of the region and few references at excavation reports are the only information concerning lithic material.

The most known study of chipped stone artefacts comes from the Neolithic settlement of Amzabegovo (Anza or Barutnica) that was excavated during the 1960s. The settlement is located in the northeastern part of the Republic of North Macedonia and dates from the Middle to the Late Neolithic (Gimbutas 1976).

Elster studied the chipped stone material from all phases (I- IV), which comprises 5293 artefacts (Elster 1976). However, the reference will be limited only to the material from Phase IV

(1736 pieces), which corresponds to the beginning of the Late Neolithic period (5200-5000 BC). The raw materials used for the production of chipped stone tools include quartz (25.3%), volcanic rocks of gray, black and brown color (23.1%), chalcedony (15.8%), dark red jasper (11.6%), yellow, brown, gray and green jasper (11.2%), opalite (6.9%), chert (3.7%), honey-brown flint (0.2%) and other materials (2.4%) (Ibid., 264-265). Most of raw materials are considered of local origin, derived from the outcrops of Ovčepole. A survey of minerals conducted by Weide (1976) recorded several types of stones such as jasper (yellow-brownish and yellow-reddish), quartz, calcite, opalite, jadeite, flint and steatite. However, there is also imported material, like honey-brown flint that, according to Elster, resembles Romanian or Bulgarian flint, as well as opalite of unknown sources (Elster 1976, 265).

The most available raw material at the settlement is quartz with large cobbles that were exploited on-site. In contrast, there are few cores of honey flint. The products with retouch show small percentages during this period (7.6%). The tool inventory includes retouched blades (most bearing sickle gloss), end-scrapers, side-scrapers and disc-scrapers, perforating tools and composite tools. Elster suggests that there was a minimal degree of modification and retouch of the blanks since the occupants preferred to produce new ones from the available raw materials. The industry is characterized as disposable, although many tools show evidence of re-use and maintenance (Ibid., 277-278).

During the last decade, Dimitrovska studied the lithic material from the Neolithic settlement of Rug-Bair (2012a). The settlement is also located at the Ovčepole valley (16 km from Amzabegovo) and dates to the Middle Neolithic period. Except for the analysis of the Middle Neolithic material (which belongs to an earlier phase regarding our study), Dimitrovska made some observations on the chipped stone material from the Eneolithic Sites at St. Atanas and Cocev Kamen in the same region demonstrating the use of local primary and secondary sources (gray chalcedony of excellent quality and flint), as well as the existence of a workshop. The area is abundant with volcanic rocks and minerals and the existence of primary deposits for some raw materials points to the exploitation and dependence on local sources (Dimitrovska 2012b, 427).

Regarding honey flint (or Balkan flint), Dimitrovska observes that all Neolithic assemblages from the Amzabegovo-Vrisnic culture in the eastern Republic of North Macedonia comprise small number of artefacts. She also suggests on-site exploitation since some cortical artefacts, crested blades and waste are present. A local provenance of honey-brown flint is also proposed, based on indications of primary raw material sources that could be traced at the mines and quarries for non-metals, like Češinovo-Spančevo. Similarities with other Early and Middle Neolithic assemblages from Serbia, as well as western Bulgaria, are recorded based on raw materials and tool typology. Additionally, parallels are reported with the settlements of Greek Macedonia, like Sitagroi, Dikili Tash and Dimitra. The use of chalcedony, quartz, honey-brown flint and less jasper also characterizes these industries (Dimitrovska 2012a, 19-20). However, the higher percentages of honey brown flint at the Greek sites, but also the absence of obsidian in the industries of the Republic of North Macedonia, are factors that provide a partially differentiated picture.

Less information derives from the region of Pelagonia and Ohrid Lake in the southern part of the Republic of North Macedonia since specialized studies on the chipped stone assemblages have not been conducted so far. According to some general information from Neolithic settlements of the area, a diversity of raw materials for tools' production is reported. Quartz and quartzite are the most common materials at the settlements of this region, as well as chalcedony and opalite. However, some raw materials were imported, pointing to early trade. The shaping of the cores was probably carried out at the outcrops and prepared cores were introduced into the settlements and worked on-site. The most frequent tool types include blades, end-scrapers and side-scrapers, perforating tools and projectile points (Tolevski 2009).

iii) Bulgaria

Even though the region of present-day Bulgaria is far from the study area, it was decided to highlight some aspects related to the chipped stone production to favor a discussion regarding two main topics, the so-called Balkan flint and the circulation of long blades during the Chalcolithic period. Additionally, some general tendencies of the Late Neolithic and Chalcolithic chipped stone industries will also be mentioned. The research of chipped stone assemblages from Bulgaria is rich in publications and reports from Neolithic and Chalcolithic settlements. The Early Neolithic and the process of neolithization has been a central issue for many researchers and a series of publications of early Neolithic chipped stone industries have been produced (Gatsov 1993; 2009; Gurova 2008; 2012; 2018; Gurova & Bonsall 2014). Additionally, a particular focus on the Late Neolithic and Chalcolithic assemblages also resulted in many specialized lithic studies (Gatsov 2009; Gurova 2011; Gurova et al. 2016; Manolakakis 1996; 2005).

The so-called Balkan flint is an excellent quality yellow-honey waxy colored material with white or light gray spots. Research and petrographic analysis of the archaeological material connected this raw material to outcrops at the northwest and northeast (Dobrutza area) Bulgaria (Gurova & Nachev 2008). The use of Balkan flint is attested from the Early Neolithic period and is related to the circulation of formal tools and long blades made by specialized producers. It also takes an essential place at the discussions regarding the neolithization process since products (retouched tools, long blades) had been part of trade in long distances at southeast Europe during this early period (Biagi & Starnini 2010; Gatsov 2009; Gurova 2008; Gurova & Nachev 2008; Kaczanowska & Kozlowski 1990; Kozlowski 1982; Kozlowski & Kozlowski 1984; Šarić 2003). During the Chalcolithic period, an excellent quality honey-brown flint is present in the assemblages of northeastern Bulgaria. Outcrops of this flint variety are located exclusively in the Ludogorie Plateau (Ravno area, northeast Bulgaria). This type of flint was used for blade production and reached its higher exploitation during the final Chalcolithic (Manolakakis 2008).

Concerning the Late Neolithic chipped stone industries (Karanovo III, III–IV and IV cultures), the research conducted by Gatsov, including material from sites of western Bulgaria (1993), provide important information. Gatsov studied the material from Early and Late Neolithic sites of western Bulgaria, to demonstrate the changes that occurred in the lithic industries during these two periods. He suggests that at the beginning of the Late Neolithic, a change occurred, which is attested at the chipped stone industries. According to the study of the material from the settlements of Topolniča, Strumsko, Damianitsa and Sapareva Bania I, Gatsov concluded that during the Late Neolithic, the settlements used local raw materials of lower quality and chalcedony for tool production, while the demand for fine quality Balkan flint of the earlier period declined. In technological terms, the macrolithization that was dominant during the Early Neolithic was replaced by smaller blade and flake cores. The prevalence of flake debitage is recorded, while the dominant tool-type includes end-scrapers shaped on flakes (Gatsov 1993, 40-41, 43-44).

Similar observations were made by Gurova, who compared the lithic material from the Early and the Late Neolithic settlements in the southeast and central Bulgaria (Karanovo III-IV, Kapitan Dimitrievo, Ussoe I, Balgarchevo, Harmanli, Apriltsi, Ezero, Sarnevo). Most Late Neolithic flint assemblages show variability in the raw materials used for debitage and tool production. The raw materials are mainly local, deriving from secondary deposits of siliceous rocks. Additionally, the macrolithic characteristics of the previous period (Early Neolithic) turned to small cores for flake and blade production. Regarding tool typology, the dominance of end-scrapers is noteworthy, characterized by a variety of shapes, sizes (smaller than the previous period) and forms (typically semicircular). Additionally, the presence of geometric microliths is also reported at many settlements (trapezes, crescents and rare atypical shapes) (Gurova 2018).

Concerning the use of Balkan flint and the decline of its distribution system, Gurova claims that it's not irrelevant to the sweeping cultural changes that took place during the mid-6th millennium, including changes in settlement patterns and social structure. She also suggests that there should be no natural constraint on access to Balkan flint sources in the Late Neolithic. Still, it seems that these changes could have severely affected the Balkan flint network and distribution system, which functioned successfully during the Early Neolithic (Ibid.).

During the Chalcolithic period (Early: 4900/4850–4600/4550; Middle: 4600/4550–4500/4400; Late: 4500/4400–4100/3800 cal BC; Boyadžiev 1995, 179) the lithic industries are characterized by the dominance of blades and retouched blade tools with a variety of tool types (Gatsov 2009, 43-47). The observations of Gurova on the material of four chalcolithic settlements (Kosharna, Ivanovo, Burgas and Varhari) demonstrate that important factors for the variability of the flint assemblages are raw material availability, the procurement strategy adopted and the existing exchange network in each case. The presence of an extensive supra-regional distribution of high-quality Ludogorie flint (northeast Bulgaria) with very scarce evidence of cores and the initial stage of chaîne opératoire is noteworthy. This material circulated in the form of complete blades with exceptional length (super-blades), which were found in mortuary contexts (Varna and Dobrutza cemeteries) pointing to ritual deposition. Additionally, super-blades also appear in hoards containing flints in domestic contexts. The distribution and active use of fragmented long blades in domestic contexts also indicate the practical use of long blades (Gatsov 2009, 43-47; Gurova 2011, 284; Gurova et al. 2016).

As regards the tool typology of the Chalcolithic industries, the most common tool types involve end-scrapers (on large and regular blade fragments), retouched and truncated blades, sickles, burins, secondary splintered pieces, geometric microliths, denticulated tools and bifacial projectile points (Gurova 2011, 284).

Similarly, the research of Manolakakis on Chalcolithic settlements and cemeteries at northeastern Bulgaria demonstrates two different lithic production strategies during the Chalcolithic period. On the one hand, domestic production of local materials is attested, where all settlements shared the same technical knowledge and conception of debitage. On the other hand, specialized production of long blades is reported, with no traces of on-site production. Long blades were made of Balkan flint derived from the Ravno area (Ludogorie flint, north-east Bulgaria) and are characterized by highly skilled production techniques (pressure). The circulation of these blades as semi-finished products is attested up to a distance of 700 km. Manolakakis interpreted the presence of long blades as prestige goods of great social and cultural value, due to their presence in burial contexts, but also related the presence of Balkan flint and long blades of the Graphite Pottery Zone acting as a form of barrier against the obsidian which was widespread in all the neighboring cultures (Manolakakis 2005, 279; 2008, 111-121).

Finally, as regards obsidian, this material was not preferred in the Bulgarian region during the Neolithic and the Chalcolithic and a minimal number of obsidian products has been reported so far. Recent p-XRF analysis on artefacts from Early Neolithic sites and the Late Chalcolithic Varna cemetery indicate a Carpathian provenance of obsidian (C1 and C2) (Bonsall et al. 2017a; 2017b; Milić 2016, 217-218).

6.3 Comparisons and discussion

Taking into account the information derived from the chipped stone assemblages of northern Greece and Thessaly, but also the cases of the southern Balkans, the similarities and differences in relation to the material of Anarghiri IXb will be highlighted. The discussion will be focused on the three main parts of the analysis, that is, the raw materials, the technological characteristics and the tool typology for each chronological period. Thus, in the first place, the focus will be laid on the lithic material of the Late Neolithic period (5400/5300-4600/4500 BC), which is represented by numerous settlements. As it has already been made clear, in some cases, the analysis of the chipped stone artefacts was conducted by a further separation between the LNI and the LNII periods. However, since this subdivision was not possible for the material under study, all the data from the LNI and the LNII periods will be treated unified in comparison to the Late Neolithic material of Anarghiri IXb. The comparison of the early Final Neolithic material from the Anarghiri IXb (4600/4500-4300/4200 cal BC) to contemporary settlements follows in the second part. Additionally, in the cases of settlements with a long duration of occupation covering both the LN and the FN periods, where there is no clear distinction of the studied lithic industries between the two chronological periods, the chipped stone materials will be compared to the Late Neolithic material of the Anarghiri IXb. Finally, the few available data deriving from Albania and the Republic North Macedonia, but also the information from Bulgaria, will enrich the discussion, demonstrating possible correlations to the broader geographical area.

The chipped stone industries of the Late Neolithic

Most of the examined settlements are attributed to the Late Neolithic period and correspond to the Late Neolithic assemblage of Anarghiri IXb. In western Macedonia, the prehistoric settlements of Dispilio (Phase A), Avgi (Avgi II, III), Piges Koromilias Cave, Servia (Phase 6-7), Kleitos (Kleitos I and Kleitos II) and Toumba Kremastis Koiladas are represented by a Late Neolithic occupation phase. The settlement of Megalo Nisi Galanis, even though occupied during both the Late and the Final Neolithic period, will be compared to the Final Neolithic material since the main information on the lithic assemblage derives from the latter period. In central Macedonia, the settlement of Paliambela demonstrates an occupation period during the Late Neolithic. Additionally, Makriyalos I and Makriyalos II are both integrated into the Late Neolithic period. Similarly, Stavroupoli Ib and II (LNI), Thermi B (Thermi II), Vasilika III-IV and Kavallari (LNII) also cover this chronological period.

Moving to the east, the settlements of Sitagroi II, Dimitra II, Dikili Tash I, Promachon- Topolniča I-IV, Proskinites and Makri II are represented by occupation phases attributed to the Late Neolithic. Moreover, in Thessaly, all the examined settlements cover the Late Neolithic period.

As regards the raw materials, the general use of regional and local materials is confirmed in most cases. As it has been demonstrated, the industries of central Macedonia are largely represented by quartz and local jaspers (siliceous limonite). In eastern Macedonia, chalcedony and flint are abundant, as well as honey flint, while flints of medium to good quality are dominant at the settlements of Proskinites and Makri in Thrace. In Thessaly, the main raw materials involve obsidian at the coastal settlements and chocolate flint at the western part of the plain. In the case of western Macedonia, the raw materials used include primarily flint of excellent quality, reddish brown radiolarite and small quantities of quartz, local cherts and obsidian. The preliminary analysis of the chipped stone assemblages from this region does not allow many correlations to the settlement of Anarghiri IXb. However, some observations can be made regarding raw materials.

The most common raw material used for the production of tools at the settlements of western Macedonia is excellent quality flint. The material is represented by a variety of colors like gray and dark gray, pale brown and yellowish brown, black and olive, mainly related to the production of blades and microblades. The settlement of Anarghiri IXb relied largely on this material, which covers a significant part of the Late Neolithic industry (LN: 70.1%), with gray flint to dominate. The information from the settlements of western Macedonia confirms the presence and prevalence of excellent quality flint both in the case of Dispilio and Avgi, as well as Servia. At Dispilio, almost 65% of the material is represented by good quality flint, while the exact percentages at the rest of the settlements are not available. Another critical observation is related to the use of yellowish brown flint, a variety that is also reported at some settlements. Again, the only numerical representation derives from Dispilio (32.9%), which, however, includes not only yellowish brown flint, but also flints of pale brown and brown color. This fact probably provides a higher representation of the category of yellowish brown flint. In any case, even if this material is not that highly represented, its presence is more numerous in comparison to Anarghiri IXb, where only a few tools have been recovered from the Late Neolithic deposits. The presence of yellowish brown flint is also confirmed at the settlement of Servia, while, in all cases, it was introduced in the form of ready-tools.

Another raw material which is common among the settlements of western Macedonia is reddish brown radiolarite of excellent quality. This material is present in the industries of Dispilio, Servia, Toumba Kremastis Koiladas and probably in Avgi. The percentage of radiolarite at Dispilio (23.2%) is much higher in comparison to Anarghiri IXb, which during this period corresponds only to 6%. In the case of Servia, Avgi and Toumba Kremastis Koiladas, no numerical representation is available. However, in most cases, the material is present in the form of ready tools with no traces of on-site production, apart from Dispilio and Anarghiri IXb.

The use of obsidian is also attested at all settlements, though in minimal percentages. However, the representation of obsidian at the settlement of Anarghiri IXb proves to be higher (4.4%) in comparison with the percentage reported at Dispilio (2%), Avgi (0.9%), Kleitos (3%), Servia (9 artefacts) and Toumba Kremastis Koiladas (few artefacts). In most cases, obsidian is considered to derive from Melos. Nevertheless, Dispilio has also yielded obsidian of Carpathian origin, a source that is not identified at the rest settlements of western Macedonia where obsidian characterization has been carried out.

Finally, the use of local raw materials is common in the settlements of western Macedonia. In most cases, the use of medium to low-quality local materials is limited. The materials include small quantities of quartz (medium/low quality) and local cherts. Additionally, reddish brown radiolarite of medium quality in the form of pebbles is attested in all cases. This material derives from secondary deposits, as evidenced at the settlements of Anarghiri IXb, Dispilio, Servia, Avgi and Toumba Kremastis Koiladas. Moreover, the presence of quartzite is reported at the settlement of Anarghiri IXb and Servia in minimal quantities, while chalcedony is identified only at the Anarghiri IXb settlement so far.

According to the schema mentioned earlier, two sites are differentiated, Toumba Kremastis Koiladas and Piges Koromilias Cave. In the first case, quartz of both good and low quality represents almost half of the raw materials used. Toumba Kremastis Koiladas is the only settlement that used quartz for tool manufacture to a high degree. However, this could be related to the character of the excavated area since the material derives from an area at the margins of the settlement. Thus, the investigation of the main residential area could provide a differentiated picture of the lithic industry. In the second case, the prevalence of quartz artefacts among the small material that derived from the cave, should not be regarded indicative since the site had a seasonal character and the tools were brought along ready for use.

If we turn to the area of central Macedonia, we observe the already mentioned reliance of Stavroupoli, Thermi and Vasilika on the exploitation of local chert (siliceous limonite) and quartz to a substantial degree. Similar is the case of Kavallari, where local jasper and quartz played an important role, but also flint. The only settlement that indicates a slightly different model is Makriyalos, where the dominance of quartz is followed by chocolate radiolarite (28%) and siliceous limonite (17%). The geographical location of Makriyalos close to the slopes of the Pieria Mountains and riverbeds (Aliakmon River), could explain the increased use of radiolarite. Additionally, fine quality volcanic rocks are also numerous in the industry of Makriyalos and are considered to derive from a distant region (Thrace), although a local source cannot be excluded, while excellent quality gray semi-translucent flint could derive from northwestern Greece (Skourtopoulou 1999, 122; 2013, 3). Likewise, the presence of excellent quality flint is also attested at the industries of other settlements, but in smaller quantities in comparison to western Macedonia. Stavroupoli and Kavallari have yielded increased proportions of fine quality flints (almost 23%) with a variety of colors, including yellowish brown flint. On the contrary, at the settlement of Thermi flint is rather underrepresented (less than 3%).

The industries of eastern Macedonia are characterized by the increased use of chalcedony, flint and quartz, including rock crystal. Regarding flint, the yellowish brown variety prevails in all cases and is primarily connected to the sources at the Rhodope Mountains. In fact, at Sitagroi II is the most common raw material used for tool production (73.3%). Dimitra II and Dikili Tash I are mainly represented by chalcedony, followed by flint. The use of flint is also common in the industry of Promachon-Topolniča, mainly of blue and yellowish brown color, while chalcedony and quartz are less represented. Finally, at Proskinites and Makri, the presence of various flints of local or regional origin characterizes the industries, whereas chalcedony and quartz are less common.

As regards the rest of the raw materials, the rare presence of obsidian at eastern Macedonia and Thrace is noteworthy (less than 1%). Obsidian is more frequent at the settlements of central Macedonia (Thermi, Stavroupoli, Makriyalos, Paliambela), although still represented by small percentages. Among the settlements of this region, Paliambela and Stavroupoli provide higher percentages of obsidian, while the on-site exploitation is also attested, though to a limited degree.

Moreover, reddish brown radiolarite is also present at the settlements of central, eastern Macedonia and Thrace, but seems to decline as we move to the east. Except for its outstanding representation at Makriyalos, the rest of the settlements yielded small percentages of this material (less than 5%). Similarly, rock crystal is attested only in the industries of eastern Macedonia, still in small quantities. Other raw materials, like quartzite, schist, or limestone, are reported in the case of Stavroupoli, including few artefacts.

In the case of Thessaly, the model of the two complementary raw materials, obsidian and chocolate flint characterize the lithic industries. Fine quality chocolate flint prevails at the industries of western Thessaly, while a small number also includes lower quality material. On the contrary, the industries of eastern Thessaly are characterized by the prevalence of obsidian. Fine quality chocolate flint is less represented in this area, as well as medium quality dark reddish radiolarite. All Thessalian settlements also used fine quality flint, including yellowish brown, gray and olive varieties, but in small quantities. Other raw materials used to a lesser degree involve chalcedony, opaque cherts, schist and quartz, as well as siliceous limonite at Theopetra Cave.

According to the above comparison, it is apparent that most Neolithic settlements of northern Greece used mainly local and regional materials for their tool production, with few exceptions. In most cases, this observation is in accordance with the geology and lithology of each area and has already been supported by several researchers (Dimitriadis & Skourtopoulou 2001, Kakavakis 2011; 2015; Kourtessi-Philippakis 2009). Taking into account the material of Anarghiri IXb and the information deriving from the neighboring settlements, we can argue that this is also the case for the industries of western Macedonia. On the other hand, the settlements of Thessaly demonstrate a different pattern. In particular, the coastal settlements of Thessaly relied upon the use of imported Melian obsidian to a high degree. However, at the central and western part of Thessaly, the use of excellent quality local material (chocolate flint) prevails (Karimali 2001).

As regards the technological characteristics of the Late Neolithic industries, in almost all cases, the decortication of raw materials was taking place away from the settlement. The low percentages of cortical flakes demonstrate that cores were mainly introduced shaped or prepared. Few exceptions are related to the exploitation of local materials and pebbles from secondary sources. At the settlement of Anarghiri IXb, this is evidenced in the cases of medium quality radiolarite, quartz, or coarse-grained cherts. Similarly, the exploitation of radiolarian pebbles at Servia and quartz at Toumba Kremastis Koiladas includes all reduction stages. Cortical flakes and crested blades are generally few, also in the case of Dispilio and Avgi. The same is supported by the material from central, eastern Macedonia and Thrace. However, the settlement of Vasilika and Thermi B attest the on-site decortication of siliceous limonite and quartz, a fact that is probably related to their character as production centers of chipped stone tools (Skourtopoulou 2013, 11-12).

The cores were introduced into the settlements prepared and on-site knapping was taking place to a small degree since the representation of cores and waste is generally low. This is attested to the settlements of Avgi, Anarghiri IXb, Dispilio, Servia, but also in Stavroupoli, Kavallari and Makriyalos. A similar pattern is also observed in eastern Macedonia and Thrace, where the percentages of cores are less than 4% (except for Dikili Tash I), as well as in the case of the Thessalian settlements. In contrast, the settlements of Vasilika (12%) and Thermi (8%) in central Macedonia show an increased presence of cores, due to the extensive production of chipped stone tools. It should also be noted the increased percentage of quartz cores (7%) at the site of Toumba Kremastis Koiladas, where the material was worked on-site to a high degree.

Concerning the products, the industries of western Macedonia are more related to blade production and less to the manufacture of flakes and microblades. At Anarghiri, IXb blades make up almost 70% of the total material. This observation fits well with the case of Avgi, where blades cover more than half of the material (53-57%) and flakes are less represented (30-37%), as well as Toumba Kremastis Koiladas (for flint products). However, in the case of Dispilio, the preliminary report of the Late Neolithic material demonstrates the prevalence of microblades (30.5%) and flakes (30.5%) over blades (13.4%) and blade-flakes (4.9%). On the other hand, the industries of central Macedonia were more focused on flake production (Thermi, Vasilika), or at least flakes are well represented (Stavroupoli, Makriyalos, Kavallari). Similarly, in eastern Macedonia, the settlements of Dikili Tash I, Dimitra II and Promachon-Topolniča also show increased percentages of flakes, even though blades prevail. Conversely, the settlement of Sitagroi is differentiated with the dominance of blades and microblades. Thrace is also characterized by the prevalence of flake production over blades (Proskinites, Makri II). In Thessaly, the settlements of Dimini, Ag. Sofia and Orgozinos produced mainly blades, while at Theopetra and Plateia Magoula Zarkou flakes and blade-flakes are more common.

As for the knapping techniques used for tool production, direct percussion with a hard and a soft hammer, indirect percussion and pressure techniques are evidenced in most cases. Direct percussion with a hard hammer is attested for the production of flakes and mostly during the decortication stages. The application of direct percussion with a soft hammer is connected mainly to flake and blade-flake production, usually of local and regional materials. Additionally, there are many cases where direct percussion with a soft hammer is also connected to blade production.

Apart from the settlements of Anarghiri IXb and Dispilio in western Macedonia, Thermi, Sitagroi II, Dimitra II and Proskinites also document the use of this technique for blade production. The application of indirect percussion is attested in the majority of the settlements, involving blade extraction. Once again, the evidence of Dispilio and Anarghiri IXb from western Macedonia, but also Makriyalos, Stavroupoli, Thermi, Dikili Tash I, Proskinites and Makri demonstrate the use of this technique for blade and microblade production. In Thessaly, this technique is attested at Dimini and is related to good quality materials, like chocolate flint. Finally, the application of pressure technique is related to the production of blades and microblades of excellent quality materials like obsidian, yellowish brown flint and chocolate radiolarite, as well as rock crystal in eastern Macedonia. The production of pressure blades and microblades of fine quality flints is also recorded in some cases at Anarghiri IXb, Dispilio, Avgi, Makriyalos, Stavroupoli and the settlement of Dimitra II. At Sitagroi II and Dikili Tash I, pressure blades of imported yellowish brown flint (Balkan flint) were produced, as well as rock crystal, including the site of Promachon-Topolniča. Finally, blades and microblades of obsidian were produced in Thessaly by pressure technique (Dimini, Ag. Sofia), but also of excellent quality chocolate flint (Orgozinos, Plateia Magoula Zarkou).

The above observations demonstrate the correlation between the raw materials used, the products and the knapping technique applied in each case. Blades and microblades are more numerous where fine quality flints, fine quality radiolarite and obsidian are abundant. Flakes and blade-flakes are also represented by these materials but to a smaller degree. In contrast, quartz, chalcedony and local jasper are more represented by flakes and blade-flakes. Similar is the correlation of raw materials with the knapping technique applied. Obsidian blades and microblades were mainly produced by pressure technique, as well as blades of yellowish brown flint (Balkan flint). Fine quality flints were worked by indirect percussion or direct percussion with a soft hammer, but also some cases of pressure technique are attested. Finally, quartz was exploited by direct percussion with a soft hammer and in some cases, by bipolar technique (Thermi, Makriyalos).

Regarding the tool typology, a variety of tool types is recorded at most Late Neolithic settlements. However, some differences are recorded in the representation of the tool types. First of all, the percentage of tools in the lithic industries shows some variations among the settlements. To begin with western Macedonia, tools at the settlement of Anarghiri IXb constitute more than half of the total assemblage (56.55%). This percentage is slightly higher when it is compared to Dispilio (48.7%) and Avgi (1/3 of all lithic artefacts) but lower in comparison to Toumba Kremastis Koiladas, where the percentage of tools made of flint and chert is almost 80% (in contrast to quartz, 42.6%). In central Macedonia, tools are well represented at the settlements of Stavroupoli (57%), Vasilika (49%) and Kavallari (56%), while a smaller percentage is reported for Thermi (23%). In the region of eastern Macedonia and Thrace Promachon-Topolniča (43%), Dikili Tash I (40%) and Proskinites (57%) show an increased presence of tools, whereas, at Sitagroi II (11.2%), Dimitra (14%) and Makri (14.6%) tools are less represented. In Thessaly, the industries of Dimini (42.8%), Ag. Sofia (57.3%) and Theopetra (30%) also yielded increased quantities of tools.

The preference of blade or flake blanks for the shaping of tools seems to be connected to the general orientation of each lithic industry. Thus, the use of blade blanks is reported at Anarghiri IXb (90%), Avgi (80-90%), Dispilio and Toumba Kremastis Koiladas. Conversely, the settlements of central Macedonia show a higher representation of tools shaped on flakes (Makriyalos, Stavroupoli, Thermi, Vasilika). In eastern Macedonia and Thrace, most of the tools are shaped on blades (Sitagroi II, Dikili Tash I, Dimitra II, Promachon-Topolniča, Makri), except Proskinites where flake tools are more numerous. Similar is the case of Dimini, Ag. Sofia and Orgozinos in Thessaly where blade tools prevail, while at Theopetra and Plateia Magoula Zarkou flake tools are more usual.

The most frequent tool type at the industries of western Macedonia is sickle blades/elements either retouched or unretouched. At the Anarghiri IXb assemblage, this tool type represents half of the tools (51%). A similarly high percentage is recorded at Dispilio (62.5%), but Avgi is differentiated with a rather small percentage (23.6%). In central Macedonia, the presence of sickles is, in most cases, small (Makriyalos, Stavroupoli, Thermi, Vasilika, Kavallari). Additionally, the industries of eastern Macedonia show an increased percentage of sickles (Sitagroi II, Dikili Tash I, Dimitra II, Promachon-Topolniča), while this tool type is not very common at Proskinites and Makri in Thrace. At the settlements of Thessaly, sickles are generally underrepresented, except for Plateia Magoula Zarkou (18%).

As regards end-scrapers, this tool type is well-represented in the industry of Anarghiri IXb (22.5%), while at Dispilio and Avgi end-scrapers are less frequent. In central Macedonia, increased numbers of scrapers are reported only at Thermi in comparison to the rest settlements. On the contrary, scrapers are frequent in the industries of eastern Macedonia (Sitagroi II, Dikili Tash I, Dimitra II, Promachon-Topolniča), as well as the settlements of Thrace (Makri, Proskinites). As for

Thessaly, in most cases, scrapers are underrepresented, except Theopetra and Magoula Orgozinos. Concerning the end-scrapers' types, end-scrapers shaped on a blade are rather common in the cases of Anarghiri IXb, Avgi, Dispilio, Kavallari, Sitagroi II, Makri, Dimini, Ag. Sofia, Orgozinos, while end-scrapers on flakes are usual at the industries of Makriyalos, Thermi and Vasilika, Dimitra II, Dikili Tash I, Proskinites and Theopetra. Additionally, double end-scrapers (Anarghiri IXb, Stavroupoli, Dimitra II, Kavallari, Dikili Tash I, Proskinites), side-scrapers (Anarghiri IXb, Stavroupoli, Dikili Tash I, Theopetra) and end-scrapers with denticulated working edge (Anarghiri IXb, Stavroupoli, Dikili Tash I) are less represented. Finally, in some industries, the use of long retouched blades with an end-scraper's working edge is also reported (Anarghiri IXb, Stavroupoli, Dimini, Ag. Sofia, Theopetra, Sitagroi II).

Some other interesting differences in tool representation concern perforating tools, which are highly represented in Avgi, in comparison to Anarghiri IXb and Dispilio. In central Macedonia, Stavroupoli has reported increased numbers of perforating tools, while at most settlements, they do not exceed 8-10% of the tools. In Sitagroi II, Dikili Tash I, Dimitra II and Promachon-Topolniča, their presence is smaller than 5%, but the settlement of Proskinites yielded a higher percentage (18%). In Thessaly, perforating tools at Dimini, Plateia Magoula Zarkou, Theopetra and Orgozinos are well represented. At almost all settlements, the perforating point is either shaped at the distal or proximal end of the tool or is formed at the end of an already bilaterally retouched blade with abrupt retouch.

Blades with lateral retouch are also common at many settlements of western, central and eastern Macedonia and Thrace. However, at Thermi and Vasilika, retouched flakes are more usual. Additionally, in Thessaly, retouched blades constitute an important tool-type at Ag. Sofia, as well as retouched flakes at Plateia Magoula Zarkou.

The remaining tool types are less common in most lithic industries. Denticulated, backed, truncated and notched tools are generally present in small percentages, with some variations among the settlements, while splintered pieces, burins, geometrics and projectile points are even less frequent. Exceptions are increased numbers of splintered pieces at Thermi and Vasilika, as well as Makri, Plateia Magoula Zarkou and Ag. Sofia. Higher percentages of truncated tools are reported at Sitagroi II and Avgi.

The projectile points show variability of types, although their presence is minimal in most cases. Usually, their manufacture is simple with triangular shapes and bifacial lateral or partial retouch. Projectiles are reported in the industries of Anarghiri IXb, Avgi and Dispilio, Servia, Toumba Kremastis Koiladas, Thermi, Vasilika, Stavroupoli, Makriyalos, Proskinites, Makri, Dimini, Ag. Sofia and Theopetra Cave. At the same time, more careful design with bifacial covering retouch characterizes the tanged-and-barbed projectile points. Their presence is attested to Avgi, Dispilio, Toumba Kremastis Koiladas, Stavroupoli and Makriyalos. In Stavroupoli, there is also a possible semi-manufactured obsidian projectile point shaped by an oblique break. At Makri and Makriyalos, atypical triangular pressure points are reported, while in Dimitra II, there is a possible fragment of a leaf-shaped projectile. At the Thessalian settlements, Dimini shows a significant percentage of projectile points (7.9%, n:8). Almost all are of obsidian with covering bifacial retouch, leaf-shaped or tanged, but there is also a triangular point of yellowish brown flint. The settlement of Anarghiri IXb, apart from the simple shaped projectile types, includes two leaf-shaped points shaped by covering retouch, one of which is of excellent quality gray flint.

Finally, geometrics are usually few and their presence is reported at Anarghiri IXb (0.2%), Dispilio, Vasilika, Stavroupoli, Dimitra II (0.4%), Dikili Tash I (1%) and Ag. Sofia (0.5%), in most cases shaping a trapeze.

The chipped stone industries of the Final Neolithic

The Final Neolithic period of the Anarghiri IXb settlement dates between 4600/4500-4300/4200 cal BC. In contrast to the previous period, the material is not that comparable, on the one hand, because of the few excavated settlements of this chronological period and, on the other hand, due to the lack of relevant chipped stone studies. In accordance with the examined settlements, the material under comparison will be focused on Megalo Nisi Galanis in Western Macedonia, Sitagroi III and Dikili Tash II in eastern Macedonia. Additionally, the settlement of Mandalo II in central Macedonia is also attributed to this period.

Regarding the raw materials, we have already stressed the changes that occurred in the industry of Anarghiri IXb this period. The decline of gray flint and quartz, as well as the total absence of black flint, on the one hand, and the increase of pale brown flint, yellowish brown flint, chalcedony, obsidian and radiolarite, on the other hand, characterizes the changes of this period. The only contemporary settlement in the close region is Megalo Nisi Galanis, although it provides limited information. The raw materials used include mainly fine chocolate flint (radiolarite), yellowish brown flint, but also gray/ brown-gray and other fine quality flints. Additionally, the use of quartz and obsidian is limited. At the same time, local radiolarite in the form of pebbles was also used for tool production.

In the area of Central Macedonia, the settlement of Mandalo II is examined regarding the presence of obsidian, which is the only available information concerning the chipped stone industry. The nine obsidian artefacts originate exclusively from Carpathian sources.

Moving to eastern Macedonia, some changes are recorded during this period in the use of raw materials at the settlement of Sitagroi (Sitagroi III), where almost half of the material is of yellowish brown flint. However, in comparison to the previous period, its presence declines, as in the case of quartz and rock crystal. On the contrary, the representation of chalcedony and other flints increases. A significant change is recorded at the settlement of Dikili Tash II since the assemblage is completely represented by imported yellowish brown flint, probably of the regional variety deriving from the Rhodope Mountains.

As regards technological characteristics, the available information is also limited. At Megalo Nisi Galanis, the low quality reddish brown material was used for the production of flakes, while blades were made of excellent quality materials and produced by specialized techniques. Simple knapping techniques were used for the production of quartz artefacts, while pressure flaking is attested for obsidian blades and microblades, but also for some excellent quality flints. The Carpathian obsidian of Mandalo II is represented by a core fragment, flakes, technical products and blades. However, the on-site production is rather unlikely, according to Milić, due to the low number of artefacts (2016, 220).

At the settlement of Sitagroi III, the number of cores declines this period, as well as blanks, but a rise of waste products is observed. Additionally, the number of blades and flakes increases while microblades decrease to 2/3 of the previous period. On the other hand, the material of Dikili Tash II is mainly represented by blades, few microblades and waste. The products were imported in the form of finished tools, probably produced by pressure technique.

As regards the tool types, the variety in tool typology seems to characterize also this period. The material from Anarghiri IXb demonstrates a slight decrease of retouched and unretouched sickle blades/elements, denticulated and truncated tools. On the other hand, an increase of blades with lateral retouch, splintered pieces and a small rise of end-scrapers is attested. Nevertheless, sickles remain the dominant tool type. In the case of Megalo Nisi Galanis, no specific tool types are reported. However, there is a tendency of extensively use of tools made of excellent quality materials, until they become too small (probably because of resharpening and recycling), even technical products. Conversely, no intensive use of obsidian blanks is mentioned.

Moving to eastern Macedonia, the total number of tools in Sitagroi III decreases. However, sickles and end-scrapers remain the dominant tool types, while the representation of most tools shows slight differences among the two periods. The number of end-scrapers increase, as well as truncations and Fiera points. However, the material studied by Kakavakis (2011, 151-153) and Manolakakis (2005, 197-200) deriving from this period include some new types, like burins, splintered pieces, geometrics and notches, still few. On the contrary, the tools from the second phase of Dikili Tash show important differences. The representation of end-scrapers increases, as well as blades with lateral retouch, denticulated tools and truncations. However, retouched sickle blades/elements show a significant decrease, while geometrics are not represented at this phase.

Finally, the presence of projectile points is attested only at the settlements of Anarghiri IXb and Megalo Nisi Galanis. Several tanged-and-barbed projectiles characterize this tool type of Anarghiri IXb, as well as few atypical leaf-shaped points. On the other hand, the two obsidian projectile points stress the similarities with Thessaly and southern Greece, while the large spearhead of yellowish brown flint is probably related to distant networks operating to the north. At Megalo Nisi Galanis the percentage of projectile points is not available, but the presence of triangular points with bifacial covering retouch is attested at the FN deposits (Fotiadis et al. 2019, 31, Fig. 19: a-b).

To conclude, we observe that the raw materials used for tool production in western Macedonia follow in general the pattern of local and regional materials of the previous period, but some changes at their representation are recorded. The increase of obsidian and yellowish brown flint has already been mentioned in the case of Anarghiri IXb settlement, but regional flints remain dominant. In the case of Megalo Nisi Galanis the use of local quartz and cherts, but also fine quality regional materials is attested. Additionally, the presence of imported yellowish brown flint and chocolate radiolarite, as well as the increase of obsidian during this period fits well with the rise of these materials at the settlement of Anarghiri IXb. At the same time, changes at the representation of raw materials are also observed in the settlements of eastern Macedonia. At Sitagroi III, yellowish brown flint decreases, though it is still dominant. Conversely, Dikili Tash II is characterized by the exclusive use of this material for the production of blades and microblades, which were imported as ready tools.

Regarding tools, end-scrapers and sickle blades/elements remain the most common tool types, with an increase of end-scrapers in most cases. It should also be noted that the type of end-scraper shaped on long blades is represented at the industries of Dikili Tash II and Sitagroi III, as well as the long blades (usually retouched) made of yellowish brown flint, like in the case of Anarghiri IXb. The information deriving from the Anarghiri IXb material demonstrates an increase in the resharpening of blades, in the presence of heavily retouched and recycled tools during this period, connected mainly to fine quality pale brown and yellowish brown flint, as well as radiolarite and gray flint. A similar pattern could probably be reflected at the tools of Megalo Nisi Galanis, while in eastern Macedonia, these practices were not that common.

Even though the available information regarding this period is limited, we could comment on the increase of exotic and /or imported raw materials in the case of Anarghiri IXb and the exclusive use of imported yellowish brown flint at Dikili Tash II. During this period, Carpathian obsidian is attested at the settlement of Mandalo, pointing to communication and extended networks operated to the north. Additionally, the dominance of blade tools at almost all settlements is noteworthy, which in some cases were intensively resharpened and recycled (mainly of excellent quality flints).

Correlations to the southern Balkans

Although the information deriving from the southern Balkans is rather fragmented, the use of local sources for tool production is attested in most cases. The settlements of Kallamas and Maliq in the Albanian region used locally available materials like reddish brown radiolarite and various flints. Taking into consideration the geology of the area, at least the southern part of the Korçë basin is part of the Hellenides zone and the Pindus range. Likewise western Macedonia, radiolarites and siliceous carbonates are present. Most of the raw materials used for tool production are considered of local origin from the mountains of the Korçë region, which are rich in siliceous rocks, often of excellent quality (Kourtessi-Philippakis & Astruc 2002, 76). Apart from the presence of reddish radiolarite, flints of good quality are also reported, like gray, brown, as well as excellent quality yellowish brown-honey flint. The sources of these materials are considered local or regional, while the honey colored flint is regarded to derive from the southwestern part of Albania. This material is also attested to the Neolithic settlements of western Macedonia (Dispilio, Servia, Megalo Nisi Galanis, Anarghiri IXb) in the form of finished tools. The possible source of yellowish brown flint from the Albanian region could be part of the interaction and communication between the southern settlements of Albania and northwestern Greece. Additionally, the presence of the few obsidian artefacts that originate from Melos indicates the networks operated among these regions.

The cores of local materials were introduced into the settlements prepared and worked on-site. Tool production was based on blades that were used either unretouched or retouched. The presence of sickle blades demonstrates their use in agricultural activities, while the type of end-scraper on a blade is also usual. The available information from the Maliq II settlement points to some similarities regarding the tool types of the Final Neolithic material from Anarghiri IXb. End-scrapers, sickle blades and perforating tools are also common in the settlement. On the other hand, most projectile points belong to the type of triangular with bifacial covering retouch that is absent from the settlement of Anarghiri IXb, but is attested at Megalo Nisi Galanis.

The information regarding the industries of the Republic of North Macedonia is also limited. Local raw materials are dominant at the Late Neolithic Amzabegovo (Phase IV), which in this case include mainly quartz, but also flints, chalcedony and jasper. Additionally, the presence of exotic materials is also attested by honey-colored flint and opalite from unknown sources, while the absence of obsidian is characteristic of the industries of the Republic of North Macedonia (at least at the current state of research). On the other hand, recent research suggests a local origin of the honey-colored flint (Dimitrovska 2012a; 2012b). The tool typology includes retouched blades, sickles, end-scrapers on flakes and blades, perforating and composite tools, but is characterized as disposable since modification by retouch is quite rare.

Finally, the lithic industries of Bulgaria during the Late Neolithic are characterized by the use of local raw materials and a strong preference for flake tools that were mostly represented by end-scrapers, while the presence of geometrics is also attested. During the Chalcolithic period, the use of local materials continues to prevail. However, the circulation of tools made of honey-brown flint from northeast Bulgaria characterizes this period. The latter was part of extended long-distance networks, including mainly blade tools and long-blades detached by pressure, which reached the northeastern part of Greece. The presence of honey-brown Balkan flint is attested at the settlements of Sitagroi, Dimitra, Promachon-Topolniča and Dikili Tash, although reported in small percentages in comparison to the regional material from the Rhodope Mountains. It is supported that tools made of Balkan flint reached the settlements that were affected by the Maritsa culture, characterized by pottery with graphite decoration, as in the case of Sitagroi, Dimitra and Dikili Tash (Manolakakis 2005, 279). However, artefacts of yellowish brown flint have been recorded at many other Late and Final Neolithic settlements of northern Greece, Thessaly and southern Greece. Whether this material is identified with the so-called Balkan flint or is related to the regional material of Rhodope Mountains, or even originates from other sources (west coast of Greece, Albania, etc.), remains unknown for the moment. Concerning tool production, we could stress the general tendency for blade tools. The type of end-scrapers on long blades is attested at many settlements of northern Greece, as well as most tool types like sickle blades, truncations, splintered pieces, geometrics, etc. Among the tools of Balkan flint that circulated during the Chalcolithic period are long pressure blades. Single long blades of this material are reported from Sitagroi III (Tringham 2003, 91), Dikili Tash II (Sériadès 1992, 75) and Kavallari (Kakavakis 2011, 129; Pl. 10:a, 18:a), while the long blade found at the settlement of Anarghiri IXb should also be included. Thus, it seems that at least eastern Macedonia was part of an extended network regarding the introduction of tools made of Balkan flint. However, according to Kakavakis, the small number of products, as well as their specialized production, could support the action of itinerant traders (Ibid., 234-235).

Chapter 7.

Chipped stone tools and exchange networks

7.1 Exchange models of chipped stone in Greek prehistory

The circulation of obsidian

For many decades, the main focus of researchers regarding raw material circulation and exchange among prehistoric settlements was related to obsidian. The fact that this raw material had specific sources of provenance in the Aegean (Melos, Nisiros, Antiparos) and elsewhere (Carpathia, Central Anatolia, Sardinia, Lipari, Palmarola and Pantelleria in Italy) enabled the characterization studies and the development of many theoretical models concerning its origin, distribution and exchange among the prehistoric communities.

The first models related to obsidian provenance and distribution evolved during the decade of the 1960s with the increased developments in chemical methods and analysis. One of the first works by Renfrew and his team focused on the provenance of obsidian motivated by the vast quantities of the material uncovered in the Saliagos excavation, which proved to be of Melian origin. By analyzing a variety of samples from various excavations, they demonstrated the dominance of Melian obsidian not only around coastal Greece, but also on the mainland. Based on studies of Neolithic sites in Anatolia, their research resulted in the theory of 'down-the-line' trade, suggesting that the density of the obsidian in a settlement was related to its distance from the sources (Renfrew et al. 1965; 1968). They proposed the separation of the settlements into 'contact zones' which included settlements in a radius of less than 300 km away from the sources and 'supply zones', which referred to settlements of longer distances (more than 300 km). In the first case, the contact zones were suggested to be close to the sources and had direct access to the obsidian material, while the latter referred to settlements in an interaction zone where obsidian was distributed indirectly ('down-the-line') and in smaller quantities through more complex exchange chains that involved many settlements in between (Renfrew 1977, 77-79).

During the 1980s Torrence criticized Renfrew's model, supporting that it was mainly based on quantitative criteria and took into account only two variables, the distance of the settlements from the source and the quantity of the material. Her work at the Melos quarries and coastal settlements in the South Aegean focused on the efficiency of the production, which refers to the degree of standardization or simplification in production techniques to maintain control over time, energy and material inputs (Torrence 1986). The examination of various attributes related to quarrying techniques and core preparation suggested to Torrence that during the Neolithic period, there was direct access to obsidian sources by non-specialized consumers, with an expedient character and in combination to other activities, like fishing. At the same time, skillful specialized knappers also had direct access, and their action was mainly related to the procurement of preform blade cores (Ibid.).

A few years later, the research of Perlès in Thessaly and the South Aegean suggested that there was no fall-off with distance on a north-south axis since the material is well represented at many Neolithic settlements of eastern Thessaly. Perlès supported that the settlements close to the source could directly acquire the raw material, but in the case of settlements located further away, this would be impossible. By examining the type of debitage, the stage of obsidian import and the percentages of other raw materials in each case, she claimed that the core preparation and pressure blade production was the act of specialized craftsmen. Thus, she proposed that the distribution of obsidian was the result of itinerant middlemen who supplied the raw material directly and travelled long distances to distribute obsidian (Perlès 1990; 1992b). Perlès distinguished three different strategies of obsidian supply and distribution. The first one involved the settlers of the islands and coastal settlements, which supplied the material directly from the sources. The second involved settlements further away (Thessaly) where obsidian was abundant but introduced in pre-shaped form by exchange with the action of itinerant knappers. Finally, the more distant areas in the mainland (Macedonia) were involved in indirect procurement, as in the previous case, but the material is present in small quantities. Perlès also suggested that different production strategies existed during the Early and Middle Neolithic when obsidian knapping was more skillful and itinerant specialists prepared and distributed the obsidian cores. During the later phases of the Neolithic (LN, FN), the variability in the stages of obsidian introduction to the settlements and the different degree of knapping skills attested, indicated the de-specialization of obsidian production. During this period Melos was inhabited and the technical improvements in transportation and seafaring allowed the direct supply to more non-specialized teams. For the later periods, she proposed the existence of off-site core preparation workshops in various coastal regions that supplied Thessaly and northern Greece with prepared cores (Ibid.).

In the following years, a critical examination of these models developed regarding the factors and variables that were being compared or evaluated in each case. Karimali (1994, 50-57) proposed additional qualitative variables that could affect the interpretation of obsidian acquisition and distribution, like the general geomorphological area where the settlements were located and the regional networks that could have been developed. By examining the material from the settlements that were away from the Aegean coast, Karimali also suggested that the presence of obsidian in Thessaly was reduced not only on a north- south axis but also from east to west. Thessaly was a supply zone where obsidian in smaller quantities was distributed in the form of prepared cores and mainly indirectly through the action of intermediaries (Karimali 2009). The analysis of obsidian production and distribution in Thessaly suggested to Karimali that the prehistoric settlements were connected by regional cultural identity. This turned her focus on the social context of space and distance, which played an important role, as well as the need to emphasize the micro-regional and micro-temporal scale (Karimali 2001, 757-759). Thus, she proposed the parallel existence of multiple exchange networks between regions as part of the same cultural mechanisms and commonly shared identities, a fact that has also been supported by ethnoarchaeological research (Karimali 2005b).

A recent work regarding the provenance and distribution of obsidian was conducted by Milić (2016). Milić analyzed a large number of obsidian artefacts from several Neolithic settlements of western Anatolia, Balkans and the Neolithic Aegean, paying particular attention to the outer zones of obsidian distribution. Her research demonstrates cases of obsidian overlaps at the edges of distribution zones, which derived from different sources. Thus, the presence of a main raw material from one source was accompanied by sporadic or occasional artefacts from a second source, like in the case of Neolithic Dispilio in northern Greece. Milić supported that interactions among settlements did not always have the same character, but were shaped in a micro-regional scale, where our focus should be laid. The parallel existence of two different obsidian sources point not only to exchange networks but also to the direction of contact between the settlements during this process. This could also be affirmed by other archaeological materials that were exchanged along with obsidian artefacts, in combination with other activities. Finally, she suggested that obsidian was an expression and a secondary materialization of other social processes taking place among the settlements. By focusing on the micro-regional scale and detecting differences and similarities, it might be possible to unveil how agents within different distribution networks and systems engaged with each other (Milić 2016).

Flint and other raw materials

Apart from the extended discussion regarding obsidian provenance and circulation, more research followed concerning other raw materials involved in chipped stone production. In the last decades, the pattern of local or regional exchange networks has been developed due to the increased analysis of lithic assemblages from many prehistoric settlements of northern Greece. More specifically, in the chipped stone industries of northern Greece flint, chert, radiolarite, jasper, quartz and chalcedony are some of the common raw materials involved in tool production, while the percentages of obsidian are low (Kakavakis 2011, 76-78). Although the provenance of many of the materials is yet unknown and many questions arise regarding their presence within the settlements, the discussion on the circulation of certain raw materials proves to be intriguing. The petrographic characterization of samples from Neolithic settlements of northern Greece that has already been mentioned in a previous chapter (see Chapter 4.2.2), in most cases, demonstrates the prevalence of local or regional raw materials for the production of tools in a strong correlation to the geological background of each area (Dimitriadis & Skourtopoulou 2001, 784-786). Consequently, the general picture of northern Greece contrasts to southern Greece, where imported raw materials were mostly used, with obsidian to dominate, while flints of local or unknown origin are less common. In northern Greece, local and regional materials played an important role in tool production and, at the same time, imported material, like obsidian and honey flint, are present in small quantities (Kourtessi-Philippakis 2009, 305).

The research of Skourtopoulou on the lithic material of Neolithic settlements in central Macedonia suggested the existence of multiple production systems and tool distribution at a local and regional level. In central Macedonia, siliceous limonite, a local material with sources close to Vasilika, was distributed by the Neolithic settlements of Vasilika and Thermi in a radius of 50 km. The two settlements were implicated in the production of tools made of siliceous limonite. Thermi is characterized as a center of production (workshop) from where chipped stone tools of this material were distributed. In contrast, adjacent settlements where only finished tools of siliceous limonite were found and no traces of on-site production are attested, are characterized as recipients of finished products, participating in small-scale exchange networks. Good examples are Stavroupoli in the Thermaic Gulf and Makriyalos in Pieria. At the same time, the presence of high-quality flints (probably derived from the Rhodope range) and excellent quality radiolarite (derived from Thessaly) in the form of finished products points to the existence of parallel regional east-south directed networks. Additionally, the increased presence of obsidian in comparison to other settlements of central and eastern Macedonia indicates that at least the settlement of Stavroupoli was involved in coastal exchange, probably related to the social and cultural choices of the prehistoric community (Skourtopoulou 2002, 245-247; 2004, 401-402).

A similar picture is recorded in eastern Macedonia. The prehistoric settlements of Dikili Tash, Dimitra and Sitagroi are also characterized by the use of local or regional raw materials that in this case involve chalcedony, quartz, various flints (among them 'honey' flint), as well as small quantities of jasper, rock crystal and in few cases obsidian. However, the case of Sitagroi is dissimilar, due to the high representation of 'honey' flint, which was worked on-site. The presence of honey or 'Balkan flint' has been an extended matter of discussion. Its presence is attested at many settlements in southern Greece from the early prehistoric periods, as well as Thessaly, Macedonia and Thrace. The source of the material is likely in North-East Bulgaria or perhaps further to the west. 'Balkan' or 'honey' flint from Bulgaria circulated in the form of tools mainly in eastern Macedonia, but also in central and western Macedonia, as well as in Thessaly. However, a possible source in the Rhodope Mountains of similar material is proposed and was distinguished by the former based on the specialized techniques used for the production of tools (pressure) (Manolakakis 2005, 201-202). It seems that the regional variety is more common in comparison to the imported Balkan flint. However, its representation varies among the settlements of eastern Macedonia, while only in the case of Sitagroi, on-site production of the regional material can be supported (Tringham 2003, 84). It is possible that, apart from the rest local and regional materials, a network for the distribution of honey flint had developed mainly east of the Strymonas River with Sitagroi as a possible production center (Kakavakis 2011, 234; 2015, 38).

Jasper (radiolarite) of possible western origin (Pindus) presents another possible case of acquisition and distribution of materials between eastern and western northern Greece (Kourtessi-Philippakis 2009, 308-309). Similarly, the increased presence of high-quality honey flint at the settlements of eastern Macedonia, in contrast to the limited presence of this material in central and western Macedonia, could be related to networks developed between the settlements of east and west northern Greece. Additionally, as in the case of western and eastern Thessaly, the quantities of excellent quality radiolarite reduces when moving to the east, where the presence of honey flint is more common. The opposite direction points to the decline of honey flint when moving to the west. Kourtessi-Philippakis also suggests four crucial parameters in order to explain the variability of the lithic industries of northern Greece and the complexity of the exchange networks: the lithological background of each area, the technological skills and the related products, the economic strategies involving raw material availability and procurement modalities, as well as the territorial parameter referring to sources' control and exploitation (Ibid., 309-310).

Moreover, in the area of eastern Macedonia and Thrace, the location of the Petrota and Nigrita quarries of flint and chalcedony, pointed to the off-site stone working in a great extent, since various traces of decortication and core preparation stages have been attested. It has been suggested that the first stages of core preparation were taking place away from the settlements, probably at the quarrying areas, as evidenced by the lack of decortication products in most settlements. Likewise, Kakavakis observed that settlements with similar distance from the Nigrita sources had different strategies of raw material acquisition. The statistical analysis and the stage of importation of the products suggested that the settlements west of the Strymon River did not have direct access to the sources. This could be interpreted by landscape negotiations between neighboring regions in terms of territoriality (Kakavakis 2015, 38-39).

The exchange networks of the Thessalian Neolithic settlements were examined by Karimali, who proposed the existence of multiple exchange systems that could be working parallel to each other in a settlement (Karimali 1994; 2009). Karimali differentiated the settlements regarding their distance from the Aegean coast as a factor that could affect the quantities of obsidian. She suggested that during the Late and the Final Neolithic period, obsidian was dominant and highly represented at the settlements located close to the coast, but in the mainland and the western part of Thessaly, the proportion of obsidian was decreasing. On the contrary, the settlements located in western Thessaly used mainly excellent quality chocolate flint, which was decreasing moving to the east. Moreover, some settlements in the middle of the Thessalian plain participated equally in both networks. This observation suggested to Karimali that both networks were running parallel and sometimes overlapped each other. This suggestion was also reinforced by the stage of production that each material was introduced into the settlement. Thus, obsidian is present in the form of prepared cores at the east coast and moving to the west, it is represented by ready tools (blades), while the exact opposite is observed for chocolate flint, with the opposite direction. The above research stressed the significance not only of the geographical and geological variations, but most importantly, the social space and the choices made by the prehistoric communities on a different level. The settlements of the Late and Final Neolithic could get involved in different and parallel networks, each of them in a different degree of participation and at the same time with a variety of mechanisms developed among the local exchange networks (Karimali 2009, 23-24).

The discussion on the nature and the diversification of chipped stone exchange networks has also been interpreted in relation to other archaeological materials. Kakavakis, at his recent work on the chipped stone industries of northern Greece, concluded that the frequency of lithics imported from distant sources or regional sources of indirect supply is also relative to the frequency of artefacts bearing symbolic meaning, like spondylus shell ornaments, decorated pottery, clay figurines and copper. Thus, he suggests that the indirect acquisition of chipped stone tools during the Late Neolithic was part of social interaction and exchange into meaningful contexts, with other archaeological materials to get also involved (Kakavakis 2014, 603-604; 2017, 439-440).

Furthermore, based on raw material and skillful specialized production, some tool types are considered the result of circulation and exchange carrying symbolic meanings. The symbolic character of some unique arrowheads of highly skilled craftsmanship has already been supported in the cases of triangular spearheads that circulated in Greece and the Balkans during the Final Neolithic period (Perlès 1992b, 143). Similarly, the obsidian projectile points shaped by the use of pressure techniques that are present at many settlements in the Aegean islands and the Greek mainland indicate the large scale of the product's circulation and exchange. The same is supported in the case of the long blades made of Balkan flint during the Early Neolithic and later, during the Chalcolithic, pointing to the circulation of specific tools in a larger scale which was reflecting symbolic or social dimensions (status, cultural identity, etc.) (Manolakakis 2008; 2017).

Apart from the exchange of raw materials and the circulation of products, the exchange has many other forms. Technology has also been viewed as an embodied experience that involves technical knowledge and social practice. The transmission of this knowledge and experience by individuals or teams of specialized knappers involved in various networks could result in the communication at a technical level and the exchange of technological knowledge and expertise (Dobres 2000; Edmonds 1995).

7.2 Exchange networks in the Anarghiri IXb settlement

Taking into consideration the previous overview on the exchange networks related to the chipped stone industries in Greece, an approach on the networks that operated in the case of Anarghiri IXb settlement during the Late and the Final Neolithic will be attempted. However, the lack of research and identification of the raw material sources in the region of western Macedonia is a limiting factor. The same obstacle arises from the incomplete information which derives from the neighboring settlements in western Macedonia. Thus, the discussion will be based on preliminary observations and comments deriving from the evaluation of the Anarghiri IXb lithic material in comparison to the available information from the Neolithic settlements of western Macedonia.

First of all, the existence of two exotic materials is attested to the settlement, obsidian and yellowish brown flint. Obsidian from Anarghiri IXb, probably of Melian origin, constitutes the most numerous assemblage among the Neolithic settlements of northern Greece. The stratified material consists of 321 pieces, while the total number from the excavated area reaches 627 pieces. The percentage of this material of the total studied lithic assemblage is 4.4% during the Late Neolithic, while it increases to 6.3% during the Final Neolithic period. Such a relatively high representation of obsidian in northern Greece is attested only in the case of Stavroupoli (Phase I: 8%, Phase II: 3.5%) located at the Thermaic Gulf and Paliambela Pierias (almost 10%). It has been supported that the settlements in the interior of Macedonia are expected to have smaller amounts of obsidian in comparison to the coastal sites. However, this is not the case of the Anarghiri IXb settlement. More specifically, with the recent work of Milić in the area, it is reported that obsidian in Dispilio represents 2% of the total lithic material (58 pieces), in Kleitos 3% (200 pieces) and Mandalo 1% (12 pieces). It is possible that this could be related to the extent of the excavated area of Anarghiri IXb (1.7 ha), which, nevertheless, is similar to Kleitos (2 ha), but not to many other sites (Dispilio: 0.14 ha, Mandalo: 0.017 ha). However, the settlement of Makriyalos located close to the Thermaic Gulf, even though excavated in an area of almost 6 ha, yielded only 39 obsidian artefacts. Thus, the extent of the excavated area should not be considered the only factor that affects the representation of obsidian in an industry. Similarly, it seems that the access to the obsidian networks was not exclusively related to the settlement's proximity to the Aegean coast (inland or coastal settlements).

Another interesting observation in the case of Anarghiri IXb refers to the presence of not only obsidian products (blades and microblades), but also of few cores, technical products and flakes. The material was knapped on-site to a small extent. In the case of Dispilio, where both Melian and

Carpathian obsidian is attested, only a couple of flakes and rejuvenation products have been found. Additionally, Kleitos yielded Melian obsidian exclusively, mainly from the Adamas source and less from Demenegaki. Few cores, debris and technical products are also present, as well as prismatic blades. It seems that in the case of Kleitos, part of the material was also imported in the form of prepared cores. However, Milić, in her technological analysis, observed that part of the products had irregularities and were not of skillful manufacture. This could lead to the suggestion that the material was partially worked with percussion technique, probably by local or regional artisans. Similar observations allow us to make the same suggestion regarding the Anarghiri IXb material. Pressure prismatic blades and microblades of fine knapping in technical terms point to products of specialized knappers that were imported to the settlement ready-made. At the same time few obsidian cores were probably introduced fully prepared. Moreover, some cases of unstandardized and less careful production of artefacts is also recorded. The cores, technical products and flakes demonstrate a rather unsophisticated production, which may support the implication of local or regional knappers in the process.

In any case, the percentage of obsidian in Anarghiri IXb points to a more intensive introduction of the material, which seems to increase during the Final Neolithic period. Obsidian could have reached western Macedonia through Thessaly or the coastal settlements of central Macedonia. Aliakmon River could constitute a natural route of communication between these regions. At the same time, the settlements of Dispilio and Mandalo have yielded some Carpathian obsidian, which indicates their implication in a wider exchange network operated in the north.

Another exotic raw material used, probably an object of exchange, is the yellowish brown flint. This material is present at the settlement of Anarghiri IXb in a small percentage during the Late Neolithic (0.6% of flints), while it is more common in the next period (15.3% of flints). Yellowish brown flint or 'honey' flint or 'Balkan flint' as it is often referred to in the bibliography, is present at the settlements only in the form of finished products (blades, tools). The only exception is the site of Sitagroi, where high proportions of this material were worked on-site, related, however, to the regional honey flint that derived from the Rhodope Mountains. In the Anarghiri IXb settlement during the Late Neolithic, there are only eight products of yellowish brown flint (retouched and unretouched blades). Among them is an unretouched long pressure blade (18.6cm) made of a material that macroscopically resembles 'Balkan' flint. This tool reminds the long pressure blades that were coming from the region of Bulgaria in the Balkan area during the Chalcolithic period (Gatsov 2009, 43-45; Gurova et al. 2016; Manolakakis 2008). It is interesting to note that there is a shift in the number of products made of yellowish brown flint during the Final Neolithic. More precisely, 18% of this raw material category corresponds to the opaque yellowish brown flint with white inclusions, while the majority is made of a fine translucent variety (77%). It is not clear whether these two varieties derive from the same sources, or could indicate a different origin (e.g., western coasts and Albania for the translucent variety). Apart from the unretouched products, a number of yellowish brown flint describe tool types that are characterized in most cases of heavy retouch and a high degree of resharpening and recycling. Furthermore, few technical products and flakes used as cores are also documented. It seems that limited on-site production was practiced. This material was imported and related to high-quality technical skills, like pressure flaking. Its presence is also attested at neighboring settlements like Dispilio in high percentage (33%), Servia and Megalo Nisi Galanis (no percentage available). However, it seems that the proportion that reached the Anarghiri IXb settlement was smaller, at least in comparison to the site of Dispilio.

Apart from these two imported materials, a great variety of high-quality semi-translucent flints is documented at the settlement of Anarghiri IXb. Gray, pale brown, reddish brown, black and olive flints cover the majority of the toolkit. The origin of these materials is still unknown, but it is possible their sources to be located in the mountains of western Macedonia and the Pindus range. Gray flint covers almost half of the assemblage during the Late Neolithic. There is a clear and excellent quality of this material, but also some lower qualities with impurities. It has been demonstrated that the material was mainly imported in the form of prepared cores and knapped on-site. Similarly, black flint, which is present only during the Late Neolithic period, was introduced into the settlement in the form of partially prepared cores, small in size. Olive and reddish brown flint is mainly present in the form of products and it is suggested that they were imported to the settlement as finished tools. A similar case refers to pale brown flint, which nevertheless, is connected to a couple of cores and few technical pieces.

During the Final Neolithic period, the total absence of black flint is noteworthy. Additionally, the representation of gray flint decreases, while pale brown flint rises in number. The production scheme does not change significantly. Gray and pale brown flint are represented by cores and technical pieces, while the products include mainly blade tools. Additionally, few cores and technical products of olive and reddish brown flint are recorded for the first time, pointing to small-scale production. The above-mentioned materials are also represented in the industries of western Macedonia, in most cases, with little evidence of on-site production. In the case of

Anarghiri IXb, at least gray and black flint seem to be exploited at the settlement and the same is reported for Dispilio. However, it could be suggested that part of the materials circulated on a regional scale among the settlements of western Macedonia and were mainly imported in the form of products and less as prepared cores. Nevertheless, a direct acquisition from the sources known by the prehistoric communities of the region could also be proposed, which shared not only materials but also technological knowledge, skills and ideas.

Another material that was used for the tool production at the settlement of Anarghiri IXb is radiolarite. During the Late Neolithic, its percentage is rather low (5.9%), but in the next period, its use increases (11%). However, the presence of lower quality material in the form of river pebbles has already been mentioned. Its presence at the settlement covers all the production stages since there are raw nodules, cores, technical pieces and blanks. On the contrary, the fine quality material represented by few cores and a couple of technical pieces seems to be imported mainly in the form of finished products, with a high representation of regular blades and few microblades. During the Final Neolithic, this schema continuous, with the lower quality material to be flaked on-site, represented by all production stages, while the products include mainly flakes and blade-flakes, but few irregular blades. The fine quality material is represented by a few cores and technical pieces, attesting small-scale exploitation at the settlement area. Additionally, the majority of the fine quality material is represented by regular blades and blade tools. It could be suggested that the lower quality material was easily accessible to the prehistoric community, if we take into account the stage of importation of the material and the technical characteristics (raw nodules, cortical and other technical products). A possible secondary source close to the settlement, a stream or a riverbank, or even its possible origin at the close Voras Mountain, could point to the direct access of this material. A different case is related to the excellent quality dark reddish brown radiolarite. The few evidence of on-site knapping, the technical skills that are required for the production of regular and prismatic blades and microblades, the high percentages of retouched and recycled tools, point to a more distant origin and possibly the action of more specialized knappers.

The fine quality radiolarite of the Anarghiri IXb settlement is compatible with the high-quality chocolate flint that is attested at many Neolithic settlements in Thessaly. The material was majorly exploited and used for the production of prismatic blades by the occupants of western Thessaly. Its presence is also attested at Dispilio, Megalo Nisi Galanis, Servia, Toumba Kremastis Koiladas and probably Avgi. At least at Megalo Nisi Galanis and Servia, an excellent quality chocolate flint is reported and separated by the lower quality material derived from secondary deposits (Aliakmon River). It seems that the settlements of western Macedonia followed the same strategy. Low-quality radiolarite was accessible directly from secondary sources and mainly used for the production of flakes and less regular blades, while the high-quality material was probably imported in the form of tools. In the second case, the tools, but also some prepared cores, could be imported from the Thessalian settlements through exchange networks.

On the other hand, the origin of the high-quality radiolarite from northern Pindus is also possible, and its exploitation by the settlements of western Macedonia could be either direct or by importing ready tools that could have been produced by regional skilled artisans. It should be noted that the percentage of radiolarite at the site of Dispilio is much higher, at least in comparison to Anarghiri IXb, probably due to its proximity to the Aliakmon River and the mountainous area of Pindus. Similarly, at Megalo Nisi Galanis, reddish brown flint prevails over the rest raw materials, and the same is observed at the site of Servia. However, the distance of the Anarghiri IXb settlement from Pindus and the few evidence for on-site knapping of this fine quality material probably support its indirect procurement (finished products and few prepared cores).

Finally, the presence of chalcedony at the settlement of Anarghiri IXb is generally low but seems to increase during the Final Neolithic (LN: 2%, FN: 5%). The material is of medium quality and during the Late Neolithic is present only in the form of flakes, blade-flakes and few blades, indicating that it was introduced into the settlement in the form of ready products. In the next period, a nodule and a core, as well as few technical pieces, are recorded. Half of the products are flakes and blade-flakes, while the rest blanks correspond to blades. It seems that part of knapping was taking place in the settlement, but once again, imported material is attested. Chalcedony is abundant in eastern Macedonia, where this material was widely used. Its presence at the settlements of central and western Macedonia is scarce. Importation of this material from the east is possible, but the medium quality of the material proves such a hypothesis to be unlikely. We could search for possible sources in the region of western Macedonia since this could also explain the presence of the raw nodule and the core. Chalcedony is also reported at the settlements of Pelagonia, in the southern part of the Republic of North Macedonia, but also at the settlement of Sovjan (Bronze Age) in the Korçë basin, considered as local material (Kourtessi-Philippakis & Astruc 2002, 81). Additionally, few Thessalian settlements, like Magoula Orgozinos, as well as the Early Neolithic settlement of Achilleion (Elster 1989, 275), have also reported small quantities of chalcedony, which are also considered of local origin. However, the excellent quality material that is present at the settlement of Anarghiri IXb in the form of few retouched tools of skillful production is considered imported.

Apart from the raw material provenance that could demonstrate the existence of exchange networks, some other parameters could also be examined. Some categories of products that are the result of skilled and specialized work are also considered as the result of exchange in a network of tools' circulation. This could be mainly supported for some fine bifacial projectile points that are present during both chronological periods at the settlement of Anarghiri IXb. One of the Late Neolithic projectiles of gray flint is of excellent knapping quality, with bifacial removals and symmetry that indicate a skilled production, probably by pressure technique. It is possible that it was produced by specialized knappers and brought to the settlement in the form of exchange. The remaining projectiles are more simple and unsophisticated, pointing to the work of perhaps local knappers. Additionally, the presence of the long pressure blade of yellowish brown flint is another example of this period. The different size of the tool in combination with its exotic raw material and the technique used for its production indicates its import to the settlement by exchange networks. These long blades are well known at the Chalcolithic settlements of Bulgaria and were widely circulated during this period. The blade arrived at the settlement as a gift or exchange, possibly along with other materials.

During the Final Neolithic, the presence of imported tools is more evidenced. Once again, in the case of projectiles, two outstanding obsidian arrowheads of high skilled manufacture by pressure technique are considered the result of exchange. In northern Greece, there are no references for projectile points made of obsidian, except for a possible preform reported at the settlement of Stavroupoli (Skourtopoulou 2004, 389). Similar obsidian projectiles bearing covering bifacial retouch are more common at the Neolithic settlements of Thessaly, southern Greece and the Aegean. The wide area of circulation of these artefacts demonstrates their manufacture by specialized artisans and their distribution by complex systems of exchange. Additionally, the unique spearhead of high quality yellowish brown flint is another imported tool. Its high technical standard excludes the possibility to have been made by locals. The spearhead does not seem to bear traces of use and could be considered as a prestige item. There are no similar spearheads at the settlements of northern Greece, while parallels in the Greek Neolithic are rare. Moreover, the high quality of the raw material used for its production points to distant sources, probably to the north.

The remaining bifacial and symmetrical arrowheads of high technical standard could also be considered imported as the result of exchange. The similarities in shapes and raw materials in a wide area could demonstrate their production by skillful artisans who distributed their products or at least communicated at a technical level. Similar tanged and barbed projectile points covered by bifacial retouch and made of fine quality flints (gray, pale brown, yellowish brown) are common at the sites of northern Greece, like Dispilio and Avgi, Toumba Kremastis Koiladas, Makriyalos and Stavroupoli. Additionally, there are some bifacial tanged and barbed projectiles that resemble some from Thessalian settlements made of fine quality radiolarite, which could also be imported. However, it should be noted that the presence of semi-products in the settlement points to an effort of production by the locals. In these cases, as it has already been mentioned, the shaping of the tool sometimes is unsophisticated, with asymmetrical tangs or barbs.

Apart from the projectile points, the excellent quality chalcedony tools of the Final Neolithic layers (an end-scraper, a bilaterally retouched blade and two perforating tools) seem to have been produced by skillful artisans. Not only the high quality of the material, but also the detailed and delicate pressure retouch point to this direction.

The similarities observed regarding the imported raw materials and tools at the settlement of Anarghiri IXb to those recorded at the sites of Dispilio, Avgi, Megalo Nisi Galanis, Toumba Kremastis Koiladas and Servia, point to similar or common exchange networks that the settlements participated in the area of western Macedonia. First of all, the presence of obsidian and yellowish brown flint at the same production stage (except obsidian), and at the same time, the exploitation of the same regional high-quality flints and excellent quality radiolarite is favorable to this direction. However, the diversification regarding the distribution of the materials among the settlements of western Macedonia is indicative of the different management of raw materials, different access, or degree of interaction. As regards obsidian, it should be stressed that the percentage recorded at the settlement of Anarghiri IXb is unique for the area and could point to a more intensive introduction of the material. At the same time, the percentage of obsidian at the site of Kleitos is also increased in comparison to the rest settlements of western Macedonia. It seems that obsidian is present in higher percentages at the settlements where evidence of on-site exploitation are reported. In any case, the settlements of western Macedonia did not rely on its use to a significant degree since excellent quality materials were available in the region for the production of their tools. Thus, obsidian should not be entirely related to its practical use, but might also reflect social choices of the community, like the participation in wider social networks and the links to distant areas.

On the other hand, the presence of Carpathian obsidian at the sites of Dispilio and Mandalo, which in the first case coexists with the Melian obsidian, demonstrates another network of obsidian distribution operating in the north, from which the rest settlements of western Macedonia and northern Greece were excluded. As Milić has proposed, the existence of the Carpathian obsidian should not be considered of utilitarian use, but mainly of symbolic value, since the closer settlements at the north that could supply this material were 300 km away. Thus, it was easier to obtain Melian obsidian from the regional networks, than the Carpathian exchange systems (Milić 2016, 243).

If we turn to the presence of yellowish brown flint, we could also suggest that a similar network provided this raw material in the form of finished products to most settlements. Either its origin is from the Bulgarian region, or the western coasts of Greece or Albania, the material is documented at the same production stage. Additionally, if we suppose that it originates from the Rhodope Mountains, an introduction from the east could also be possible, much higher of the expected percentages (Kourtessi-Philippakis 2009, 309). However, the tiny quantities of this material documented at the settlements of central Macedonia create a gap between the two areas (eastern and western Macedonia) that proves problematic. We could suggest that a western origin of yellowish brown flint is more possible. Additionally, a recent survey in the area of Kastoria has located raw nodules of honey flint in secondary deposits (Aliakmon River), pointing to a possible regional origin of the material (Galanidou 2010). The percentage of this material is higher at Dispilio than in Anarghiri IXb, but in all cases, the on-site production is not evidenced.

Turning to the micro-regional scale, all settlements of western Macedonia had access (direct or indirect) to excellent quality material, which covered the lithic production to a high degree. The excellent quality radiolarite connects the settlements of the region, probably through an indirect supply of tools and rarely cores. Similar observations can be made for fine quality flints. Gray, pale brown, black and olive flint are common in the industries of western Macedonia. It is noteworthy that during the Final Neolithic black flint is absent from the Anarghiri IXb, the time that the exotic materials like obsidian and yellowish brown flint, as well as regional material as pale brown flint, fine quality radiolarite and chalcedony increase. The total absence of this black flint demonstrates a change that occurred regarding its supply and partially to gray flint with a significant decrease. Whether this change in the preferences of raw materials is related to economic, social, or territorial factors is unknown. We could suggest that the change recorded in the case of Anarghiri IXb, could reflect possible changes at the networks, or restricted access, where the Anarghiri IXb settlement could not participate anymore. On the other hand, it could also be related to the strengthening of more extended networks if we consider the shift of obsidian and yellowish brown flint or the decision of the local artisans to replace this material with others.

The above discussion attempted to shed light on the possible communication and exchange networks of the Anarghiri IXb settlement, motivated by the evidence from the lithic record. Of course, in order to understand and examine the networks that the Anarghiri IXb settlement was participating it is critical to consider other materials. However, the lack of studies of other groups of archaeological material from the Anarghiri IXb settlement does not allow for formulation of such hypotheses for the time being. The little available information deriving from the neighboring settlements of western Macedonia make such an attempt even more difficult. However, the similarities reported regarding pottery, but also the presence of many other artefacts that have been parts of goods' circulation like spondylus shells and gold ornaments well known from other contemporary settlements in Thessaly and Macedonia, suggest the participation of the settlement in extensive and well-organized networks.

To conclude, we could suggest that multiple exchange networks (regional and more distant) could operate in the case of Anarghiri IXb, including a wide range of materials of various provenances and an increase of importations during the Final Neolithic period. The interaction among the communities of western Macedonia is only partially evidenced by the chipped stone production through the similarities in the use of raw materials, the technological characteristics of the artefacts and the common tool types. The operation of a regional network (or more than one networks) sharing materials, technical knowledge, experiences and symbolic expressions is suggested and can be reinforced by the future research of other aspects of the material culture.

Chapter 8.

Final conclusions

The present research investigated the organization of chipped stone production at the prehistoric settlement of Anarghiri IXb during the Late and the Final Neolithic period, offering a comparable material from western Macedonia. The analytical study of the lithic material following the *chaîne opératoire* methodology facilitated an analysis of strategies employed by the prehistoric occupants of the settlement in regards to raw material acquisition, tool production, use and maintenance and a discussion of the diachronic development of lithic production in the Neolithic community.

The chipped stone industry of Anarghiri IXb is characterized by the use of a variety of raw materials for tool production, including local and regional materials, as well as materials from exotic sources to a smaller degree. Flint is the dominant raw material used during both chronological periods, followed by radiolarite and obsidian, while the use of local chert, chalcedony, quartz and quartzite was limited. The high-quality flints of gray, black, pale brown, olive and reddish brown color probably derived from the mountain ranges of western Macedonia and were used mainly for blade production. The prevalence of these materials in contrast to lower qualities of quartz, quartzite and chert demonstrates, on the one hand, the awareness of the raw materials' physical properties by the prehistoric knappers and, on the other hand, the availability of good quality raw materials and the knowledge of their sources in the region. At the same time, access to the sources used by other settlements in the region indicates the development of socio-economic relations with the neighboring communities. The materials could be acquired directly from the sources, possibly in combination with other activities and short trips, or were indirectly imported within regional circulation among the settlements.

Additionally, the use of exotic materials like obsidian and yellowish brown flint indicates the participation of the settlement in wider communication and exchange networks related to distant sources. However, the dependency of the tool production on the exotic materials was not significant, at least during the Late Neolithic period. The few tools made of yellowish brown flint probably reflect a more social or symbolic expression of possession of this different raw material, also evidenced by the presence of the long blade made of Balkan flint. On the other hand, the presence of an obsidian core, technical products, flakes, blades and microblades indicates the on-site production of this exotic material to a limited degree.

Between the two chronological periods, the lithic material demonstrates changes in the raw material preferences. Regional raw materials are still dominant, but the decline of gray flint and the total absence of black flint from the Final Neolithic layers with the parallel increase of pale brown flint and excellent quality radiolarite is characteristic. At the same time, an increase in exotic materials is attested concerning both obsidian and yellowish brown flint. Obsidian is still exploited to a small degree during this period, while the percentage of yellowish brown flint is significantly increased, mainly represented by ready blade tools. Local materials like chert and quartzite remain almost unchanged, while the decline of quartz is followed by a small increase in the use of chalcedony.

The decortication of cores was taking place away from the settlement area, probably close to the sources. Little evidence of the first reduction stages is connected to gray and black flint, medium quality radiolarite, quartz, or local chert. The cores, in most cases, were introduced into the settlement prepared. The only exceptions are connected to the raw nodules of medium quality radiolarite, quartz, chalcedony and some local cherts. During the Late Neolithic, gray and black flint were flaked at the settlement, while scarce evidence of on-site exploitation is connected to other excellent quality materials (pale brown flint, fine quality radiolarite). Apart from quartz and quartzite, local cherts of medium quality, but also medium quality radiolarite were exploited on-site. Finally, the presence of exotic materials is attested by obsidian artefacts, which mainly involve blades and microblades, but also a core, technical products and flakes that indicate restricted on-site exploitation of the material. In contrast, yellowish brown flint is almost exclusively present in the form of finished tools. In the Final Neolithic, cores and technical products show a small decline, while evidence for the on-site exploitation of the rest raw materials is recorded. Few cores of reddish brown and olive flint, as well as chalcedony, point to small-scale exploitation of materials that during the previous period were imported to the settlement as finished products.

In technological terms, the industry of Anarghiri IXb is oriented to blade production. During both chronological periods, blades are dominant among the artefacts, while the presence of flakes, blade-flakes and microblades is rather small. However, the information derived from cores demonstrates that a significant number is connected to flake production with plain platforms, in contrast to the majority of products (blades) where prepared butts are dominant. This could be related to the on-site exploitation mainly of local materials and low-quality radiolarite, which were used for the production of flakes and irregular blades. Thus, some tools must have been imported to the settlement as finished products. The raw materials used for blades are characteristic to this direction, except gray and black flint that were clearly worked on-site. Blades and microblades were mainly made of fine quality flints during both periods, fine quality radiolarite, obsidian and few cases of chert. Flakes and blade-flakes were produced by gray, pale brown flint, but also chalcedony, radiolarite, and quartz, while the rest materials are underrepresented.

The examination of cores indicates two different strategies of exploitation. The first is simple with plain or cortical platforms and less careful preparation that is mainly connected to lower quality materials, like chert, medium quality radiolarite, quartz and quartzite for the production of flakes, blade-flakes and irregular blades. At the same time, a more specialized production is attested by prepared cores with geometric shapes and more careful design connected to excellent quality material for the production of blades and microblades (flints, radiolarite, few cherts and obsidian). This is also supported by the technical pieces since core preparation with guiding crests, but also the effort to fix the errors and ensure the normal procedure of knapping (rejuvenation products) is mainly related to fine quality materials.

The evidence derived from the products also attests different knapping techniques and technical choices. Local quartz, quartzite, low quality radiolarite and chalcedony are mostly related to flake and blade-flake production, which in most cases includes irregular products. This could be caused by the restrictions of the physical properties of the materials that were probably not that suitable for blade production, but also to the knapping techniques involved. The exploitation of most local materials is not connected to a predetermined debitage production, but rather to an expedient production (especially in the case of quartz). On the other hand, the exploitation of fine quality materials is related to blade production, indicating a more demanding procedure that involves core platform preparation, guiding crests and more careful design of the cores.

In the case of imported exotic materials, the products are majorly related to prismatic blades and microblades that have been produced by indirect percussion and pressure techniques. These products point to excellent knapping skills and were probably produced by specialists. However, in the case of obsidian, apart from the prismatic blades and microblades, there are also many irregular products with less careful design that point to lower knapping skills and the application of percussion techniques. The evidence for on-site production of obsidian demonstrates that apart from the imported blanks, a number of products was manufactured by knappers that were not very experienced in skilled knapping.

Additionally, the knapping techniques applied for tool production are related to the raw materials used. Excellent quality materials were knapped by indirect percussion and direct percussion with a soft hammer, but there is also evidence for the use of pressure technique. Flakes and blade-flakes were mainly detached by direct percussion with a soft hammer. During the Final Neolithic period, an increase in the use of indirect percussion and pressure technique could be supported, probably related to the increased number of prismatic blades and microblades made of exotic materials.

Consequently, different production systems are recorded at the settlement for the production of the desired tools. The first one refers to specialized production of prismatic blade blanks and tools, which is related to the imported exotic materials (obsidian, yellowish brown flint). At the same time, a domestic production is attested with products of unstandardized form and simple knapping techniques including the exploitation of local raw materials. Finally, the production related to excellent quality regional materials, with evidence of on-site knapping, is mostly characterized by regular and prismatic blade tools and was probably performed by specialized regional knappers working in the area, or by locals who had developed some degree of specialized skills. These raw materials were imported in the form of ready-made products (blanks and tools), but some prepared cores were also worked in the settlement.

More than half of the lithic material was turned into tools during both chronological periods. Fine quality flints and radiolarite were mostly preferred for tools with further modification, but also chert and chalcedony, whereas quartz and quartzite were rarely retouched and probably used expediently. Additionally, obsidian was mainly used unretouched in the form of blade and microblade blanks. During the Late Neolithic half of tools were made of gray flint, while the representation of pale brown flint, black flint and radiolarite is significantly smaller. A change in the preferences of raw materials used for tools is recorded at the Final Neolithic period, with the decrease of gray flint and the rise of pale brown flint, yellowish brown flint and radiolarite. This change does not seem irrelevant to the general changes in the representation of raw materials during the Final Neolithic period.

Most tool types were majorly shaped on blade blanks. Flakes and blade-flakes are usually common at denticulated, notched, splintered pieces and backed tools. Microblades were rarely modified, involving lateral retouch, micro-perforators, notches, etc. The raw materials used for the production of certain tool types seem to be related to the desired products, depending on the initial size of blanks produced from each raw material and its physical properties. It is possible that the future use of the tool and the activity that it would serve determined the raw materials that would be used for its production. Thus, the need for laminar products (mainly used for cutting and agricultural activities) was satisfied to a great degree by fine quality materials that could produce long and sharp tools. On the contrary, local low-quality materials could hardly correspond to a successive production of regular and prismatic blades. Moreover, further modifications for controlling the size of the blanks and tools (truncation, intentional break) were not usual during both chronological periods, a fact that demonstrates that the blanks had the desired dimensions during initial flaking, pointing to a predetermined skilful knapping.

The Anarghiri IXb industry is characterized by a variety of tool types. However, the dominant tool-type consists of sickles, retouched and unretouched, which cover almost half of the toolkit, followed by scrapers. Perforating tools and blades with lateral retouch are also common tool types, while the remaining types (denticulated, notched, splintered and backed tools, burins, truncations, composite tools, retouched flakes, projectile points) are less represented (< 3%). Few differences regarding the numerical representation of tool types are observed between the two chronological periods, with more characteristic the increase of blades with lateral retouch and splintered pieces. At the same time, a diversity of types and raw materials concerning the projectile points is also recorded. During the Final Neolithic period, the evidence of skillful manufacture of projectile points bearing pressure covering retouch, especially on projectiles of exotic materials, demonstrates their importation from distant areas. In few cases, projectile points of exotic materials are intact and do not show impact fractures. This fact could indicate their possible role, not as tools for practical use, but could bear symbolically loaded meanings, as markers of the communication and interaction with broader networks, or as a reflection of the status and the position of the owner(s) in the community.

Several strategies were followed in order to prolong the use-life of certain tools. The intensive use and maintenance of tools are largely related to sickles since resharpening of the active edges is recorded on half the tools. Additionally, the use of both tool edges and the presence of heavily retouched tools also points to this direction. Furthermore, the recycling of tools is also well attested, covering almost 1/4 of the tools and mainly involves end-scrapers and perforating tools, as well as splintered pieces. Heavy retouch and recycling of tools are more common during the Final Neolithic period. They are mainly related to fine quality flints (pale brown, gray), excellent quality radiolarite, but also to yellowish brown flint, which is highly implicated in these strategies. It could be claimed that an attempt to economize the raw material is reflected in these practices since they are usually encountered to excellent quality materials. This suggestion could also be reinforced by the increased number of retouched technical products during this period (mainly of excellent quality materials). Additionally, the fact that these practices were more common during the Final Neolithic period might reflect possible changes in raw material supplies or the restricted access to some of them. On the other hand, different factors could also be involved, like the special meaning of some artefacts and the personal relation of the owner to specific tools or raw materials.

The chipped stone tools of Anarghiri IXb reflect the activities that were practiced by the prehistoric community. Agricultural activities probably played an important role in the economy of the settlement according to the high number of sickles. Additionally, chipped stone tools were used in everyday domestic activities like food preparation and leatherworking, but were also involved in the manufacturing of other tools and artefacts, like bone and wooden tools, ornaments, etc. Finally, the presence of projectile points demonstrates the implication of the settlement's inhabitants to hunting activities, also confirmed by the antler equipment (Arampatzis 2019, 164-185, 216). A small decline in cutting tools (mainly sickles) and a slight increase in splintered pieces, scraping and hunting tools is recorded at the Final Neolithic, still insignificant. The lithic material does not indicate any considerable changes in the activities that were practiced by the community, at least as these are reflected in the lithic record.

The integration of the Anarghiri IXb settlement in the broader area demonstrates similarities to the contemporary settlements of western Macedonia. The available data from the Late Neolithic chipped stone industries of the neighboring settlements, although limited, point to similar patterns in raw material use and tool production. Most settlements in the region use common raw materials of local and regional origin, but also exotic ones. The examined industries demonstrate the generally low use of local materials, including chert, quartz and medium/low-quality radiolarite that derives from secondary sources. The use of materials that are considered regional, like fine quality flints (gray, brown, pale brown, black) and reddish brown radiolarite of excellent quality, is also attested. In most cases, imported products and few prepared cores are related to regional materials, with few evidence of on-site knapping. The technological characteristics of these artefacts indicate the use of techniques that would require high technical knowledge and skills (e.g., prismatic blades) and could point to the implication of specialized knappers that were working in the region. Finally, the indirect procurement of exotic materials like obsidian and yellowish brown flint in the form of ready tools is rather common. At the same time, some exceptions of this pattern are observed, like the settlement of Toumba Kremastis Koiladas, where local quartz of low quality represents almost half of the lithic material. However, this could be related to the nature of the excavated area since the material derives from hundreds of pits that were revealed at the margins of the settlement. Similar is the case of the small material from Piges Koromilias Cave that had a seasonal character and the tools were carried by the people who used the cave.

At the same time, the raw materials' distribution demonstrates some variations at the micro-regional scale. For example, reddish brown radiolarite and yellowish brown flint are represented by small percentages in the Anarghiri IXb assemblage when compared to Late Neolithic Dispilio, where these materials cover almost half of the industry. Conversely, fine quality flints and obsidian are present in larger quantities in the settlement of Anarghiri IXb. The variation in the use and reliance on specific raw materials indicates differences that could be related to many factors. Some of these could be relevant to the proximity of the settlements close to secondary sources and mountainous areas with potential primary sources (Aliakmon River, Pindus, etc.). Additionally, the degree of accessibility to the sources (in the case of direct procurement) would be an important parameter, which could be affected by the possible control of the sources. Moreover, the preferences on certain imported materials could be connected to the degree of the settlement's participation in particular communication and exchange networks, related to specific social strategies involved in the production of chipped stone tools. The settlements could participate in social and economic networks in a different degree, or could get involved in multiple exchange networks in parallel. Nevertheless, the scarce and preliminary information deriving from the Neolithic settlements of western Macedonia, along with the lack of identification of specific raw material sources in the region, do not allow any reliable suggestions.

In any case, the operation of a regional network among the settlements of western Macedonia sharing the same raw materials and producing similar tool types is suggested. The circulation and use of common distant materials that reached the region underline the communication and the operation of exchange networks. This is the case of excellent quality radiolarite that could derive from the western Thessalian settlements or northern Pindus, and the tools of yellowish brown flint with a possible north-west origin (Albania?). However, the presence of Carpathian obsidian at Dispilio points to the participation of the settlement to a parallel network operated to the north Balkans and central Europe, in contrast to the rest settlements of the region. On the other hand, the obsidian distribution among the settlements of western Macedonia is diversified, since higher percentages are recorded at the settlements practicing small-scale exploitation of obsidian, like Anarghiri IXb and Kleitos. The increased quantity of obsidian at these settlements and the evidence for on-site production point to an intensive introduction of the material in various production stages and the implication of the settlements in the obsidian networks to a higher degree.

Additionally, the technological characteristics of the artefacts also point to similar technical choices in the exploitation of raw materials. Local materials probably directly acquired from secondary sources were used to a small degree, in order to produce flakes, blade-flakes and less irregular blades. On the other hand, most settlements are focused on blade production using excellent quality regional materials. The limited evidence of on-site knapping of regional materials, in addition to the high technical skills required for the production of prismatic blades and microblades, indicate the possible implication of specialized knappers that were familiar with the geography of raw material sources and were operating in the region. Moreover, many similarities on the tool types could demonstrate the communication and exchange of technological knowledge and expertise. It is noteworthy that many tanged and barbed projectile points made of excellent quality materials (gray and black flint, reddish brown radiolarite) with bifacial covering retouch show many similarities, morphologically but also technically. These tools could have been produced by specialists and distributed in the region.

In comparison to the rest of northern Greece and Thessaly, the examination of the industries from settlements of central and eastern Macedonia, Thrace and Thessaly provide a rather diversified picture pointing to regional patterns. The use of local and regional raw materials for tool production is attested in most cases but is differentiated on the raw materials used, varying according to the geological background of each region. Thus, quartz and siliceous limonite prevail at the settlements of central Macedonia, chalcedony and flint (including yellowish brown flint) are more common to eastern Macedonia, while in Thrace local flints of medium quality are preferred for tool production. However, the examination of the Neolithic settlements in central and eastern Macedonia also points to differences in the distribution of raw materials in a micro-regional scale (e.g., Makriyalos for central Macedonia and Sitagroi for eastern Macedonia). This diversity has been interpreted as the result of the geomorphological characteristics of each region, but also due to the preferential use of primary sources and the territorial negotiations. At the same time, the different representation of imported raw materials in a settlement could be relevant to the different degree of participation to social networks along with other materials that were circulating (Dimitriadis & Skourtopoulou 2001; Kakavakis 2011; 2014; 2017; Kourtessi-Philippakis 2009).

On the other hand, the industries of Thessaly show a different picture since the dominance of an exotic material (obsidian) is attested at the coastal settlements, while the settlements at the western plain use other excellent quality local materials (chocolate flint). At the same time, some other settlements seem to participate equally in both networks. It seems that the preference on certain raw materials is not only based on the proximity to the coast and the geomorphology of the region (physical and human topography), but also to the social space, the affiliations and the degree of interaction between the prehistoric settlements (Karimali 2009).

Apart from the above-mentioned regional patterns, interactions among the settlements of western Macedonia and the adjacent regions could be possible on the grounds of raw materials, supported by the presence of high-quality chocolate flint that could derive from western Thessaly (through natural passages in Servia region) and obsidian that could be supplied from Thessaly or the coastal settlements of central Macedonia (through Aliakmon river as route of communication). Similarly, but with the opposite direction, the settlements of western Macedonia could provide high-quality flints to the settlements of central Macedonia, like Stavroupoli and Makriyalos (excellent quality gray flints) (Skourtopoulou 2002, 548). Moreover, the similarities recorded regarding the knapping techniques and tool types could also reflect the communication and exchange of technological knowledge among the settlements.

The comparison of the early Final Neolithic material from Anarghiri IXb with contemporary settlements, although limited, demonstrates that most of the settlements were more implicated in networks that supplied imported raw materials and tools. At the settlement of Megalo Nisi Galanis an increase in the frequency of obsidian is reported, while the presence of triangular bifacial projectile points that were circulating in the Balkans, the Greek mainland and the Aegean during this period is also attested (Fotiadis et al. 2019, 30, 31, Fig. 19: a-b). Additionally, the settlement of Dikili Tash II in eastern Macedonia used exclusively yellowish brown flint during this period and the tools were imported ready-made. Similarly, Carpathian obsidian is attested at FN Mandalo and the exotic material reached also Dispilio probably during this period (FN?).

Turning back to the settlement of Anarghiri IXb, the changes observed in the lithic industry from the Late to the Final Neolithic are characteristic. In regard to raw materials, the absence of black flint and the decrease of gray flint is recorded, both of which show strong evidence of on-site knapping during the Late Neolithic. It is unknown why black flint became obsolete, and the gray flint declined, but we could suggest restricted access to the sources or a possible change at the relations with other settlements that affected the supply of these materials. On the other hand, during the Final Neolithic period, an increase in imported raw materials is observed (obsidian, yellowish brown flint, fine quality radiolarite), while the application of indirect percussion and pressure techniques seems to be more usual. Similarly, imported finished tools made of yellowish brown flint and fine quality radiolarite with heavy retouch are recorded, as well as increased quantities of tools of skilled production (projectile points of obsidian and excellent quality materials). It seems that the settlement of Anarghiri IXb was involved in new or already existent broader networks that circulated exotic materials and isolated artefacts, the presence of which indicates the 'wider' and 'extroverted' character of the settlement during this period. The communication with a broader area seems to be more intense or at least becomes more clearly expressed through the chipped stone industry during the Final Neolithic period. The basic organization of tool production does not fundamentally change since regional materials continue to prevail over the rest, the application of the knapping techniques shows only small changes and the tools correspond to the same needs/activities as in the previous period. However, this emphasized presence of imported raw materials and artefacts circulated through a wide area could also indicate the strengthening of the exchange networks and social relations that were already taking place from the Late Neolithic period. As it has been supported, the increased circulation of imported chipped stone during the Late Neolithic of northern Greece is related to the growth of expressive material culture (spondylus shell, decorated pottery, copper, figurines, etc.) and the parallel circulation of 'valuable' artefacts bearing symbolic meanings and indicating increased social interaction (Kakavakis 2017; Skourtopoulou 1998a).

The changes recorded at the lithic industry of Anarghiri IXb from the Late to the Final Neolithic period could be related to various socioeconomic transformations at the settlement, also reinforced by the study of other archaeological materials. The information deriving from the wooden structures at the periphery of the settlement demonstrates a change at the outline of the settlement. During the Late Neolithic II/Final Neolithic period, it seems that a re-arrangement of habitation space occurred, attested by a shift of the enclosing system to the central area of the settlement. This could be related to the shift of the occupation from the lake to a dryland, resulted from the lake's environment and probably the continuous building activity. At the same time, the segregation of residential or open spaces could be also possible, taking into account the gradual emergence of social differentiation between individual households that is supported for this period (Giagkoulis 2019, 172-173, 179; Halstead 1999; Kotsakis 1999). Additionally, the evidence from the antler tools indicates that during the Final Neolithic period, the typological repertoire was enriched with a variety of tool types, while the presence of many ornaments, pendants and artefacts with symbolic character (expressing social identity, prestige, etc.) is mainly attested during this period (Arampatzis 2019, 214-216). Nevertheless, the picture regarding the changes that occurred at the settlement of Anarghiri IXb in the Final Neolithic period remains fragmented for the time being, since the contribution of other aspects of material culture (architecture, spatial organization, pottery and other portable finds, etc.) are required in order to proceed to more valid and synthetic interpretations.

For the moment, the lithic record of the Anarghiri IXb settlement revealed some aspects of the organization of tool production, offering an insight to the strategies, choices and options, as well as the communication networks of the prehistoric community, while the diachronic examination reflects the changes that took place during the settlement's lifetime.

Future research

The present study on the chipped stone artefacts from the Anarghiri IXb settlement has explored the organization of the lithic production during the Late and the Final Neolithic period in the region of western Macedonia. However, additional aspects of lithic production and the role of chipped stone tools can be further investigated. First of all, in the intra-communal level, the complete study of the settlement's spatial organization will enable the horizontal distribution of the material. Preliminary work points to some variations in the dispersal of raw materials, technological categories and tool groups at the excavated area. Future contextual analysis of the chipped stone artefacts will provide insights regarding the areas of tools' manufacture, use and discard and demonstrate aspects of the spatial division of the activities practiced in the domestic area. Of course, the study of other archaeological materials is also required in order to approach and interpret in a more holistic way the human action and the use of space in the prehistoric community.

The application of use-wear analysis could constitute an important research step in identifying the use and demonstrate the activities that the chipped stone tools were implicated, confirming the already suggested uses or proposing different ones, but also contributing to the identification of the treatment (resharpening, hafting, etc.) and discard of tools. Moreover, the identification of tools' use and transformations through their life-cycle in combination with the contextual analysis could demonstrate their role, either as part of fulfilling practical needs or as artefacts bearing symbolic meanings and socially embedded actions.

Additionally, the characterization of obsidian artefacts in order to identify their origin could provide interesting information, considering the unexpected quantities of this material at the inland of northern Greece. The macroscopic characteristics of the Anarghiri IXb obsidian point to its Melian origin. However, a future analysis could provide information, whether the settlement also obtained Carpathian obsidian, like the settlements of Dispilio and Mandalo, participating in a different and more extended network. Similarly, the identification of the exact Melian source (Adamas and Demenegaki) could also contribute to the discussion for the distribution of the material deriving from these two sources, which seem to have been treated in different ways (Milić 2016, 201, 236-237).

Another important issue is related to identification of lithic sources and characterization of raw materials other than obsidian. The dominance of non-obsidian raw materials at the industries of northern Greece and the already recognized variability in their exploitation calls for more precise methods in the identification of their origin. This proves to be critical, to provide comparative material and probably offer alternative sources for the acquisition of raw materials, and consequently, alternative interpretations and models for the strategies followed by the prehistoric communities regarding the organization of tool production. The general tendencies that have been suggested by the use of geological maps and the few available data by fieldwork and petrographic analysis should be enriched. In this direction, the use of similar methods of analysis, but also common terminology and characterization of the raw materials would also enable more valid comparisons among the materials of different regions.

The excavations at the Amindeon basin have brought to light many settlements inhabited during the Neolithic and the Bronze Age periods. The study of the lithic material deriving from contemporary settlements will enrich our knowledge on the lithic strategies in the inter-communal level and provide information on the similar or different management of raw materials and toolkits among close communities. For example, it will be interesting to examine whether the lakeside settlements in the close vicinity of Anarghiri IXb were using the same patterns for tool production (acquisition of raw materials, technological choices, typology, use and treatment of tools) or they show possible variations. Additionally, the diachronic study of lithic materials can demonstrate the chronological diversification and shed light not only to the organization of tool production, but also to the interpretation of the changes as they are reflected in the lithic material. In this direction, the analytical study and publication of the lithic industries from the already excavated prehistoric settlements of western Macedonia are necessary in order to make valid comparisons and demonstrate the variability of the region's lithic record in the framework of the Neolithic industries of northern Greece.

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CHIPPED STONE INDUSTRIES FROM WESTERN MACEDONIA, GREECE.

THE CASE OF THE NEOLITHIC LAKESIDE SETTLEMENT

ANARGHIRI IXb

Volume II: Figures

Inauguraldissertation

an der Philosophisch-historischen Fakultät der Universität Bern

zur Erlangung der Doktorwürde

vorgelegt von

Styliani Papadopoulou

Promotionsdatum: **27 Februar 2020**

eingereicht bei

Prof. Dr. Albert Hafner, Institut für Archäologische Wissenschaften der Universität Bern

und

Prof. Dr. Nikos Efstratiou, Department of History and Archaeology,

Aristotle University of Thessaloniki, Greece

The material of this volume includes charts, tables, plans and maps that were made by the author.

The photographs, maps and plans deriving from other sources are stated by reference.

Fig. 2.1 Geographical map of western Macedonia.

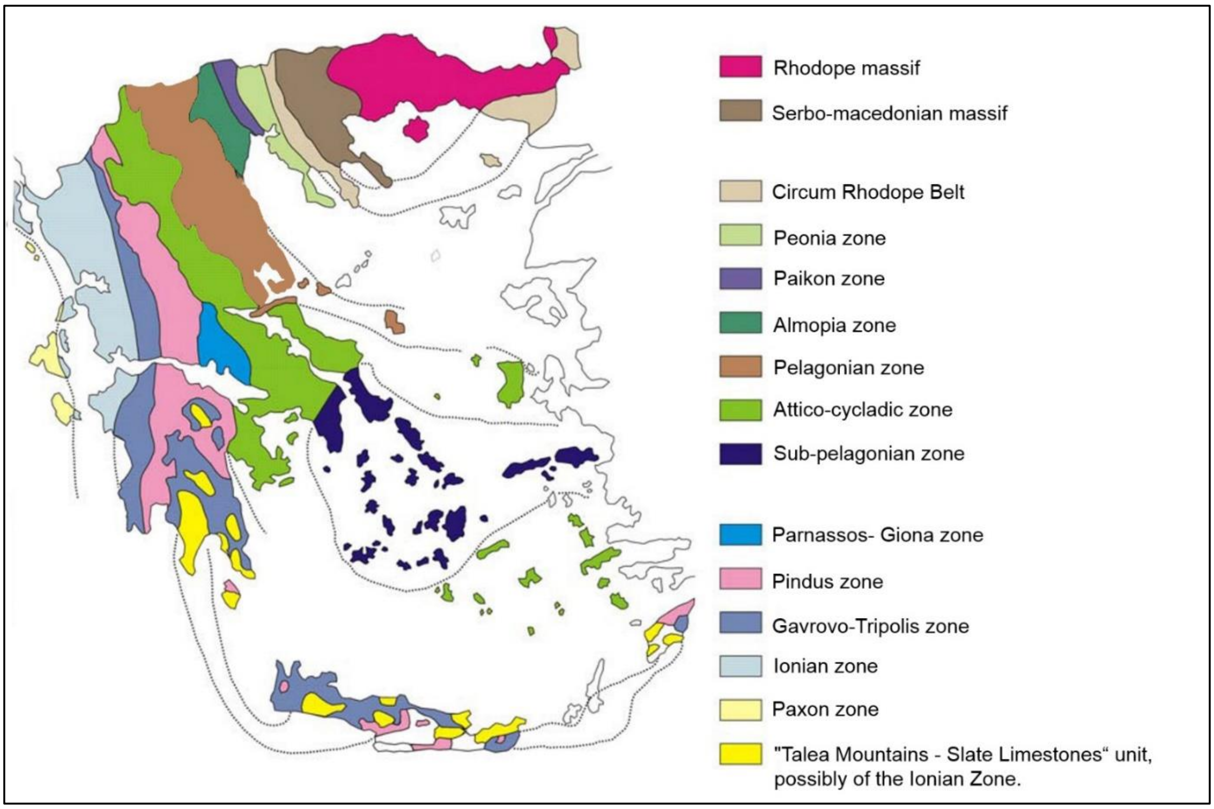


Fig. 2.2 Map of geotectonic zones of Greece (after Mountrakis 1985).

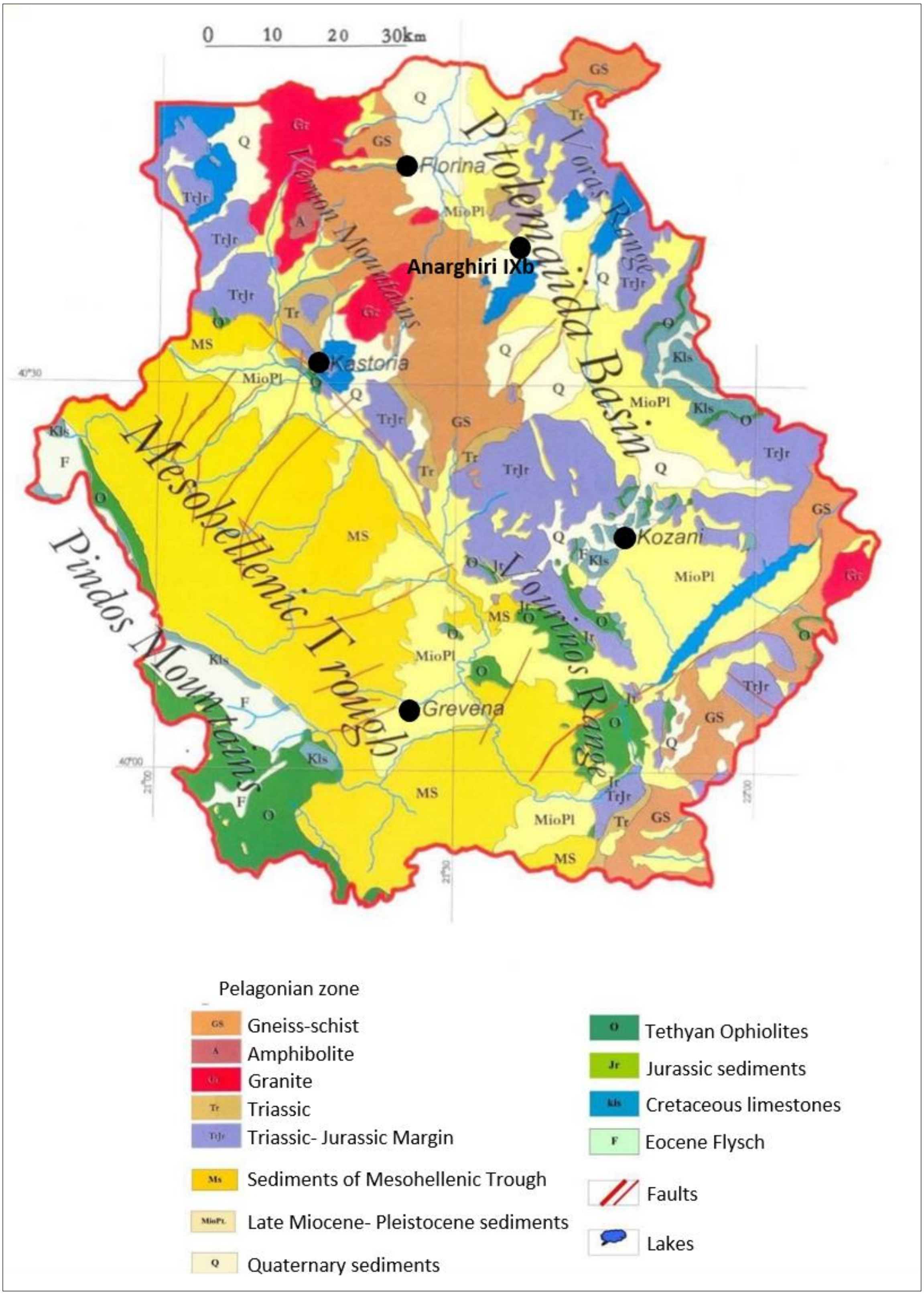
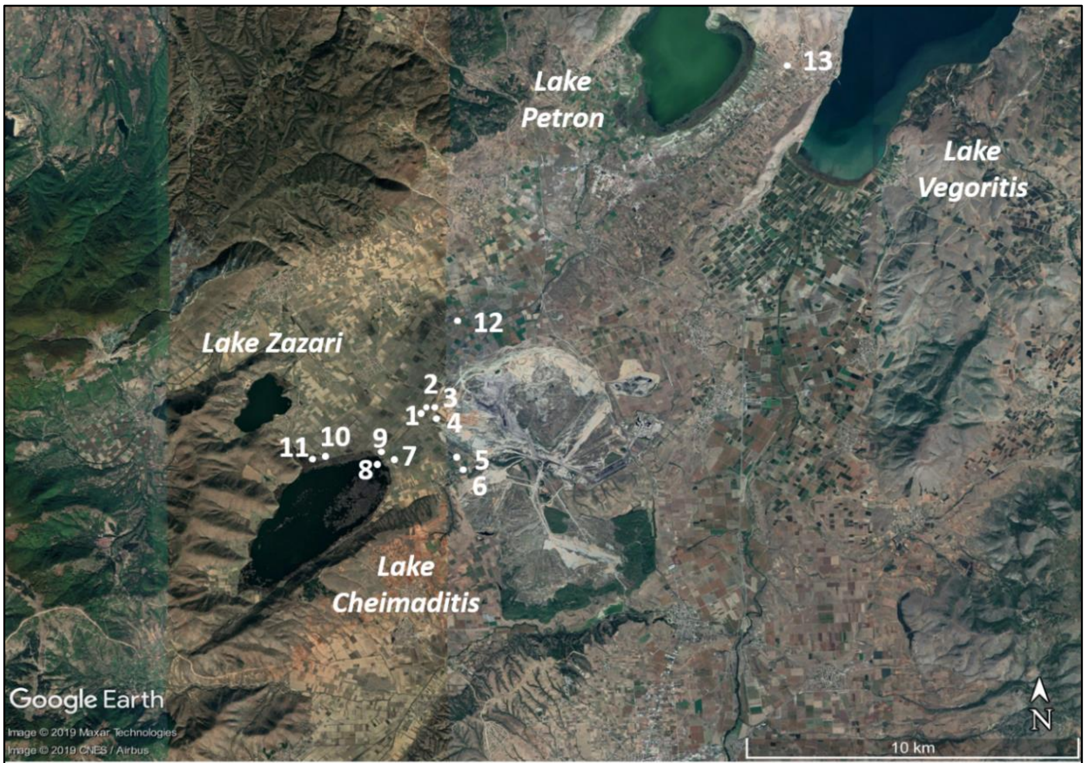


Fig. 2.3 Geological map of western Macedonia (after Rassios 2004).

Archaeological phases of Neolithic	Calibrated dates
Early Neolithic (EN)	6700/6500-5800/5600 BC
Middle Neolithic (MN)	5800/5600-5400/5300 BC
Late Neolithic I (LN I)	5400/5300-4900/4800 BC
Late Neolithic II (LN II)	4900/4800-4500 BC
Final Neolithic	4500-3300/3100 BC

Fig. 2.4 Archaeological phases of the Neolithic period in northern Greece and chronology in calibrated dates (after Andreou et al. 1996; Gallis 1996; Papadimitriou 2010; Reingruber et al. 2017).

Fig. 2.5 Map of the main Neolithic sites of western Macedonia mentioned in the text.



1. Anarghiri IXb, 2. Anarghiri IXa, 3. Sotiras V, 4. Anarghiri XI, 5. Anarghiri XIIIa, 6. Anarghiri XIII, 7. Anarghiri I, 8. Anarghiri IV, 9. Anarghiri III, 10. Limnochori II, 11. Limnochori III, 12. Rodonas II, 13. Ag. Panteleimon Necropolis of Tombs

Fig. 2.6 Map of the excavated sites in the Amindeon basin and the location of the Anarghiri IXb settlement (after Chrysostomou et al. 2015).

Fig. 2.7 Aerial photo of the excavation at Anarghiri IXb (taken from north) (Chrysostomou & Giagkoulis 2016, 8).

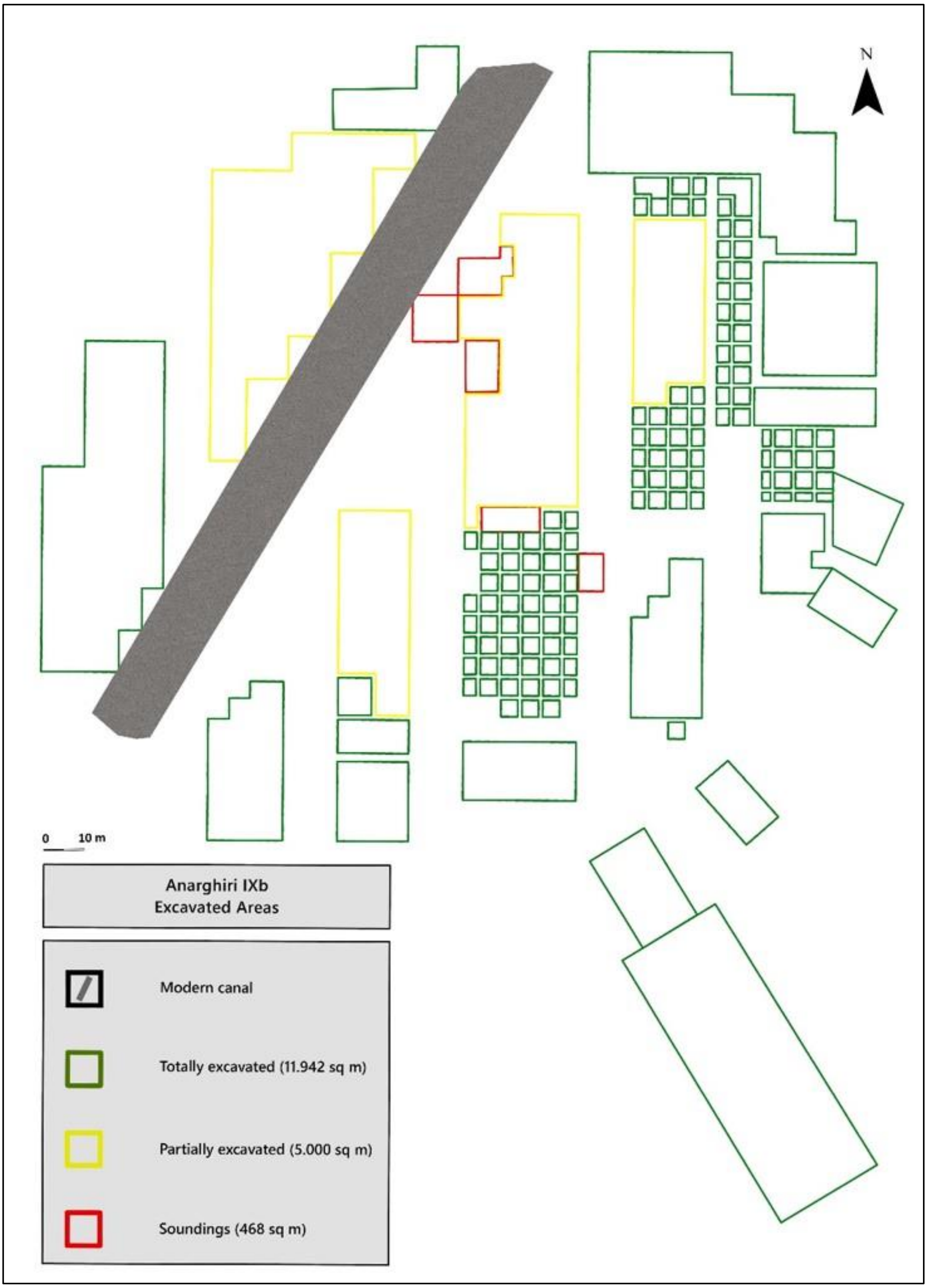


Fig. 2.8 Topographic diagram of Anarghiri IXb showing the excavated areas (Giagkoulis 2019, Vol. II, 7, Fig. 7).

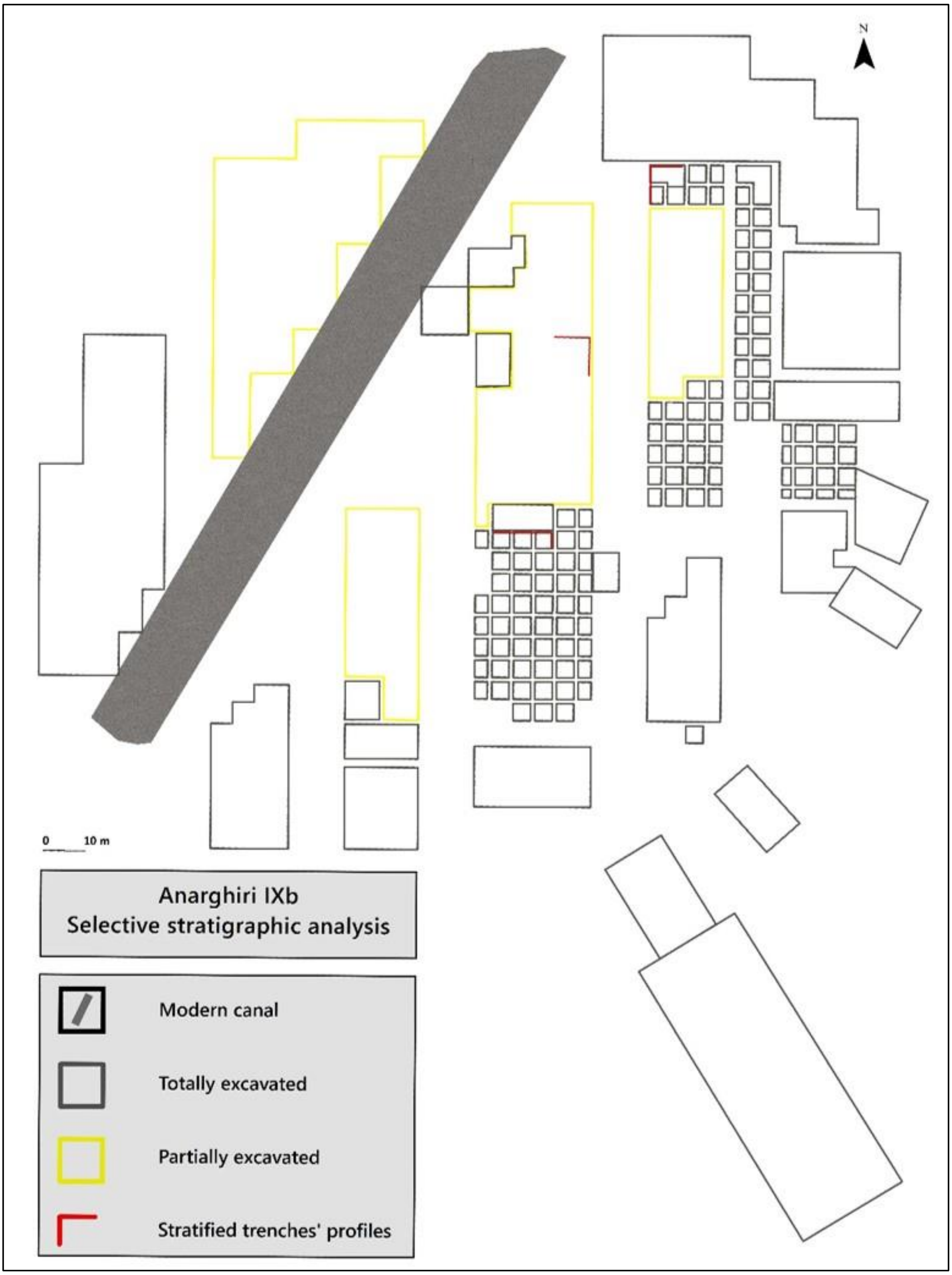
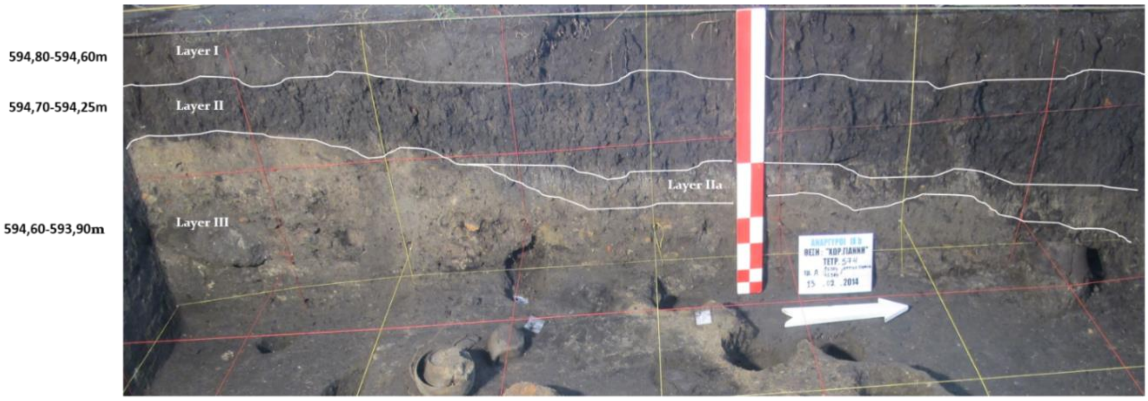


Fig. 2.9 Topographic diagram of Anarghiri IXb showing the selected trenches used for the stratigraphic analysis (Giagkoulis 2019, Vol. II, 8, Fig. 8).



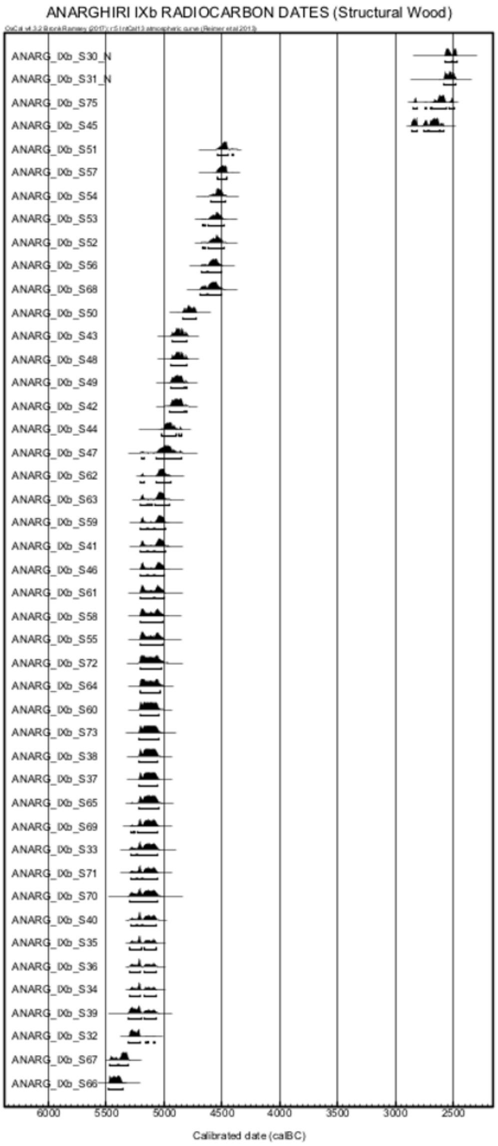
a

Trench: 574 a, Western Profile
Elevation: 594,80-593,90m

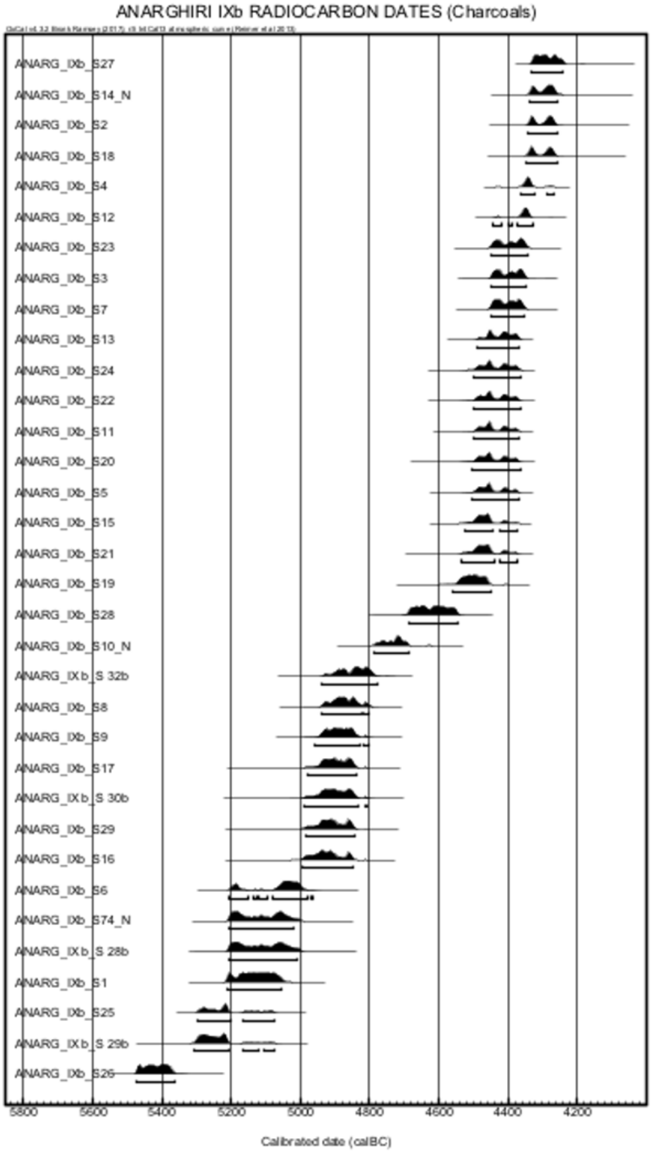
b

Trench: 833 d, Northern Profile
Elevation: 595,30-593,50m

Fig. 2.10 a-b Stratigraphic profiles: a. Trench 574a (northern excavated area), b. Trench 833d (southern excavated area)(Image synthesis: Arampatzis, C., Giagkoulis, T. and Papadopoulou S.).



a



b

Fig. 2.11 a-b Calibrated radiocarbon dates from the settlement of Anarghiri IXb:

a. structural wood, b. charcoal samples (Arampatzis 2019, 52-53; Giagkoulis 2019, Vol. III, 4, Plan 4).

Derivation of lithic material	n.
Studied material from eastern sector	5590
Electro-sieving trenches (macrolithics)	2277
Electro-sieving trenches (micro-refuse)	8820
Surface, unstratified material	1731
Material from western sector	1355
Material from season 2017	3229
TOTAL	**23002**

Fig. 4.1 Overall lithic assemblage of the Anarghiri IXb excavation.

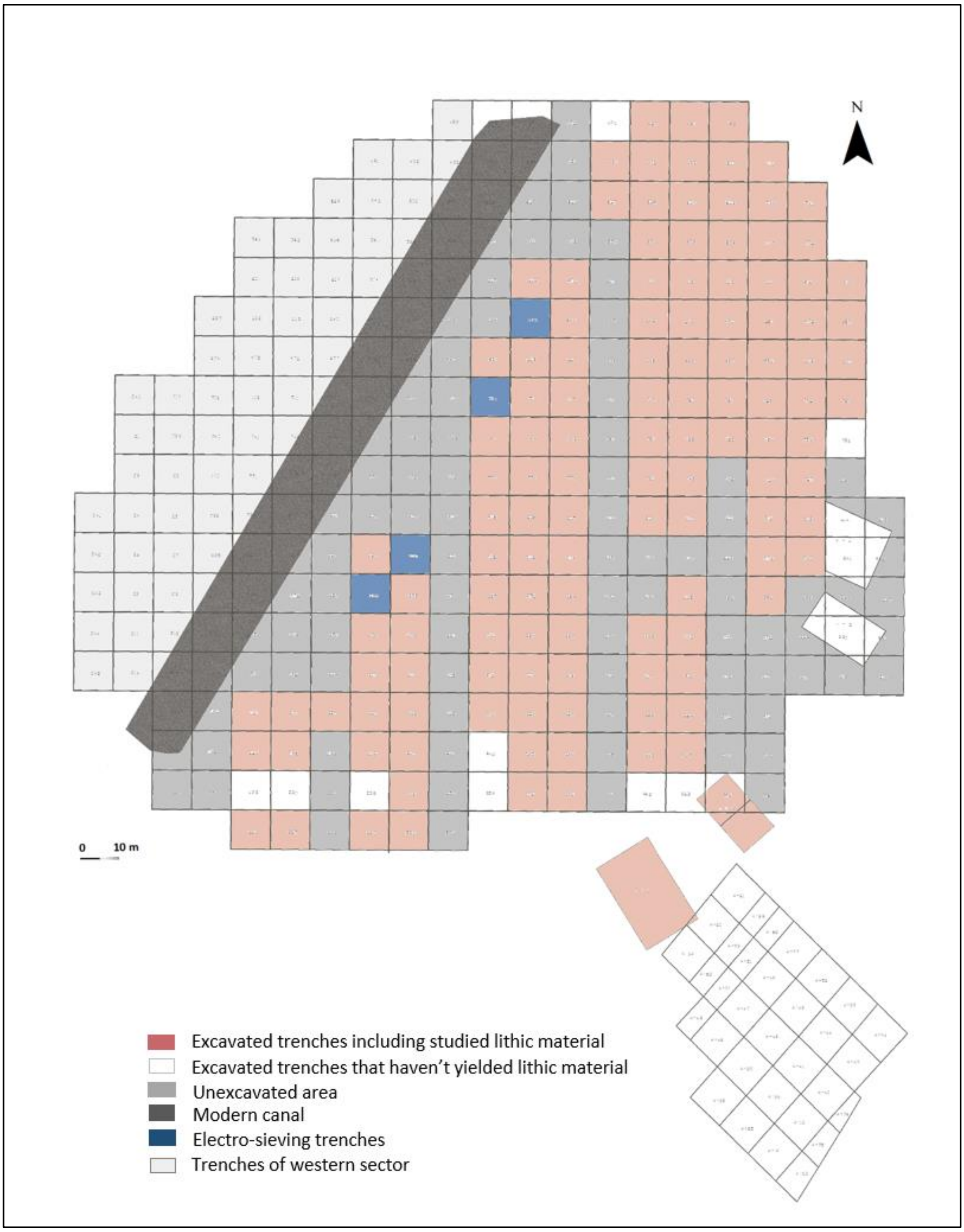


Fig. 4.2 Distribution of the studied lithic material at the excavation area.

Chronological period	Layer	Number of artefacts
Final Neolithic	Layer II	752
	Layer III	3213
Late Neolithic	Layer IV & V	1625
TOTAL MATERIAL		**5590**

Fig. 4.3 Chronological and stratigraphic distribution of the studied material.

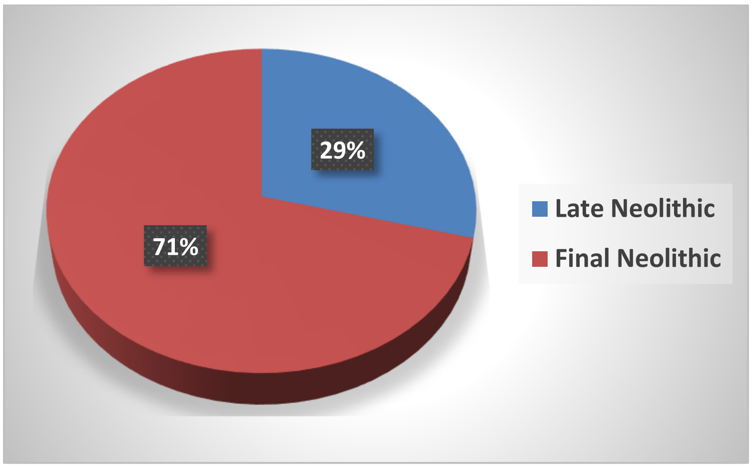


Fig. 4.4 Percentage of the chronological distribution of the studied material.

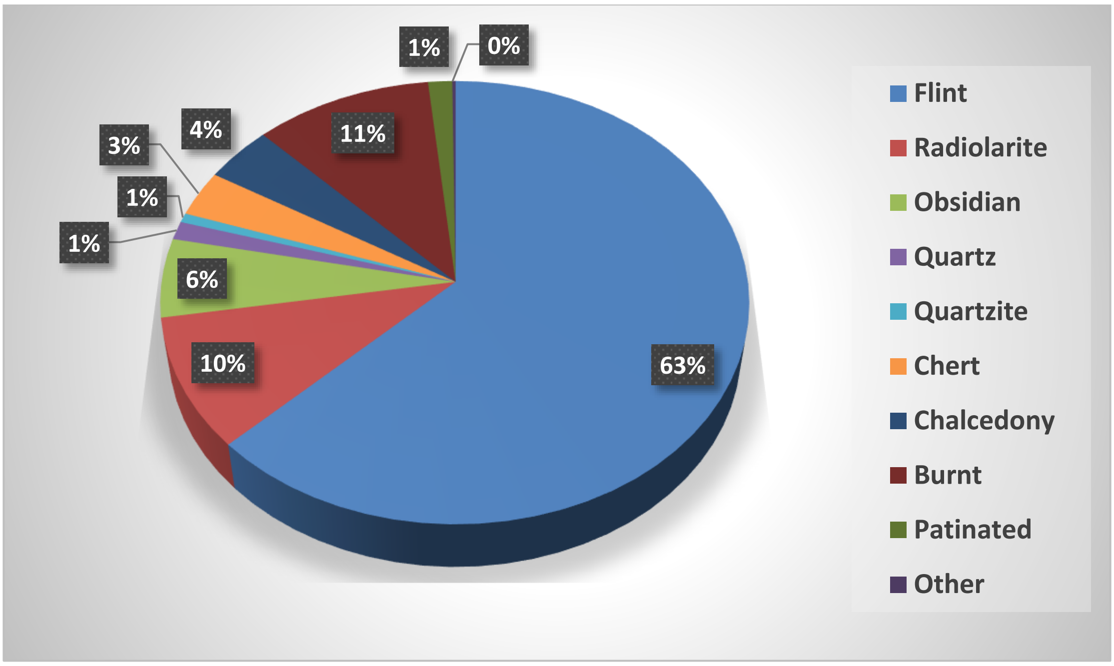


Fig. 4.5 Overall studied chipped stone artefacts from Anarghiri IXb by raw material.

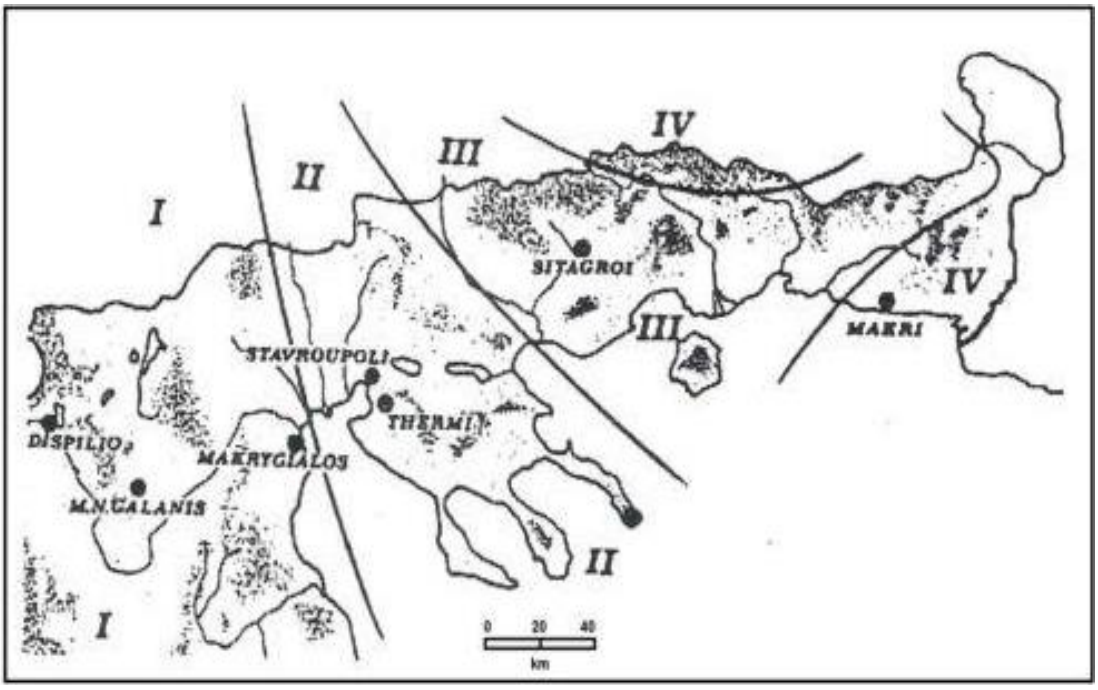


Fig.4.6 Map of northern Greece and the mineralogical distribution (Zones I-IV) (Dimitriadis & Skourtopoulou 2001, 789, Fig. 1).

RAW MATERIALS	n.	%
Flint	1137	70,1
Radiolarite	96	5,9
Obsidian	71	4,4
Quartz	34	2,1
Quartzite	9	0,6
Chert	54	3,3
Chalcedony	33	2
Burnt	164	10
Patinated	25	1,5
Other	2	0,1
TOTAL	**1625**	**100**

Fig. 4.7 Overall number and percentage of the Late Neolithic raw material categories.

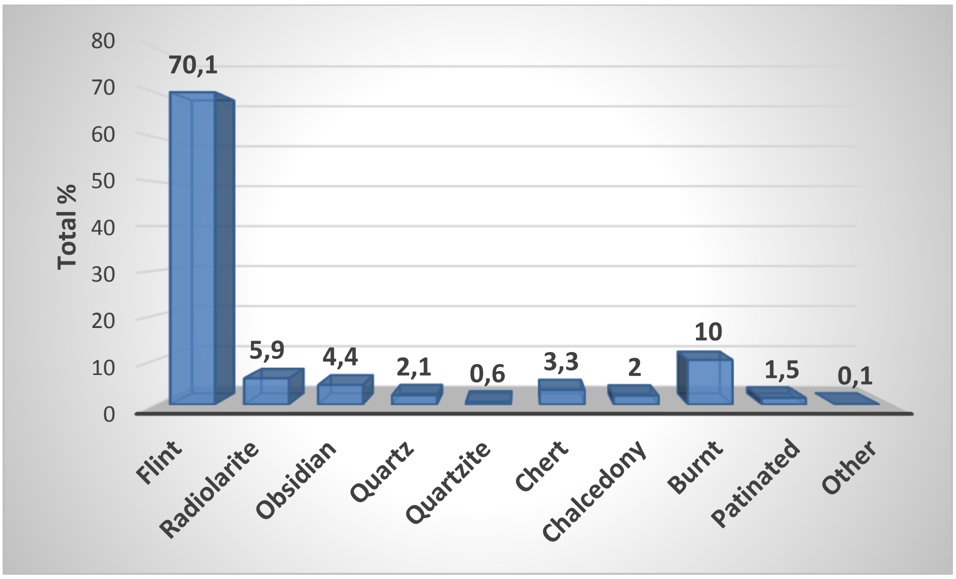


Fig. 4.8 Percentage of the Late Neolithic assemblage by raw material.

FLINT CATEGORIES	n.	%
Gray	772	67,8
Pale brown	198	17,4
Reddish brown	35	3,1
Yellowish brown	8	0,7
Black	113	10
Olive	11	1
TOTAL	**1137**	**100**

Fig.4.9 Overall number and percentage of the Late Neolithic flint categories.

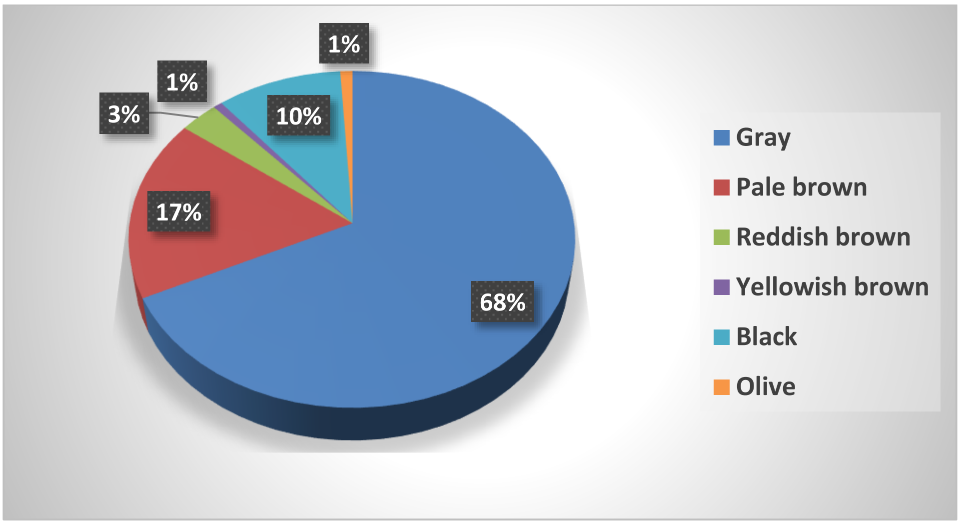


Fig. 4.10 Representation of the Late Neolithic flint categories.

RAW MATERIALS	n.	%
Flint	2376	60
Radiolarite	440	11
Obsidian	250	6,3
Quartz	40	1
Quartzite	29	0,7
Chert	133	3,4
Chalcedony	198	5
Burnt	434	11
Patinated	56	1,4
Other	9	0,2
TOTAL	**3965**	**100**

Fig.4.11 Overall number and percentage of the Final Neolithic raw material categories.

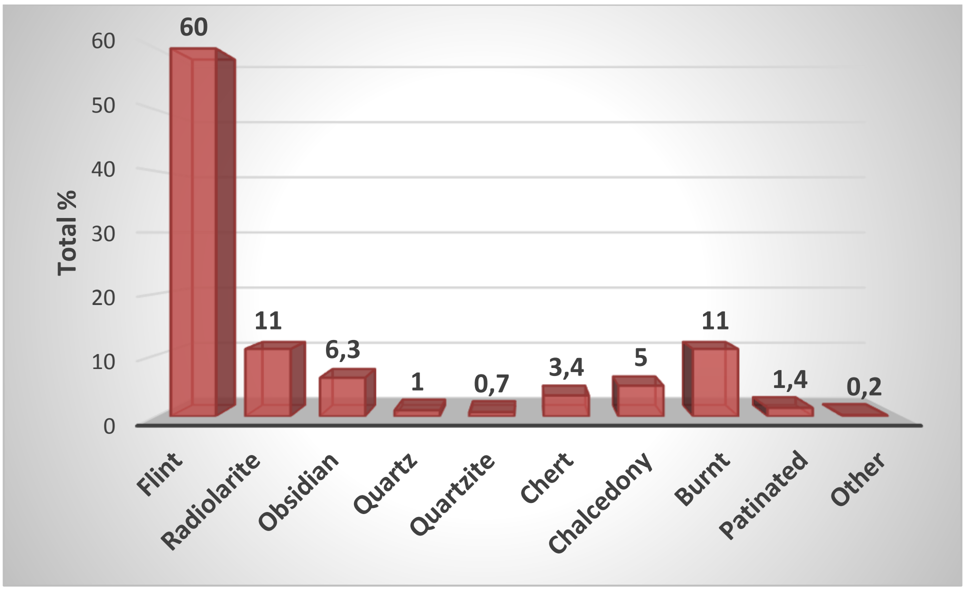


Fig. 4.12 Percentage of the Final Neolithic assemblage by raw material.

FLINT CATEGORIES	n.	%
Gray	940	39,6
Pale brown	890	37,4
Reddish brown	104	4,4
Yellowish brown	363	15,3
Olive	79	3,3
TOTAL	**2376**	**100**

Fig. 4.13 Overall number and percentage of the Final Neolithic flint categories.

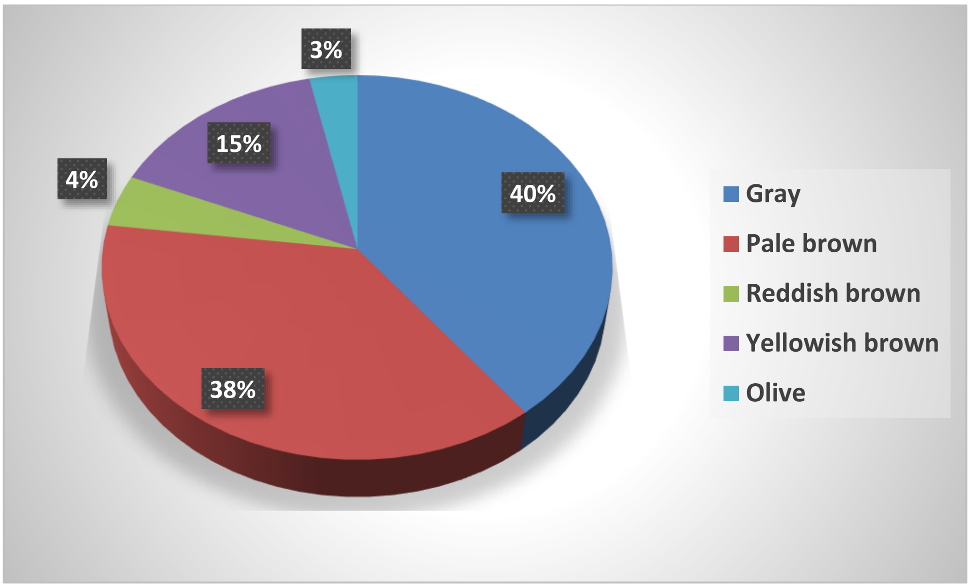


Fig. 4.14 Representation of the Final Neolithic flint categories.

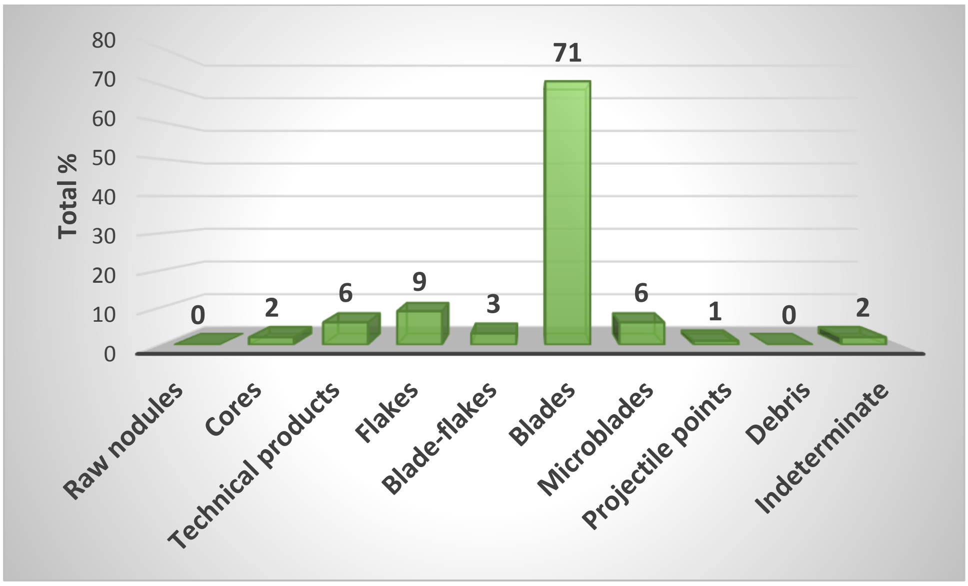


Fig. 4.15 Percentage of the total studied assemblage by technological category.

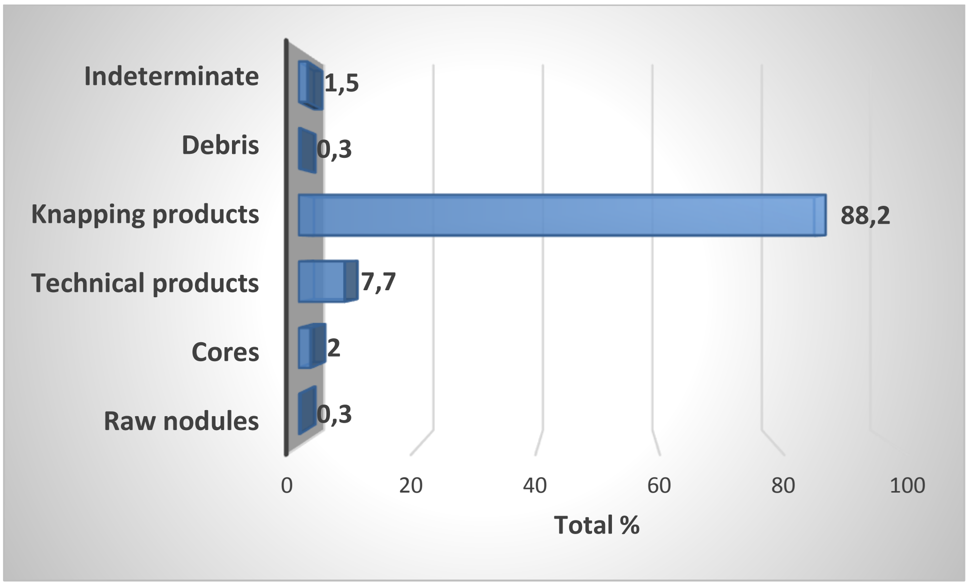


Fig. 4.16 Percentage of the basic Late Neolithic technological categories.

TECHNOLOGICAL CATEGORIES	n.	%
Raw nodules	6	0,3
Cores	33	2
Technical products	125	7,7
Flakes	163	10
Blade-flakes	39	2,4
Blades	1133	69,9
Microblades	85	5,2
Projectile points	11	0,7
Debris	5	0,3
Indeterminate	25	1,5
TOTAL	**1625**	**100**

Fig. 4.17 Overall number and percentage of the Late Neolithic technological categories.

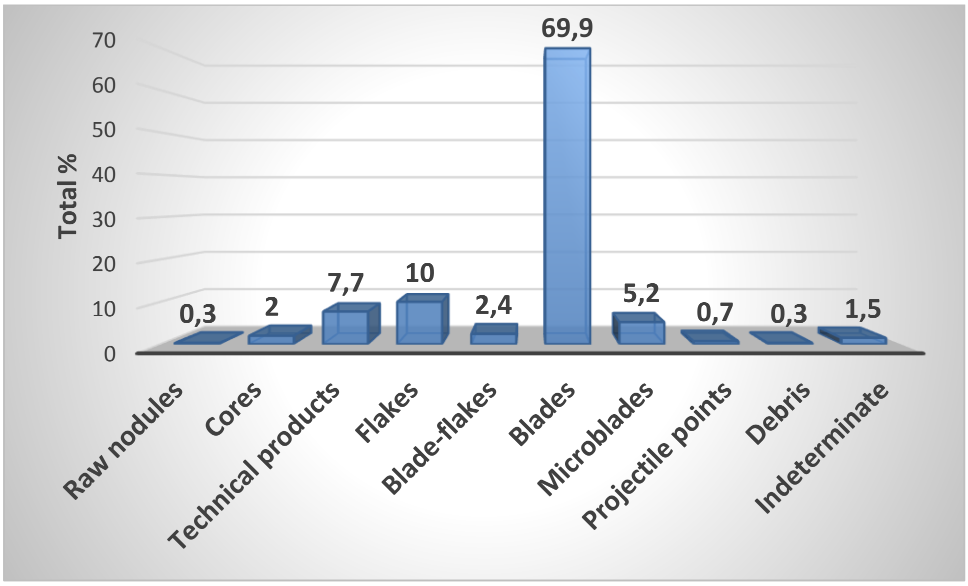


Fig. 4.18 Percentage of the Late Neolithic technological categories.

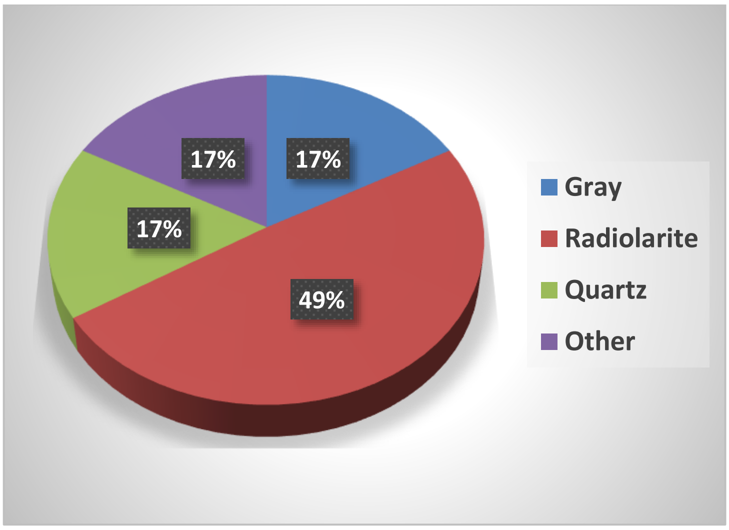


Fig. 4.19 Raw material distribution of the Late Neolithic raw nodules.

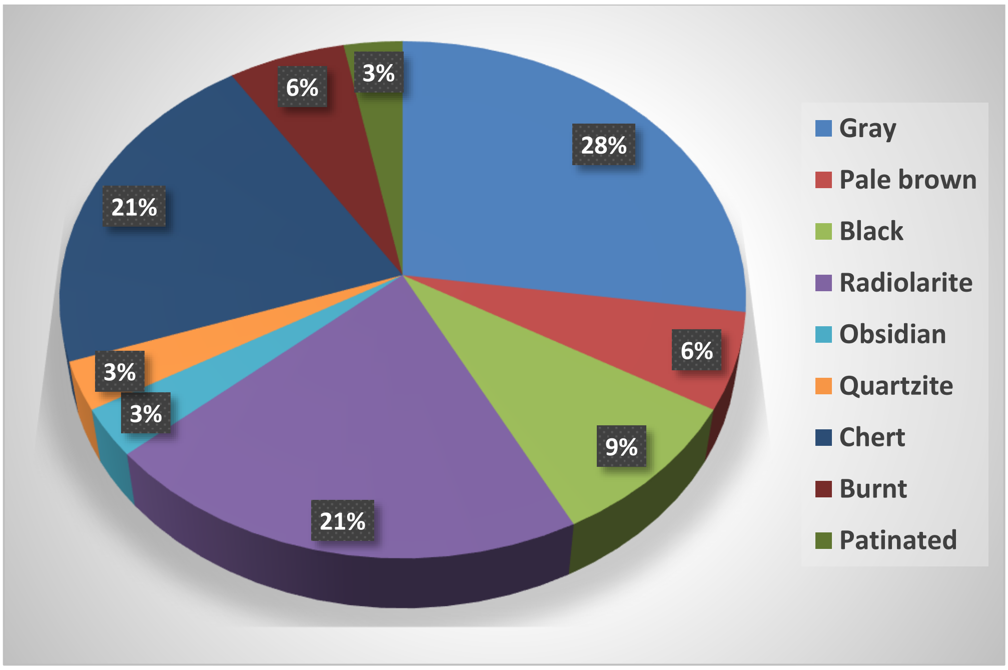


Fig. 4.20 Raw material distribution of the Late Neolithic cores.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	4,7	2	3,4	5	1,3	3,3	2,5	0,5	1,5
Pale brown flint	5	3,1	4	4,4	2,4	3,4	1,9	1,5	1,7
Black flint	3,7	1,7	2,6	2,5	2,4	2,4	1,9	1,2	1,5
Radiolarite	7,5	2,2	3,5	4,4	1,4	2,9	3,1	0,6	1,4
Obsidian	3			2,9			1,9		
Quartzite	3,7			2,9			1,9		
Chert	5,8	3,1	4,2	7,3	2,6	4,3	3,9	1,3	2,6
Burnt	4	3,8	3,9	5	4,2	4,6	1,3	0,8	1
Patinated	3,6			3			1,2		

Fig. 4.21 Dimensions of the Late Neolithic cores by raw material (maximum, minimum and mean value in cm).

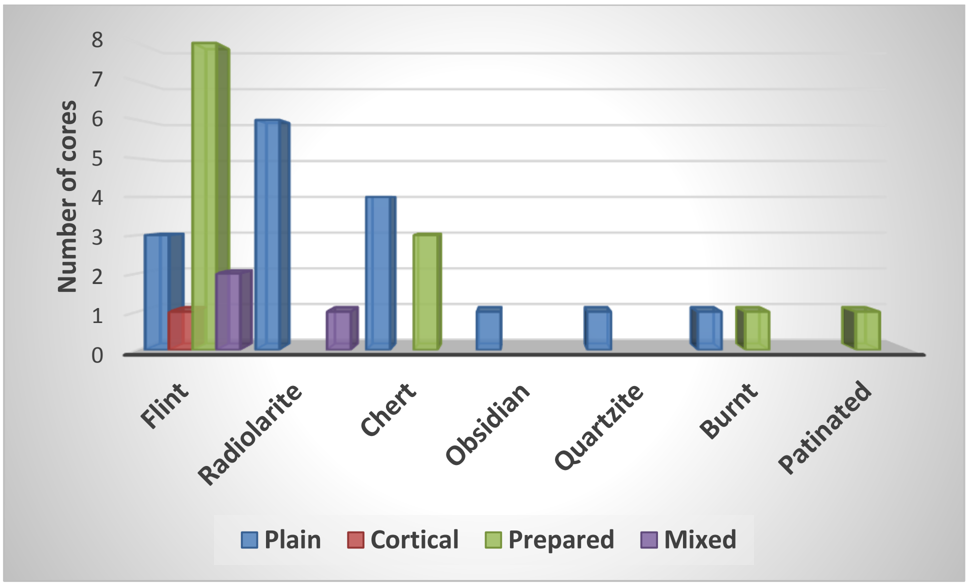


Fig. 4.22 Platform types of the Late Neolithic cores by raw material.

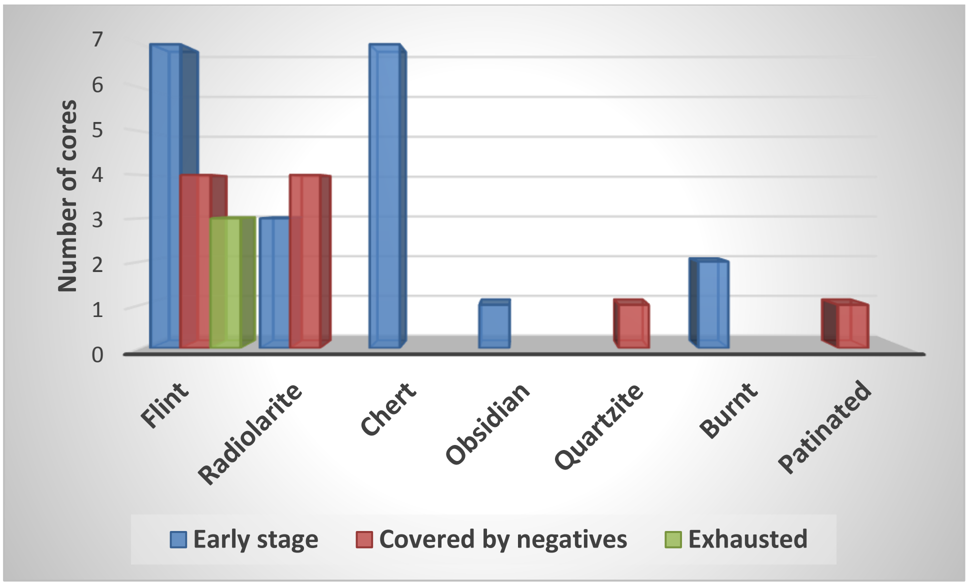


Fig. 4.23 Knapping stage of the Late Neolithic cores by raw material.

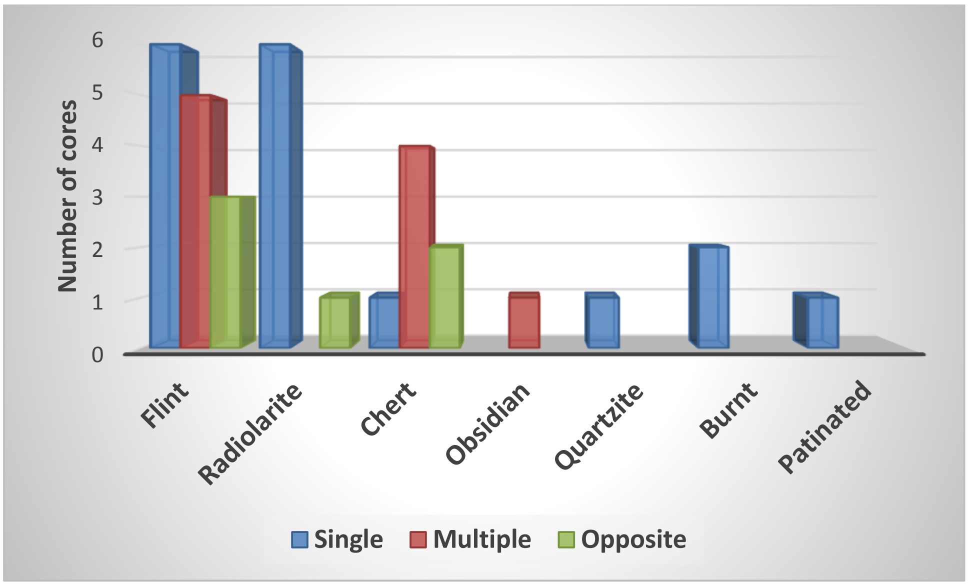


Fig. 4.24 Negatives' direction of the Late Neolithic cores by raw material.

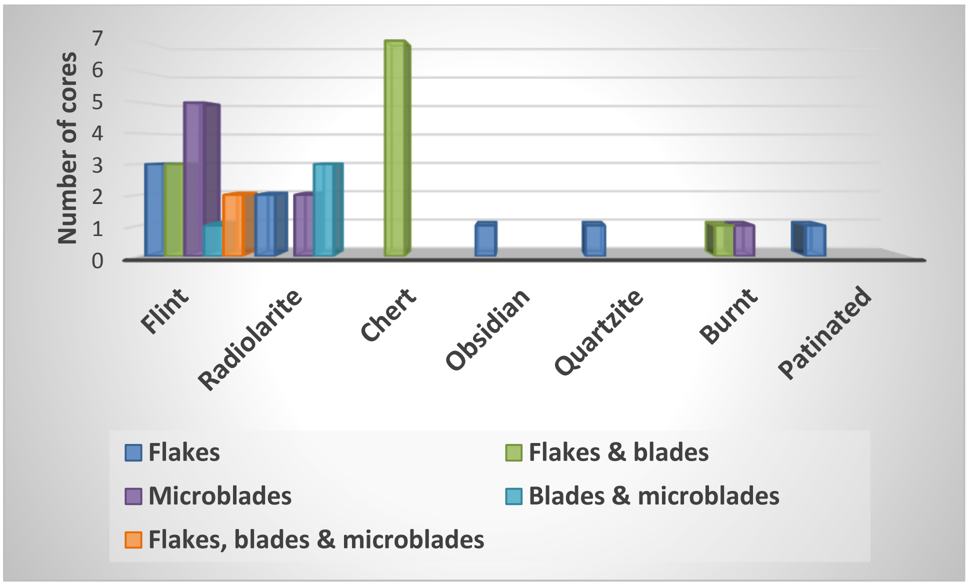


Fig. 4.25 Negative types of the Late Neolithic cores by raw material.

RAW MATERIAL CATEGORIES	Crested blades	Cortical flakes	Rej. flakes	Core rej. flakes	Core tablets	Plunging	Hinged	TOTAL
Gray flint	13	5	12	5	1	17	5	**58**
Pale brown flint	6		1	2		3	3	**15**
Reddish brown flint	1		1					**2**
Black flint	1	4	5	1		7		**18**
Olive flint								**0**
Radiolarite	2	1	2	2		1	2	**10**
Obsidian			5	2		2	2	**11**
Quartzite	1							**1**
Chert		1	3					**4**
Burnt	1		2	1		1		**5**
Patinated			1					**1**
TOTAL	**25**	**11**	**32**	**13**	**1**	**31**	**12**	**125**

Fig. 4.26 Number of the Late Neolithic technical products by category and raw material.

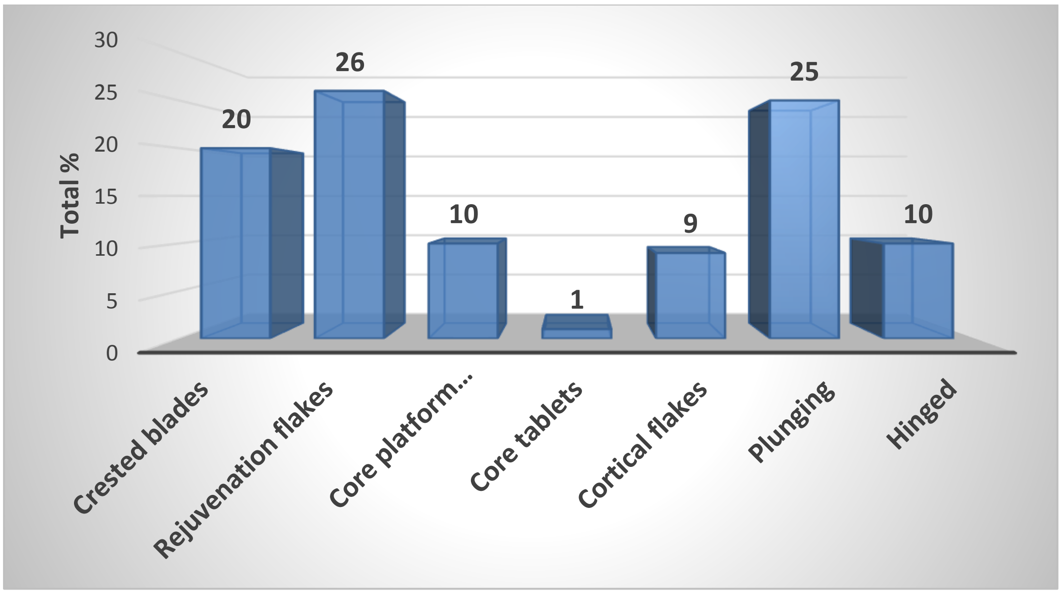


Fig. 4.27 Percentage of the Late Neolithic technical products by category.

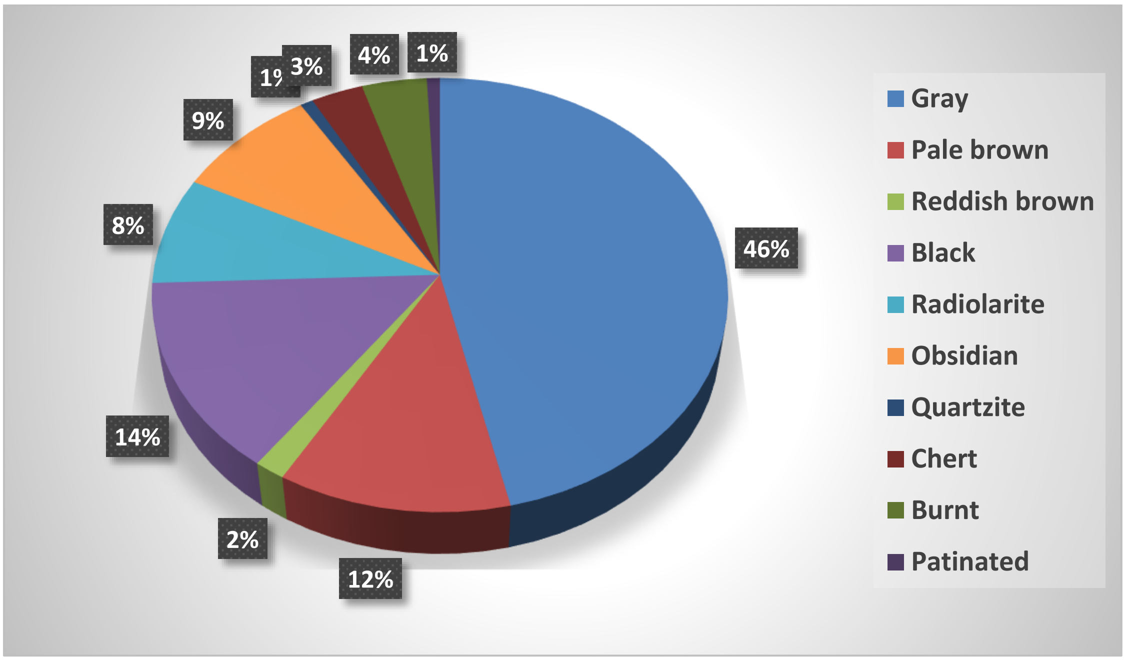


Fig. 4.28 Raw material distribution of the Late Neolithic technical products.

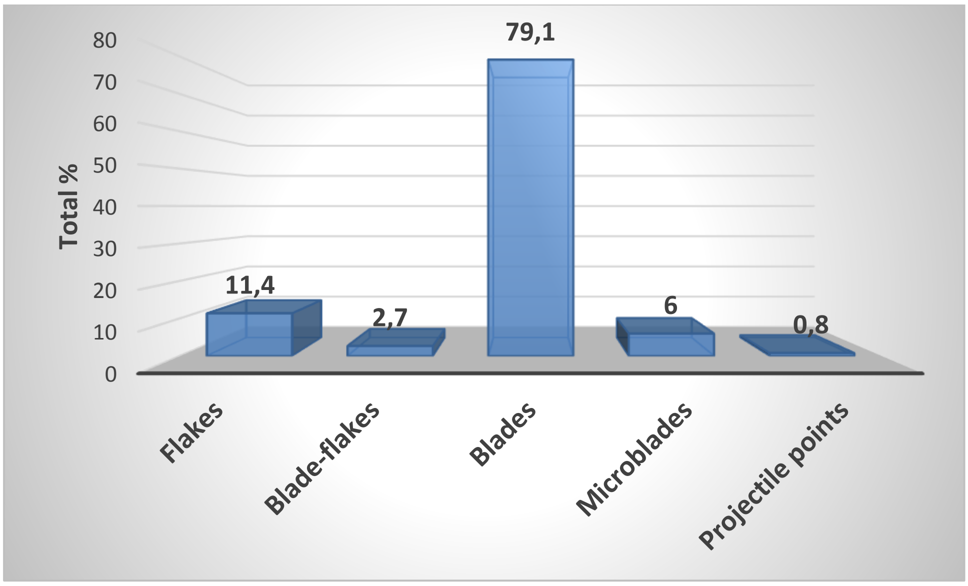


Fig. 4.29 Percentage of the Late Neolithic knapping products by category.

RAW MATERIAL CATEGORIES	Flakes	Blade-flakes	Blades	Microblades	Projectiles	TOTAL
Gray flint	58	9	585	37	6	695
Pale brown flint	9	2	161	7	2	181
Reddish brown flint	2		23	8		33
Yellowish brown flint			8			8
Black flint	9	1	75	7		92
Olive flint	3		8			11
Radiolarite	13	3	53	3		72
Obsidian	9	1	37	11		58
Quartz	21	2	3			26
Quartzite	4	1	2			7
Chert	10	6	21	2	2	41
Chalcedony	14	8	11			33
Burnt	8	6	125	10	1	150
Patinated	2		21			23
Other	1					1
TOTAL	163	39	1133	85	11	1431

Fig. 4.30 Number of the Late Neolithic knapping products by category and raw material.

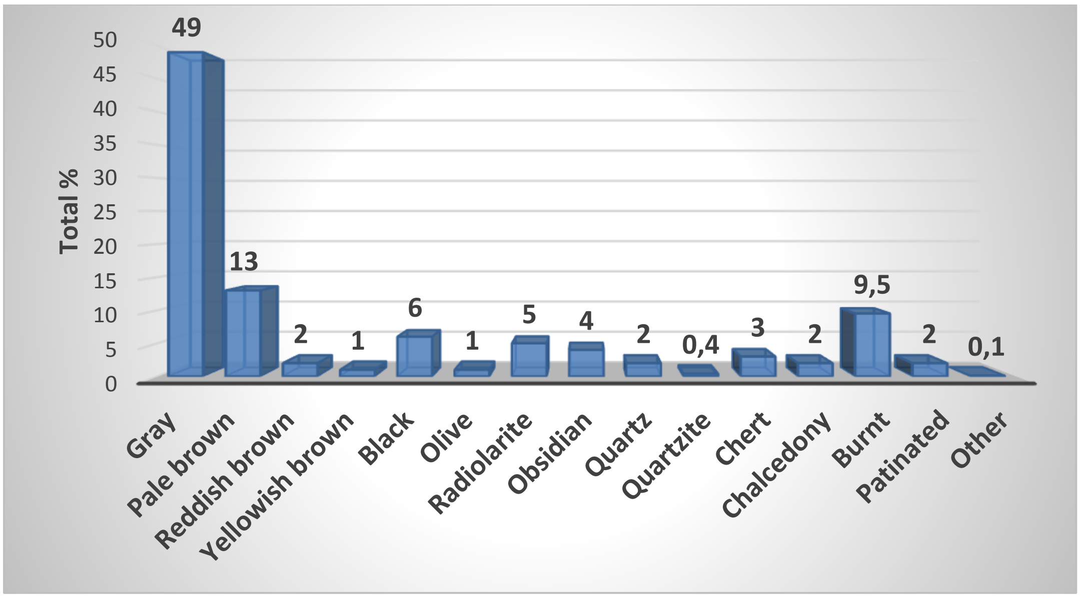


Fig. 4.31 Percentage of the Late Neolithic knapping products by raw material.

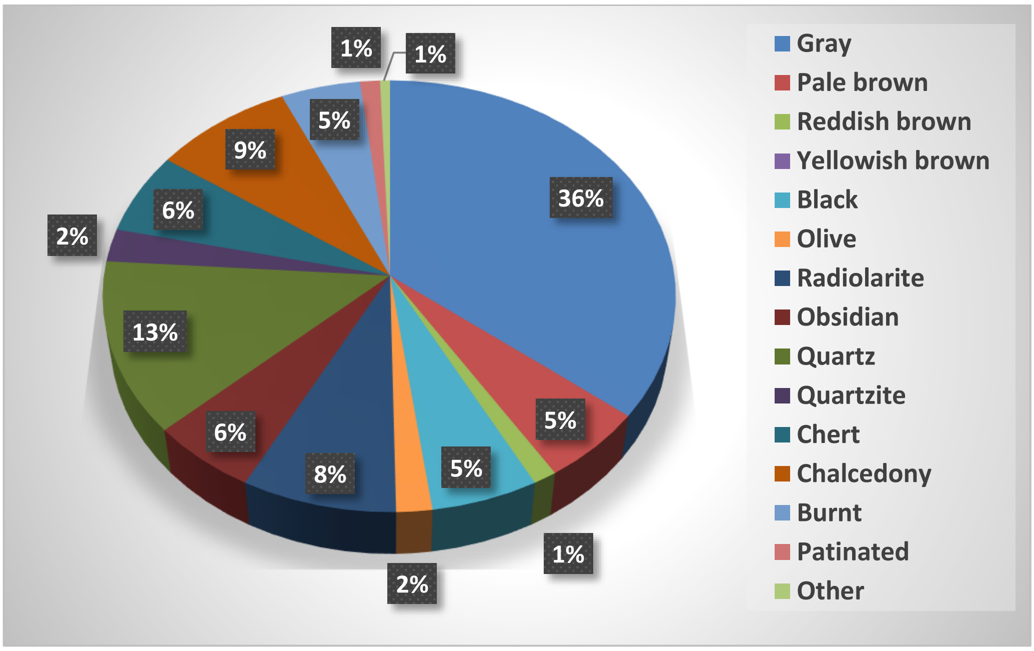


Fig. 4.32 Raw material distribution of the Late Neolithic flakes.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	5,1	1,3	2,69	4	1,2	2,25	1,2	0,1	0,43
Pale brown flint	3,7	1,7	2,58	3,6	1,5	2,3	0,8	0,2	0,46
Reddish brown flint	2,7	1,6	2,15	2,9	1,7	2,3	0,8	0,1	0,4
Black flint	3	1,6	2,23	3,2	1,3	2,18	0,8	0,1	0,45
Olive flint	3,5	1,7	2,6	2,5	1,8	2,2	0,9	0,3	0,53
Radiolarite	4,1	2,2	2,7	2,7	1,5	2	0,9	0,2	0,49
Obsidian	4,7	1,7	2,76	4,5	1,2	2,45	0,9	0,2	0,44
Quartz	4,2	2,4	3,3	4,8	1,3	2,56	2	0,1	0,72
Quartzite	3,7			3,7	2	2,6	0,7	0,5	0,57
Chert	3,3	1,8	2,8	3,1	1,5	2,2	0,7	0,2	0,47
Chalcedony	3,8	1,7	2,84	3,8	1,3	2,1	0,8	0,1	0,57
Burnt	3,6	2,5	2,9	2,4	1,2	1,6	0,7	0,1	0,45
Patinated	5,5	2,5	4	3,4	2,9	3,15	1	0,4	0,7
Other	2,2			2,6			0,5		

Fig. 4.33 Dimensions of the Late Neolithic flakes by raw material (maximum, minimum and mean value in cm).

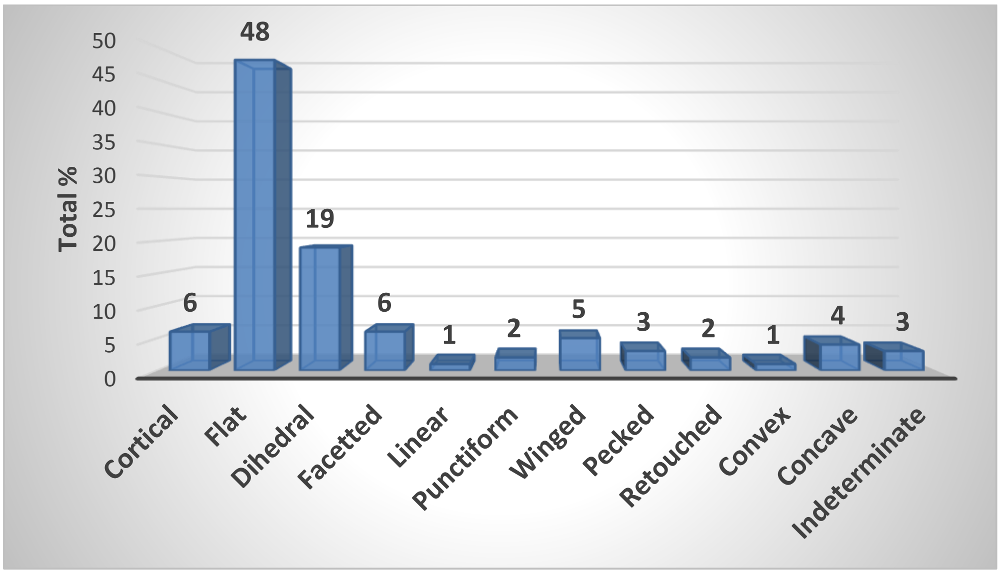


Fig. 4.34 Percentage of the Late Neolithic flakes by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	1,8	0,4	0,93	0,9	0,1	0,36
Pale brown flint	1,6	0,7	1,1	0,5	0,1	0,32
Reddish brown flint	1	1	1	0,6	0,1	0,38
Black flint	1,6	0,9	1,15	0,7	0,2	0,38
Olive flint	1			0,3		
Radiolarite	1,4	0,5	0,95	0,6	0,2	0,36
Obsidian	1,4	0,4	0,93	0,4	0,2	0,31
Quartz	1,5	0,6	1,08	0,6	0,1	0,37
Quartzite	1,2	0,7	1	0,6	0,3	0,45
Chert	1,6	0,5	1	0,9	0,2	0,43
Chalcedony	1,7	0,4	1,12	0,9	0,2	0,51
Burnt	1,6	0,4	0,82	0,5	0,2	0,3
Patinated	1,4	1,3	1,35	0,5	0,5	0,5
Other	1,4			0,3		

Fig. 4.35 Butt dimensions of the Late Neolithic flakes by raw material (maximum, minimum and mean value in cm).

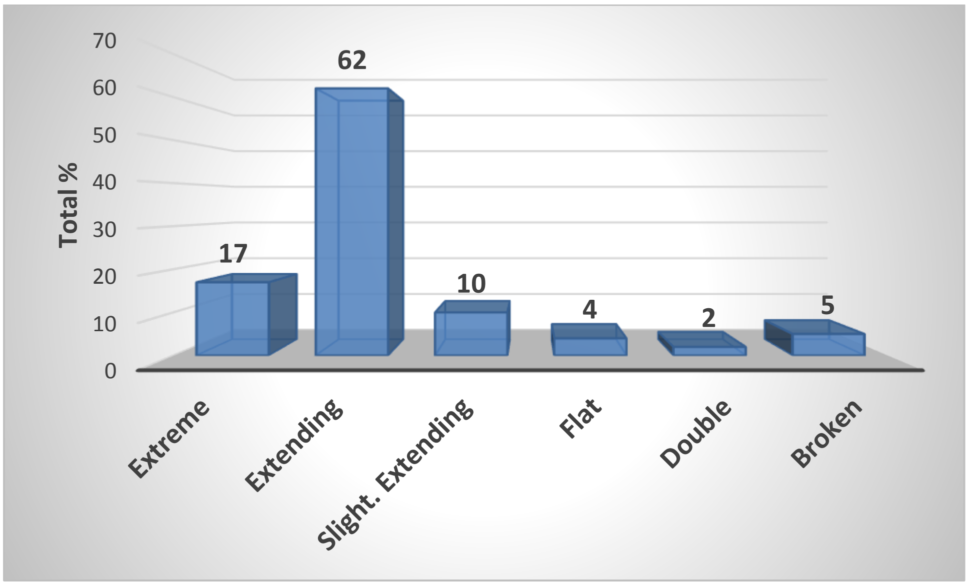


Fig. 4.36 Percentage of the Late Neolithic flakes by bulb type.

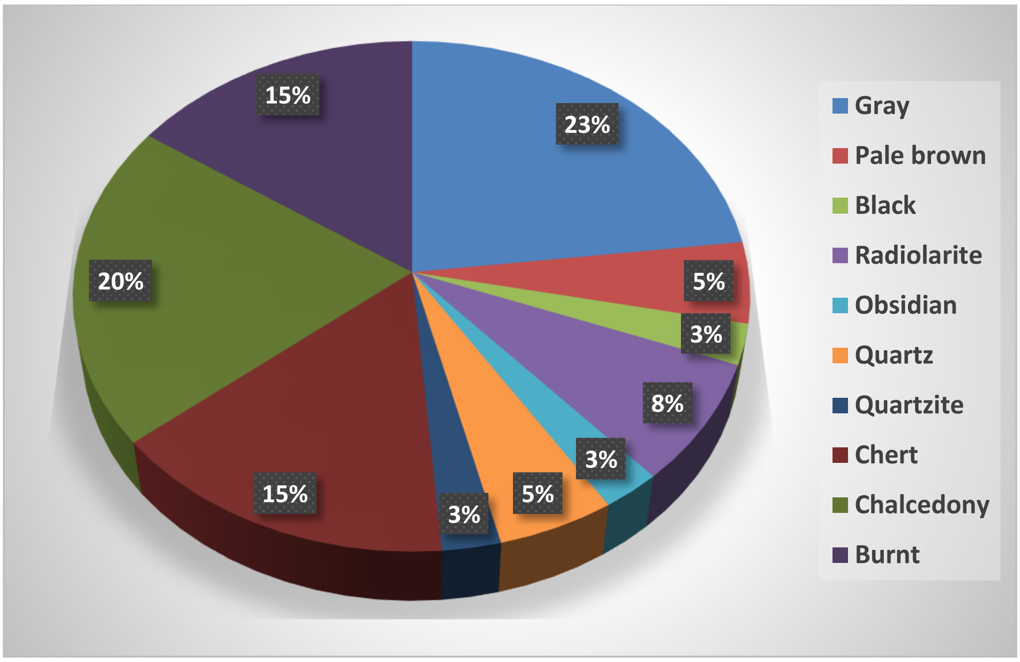


Fig. 4.37 Raw material distribution of the Late Neolithic blade-flakes.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	4,6	2,9	3,8	2	1	1,8	0,9	0,2	0,47
Pale brown flint	4,5	3,6	4,05	2,2	2,2	2,2	0,5	0,4	0,45
Black flint	2,8			1,6			0,5		
Radiolarite	4,2	3	3,5	1,8	1,5	1,6	0,8	0,5	0,65
Obsidian	3,3			1,6			0,2		
Quartz	6,4	1,9	5,5	2,8	1,5	2,15	1,3	0,3	0,8
Quartzite	4			2,2			0,8		
Chert	4,3	3,3	3,8	2,4	1,5	2	1,1	0,3	0,73
Chalcedony	5	3,5	4,14	2,5	1,5	1,83	0,9	0,2	0,5
Burnt	4,8	3,3	3,5	2,5	1,5	1,98	0,9	0,1	0,51

Fig. 4.38 Dimensions of the Late Neolithic blade-flakes by raw material (maximum, minimum and mean value in cm).

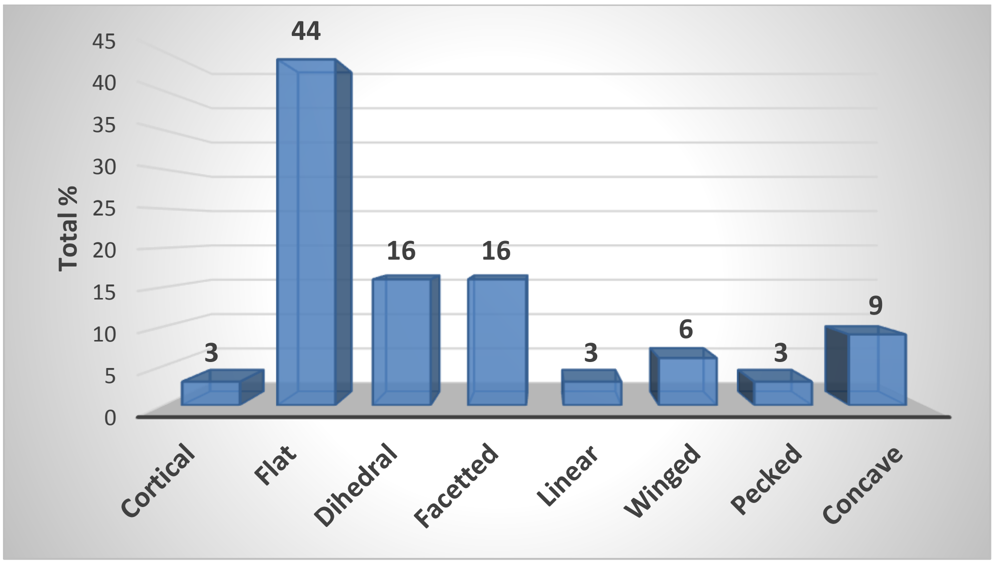


Fig. 4.39 Percentage of the Late Neolithic blade-flakes by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	1,1	0,5	0,75	0,5	0,2	0,33
Pale brown flint	1,3	0,8	1,05	0,5	0,4	0,45
Black flint	0,6			0,3		
Olive flint						
Radiolarite	1,2	0,6	0,8	0,7	0,2	0,36
Obsidian	0,6			0,2		
Quartzite	1,2			0,4		
Chert	2,1	1,1	1,46	0,6	0,3	0,46
Chalcedony	1,6	0,8	1,18	0,8	0,3	0,5
Burnt	1,4	0,8	1,2	0,8	0,3	0,56

Fig. 4.40 Butt dimensions of the Late Neolithic blade-flakes by raw material (maximum, minimum and mean value in cm).

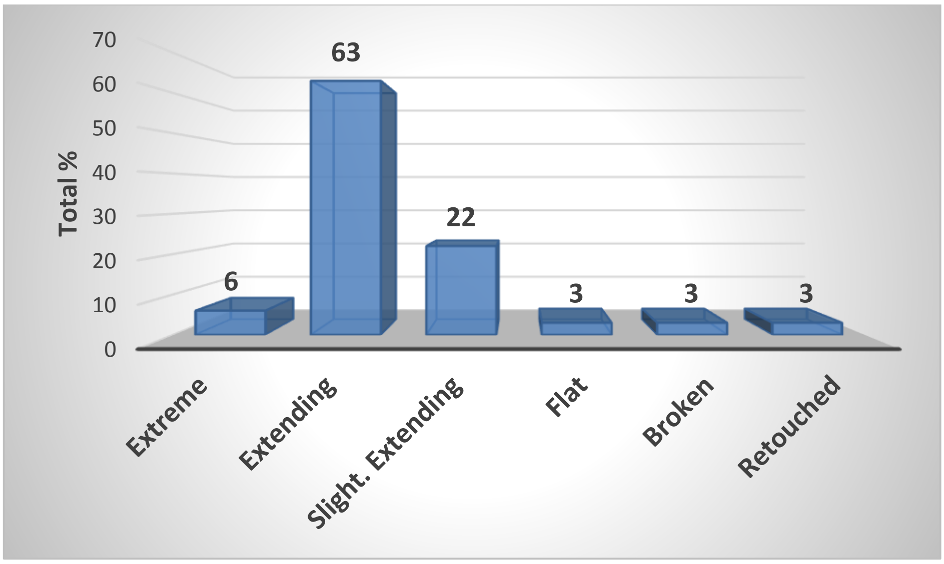


Fig. 4.41 Percentage of the Late Neolithic blade-flakes by bulb type.

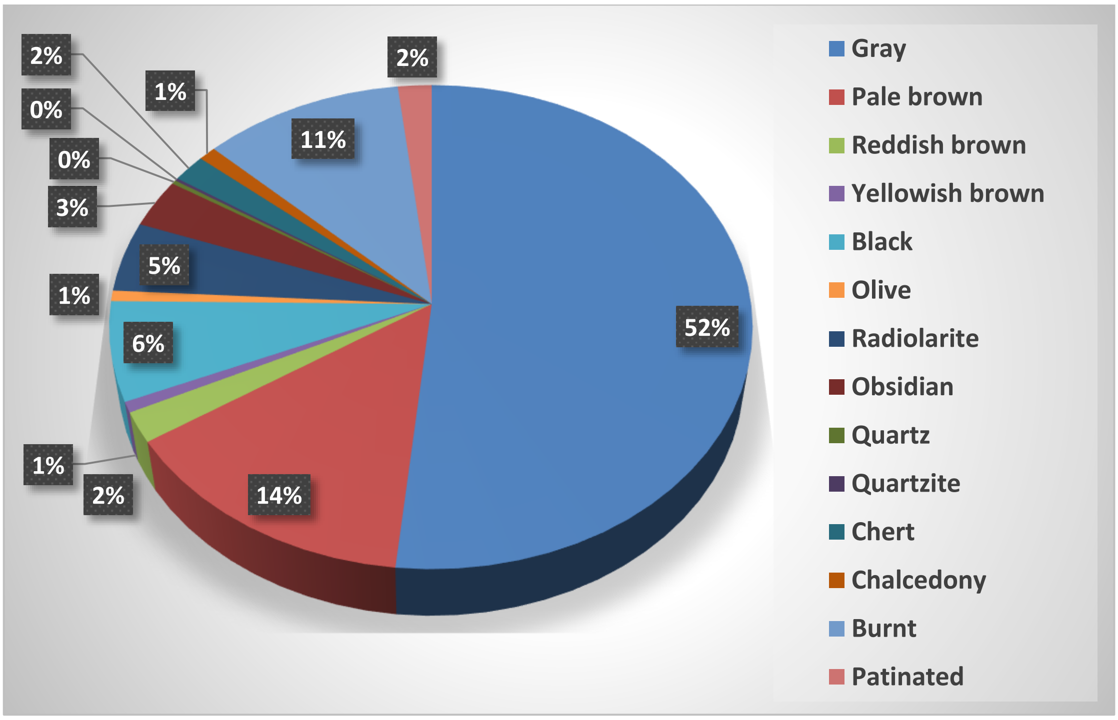


Fig. 4.42 Raw material distribution of the Late Neolithic blades.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	10,6	2,2	4,6	3,4	1	1,45	0,9	0,1	0,34
Pale brown flint	7,8	2,1	4,8	2,7	1	1,5	0,7	0,2	0,34
Reddish brown flint	5,7	2,5	3,58	2,2	1	1,36	0,6	0,2	0,27
Yellowish brown flint	18,6	1,8	5,3	2,6	1,3	1,9	0,5	0,2	0,4
Black flint	5,1	2,9	3,78	2	1	1,28	0,5	0,1	0,28
Olive flint	5,1	3,9	4,35	1,9	1,1	1,41	0,5	0,2	0,37
Radiolarite	9,2	3,2	5,1	2,7	1	1,57	0,8	0,2	0,42
Obsidian	6,6	3,1	4,16	2,2	1	1,38	0,7	0,1	0,27
Quartz	2,8	2,6	2,7	2	1	1,5	0,8	0,3	0,53
Quartzite	2	1,8	1,9	1,6	1,1	1,35	0,4	0,4	0,4
Chert	9,4	4,1	6,8	3,5	1	1,7	1	0,1	0,45
Chalcedony	6,3	3,1	4,4	2,7	1,1	1,7	0,9	0,3	0,5
Burnt	5,6	1,6	3,65	2,9	1	1,52	0,8	0,1	0,38
Patinated	3,9	3,8	3,85	2,5	1	1,7	0,8	0,2	0,45

Fig. 4.43 Dimensions of the Late Neolithic blades by raw material (maximum, minimum and mean value in cm).

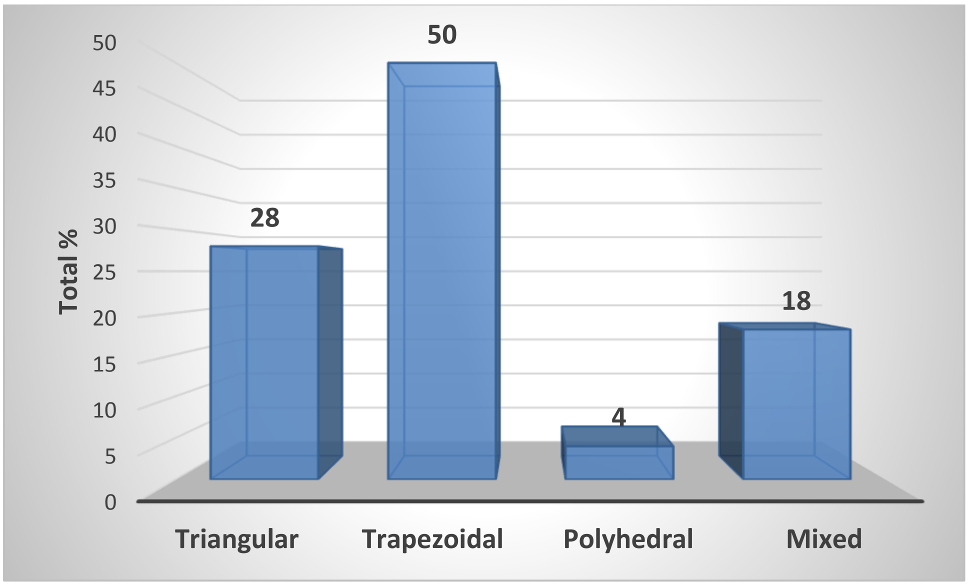


Fig. 4.44 Percentage of the Late Neolithic blades by cross-section type.

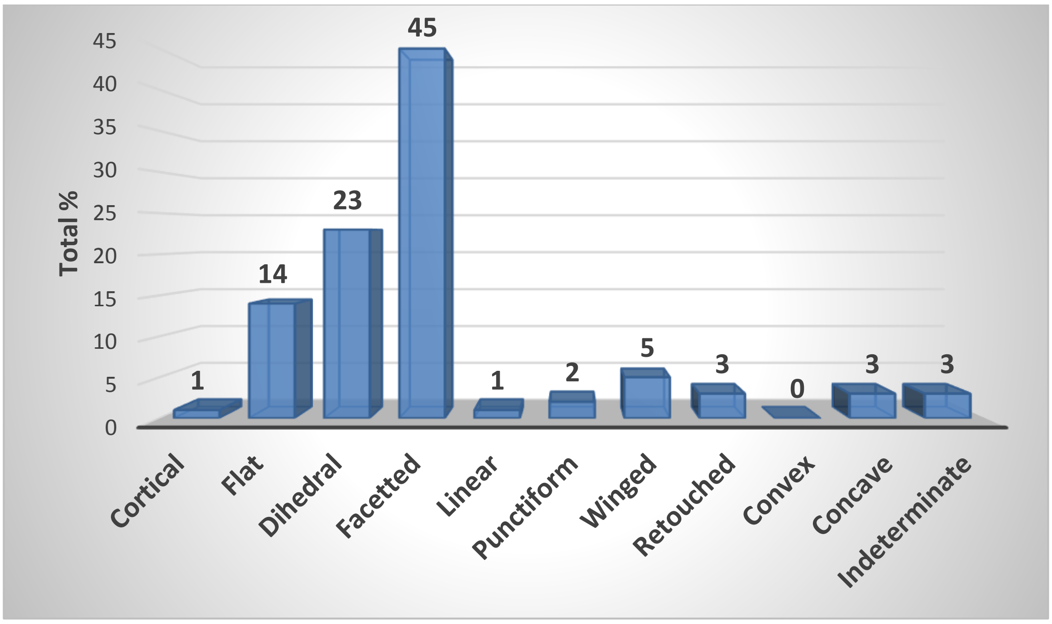


Fig. 4.45 Percentage of the Late Neolithic blades by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	1,6	0,3	0,7	0,8	0,1	0,3
Pale brown flint	1,6	0,4	0,8	0,7	0,1	0,33
Reddish brown flint	0,9	0,4	0,65	0,4	0,2	0,23
Yellowish brown flint	0,6	0,6	0,6	0,3	0,2	0,25
Black flint	1,2	0,4	0,68	0,5	0,1	0,26
Olive flint	1	0,6	0,75	0,5	0,3	0,42
Radiolarite	1,5	0,5	0,89	0,7	0,1	0,33
Obsidian	1,1	0,3	0,68	0,4	0,1	0,24
Quartz	0,6	0,6	0,6	0,5	0,5	0,5
Quartzite	0,7	0,7	0,7	0,2	0,2	0,2
Chert	2,2	0,7	1,11	0,6	0,2	0,42
Chalcedony	1,5	0,5	0,8	0,7	0,2	0,4
Burnt	1,3	0,4	0,8	0,6	0,2	0,33
Patinated	1,5	0,5	0,9	0,7	0,2	0,46

Fig. 4.46 Butt dimensions of the Late Neolithic blades by raw material (maximum, minimum and mean value in cm).

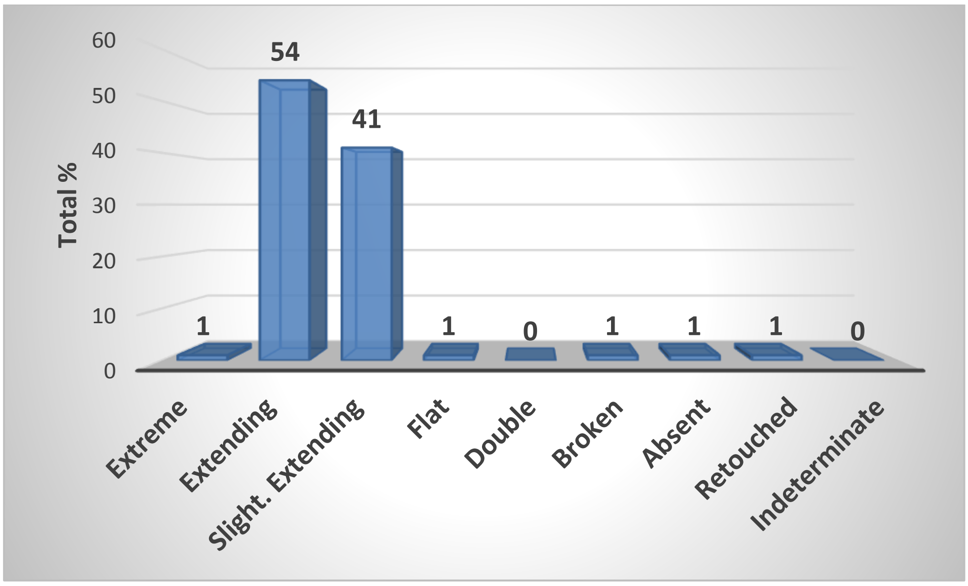


Fig. 4.47 Percentage of the Late Neolithic blades by bulb type.

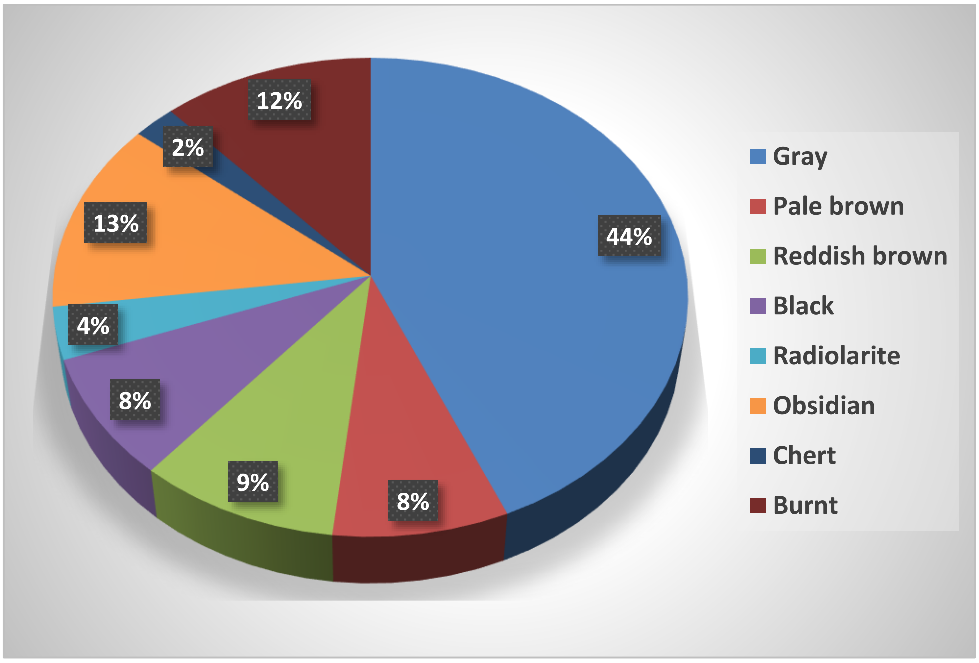


Fig. 4.48 Raw material distribution of the Late Neolithic microblades.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	5,6	2	3,7	0,9	0,5	0,8	0,4	0,1	0,24
Pale brown flint	4,7	4,7	4,7	0,9	0,6	0,81	0,5	0,2	0,31
Reddish brown flint	3,6	2,7	3	0,9	0,6	0,76	0,3	0,1	0,2
Black flint	4,5	2,3	3,6	0,9	0,8	0,85	0,3	0,2	0,21
Olive flint									
Radiolarite	2,9	2,6	2,7	0,9	0,5	0,7	0,3	0,2	0,26
Obsidian	5,6	2	3,73	0,9	0,7	0,84	0,4	0,1	0,2
Chert	3,7	3,7	3,7	0,9	0,6	0,75	0,3	0,1	0,2
Burnt	2,8	2,8	2,8	1	0,7	0,84	0,6	0,2	0,29

Fig. 4.49 Dimensions of the Late Neolithic microblades by raw material (maximum, minimum and mean value in cm).

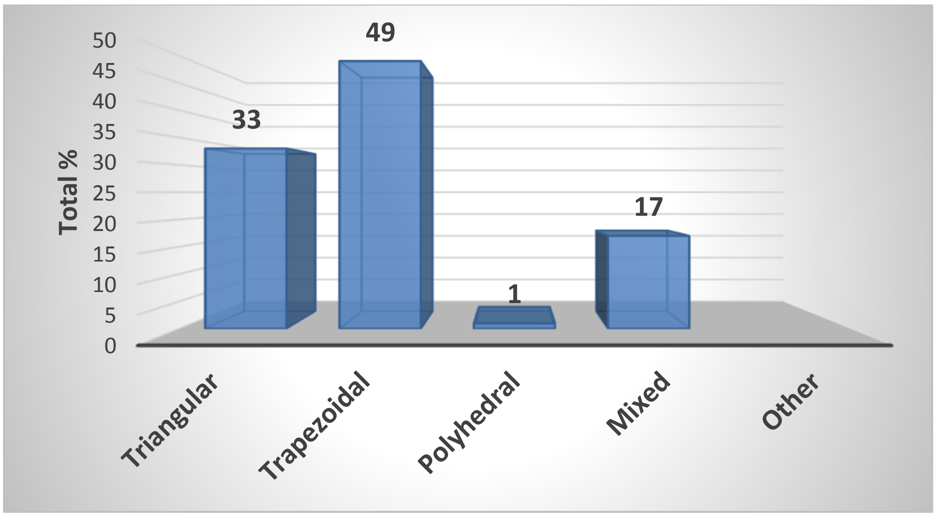


Fig. 4.50 Percentage of the Late Neolithic microblades by cross-section type.

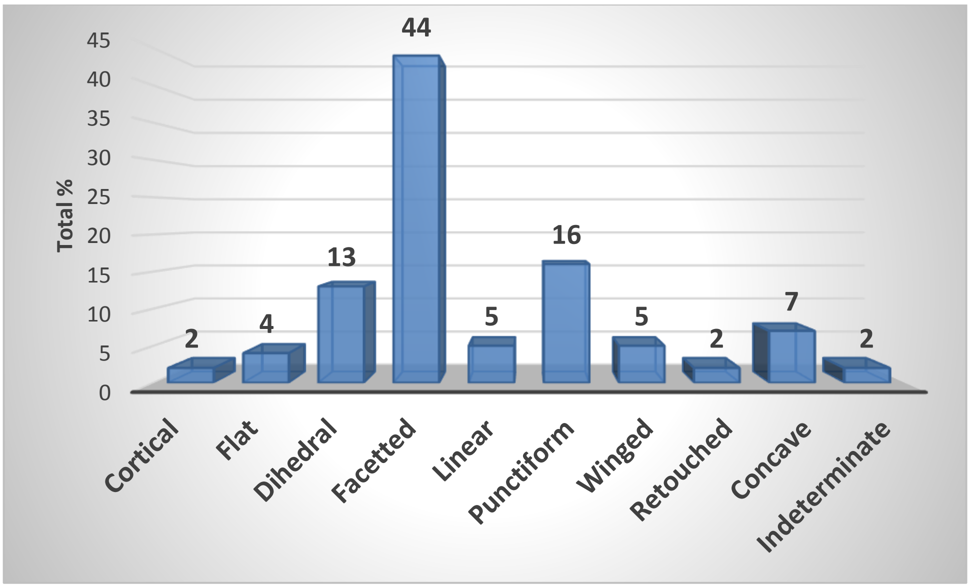


Fig. 4.51 Percentage of the Late Neolithic microblades by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	0,8	0,2	0,48	0,3	0,1	0,16
Pale brown flint	0,7	0,5	0,56	0,3	0,1	0,2
Reddish brown flint	0,7	0,3	0,5	0,4	0,1	0,21
Black flint	0,7	0,3	0,53	0,4	0,1	0,23
Olive flint						
Radiolarite	0,6	0,2	0,4	0,3	0,2	0,25
Obsidian	0,8	0,3	0,57	0,2	0,1	0,15
Chert	0,3	0,3	0,3	0,1	0,1	0,1
Burnt	0,6	0,2	0,37	0,3	0,1	0,2

Fig. 4.52 Butt dimensions of the Late Neolithic microblades by raw material (maximum, minimum and mean value in cm).

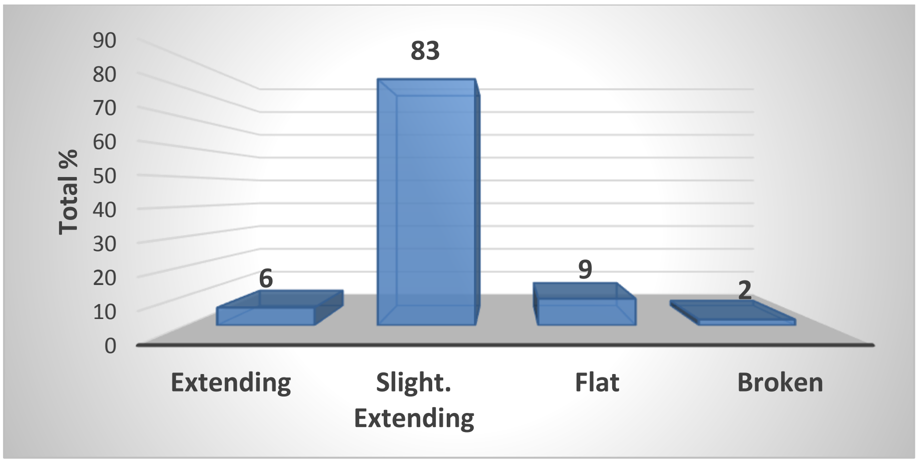


Fig. 4.53 Percentage of the Late Neolithic microblades by bulb type.

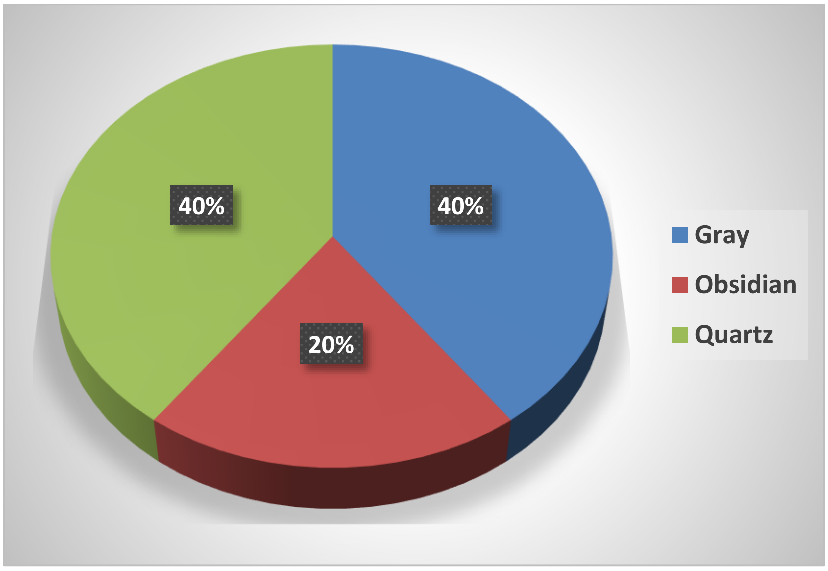


Fig. 4.54 Raw material distribution of the Late Neolithic debris.

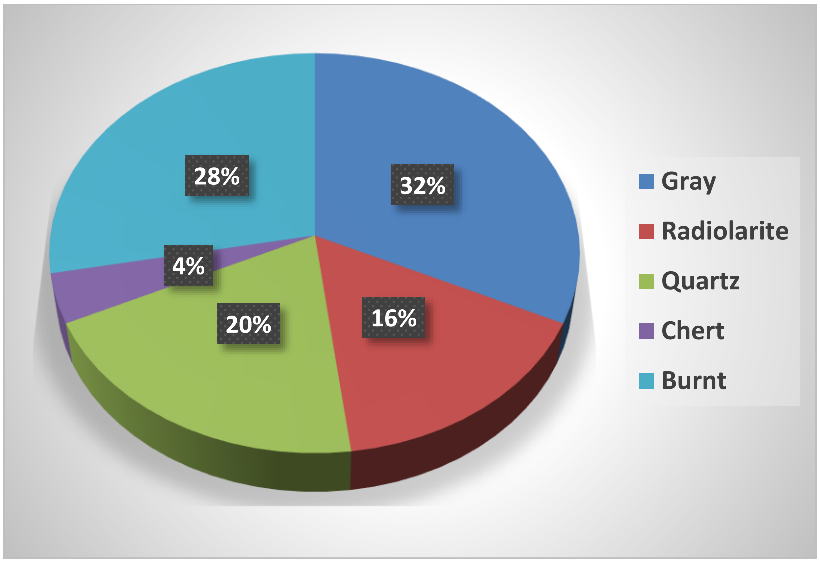


Fig. 4.55 Raw material distribution of the Late Neolithic indeterminate pieces.

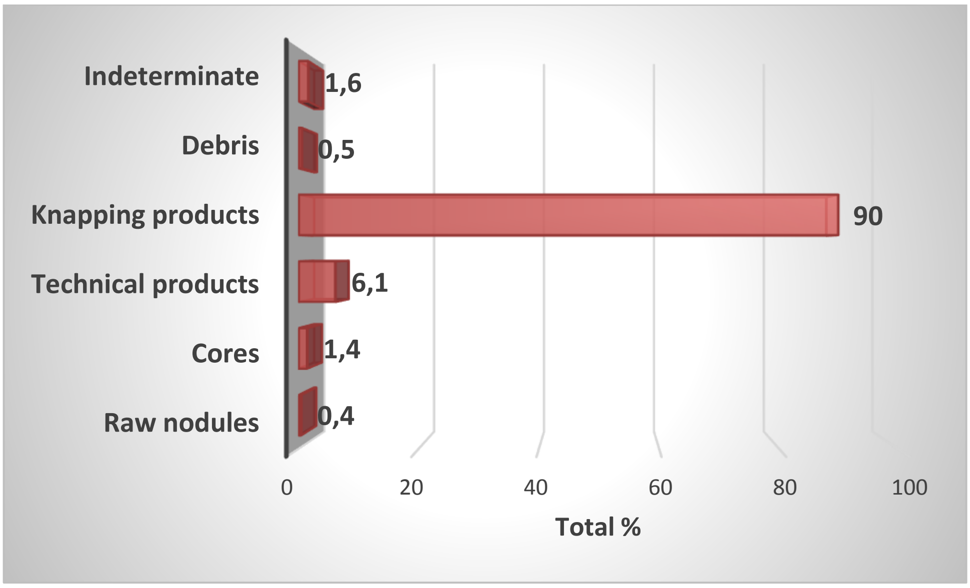


Fig. 4.56 Percentage of the basic Final Neolithic technological categories.

TECHNOLOGICAL CATEGORIES	n.	%
Raw nodules	16	0,4
Cores	59	1,4
Technical products	237	6,1
Flakes	340	8,5
Blade-flakes	117	3
Blades	2841	71,8
Microblades	237	6
Projectile points	29	0,7
Debris	18	0,5
Indeterminate	71	1,6
TOTAL	**3965**	**100**

Fig. 4.57 Overall number and percentage of the Final Neolithic technological categories.

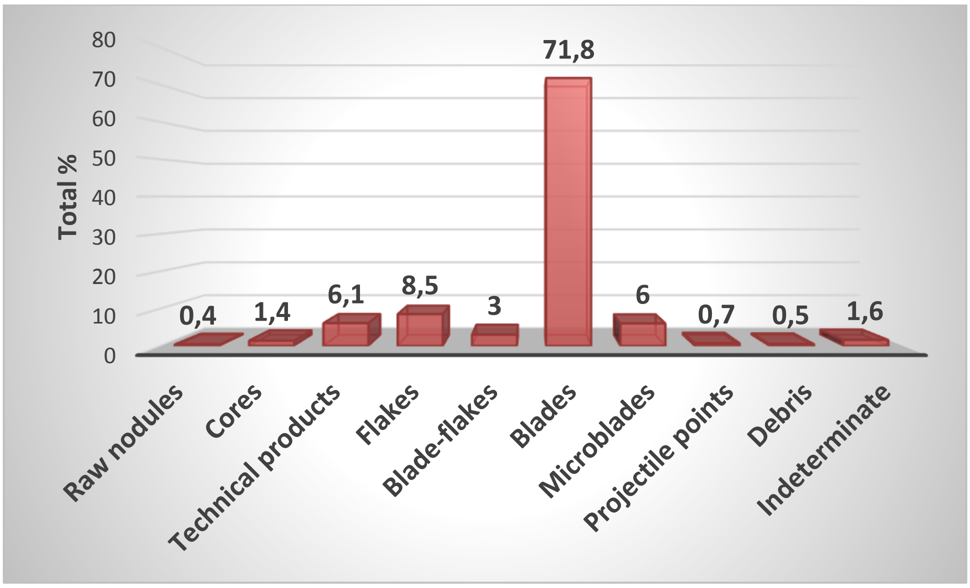


Fig. 4.58 Percentage of the Final Neolithic technological categories.

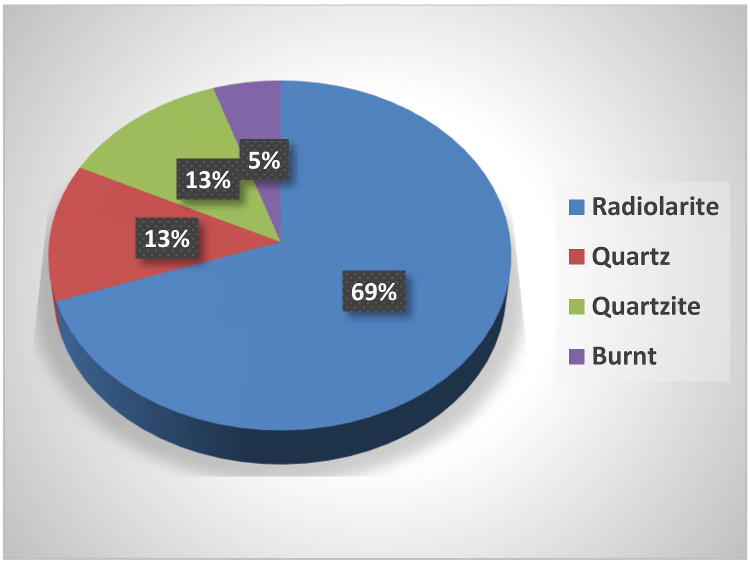


Fig. 4.59 Raw material distribution of the Final Neolithic raw nodules.

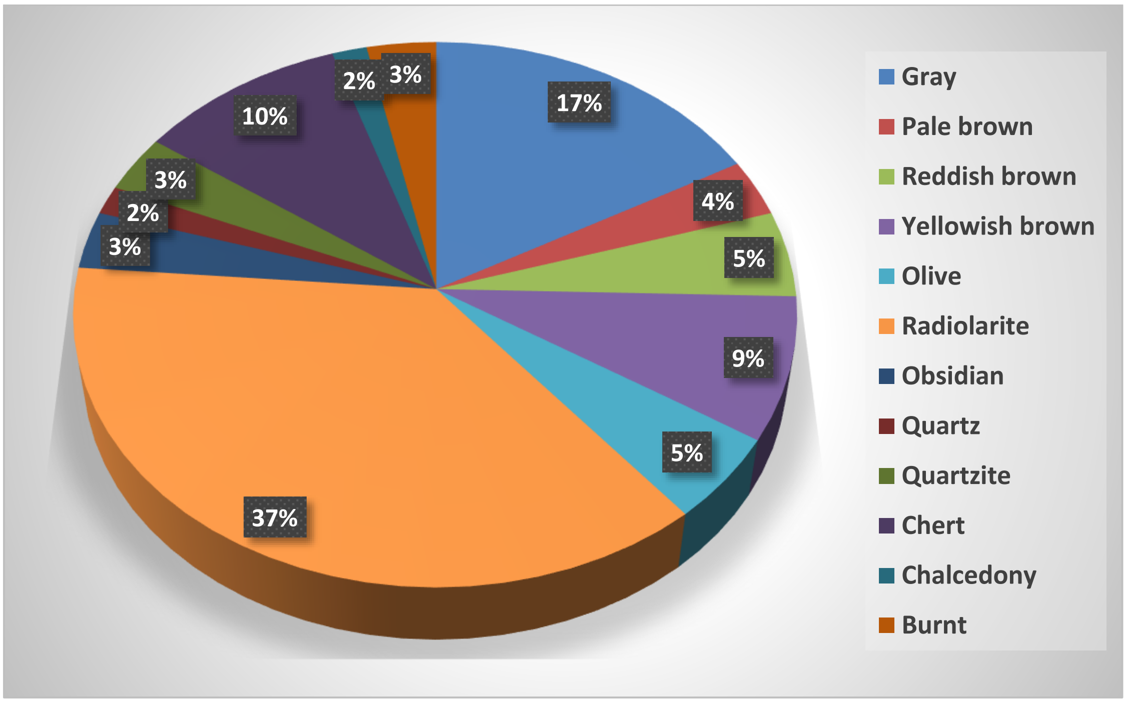


Fig. 4.60 Raw material distribution of the Final Neolithic cores.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	4,4	2,6	3,1	4,5	1,6	2,6	2,5	0,8	1,45
Pale brown flint	2,7	1,2	1,9	2	1,9	1,95	0,7	0,7	0,7
Reddish brown flint	3,7	2,8	3,3	3,4	1,7	2,5	3	0,8	1,8
Yellowish brown flint	3,3	2,2	2,8	3,1	1,2	2,3	1,5	0,4	0,86
Olive flint	3,3	1,8	2,6	4,3	1,6	2,8	2,4	0,8	1,7
Radiolarite	5,3	0,8	3,1	6,7	0,9	2,8	3,2	0,3	1,5
Obsidian	3,7	2,9	3,3	3,2	2,5	2,8	2,1	1,1	1,6
Quartz	3,2			3			2,3		
Quartzite	4	3,2	3,6	4,7	3,7	4,2	3,5	2,6	3
Chert	7	2,2	3,8	6,3	1,3	3,1	2,5	0,7	1,6
Chalcedony	3,2	2,4	2,8	3,8	3,4	3,6	3,3	1,1	2,2
Burnt	2,7	2,3	2,5	1,9	1,4	1,65	1,2	1,1	1,15

Fig. 4.61 Dimensions of the Final Neolithic cores by raw material (maximum, minimum and mean value in cm).

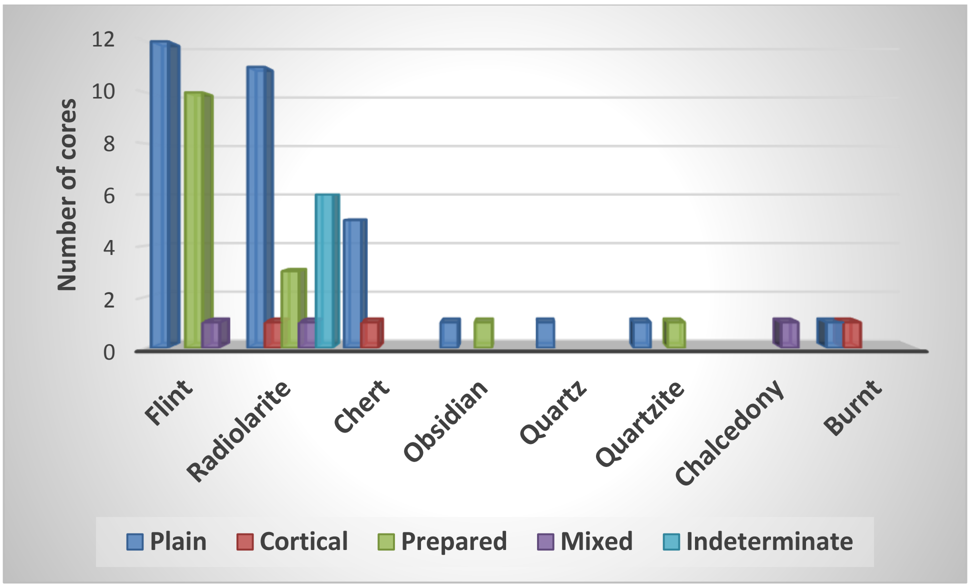


Fig. 4.62 Platform types of the Final Neolithic cores by raw material.

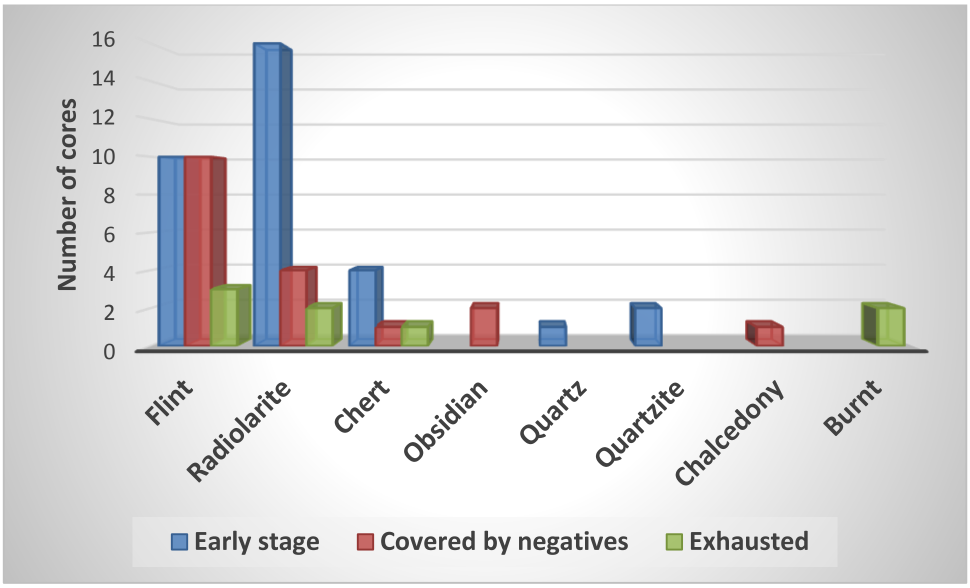


Fig. 4.63 Knapping stage of the Final Neolithic cores by raw material.

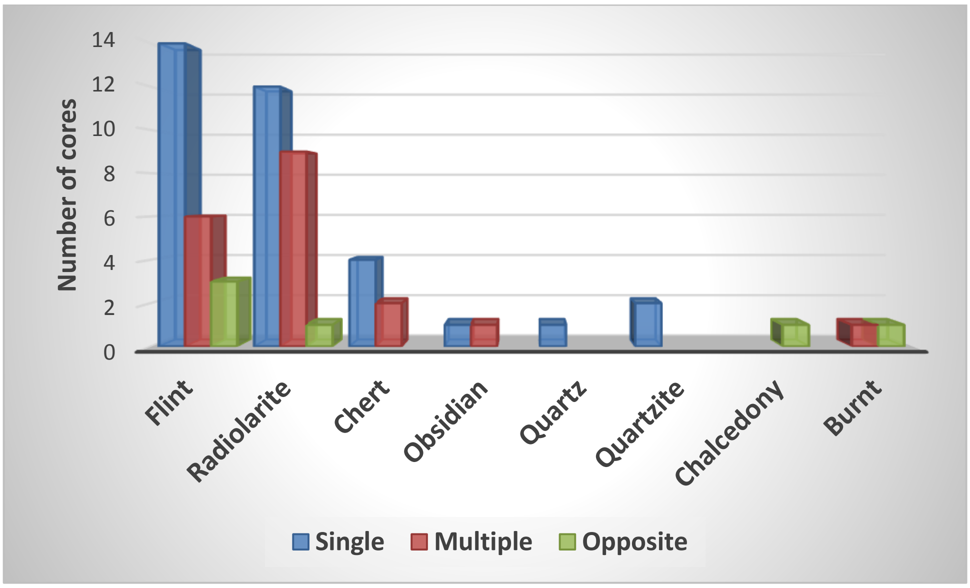


Fig. 4.64 Negatives' direction of the Final Neolithic cores by raw material.

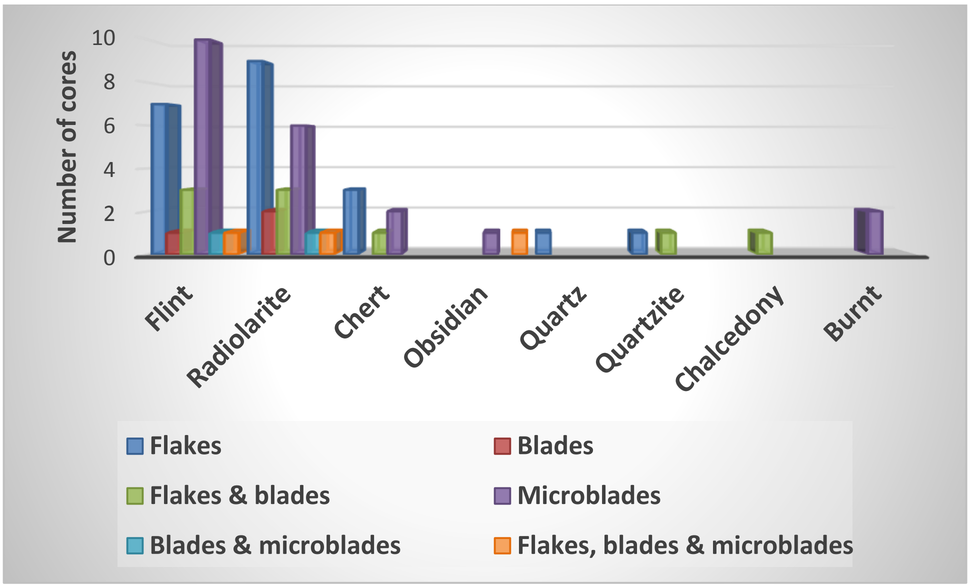


Fig. 4.65 Negative types of the Final Neolithic cores by raw material.

RAW MATERIAL CATEGORIES	Crested blades	Cortical flakes	Rej. flakes	Core rej. flakes	Core tablets	Plunging	Hinged	TOTAL
Gray flint	16	2	18	2	2	16	5	**61**
Pale brown flint	16	2	6	8		12	4	**48**
Reddish brown flint	1	1		3		3		**8**
Yellowish Brown flint	3		2	2		1	1	**9**
Olive flint	2		1			4		**7**
Radiolarite	16	8	3	4		1	4	**36**
Obsidian			11	9		7		**27**
Quartz		3						**3**
Quartzite			2					**2**
Chert	1	1	2			3		**7**
Chalcedony	4		1			2		**7**
Burnt	10	2				4	1	**17**
Patinated	2	1	1				1	**5**
TOTAL	**71**	**20**	**47**	**28**	**2**	**53**	**16**	**237**

Fig. 4.66 Number of the Final Neolithic technical products by category and raw material.

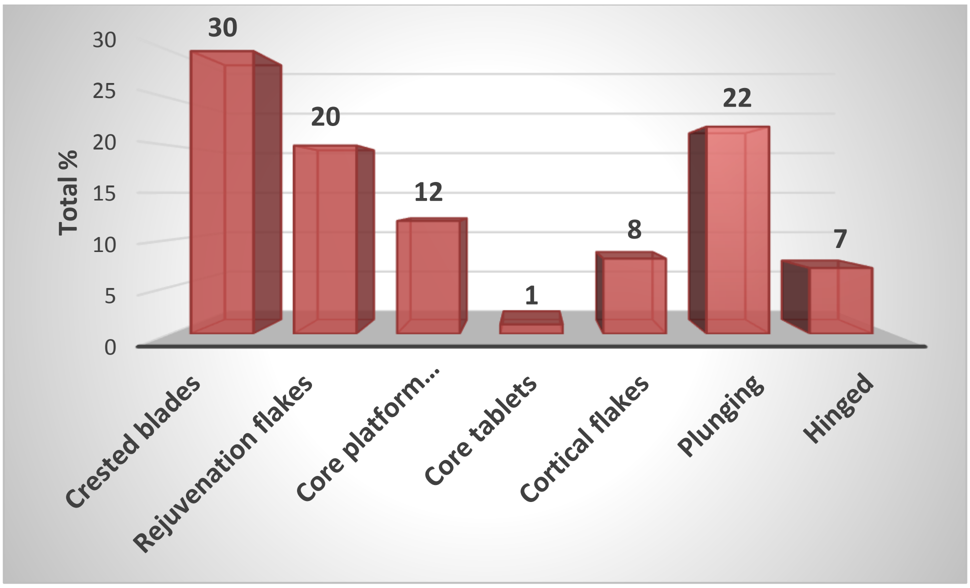


Fig. 4.67 Percentage of the Final Neolithic technical products by category.

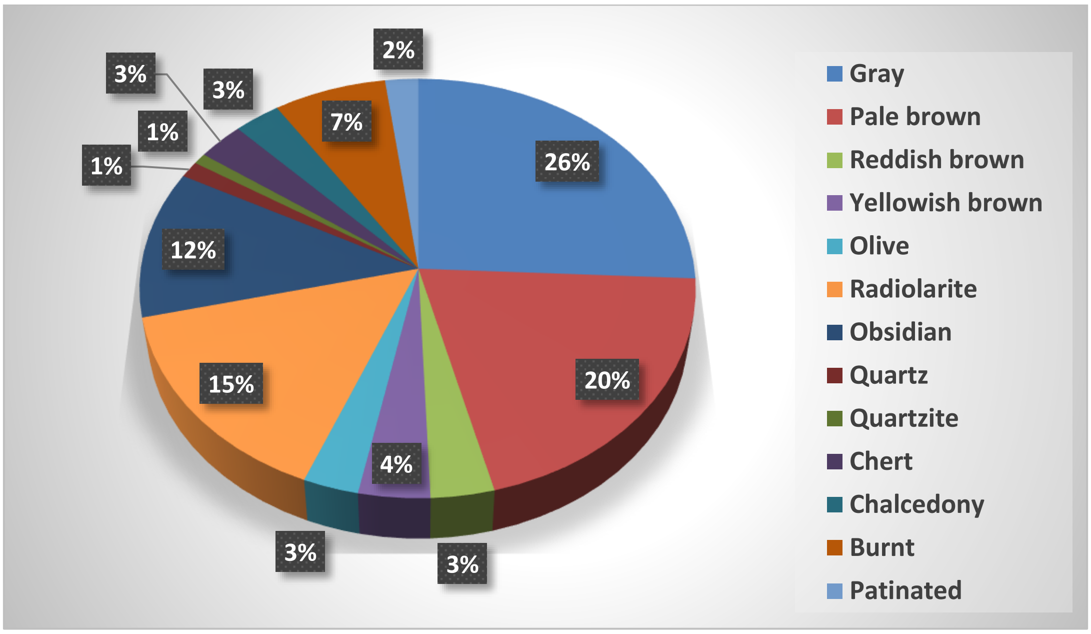


Fig. 4.68 Raw material distribution of the Final Neolithic technical products.

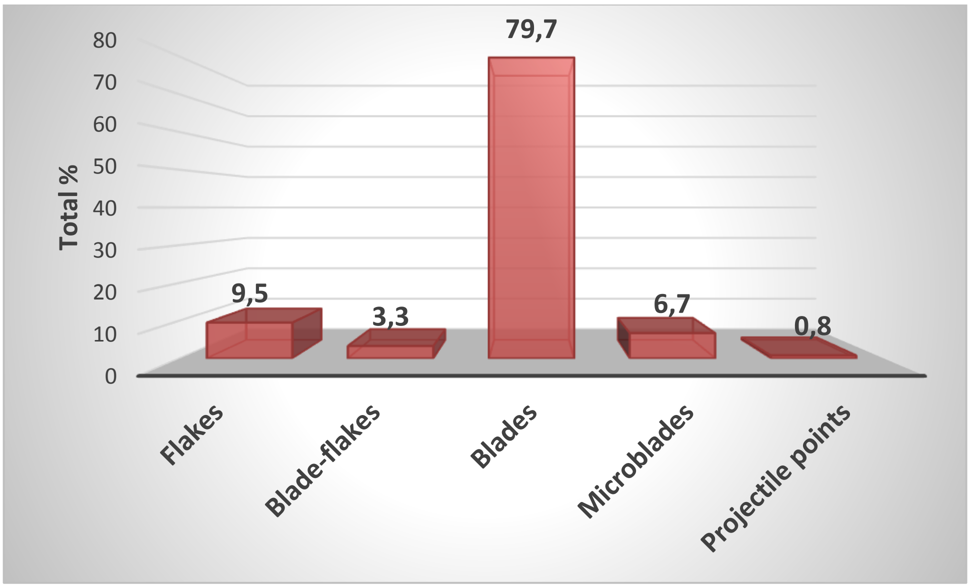


Fig. 4.69 Percentage of the Final Neolithic knapping products by category.

RAW MATERIAL CATEGORIES	Flakes	Blade-flakes	Blades	Microblades	Projectiles	TOTAL
Gray flint	66	23	696	66	5	**856**
Pale Brown flint	49	13	707	50	6	**825**
Reddish Brown flint	4		81	4		**89**
Yellowish Brown flint	11	1	306	23	4	**345**
Olive flint	2	3	59	3	2	**69**
Radiolarite	58	16	274	8	6	**362**
Obsidian	18	1	129	70	2	**220**
Quartz	14	2	10			**26**
Quartzite	3	9	8			**20**
Chert	28	6	79	1	1	**115**
Chalcedony	56	38	93	1		**188**
Burnt	25	2	354	9	1	**391**
Patinated	4	2	41	2	1	**50**
Other	2	1	4		1	**8**
TOTAL	**340**	**117**	**2841**	**237**	**29**	**3564**

Fig. 4.70 Number of the Final Neolithic knapping products by category and raw material.

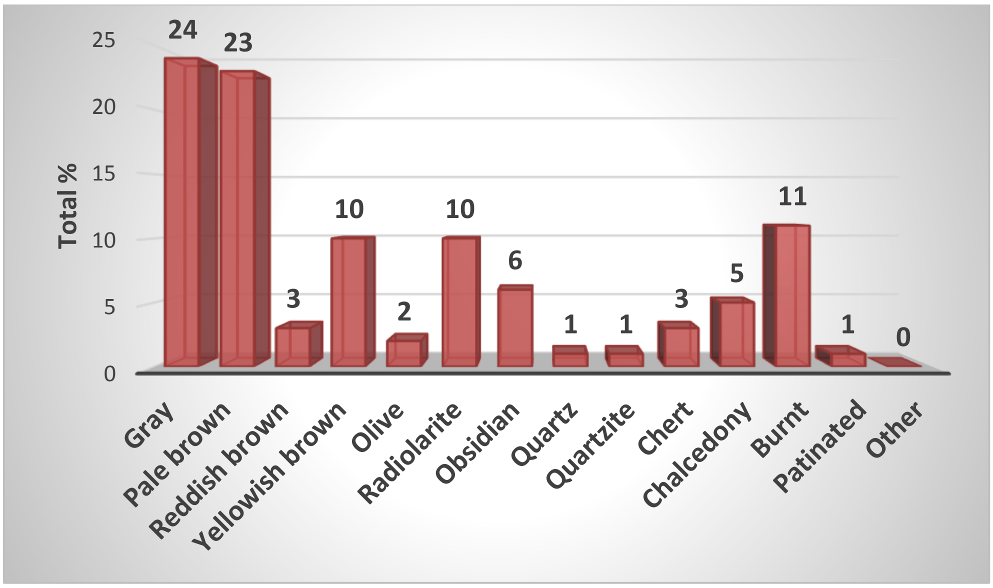


Fig. 4.71 Percentage of the Final Neolithic knapping products by raw material.

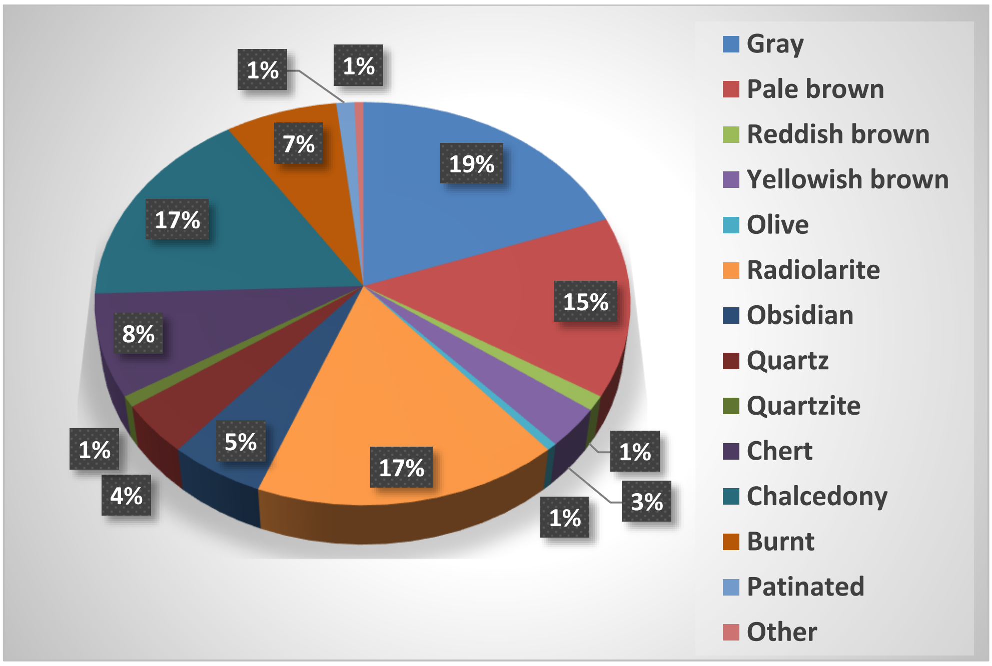


Fig. 4.72 Raw material distribution of the Final Neolithic flakes.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	4,8	1,3	2,7	5	0,8	2	1,1	0,1	0,4
Pale Brown flint	4,5	1,5	2,5	3,7	1,1	2,1	1,1	0,1	0,45
Reddish brown flint	2,4	1,6	1,9	2,3	1,4	2	0,5	0,3	0,42
Yellowish brown flint	3,4	2,1	2,58	3	1,4	2,2	0,8	0,2	0,4
Olive flint	2,8	2,7	2,75	2,7	1,7	2,2	0,4	0,4	0,4
Radiolarite	3,7	1,7	2,56	4,4	1,2	1,9	1,1	0,1	0,5
Obsidian	2,7	1,6	2	3,1	1,3	2	0,8	0,1	0,36
Quartz	4,4	2	2,9	4,3	1,1	2,1	1,2	0,3	0,7
Quartzite	3,1	2,9	3	2	1,8	1,9	0,6	0,3	0,46
Chert	5,8	1,8	3,2	4,1	1,5	2,2	1,5	0,2	0,54
Chalcedony	4,5	1,4	3	3,8	1,3	2	1,1	0,2	0,5
Burnt	3,5	1,8	2,4	3,7	1,3	1,9	1	0,2	0,8
Patinated	3,4	2,1	2,8	2,5	1,7	2,1	0,8	0,4	0,6
Other	3,5	2,8	3,1	2	1,9	1,9	0,5	0,5	0,5

Fig. 4.73 Dimensions of the Final Neolithic flakes by raw material (maximum, minimum and mean value in cm).

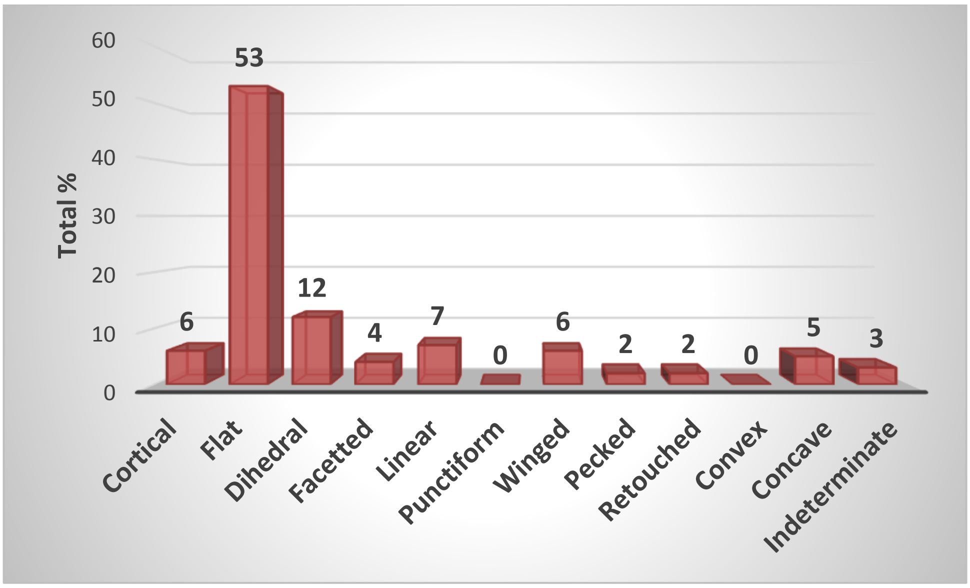


Fig. 4.74 Percentage of the Final Neolithic flakes by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	2,3	0,4	1	0,9	0,1	0,4
Pale Brown flint	4	1,7	0,8	0,6	0,1	0,3
Reddish Brown flint	1,7	0,7	1,2	0,6	0,1	0,35
Yellowish Brown flint	1,4	0,6	0,8	0,7	0,2	0,3
Olive flint	0,9	0,7	0,8	0,4	0,3	0,35
Radiolarite	2	0,4	0,8	0,8	0,1	0,36
Obsidian	1,5	0,4	0,8	0,7	0,1	0,2
Quartz	1,2	0,6	0,9	0,7	0,3	0,43
Quartzite	1,4	0,7	1,1	0,8	0,3	0,56
Chert	1,8	0,5	1	0,7	0,2	0,45
Chalcedony	2,7	0,5	1,1	1,2	0,2	0,5
Burnt	1,5	0,4	0,8	0,7	0,1	0,36
Patinated	2,1	1	1,6	1,1	0,5	0,8

Fig. 4.75 Butt dimensions of the Final Neolithic flakes by raw material (maximum, minimum and mean value in cm).

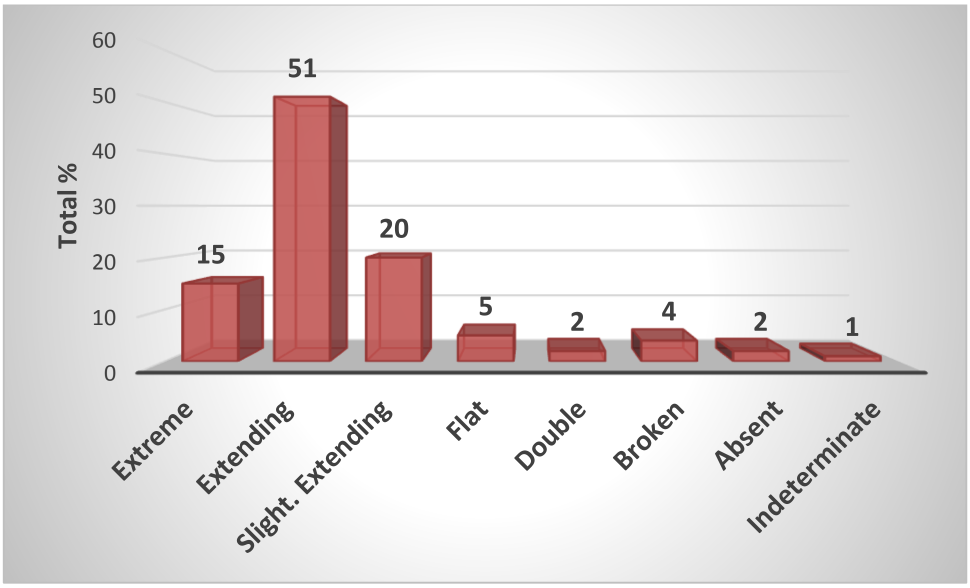


Fig. 4.76 Percentage of the Final Neolithic flakes by bulb type.

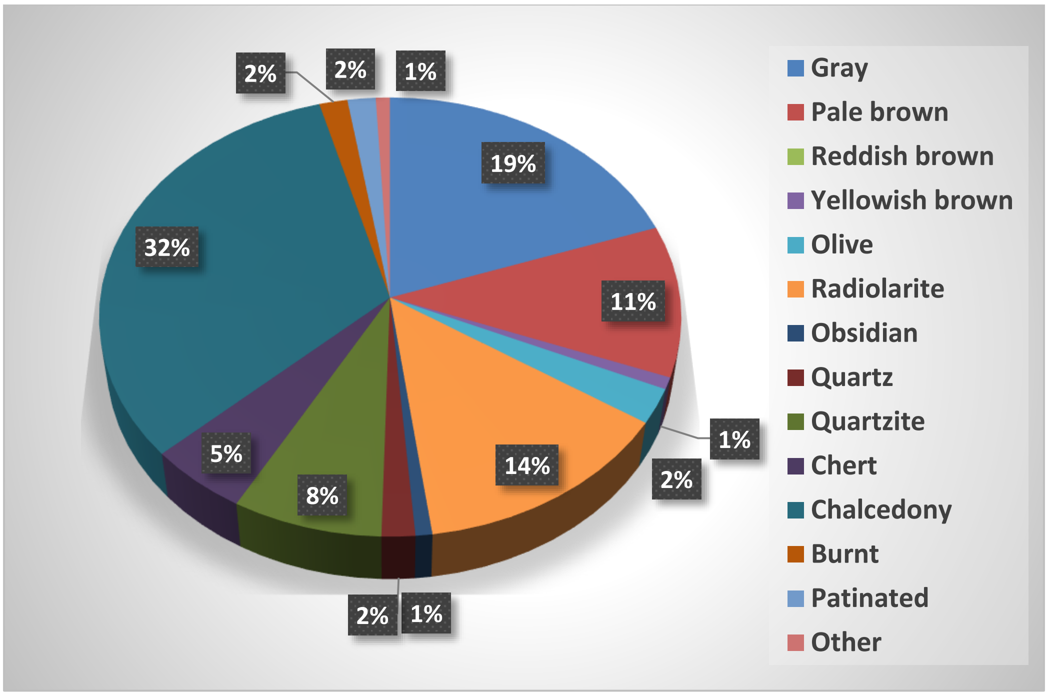


Fig. 4.77 Raw material distribution of the Final Neolithic blade-flakes.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	4,7	2,4	3,4	2,6	1,2	1,8	1,1	0,3	0,53
Pale Brown flint	4,9	2,9	3,7	2,3	1,3	1,7	0,8	0,2	0,47
Yellowish Brown flint	2,6			1,6			0,5		
Olive flint	3,6			2,7	1,3	1,9	0,7	0,4	0,53
Radiolarite	4,3	3	3,6	2,3	1,4	1,6	0,8	0,3	0,55
Obsidian	2			1			0,1		
Quartz	4,6	3,7	4,1	3,3	1,7	2,5	0,9	0,6	0,75
Quartzite	5,5	2,7	3,8	2,6	1,7	2	1	0,2	0,6
Chert	4,6	3	3,7	2,4	1,5	1,9	0,7	0,3	0,5
Chalcedony	4,6	2,6	3,4	2,3	1,2	1,7	0,9	0,2	0,49
Burnt	3,5	3	3,2	2,5	1,6	2	0,7	0,4	0,5
Patinated	3,8	2,5	3,1	2,4	1,1	1,75	0,6	0,4	0,5
Other	5,5			2,3			0,8		

Fig. 4.78 Dimensions of the Final Neolithic blade-flakes by raw material (maximum, minimum and mean value in cm).

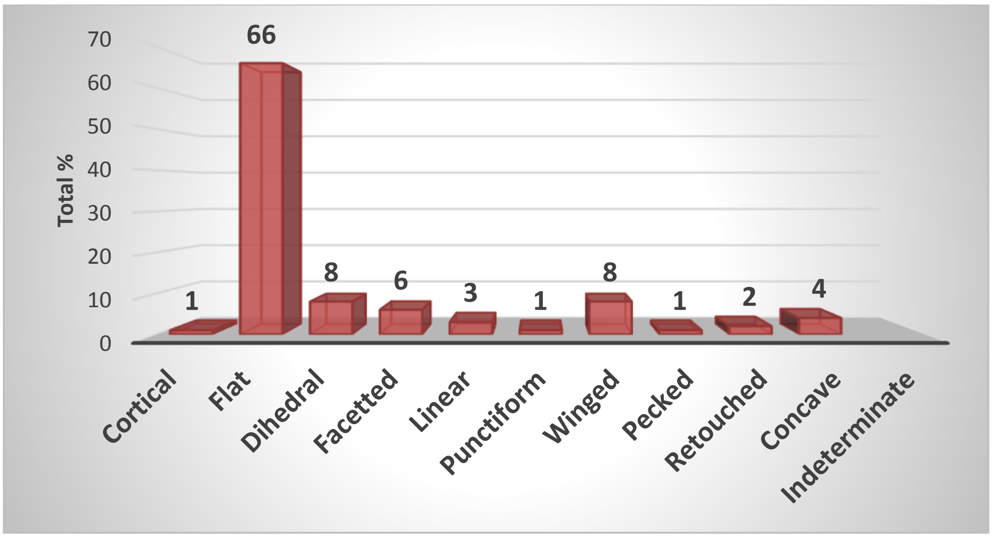


Fig. 4.79 Percentage of the Final Neolithic blade-flakes by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	1,9	0,6	1,1	0,6	0,3	0,4
Pale Brown flint	1,5	0,5	0,84	0,6	0,2	0,31
Yellowish Brown flint	0,5			0,3		
Olive flint	0,9			0,5		
Radiolarite	1,6	0,4	1	0,7	0,2	0,4
Obsidian	0,3			0,1		
Quartz	2,1	1,2	1,65	0,9	0,7	0,8
Quartzite	1,8	0,6	1,2	0,8	0,2	0,47
Chert	1,7	0,6	1,2	0,9	0,3	0,65
Chalcedony	1,8	0,4	1,1	0,8	0,2	0,46
Patinated	2			0,7		

Fig. 4.80 Butt dimensions of the Final Neolithic blade-flakes by raw material (maximum, minimum and mean value in cm).

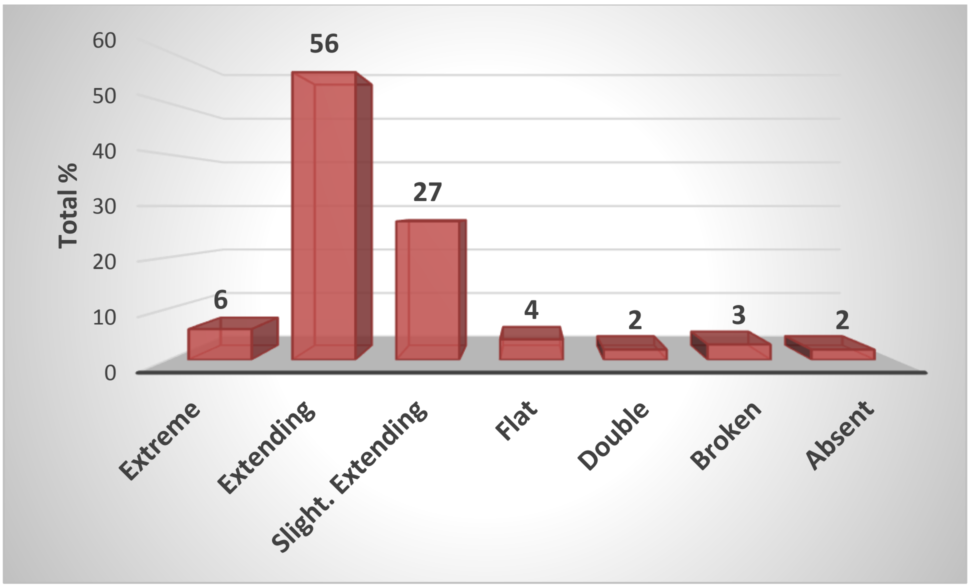


Fig. 4.81 Percentage of the Final Neolithic blade-flakes by bulb type.

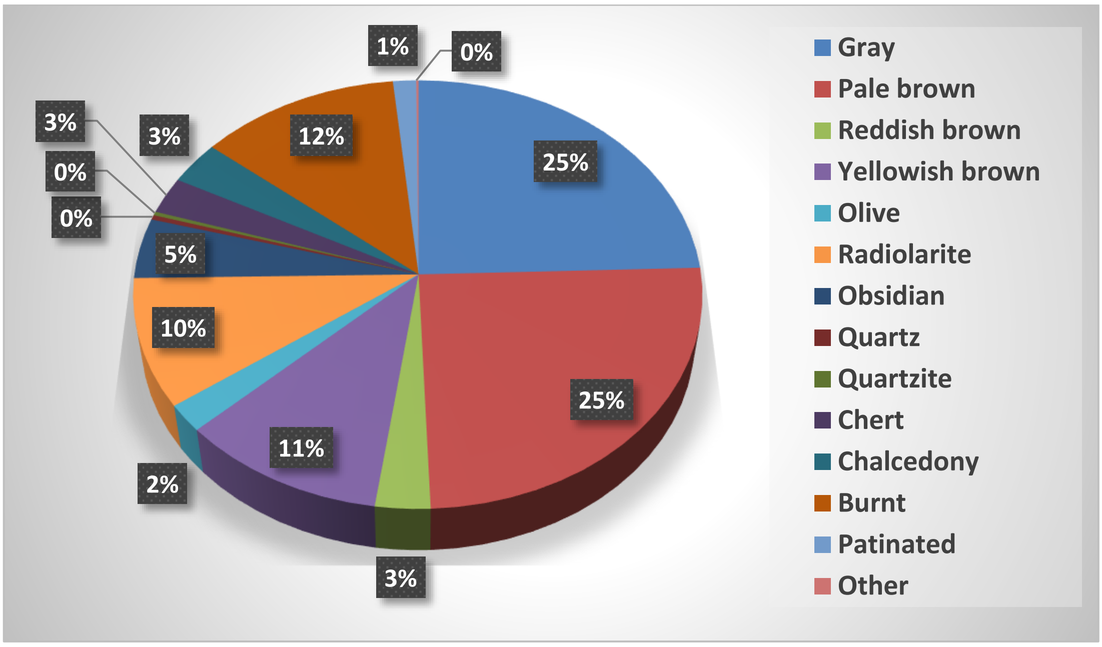


Fig. 4.82 Raw material distribution of the Final Neolithic blades.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	12,5	2,8	4,84	3,4	0,7	1,55	1,1	0,1	0,39
Pale Brown flint	8	1,4	4,5	4,4	1	1,5	1	0,1	3,8
Reddish Brown flint	6	2,4	3,4	3,3	1	1,49	1,1	0,1	3,5
Yellowish Brown flint	10,6	3	4,76	3,4	2	1,63	1,1	0,1	0,42
Olive flint	7	3,6	5,1	3,2	0,9	1,56	0,9	0,2	0,4
Radiolarite	12	2,5	5,1	4,8	1	1,6	1	0,2	0,4
Obsidian	4,2	2,2	3,35	3,5	0,6	1,2	0,7	0,1	0,26
Quartz	4,5	2	3,1	2,5	1,1	1,56	0,9	0,3	0,5
Quartzite	6,2	2,1	3,4	2,1	1,3	1,65	1	0,3	0,5
Chert	7,5	2,3	3,8	2,9	1	1,59	0,9	0,2	0,45
Chalcedony	5,1	1,1	3,7	2,5	1	1,56	0,8	0,1	0,42
Burnt	7	2,4	4	3,5	1	1,55	1	0,1	0,4
Patinated	8,9	1,4	3,38	2,7	1	1,58	0,7	0,2	0,4
Other	6,2	3,8	5	2,5	1,3	1,9	0,9	0,3	0,57

Fig. 4.83 Dimensions of the Final Neolithic blades by raw material (maximum, minimum and mean value in cm).

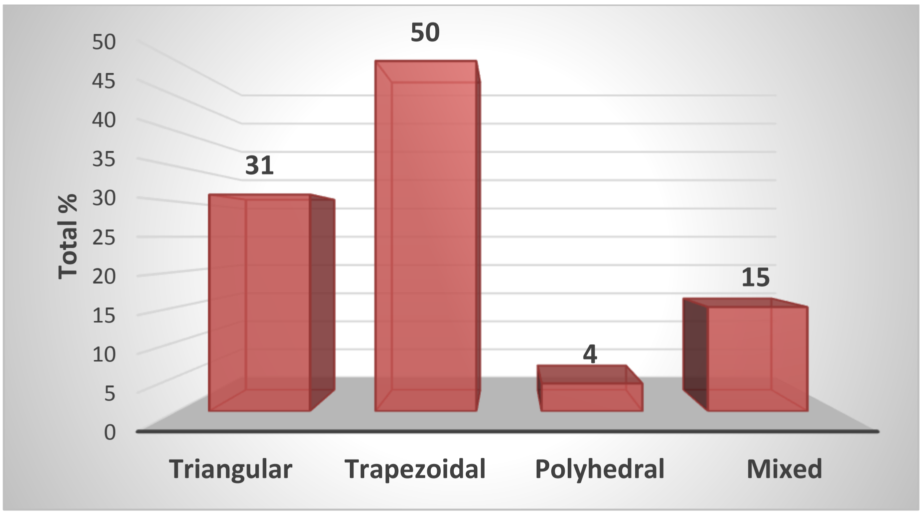


Fig. 4.84 Percentage of the Final Neolithic blades by cross-section type.

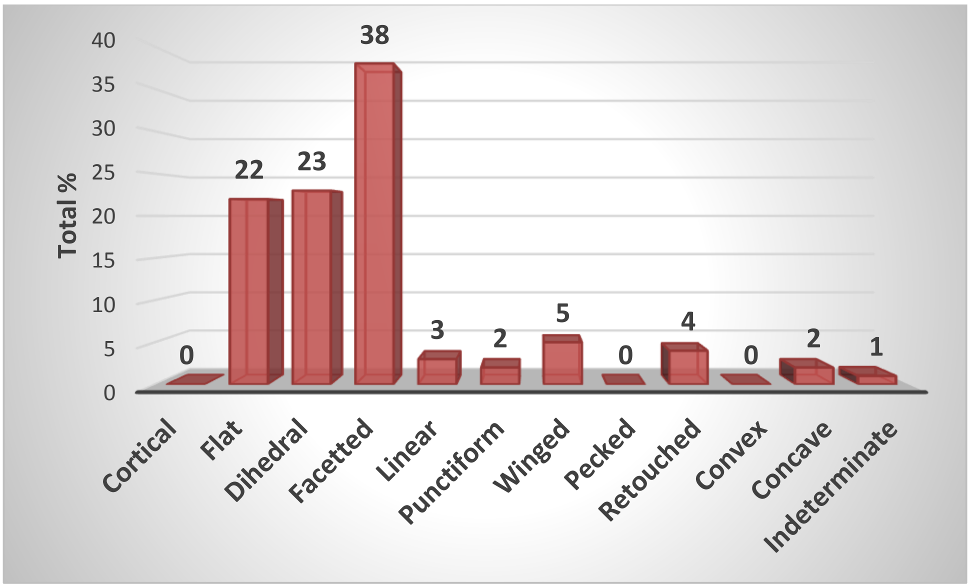


Fig. 4.85 Percentage of the Final Neolithic blades by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray	2,1	0,2	0,8	0,8	0,1	0,34
Pale Brown flint	1,8	0,3	0,83	0,8	0,1	0,33
Reddish brown flint	1,2	0,3	0,72	0,8	0,1	0,3
Yellowish brown flint	2,2	0,3	0,8	0,9	0,1	0,33
Olive flint	1,2	0,5	0,8	0,5	0,2	0,3
Radiolarite	2	0,4	0,85	0,7	0,1	0,34
Obsidian	1,5	0,3	0,66	0,5	0,1	0,25
Quartz	2	0,9	1,26	0,8	0,3	0,5
Quartzite	2	0,5	1	0,6	0,2	0,4
Chert	4,7	0,4	1	1,6	0,2	0,4
Chalcedony	2	0,5	0,9	0,7	0,2	0,38
Burnt	1,3	0,4	0,8	0,6	0,1	0,35
Patinated	1,6	0,5	0,86	0,6	0,2	0,37
Other	0,8	0,7	0,75	0,5	0,5	0,5

Fig. 4.86 Butt dimensions of the Final Neolithic blades by raw material (maximum, minimum and mean value in cm).

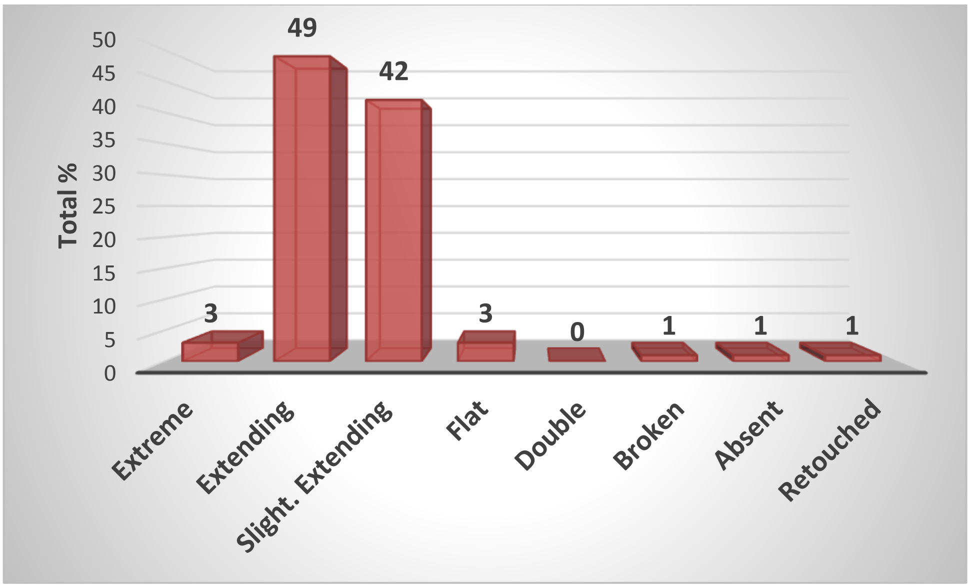


Fig. 4.87 Percentage of the Final Neolithic blades by bulb type.

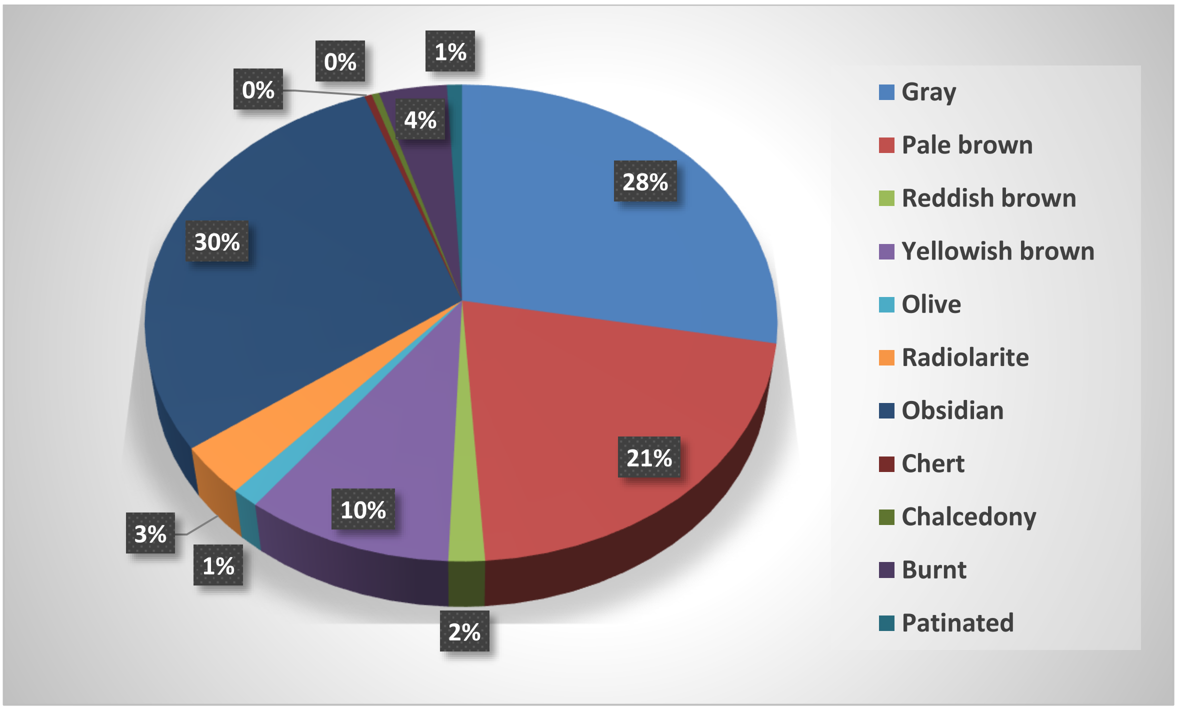


Fig. 4.88 Raw material distribution of the Final Neolithic microblades.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Gray flint	7	2,3	3,35	1	0,4	0,78	0,4	0,1	0,2
Pale Brown flint	7,1	2,2	4,1	0,9	0,4	0,8	0,5	0,1	0,2
Reddish brown flint	3			0,9	0,7	0,8	0,2	0,1	0,17
Yellowish brown flint	4,3	2,6	3,35	0,9	0,7	0,84	0,5	0,2	0,26
Olive flint	4,9	3,6	4,1	0,9	0,6	0,73	0,4	0,2	0,26
Radiolarite	3,1	1,9	2,55	0,9	0,7	0,8	1,2	0,2	0,46
Obsidian	4,5	2,1	3	0,9	0,4	0,7	0,4	0,1	0,18
Chert	1,7			0,8			0,1		
Chalcedony	2,5			0,9			0,4		
Burnt	3,4	1,4	2,52	0,9	0,7	0,8	0,4	0,1	0,24
Patinated	2,9			0,9	0,8	0,85	0,6	0,2	0,4

Fig. 4.89 Dimensions of the Final Neolithic microblades by raw material (maximum, minimum and mean value in cm).

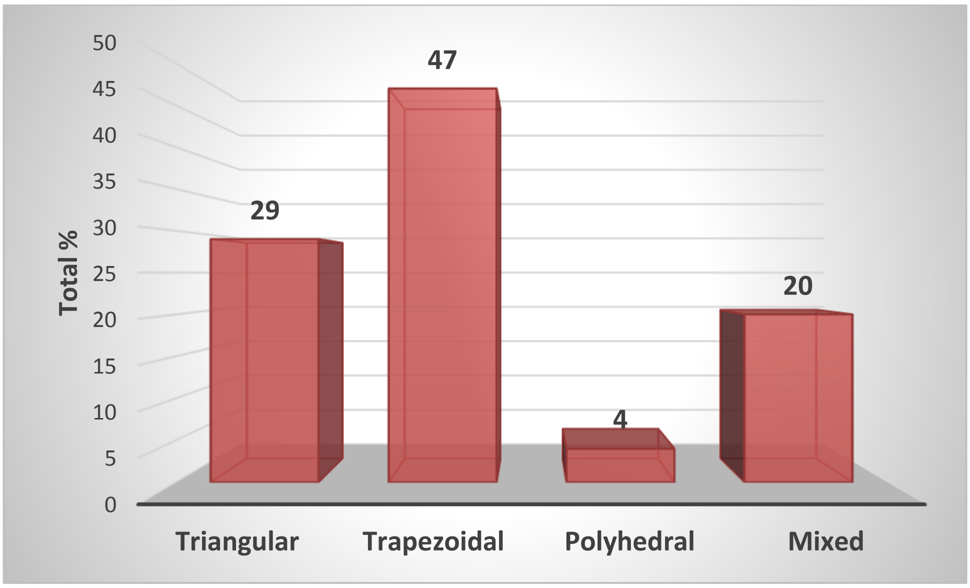


Fig. 4.90 Percentage of the Final Neolithic microblades by cross-section type.

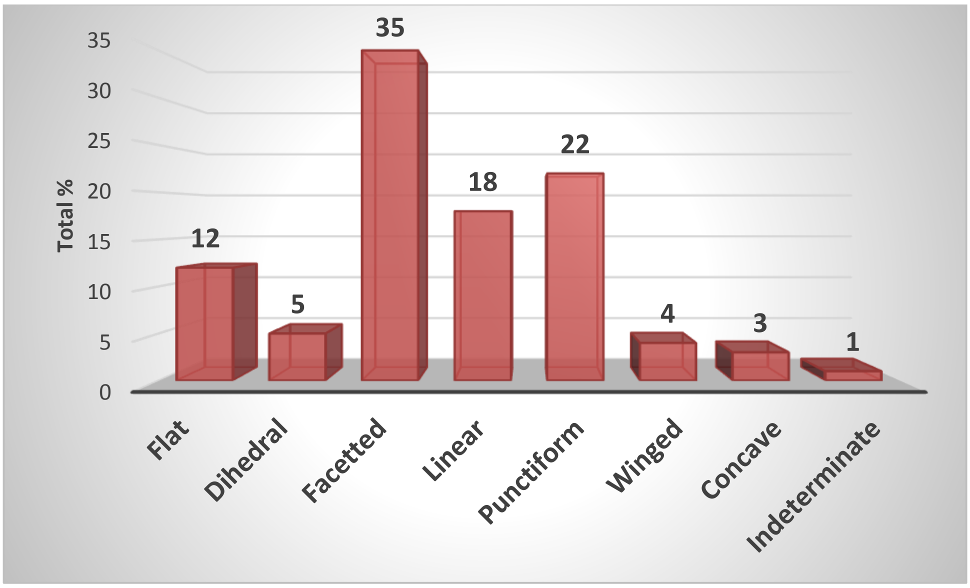


Fig. 4.91 Percentage of the Final Neolithic microblades by butt type.

RAW MATERIAL CATEGORIES	Max. length	Min. length	Mean	Max. width	Min. width	Mean
Gray flint	0,7	0,2	0,47	0,4	0,1	0,18
Pale brown flint	0,8	0,2	0,53	0,4	0,1	0,2
Reddish brown flint	0,2			0,1		
Yellowish Brown flint	0,8	0,2	0,5	0,3	0,1	0,16
Olive	0,5	0,4	0,45	0,2	0,1	0,15
Radiolarite	0,4			0,1		
Obsidian	0,7	0,2	0,44	0,2	0,1	0,15
Chert	0,4			0,1		
Chalcedony	0,8			0,4		
Burnt	0,6	0,3	0,4	0,2	0,2	0,2
Patinated	0,7	0,4	0,55	0,2	0,1	0,15

Fig. 4.92 Butt dimensions of the Final Neolithic microblades by raw material (maximum, minimum and mean value in cm).

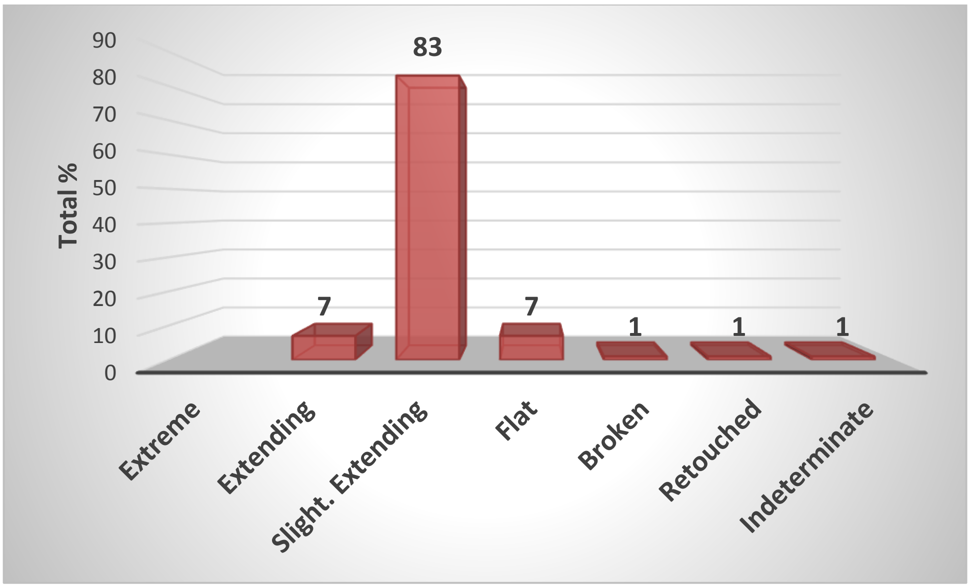


Fig. 4.93 Percentage of Final Neolithic microblades by bulb type.

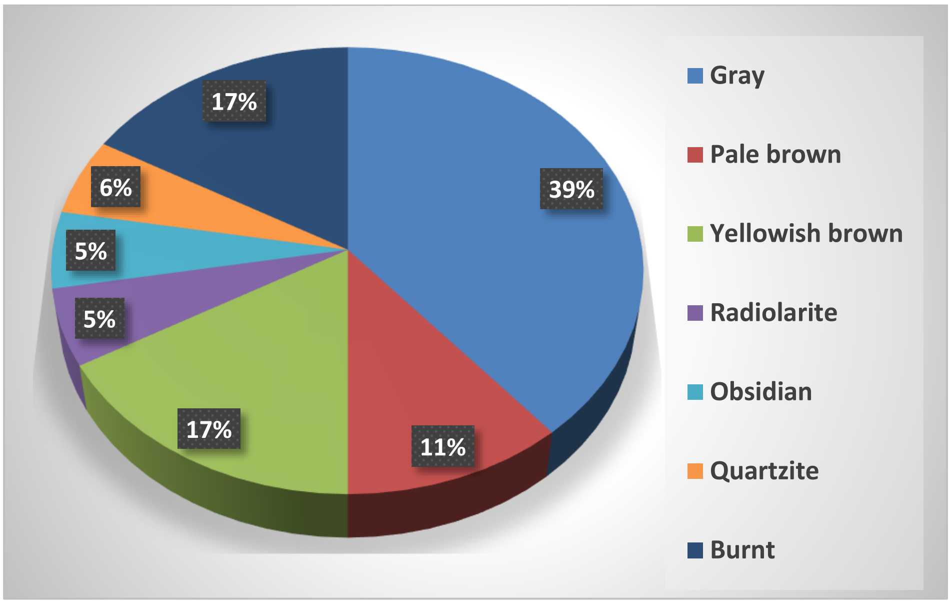


Fig. 4.94 Raw material distribution of the Final Neolithic debris.

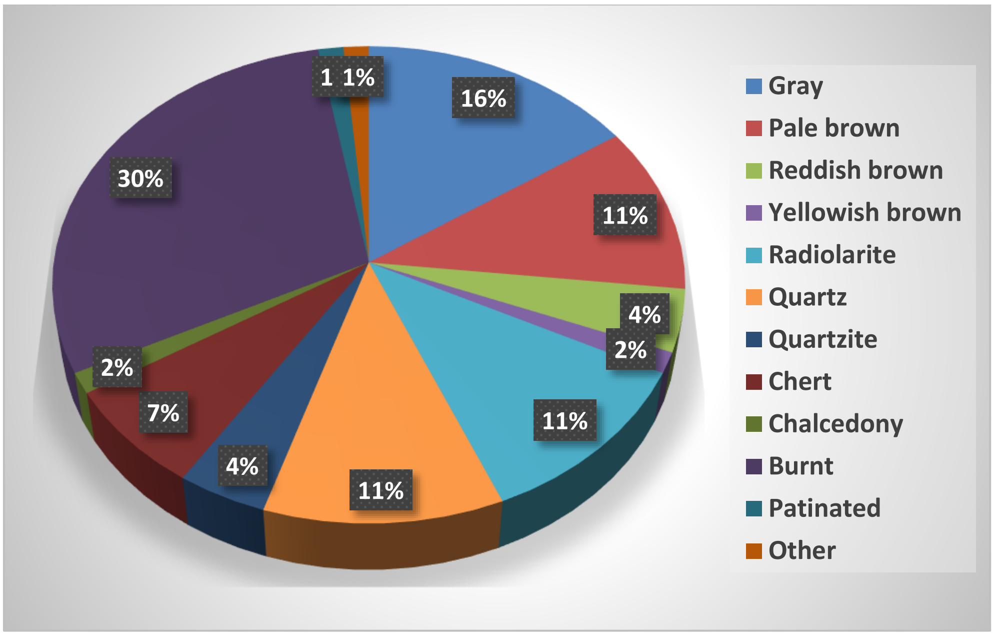


Fig. 4.95 Raw material distribution of the Final Neolithic indeterminate pieces.

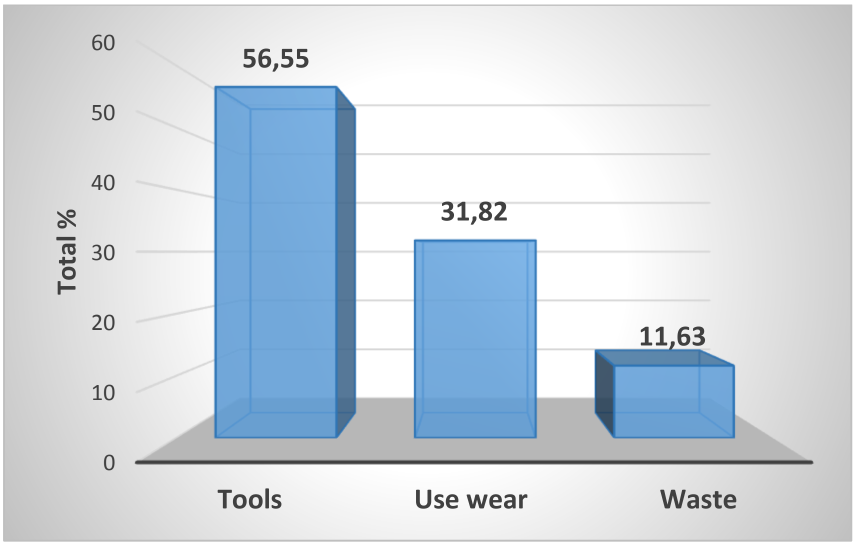


Fig. 4.96 Shaping categories of the Late Neolithic assemblage.

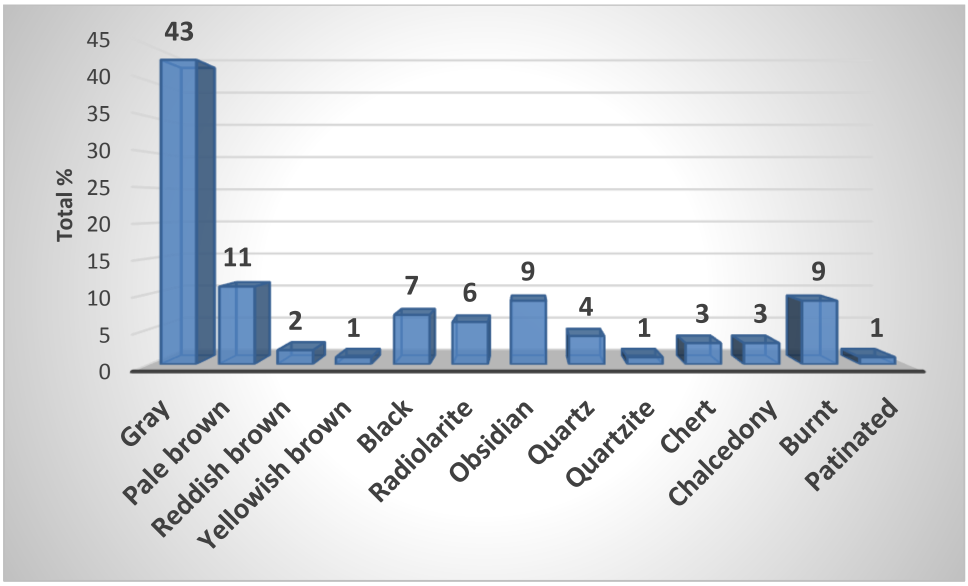


Fig. 4.97 Percentage of the Late Neolithic artefacts with use wear by raw material.

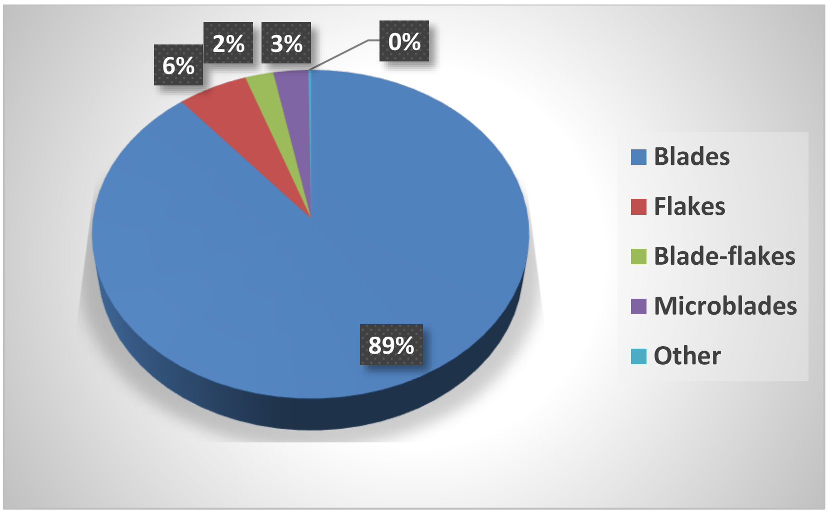


Fig. 4.98 Percentage of the Late Neolithic blank types used for tools.

TOOL TYPE	Blades	Flakes	Blade-flakes	Microblades	Other	TOTAL
Blades with lateral retouch	54	0		3		**57**
Unretouched sickles	218	5	6	11		**240**
Retouched sickles	217	3	3	5		**228**
Scrapers	187	14	5	1		**207**
Perforating tools	49	1	3	3		**56**
Projectile points	6	3			2	**11**
Truncations	16	1	1			**18**
Notches	5	3		1		**9**
Denticulated	5	5	1			**11**
Backed	7	3		1		**11**
Burins	24	1	1	1		**27**
Geometrics	1					**1**
Splintered pieces	19	7	1		2	**29**
Retouched flakes		8				**8**
Composite tools	4					**4**
TOTAL	**816**	**52**	**21**	**26**	**2**	**917**

Fig. 4.99 Number of the Late Neolithic tools by type and blank.

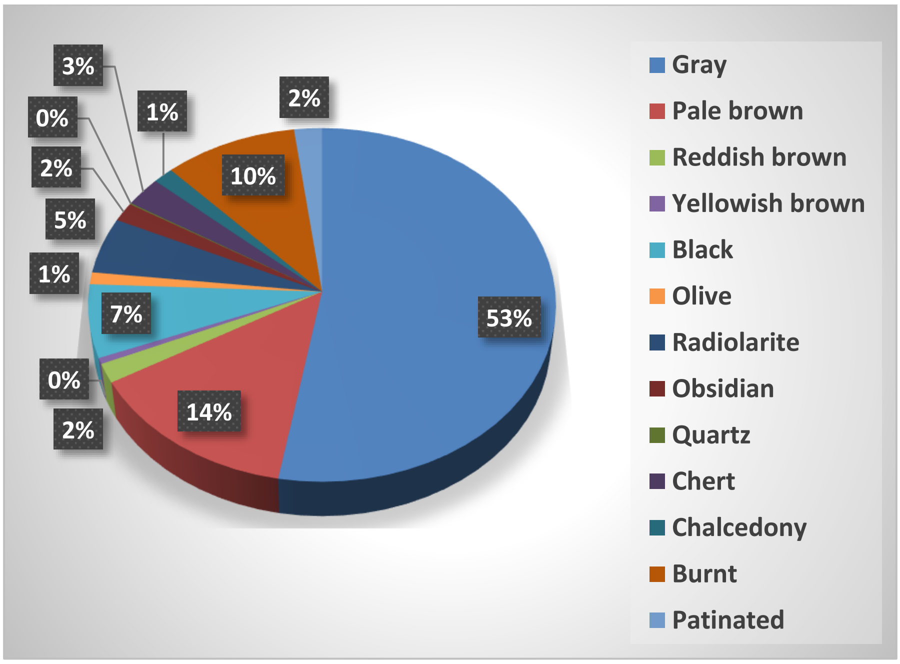


Fig. 4.100 Raw material distribution of the Late Neolithic tools.

TOOL TYPE	n.	%
Blade with lateral retouch	57	6,2
Unretouched sickles	240	26,2
Retouched sickles	228	24,8
Scrapers	207	22,5
Perforating tools	56	6,1
Projectile points	11	1,2
Truncations	18	2
Notches	9	1
Denticulated	11	1,2
Backed	11	1,2
Burins	27	3
Geometrics	1	0,1
Splintered pieces	29	3,2
Retouched flakes	8	0,9
Composite tools	4	0,4
TOTAL	**917**	**100**

Fig. 4.101 Overall number and percentage of the Late Neolithic tool types.

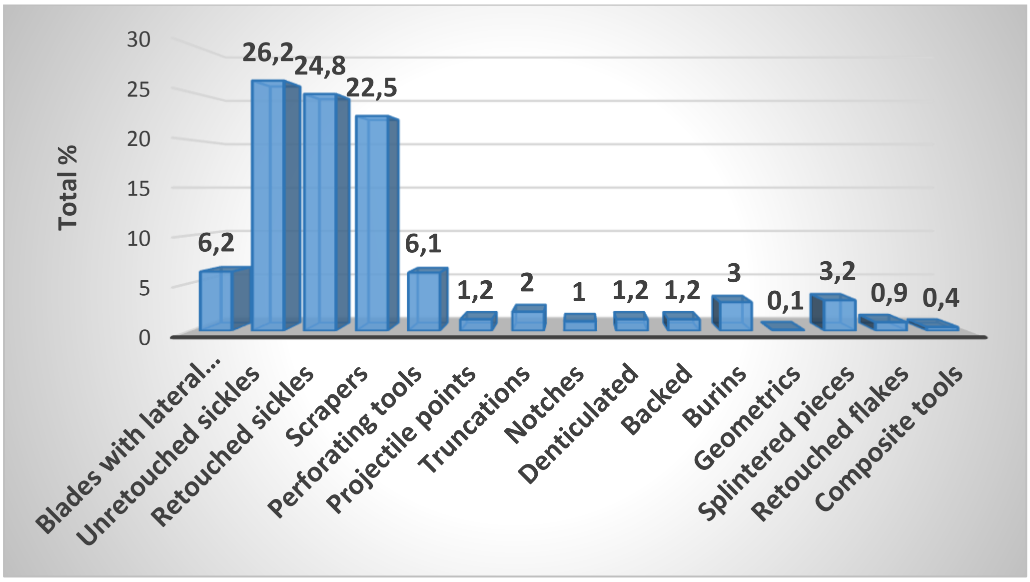


Fig. 4.102 Percentage of the Late Neolithic tools by type.

TOOL TYPE	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Sickle blades	9,4	5	5,8	2,5	1,1	1,6	0,6	0,2	0,3
Sickle elements	4,9	2,3	3,6	2,5	0,7	1,3	0,8	0,2	0,3
Retouched sickle blades	10,6	5	6,5	2,7	1	1,6	1	0,2	0,4
Retouched sickle elements	4,8	2,9	3,9	2,7	0,9	1,4	0,8	0,2	0,3
Scrapers	10,4	2	3,8	3,4	0,9	1,6	1,2	0,1	0,4
Blades with lateral retouch	7,3	3,1	5,3	3,1	0,8	1,5	0,8	0,1	0,3
Perforating tools	5	1,5	3,5	3,5	0,8	1,3	1,1	0,2	0,3
Projectile points	6,6	2,3	3,5	2,6	1,3	2	0,7	0,3	0,46
Truncations	4,5	2,7	4	2,2	1	1,4	0,6	0,2	0,3
Notches	6,2	1,8	3,8	3,4	0,9	1,8	1	0,2	0,4
Denticulated	6,6	1,9	4,2	3,1	1,2	2	1,7	0,3	0,6
Backed	0,9	1,7	2,9	2,5	0,8	1,6	0,8	0,1	0,4
Burins	4,3	3	3,4	3,3	1,1	1,5	0,6	0,2	0,4
Geometrics	1,6			1,5			0,4		
Splintered pieces	5	2	3,2	2,8	1	1,7	0,9	0,2	0,4
Retouched flakes	5,7	2,8	4,3	5,5	2	3,2	1,3	0,4	0,8
Composite tools	4,2	2,2	3,1	1,4	1	1,2	0,5	0,4	0,4

Fig. 4.103 Dimensions of the Late Neolithic tools by type (maximum, minimum & mean value in cm).

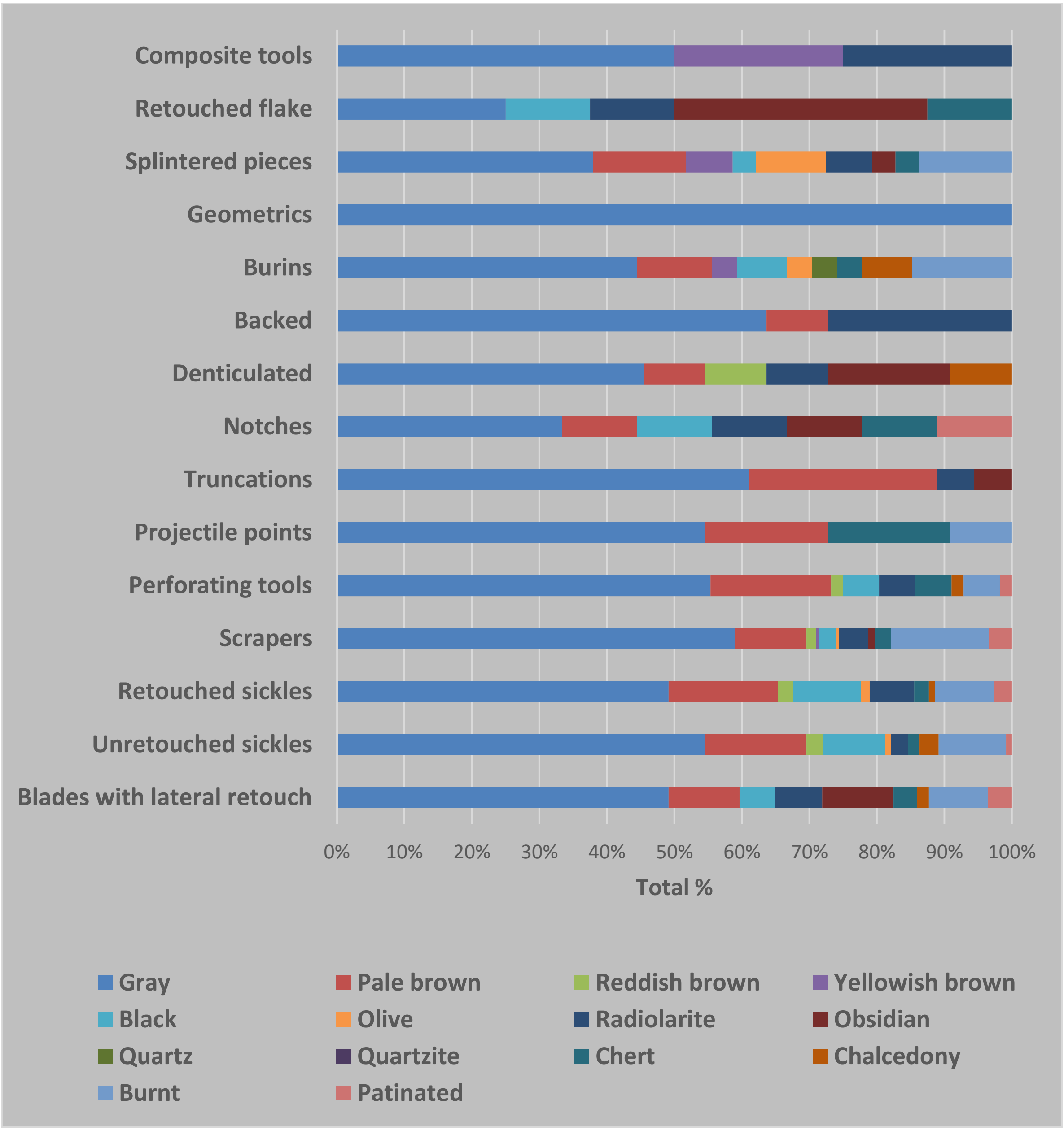


Fig. 4.104 Percentage of the Late Neolithic raw materials by tool type.

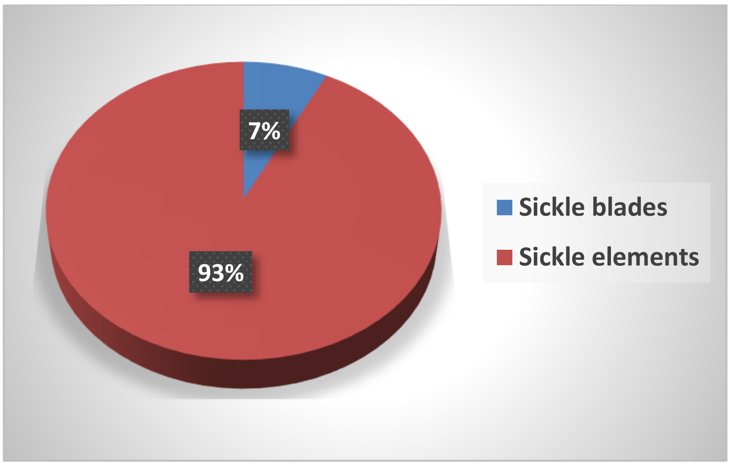


Fig. 4.105 Percentage of the Late Neolithic unretouched sickles by type.

SICKLE GLOSS	Blades	Elements	TOTAL
Bilateral	3	36	**39**
Unilateral	15	186	**201**
TOTAL	**18**	**222**	**240**

Fig. 4.106 Localization of sickle gloss at Late Neolithic unretouched sickle blades and elements.

SICKLE GLOSS	Blades	Elements	TOTAL
Oblique	7	72	**79**
Parallel	11	146	**157**
Oblique/ parallel*		4	**4**
TOTAL	**18**	**222**	**240**

Fig. 4.107 Direction of sickle gloss at Late Neolithic unretouched sickle blades and elements (* for bilateral sickle gloss).

SICKLE GLOSS	Blades	Elements	TOTAL
High	8	76	**84**
Medium	4	89	**93**
Low	6	43	**49**
Low & medium*		3	**3**
Medium & high*		11	**11**
TOTAL	**18**	**222**	**240**

Fig. 4.108 Intensity of sickle gloss at Late Neolithic unretouched sickle blades and elements (* for bilateral sickle gloss).

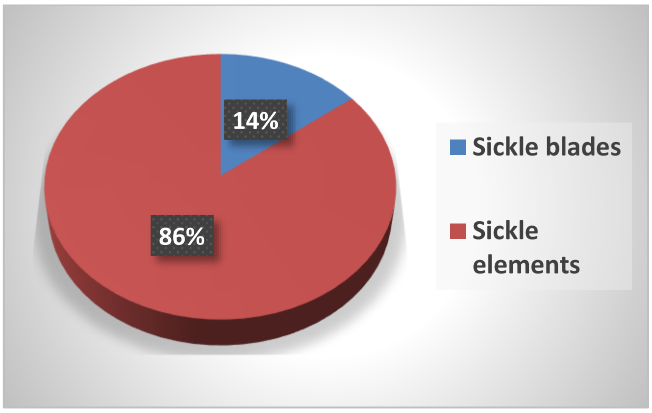


Fig. 4.109 Percentage of the Late Neolithic retouched sickles by type.

SICKLE GLOSS	Blades	Elements	TOTAL
Bilateral	10	58	**68**
Unilateral	23	137	**160**
TOTAL	**33**	**195**	**228**

Fig. 4.110 Localization of sickle gloss at Late Neolithic retouched sickle blades and elements.

SICKLE GLOSS	Blades	Elements	TOTAL
Oblique	12	65	**77**
Parallel	18	122	**140**
Oblique/ parallel*	3	8	**11**
TOTAL	**33**	**195**	**228**

Fig. 4.111 Direction of sickle gloss at Late Neolithic retouched sickle blades and elements (* for bilateral sickle gloss).

SICKLE GLOSS	Blades	Elements	TOTAL
High	21	109	**130**
Medium	9	48	**57**
Low		18	**18**
Low & medium*		5	**5**
Medium & high*	2	15	**17**
Low & high*	1		**1**
TOTAL	**33**	**195**	**228**

Fig. 4.112 Intensity of sickle gloss at Late Neolithic retouched sickle blades and elements (* for bilateral sickle gloss).

SICKLE GLOSS	RETOUCH	Blades	Elements	TOTAL
Unilateral gloss	Unilateral retouch	1	79	80
	Bilateral retouch	8	26	34
Bilateral gloss	Unilateral retouch	15	26	41
	Bilateral retouch	5	25	30
Sickle gloss and truncation		4	39	43
TOTAL		**33**	**195**	**228**

Fig. 4.113 Localization of retouch at the Late Neolithic sickle blades/elements.

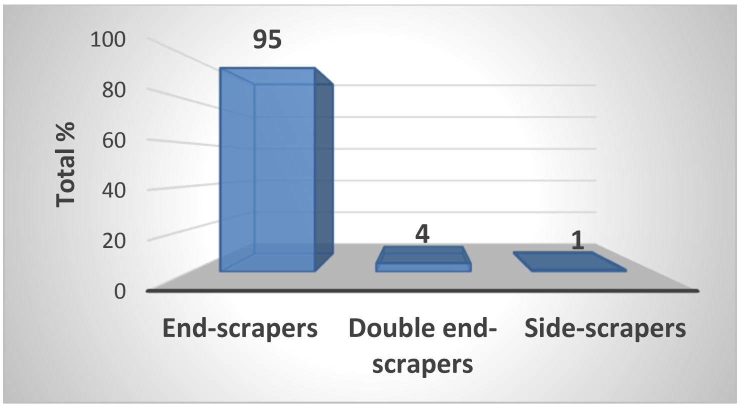


Fig. 4.114 Percentage of the Late Neolithic scrapers by type.

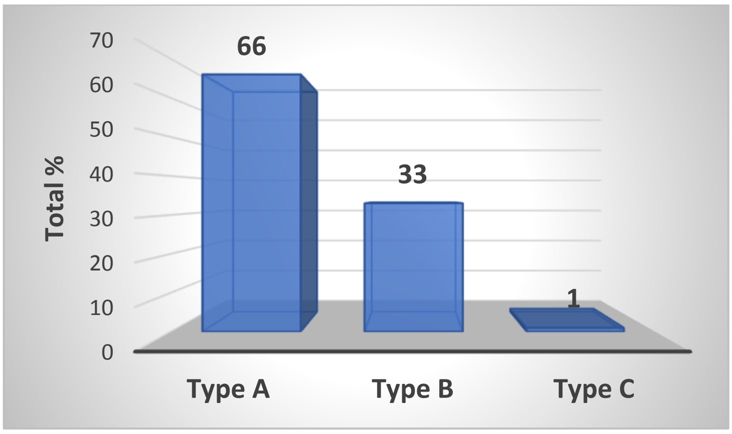


Fig. 4.115 Percentage of the Late Neolithic end-scrapers by type.

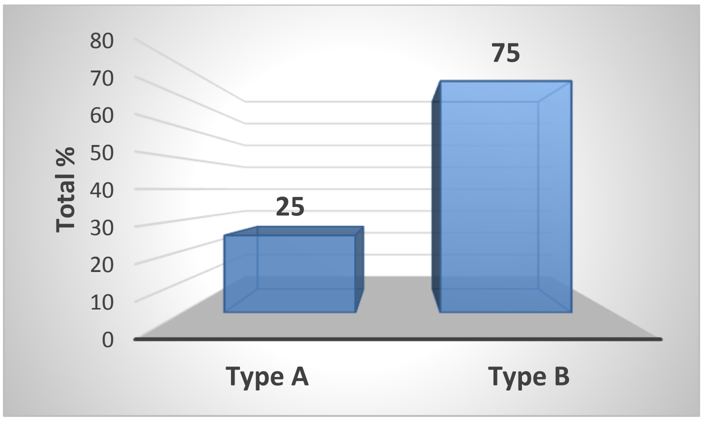


Fig. 4.116 Percentage of the Late Neolithic double end-scrapers by type.

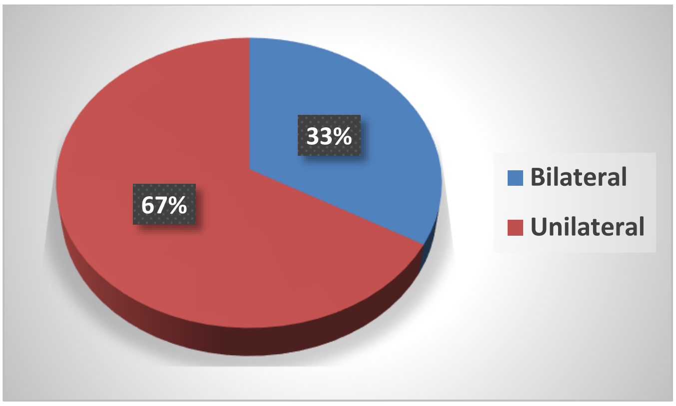


Fig. 4.117 Retouch localization of the Late Neolithic retouched blades.

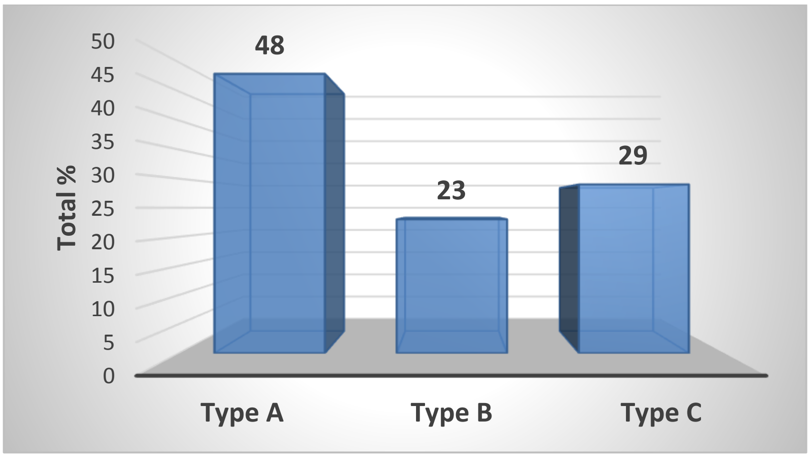


Fig. 4.118 Percentage of the Late Neolithic perforating tools by type.

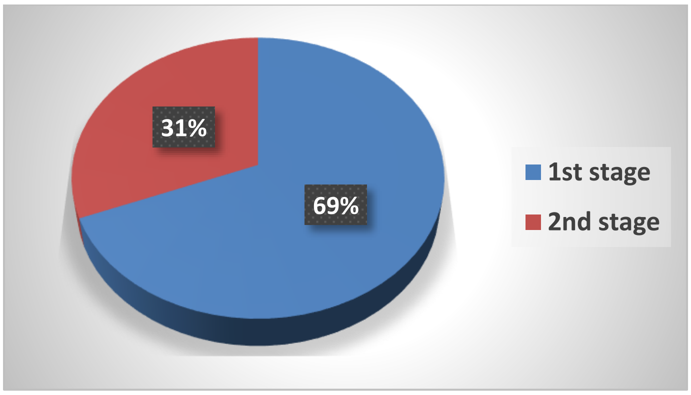


Fig. 4.119 Percentage of the Late Neolithic splintered pieces by degree of use.

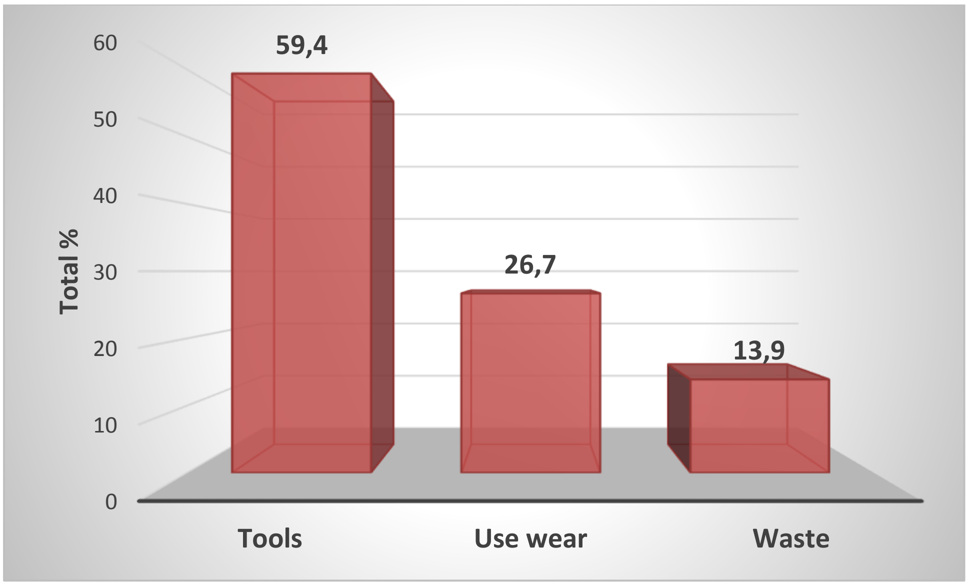


Fig. 4.120 Shaping categories of the Final Neolithic assemblage.

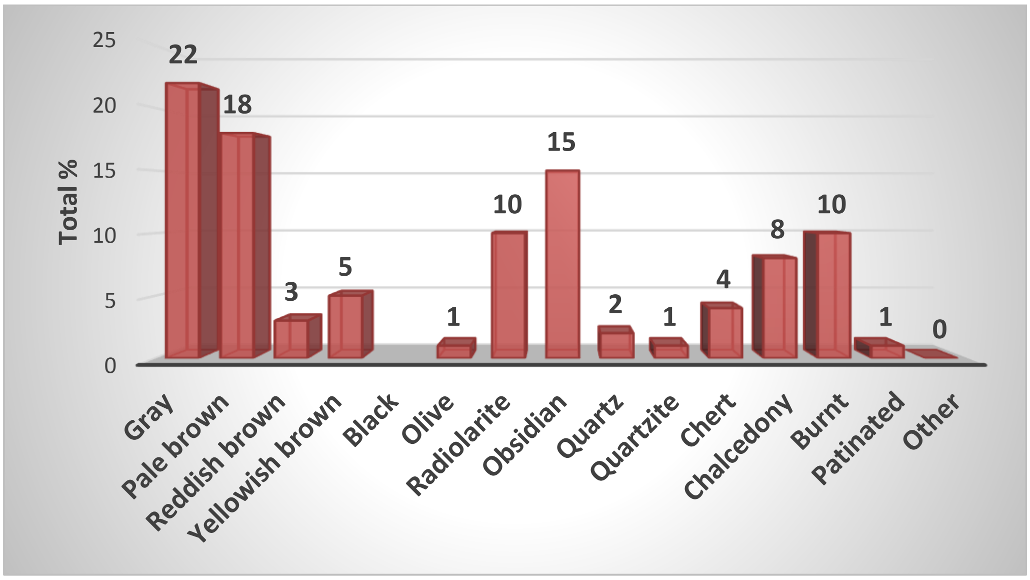


Fig. 4.121 Percentage of the Final Neolithic artefacts with use wear by raw material.

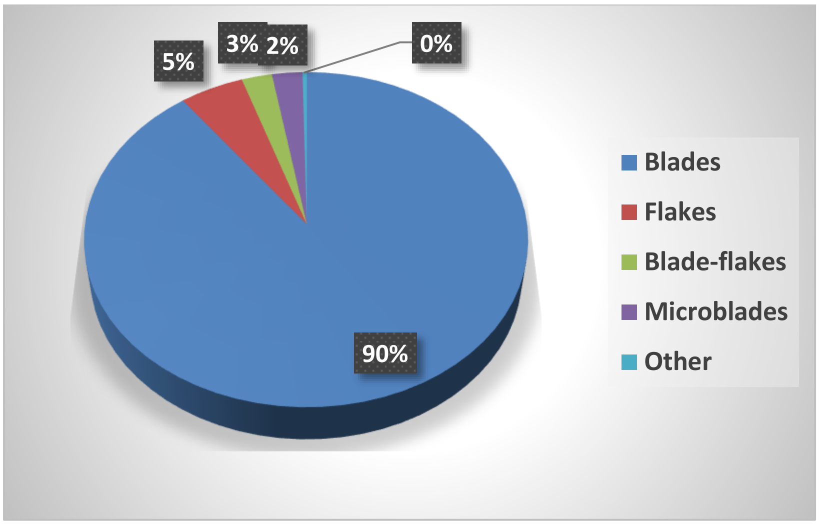


Fig. 4.122 Percentage of the Final Neolithic blank types used for tools.

TOOL TYPE	Blades	Flakes	Blade-flakes	Microblades	Other	TOTAL
Blades with lateral retouch	201			10		**211**
Unretouched sickles	501	26	20	13	1	**561**
Retouched sickles	483	7	9	11		**510**
Scrapers	521	28	7			**556**
Perforating tools	128	3	5	9		**145**
Projectile points	10	19				**29**
Truncations	33	2		6		**41**
Notches	9	3	1	2	1	**16**
Denticulated	7	4		1		**12**
Backed	35	5	4			**44**
Burins	57	4	4	1		**66**
Geometrics	15	1		2		**18**
Splintered pieces	85	23	4	1	4	**117**
Retouched flake		11	3		2	**16**
Composite tools	12			1		**13**
TOTAL	**2113**	**120**	**57**	**57**	**8**	**3416**

Fig. 4.123 Number of the Final Neolithic tools by type and blank.

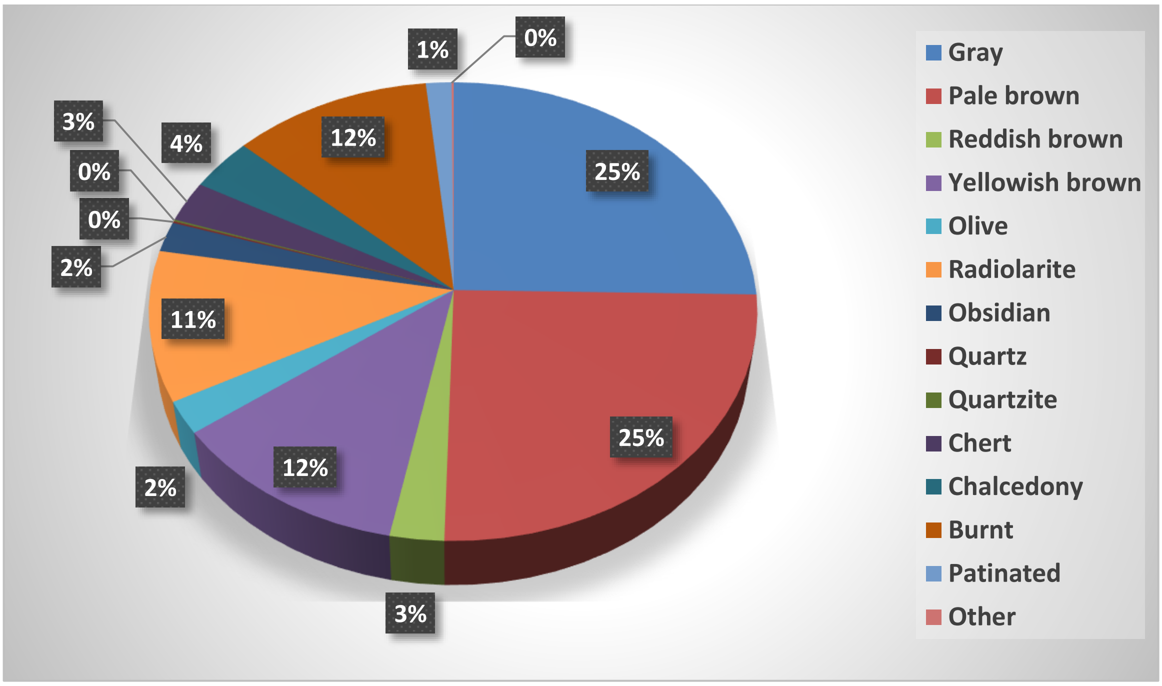


Fig. 4.124 Raw material distribution of the Final Neolithic tools.

TOOL TYPE	n.	%
Blades with lateral retouch	211	9
Unretouched sickles	561	23,8
Retouched sickles	510	21,6
Scrapers	556	23,6
Perforating tools	145	6,1
Projectile points	29	1,2
Truncations	41	1,8
Notches	16	0,7
Denticulated	12	0,5
Backed	44	2
Burins	66	2,8
Geometrics	18	0,8
Splintered pieces	117	5
Retouched flakes	16	0,6
Composite tools	13	0,5
TOTAL	**2355**	**100**

Fig. 4.125 Overall number and percentage of the Final Neolithic tool types.

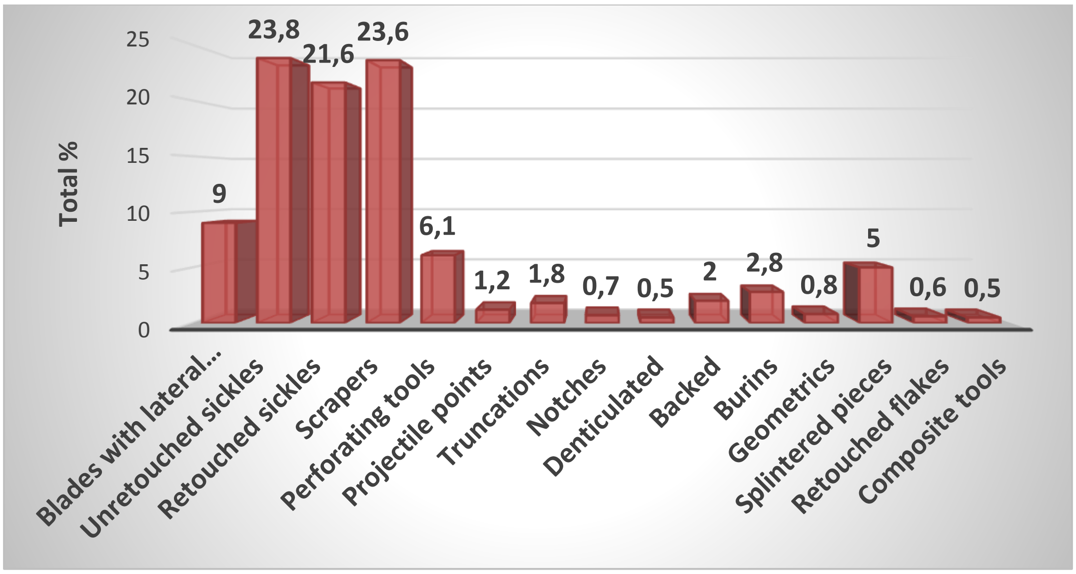


Fig. 4.126 Percentage of the Final Neolithic tools by type.

TOOL TYPE	Max. length	Min. length	Mean	Max. width	Min. width	Mean	Max. thickness	Min. thickness	Mean
Sickle blades	10,6	5	6,4	2,4	1	1,6	0,7	0,3	0,4
Sickle elements	4,9	2,3	3,5	3,5	0,8	1,5	0,8	0,1	0,3
Retouched sickle blades	12	5,1	6,7	3,4	1,1	1,7	0,9	0,3	0,5
Retouched sickle elements	4,8	1,4	3,8	4,4	0,6	1,5	1,1	0,2	0,4
Scrapers	12,5	1,6	4,2	4,8	1	1,7	1,1	0,2	0,5
Blades with lateral retouch	7	1,6	4,2	4	0,6	1,4	1,6	0,1	0,4
Perforating tools	11	2,4	3,6	2,1	0,2	1,3	0,8	0,2	0,4
Projectile points	8,1	2	3,5	2,8	1,1	1,8	0,9	0,3	0,5
Truncations	8,9	1,6	3,3	3,1	0,8	1,4	0,7	0,1	0,4
Notches	6,2	2,7	3,4	3,2	0,7	1,5	0,8	0,2	0,4
Denticulated	6,5	2,6	3,9	4,3	0,8	2	1	0,2	0,4
Backed	5,4	2,5	3,4	3,6	1,1	2,1	1,1	0,4	0,7
Burins	6,9	2,1	3,8	3,2	1	1,6	1,3	0,2	0,4
Geometrics	3,2	1,2	1,8	2,3	0,7	1,4	0,6	0,1	0,3
Splintered pieces	6,2	1,8	3	3,3	0,8	1,7	1	0,2	0,4
Retouched flakes	5,2	1,8	2,8	4,8	1,3	2	1,7	0,2	0,5
Composite tools	10,1	1,9	4,1	2,5	0,9	1,5	0,9	0,2	0,4

Fig. 4.127 Dimensions of the Final Neolithic tools by type (maximum, minimum & mean value in cm).

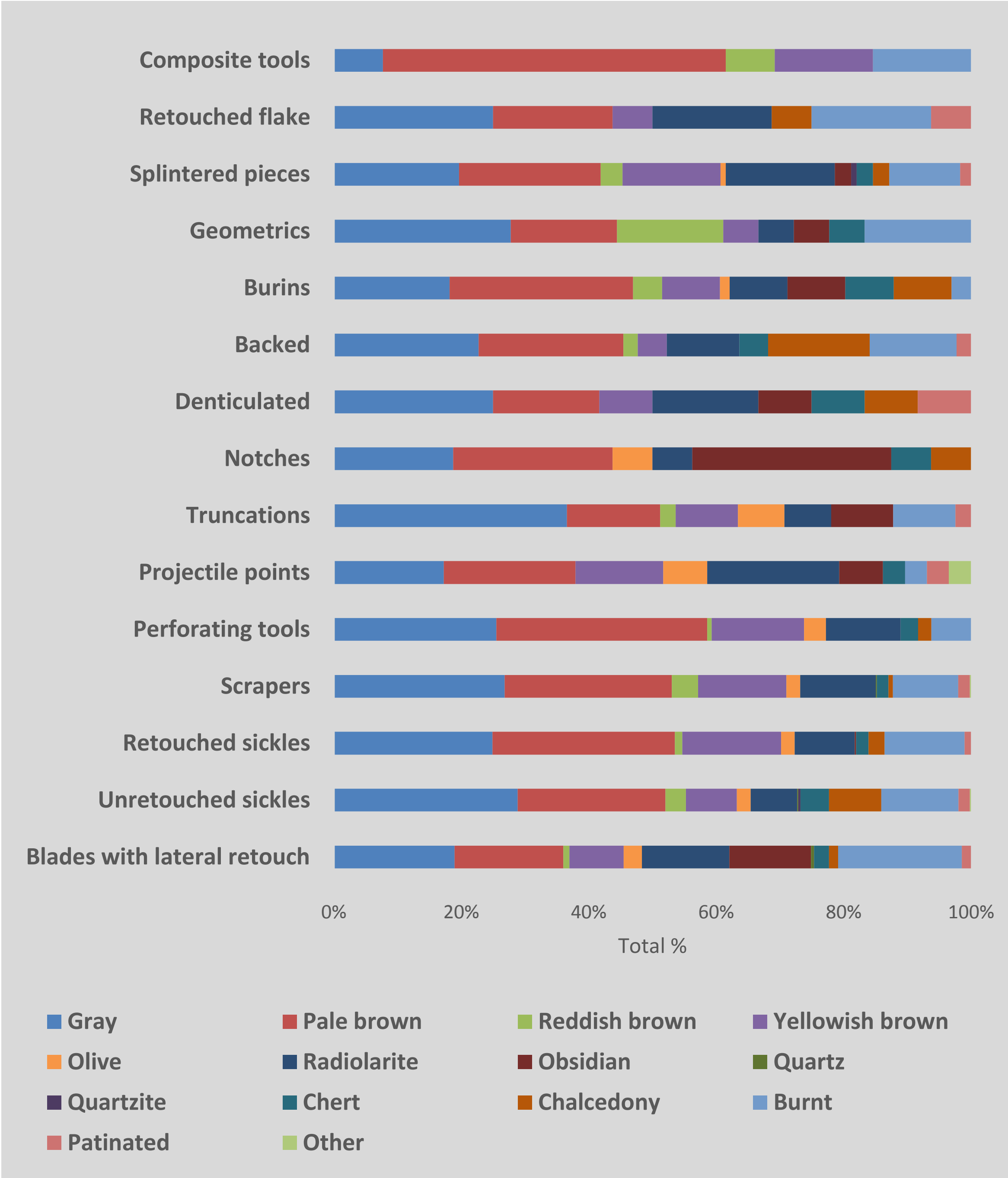


Fig. 4.128 Percentage of the Final Neolithic raw materials by tool type.

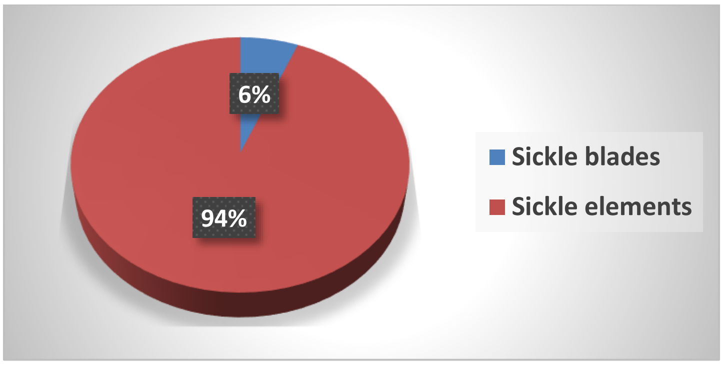


Fig. 4.129 Distribution of the Final Neolithic unretouched sickles by type.

SICKLE GLOSS	Blades	Elements	TOTAL
Bilateral	7	70	**77**
Unilateral	27	457	**484**
TOTAL	**34**	**527**	**561**

Fig. 4.130 Localization of sickle gloss at Final Neolithic unretouched sickle blades and elements.

SICKLE GLOSS	Blades	Elements	TOTAL
Oblique	4	145	**149**
Parallel	29	365	**394**
Oblique/ parallel*	1	17	**18**
TOTAL	**34**	**527**	**561**

Fig. 4.131 Direction of sickle gloss at Final Neolithic unretouched sickle blades and elements (* for bilateral sickle gloss).

SICKLE GLOSS	Blades	Elements	TOTAL
High	8	174	**182**
Medium	15	170	**185**
Low	7	157	**164**
Low & medium*	2	10	**12**
Medium & high*	2	16	**18**
TOTAL	**34**	**527**	**561**

Fig. 4.132 Intensity of sickle gloss at Final Neolithic unretouched sickle blades and elements (* for bilateral sickle gloss).

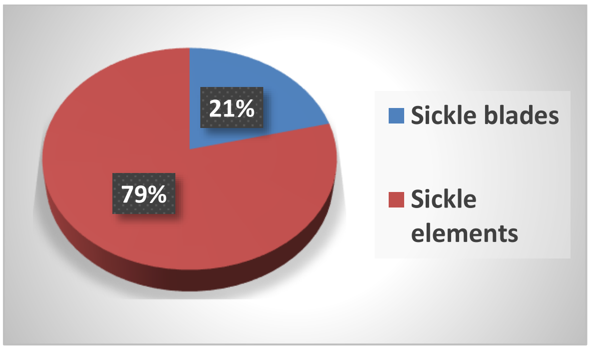


Fig. 4.133 Percentage of the Final Neolithic retouched sickles by type.

SICKLE GLOSS	Blades	Elements	TOTAL
Bilateral	35	122	**157**
Unilateral	73	280	**353**
TOTAL	**108**	**402**	**510**

Fig. 4.134 Localization of sickle gloss at Final Neolithic retouched sickle blades and elements.

SICKLE GLOSS	Blades	Elements	TOTAL
Oblique	21	75	**96**
Parallel	82	301	**383**
Oblique/ parallel*	5	26	**31**
TOTAL	**108**	**402**	**510**

Fig. 4.135 Direction of sickle gloss at Final Neolithic retouched sickle blades and elements (* for bilateral sickle gloss).

SICKLE GLOSS	Blades	Elements	TOTAL
High	47	169	**216**
Medium	39	128	**167**
Low	12	64	**76**
Low & medium*	4	13	**17**
Medium & high*	6	28	**34**
TOTAL	**108**	**402**	**510**

Fig. 4.136 Intensity of sickle gloss at Final Neolithic retouched sickle blades and elements (* for bilateral sickle gloss).

SICKLE GLOSS	RETOUCH	Blades	Elements	TOTAL
Unilateral gloss	Unilateral retouch	37	155	**192**
	Bilateral retouch	34	121	**155**
Bilateral gloss	Unilateral retouch	9	43	**52**
	Bilateral retouch	26	79	**105**
Sickle gloss and truncation		2	4	**6**
TOTAL		**108**	**402**	**510**

Fig. 4.137 Localization of retouch at the Final Neolithic sickle blades/elements.

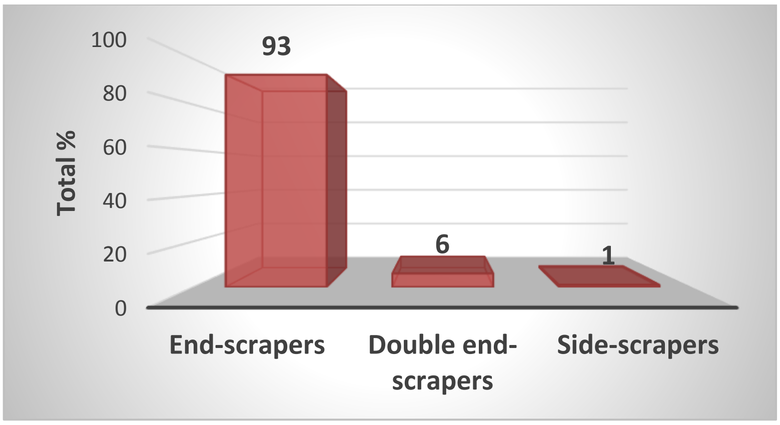


Fig. 4.138 Percentage of the Final Neolithic scrapers by type.

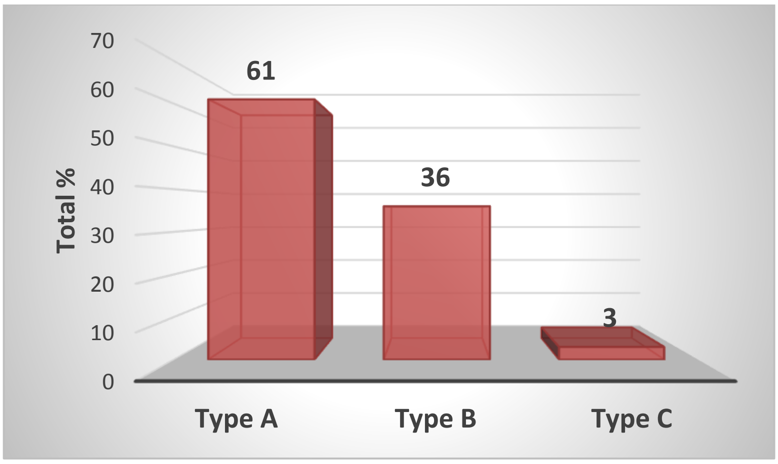


Fig. 4.139 Percentage of the Final Neolithic end-scrapers by type.

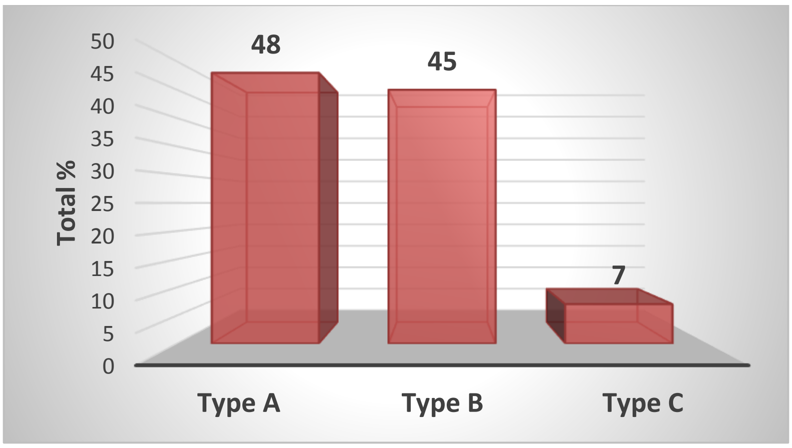


Fig. 4.140 Percentage of the Final Neolithic double end-scrapers by type.

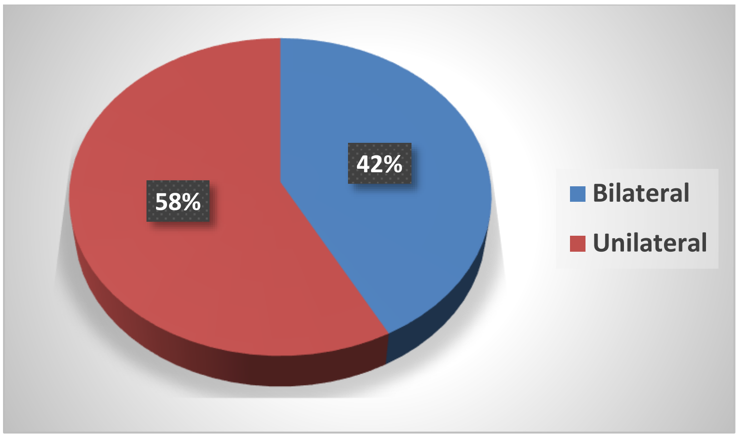


Fig. 4.141 Retouch localization of the Final Neolithic retouched blades.

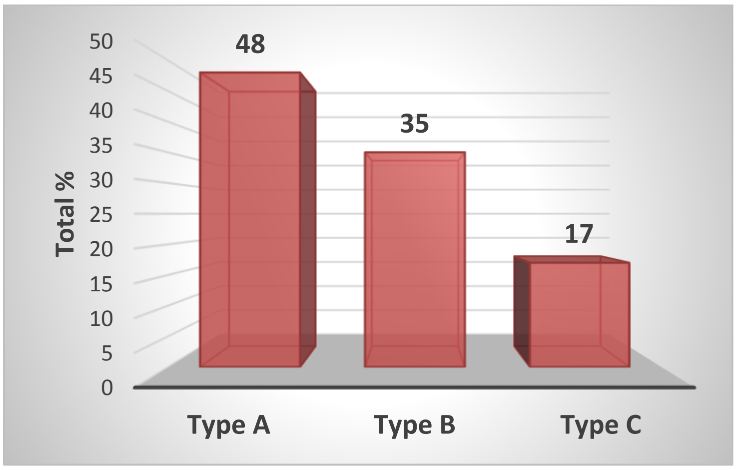


Fig. 4.142 Percentage of the Final Neolithic perforating tools by type.

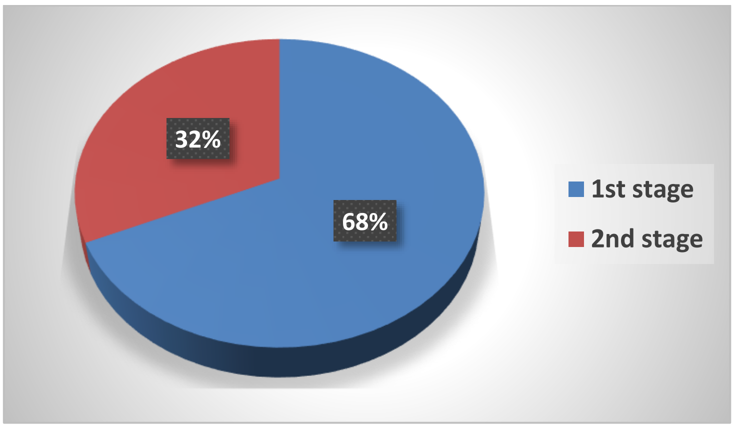


Fig. 4.143 Percentage of the Final Neolithic splintered pieces by degree of use.

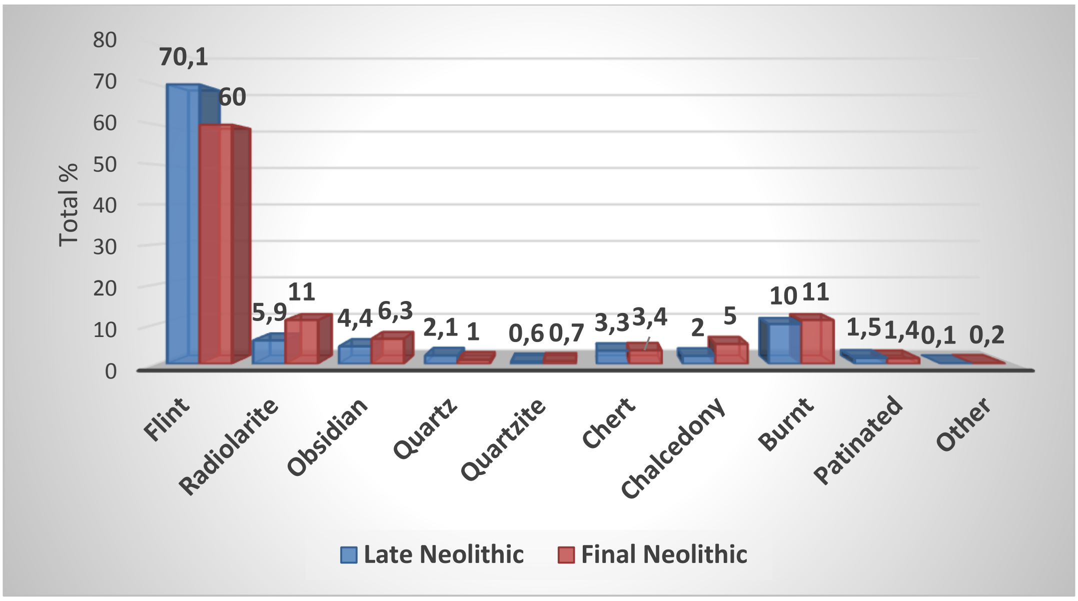


Fig. 5.1 Chronological distribution of the lithic assemblage by raw material.

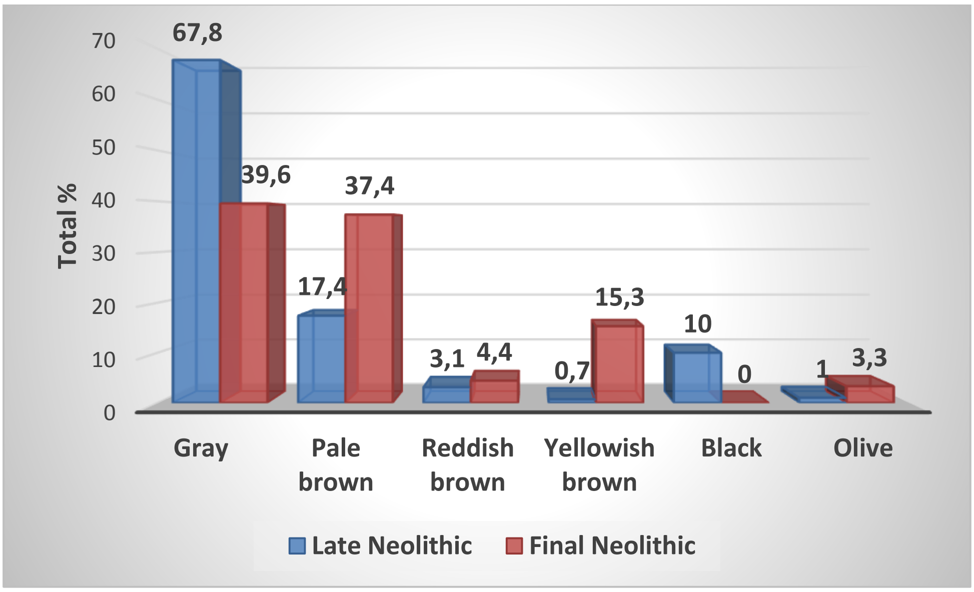


Fig. 5.2 Chronological distribution of flint categories.

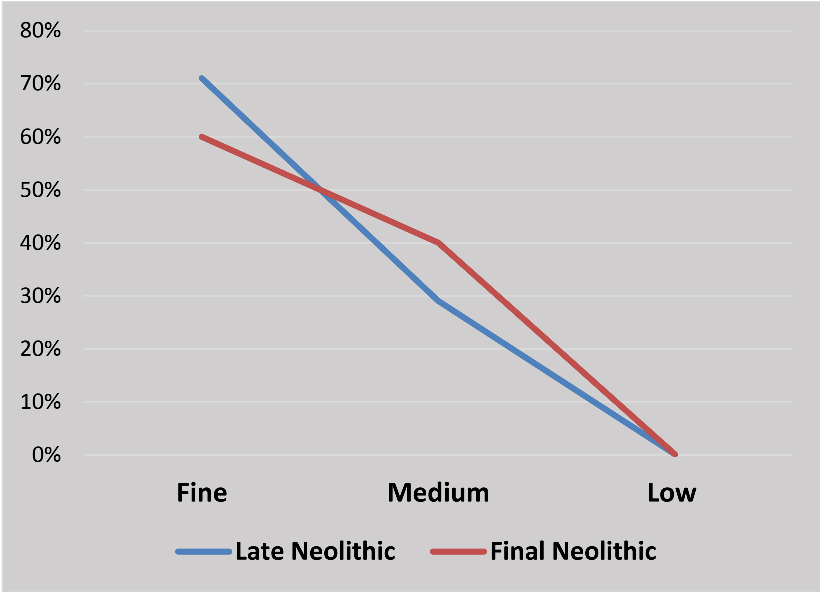


Fig. 5.3 Chronological distribution of raw material qualities.

RAW MATERIAL CATEGORY	Raw nodules	Cores	Technical products	Flakes	Blade-flakes	Blades	Microblades	Tools	Debris	Indeterminate	TOTAL
Gray flint	1	9	44	42	2	159	22	484	1	8	**772**
Pale brown flint		2	12	6	1	43	6	128			**198**
Reddish brown flint			2	1		9	7	16			**35**
Yellowish brown flint						3		5			**8**
Black flint		3	14	8	1	24	2	61			**113**
Olive flint				1				10			**11**
Radiolarite	3	7	7	8	1	17	2	47		4	**96**
Obsidian		1	7	6	1	29	11	16			**71**
Quartz	1			21	1	3		1	2	5	**34**
Quartzite		1	1	4	1	2					**9**
Chert		7	4	6	3	5	2	25	1	1	**54**
Chalcedony				9	4	6		14			**33**
TOTAL	**5**	**30**	**91**	**112**	**15**	**300**	**52**	**807**	**4**	**18**	**1434**

Fig. 5.4 Overall number of the Late Neolithic assemblage by debitage categories and raw material.

RAW MATERIAL CATEGORY	**Raw nodules**	**Cores**	**Technical products**	**Flakes**	**Blade-flakes**	**Blades**	**Microblades**	**Tools**	**Debris**	**Indeterminate**	**TOTAL**
Gray flint		10	39	45	23	161	53	596	2	11	**940**
Pale brown flint		2	30	32	6	182	31	592	7	8	**890**
Reddish brown flint	1	3	6	4		23	2	62		3	**104**
Yellowish brown flint		5	5	6	1	52	11	279	3	1	**363**
Black flint											
Olive flint		3	4	1		14	3	54			**79**
Radiolarite	11	22	22	40	9	74	4	249	1	8	**440**
Obsidian		2	25	16	1	91	64	50	1		**250**
Quartz	2	1	3	13	2	8		3		8	**40**
Quartzite	1	2	2	3	8	6		3	1	3	**29**
Chert		6	7	20	3	23	1	68		5	**133**
Chalcedony	1	1	2	38	21	45	1	88		1	**198**
TOTAL	**16**	**57**	**145**	**218**	**74**	**679**	**170**	**2044**	**15**	**48**	**3466**

Fig. 5.5 Overall number of the Final Neolithic assemblage by debitage categories and raw material.

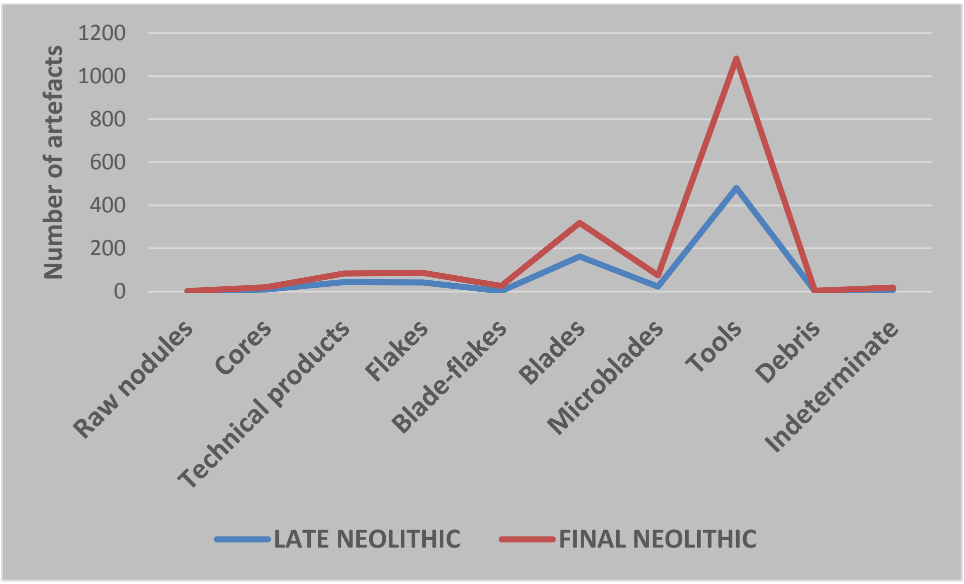


Fig. 5.6 Chronological distribution of gray flint by technological category.

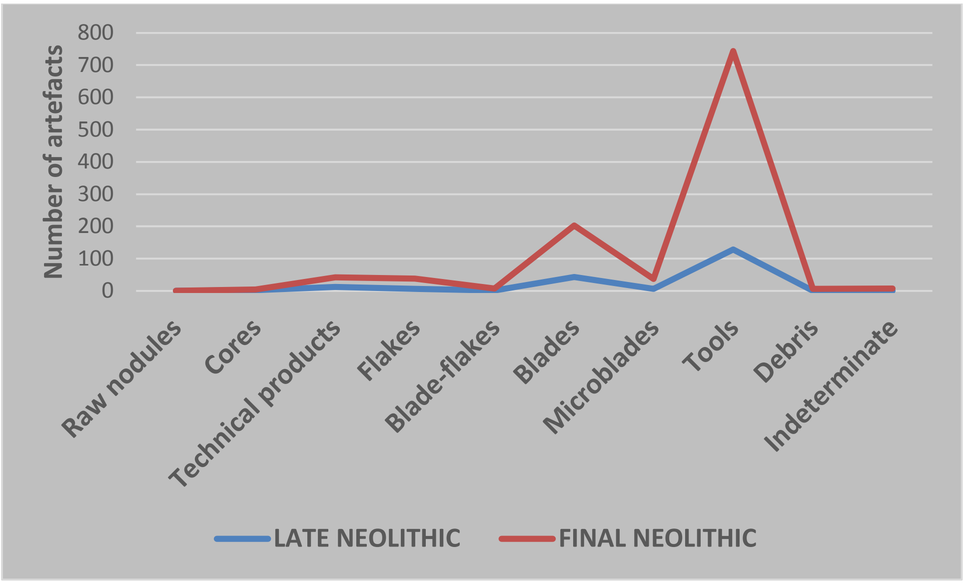


Fig. 5.7 Chronological distribution of pale brown flint by technological category.

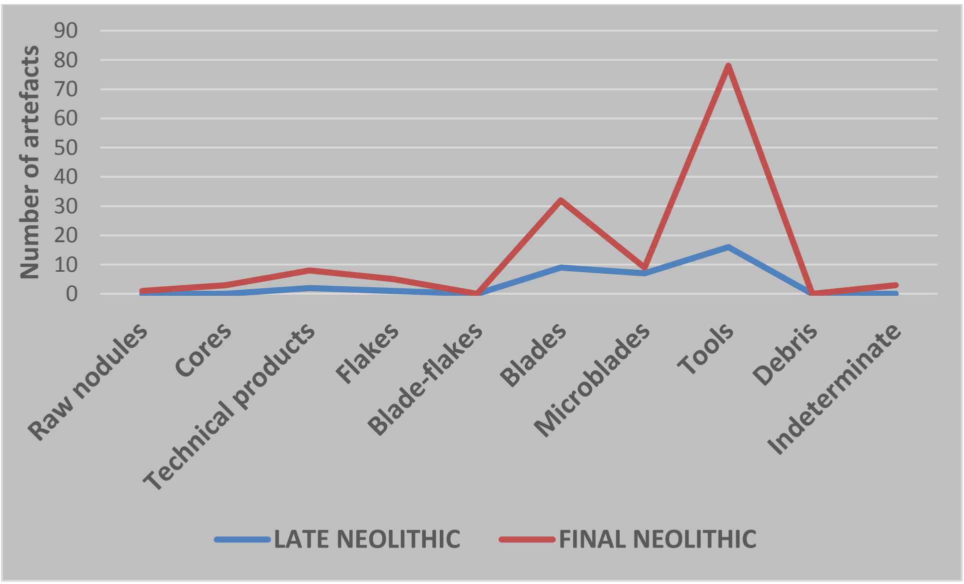


Fig. 5.8 Chronological distribution of reddish brown flint by technological category.

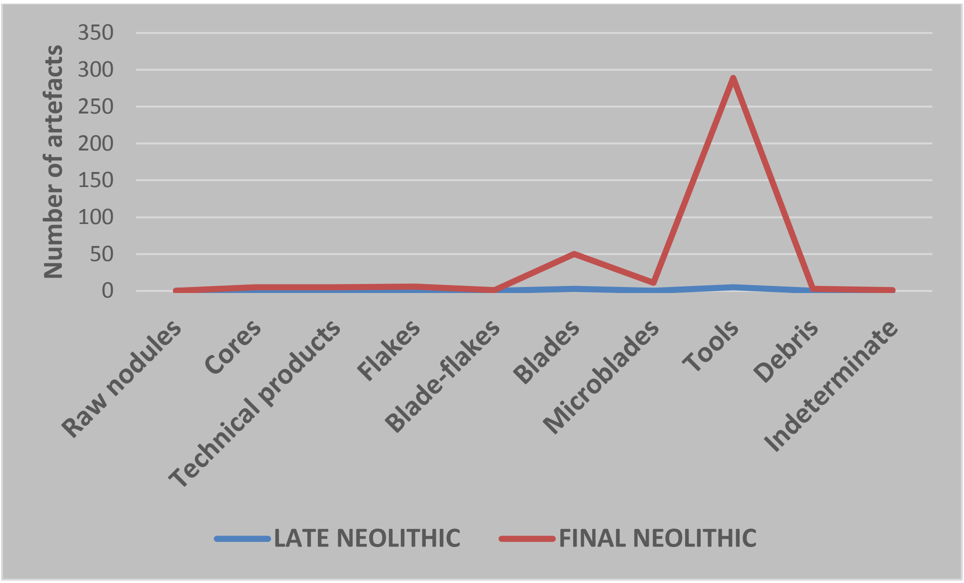


Fig. 5.9 Chronological distribution of yellowish brown flint by technological category.

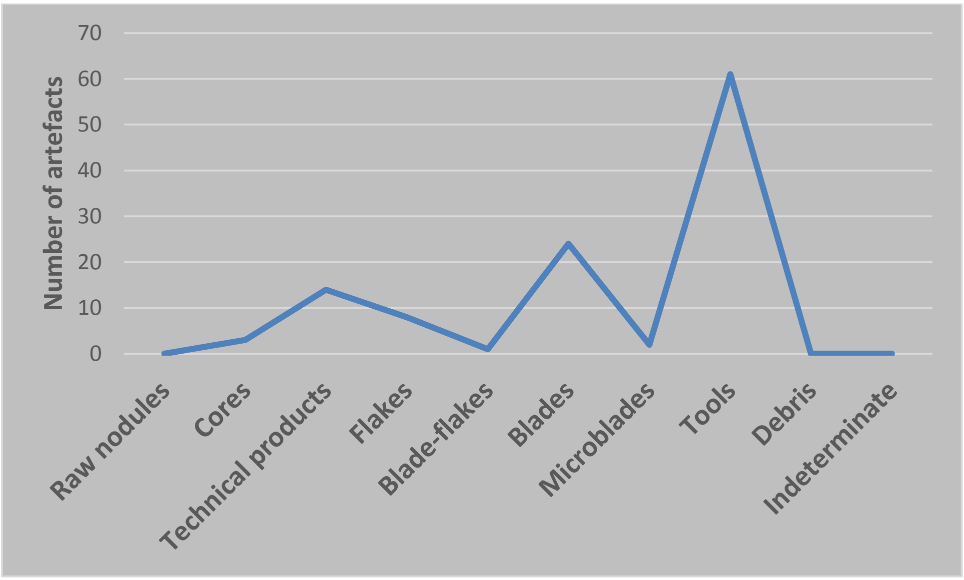


Fig. 5.10 Distribution of black flint by technological category during the Late Neolithic period.

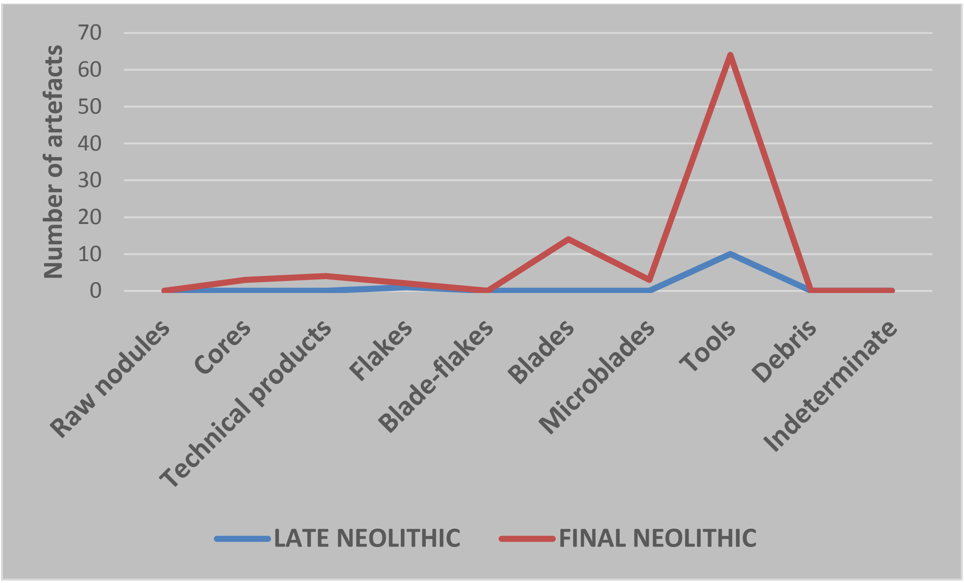


Fig. 5.11 Chronological distribution of olive flint by technological category.

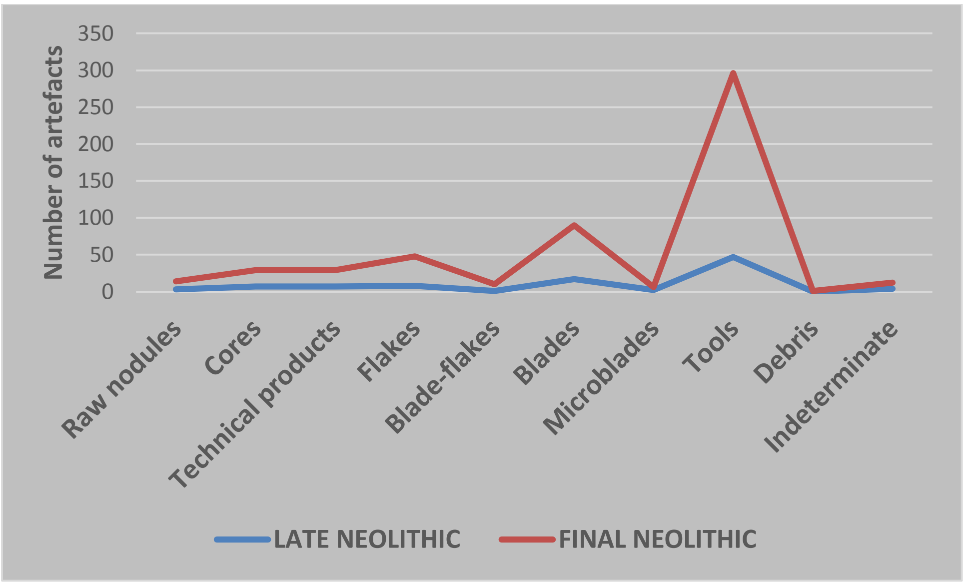


Fig. 5.12 Chronological distribution of radiolarite by technological category.

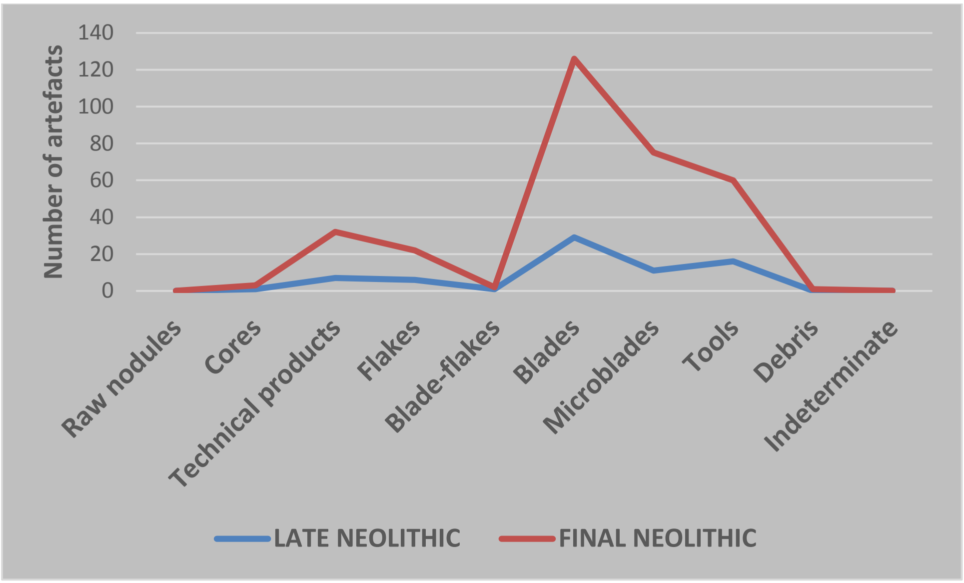


Fig. 5.13 Chronological distribution of obsidian by technological category.

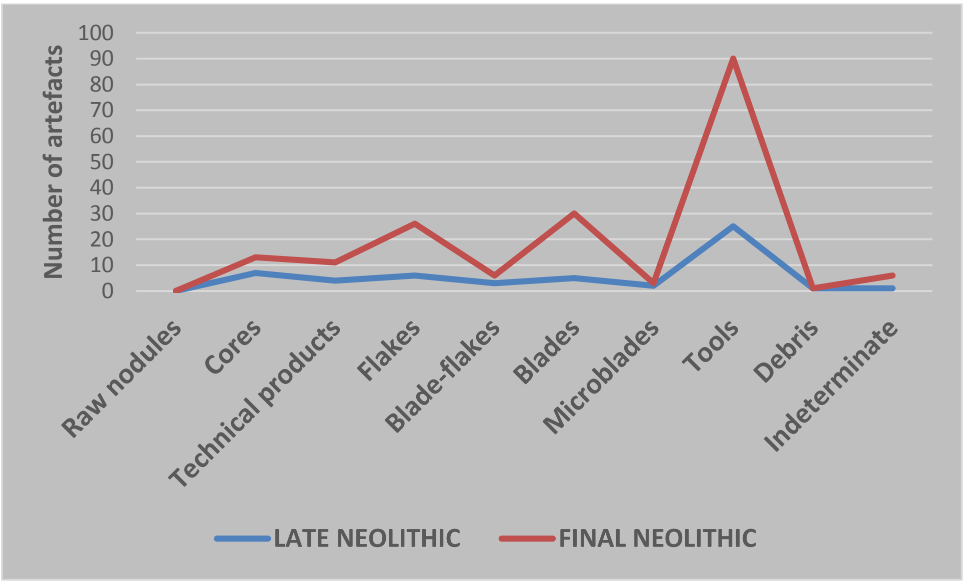


Fig. 5.14 Chronological distribution of chert by technological category.

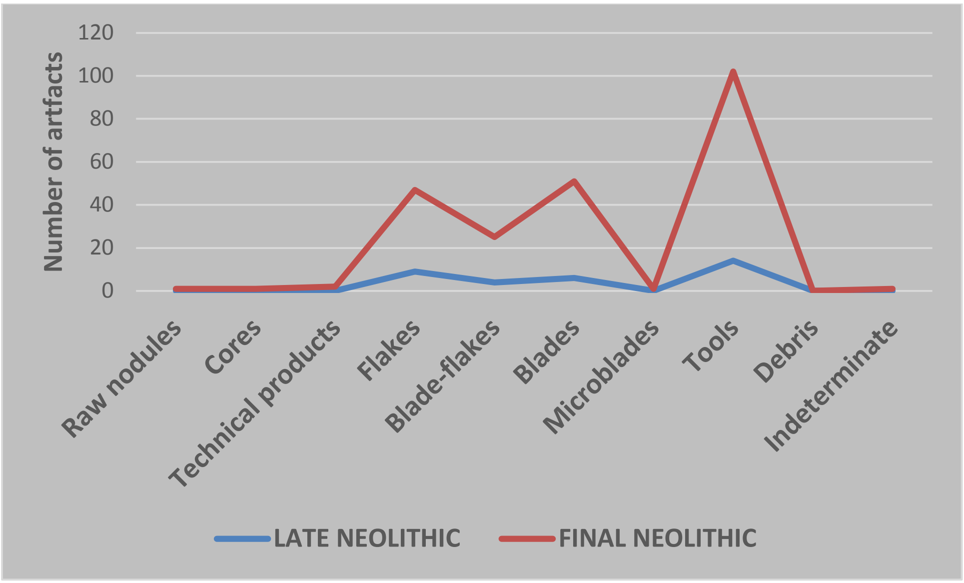


Fig. 5.15 Chronological distribution of chalcedony by technological category.

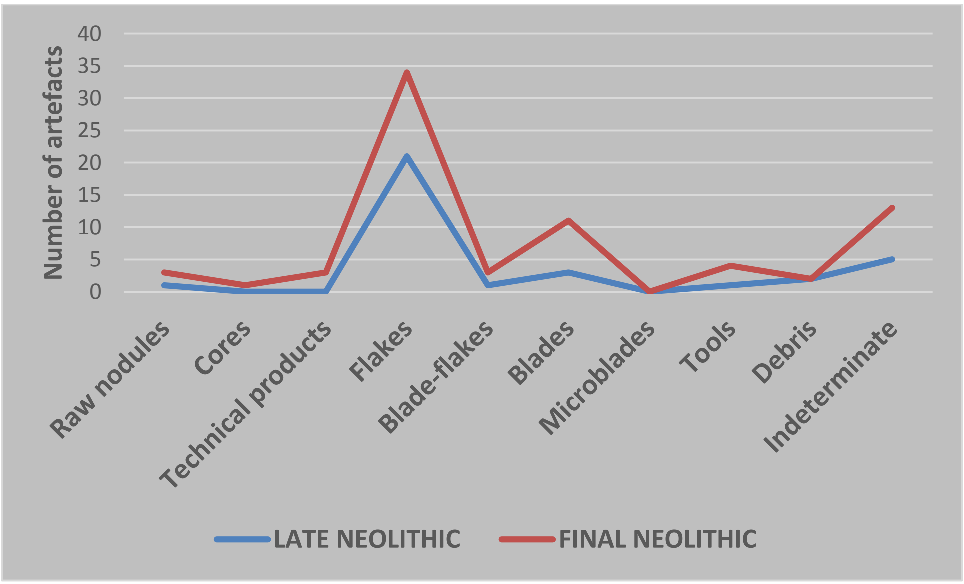


Fig. 5.16 Chronological distribution of quartz by technological category.

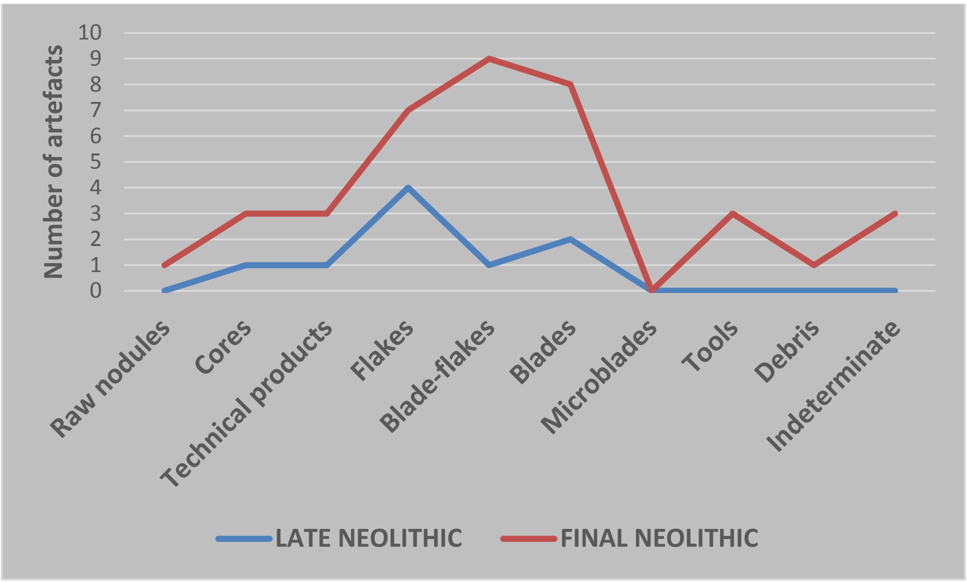


Fig. 5.17 Chronological distribution of quartzite by technological category.

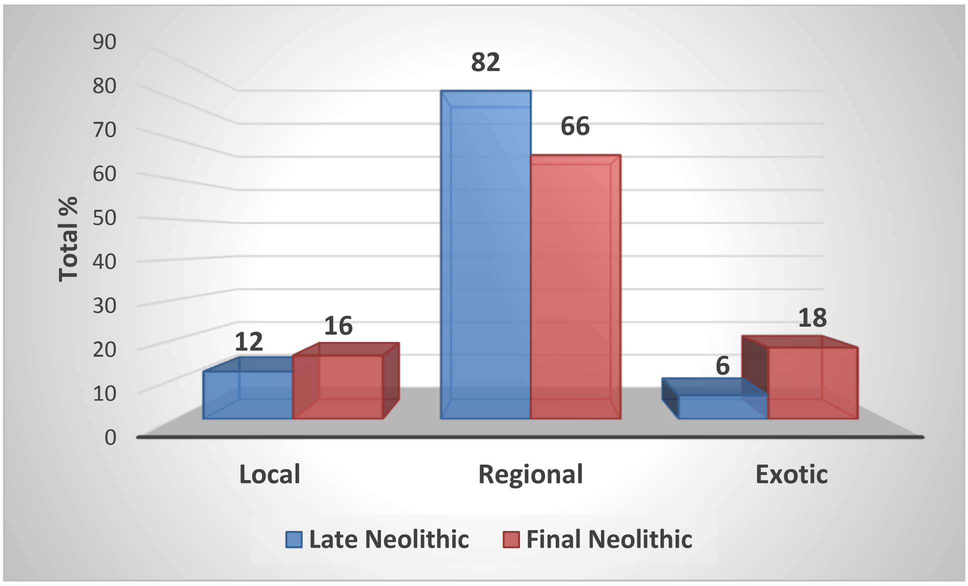


Fig. 5.18 Provenance of raw materials by chronological period.

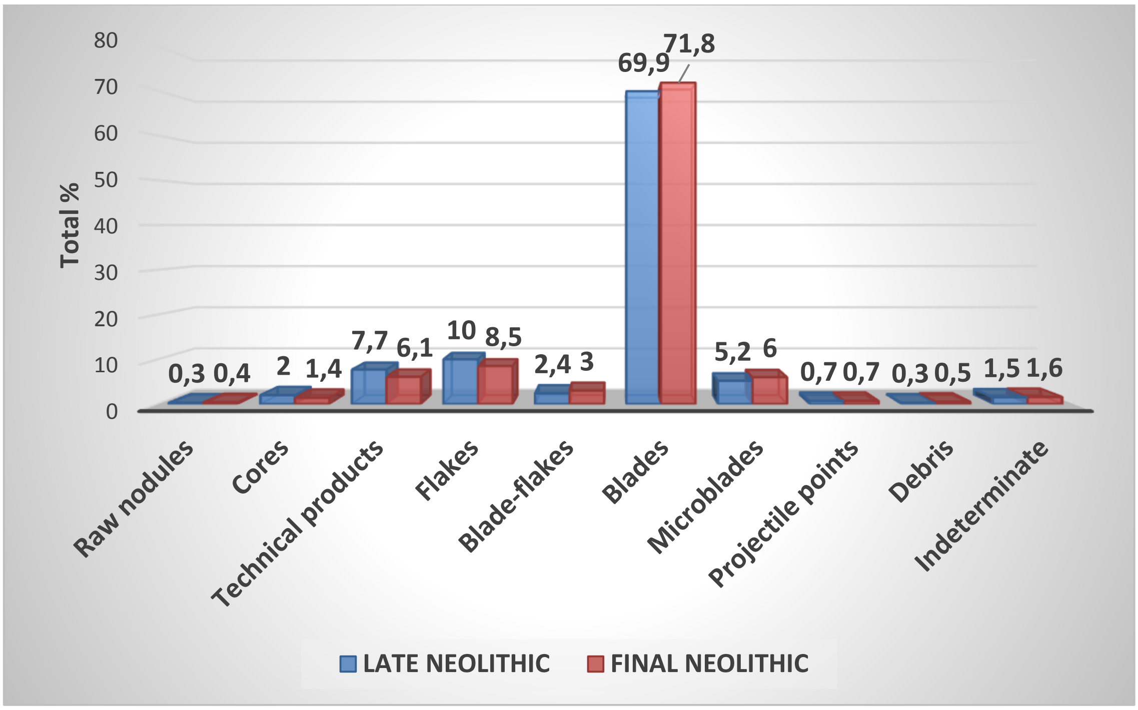


Fig. 5.19 Chronological distribution of the technological categories.

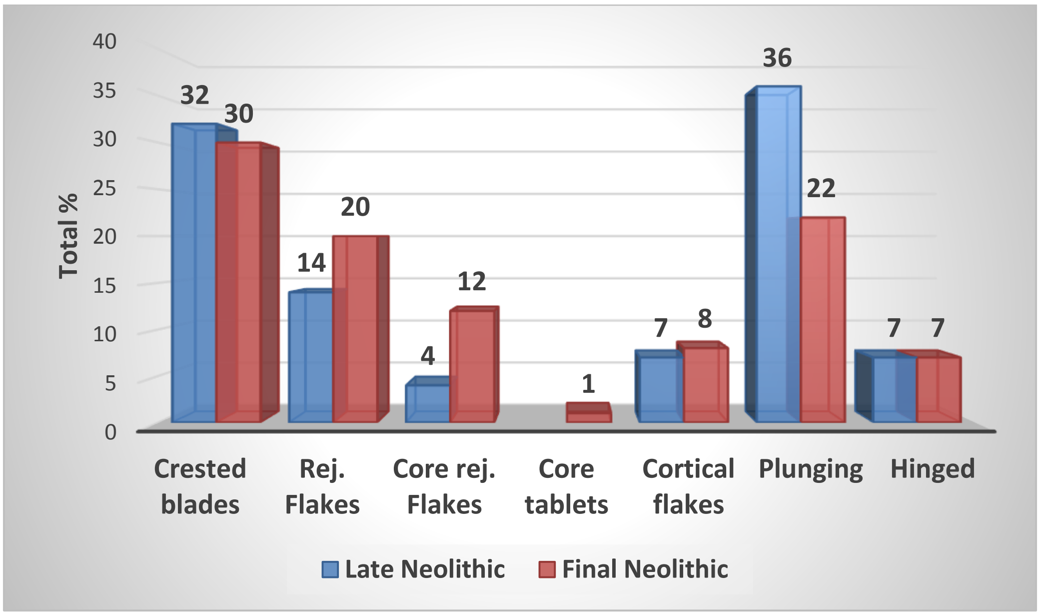


Fig. 5.20 Chronological distribution of retouched technical pieces by category.

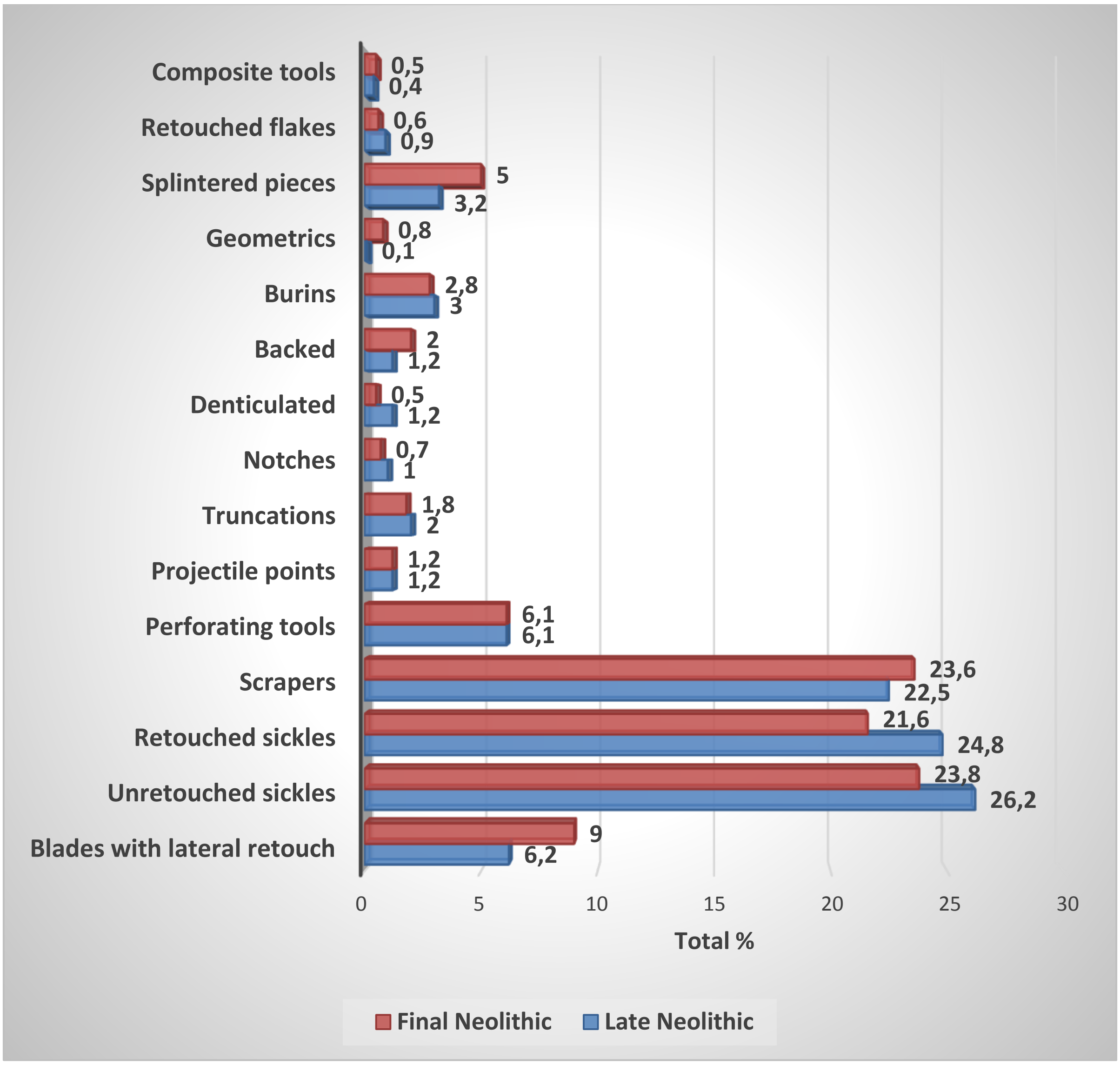


Fig. 5.21 Distribution of tool types by chronological period.

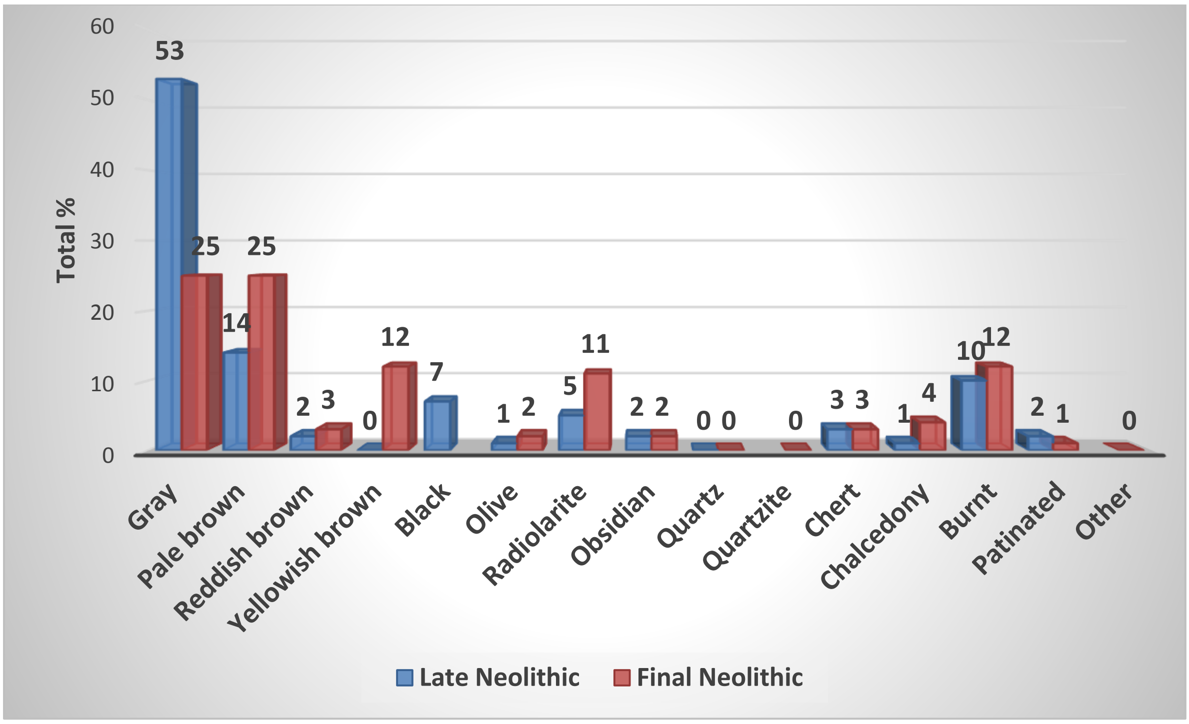


Fig. 5.22 Raw material distribution of tools by chronological period.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Black	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Unretouched sickles	28	28	38		36	20	13				16	50
Retouched sickles	23	30	31	20	38	40	32				20	15
Blades with lateral retouch	6	5		20	5		9	37			8	7
Scrapers	25	17	19		8	10	19	13			20	
Perforating tools	6	8	6		5		7				12	7
Truncations	2	4					2	6				
Denticulated	1	1	6				2	13				7
Notches	1	1			1		2	6			4	
Backed	1	1					6					
Splintered pieces	3	3		40	2	30	4	6			4	
Burins	3	1			3				100		4	14
Projectile points	1	1									8	
Geometrics	0											
Retouched flake	0				2		2	19			4	
Composite tools	0			20			2					
TOTAL %	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**0**	**100**	**100**

Fig. 5.23 Percentage of raw materials by tool type at the Late Neolithic assemblage.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Unretouched sickles	28	23	31	17	22	17		34	67	38	53
Retouched sickles	22	26	11	30	20	20	2			16	16
Blades with lateral retouch	7	6	3	7	11	12	54	33		7	4
Scrapers	25	25	37	27	22	27		33		15	5
Perforating tools	6	8	1	8	9	7				6	3
Truncations	3	1	2	2	6	1	8				
Denticulated	0	0		0		1	2			2	1
Notches	0	1			2	0	10			2	1
Backed	2	2	2	1		2				3	8
Splintered pieces	4	4	6	6	2	8	6		33	4	3
Burins	0	1		0	2	1	12			4	5
Projectile points	1	1		1	4	3	4			2	
Geometrics	1	0	5	0		0	2			1	
Retouched flake	1	1		0		1					1
Composite tools	0	1	2	1							
TOTAL %	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Fig. 5.24 Percentage of raw materials by tool type at the Final Neolithic assemblage.

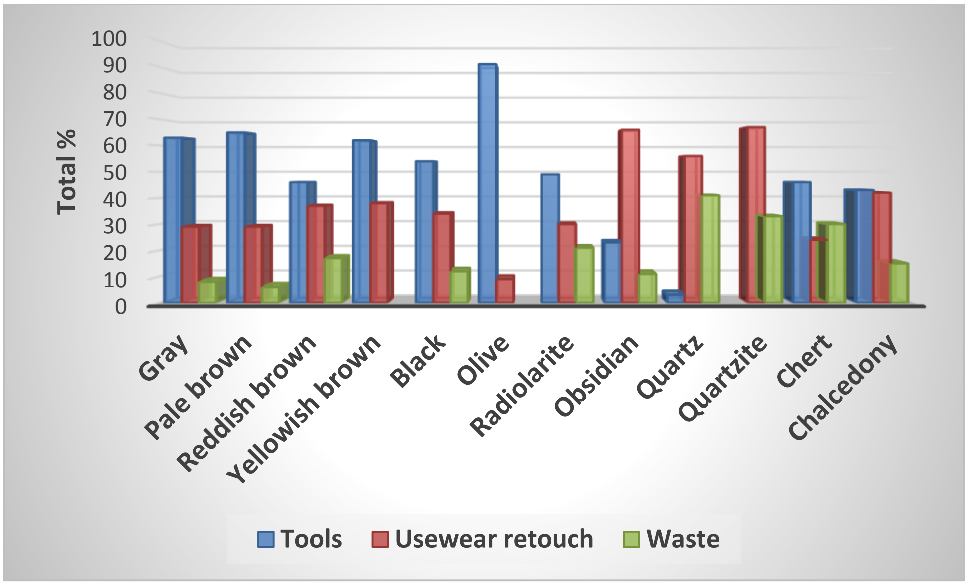


Fig. 5.25 Percentage of tools, usewear and waste by raw material at the Late Neolithic assemblage.

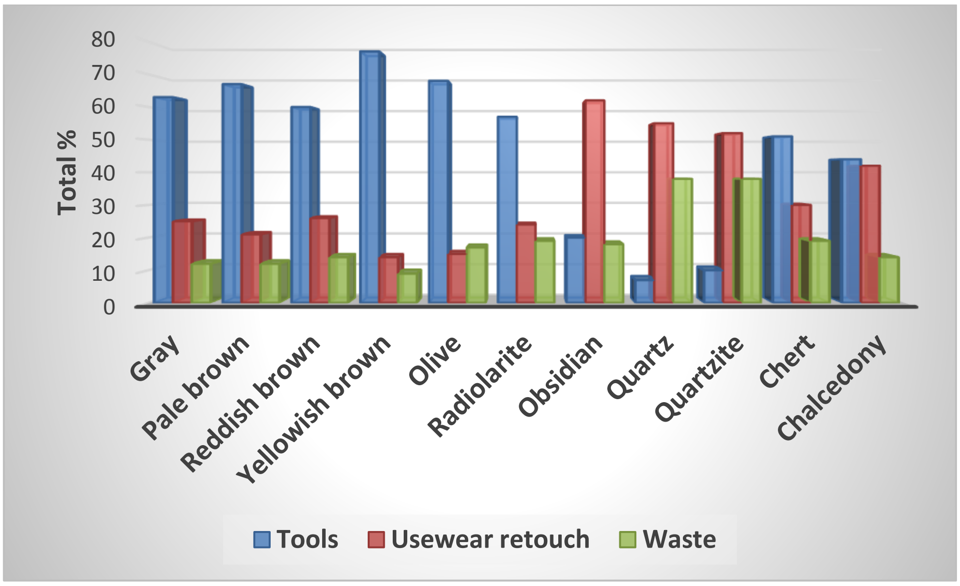


Fig. 5.26 Percentage of tools, usewear and waste by raw material at the Final Neolithic assemblage.

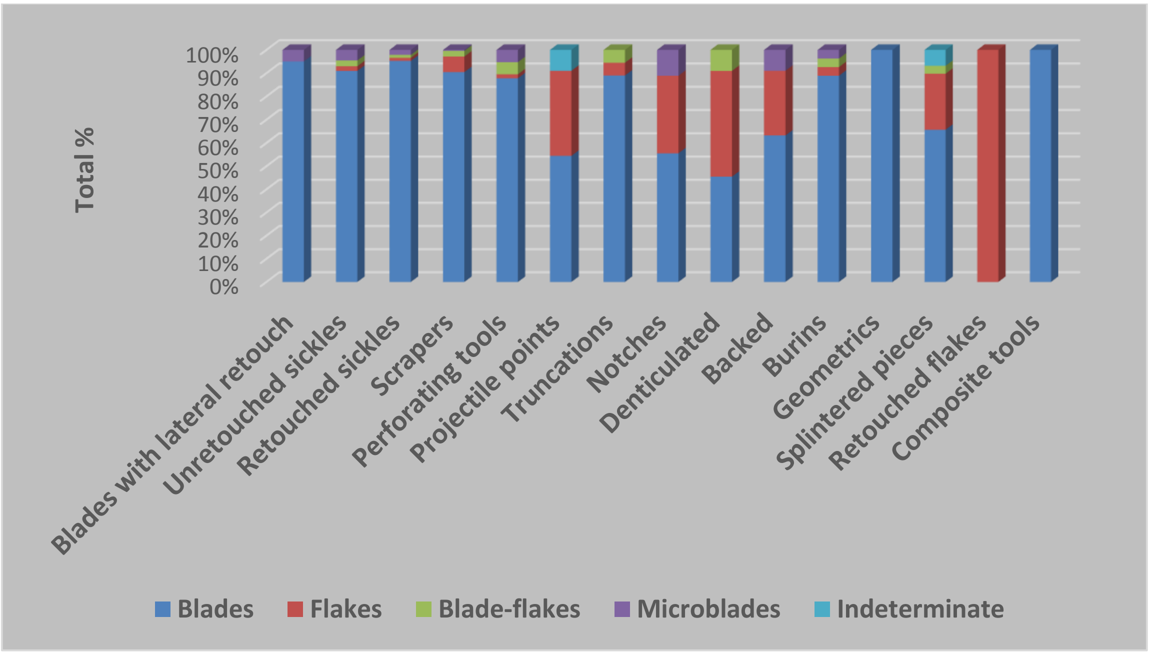


Fig. 5.27 Frequency of the Late Neolithic blanks by tool type.

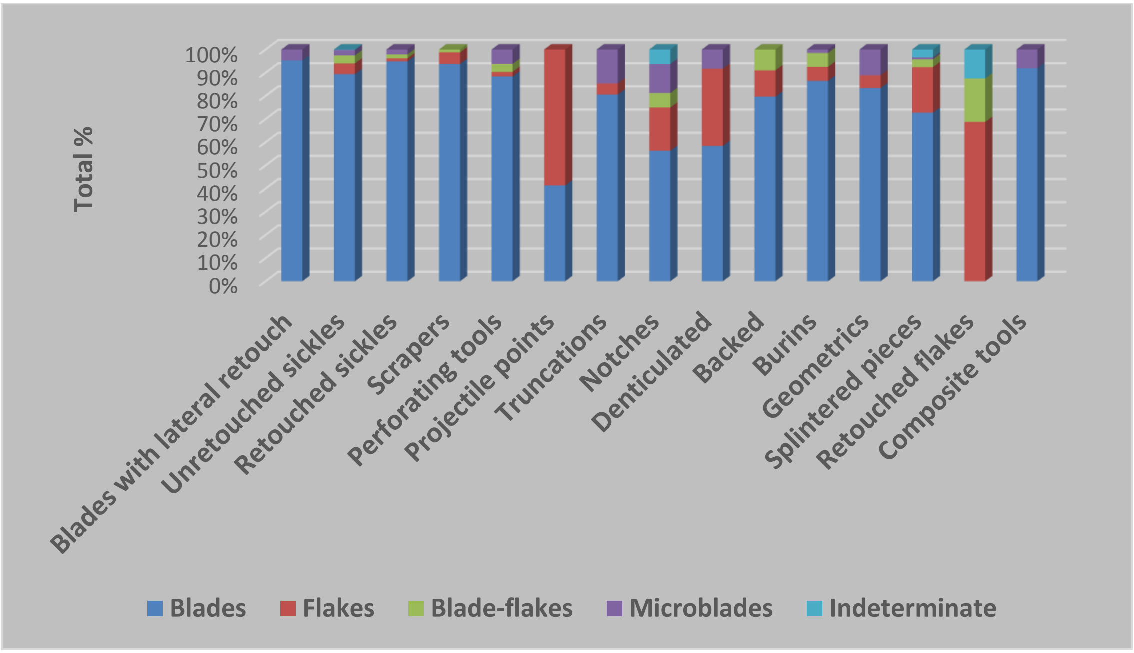


Fig. 5.28 Frequency of the Final Neolithic blanks by tool type.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Black	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Sickle blades	5,6	6,1									9,4	5
Sickle elements	3,7	4,1	4,1		3,3		2,9				3,3	3,8
Retouched sickle blades	6,3	5,8					7,2				8,1	
Retouched sickle elements	3,9	4,4	3,4		4	3,2	3,6				4,6	3,5
Scrapers	4,2	2,9	2,3	2,9	4	4,2	3,2	2,9			3,4	
Blades with lateral retouch	4,6	6			4,6		6,2	2,8			6,9	4,4
Perforating tools	3,6	4,2	2,6		3,1		3,5				4,25	1,5
Projectile points	4	3									3,6	
Truncations	4,2	4,5					3,4	2,7				
Notches	6,2	4,8			2,9		2,4	3,4			2,6	
Denticulated	3,3	4,9	2,7				4,1	5,6				2,6
Backed	3,3	1,5					2,5					
Burins	3,6	3		3,5	3,4	4,8			1,9		4,1	3,2
Geometrics	1,6											
Splintered pieces	3,3	3,4		2,35	2,3	3	3	3,2			3,3	
Retouched flakes	5,7				2,6		5,7	2,9			2,9	
Composite tools	3,2			3,2			2,9					

Fig. 5.29 Mean value of the Late Neolithic tools' length (in cm) by raw material.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Sickle blades	8	5,9	5,2	8,3	5	6,4				6,1	
Sickle elements	3,6	3,5	3,3	4,75	4,6	3,2		2,6	3,3	3,7	3,3
Retouched sickle blades	6,8	6,3	5,9	6,2	6,4	7,8				5,7	
Retouched sickle elements	3,8	3,7		3,5		3,6	2,9		4,2	3,4	3,6
Scrapers	4,8	4	2,7	4,5	3,8	4,5		2,1		2,9	3,4
Blades with lateral retouch	4,3	4,1	3,1	3,4		5	3,6	4		3,5	2,8
Perforating tools	3,5	3,9	3,4	4,5	4,3	5,1				3,5	3,3
Projectile points	4,3	3,4		3,8	4,3	3,8	2,3			2,6	
Truncations	3,6	3,2	3,4	3,6			2,8				
Notches	3,1	4,6			3,5	2,8	2,9			3,2	4
Denticulated	4	3		5,9		4,8	2,35			3,6	5
Backed	4,1	3,3	3,4	4,4		3,4				3	3,9
Burins	3,6	4,9	3	3,7	2,1	3,6	2,6			3	4,1
Geometrics	1,8	1,8	2	1,4		2,1				1,6	
Splintered pieces	2,6	2,8	2,5	3	3	2,7	2,5		4,3	3,3	2,8
Retouched flakes	3	2,5		3,4		3,3					3,5
Composite tools	3,7	4,6	5,5	4,1							

Fig. 5.30 Mean value of the Final Neolithic tools' length (in cm) by raw material.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Black	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Sickle blades	1,6	1,6									1,8	2,5
Sickle elements	1,3	1,4	1,4		1,1	1,2	1,3				1,4	1,7
Retouched sickle blades	1,5	1,8					1,7				2	
Retouched sickle elements	1,4	1,4	1,1		1,3	1,3	1,5				1,3	1,4
Scrapers	1,8	1,6	1,5	2,3	1,2	1,9	1,7	1,7			2,25	
Blades with lateral retouch	1,4	1,5			1,5		1,4	1,8			1,9	1,8
Perforating tools	1,2	1,1	1,1		1,2		1,3				2,66	1,1
Projectile points	2	2,3									2	
Truncations	1,3	1,6					1,6	1,5				
Notches	1,6	2,6			0,9		1,5	1,3			1,9	
Denticulated	1,8	1,2	2,9				2,3	2,6				2
Backed	1,7	1,5					1,3					
Burins	1,2	1,6		1,9	1,4	1,4			1,5		1,7	2,2
Geometrics	1,5											
Splintered pieces	1,8	1,4		2	1,9	1,8	1,55	2,2			2,8	
Retouched flakes	2,6				3,5		5,5	2,6			2	
Composite tools	3,2			3,2			2,9					

Fig. 5.31 Mean value of the Late Neolithic tools' width (in cm) by raw material.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Sickle blades	1,8	1,47	1,45	1,6	2,2	1,3				1,6	
Sickle elements	1,5	1,4	1,3	1,4	1,4	1,5		1,1	1,7	1,6	1,6
Retouched sickle blades	1,7	1,6	1,35	1,75	1,7	1,9				1,55	
Retouched sickle elements	1,5	1,4	1,25	1,5	1,3	1,6	1,3		1,8	1,68	1,6
Scrapers	1,7	1,68	1,8	1,9	2	1,9		1,4		1,8	1,8
Blades with lateral retouch	1,5	1,4	1,3	1,4	1,3	1,6	1,2	1,4		1,5	1,6
Perforating tools	1,2	1,3	1,5	1,2	1,48	1,2				1,7	1,2
Projectile points	1,7	1,7		2	2,3	2,1	1,2			2,4	
Truncations	1,5	1,1	1,2	1,2	1,5	1,2	1,4				
Notches	1,3	1,5			1,5	3,2	1,3			2	2
Denticulated	1,8	2,3		1,7		1,95	0,9			1,6	4,3
Backed	1,6	1,5	1,4	1,7		1,7				2,6	1,9
Burins	1,4	1,5	1,5	1,2	1,2	1,2	1,4			1,7	2
Geometrics	1,8	1,5	1,4	1		0,7				1,6	
Splintered pieces	1,8	1,6	1,8	1,7	1,8	1,5	1,8		2,2	1,7	1,9
Retouched flakes	2,8	1,8		1,7		1,7					1,8
Composite tools	1,2	1,6	1,3	1,4							

Fig. 5.32 Mean value of the Final Neolithic tools' width (in cm) by raw material.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Black	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Sickle blades	0,36	0,3									0,5	0,6
Sickle elements	0,3	0,3	0,36		0,26	0,25	0,3				0,33	0,45
Retouched sickle blades	0,4	0,38					0,44				0,75	
Retouched sickle elements	0,34	0,36	0,28		0,3	0,45	0,4				0,46	0,45
Scrapers	0,5	0,5	0,23	0,5	0,5	0,5	0,5	0,45			0,65	
Blades with lateral retouch	0,4	0,4			0,35		0,4	0,4			0,7	0,7
Perforating tools	0,37	0,4	0,3		0,3		0,4				0,66	0,3
Projectile points	0,5	0,4									0,5	
Truncations	0,37	0,34					0,3	0,5				
Notches	0,26	0,7			0,2		0,4	0,2			0,4	
Denticulated	0,7	0,3	0,8				0,9	0,4				0,8
Backed	0,48	0,4					0,33					
Burins	0,35	0,36		0,4	0,35	0,3			1,3		0,5	0,5
Geometrics	0,4											
Splintered pieces	0,4	0,5		0,5	0,3	0,6	0,5	0,5			0,7	
Retouched flakes	0,8				1,3		5,1	0,75			0,6	
Composite tools	0,4			0,4			0,5					

Fig. 5.33 Mean value of the Late Neolithic tools' thickness (in cm) by raw material.

TOOL TYPE	Gray	Pale brown	Reddish brown	Yellowish brown	Olive	Radiolarite	Obsidian	Quartz	Quartzite	Chert	Chalcedony
Sickle blades	0,46	0,45	0,35	0,44	0,5	0,3				0,63	
Sickle elements	0,36	0,33	0,3	0,32	0,38	0,36		0,5	0,4	0,44	0,44
Retouched sickle blades	0,48	0,48	0,4	0,52	0,42	0,52				0,45	
Retouched sickle elements	0,4	0,37	0,35	0,4	0,36	0,4	0,4		0,5	0,5	0,47
Scrapers	0,48	0,46	0,46	0,5	0,55	0,5		0,4		0,5	0,6
Blades with lateral retouch	0,43	0,38	0,3	0,38	0,36	0,4	0,35	0,8		0,48	0,44
Perforating tools	0,4	0,4	0,4	0,44	0,42	0,4				0,57	0,4
Projectile points	0,4	0,5		0,6	0,5	0,6	0,4			0,7	
Truncations	0,35	0,28	0,3	0,3	0,5	0,33	0,3				
Notches	0,36	0,32			0,3	0,8	0,24			0,8	0,7
Denticulated	0,53	0,35		0,5		0,35	0,2			0,6	1
Backed	0,55	0,48	0,4	0,55		0,44				0,6	0,67
Burins	0,4	0,3	0,3	0,35	0,2	0,4	0,3			0,44	0,45
Geometrics	0,3	0,3	0,26	0,2		0,3				0,5	
Splintered pieces	0,5	0,4	0,47	0,4	0,5	0,46	0,36		0,5	0,5	0,5
Retouched flakes	0,75	0,3		0,4		0,7					0,2
Composite tools	0,5	0,5	0,4	0,4							

Fig. 5.34 Mean value of the Final Neolithic tools' thickness (in cm) by raw material.

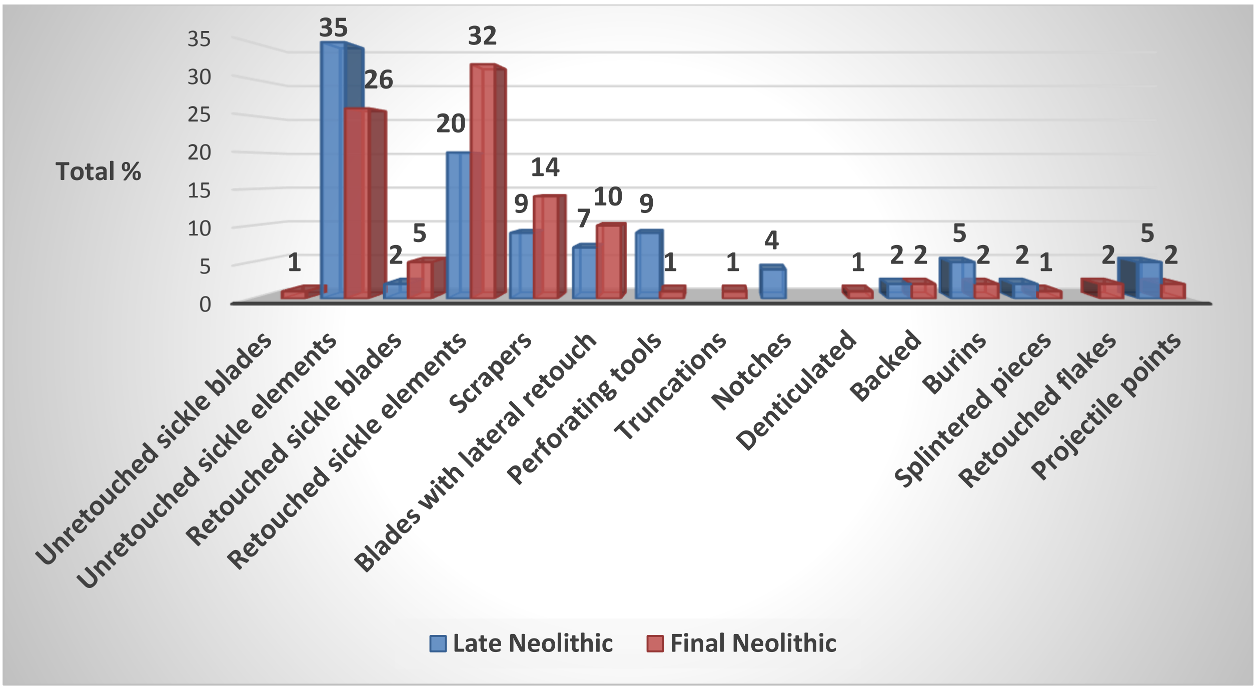


Fig. 5.35 Chronological distribution of deliberate fracture at tools by type.

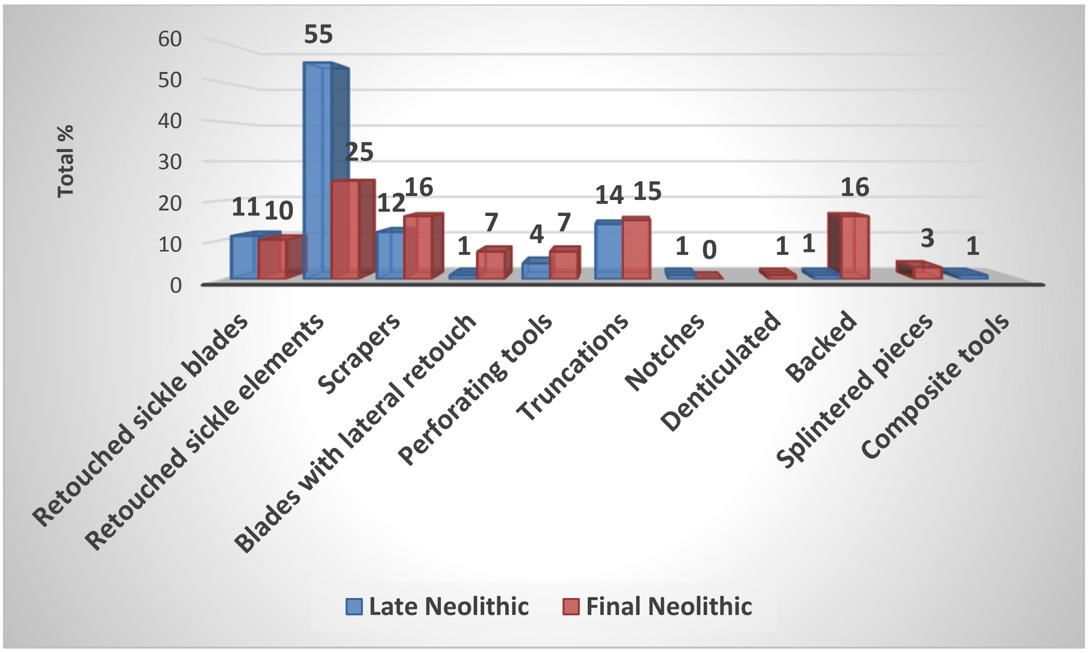


Fig. 5.36 Chronological distribution of truncation by tool type.

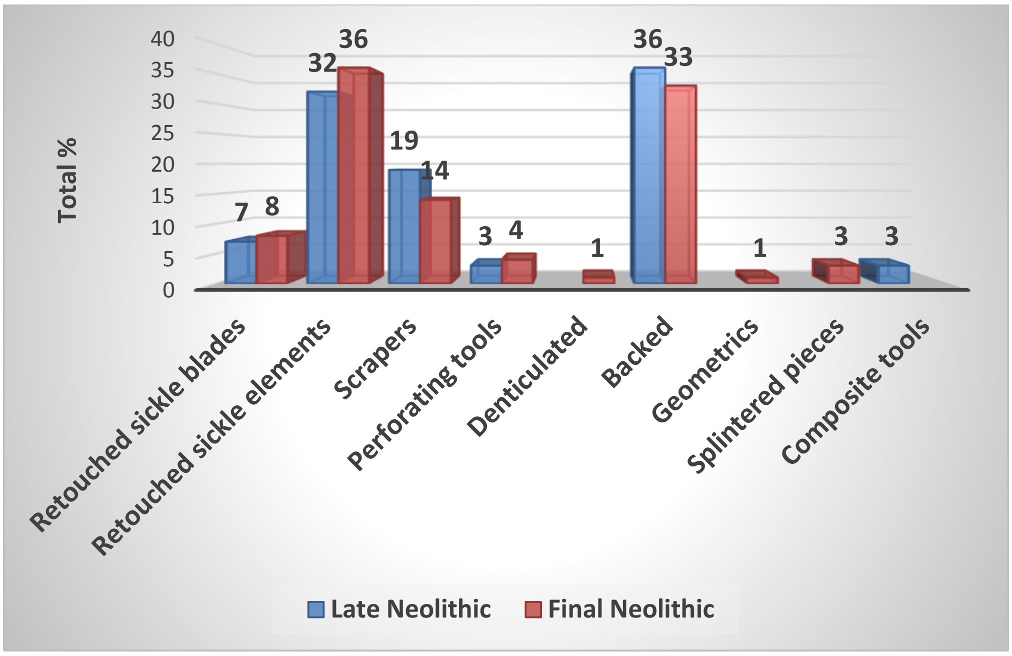


Fig. 5.37 Chronological distribution of backed artefacts by tool type.

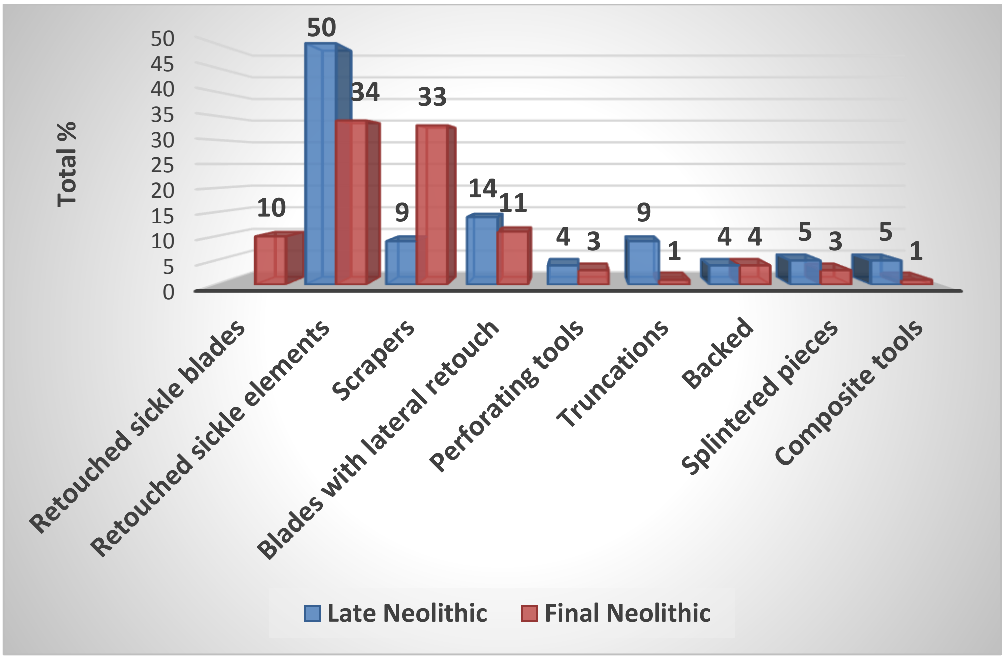


Fig. 5.38 Chronological distribution of shouldered artefacts by tool type.

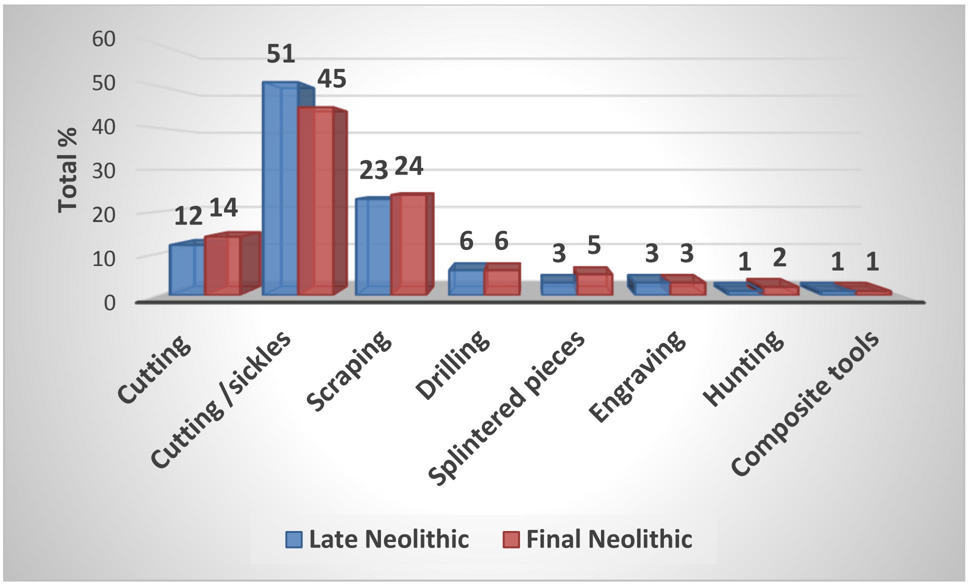


Fig. 5.39 Chronological distribution of activities related to tool groups.

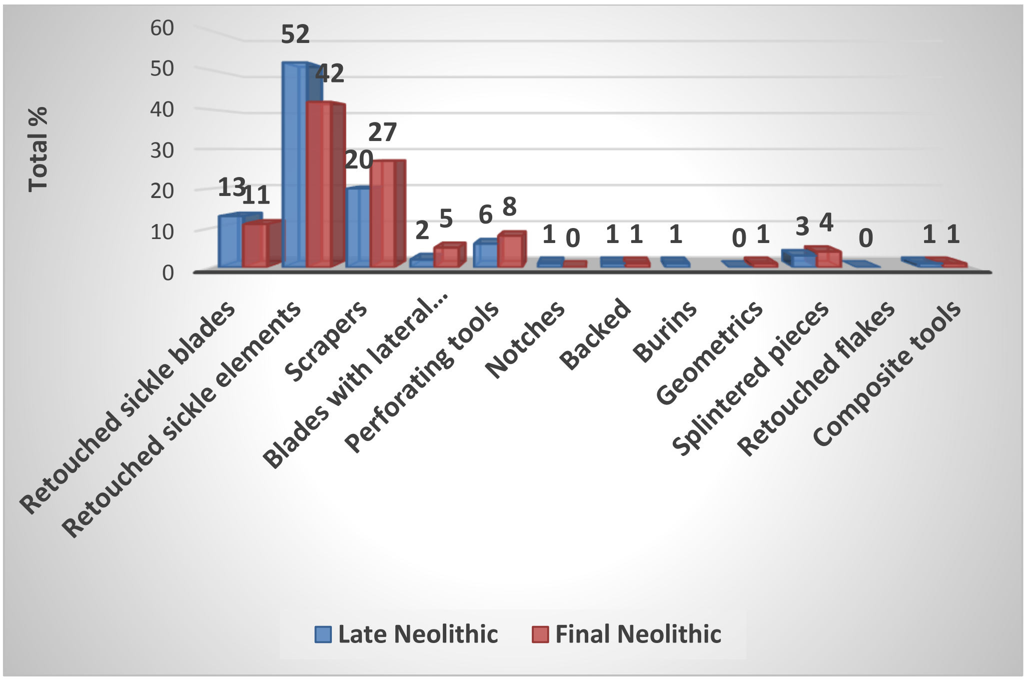


Fig. 5.40 Chronological distribution of resharpened tools by type.

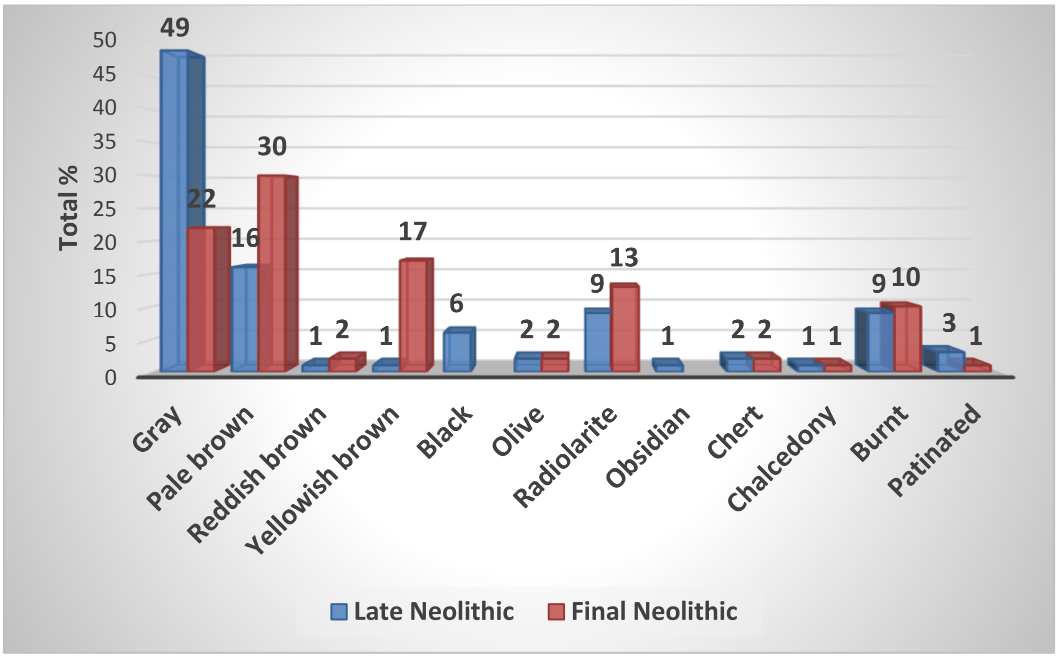


Fig. 5.41 Chronological distribution of resharpened tools by raw material.

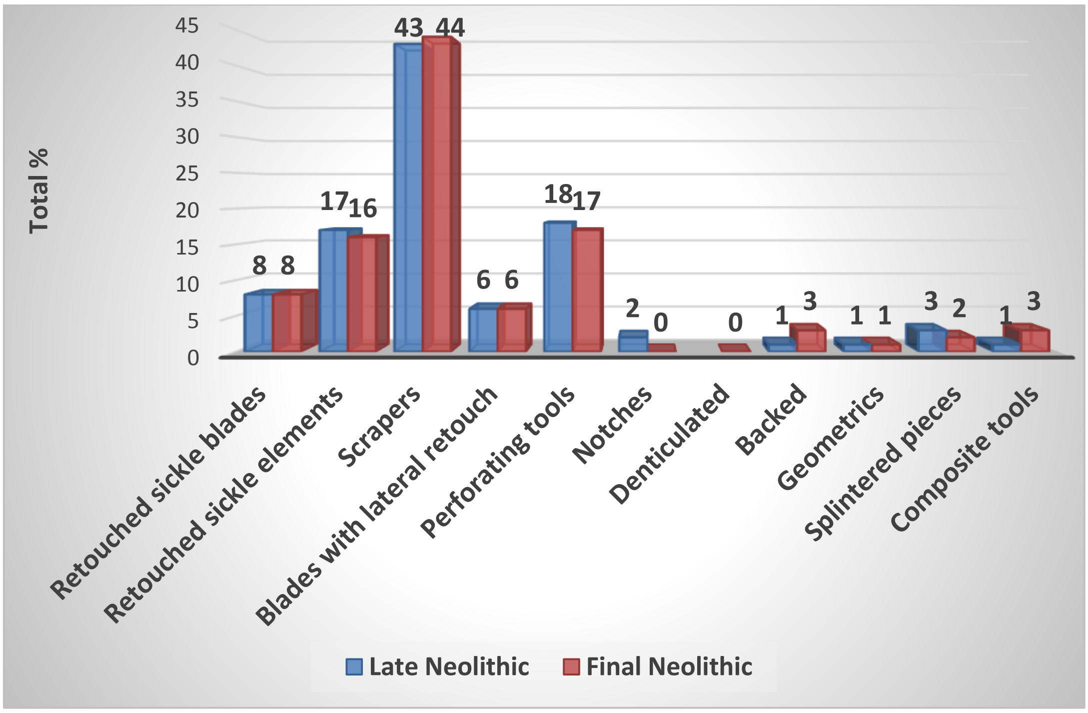


Fig. 5.42 Chronological distribution of heavily retouched tools by type.

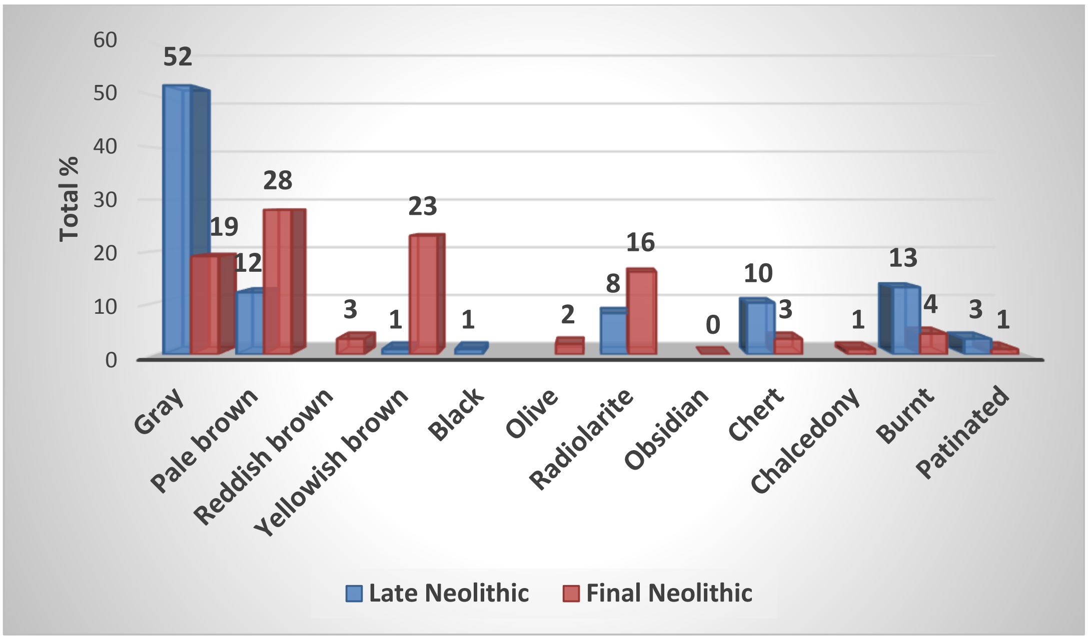


Fig. 5.43 Chronological distribution of heavily retouched tools by raw material.

TOOL TYPES	Unretouched sickles		Retouched sickles		Retouched blades	
CHRONOLOGICAL PERIOD	**LN**	**FN**	**LN**	**FN**	**LN**	**FN**
Bilateral	16	14	30	31	33	42
Unilateral	84	86	70	69	67	58
TOTAL %	**100**	**100**	**100**	**100**	**100**	**100**

Fig. 5.44 Distribution of unilateral and bilateral use of unretouched sickles, retouched sickles and retouched blades during the Late and the Final Neolithic (values in %).

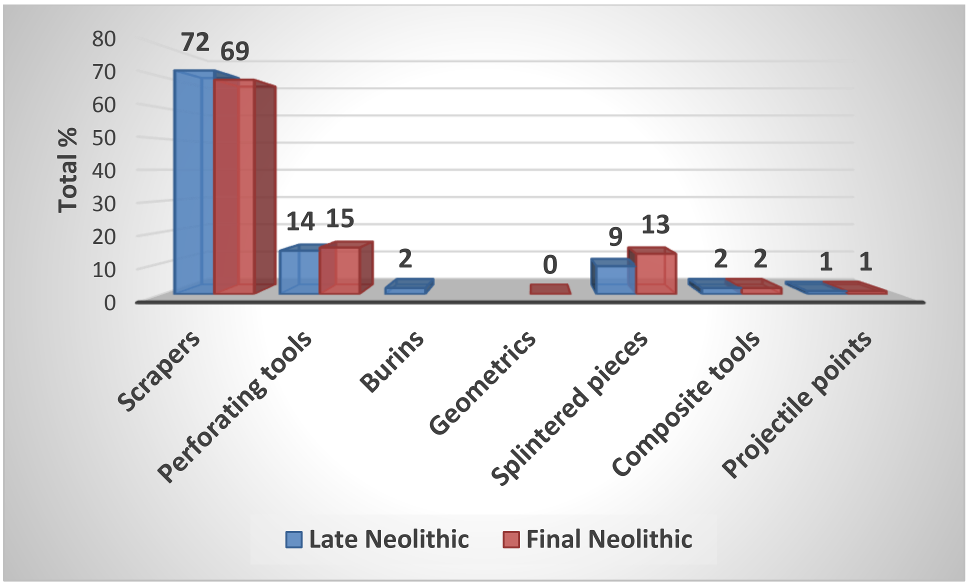


Fig. 5.45 Chronological distribution of recycled tools by type.

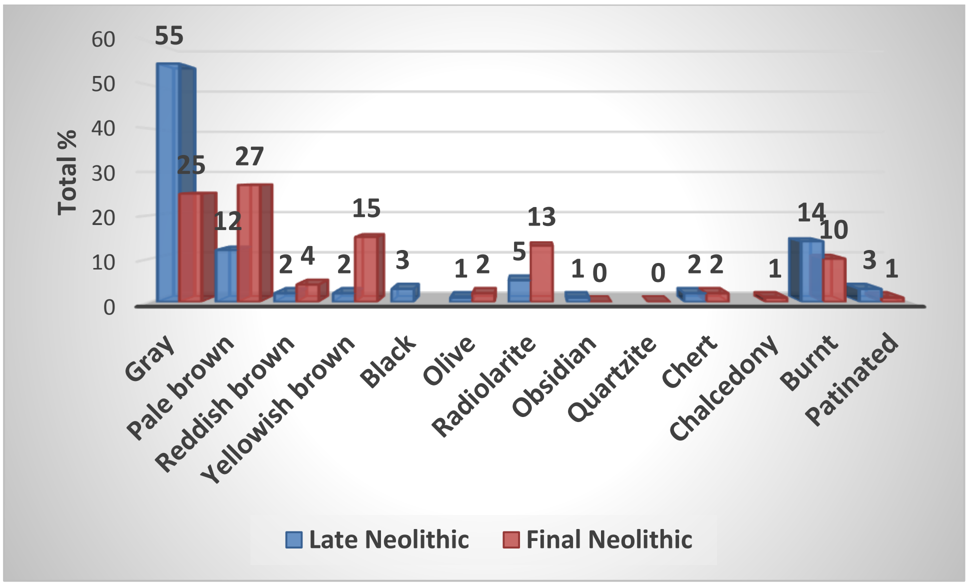


Fig. 5.46 Chronological distribution of recycled tools by raw material.

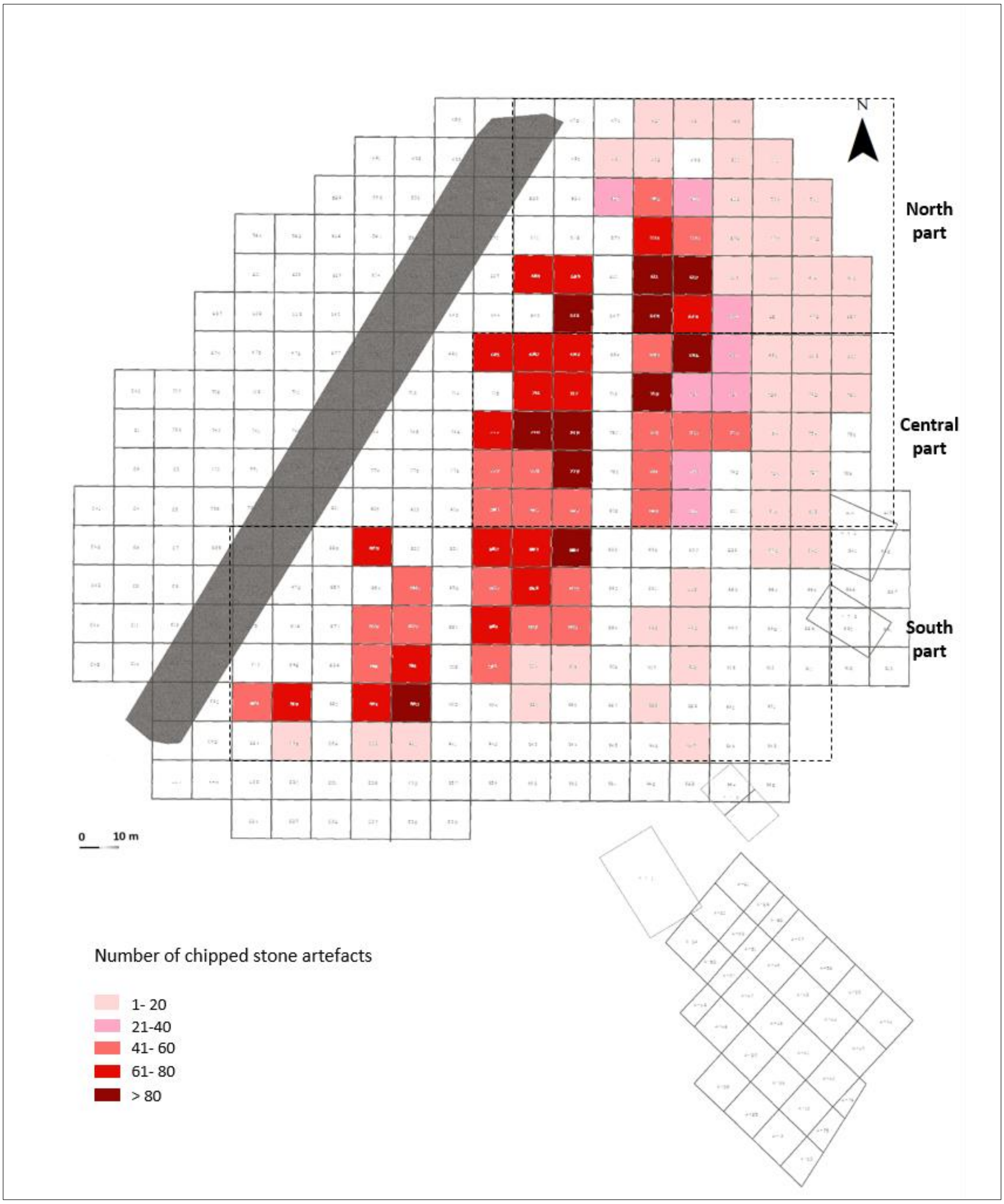


Fig. 5.47 Horizontal distribution of the Final Neolithic chipped stone artefacts at the excavated area.

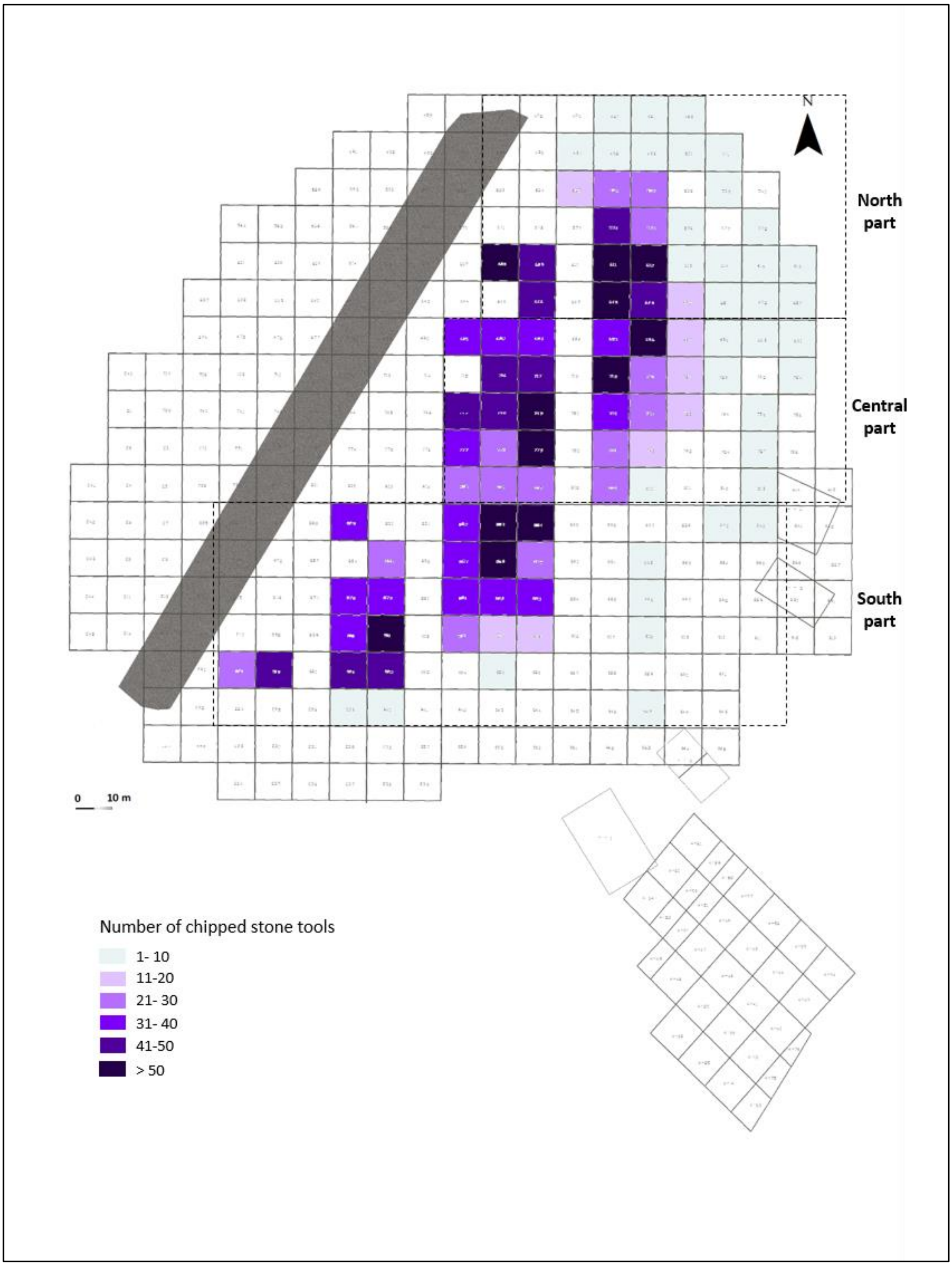


Fig. 5.48 Horizontal distribution of the Final Neolithic tools at the excavated area.

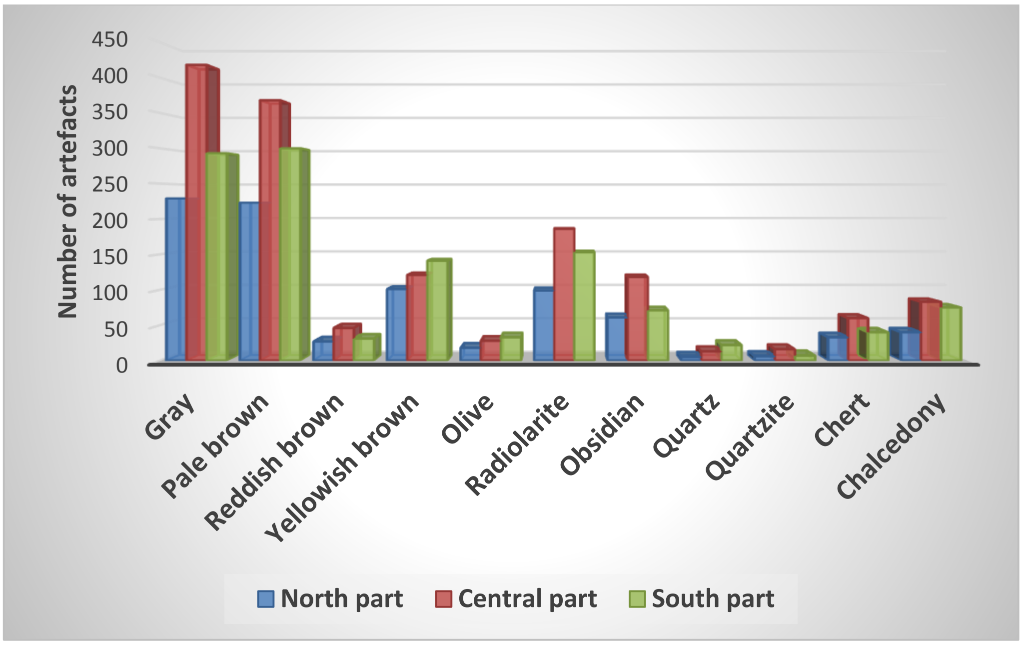


Fig. 5.49 Spatial distribution of the Final Neolithic assemblage by raw material.

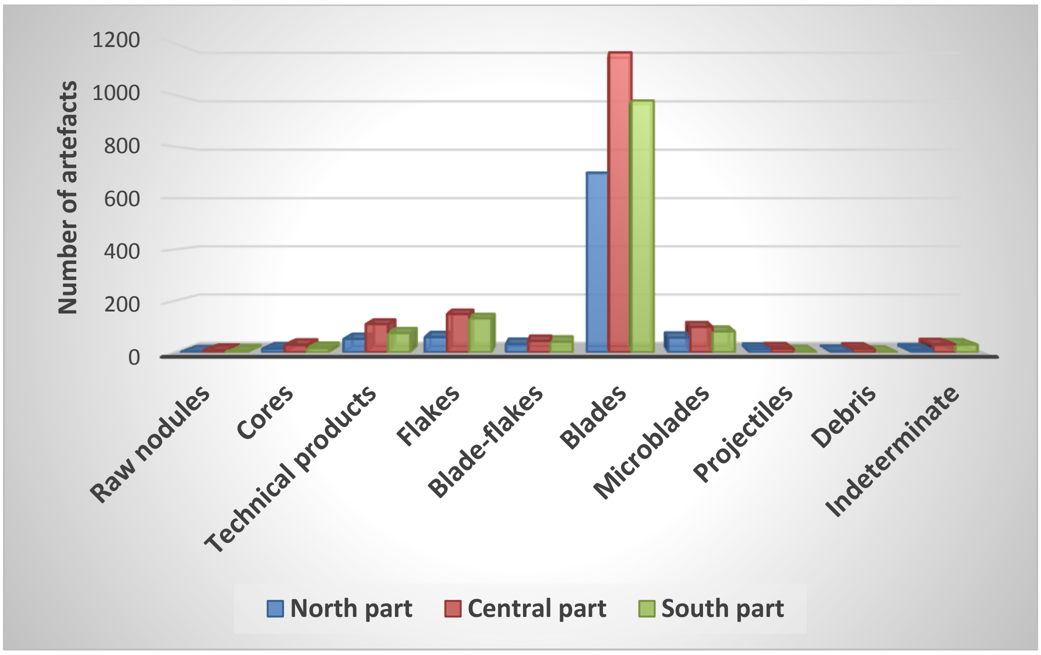


Fig. 5.50 Spatial distribution of the Final Neolithic assemblage by technological category.

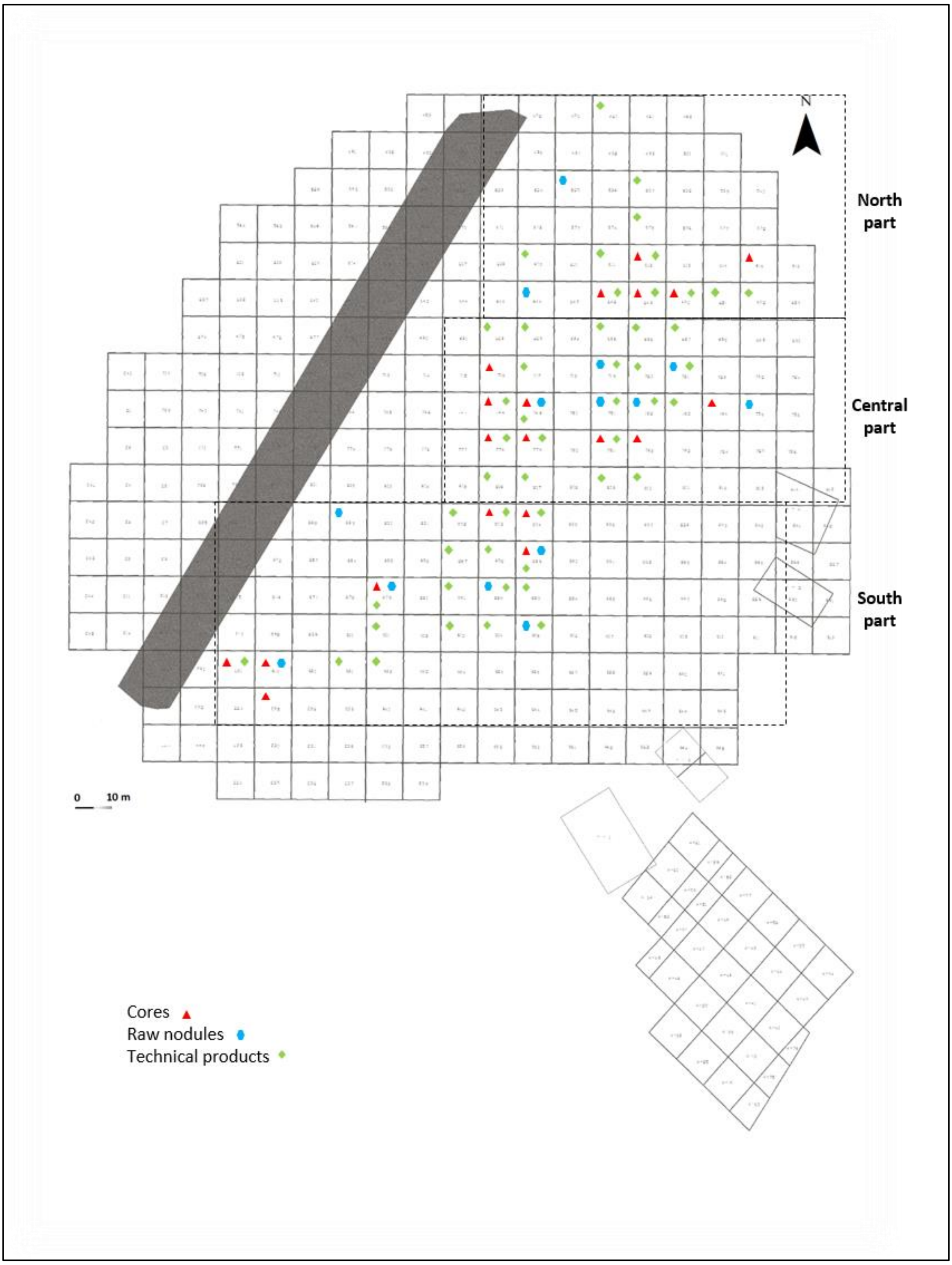


Fig. 5.51 Horizontal distribution of cores, raw nodules and technical products at the excavated area.

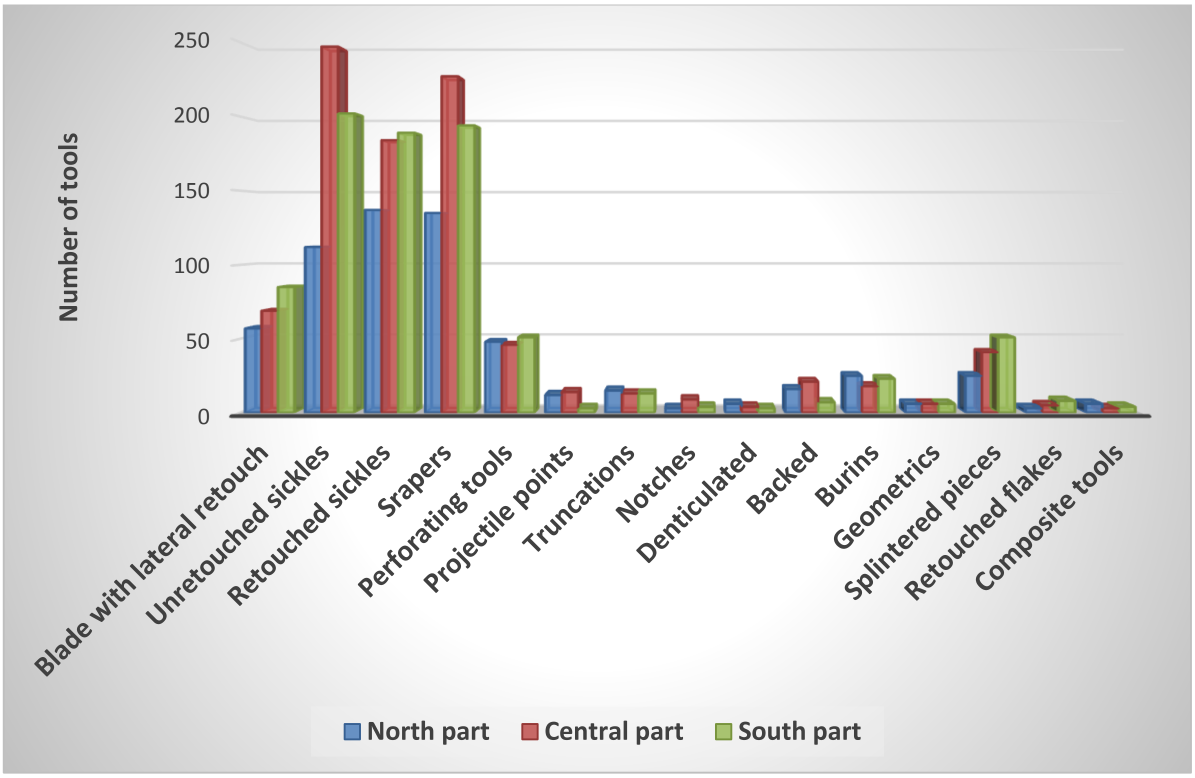


Fig. 5.52 Spatial distribution of the Final Neolithic assemblage by tool type.

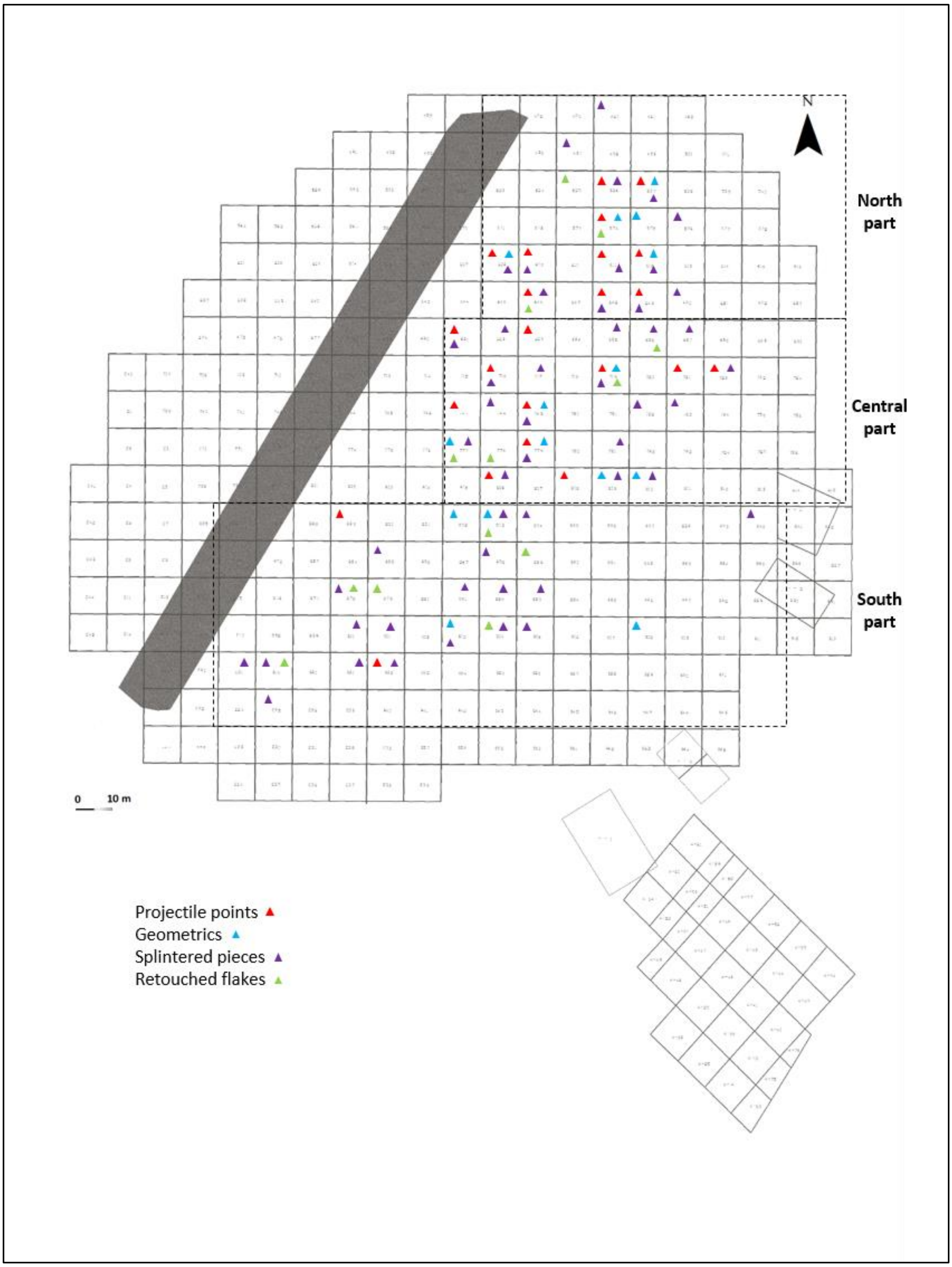
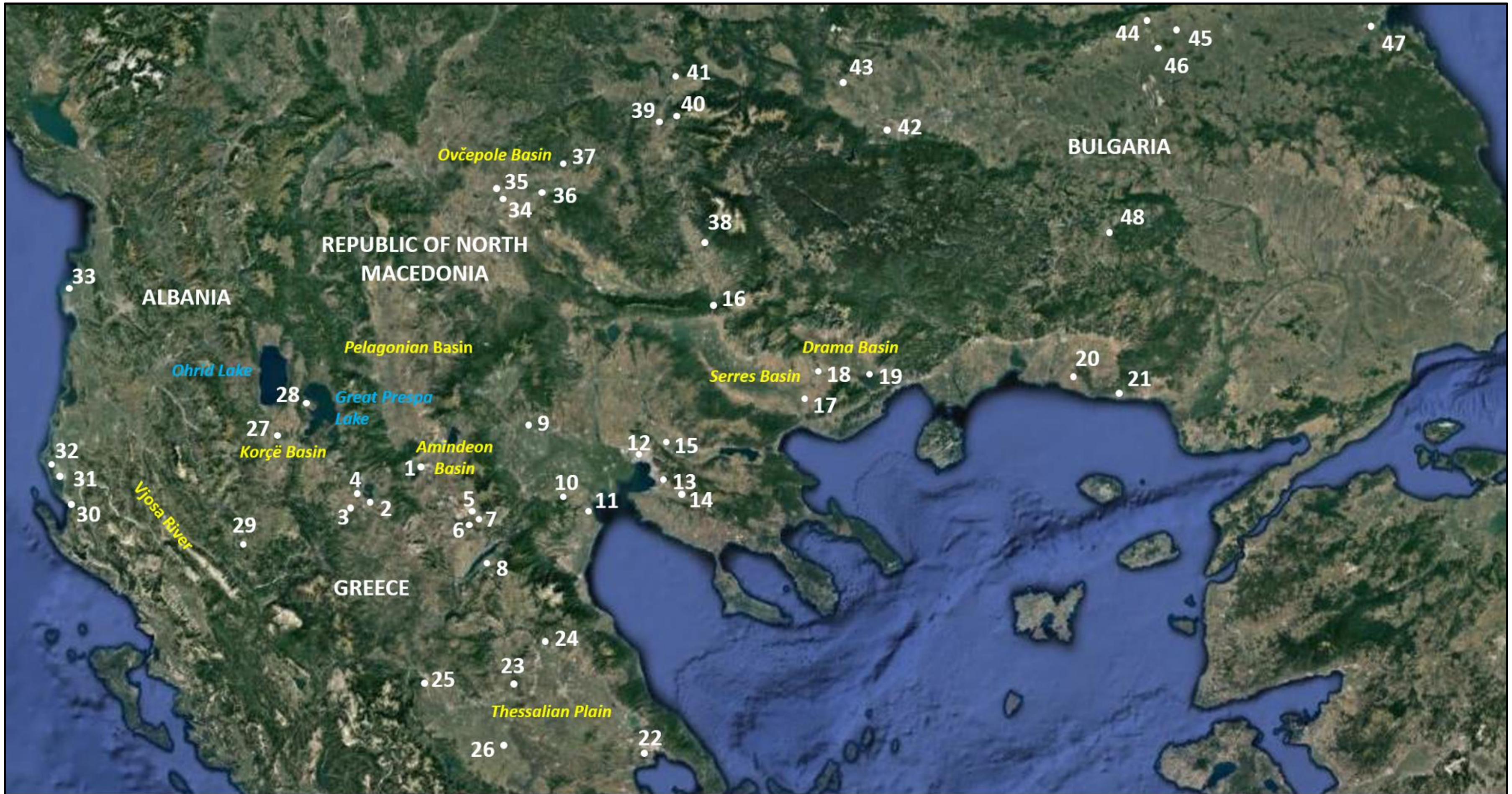


Fig. 5.53 Horizontal distribution of selected tool types (projectile points, geometrics, splintered pieces and retouched flakes) at the excavated area.



1. Anarghiri IXb, 2. Dispilio, 3. Avgi, 4. Piges Koromilias Cave, 5. Kleitos, 6. Megalo Nisi Galanis, 7. Toumba Kremastis Koiladas, 8. Servia, 9. Mandalo, 10. Paliambela, 11. Makriyalos, 12. Stavroupoli, 13. Thermi, 14. Vasilika, 15. Kavalari, 16. Promachon-Topolniča, 17. Dimitra, 18. Sitagroi, 19. Dikili Tash, 20. Proskynites, 21. Makri, 22. Dimini, 23. Plateia Magoula Zarkou, 24. Ag. Sofia, 25. Theopetra Cave, 26. Magoula Orgozinos, 27. Maliq, 28. Kallamas, 29. Kamnic, 30. Vjore, 31. Putanja, 32. Dalani i Vogël, 33. Bishti i Pallës, 34. Amzabegovo, 35. Rug-Bair, 36. St. Atanas, 37. Cocev Kamen, 38. Damianitsa, 39. Balgartchevo, 40. Strumsko, 41. Sapareva Bania I, 42. Kapitan Dimitrievo, 43. Apriltsi, 44. Karanovo, 45. Ezero, 46. Sarnevo, 47. Burgas, 48. Varhari.

Fig. 6.1 Map of Neolithic sites of northern Greece, Thessaly and southern Balkans mentioned in the text.

CHIPPED STONE INDUSTRIES FROM WESTERN MACEDONIA, GREECE.

THE CASE OF THE NEOLITHIC LAKESIDE SETTLEMENT

ANARGHIRI IXb

Volume III: Plates

Inauguraldissertation

an der Philosophisch-historischen Fakultät der Universität Bern

zur Erlangung der Doktorwürde

vorgelegt von

Styliani Papadopoulou

Promotionsdatum: **27 Februar 2020**

eingereicht bei

Prof. Dr. Albert Hafner, Institut für Archäologische Wissenschaften der Universität Bern

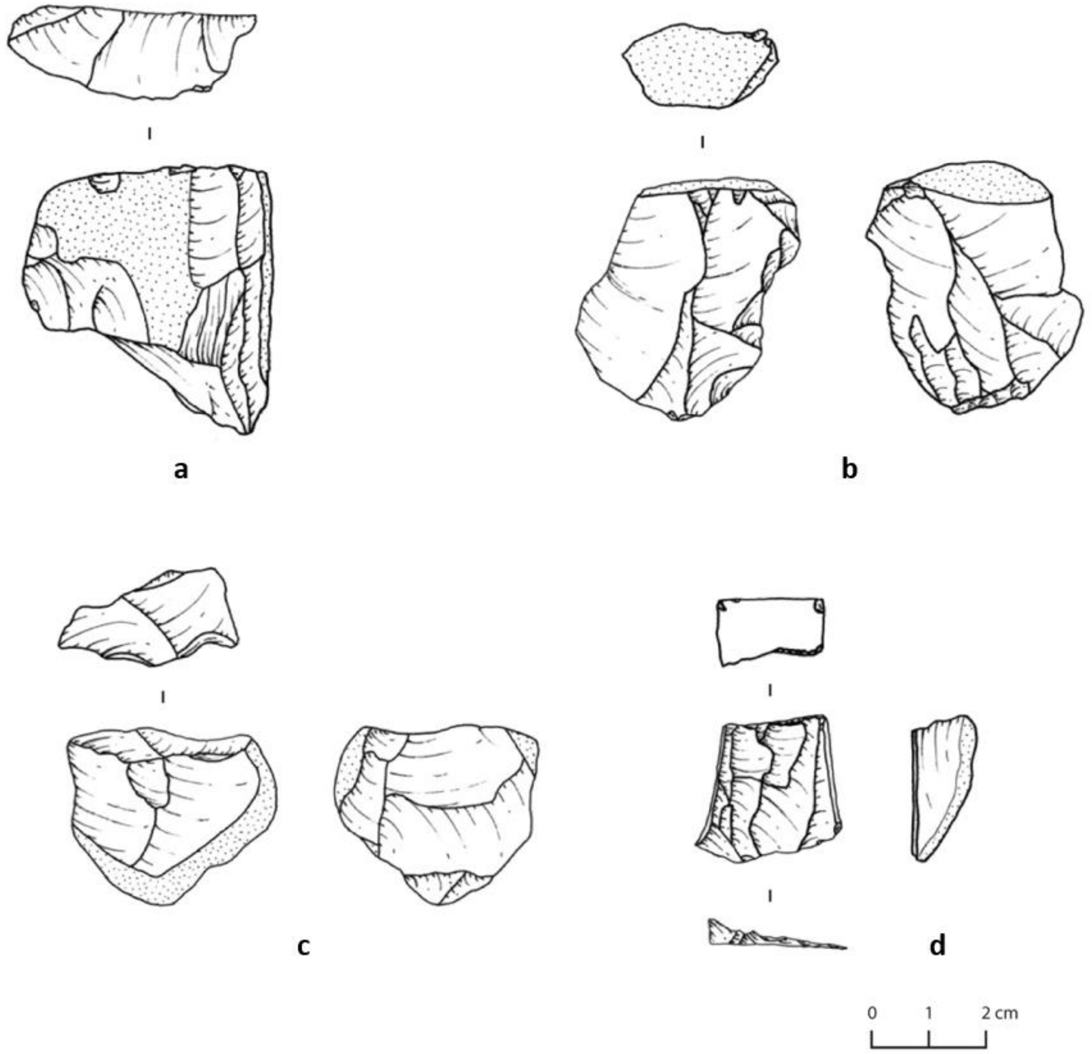
und

Prof. Dr. Nikos Efstratiou, Department of History and Archaeology,

Aristotle University of Thessaloniki, Greece

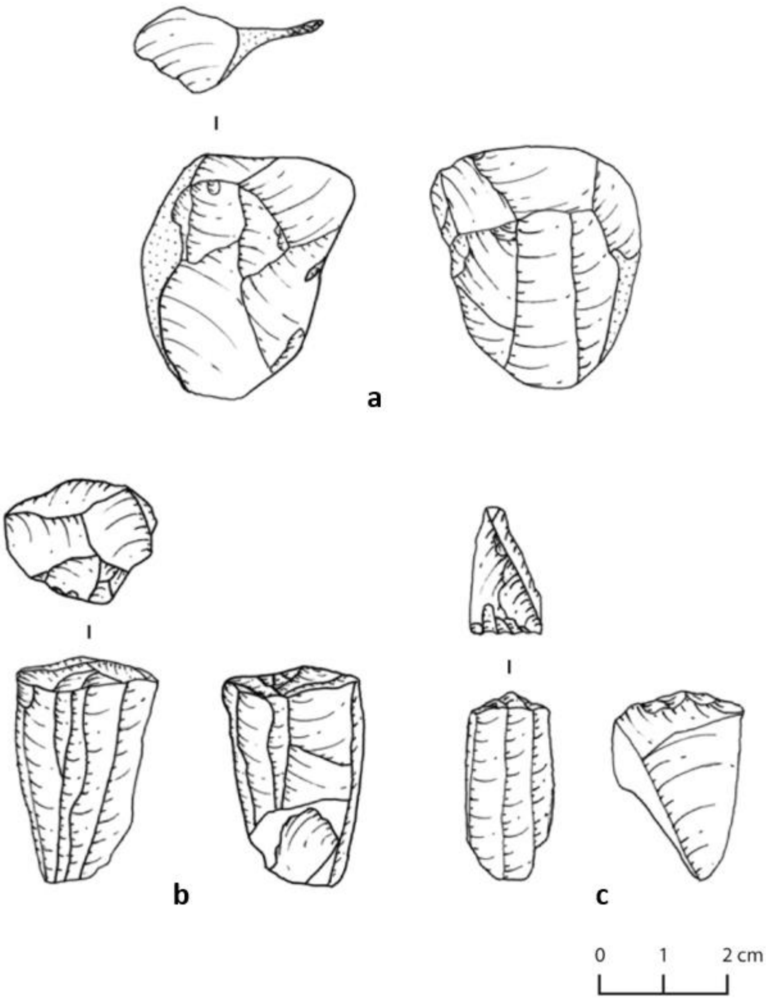
The photographic documentation and graphic representation of the artefacts was performed by the author. Further processing of the original drawings was carried out by Odysseas Metaxas (inking, digital processing).

PLATE I



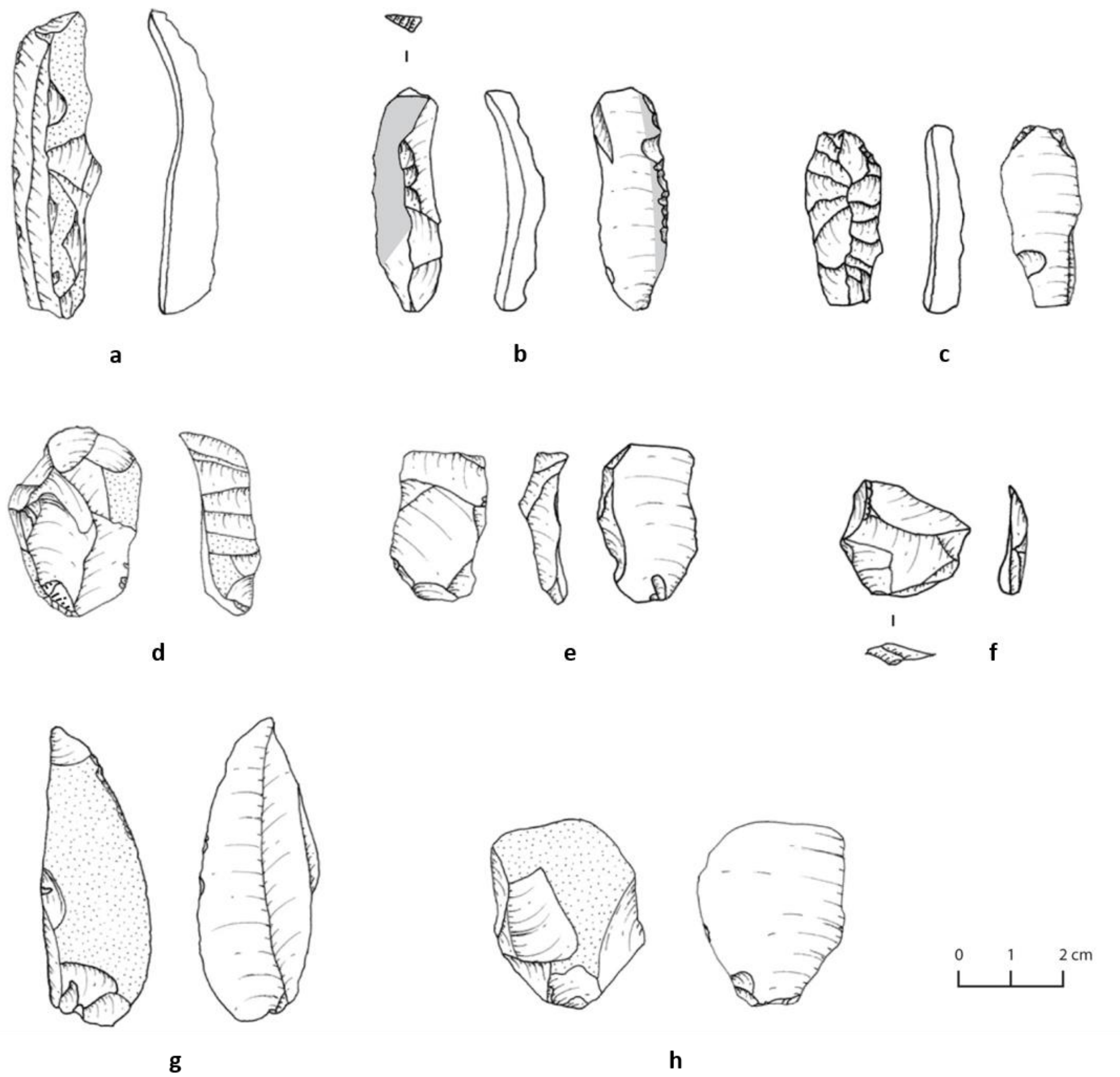
Cores (Late Neolithic): a, b Gray flint, blade and flake cores (A9b.AE1801, A9b.AE5633); c. Radiolarite, flake core (A9b.AE7332); d. Black flint, microblade core (A9b.AE9738).

PLATE II



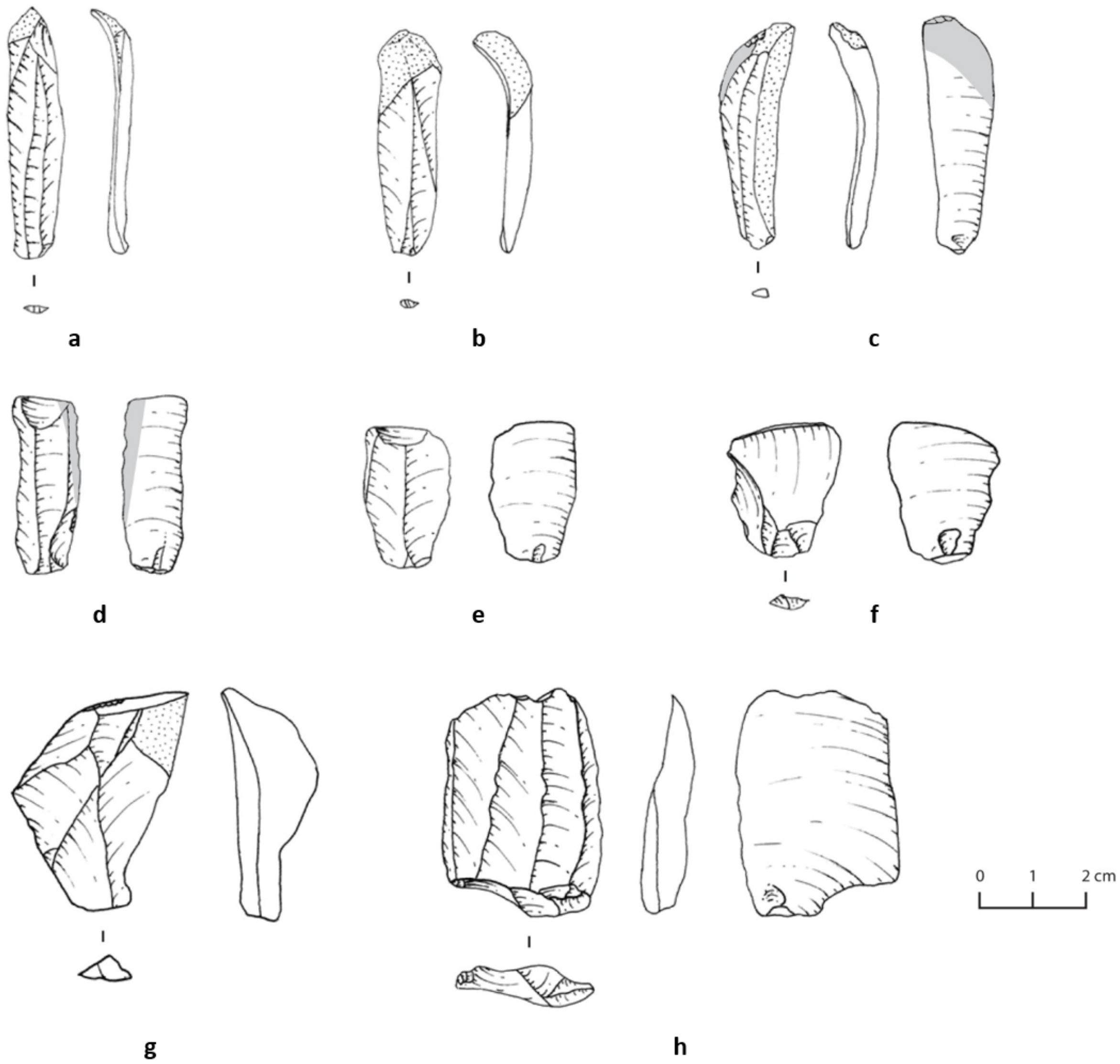
Cores (Final Neolithic): a. Obsidian, flake, blade & microblade core (A9b.AE5654); b, c. Gray flint, microblade cores (A9b.AE5603, A9b.AE5544).

PLATE III



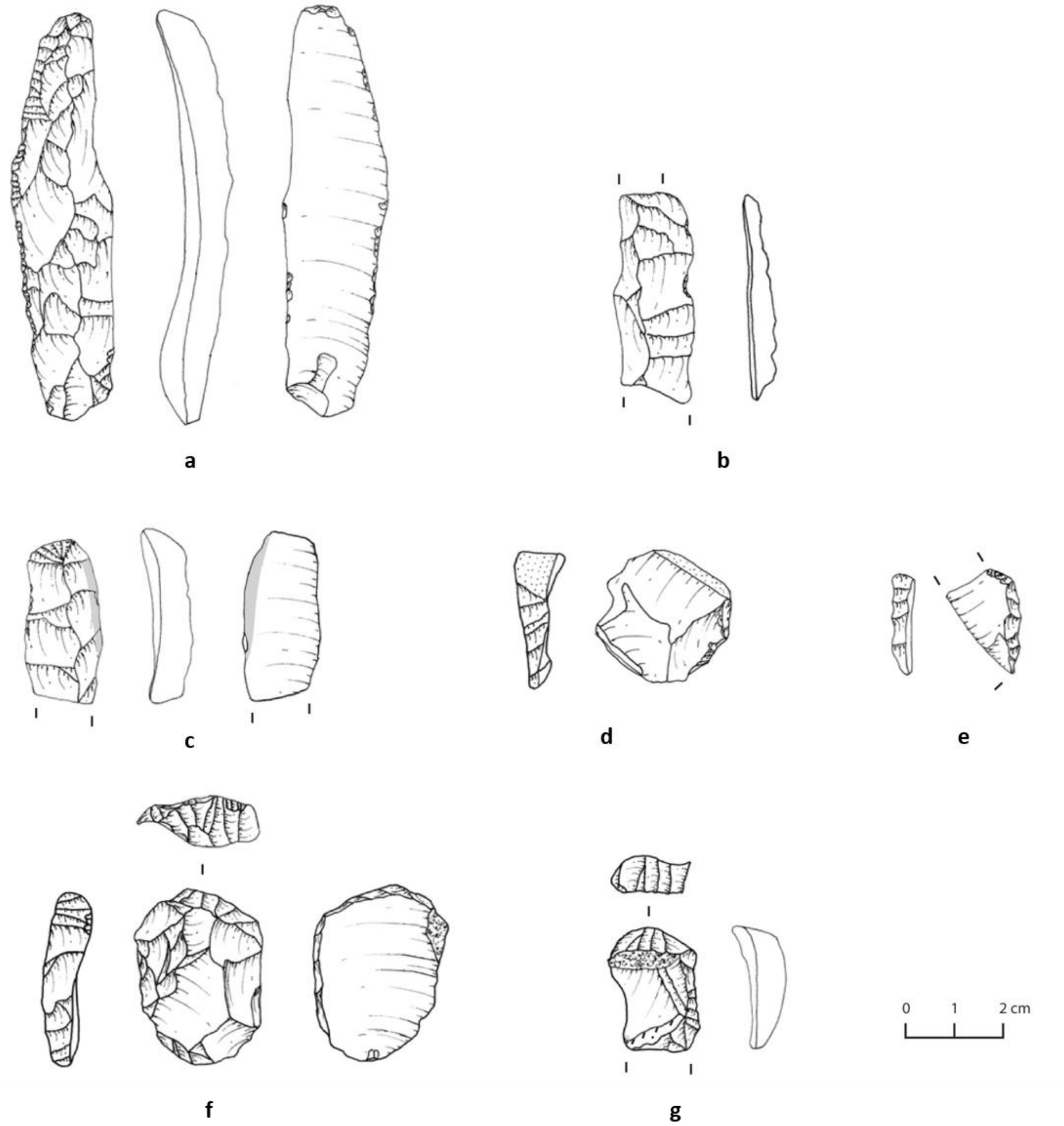
Technical products (Late Neolithic). Crested blades: a, c. Gray flint (A9b. 9359, A9b.AE9719); b. Pale brown flint (A9b.AE4544). Core platform rejuvenation flakes: d, e. Gray flint (A9b.AE8967, A9b.7550); f. Black flint (A9b.AE9036). Cortical flakes: g. Gray flint (A9b.AE9724); h. Chert (A9b.AE9721).

PLATE IV



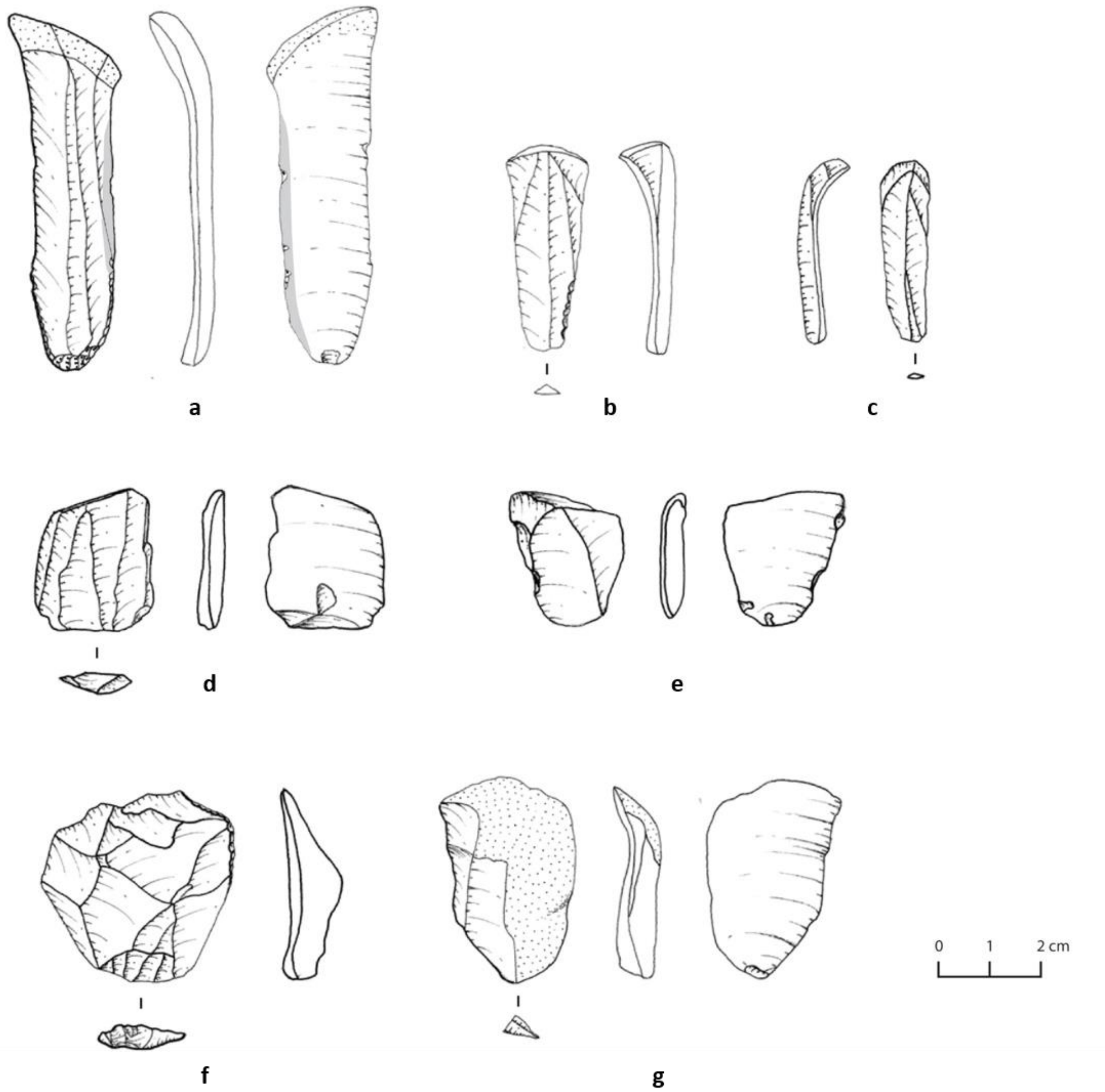
Technical products (Late Neolithic). Plunging blades: a. Pale brown flint (A9b.AE3938); b. Gray flint (A9b.AE8970); c. Black flint (A9b.AE2706). Hinged artefacts: d, e. Gray flint (A9b.AE9674, A9b.AE3892); f. Obsidian (A9b.AE9004). Rejuvenation flakes: g. Black flint (A9b.AE9718); h. Gray flint (A9b.AE7566).

PLATE V



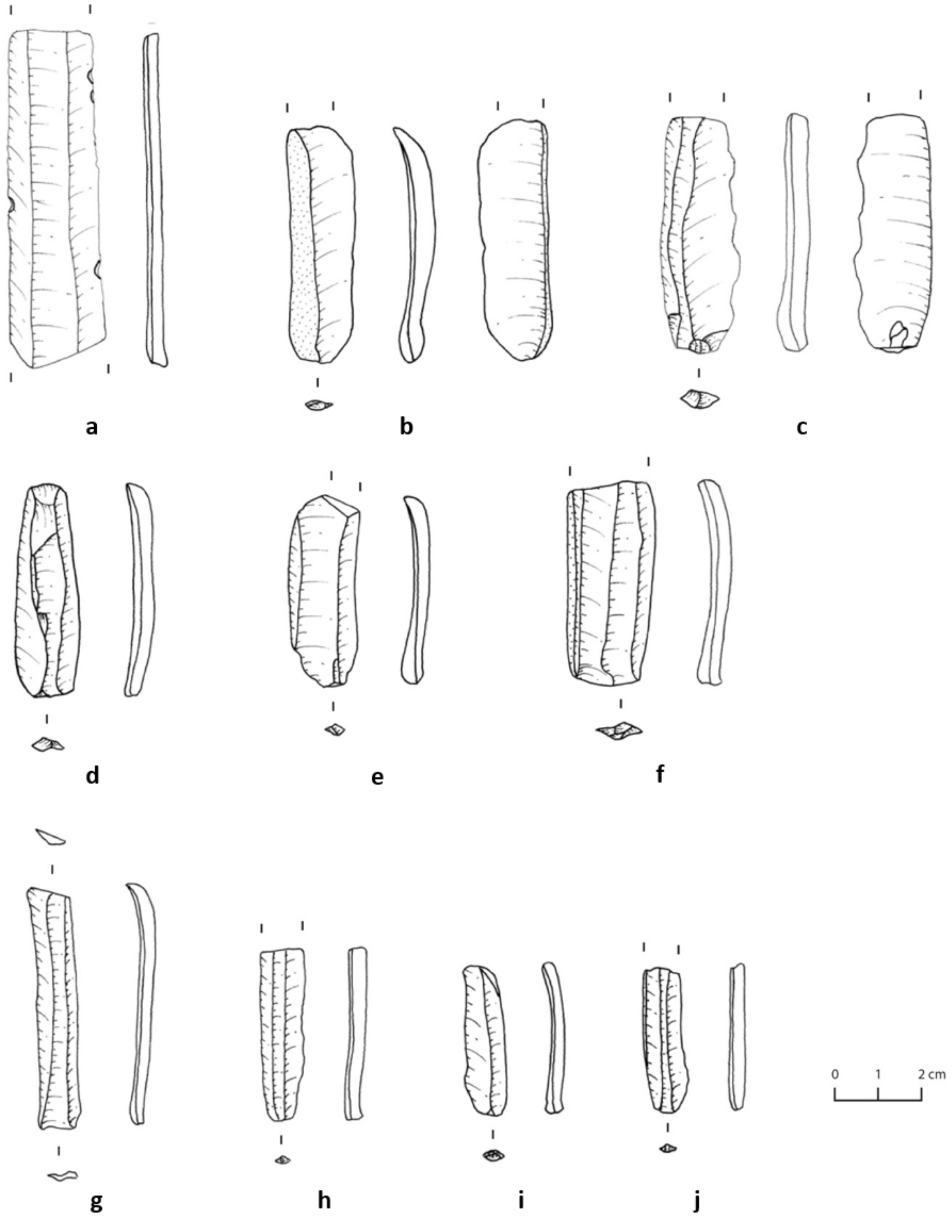
Technical products (Final Neolithic). Crested blades: a. Radiolarite (A9b. 7757); b. Pale brown flint (A9b.AE2293); c. Gray flint (A9b.AE746). Core platform rejuvenation flakes: d. Gray flint (9b.AE5599,); e, g. Obsidian (A9b.5637, A9b.AE5823). Core tablet: f. Gray flint (A9b.AE5889).

PLATE VI



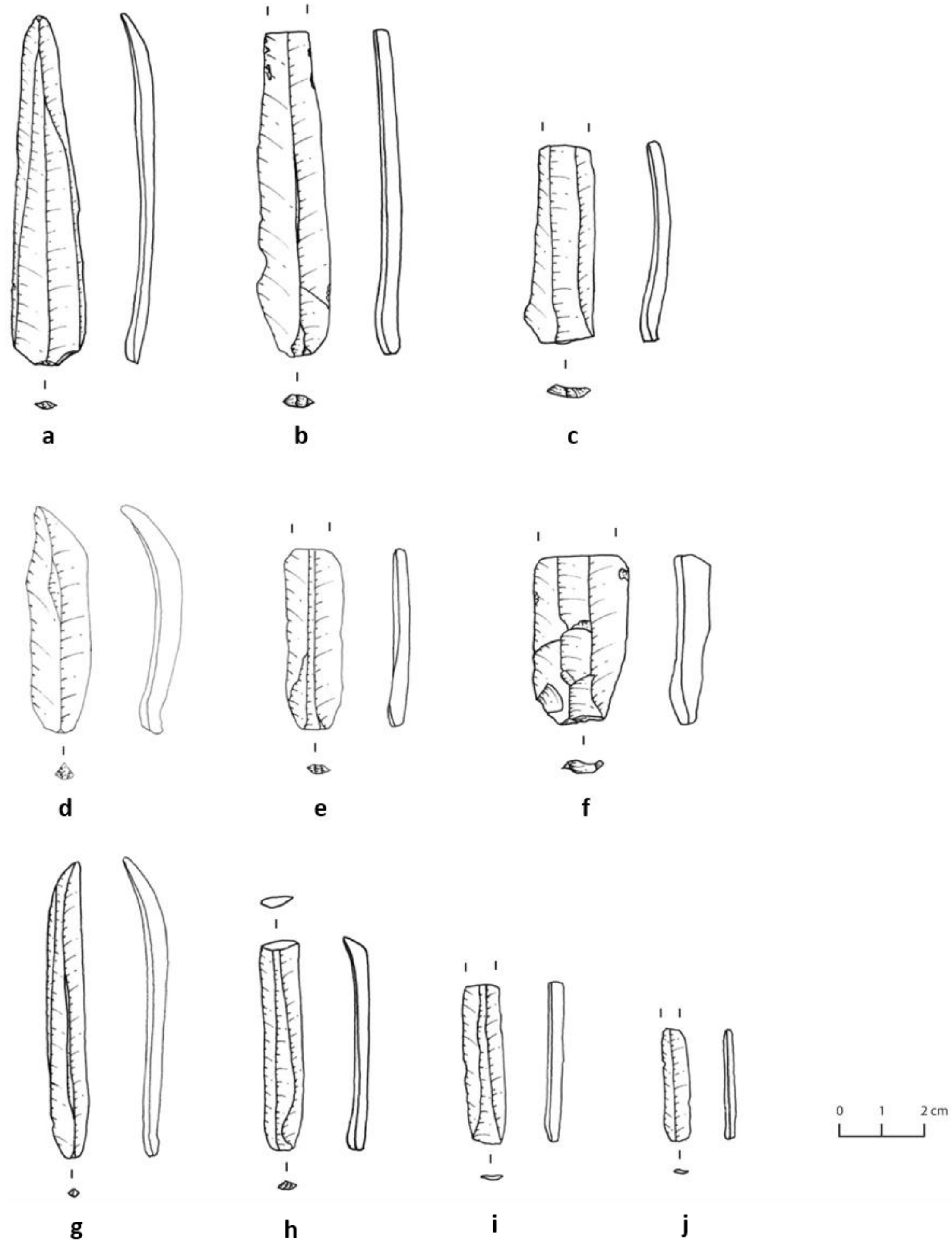
Technical products (Final Neolithic). Plunging blades: a. Olive flint (A9b.AE4975); b. Pale brown flint (A9b.AE669); c. Obsidian (A9b.AE3488). Hinged artefacts: d, e. Gray flint (A9b.AE5557, A9b.AE6060). Rejuvenation flakes: f. Radiolarite (A9b.AE5904). Cortical flakes: g. Gray flint (A9b.AE6136).

PLATE VII



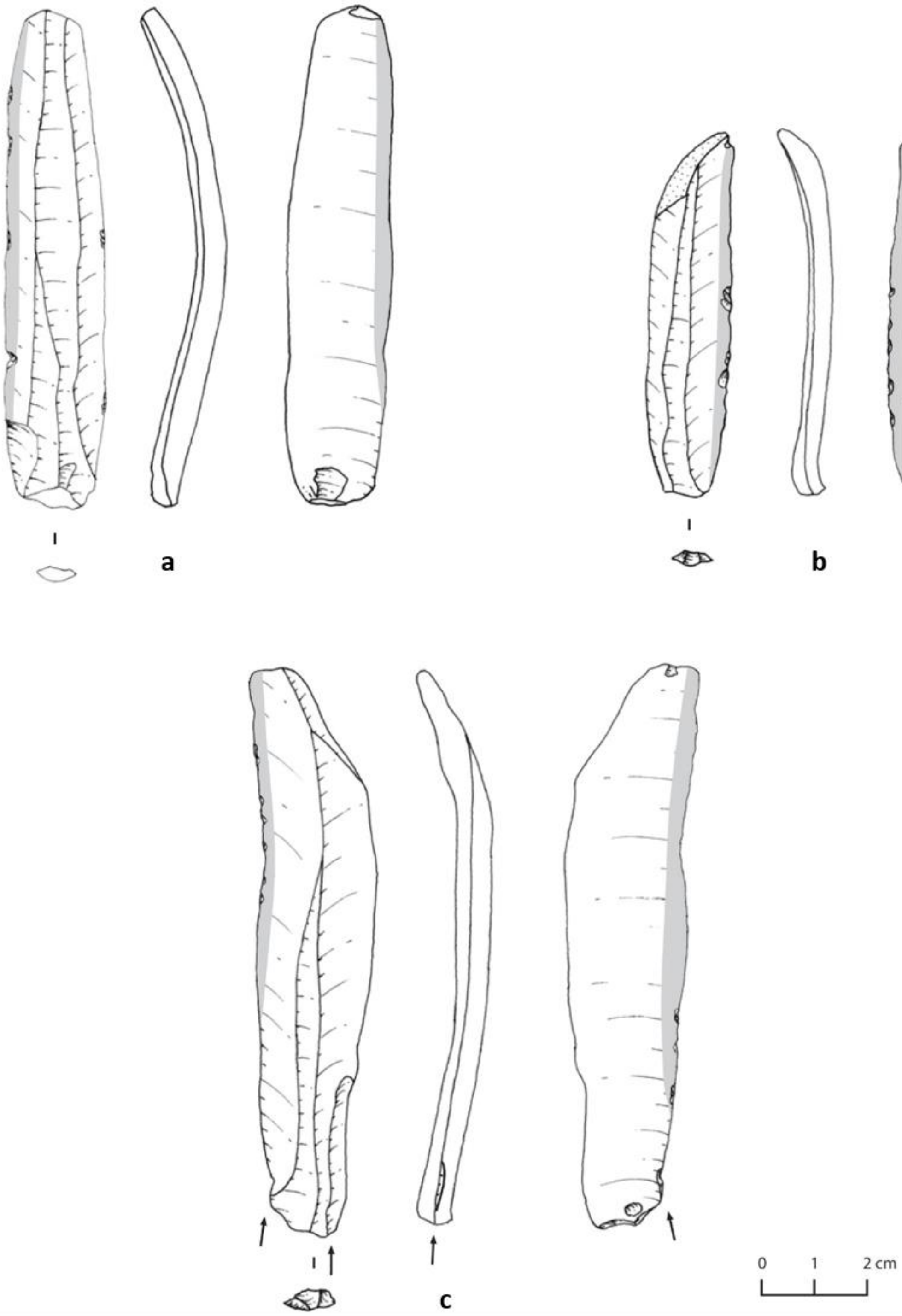
Unretouched blades & microblades (Late Neolithic). Blades: a. Yellowish brown flint (A9b.AE9705); b, d, e. Gray flint (A9b.AE9470, A9b.AE9676, A9b.AE502); c. Obsidian (A9b.AE510); f. Black flint (A9b.AE2387). Microblades: g, j. Obsidian (A9b.AE2790, A9b.AE3856); h. Gray flint (A9b.AE9459); i. Black flint (A9b.AE6734).

PLATE VIII



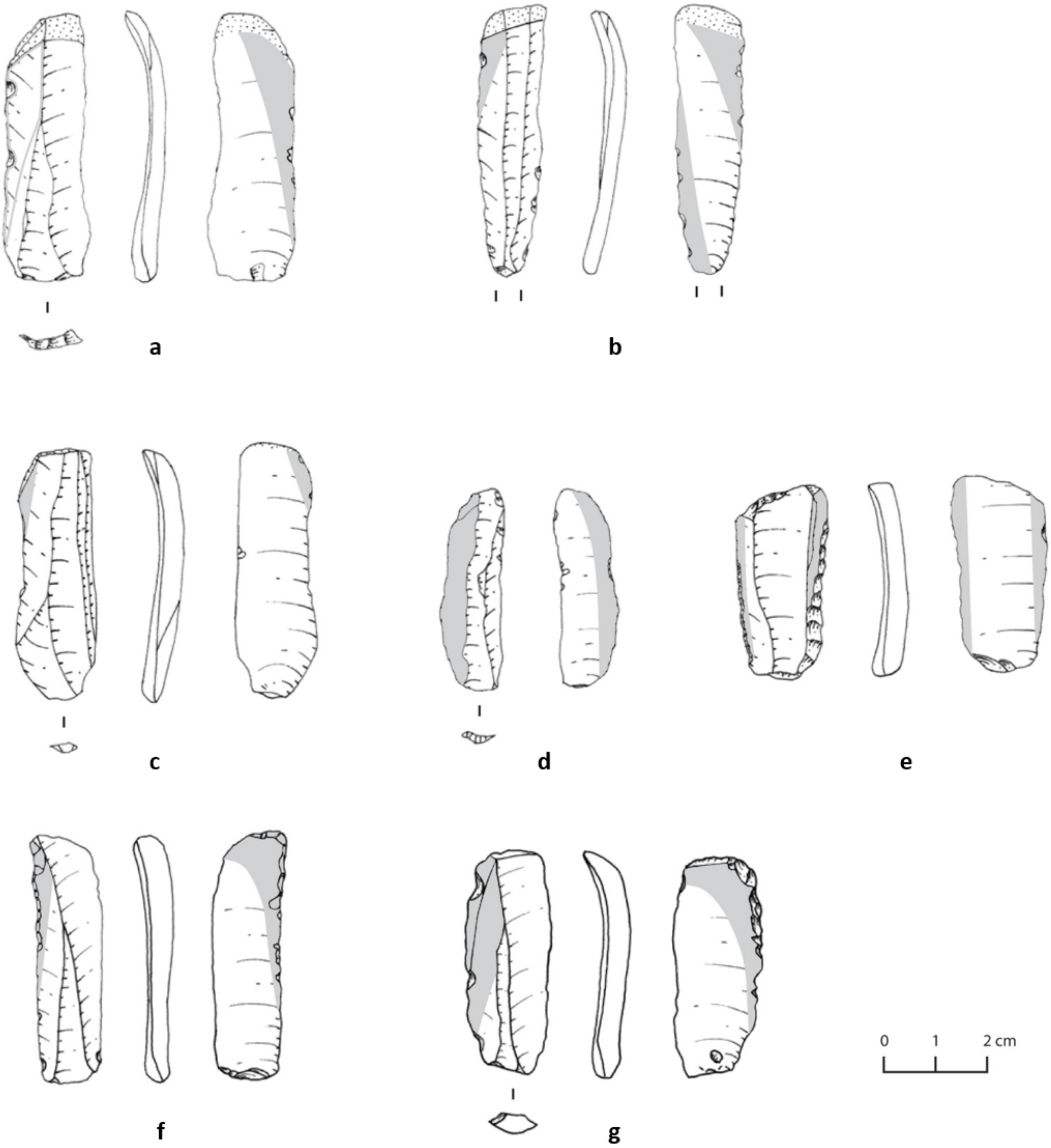
Unretouched blades & microblades (Final Neolithic). Blades: a, d. Gray flint (A9b.AE7024, A9b.AE3785); b. Yellowish brown flint (A9b.AE3859); c. Radiolarite (A9b.AE3785); e, f. Obsidian (A9b.AE3041, A9b.AE4066). Microblades: g, h. Pale brown flint (A9b.AE1876, A9b.AE3420); i, j. Obsidian (A9b.AE738, A9b.AE2986).

PLATE IX



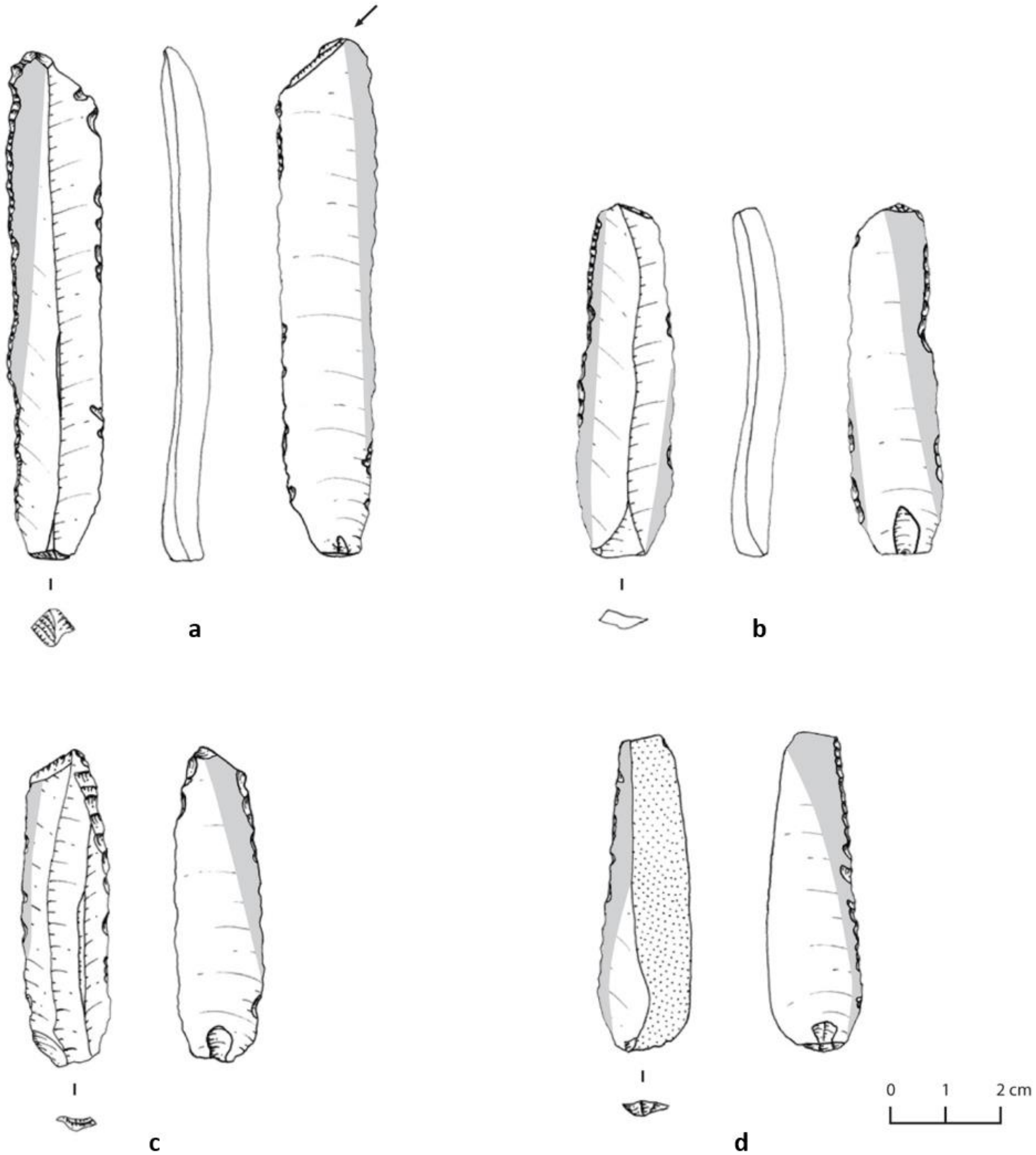
Sickle blades. Late Neolithic: a. Chert (A9b.AE8297); b. Gray flint (A9b.AE5411). Final Neolithic: c. Gray flint (A9b.AE8371).

PLATE X



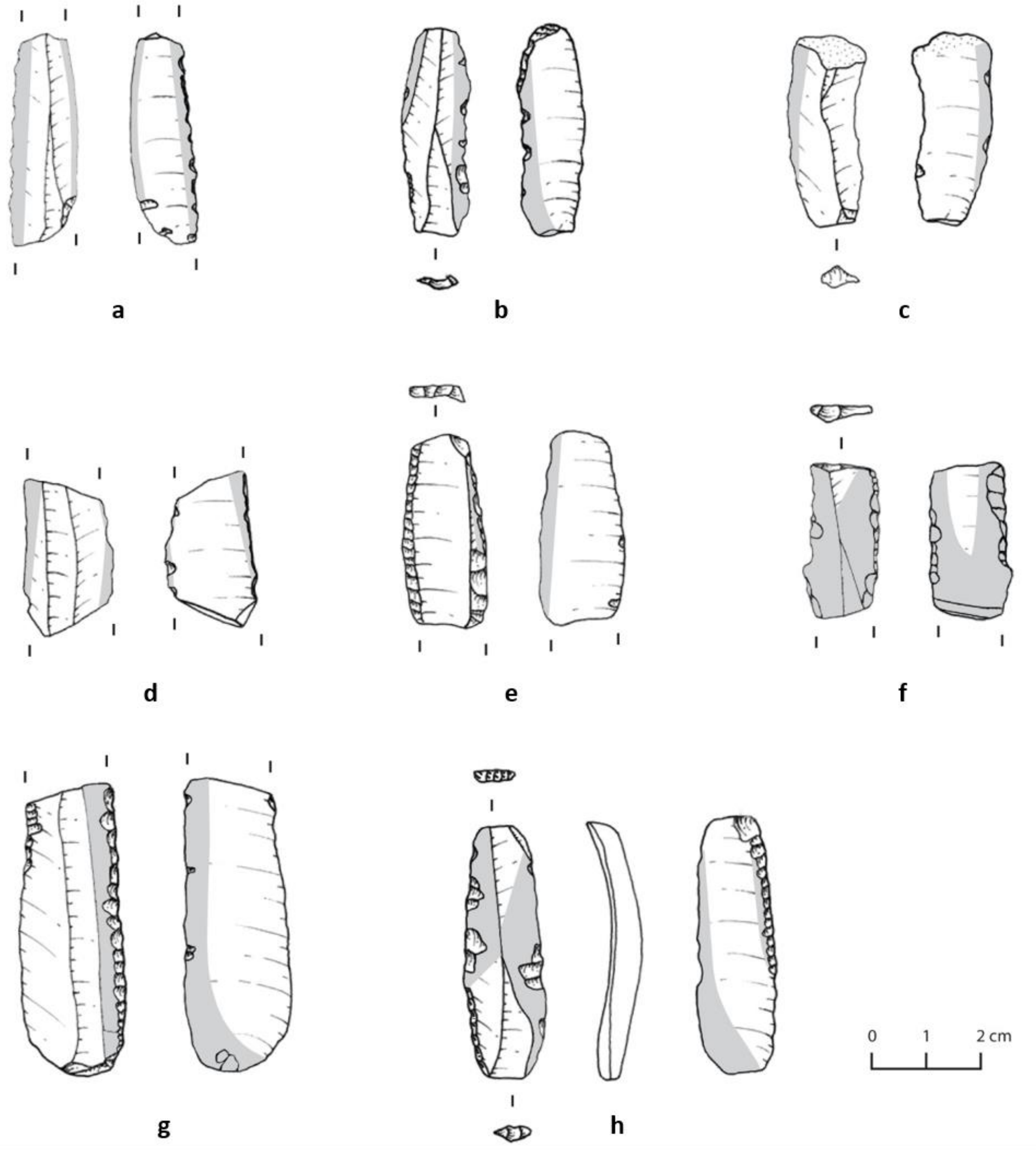
Sickle blades & sickle elements (Late Neolithic). Sickle blades: a-c. Gray flint (A9b.AE4414, A9b.AE4381, A9b.AE283). Sickle elements: d. Black flint (A9b.AE4366). Retouched sickle elements: e. Radiolarite (A9b.AE9215), f. Black flint (A9b.AE9803), g. Gray flint (A9b.AE5143).

PLATE XI



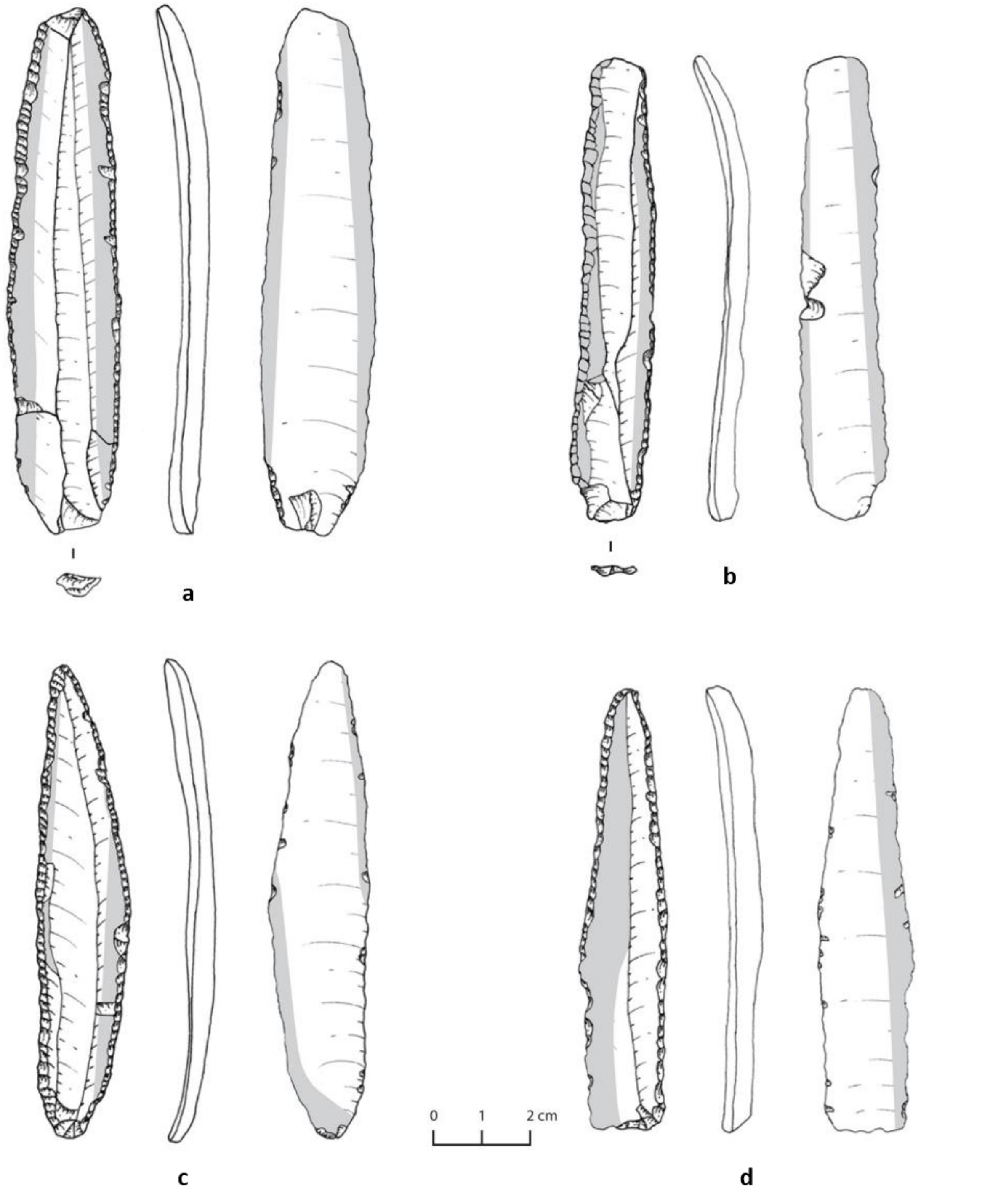
Retouched sickle blades (Late Neolithic): a, b, d. Gray flint (A9b.AE9230, A9b.AE5421, A9b.AE9815); c. Pale brown flint (A9b.AE505).

PLATE XII



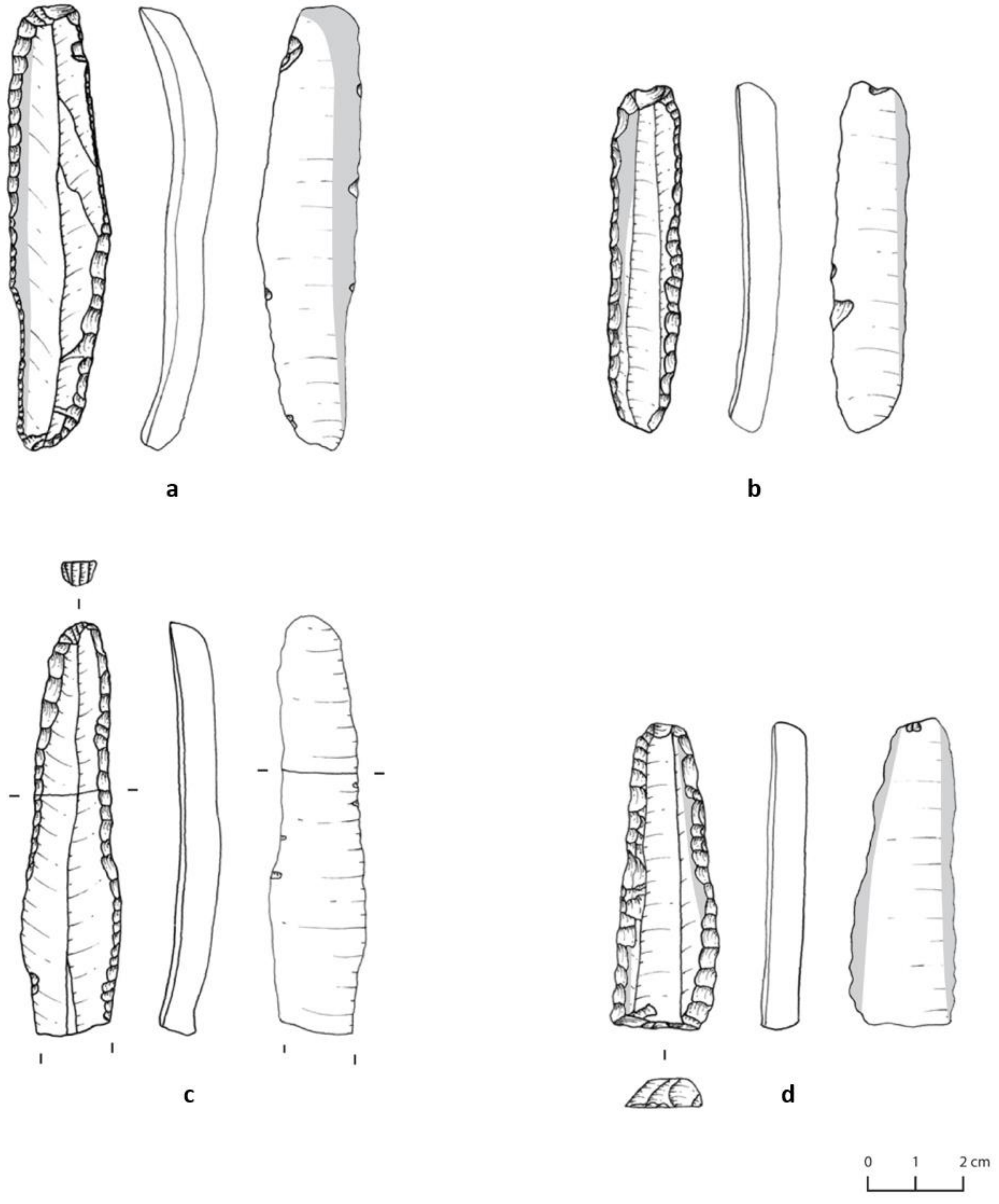
Sickle elements (Final Neolithic). Unretouched: a. Pale brown flint (A9b.AE9370); c. Chalcedony (A9b.AE1193); d. Yellowish brown flint (A9b.AE354). Retouched: e, h. Pale brown flint (A9b.AE8280, A9b.AE5313); b, f. Radiolarite (A9b.AE9375, A9b.AE8569). Retouched sickle blade: g. Olive (A9b.AE8546).

PLATE XIII



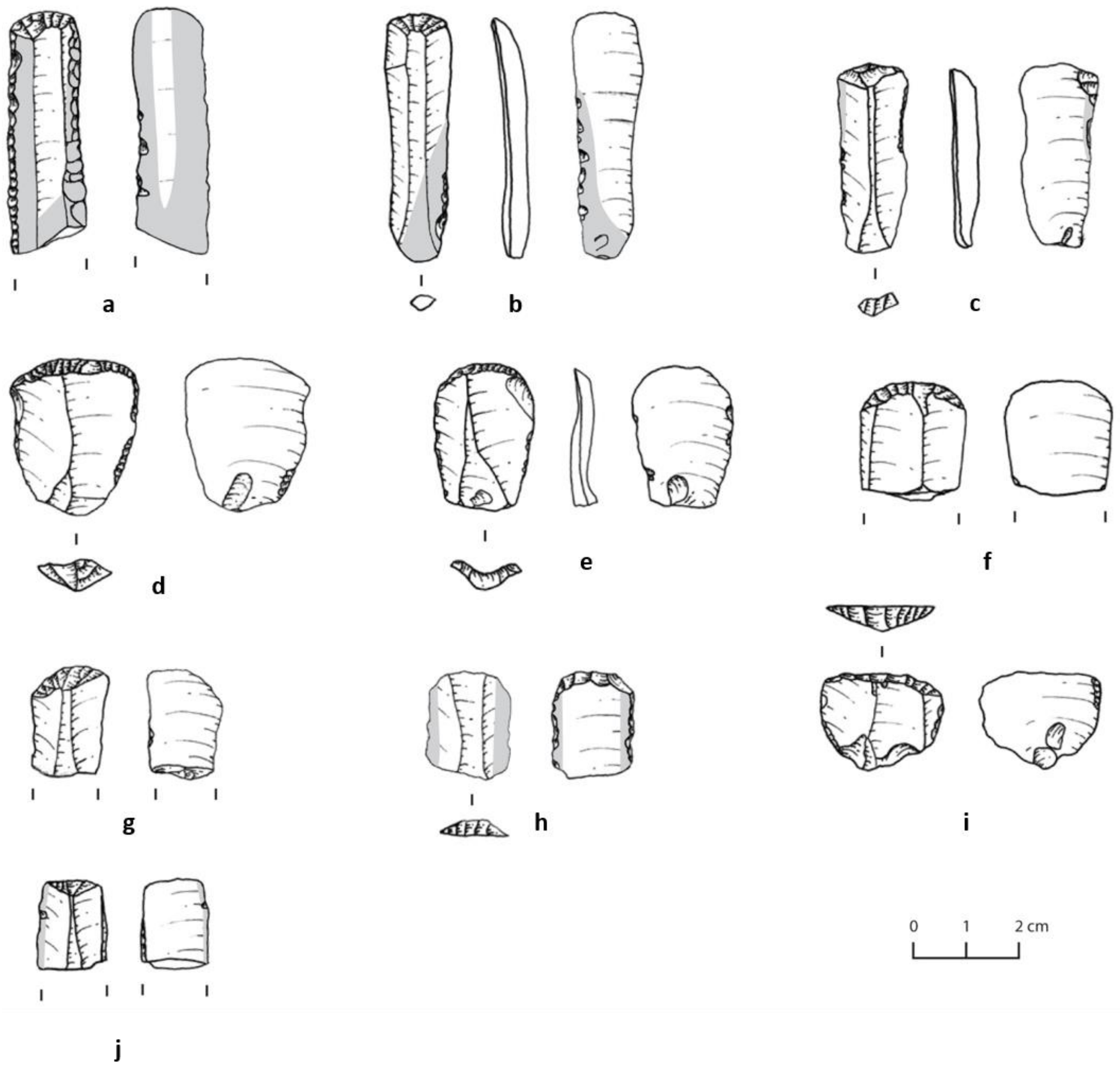
Retouched sickle blades (Final Neolithic): a, b, c. Gray flint (A9b.AE7728, A9b.AE8269, A9b.AE8265); d. Radiolarite (A9b.AE8413).

PLATE XIV



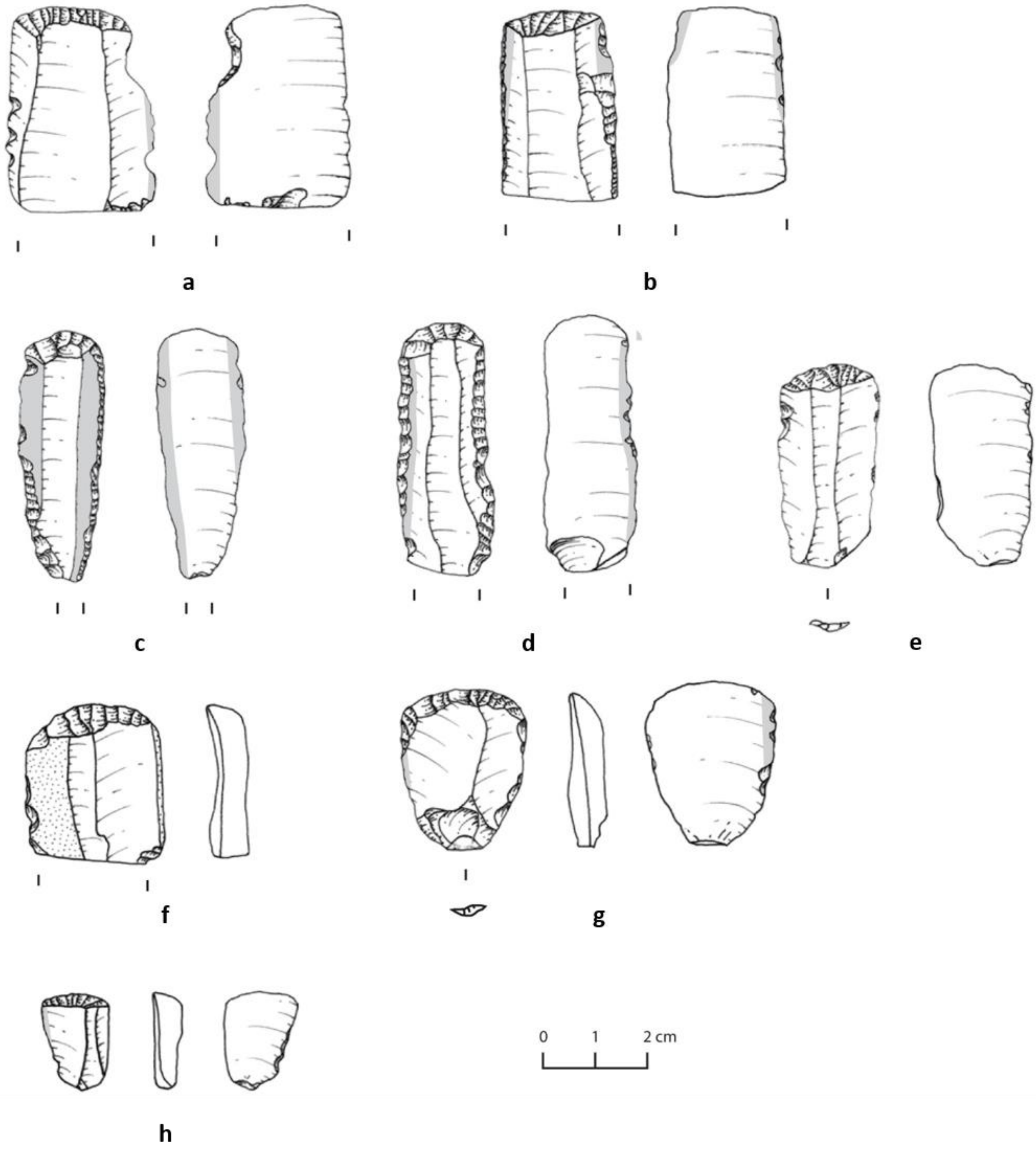
Blades with heavy bilateral retouch. Late Neolithic: a. Radiolarite (A9b.AE8674); b. Chert (A9b.AE9232). Final Neolithic: c. Gray flint (A9b.AE7752); d. Pale brown flint (A9b.AE8445).

PLATE XV



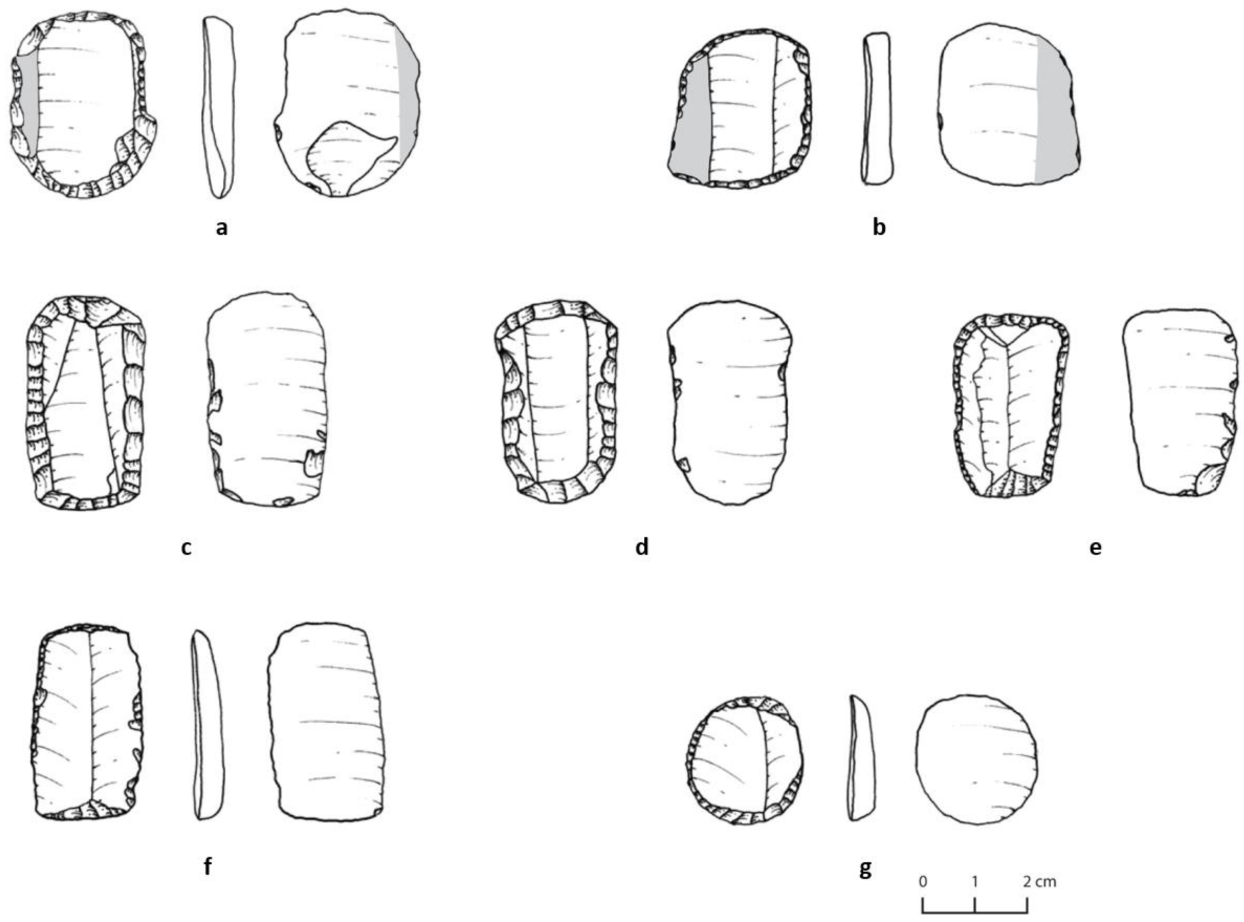
End-scrapers (Late Neolithic). Type A: d, e. Radiolarite (A9b.AE9866, A9b.AE8390); a, b, c, f, g. Gray flint (A9b.AE8687, A9b.AE9228, A9b.AE8571, A9b.AE9833, A9b.AE9796). Type B: j. Gray flint (A9b.AE651). Type C: h. Gray flint (A9b.AE9806); i. Obsidian (A9b.AE8305).

PLATE XVI



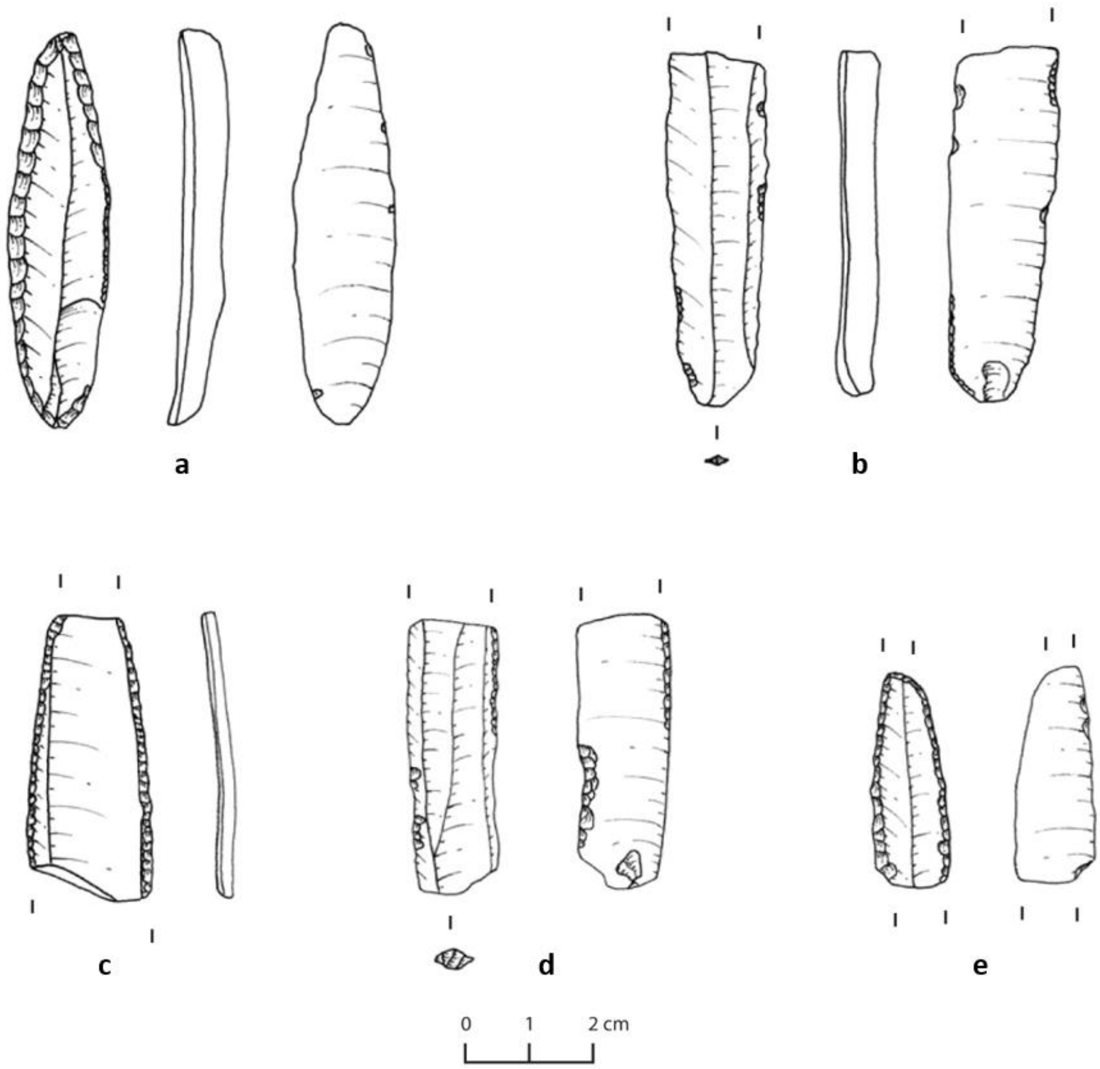
End-scrapers (Final Neolithic). Type A: a, d, e. Radiolarite (A9b.AE8505, A9b.AE4569, A9b.AE8463); c, g. Yellowish brown flint (A9b.AE8649, A9b.AE4973); f. Olive flint (A9b.AE7699). Type B: b. Radiolarite (A9b.AE8606); h. Gray flint (A9b.AE7903).

PLATE XVII



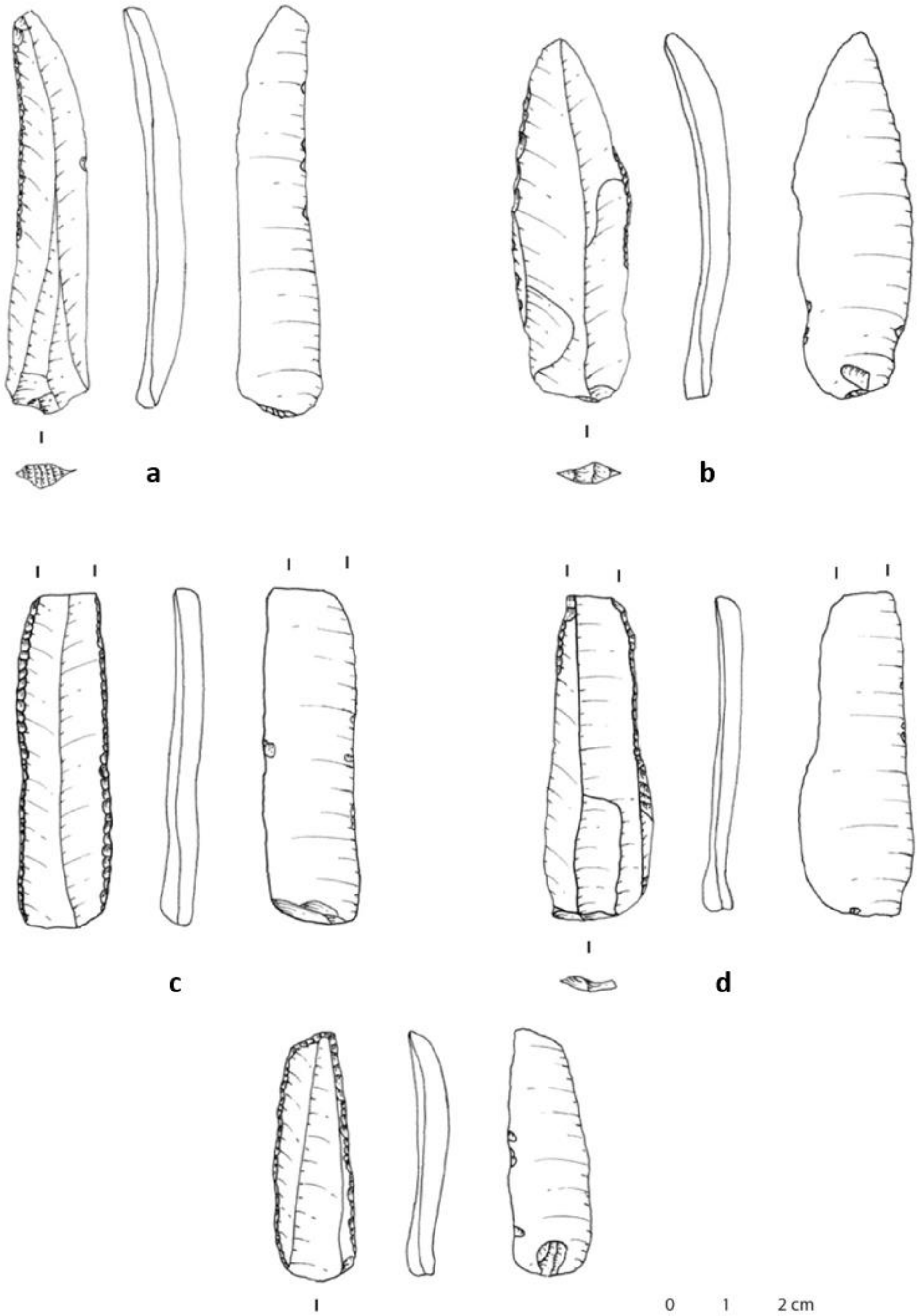
Double end-scrapers. Late Neolithic, Type A: a. Gray flint (A9b.AE8296); b. Pale brown flint (A9b.AE5156). Final Neolithic, Type A: c. Pale brown flint (A9b.AE5352); d. Gray flint (A9b.AE4655); e. Radiolarite (A9b.AE8540). Type B: f. Gray flint (A9b.AE9884). Type C: g. Pale brown flint (A9b.AE4956).

PLATE XVIII



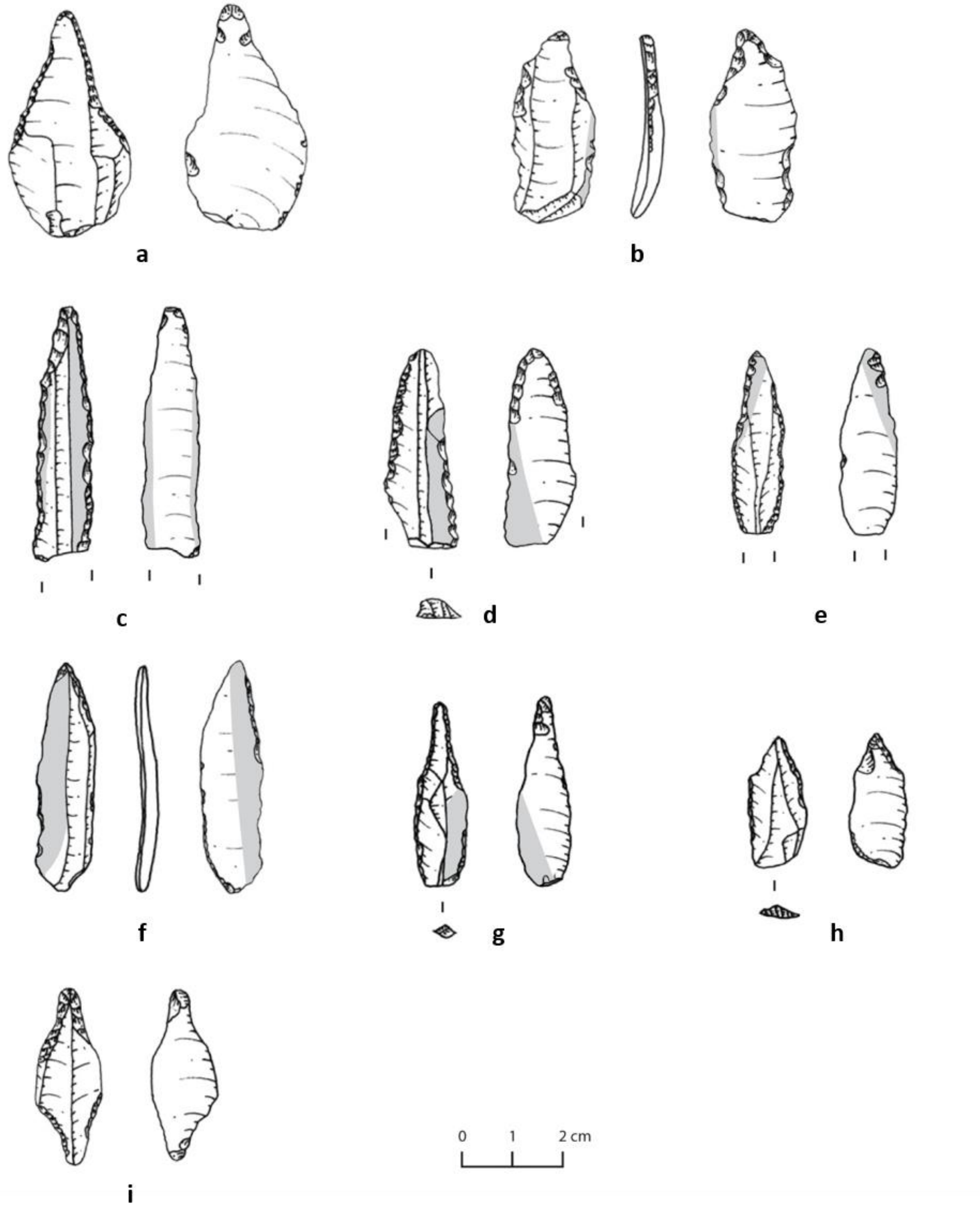
Blades with lateral/bilateral retouch (Late Neolithic): a. Radiolarite (A9b.AE8372); b. Obsidian (A9b.AE4363); c, d. Gray flint (A9b.AE9183, A9b.AE9825); e. Pale brown flint (A9b.AE9187).

PLATE XIX



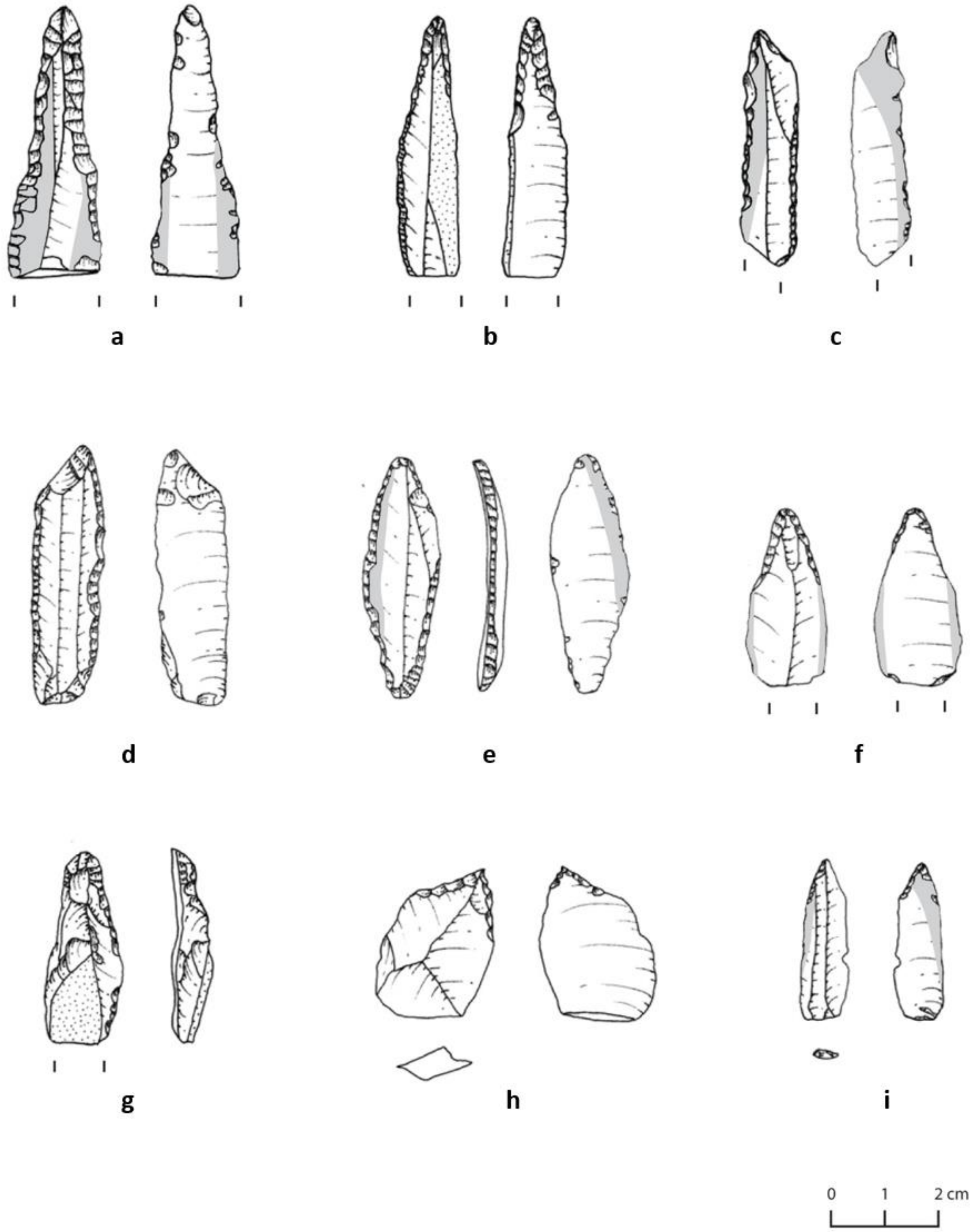
Blades with lateral/bilateral retouch (Final Neolithic): a. Olive flint (A9b.AE8647); b, c, d. Radiolarite (A9b.AE7645, A9b.AE8492, A9b.AE8479); e. Obsidian (A9b.AE5135).

PLATE XX



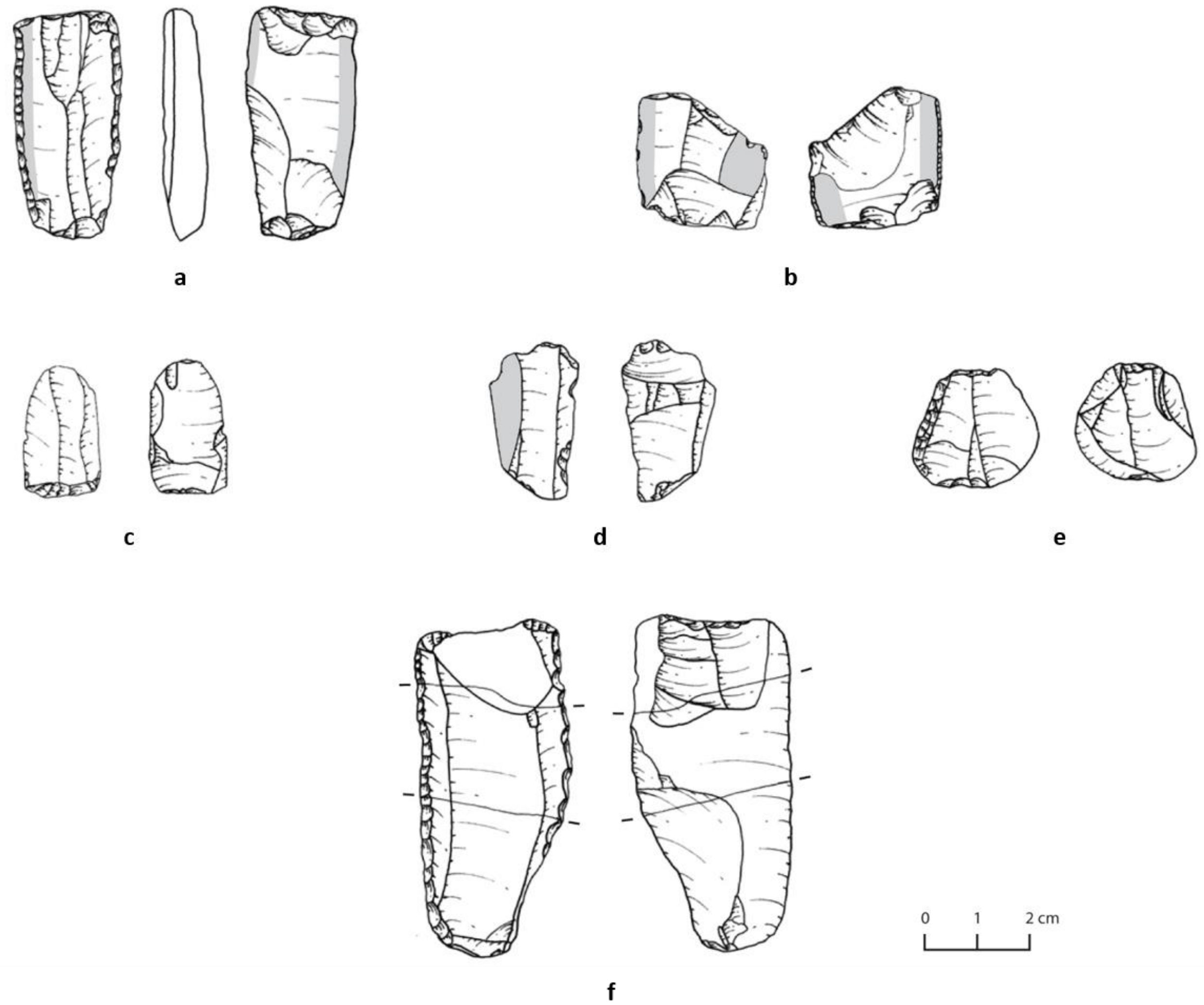
Perforating tools (Late Neolithic). Type A: a. Chert (A9b.AE8243); b. Pale brown flint (A9b.AE8470); f. Gray flint (A9b.AE9765); h. Reddish brown flint (A9b.AE8455). Type B: c, g. Gray flint (A9b.AE8471, A9b.AE9116); d, e. Pale brown flint (A9b.AE7898, A9b.AE8395). **Double perforating tool**: i. Gray flint (A9b.AE8983).

PLATE XXI



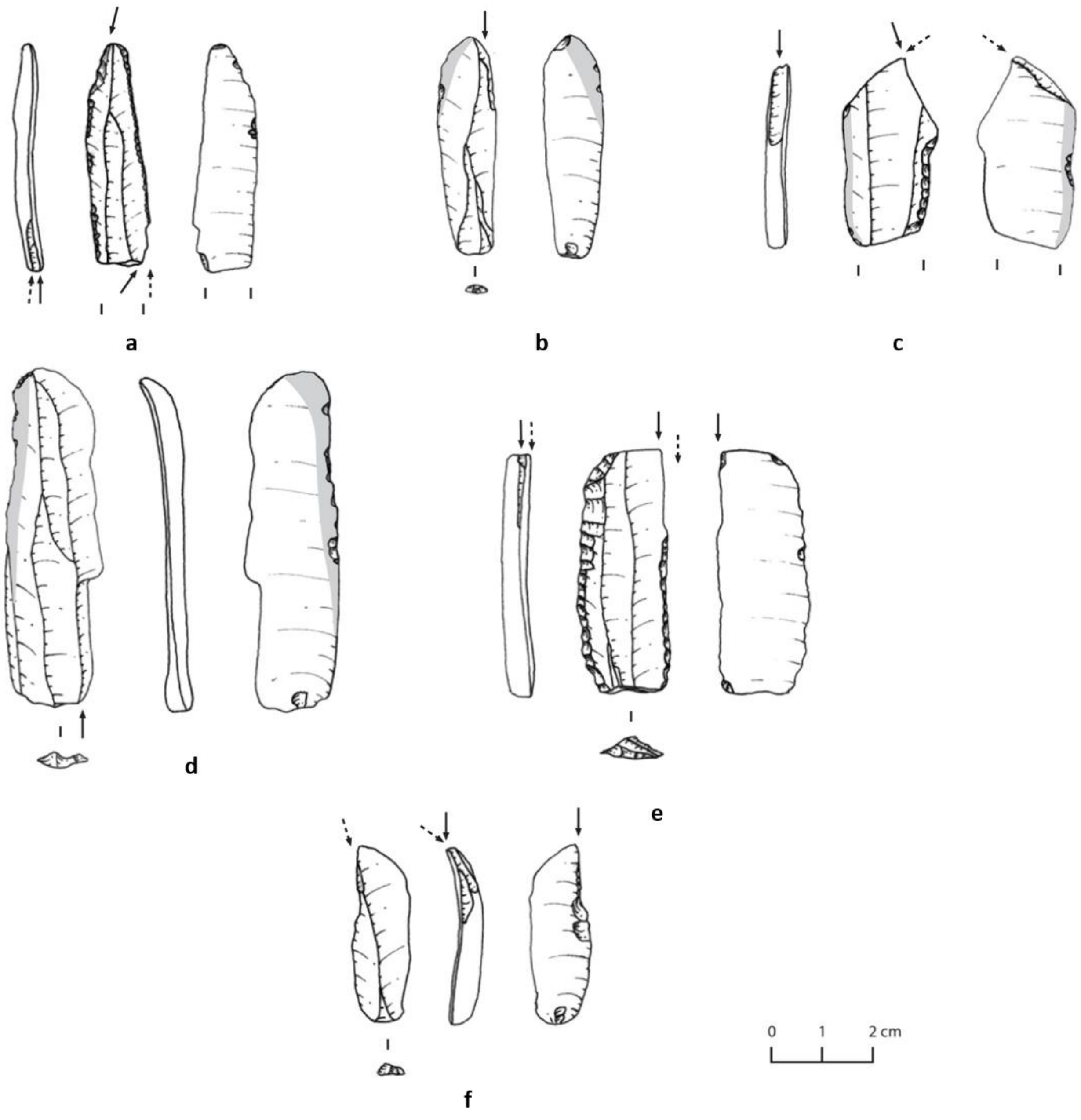
Perforating tools (Final Neolithic). Type A: f, g, h. Gray flint (A9b.AE8213, A9b.AE471, A9b.AE5002). Type B: a, e. Pale brown flint (A9b.AE7891, A9b.AE8532); c. Chalcedony (A9b.AE8472); b, d. Gray flint (A9b.AE8477, A9b.AE7696). Type C: i. Gray flint (A9b.AE4294).

PLATE XXII



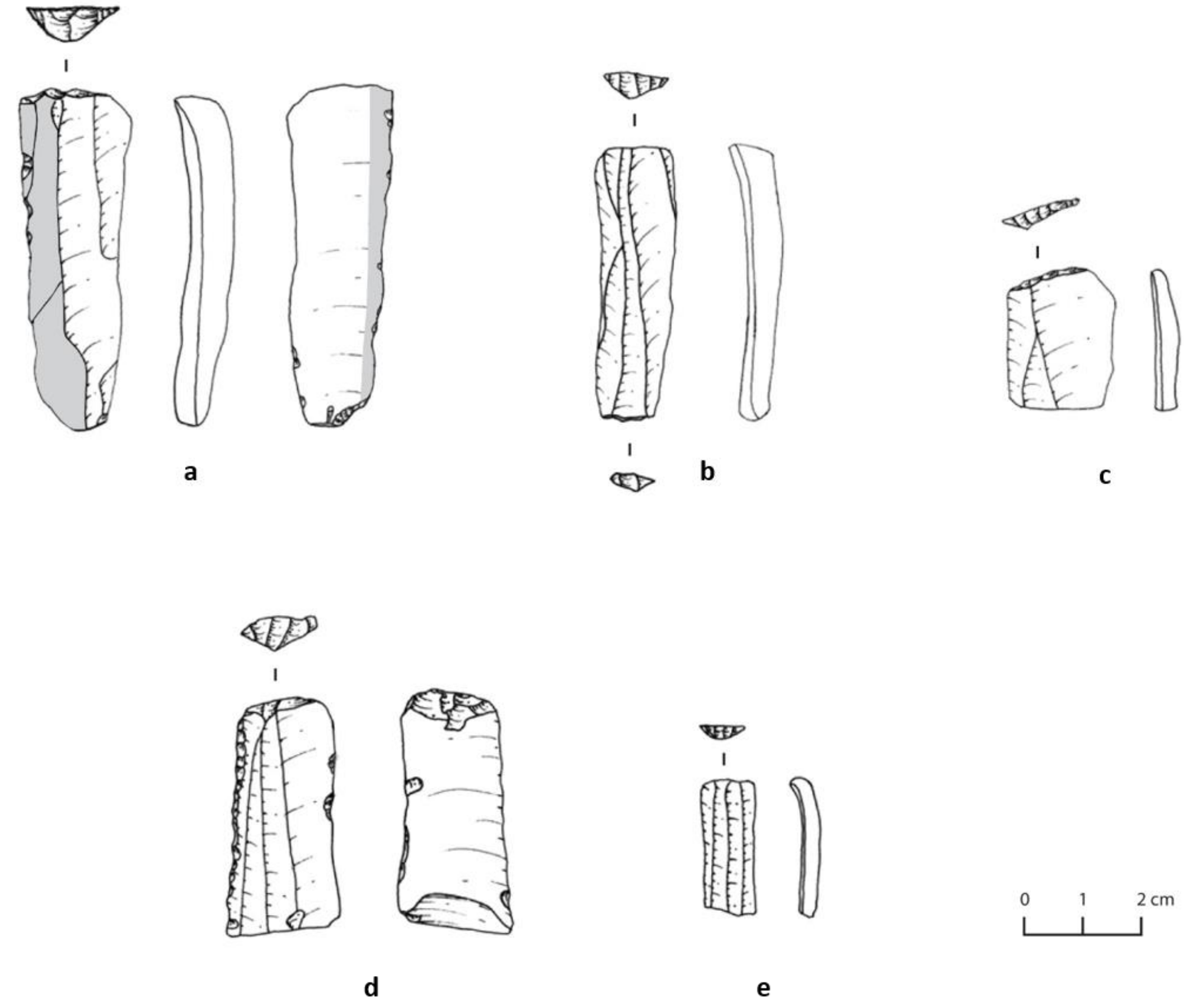
Splintered pieces. Late Neolithic: a. Gray flint (A9b.AE4571); b. Yellowish brown flint (A9b.AE2599); c. Pale brown flint (A9b.AE6549). Final Neolithic: d, f. Yellowish brown flint (A9b.AE6932, A9b.AE5154/6940); e. Radiolarite (A9b.AE5688).

PLATE XXIII



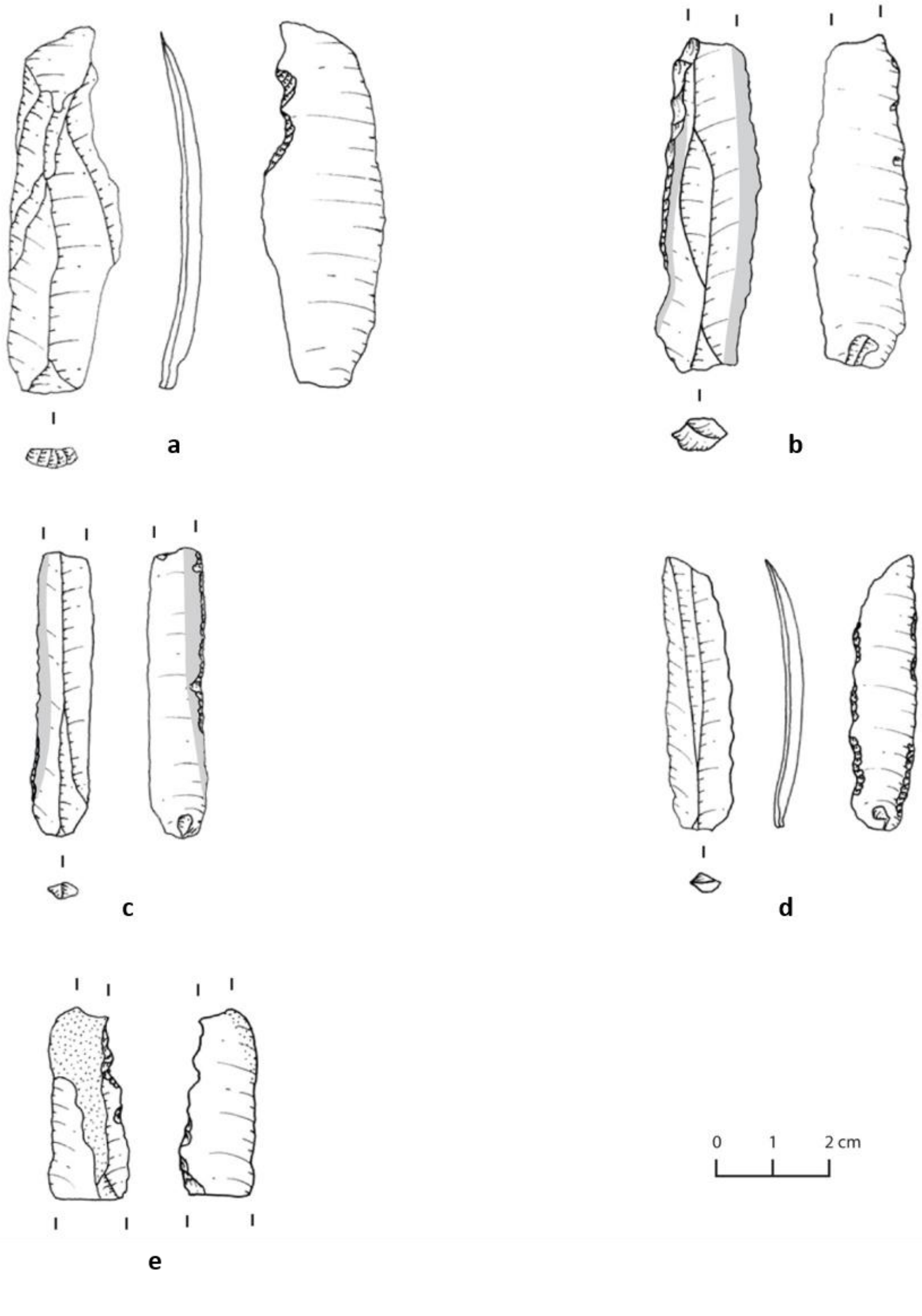
Burins. Late Neolithic: a, b. Gray flint (A9b.AE9171, A9b.AE9255); c. Yellowish brown flint (A9b.AE7731). Final Neolithic: d. Yellowish brown flint (A9b.AE4136); e. Chert (A9b.AE8528); f. Obsidian (A9b.AE2496).

PLATE XXIV



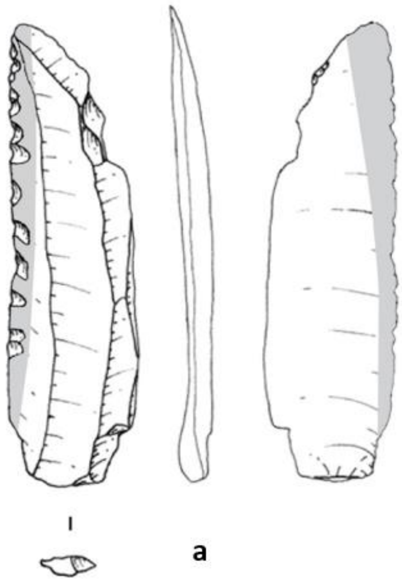
Truncations. Late Neolithic: b. Gray flint (A9b.AE9897); c. Pale brown flint (A9b.AE3130). Final Neolithic: a. Gray flint (A9b.AE9048); d. Yellowish brown flint (A9b.AE7895); e. Obsidian (A9b.AE8912).

PLATE XXV

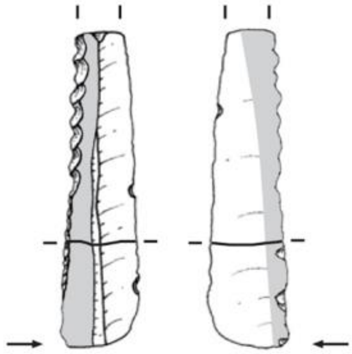


Denticulated tools (Late Neolithic): a. Obsidian (A9b.AE848); b, d. Pale brown flint (A9b.AE7714, A9b.AE500); c. Radiolarite (A9b.AE4512); e. Gray flint (A9b.AE9841).

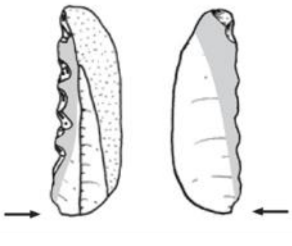
PLATE XXVI



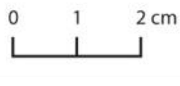
a

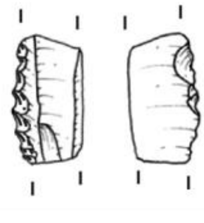


b



c

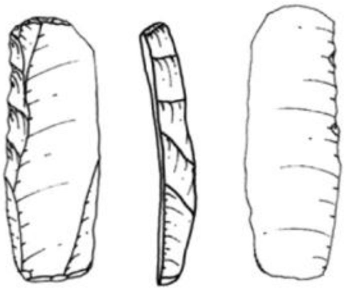




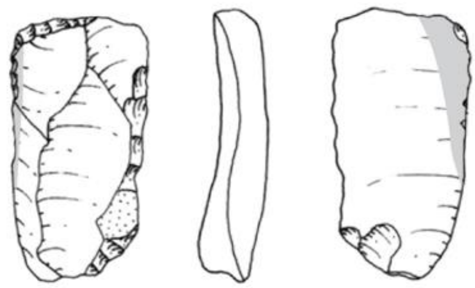
d

Denticulated tools (Final Neolithic): a, b, c. Pale brown flint (A9b.AE4633, A9b.AE4654, A9b.AE5039); d. Obsidian (A9b.AE9861).

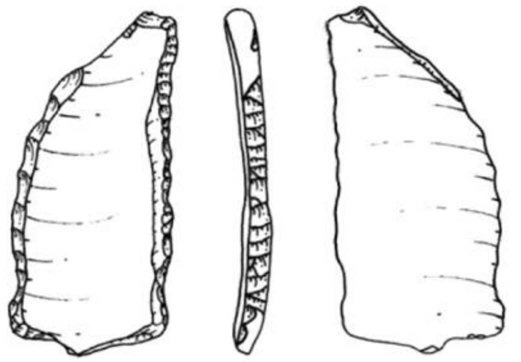
PLATE XXVII



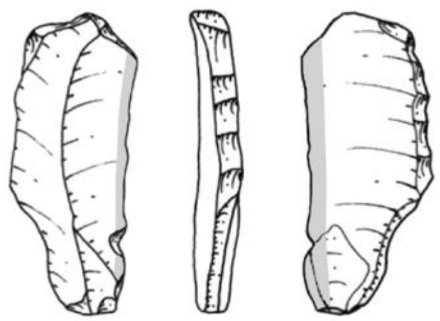
a



b



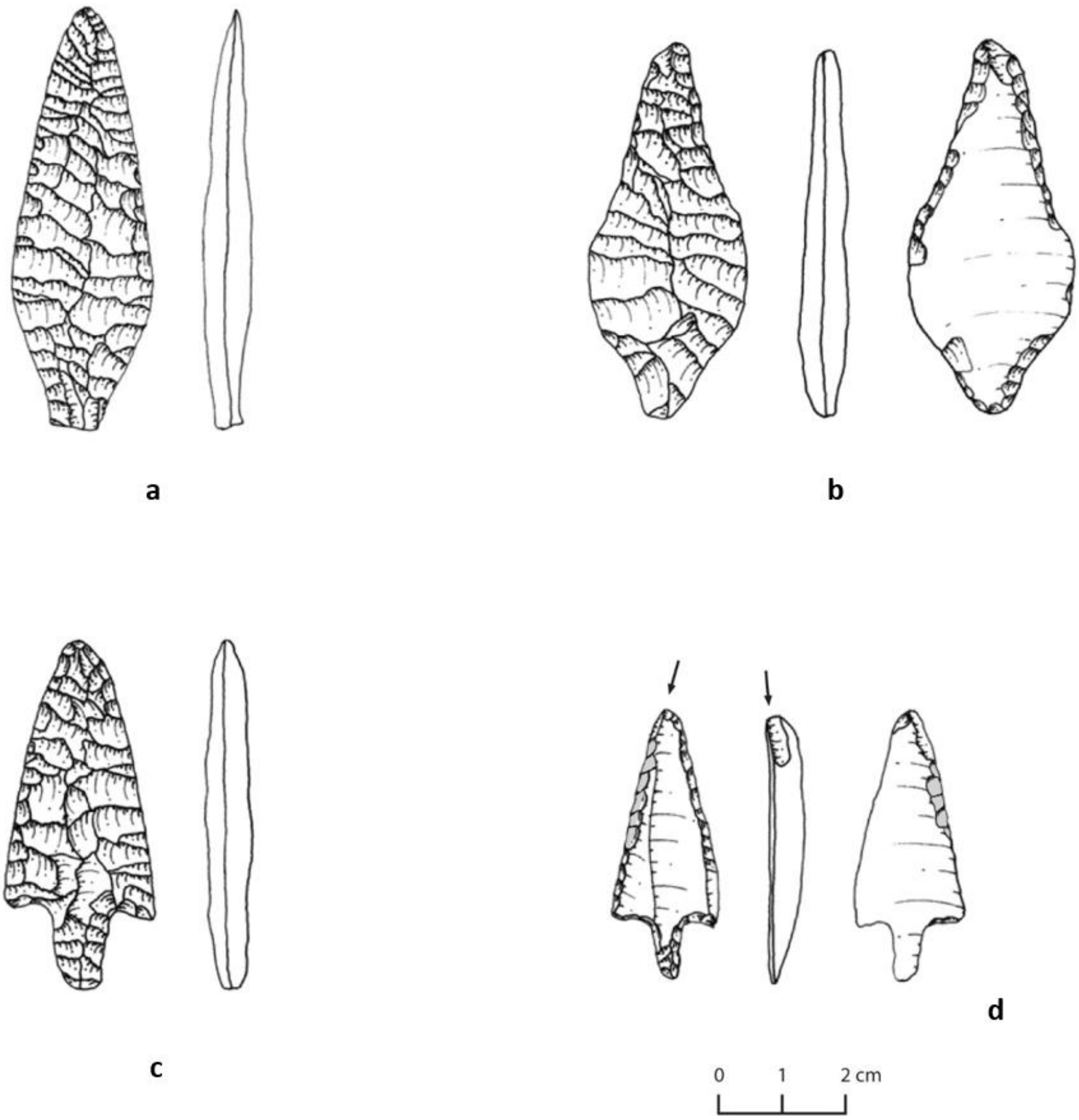
c



d

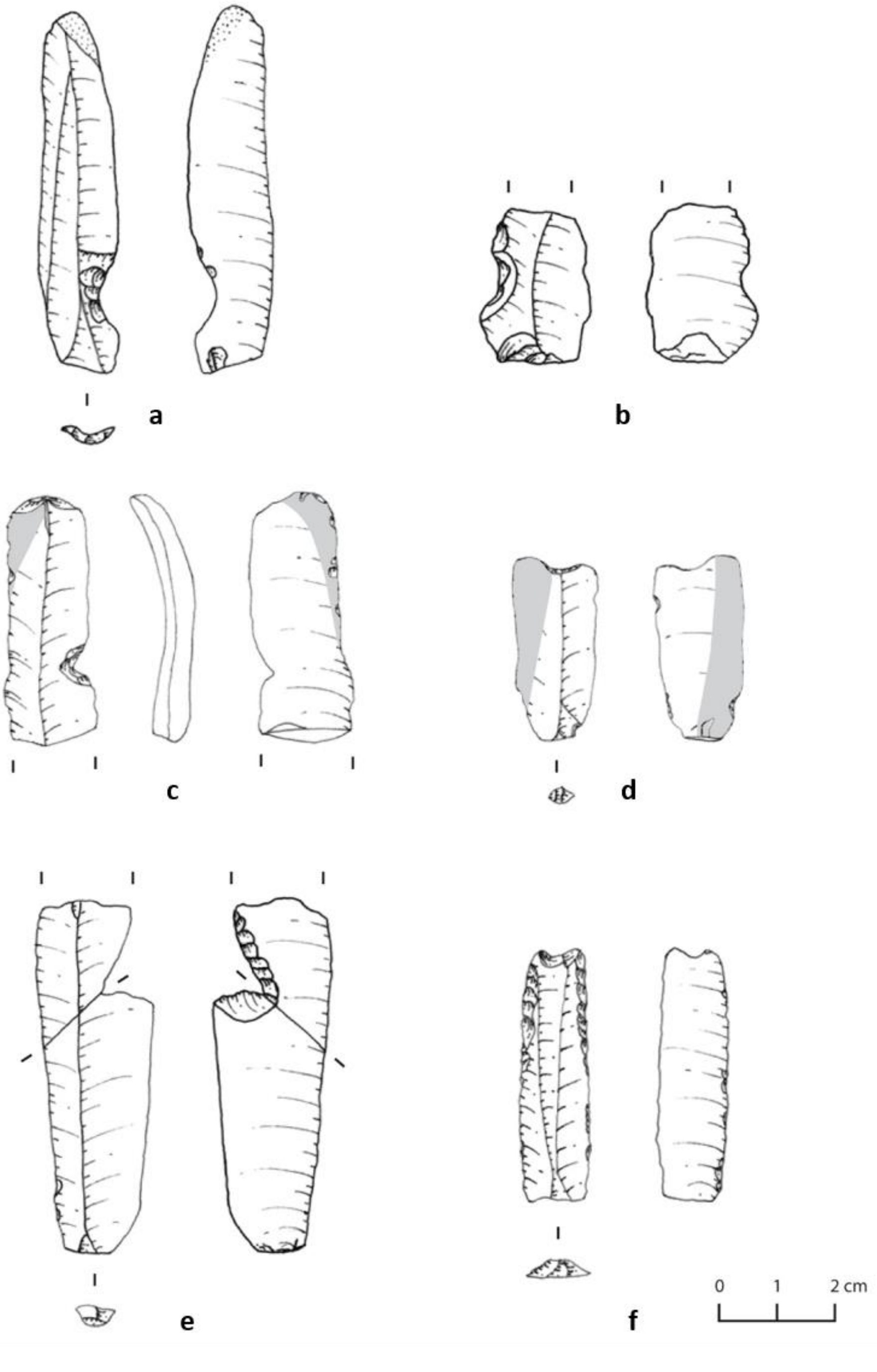
Backed tools. Late Neolithic: a, b. Gray flint (A9b.AE2952, A9b.AE4733). Final Neolithic: c. Radiolarite (A9b.AE4628); d. Chalcedony (A9b.AE668).

PLATE XXVIII



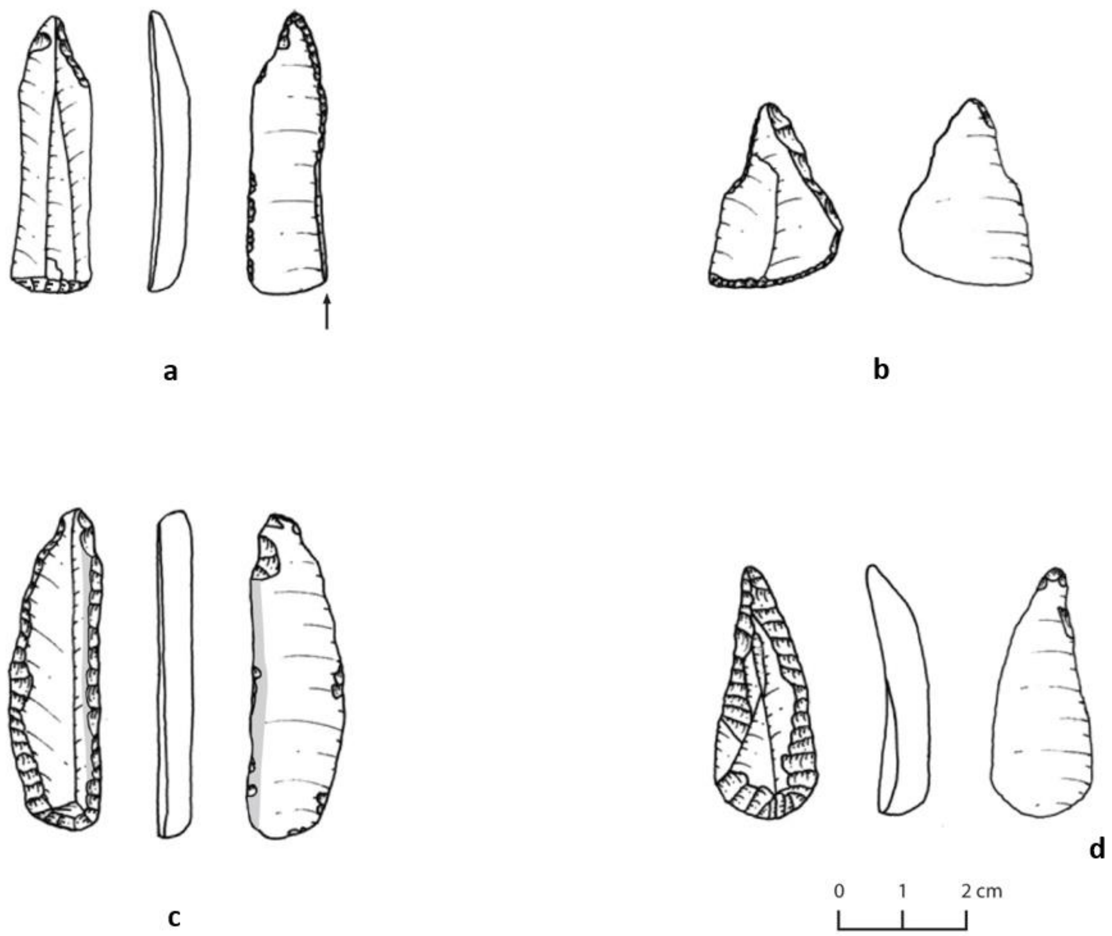
Projectile points. Late Neolithic: a, b. Gray flint (A9b.AE9727, A9b.AE7524). Final Neolithic: c. Radiolarite (A9b.AE4438); d. Gray flint (A9b.AE4435).

PLATE XXIX



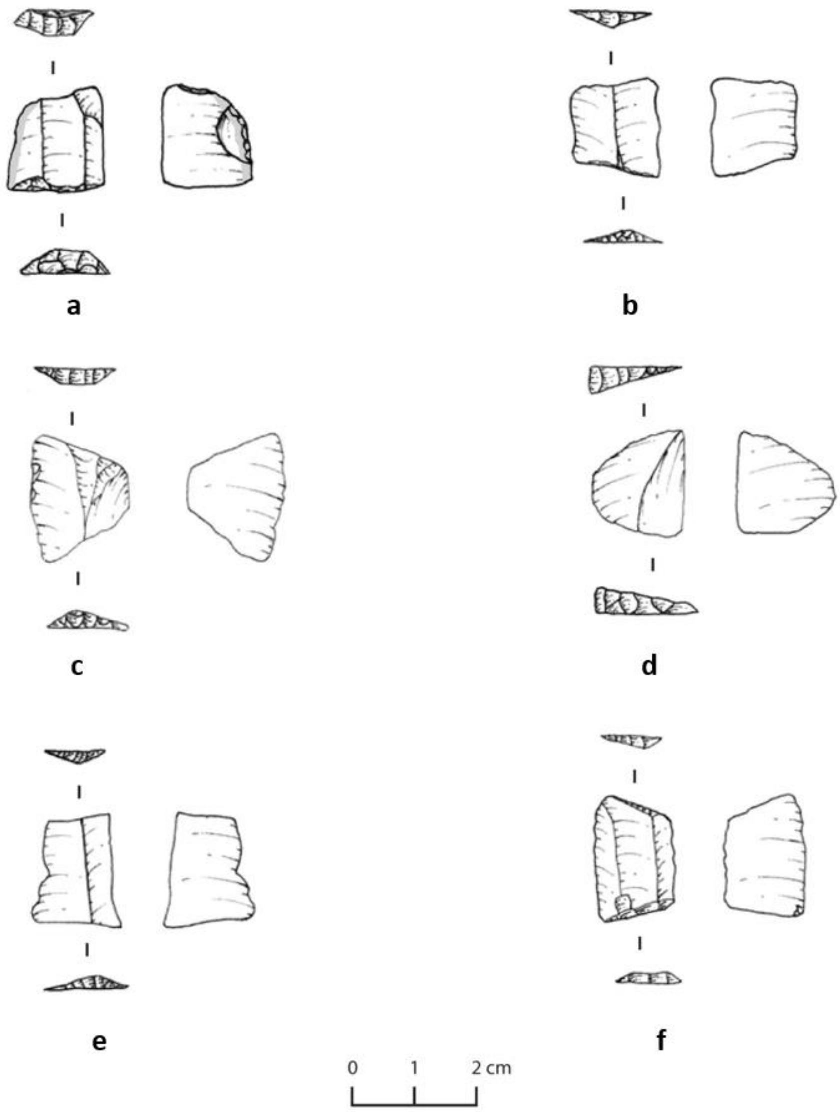
Notches. Late Neolithic: a, c, d. Gray flint (A9b.AE9857, A9b.AE9143, A9b.AE6663); b. Chert (A9b.AE9602). Final Neolithic: e, f. Pale brown flint (A9b.AE2333, A9b.AE3419).

PLATE XXX



Composite tools. Late Neolithic: a. Gray flint (A9b.AE9158). Final Neolithic: b. Burnt (A9b.AE8533); c, d. Yellowish brown flint (A9b.AE5296, A9b.AE8236).

PLATE XXXI



Geometrics. Late Neolithic: a. Gray flint (A9b.AE3087). Final Neolithic: b, e. Gray flint (A9b.AE2819, A9b.AE3509); c, f. Reddish brown flint (A9b.AE8610, A9b.AE357); d. Chert (A9b.AED529).

PLATE XXXII

a

b

c

d

Cores. Late Neolithic: a. Black flint (A9b.AE9736); b. Radiolarite (A9b.AE7271). Final Neolithic: c. Gray flint (A9b.AE5672). **Crested blade.** Late Neolithic: d. Radiolarite (A9b.AE8145).

PLATE XXXIII

a

b

c

Unretouched blades & microblades. Late Neolithic: a. Black flint; b. Gray flint; c. Long blade of yellowish brown flint (A9b.AE2944).

PLATE XXXIV

a

b

Blades & microblades. Final Neolithic: a. Radiolarite, retouched and unretouched; b. Obsidian, unretouched.

PLATE XXXV

a

b

c

Retouched sickle blades. Final Neolithic: a. Gray flint (A9b.AE8268); b. Yellowish brown flint (A9b.AE8370). **Circular double end-scraper** (Type C). Final Neolithic: c. Gray flint (A9b.AE8490).

PLATE XXXVI

a

b

c

d

End-scrapers. Final Neolithic: a, b. Yellowish brown flint (A9b.AE4514, A9b.AE4971); c, d. Radiolarite (A9b.AE8000, A9b.AE8228).

PLATE XXXVII

a b

c d

Perforating tools. Late Neolithic: a. Black flint (A9b.AE9798). Final Neolithic: b. Gray flint (A9b.AE8375); c. Radiolarite (A9b.AE5011); d. Yellowish brown flint (A9b.AE8180).

PLATE XXXVIII

a

b

c

Composite tool. a. Reddish brown flint (A9b.AE8090). **Denticulated and truncated blade fragment.** b. Yellowish brown flint (A9b.AE8574). **Splintered pieces.** c. Yellowish brown flint (all Final Neolithic).

PLATE XXXIX

a

b

c

Projectile points. Final Neolithic: a. Spearhead of yellowish brown flint (A9b.AE4428); b. Tanged, yellowish brown flint (A9b.AE4432); c. Tanged and barbed, radiolarite (A9b.AE4630).

PLATE XL

a

b

c

d

Projectile points. Final Neolithic: a. Tanged and barbed, gray flint (A9b.AE4443); b. Tanged, dark gray-olive flint (A9b.AE4439); c. Tanged, obsidian (A9b.AE4429); d. Tanged and barbed, obsidian (A9b.AE4452).