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Nataliya Ivanova
Наталия Иванова

Socioeconomic Implications of Cereal Crop Production in Inland Thrace during the Late Iron Age

Социални и икономически аспекти на производството на зърнени култури във вътрешна Тракия през късножелязната епоха



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Abstract

This study explores the operation sequences of the production, processing, and storage of cereal crops in inland Thrace during the second half of the first millennium BC. This period saw the rise of tribal states and the appearance of urban centres in the Thracian hinterland with important trading links with Classical Greece and the Hellenistic world. By combining archaeological data with archaeobotanical and ethnographic studies as well as the available documentary and iconographic sources, the research addresses questions regarding access and ownership of arable land, the intended purpose of agricultural produce as well as tradition and novelty in the agricultural methods and tools.

The geographical characteristics of the region demonstrates its favourable conditions for agriculture, while the palynological data suggest that woodland clearance for arable and pasture land increased during the second half of the first millennium BC. The available archaeobotanical studies reveal the variety of species cultivated by the local Thracian population and demonstrate the primary position of cereal food in the diet. A major change in the preferred cereal species has been attested during the Late Iron Age with bread/durum wheat being predominant as opposed to einkorn and emmer.

The investigation of agricultural tools and structures connected to cereal crop production, storage, and processing reveals not only the tradition in the employed implements but also the adoption of advanced techniques by the local Thracian communities. While the discovery of agricultural implements at the major urban sites, which are better excavated and provide more secure dating, is of great significance, our knowledge about the Thracian countryside is still very limited. The deposition of farming tools at cult sites – peak sanctuaries and pit complexes – sheds light on the importance of agriculture in the practised rituals. Ethnographic parallels as well as the available iconographic sources and literary references assist in the reconstruction of past farming practices and implements. The comprehensive analysis of the different stages involved in cereal crop production contributes to our understanding of the economic choices and social complexity of Thracian society.

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CHAPTER I

INTRODUCTION

"*Stranger, why do all of you thus wait for so long outside the walls? Our men do not live in the town, but they have moved to the Thracian mainland where they plough the wheat-bearing fields…*"

Apollonius of Rhodes. *Argonautica* I. 793.

The general impression acquired from ancient literature regarding Thrace is one of a fertile land, favourable for agriculture and abundant in timber (Hdt. *Histories* V.23; Thuk. *History of the Peloponnesian War* IV.108), metals (Hdt. *Histories* VII.112), and grain (Xen. *Anabasis*. VII.1.13). Already Homer describes the Thracian land as "deep-soiled" (*Iliad* 11.222), and Apollonius of Rhodes in his *Argonautica* (I.793-828) refers to "wheat-bearing fields" and "snowy ploughlands of Thrace". During Alexander's campaign against the Getae, the army passed through a field of standing corn (Arrian. *Anabasis Alexandri* I.4). In his speech to the Greek soldiers, Xenophon underlines the abundance of food they found in Thracian villages (*Anabasis* VII.6.28; 31). The epithet "millet-eating" (*Anabasis* VII.5.12), used to portray the population around Salmydessus in Strandzha Mountains, although loaded with negative connotation, indicates that cereal food formed the staple diet. At the same time, Herodotus states that for the Thracians to be a tiller of the ground is the most dishonorable thing, while to live by war and plunder is the most glorious (*Histories* V.6.2). This statement is found in the context of descriptions regarding the specific, non-Greek customs of the various Thracian tribes and is thus intended to denote the "barbaric", uncivilised way of life. Although the ancient authors do not represent the Thracians as farmers, we have both literary and archaeological evidence to suggest that agriculture was a significant means of subsistence and played an important role in the economy of ancient Thrace. While there is a number of studies on Classical and Hellenistic Greece regarding agricultural practices and tools, grain trade, land ownership and control, the economy, etc. (Rostovtzeff 1941; Forbes 1976, 5-11; White 1984, 27-72; 1988, 211-218; Amouretti 1986; Halstead 1987, 77-87; Osborne 1987; Wells 1992; Isager, Skydsagaard 1992; Amouretti, Brun 1993; Burford 1993; Foxhall 1996, 44-67; 2007; Davies 2007, 333-361; Möller 2007, 362-384; von Reden 2007, 385-406; Reger 2007, 460-483), the territory of Thrace has remained largely peripheral to such discussions.

Different cereal crops in different parts of the world have formed the staple diet of human population for millennia and played an important role in the ancient economy. The comprehensive study of cereal crop production can reveal subsistence strategies, technological knowledge, intra- and interregional communications, and social complexity. The study investigates the operation sequences of the production, storage, and processing of cereal crops in inland Thrace during the second half of the first millennium BC. This period saw the rise of tribal states and the appearance of urban centres in the Thracian hinterland with important trading links with Classical Greece and the Hellenistic world. In this context, the research's main aim is to explore the organisation of cereal crop production in the region and discuss the relationship between agricultural practices and innovation on the one hand and economic transformation and social complexity on the other.

I.1. TERRITORIAL AND CHRONOLOGICAL FRAMES

In geographical terms, the region known as Thrace covers the northern part of South East Europe. Its boundaries and meaning, however, have varied throughout the years. While the term was initially used to denote the land inhabited by the various Thracian tribes north of the Aegean Sea, following the Roman conquest, the name was applied to the province of Thracia with territory restricted to the area south of the Balkan Range. In the late third century AD, the diocese of Thrace included six provinces: Thracia, Haemimonthus, Rhodope, Europa, Moesia Secunda, and Scythia Minor. In the Byzantine period, the theme of Thrace encompassed only the territory of what is nowadays eastern Thrace, while to the west was the theme of Macedonia. After the drawing up of the state boundaries of Bulgaria, Turkey, and Greece with the treaties of Berlin, Sèvres, and Lausanne (from 1885 to 1923), the term Thrace is used to designate: a) south-eastern Bulgaria or *northern Thrace*; b) the European part of Turkey or *eastern Thrace*, and c) north-eastern Greece or *western Thrace*.

Despite the flexibility of its boundaries (see also Bouzek, Graninger 2015, 12-15), the territory of ancient Thrace is most often regarded as the area between the Aegean Sea to the south, the Danube to the north, and the Black and Marmara Sea to the east. The western frontier was marked by the Axios-Strymon valleys to the south-west (Hdt. *Histories* V.17; Pseudo-Scylax *Periplous* 67; Strabo VII.7, 4) and the Morava River to the north-west (Фол 1975, 10-11). During the reign of Lysimachus, the western boundary shifted further eastwards to the Nestos River (Strabo VII fr. 33, 35). The focus of the study falls on the hinterland of Thrace within the borders of present day Bulgaria (fig. 1). This is determined by the main aim of the research – to investigate the organisation of cereal crop production within the local Thracian communities[1] as well as by the state of research and available data. Thus, while there are no data on European Turkey regarding the period under examination, the studies in northern Greece concern mainly the cities on the coast with Greek population.

The first millennium BC in Thrace is defined as the Iron Age, divided into Early and Late. The periodisation of the Early Iron Age (EIA) has been examined by many scholars[2] with the most recent studies placing its beginning between 1050 and 950 BC and its end between 550 and 450 BC, depending on the specific areas of Thrace. The Late Iron Age (LIA) encompasses the period between the middle of the sixth or the middle of the fifth until the late first century BC or the first few decades of the first century AD when Thrace was annexed by the Roman Empire (Домарадски 1994, 46-48; Домарадски, Танева 1998; Theodossiev 2000, 11-13; Tonkova, Savatinov 2001, 95-96). The LIA is usually divided into Classical and Hellenistic periods with the latter term used to denote the historical period after the campaigns of Philip II and Alexander III, i.e. the period of the "Successors" whose duration, however, was different in the various regions (Delev 1998, 376). For the Odrysian kingdom of Thrace this lasted until 45 AD when the last king, Roemetalkes III, was removed by the Emperor Claudius, and the Roman province of Thracia was established. The exact beginning of the Hellenistic Age has also been debated with the most popular view being the death of Alexander III in 323 BC. As regards Thrace, it has been argued that the process of urbanisation in the region during the fourth century BC (the Macedonian colonisation starting with Philip II and the emergence of the royal cities of the Thracian kings such as Seuthopolis and Helis, the employment of Greek language for political purposes and the appearance of Greek mercenary armies in the service of the Odrysian rulers) suggest that the term Early Hellenistic may be applied already from the reign of Kotys I (384/3 BC) (Delev 1998, 376-384).

[1] It should be pointed out, however, that in the urban centres recorded in inland Thrace there is evidence for Greek presence or strong Greek influence.

[2] See for instance: Миков 1933; Чичикова 1974, 19-27; Hänsel 1976; Toncheva 1980; Гергова 1986, 11-26; Gergova 1987, 7-18; Taylor 1989, 68-92; Гоцев 1990, 17-20; Archibald 1998, 16-34; Бориславов 1999, 5-12; Ников 2000.

I.2. THE LATE IRON AGE BACKGROUND

The LIA in Thrace is a period of important changes in society. This is a time when there was already a number of Greek colonies on the coasts of the Aegean, west Pontic (Black Sea), and the Propontis (Sea of Marmara), and the contacts with the local Thracian communities intensified[3]. The period is characterised with the emergence of the first tribal states, among which that of the Triballi in the north-west, the Getae in the north-east, and the Odrysae in south-eastern Thrace, the latter being the most powerful and proactive in the political history of South East Europe. It has been pointed out that the Thracians were never entirely unified, nor did they succeed in forming a centralised kingdom controlling their entire territory. Many scholars have analysed the information provided by the ancient sources on the history of Thrace (Данов 1969; Фол 1972; 1975; 1997; Fol, Hammond 1988, 234-253; Fol et al. 2000; Тачева 1987; 2006; Archibald 1998; Jordanov 1996, 223-240; 2000, 101-130; Йорданов 1998; Delev 2015, 48-58; 2015a, 59-74) and have presented a detailed picture of the political events of the period. Archaeological investigations supplement our knowledge and demonstrate not only growth in the number of settlements compared to the EIA but also the existence of significant centres with urban characteristics[4] in the Thracian interior as early as the second half of the sixth century BC. Some of these centres emerged as trading posts on important routes connecting the north Aegean to the Thracian interior; others were founded as "royal cities" of the Thracian rulers or were transformed into large centres after the Macedonian conquest. Furthermore, many of the agricultural tools discussed later on in the study come from these centres, since they have been excavated or are still in process of exploration and present detailed publications of the results. Among the characteristic sites for the period, where items related to agriculture have been discovered, are also the peak sanctuaries and pit complexes[5] (fig. 2).

Among the earliest centres of major importance is the settlement at Koprivlen on the right bank of the Mesta River in the region of Gotse Delchev, south-west Bulgaria (Bozkova et al. 2002). The excavations have revealed remains of a fortification wall and monumental buildings with roof tiles, evidence for pottery production, and imported goods showing connections with the north Aegean coast. The investigated pit complex in the close vicinity functioned between the end of the sixth century BC and the first century AD (Vulcheva, Dimitrova 2005, 193-200). The surveys conducted in the middle Mesta region have demonstrated an increase in the number of settlements during the LIA compared to earlier periods (Tzvetkova 2002, 43-44), but no systematic excavations have been carried out at the registered sites. Another major centre is the site at Adzhiyska Vodenitsa, near the village of Vetren, identified with great probability with *emporion* of Pistiros[6] (Домарадски 1995; Домарадски, Танева 1998). The site was probably visited already at the end of the sixth century BC (Боузек и др. 2006, 48). The settlement was fortified around the middle of the fifth century BC enclosing a territory of at least 50 hectares (Archibald 2000, 229). The second stage in the site's existence, from the end of the first quarter of the fourth century BC till the beginning of the third century BC, ended in fire. After that, its function changed – the site became a production centre that existed till the beginning of the

[3] The literature on Greek colonisation on the Thracian littorals and the relations with the indigenous population is extensive. Some of the major works include: Данов 1947; Lazaridis 1971; Markov 1977, 33-45; 1980, 145-154; Koukouli-Chrysanthaki 1986, 82-98; Ognenova-Marinova 1986, 238-244; Porozhanov 1986, 158-165; Isaac 1986; Tsetskhladze, De Angelis 1994; Tsetskhladze 1998; 1998a, 51-74; Boardman 1999; Graham 2001; Snodgrass, Tsetskhladze 2002; Avram et al. 2004, 924-973; Bilde, Stolba 2006; Grammenos, Petropoulos 2007; Gabrielsen, Lund 2007; Damyanov 2015, 295-307.

[4] For urbanisation in Thrace, see Димитров 1958а, 683-699; Fol 1970, 90-99; Чичикова 1972, 327-333; 1985, 85-93; Велков 1982а; Фол, Спиридонов 1983; Балабанов 1986, 41-59; 2008, 248-265; Гочева 1986, 60-74; Домарадски, Танева 1998, 15-44; Попов 2002; Archibald 2004, 885-899; Bouzek 2005, 1-7; Nankov 2015, 399-411. For a discussion on the term polis, see Archibald 2013, 55-66.

[5] For the characteristics and the function of the pit complexes, see chapter IV.2.1.

[6] The identification of the site became possible after the discovery of an inscription at Asar Dere near Vetren initially published by V. Velkov and L. Domaradzka 1994, 1-15. See also: Chankowski, Domaradzka 1999, 246-258. For other interpretations regarding the location of Pistiros, see Demetriou 2010, 77-93; Bravo, Chankowski 1999, 275-317. For a discussion on the term *emporion* and whether Pistiros was a polis, see Hansen 1997, 83-105; 2006, 1-39.

second century BC. Evidence for production activities (metallurgy), however, has been recorded already in the second phase (Katinčarova 2002, 33). Fourth century BC Pistiros had a regular city plan with streets lined with colonnades and a sophisticated drainage system with well-built channels. The site is situated on the left bank of Maritsa River, which was still navigable in the nineteenth century for small boats, and it has been suggested that the site must have had a river harbour, an assumption supported also by the great number of recorded transport amphorae (Bouzek 1996, 221; Titz 2002, 233-234).

Other settlements with central administrative functions include that at Vasil Levski village in the region of Karlovo (Кисьов 2004, 51-73) and the site of Pamuk Tepe near the village of Krastevich in the outskirts of Sredna Gora, where there is also evidence for metal production (Маджаров, Танчева 2009, 240-243). The recorded architectural remains, coins and imports (Attic figured and black-glazed pottery and amphora ware) at these sites testifies to their economic significance and higher position in the settlements hierarchy.

In the beginning of the second half of the fourth century BC most of the Thracian lands south of the Haemus fell under Macedonian power (Jordanov 1996, 223-240). In Thrace, Philip II reconstructed old Thracian settlements into cities, the best known among them being Cabyle (Велков 1982; 1991, 143-152; Domaradzki 1990, 50-60) and Philippopolis (Домарадски, Танева 1998, 22-29; Попов 2002, 124-130), and left garrisons in the conquered or newly established settlements. The former Thracian kings were now feudatory to the Macedonian kingdom. After the death of Alexander III, the Thracian lands were assigned to Lysimachus, who proclaimed himself king of Thrace in 305 BC and built a new city for his capital – Lysimacheia on the Thracian Chersonese. While Lysimachus was in control of the Thracian littorals with the Greek cities, independent Thracian kingdoms flourished in the interior. Such was that of the Odrysian king Seuthes III (330 – after 270 BC), who founded his capital Seuthopolis near present day Kazanluk (Dimitrov, Čičikova 1978; Димитров и др. 1984). Seuthopolis was built *ex novo* according to a previously designed plan. The revised studies on the amphora stamps from the site have shown that the amphora imports in the city date no earlier than *c.* 315 BC (Balkanska, Tzochev 2008, 190). Thus, the foundation of the city should be seen during the last quarter of the fourth century BC. Recent detailed analysis of the fortifications of Seuthopolis has led to the suggestion that it was not only a Hellenised city but also a fortified camp built under strong Macedonian influence (Nankov 2008, 15-56). The city was besieged and destroyed most probably in 252 BC during the march of Antiochus II through southern Thrace (Nankov 2008, 41). The surface surveys conducted in the region of Seuthopolis have demonstrated a dense settlement system in the area and an increase in settlement numbers during the LIA (Попов 2002, 131; Sobotkova 2012, 147, fig. VI-3, 148, figs. VI-4, VI-5, 156-157).

The more recent discoveries of the sites at Kozi Gramadi in the Sredna Gora Mountains (Христов 2011-2012), Smilovene near Koprivshtitsa (Агре, Дичев 2011, 194-196), Sinemorets (Агре 2016) and Knyazhevo, municipality of Topolovgrad (Агре 2012, 170-171; Агре, Дичев 2016, 266-270) have revealed the existence of fortified places which functioned as residential complexes of the ruling elite. Finally, the excavations at Halka Bunar in the region of Chirpan have resulted in the discovery of residential, cult, and manufacturing structures (pottery kilns) as well as evidence for metallurgical activities from the Classical and Early Hellenistic periods (Тонкова 2002, 148-196; Тонкова, Сидерис 2010).

In the north-east, the Getae had profited from Philip II's conquest of the Odrysae and by the second half of the fourth century occupied areas on both sides of the Danube (Lund 1992, 43). The investigations at Sboryanovo, identified with great probability with the Getic capital of Helis, have revealed its economic, political, and military importance during the Early Hellenistic period (Stoyanov 2002, 207-221). The site had a short life span: from 325 till 250 BC when it was destroyed by an earthquake. In the interior of the city, structures with residential and/or farm functions as well as with probable ritual character have been recorded (Стоянов 2006,

81). The coins discovered demonstrate intensive contacts with the Greek colonies on the west Black Sea coast, and the variety and quantity of imports, especially the amphora ware, points to regular relations with Thasos, the western Anatolian coast, and the centres of the Pontic basin (Stoyanov 2002, 215-216). Outside the fortified area there is evidence of dwellings and production complexes (pottery kilns).

The period till the beginning of the third century BC is an era of great material, cultural, and political advance for the Thracians. Thrace was now part of the Hellenistic world and was open to the movement of ideas, knowledge, and goods. The social stratification of Thracian society is clearly visible in the monumental tomb constructions of the aristocratic elite decorated with frescoes and furnished with imported pottery, metal ware and valuable objects. This is attested also in the settlement hierarchy. The appearance of the first urban centres in the Thracian interior demonstrates the active interactions of the indigenous population with the communities of the Aegean and the Eastern Mediterranean. It should be pointed out, however, that we know much more about the ruling elite and the urban centres than the life of the ordinary population in the countryside. Furthermore, the small number of sites that can be identified as villages is in sharp contrast to those interpreted as pit complexes whose number has grown considerably in the last three decades. A possible explanation for the lack of sites of lower rank may be their short term occupation and light structures that have left scarce or even no traces in the archaeological record.

The natural resources and the environmental conditions are among the major factors that should be taken into consideration when studying the economy in a given region. Agriculture is directly related to ecological factors, land fertility and its suitability for certain crops as well as to the availability to raw materials for the manufacture of tools. In addition, factors such as available labour force and technical skills are also of great importance and visible in the quantity and quality of the produce and goods, and their trade. This is also interrelated to social and political factors as a prerequisite and consequence of the existing economy models.

Both literary and archaeological evidence imply the great variety of natural resources exploited in Thrace during the second half of the first millennium BC, including timber, metal ores, clay for pottery and bricks, stone, textiles, and foodstuffs. It should be pointed out, that it is not their exploitation that is a novelty for the period but rather its considerable scale. New territories were cleared for pasture and cultivation of crops. Agriculture played a major role in the economy as it provided the daily requirement of food, but the model at which it operated is much difficult to investigate.

I.3. DEFINING CEREAL CROP PRODUCTION

Cereal crops are members of the grass family (*Gramineae*) cultivated primarily for their starchy seeds (dry fruits). Starch, a carbohydrate stored in most plants, is a major element of the average human diet, providing a low-cost energy source. Cereals are high in starch, which may be used in pure or in flour form. The common cereals are wheat, rice, corn, rye, oats, barley, sorghum, and some of the millets.

The term "production of cereal crops" in its broader sense is used here to denote the entire process of cereal farming commencing with tillage – the preparation of the soil for cultivation. The following stages include sowing, harvesting, threshing and winnowing, sieving, parching, pounding, storage, and grinding of cereal crops. Variations in the sequence, tools, and methods applied depend on climatic factors, cultural preferences, available technology, and cereal species. G. Hillman takes into consideration both the climatic conditions and most importantly the type of cereal crops (glume wheats as opposed to free-threshing cereals) and illustrates the different stages of the process based on ethnographic observations in Turkey (Hillman 1984, figs. 2-4). It becomes clear that some actions may be repeated two or several times (for the glume wheats).

The process of cereal crop production is divided here into three major stages: a) *Production*, used in its narrow sense to denote the initial phase of the process until the storage of the produce (chapter III); b) *Storage* (chapter IV); and c) *Processing*. Although "processing" may refer also to sieving, drying, and dehusking, here the term is used primarily as a synonym of grinding, thus indicating the final stage of cereal preparation (chapter V). Other processing methods, such as thermal (cooking)[7] or microbial activities (for instance, fermentation), are not considered in the study (but see the literary references in chapter II.3).

I.4. HISTORY OF RESEARCH

The study of ancient agriculture in Thrace is uneven for the different periods and is generally scarce especially when compared to Greece and the Aegean. Thus, while the role of agriculture and the different tools and techniques applied during the prehistoric periods have been subject of detailed discussion, the same is not true for the first millennium BC. In few short articles in the early twentieth century, R. Popov presented the available evidence (grinding stones, antler and flint tools, remains of carbonised cereals) from prehistoric sites in Bulgaria and commented on the agriculture techniques applied by the early farmers (Попов 1919, 150-165; 1935-1936, 155-156; 1936-1937, 37-39). Later, P. Detev discussed in greater detail the prehistoric agricultural implements, their specifics in shape and function as well as their development through time (Детев 1960, 61-74; 1968, 49-63). He also presented the available archaeobotanical data from prehistoric sites and discussed the harvesting and storage methods. The agricultural implements discovered at Neolithic and Chalcolithic sites in Bulgaria were further examined by K. Kanchev (Кънчев 1967, 50-64), while G. Georgiev focused on the Karanovo-type sickles (Георгиев 1958, 369-384).

In the last quarter of the twentieth century, the systematic excavations of a number of prehistoric settlements has resulted in the publication of monographs in which special attention has been paid to the economic life of the early inhabitants (Тодорова и др. 1975 – Golyamo Delchevo; Радунчева 1976 – Vinitsa; Георгиев и др. 1979 – Ezero; Тодорова и др. 1983 – Ovcharovo, etc.). According to H. Todorova, agriculture played a predominant role in the prehistoric economy in the region (Тодорова 1971, 44-50; 1973, 17-27). She has suggested that the employment of ardshares and draught animals occurred during the Chalcolithic, which in turn resulted in a population growth, the development of copper working and social stratification visible in the Varna necropolis. This view is supported also by N. Skakun who has applied use-wear analysis on artefacts from Neolithic and Chalcolithic sites in Bulgaria and has argued that during the latter period there was an improvement in agricultural practices (Skakun 1999, 199-210). This is expressed in the appearance of previously unknown as well as modified earlier agricultural implements. An entirely opposite theory regarding the character of the prehistoric economy is held by A. Raduncheva (Радунчева 1976, 102-197; 1981, 7-29; 2003, 37-43). According to her, agriculture did not occupy the dominant position in the livelihood of the prehistoric population as opposed to stock-breeding. The main arguments of these two completely contrary theories have been recently reviewed by M. Klasnakov (Класнаков 2006, 7-16). Although he is more inclined to accept Todorova's theory, Klasnakov has pointed out that at the present state of research it is difficult to determine the position of agriculture and stock-breeding and emphasises on the necessity of applying interdisciplinary approaches in the study of prehistoric economy. It is possibly too simplistic to make such clear distinctions between the role of agriculture and stock-breeding snice both are interrelated and the predominance of one, if such existed, may be due to geographical and environmental factors.

Publications on Roman and Medieval agricultural implements from the region are also much more common than those on tools from the LIA. It should be pointed out, however, that although the quantity of the accumulated material is huge, the publications represent only brief descriptive reports,

[7] For the cooking techniques and tools applied in ancient Thrace, see Георгиева, Филипова 2016, 277-296.

and studies regarding technological, typological, and chronological development are comparatively few. This is most probably due to the conservatism in the implements' shapes and the common lack of exact discovery context, both facts hindering a precise chronology (Щерева, Радева 2001, 79). In his study on the development of traditional iron tools in Bulgaria, L. Dukov discusses the various iron tools (hoes, spades, ploughshares, sickles, and pruning-knifes) and comments on the development of shapes through time (Дуков 1965, 141-182). Although the material available at that time is dated exclusively to the Roman period, the study represents a comprehensive analysis of the agricultural implements, their function and evolution. In another article, Dukov examines Pliny's text on ploughshares set in the background of the available archaeological data and ethnographic parallels (Дуков 1972, 267-270). In his comprehensive study on agriculture during the first millennium AD in South East Europe, J. Henning presents a typology of the farm complexes and the recorded agricultural implements as well as their development through time (Henning 1987). N. Rusev has published four collective finds of antique agricultural implements which represent chance finds from the region of Popovo and Opaka, northeast Bulgaria (Русев 2006, 23-35). The most recent study, authored by I. Cholakov, presents the Roman and early Byzantine metal tools from the territory of Bulgaria – their function, typology, and spatial distribution – including also implements connected to agriculture (Чолаков 2010, 21-82).

Agriculture during the Medieval period is discussed by I. Sakuzov (Сакъзов 1927, 452-463), who examines the documentary sources and emphasises the advanced agriculture of the Slavonic tribes, the fertility of the Thracian lands and their importance as a grain supplier for Constantinople. Later, using literary, ethnographic, and archaeological data, Y. Čangova analyses the Medieval implements and farming techniques in greater detail and comments on the importance of agriculture in the Bulgarian Kingdom from its foundation in the seventh until the fourteen century AD when it became part of the Ottoman Empire (Чангова 1962, 21-31; 1981, 155-181). The agriculture during the Medieval period in the region is also discussed by S. Vitlyanov (Витлянов 1992, 231-238), who points out the lack of a common terminology and classification of the iron ploughshares. The author distinguishes four types of ploughshares according to their shape and examines their evolution through time. He argues that the appearance of new shapes, in particular, the ploughshares with a collar, is a result of an internal development as opposed to their introduction by the Slavs.

Already in the second quarter of the twentieth century H. Vakarelski discusses the traditional farming techniques and tools in the Bulgarian lands: different types of wooden ploughs, their parts, terminology, geographical distribution, and historical development (Вакарелски 1929, 55-109). The author also examines the iron ploughshares, sickles, threshing methods and tools (Вакарелски 1931, 131-165; 1936, 61-85; 1936a, 425-433) as well as rakes and hayforks (Вакарелски 1943, 94-128). A classification of the wooden ploughs and iron plough parts in the Bulgarian lands is presented by V. Marinov (Маринов 1963, 103-118; 1966, 27-31; 1970, 24-28), who also revises the descriptions given in earlier publications, particularly, those by D. Marinov (Маринов 1901, 129-136), J. Obrebski (1929, 10-54), H. Vakarelski (Вакарелски 1929, 55-109), and Z. Vuzharova (Въжарова 1956). A typology of the ploughs attested in the region is further presented by H. Holiochev, who uses the angle for attaching the draught-pole to the stilt or the sole as a main typological criterion (Холиолчев 1981, 14-23). A special chapter dedicated to the traditional Bulgarian agriculture is included in the *Етнография на България* (*Ethnography of Bulgaria*) (Вакарелски 2007, 83-119) where the various implements and agricultural methods are presented in detail.

The study of ancient agriculture would be incomplete without the application of archaeobotanical analyses. The work of N. Arnaudov (Арнаудов1937/38, 33-51; 1937/38a, 79-99; 1940/41, 17-29) in the second quarter of the twentieth century marks the beginning of archaeobotanical studies in Bulgaria. Chapters dedicated to the recovered plant remains appear in a number of monographs on excavated prehistoric settlements. Thus, M. Hopf examines the

plant remains from Goliyamo Delchevo (Хопф 1975, 303-324) and Polyanitsa (Hopf 1988, 34-36), E. Haynalova studies the remains from Nova Zagora (Хайнялова 1980, 91-98), Z. Yanushevich those from Ovcharovo (Янушевич 1983, 106-118), K.-E. Behre discusses the plant remains from Sava (Behre 1977, 214-215), while J. Renfrew (1979, 243-265) comments on the main cereal crops cultivated during the Neolithic and Chalcolithic. R. Dennell investigates the material from the prehistoric tells at Chavdar, Kazanluk, and Ezero and points out the necessity of considering the activities associated with the preparation and consumption of plant remains as well as the composition of the archaeobotanical samples before attempting to reconstruct the crop economy (Dennell 1972, 149-194; 1974, 33-37; 1974a, 275-284; 1976, 229-247; Денел 1979, 415-425). L. Lisitsina and L. Filipovitch (Лисицина, Филипович 1980, 5-90) as well as Tz. Popova (Попова 2009, 71-165) publish catalogues of plant species from the Balkan Peninsula and Bulgaria respectively. E. Bozilova's investigations in collaboration with other researchers on the palynological and palaeoethnobotanical evidence from different regions of the country has resulted in numerous publications focusing on the reconstruction of the palaeoenvironment and the human impact on it (Божилова, Иванов 1985, 43-48; Bozilova, Popova 1992, 17-25; Bozilova, Filipova 1991, 87-96; Bozilova, Tonkov 1984, 77-84; 1998, 141-148; 2007, 531-534). Archaeobotanical investigations on a number of prehistoric sites by E. Chakalova (Чакалова, Божилова 1980, 152-162; 1984, 18-27; 2002, 191-202; Chakalova, Sarbinska 1986, 156-159), E. Marinova (Маринова 2002, 13-24; Marinova 2003, 499-504; 2006, 187-194; 2008; 2009, 59-62; Marinova et al. 2002, 1-11), and Tz. Popova (Popova 1995, 193-207; 2010; Попова 2009, 71-165; Popova, Marinova 2006, 523-532) have revealed various material including evidence for the cultivated cereal crops as well as different pulses, weeds and charred wood. The collected data have demonstrated the presence of almost all the crop plants typical for the early agriculture already during the Neolithic period as well as the predominance of einkorn and emmer until the middle of the first millennium BC. The work by S.-M. Valamoti on prehistoric sites in northern Greece should also be mentioned, as she has authored a number of publications dealing specifically with cereal crops (Valamoti 2002a, 2-15; 2011, 19-39; Valamoti et al. 2008, 265-270). It should be pointed out, however, that the majority of the archaeobotanical studies refer to the prehistoric periods, and the investigation of plant remains from the LIA is very limited. The latter is published mainly by Popova who investigates the material from recent excavations (Popova 1996, 173-174; 2002, 289-297; 2002a, 280-289; 2005, 99-102; Попова 2005, 161-164; 2006, 518-519; 2006a, 509-518; 2008, 550-555). Athough these analyses are very valuable, the interpretation is often limited to identification and quantitative presentation of the recovered plant species, thus lacking conclusions regarding the crop economy of the period. A recent archaeobotanical study on south-eastern Bulgaria from the middle of the fifth century BC till the sixth century AD contributes to the investigation of plant remains from the historical period (Славова 2013).

The study of agriculture during the LIA in Thrace was initiated by G. Katsarov at the beginning of the twentieth century. He was the first to collect and discuss the texts of ancient authors regarding different aspects of Thracian life thus including references on farming and cereal crops (Кацаров 1913, 1-97; 1933, 3-9). The literary evidence is, however, incomplete and sporadic, and already Katsarov pointed out the significance that future archaeological discoveries would have for revealing the Thracian history and culture. The most comprehensive study regarding the agriculture of ancient Thrace is the work edited by I. Venedikov entitled as *Развитие на земеделието по българските земи* (*Development of agriculture in the Bulgarian lands*) (Венедиков 1981). It examines the agriculture tools and practices from the prehistoric periods till the seventeen century AD. The study presents also the available literary and iconographic evidence regarding ancient agriculture, including topics such as land ownership and control, the position of the Thracian farmer, trade with cereal foods as well as beliefs and gods connected to agriculture. The variety of cereal crops grown in Thrace and the evidence for viticulture and horticulture are also discussed. The separate stages of cereal crop production, employing specific

tools, are further examined, but the number of securely dated implements from the pre-Roman period is very limited. Thus, while the available evidence suggests the use of a spoon-shaped iron ploughshare and a wooden ard with a curved draught-pole, Venedikov assumes the use of the dikella by the Thracian farmers, for which, however, there is no archaeological data. A special section is devoted to the numismatic material that provides evidence for ancient agriculture, authored by Y. Youroukova (Юрукова 1981, 118-130).

The topic of food and its consumption in Thrace during the end of the second and the first millennium BC is examined by R. Georgieva as part of the study *Етнология на траките* (*Ethnology of the Thracians*) (Георгиева 1999, 71-111). By combining the available literary, iconographic, archaeological, archaeobotanical, archaeozoological, and ethnographic evidence, she presents all types of food attested in the Thracian culture: cereals, pulses, fruits and vegetables, meat and dairy products, drinks, honey, and spices. Attention is paid also to the preservation and storage practices, the types of vessels employed in the production, consumption, and storage of food, the daily regime, and the role of food in the ritual practices in Thrace. In a more recent article the same author presents again the evidence for agriculture and stockbreeding in ancient Thrace using new data and commenting on topics like the role of agricultural production in the foreign trade (Георгиева 2016, 109-132). E. Filipova examines the literary and palaeobotanical sources for bread types and the various ways of their preparation in Thrace (Филипова 2017, 297-310). P. Balabanov emphasizes on the lack of social and economic homogeneity in the lands of ancient Thrace as well as on the restricted property rights of the rulers (Balabanov 2016, 93-107).

Specific studies regarding certain implements are confined to the examination of the pithoi from Seuthopolis (Čičikova 1958, 466-481; Чичикова 1958, 475-487; 1984, 54-65), Koprivlen (Hadjiangelov 2002, 163-166; 2005, 91-97), Pistiros (Lazov 1999, 339-348), Babyashka Chuka (Димчева 2008, 154-158), and Kozi Gramadi (Иванов 2011, 163-167) as well as the chance finds of grinding stones in the regions of Shumen (Атанасов 1982, 41-48) and Isperih, north-eastern Bulgaria (Александров 2006, 49-56; 2007, 259-261). Of great significance is the article on metal agricultural tools discovered on the territory of Bulgaria dated to the sixth – first century BC, as it presents unpublished materials from museum collections and ongoing excavations (Андонова 2013, 349-366)[8].

The works of Katsarov, Venedikov, and Georgieva as well as the catalogue of metal tools by Andonova are thus the only more comprehensive studies concerning agriculture practices and the preparation and consumption of cereal food in LIA Thrace. Although the topic attracted academic attention already from the beginning of the twentieth century, the research on Thracian farming has been confined largely to the analysis of the very valuable but insufficient literary and iconographic sources. The number of securely dated agricultural implements from the LIA is still not large, but new data have been accumulating as a result of the growing number of excavations and surveys.

In this respect, the study represents a much needed up-to date presentation of the agriculture tools as well as the only thorough synthesis of data regarding agriculture practices in inland Thrace during the LIA. The exploration of ancient farming requires a comprehensive analysis of the political, economic, social, technological, and environmental context of the relevant period and region. Thus, the topic is not only vast but also complex as the available data is restricted, and we are obliged to search for answers in various places and apply various approaches. By employing different types of evidence (see chapter II) the study contributes to our understanding of agriculture in LIA inland Thrace and its role in the economy – a topic that has remained to a large extent neglected.

[8] I would like to express my gratitude to A. Andonova for giving me the opportunity to read her article before its formal publication. In addition, some of the implements presented in the study have been collected by Andonova as part of her PhD thesis. While Andonova's study is dealing with all classes of metal implements from the LIA – craft tools, medical instruments, tools for every-day use, agricultural tools, etc., the current work focuses on agriculture, and particularly reconstruction of the entire process of cereal crop production.

CHAPTER II

RECONSTRUCTING ANCIENT FARMING PRACTICES

Ancient farming can be studied by examining four different classes of remains: the husbanded plants and animals, the landscape in which they were managed, the human diet, and the agricultural implements and relevant structures. On the other hand, questions, such as access to and ownership of arable land and the position of the farmer, are impossible to answer without examining the available documentary sources. The reconstruction of ancient farming may be supplemented also by the study of contemporary agriculture in a given region and the application of experimental studies. Each of these approaches, however, possesses some limitations. In the majority of cases, the evidence for past agriculture is very limited. This applies to a great extent for ancient Thrace where the study of the production of cereal crops, in particular, is hindered by inadequate data regarding non-urban settlements, insufficient archaeobotanical analyses from LIA sites and landscape studies for the period. The investigation of agricultural tools themselves also presents some problems. While the majority of implements used for land cultivation was manufactured of perishable materials and thus has left no trace in the archaeological record, storage vessels are rarely found intact, and storage pits contain the intended produce only in cases of sudden abandonment of the site, which often makes them difficult to recognise. In addition, the grain processing devices are largely neglected by scholars and lack precise stratigraphical information. Analysis of bone material from the period, although restricted to the necropolis at Sboryanovo and the pit complex at Gledachevo (Златева-Рангелова 2003), assists in revealing the palaeodiet. Thus, only by combining archaeological, textual, and iconographic evidence with the application of archaeobotanical, palynological, ethnographic, and experimental studies and integrating these with other types of data, for instance, settlement patterns and reconstruction of the human diet, we may hope to achieve a relatively accurate picture of past farming and its socioeconomic implications.

II.1. ARCHAEOLOGICAL RECORD

The available archaeological data are represented by tools and structures employed in different stages of the process of cerealcrop production. It should be pointed out, however, that the distribution of the investigated materials and structures within the region is uneven, which is due mainly to the state of archaeological research and publication. Agricultural tools are discovered in different contexts. Of major importance are the examples recorded at the urban centres in the Thracian interior, in particular, Seuthopolis, Sboryanovo, and emporion of Pistiros, the latter two still being systematically excavated. Tools connected to agriculture have been discovered also at ritual sites, among which the peak sanctuaries at Ada Tepe and Babyashka Chuka stand out. During the last decades, the number of excavated pit fields in Thrace has grown considerably, which has resulted in detailed discussions about their characteristics and function. The pit complexes are significant for our study, as they have not only yielded agricultural implements but also add to the discussion of storage practices. Structures with possible storage or farm functions have been identified within some of the recently excavated sites, and a few of the recorded tools come from funerary contexts. Finally, a great number of the materials represent chance finds without firm information about their depositional context. These are, however, also included in the study, as they complement the spatial distribution and typological variety of the relevant artefact.

The agricultural implements discussed in the study are divided into three main groups according to their primary function:

1) ***Tools connected to land cultivation and harvesting***. The data from LIA Thrace are confined to iron ploughshares, hoes, and sickles. These come from some of the major urban centres in the Thracian hinterland: Seuthopolis, Sboryanovo, and emporion of Pistiros. In addition, some of the tools are discovered in cult contexts (peak sanctuaries and pit complexes), which raises questions

about the role of agriculture in the rituals practised. One ploughshare was discovered in a tomb, and there are a few examples without certain context. Although the number of iron ploughshares, hoes, and sickles from the period under study is not large[9] and the state of preservation is often fragmentary, their presence indicates the high level of agricultural technology employed by the local population.

2) ***Vessels and structures connected to storage***. The ubiquitous distribution of pithoi places them among one of the most characteristic methods of storage in the period under study. The nature of the stored produce, whether solid food, different liquids, or even inorganic items is, however, far from certain and requires the application of residue analysis. Besides their utilitarian function as storage containers used also in connection to metallurgical activities, fragmentary pithoi are among the compulsory elements at cult sites. Dug into the ground intact vessels sometimes served as ritual pits. The pithoi recorded at Koprivlen (Hadjiangelov 2002, 163-166; 2005, 91-97), Seuthopolis (Чичикова 1984, 54-65), Pistiros (Lazov 1999, 339-348), Babyashka Chuka (Димчева 2008, 154-158), and Kozi Gramadi (Иванов 2011, 163-167) have been subject to typological analysis by different authors, which, however, does not demonstrate development of shapes through time. Common manufacture techniques were used for the production of the pithoi in Thrace, and the signs and stamps recorded on some of the vessels shed light on the organisation behind their production. Alternative storage methods are represented by subterranean pits and containers that have left no trace in the archaeological record but which existence is supposed on the basis of ethnographic parallels. While the storage function of subterranean pits found within settlements is very plausible, although not in all cases certain, the function of the pit complexes outside settlements is more debated. Careful examination demonstrates that, although the character of these structures may be related to ritual, a possible storage function should not be ruled out.

3) ***Grain processing devices***. The ubiquitous distribution of grinding stones of various shape and size already in the prehistoric periods is marked by the necessity of processing seeds and grains before human consumption. Although very conservative in their development, there are few major improvements in the evolution of this type of implements – the appearance of the Olynthus mill in the LIA and the rotary quern in Roman times, which in turn allowed the employment of animal power. The appearance of the Olynthus mill in the Classical period and its wide distribution, including the Thracian hinterland, demonstrates the quick spread and adoption of this advanced grinding technique. The sites that have produced Olynthus mills in Thrace represent both settlements and ritual sites, and there is also a number of surface finds without firm context (Appendix C). The catalogue includes 44 upper and eight lower stones of Olynthus mills. Although a number of examples are in a fragmentary state, the majority are preserved well enough, which allows us to determine their type. The suggested typology of handle-operated upper stones of Olynthus mills recorded in inland Thrace has several objectives: to investigate the spatial and quantitative distribution of types and subtypes and determine whether there is a correlation between depositional context and type of hopper-rubber.

II.2. CEREAL CROPS AND THE PALAEOENVIRONMENT

Visualising ancient agricultural production requires a comprehensive presentation of the natural environment, as the combination of geographical factors, such as climate, relief, water resources, soils, and vegetation, has important implications for the subsistence dominant in a given region. The natural resources, exploited in antiquity when there was no industrialisation, had a much greater influence on people's life than at present, which makes the reconstruction of the palaeoenvironment a necessary, though a difficult task.

Information about the geography of Thrace is given by the ancient authors among whom are

[9] Andonova's article on iron agriculture tools from the LIA includes nine plougshares and one model of such, 34 sickles, and four hoes (2013, 358-363).

Herodotus (*Histories* IV; V; VII; VIII), Thukydides (*History of the Peloponnesian War* II; IV), Xenophon (*Anabasis* VII), Pseudo-Scylax (*Periplous* 67), Pseudo-Scymnus (*Circumnavigation of the Earth* 618-790), Strabo (*Geography* VII), and later by Pomponius Mela (*De Chorographia* II.2), Pliny the Elder (*Natural History* IV.11), and Arrian (*Anabasis Alexandri* I.1-3; *Periplus Ponti Euxini* 32; 35-37). They describe geographical features and mention rivers, mountains, settlements, and tribal territories as well as distances between different places. The sources contain little information about the climate or note only some exceptional weather conditions. Xenophon mentions the cold day he and his army spent near Perinthus – there was heavy snow and the water froze (*Anabasis* VII.4). According to Pomponius Mela, who wrote around the middle of the first century AD, the climate of Thrace was cold, the soils were not fertile, and there were not many rivers (*De Chorographia* II.2). Theophrastus (*De Causis Plantarum* V.14.5) recorded changes in local climates that he had observed: after the trees had been cut down around Philippoi, for example, the waters dried up, and the weather became warmer.

The information provided by the literary sources has been used by a few scholars in reconstructing the environmental conditions in Thrace. Thus, the Czech scholar and traveller K. Ireček, citing Medieval sources, describes the area around present-day Stara Zagora in the Upper Thracian Plain as abundant with wheat, barley, rye, vineyards, flocks, and herds (Иречек 1899, 164). After travelling to South East Europe at the beginning of the twentieth century, S. Casson has published a book on Macedonia, Thrace, and Illyria. Using both the information provided by the classical authors and his own observations, Casson refers to Macedonia as a supplier of timber for the Greek world (1971, 53), while Thrace is described as its granary: the Nestos and Hebros plains possessing fertile soils suitable for wheat cultivation (1971, 56). In his study on agriculture in Thrace, I. Venedikov also discusses environmental conditions and the exploitation of natural resources based on the literary sources (Венедиков 1981, 62-71).

The territory under study is characterised by the transitional character and diversity of all geographical features expressed in the combination of plains, high and low mountains cut by deep river gorges, upland basins, thick forests and mountain pastures, fertile river terraces, and arable lands. This variety gives a specific character of the economy in the separate subregions, each possessing different agricultural potential. The soils' characteristics and qualities are a major factor in the choice of crops to be grown in a given area. It has been noted, however, that applying present-day soil distribution maps to the past should take into consideration any changes that might have occurred (Thomas 1990, 7; Shiel 1999, 72). Cereal crops are best cultivated in rich humic soils such as chernozems and alluvial-meadow soils. At present four regions stand out from the rest as being the most suitable for cereal crop cultivation: the Danubian Plain and especially its eastern part, the Upper Thracian Plain (the territory between the Sredna Gora mountains to the north and west, the Rhodope, Sakar and Strandzha Mountains to the south and the Black Sea to the east), the Burgas lowland, and the plains south of the Rhodope Mountains. Cereal crops were and continue to be grown in the mountainous areas as well, but these zones are reserved to species like rye and oats because of the specific atmospheric conditions. Wheat is the most common cereal cultivated in Thrace. It grows on flat areas, on chernozems, chernozem-smolnitsi, alluvial-meadow, and brown forest soils. The sowing is in the autumn, and the growth finishes in the first half of the summer thus avoiding the later summer droughts (Дончев 1994, 334). Barley is characterised with short vegetation period, and it becomes ripe before the summer droughts. Rye is tolerant to more-severe climate conditions. It grows in more humid, cooler places, in the uplands and valleys with soils poorer in humus. Rye is grown nowadays in south-western Bulgaria, the eastern Rhodope slopes, and to a lesser extent in the uplands of the central Balkan Mountains (Дончев 1994, 335). Oats requires lower temperatures and moisture and is grown in mountainous regions – the Rhodope Mountains, the northern parts of the Balkan Mountains, and in the valleys of the western and central Balkan Mountains (Дончев 1994, 337).

Environmental factors are often underestimated in the exploration of LIA sites, and joint archaeo-environmental investigations are rare and confined mainly to the prehistoric periods (Dennell, Webley 1975, 97-109; Божилова, Иванов 1985, 43-50; Божилова, Атанасова 1989, 197-204; Bozilova, Filipova-Marinova 1994, 39-50; Ognjanova-Rumenova 2008, 291-294; Chapman et al. 2009, 155-187). The combination of broad interdisciplinary studies, such as geoarchaeological (Denham 2010, 468-481), invertebrate (Porch 2010, 457-467), and pollen analyses (Rowe, Kershaw 2010, 430-441), can provide data for the reconstruction of the palaeoenvironment. In the majority of cases, however, only pollen analysis has been applied.

The analysis of pollen data can reveal past vegetation, its distribution and development, climate fluctuations as well as the human impact on the environment. Thus, for instance, a decline in arboreal pollen frequencies may be a sign of forest clearances; crop fields may be attested by the occurrence of cereal pollen and important weeds of arable lands such as Corn cockle (*Agrostemma githago*) and Cornflower (*Centaurea cyanus*); while an increase in pollen types indicating disturbance (*Rumex acetosa, Plantago lanceolata*) along with a general increase in herbaceous pollen diversity indicates grazing pressure on land (Chapman et al. 2009, 160). Preservation of pollen depends on characteristics related to both taxonomic origin and depositional environments – optimal preservation requires anaerobic or acidic environments such as wetlands, lake sediments, and dry cave earths which hinder decomposition bacteria (Rowe, Kershaw 2010, 431). Depending on their type, plants vary greatly in the amount of pollen they produce and the distance to which pollen grains are dispersed. It has been pointed out that spatial representation of the pollen rain is determined by the size of the basin. Thus, if a basin is smaller than five ha, the pollen derives from local sources and represents changes in the vegetation of the immediate vicinity; if the basin is larger, pollen from up to hundreds of kilometres may have been present (Willis et al. 1997, 740-750; 1998, 101-113).

Throughout the last 30 years, palynological analyses have been conducted for different ecological zones in Bulgaria, which has resulted in the establishment of the vegetation cover and variability in the Pleistocene and Holocene as well as the human impact on the vegetation development. It should be noted, however, that while the available pollen data are used in reconstructing the landscape of some prehistoric sites (Bozilova, Tonkov 1998, 141-148; Gaydarska 2007; Chapman et al. 2009, 155-187), a more detailed reconstruction of the LIA landscape in inland Thrace has been realised only for the site of Pistiros (Baltakov et al. 1997, 181-185; Kenderova, Fitova 2002, 321-327; Kenderova et al. 2007, 272-279; Chiverrell, Archibald 2009, 287-302) and in the region of Sboryanovo (Петров и др. 1990, 192-196).

The fertile soils of the Danubian Plain were appreciated and exploited already in the prehistoric periods. Palynological investigations at Lake Durankulak and Lake Shabla-Ezerets have demonstrated that the Chalcolithic settlers around these two lakes had used humid soils in the valleys for the cultivation of wheat and barley (Bozilova, Filipova 1991, 89). An increase in arboreal pollen has been attested at Lake Durankulak corresponding to the Early Bronze Age (EBA) (2919-2392 BC) together with the first maximum of the anthropogenic pollen indicators: almost all tree pollen curves decrease, pointing to a decline in the distribution of the local forests (Marinova 2003a, 257-268). A considerable human impact has been documented during the Iron Age, around 3000 BP and around 2500 BP, expressed in the decrease of the arboreals – oak, elm, hornbeam – and synchronic increase of the herbaceous, cultivated cereals, and anthropophytic elements (Bozilova, Filipova 1991, 92; Bozilova, Tonkov 1998, 141-148). The pollen diagrams from Lake Bolata in the vicinity of Kaliakra Cape have demonstrated two periods of peak anthropogenic activity: one during the Chalcolithic and the second – from the Late Bronze Age (LBA) to the Roman period (Tonkov et al. 2011, 37).

The palynological data from the Balkan Range peat bogs has demonstrated human activity in all vegetation belts during the Bronze – Iron Age transition, marked by the lowered values of tree species in all diagrams (Filipovitch, Stefanova 1998, 41). The period coincides with the

active migration of Thracian tribes in search of new metal-mining regions in the mountains (Фол, Спиридонов 1983). Iron reduction was achieved with the help of charcoal, a possible raw material for which was the coniferous timber (Filipovitch, Stefanova 1998, 40). In addition, there is a considerable increase in the amount of cereal pollen in the diagrams from the mountainous and lowland areas, explained by the use of iron tools, which resulted in a subsequent increase in crop production (Tonkov et al. 2007, 314). In the last several centuries, deforestation of vast areas in all mountain belts, lowering of the upper forest boundary, and expansion of meadow-pasture communities are all consequences of human interference (Filipovitch 1996, 54-60).

The pollen records from the Ezero reed-swamp next to the eponymous prehistoric tell near Nova Zagora (Chapman et al. 2009, 165) and from the Straldzha marsh in the north-eastern part of the Tundzha Plain (Tonkov et al. 2008, 185-191) have revealed a strong human impact expressed in forest clearance from the LBA and EIA periods, intensifying towards 600 BC. The pollen records from Ezero have further indicated that during the EIA pasture land for stock-breeding was exploited to a larger scale than the arable fields (Chapman et al. 2009, 181). The investigations at the site at Adzhiyska Vodenitsa in the Upper Thracian Plain have revealed a wide range of plant species with cereals being predominant (Chiverrell, Archibald 2009, 297). The palynological studies in the wider region (from locations above 1400 m) have demonstrated increase in the human interference from 500 BC onwards expressed in woodland clearance for arable and pastoral land as well as increase in the humidity in 600 – 400 BC (Bozilova et al. 1990, 48-57; Filipovitch 1995, 5-11; Lazarova 2003, 245-256).

The pollen analyses from Pirin (Tonkov et al. 2002, 201-210; Stefanova, Ammann 2003, 97-107), Rila (Bozilova et al. 1990, 48-57; Tonkov, Marinova 2005, 663-671), and the Western Rhodope Mountains (Filipovitch 1995, 5-11; Filipovitch, Lazarova 2001, 167-180) demonstrate that the first human impact in south-west Bulgaria appeared in the final stages of the Neolithic (*c.* 5000 BC) when very sporadic indications of cereal cultivation and grazing occurred (Marinova et al. 2012, 413-427). Signs of large scale deforestation and more extensive land use in the region are recorded during the LBA. After *c.* 900 – 800 BC, the palynological records from northern Pirin, Maleshevska, and Osogovo Mountains demonstrate another peak of anthropogenic indicators showing mainly pasture and a partial deforestation of the area (Marinova et al. 2012, 413-427). One of the pollen diagrams from southern Pirin Mountains (Popovi Livadi, 1400 m a.s.l.) is very rich in pollen of barley (*Hordeum*) (18%) and rye (*Secale*) (up to 3%) dated to the Hellenistic and Roman periods (Tonkov et al. 2007, 314).

During the LBA – EIA transition, a reorganisation of the vegetation in the hills north of the Thracian Plain has been recorded, which points to a shift in the climate towards higher levels of humidity and lower temperatures (Chapman et al. 2009, 174). This is also supported by the data from peat bogs in the Central Rhodope and Sredna Gora Mountains, by the formation of the riparian forest communities on the Bulgarian Black Sea coast (longoz forests) dated to around 1400 – 1000 BC as well as the advance of *Silver fir* in south-western Bulgaria dated to 1400 – 700 BC, all indicating a cooler and wetter climate (Chapman et al. 2009, 174). A sharp cooling is further recorded for the Early Subatlantic Age (650 – 280 BC) in the northern hemisphere on a global scale. It has been suggested that the Early Subatlantic Age had two cooler stages – one from 680 to 450 BC, followed by a short-term warming period between 450 and 380 BC, and a second cooling stage culminating at 280 BC (Bozilova, Tonkov 2007, 533).

II.3. LITERARY AND ICONOGRAPHIC SOURCES

The information provided by ancient authors as well as the available iconographic sources related to the topic is of great significance for filling the lacunae regarding ancient farming practices. The absence of literacy in Thracian society, however, obliges us to rely on the written records of the Greek Archaic, Classical, and Hellenistic authors. Further information is provided by the Roman authors, although the different geographical and economic conditions, as well as

the chronological factor and the development of technology in Roman times, should all be taken into account when trying to reconstruct the agricultural practices in LIA Thrace.

The documentary sources concerning Greek agriculture are very limited, and this is true to a greater extent for societies outside Greece. The Greek writers engaged in agriculture related topics in detail are Hesiod and his *Works and Days*, Xenophon and his *Oeconomicus*, and Theophrastus with his botanical studies *Enquiry into Plants* and *De Causis Plantarum*. While the first two describe the farmer's life and work, thus providing information about the specific tasks that should be performed, Theophrastus' works emphasise the plants themselves rather than farming as a whole. Individual activities connected to agriculture are also found in the Homeric poems. Different passages in the works of historians, playwrights, and orators shed light on agriculture related topics (Appendix B.1).

While some of the Greek authors had first-hand knowledge of Thracians, the information we collect from the various works regarding agriculture is inadequate and often intended to distinguish Greek from Thracian and thus presented as a curiosity. The majority of references related to the region under study are found in Xenophon's *Anabasis,* who actually visited southern Thrace on his way back from the Persian expedition and remained there in service of Seuthes II for more than a month. His *Anabasis* is not only an invaluable source for the political history of the region during the beginning of the fourth century BC but it also gives detailed geographical descriptions and references to various aspects of life in Thrace.

The available literary evidence demonstrates the variety of cereal crops grown in Thrace (Appendix B.1). While millet was typical for the lower parts of Strandzha Mountains (*Anabasis* VII.5.12), Xenophon mentions also barley and wheat (*Anabasis* VII.1.13) in the region around the Propontis and north along the Hebros valley. Demosthenes speaks of rye and millet (10.16), and Galen informs us about the Thracian word for rye – *briza*, the bread of which was black and malodorous (*On the Properties of Foodstuffs* 13.514 ff.). Different qualities of the cereal crops in Thrace are also mentioned by the ancient authors, often described as peculiarities. According to Theophrastus, the Thracian wheat is many-coated and sprouts late (*De Causis Plantarum* IV.11.5), which he explains with the climate conditions in the region, particularly, the cold and long winters. Pliny the Elder mentions a type of wheat that ripens for three months and another one that grows in forty days (*Natural History* 18.12). Pseudo-Aristotle informs us about the barley cultivated in the Struma valley that was so bad in taste that only people could eat it, but no animal would ever try it (*De Mirabilibus Auscultationibus* 116). That grain was a staple in antiquity is evident from ethnographic studies in Greece and Bulgaria which demonstrate that except some recent additions such as potatoes and maize, for instance, most of the same cultigens that were important in antiquity are important today as well (Foxhall, Forbes 1982, 65; Вакарелски 2007, 83).

It has long been recognised that the quality of the bread was an indicator of social status. Thus, the use of leavened bread which required a good quality wheat flour and time for the dough to rise was most probably a privilege only for the Thracian aristocracy (Георгиева 1999, 74). Herodotus mentions that the bread intended for the future king Perdiccas always doubled its size while baking (Hdt. *Histories* VIII. 137.3). The story is told as a curiosity interpreted as a sign for the future greatness of Perdiccas. It may be recognised, however, as indirect evidence for the use of leavened bread by the Macedonian elite. Its use in Thrace is attested by Xenophon in his description of the dinner organised by Seuthes II for the Greek commanders (*Anabasis* VII.3.21 ff.). There were three-legged tables for all the guests with meat cut into pieces and loaves of leavened bread. Yeast was most probably prepared from the grains of sour beans or from wheat flour blended with grape juice, fermented and dried in the sun (Георгиева 1999, 74). Bread was produced also from barley (Xen. *Anabasis* VII.1.33-41; Pseudo-Aristotle. *De Mirabilibus Auscultationibus* 116) and probably millet, the latter being used as food by the poorest or in years of shortage, as it is much more difficult to digest.

In addition to bread, cereals were consumed as porridge made of barley or wheat groats. Herodotus mentions that the inhabitants of Chalcidice prepared some kind of bulgur (VII. 119.1-2). It is usually prepared from barley or wheat by grinding the grains after soaking and baking or by boiling and then grinding them. The processing of grain in this way leads to its preservation for a longer period. By adding liquids – milk, water, or honey – different kinds of porridge can be prepared that are also rich in calories. Some sort of bulgur was used already in the prehistoric periods, as evident from the analyses conducted on archaeobotanical remains from Bronze Age Greece and Neolithic Bulgaria (Valamoti 2011, 24).

Barley was used also for the preparation of drinks. Xenophon describes the barley wine in the village of the Armenians as very strong but very good and with barley-grains floating on top, so it was drunk with straws (*Anabasis* IV.5.26ff.). In his *Deipnosophists* (X. 447 b–d), Athenaeus discusses the information provided by different authors on the use of barley drinks and the consequences of their consumption. The text is significant, as it mentions a barley drink (beer) consumed by the Thracians which they called *bryton*. The Paeonians had a drink made of millet and some sort of aromatic plant called *parabias*. It has also been pointed out that the Thracians might have prepared *kykeon* – a hallucinogenic drink used in Greece during the Eleusinian Mysteries made from barley, water, and fresh mint which quickly fermented (Георгиева 1999, 85; Harrison 1903, 156).

The literary evidence thus demonstrates both the abundance of cereal crops in Thrace and the variety of ways in which they were prepared and consumed. The ancient diet included also pulses, vegetables, fruit, meat, and dairy products, the latter two predominant in mountainous regions where stock-breeding played the main role in the subsistence (Георгиева 1999, 76-85). For the majority of Thrace, however, grain and vegetable diet formed the staple food. This is supported by the examination of the chemical elements in the bone materials from the necropolises at Sboryanovo and Apollonia Pontica as well as from the pit complex at Gledachevo, aimed at reconstructing the palaeodiet of the Thracians (Златева-Рангелова 2003). The conducted analyses have demonstrated the predominance of cereal and vegetable food for the inhabitants of Sboryanovo and the individuals at Gledachevo, and the presence of fish, sea-food, and cereals for the population at Apollonia Pontica (Златева-Рангелова 2003). Interesting is the established difference according to the gender of the individuals at Sboryanovo – mainly vegetarian diet for the women, and a mixed diet for the men with predominant consumption of meat (Златева-Рангелова 2003). This may be due to different social status of the examined individuals or can reflect an actual gender differentiation in the diet. The results are based on the analysis of four male and four female skeletons and, therefore, more data are required to prove any assumptions on gender differences in the diet.

The literary references are also of great importance when examining issues related to grain trade and land ownership and control. Although very limited in number (chapter III.2.3), these are invaluable sources for the reconstruction of the political and economic situation in Thrace.

The iconographic sources (Appendix B.2) are represented by painted pottery, terracotta statuettes, funerary stelae, amphora stamps, and numismatic material. With the exception of depictions of ears of corn on both vases and coins, farming activities are relatively rarely represented in either painted pottery or sculpture during the Archaic, Classical, and Hellenistic periods. Furthermore, depictions concerning the production and processing of cereals are rather limited compared to those related to viticulture. Nevertheless, the reconstruction of some of the agricultural implements that have left no trace in the archaeological record is possible only after careful examination of the illustrative scenes.

The terracotta statuettes connected to the topic represent ploughing or grinding/pounding. Only two such examples come from Thrace, though both are found at the Greek colony of Apollonia Pontica. Attic painted pottery from different museum collections outside Bulgaria depicts agricultural tasks, predominantly ploughing and sowing, while threshing is attested on

only one vessel. Grinding, pounding and/or kneading appear on both black and red-figured vessels. Amphora stamps depict various agricultural tools including sickles, ards, pruning-hooks, hoes, and winnowing forks. Finally, a pair of oxen and agricultural implements appear on two funerary stelae from Turkish Thrace dated to the Roman period. In Greek vase paintings, sickles and pestles are sometimes depicted as weapons, particularly, in scenes with Orpheus and Perseus, demonstrating the multi-purpose function of the implements. Thus, the available sources may be used as a parallel for the agricultural implements employed in the Thracian lands, although we should keep in mind their Greek origin.

The numismatic material related to the topic is confined to coins of some of the Greek coastal cities and some Thracian rulers. The symbols depicted, usually related to the fertility of the land, imply the economic significance of agriculture. The coins depict deities connected to fertility with their characteristic attributes. In the pre-Roman period, such depictions are found on the coins of some of the Scythian kings struck in Callatis, Tomi, Dionysopolis, and Odessos during the second half of the second and the first half of the first century BC (Юрукова 1981, 120). The obverse usually represents Demeter with a wreath of corn ears, while corn ears or the horn of plenty, a symbol of fertility, appear on the reverse. Corn ears appear also on the reverse of the coins of the Greek towns of southern Thrace (Head 1911, 246-281). Among these are Aenus, where an ear of corn is depicted on silver and bronze coins of the first half of the fourth century BC, and Maroneia where, however, the vine was the main symbol and is represented much more often. On the reverse of some of the coins of Abdera there are three ears of corn, a symbol of the fertile plain around the city. Among the other coins, on the reverse of which there is an ear of corn or a corn wreath, are the coins struck at some cities of the Thracian Chersonese and on the European coast of the Propontis (Head 1911, 246-281; Юрукова 1981, 122). Ears of barley appear on the reverse of some of the coins of the Thracian rulers: Hebryzelmis, Kersobleptes, Seuthes III, and Rhoemetalces I (Appendix B.2.39-43).

II.4. ARCHAEOBOTANICAL STUDIES

The significance of the archaeobotanical analyses for distinguishing different stages of crop processing, identifying modes of storage and thus reconstructing crop economy has long been recognised (Dennell 1972, 149-194; 1974a, 275-284; 1976, 229-247; Hillman 1981, 123-162; 1984, 1-41; Hubbard 1976, 257-265; Jones 1984, 43-61; 1987, 115-123; 1987a, 311-323; 1990, 91-96). The archaeobotanical studies conducted on prehistoric sites in Bulgaria (Dennell 1974, 33-37; Marinova 2006, 187-194; 2007, 93-109; 2009, 59-62; Popova, Marinova 2006, 523-532; Popova 2010; Попова 2009, 71-124) and northern Greece (Valamoti 2002a, 2-15; 2003, 97-111; 2007, 91-108) have demonstrated the presence of almost all the crop plants typical for the early agriculture. The cultivated plants correspond to the so-called "Near Eastern crop assemblage" (Zohary, Hopf 2000, 241-246). The evidence from northern Greece originates mainly from Late and Final Neolithic sites and indicates the dominance of cereals and pulses. The cereals include einkorn, emmer, bread wheat, two and six-row barley, hulled and naked. The archaeobotanical assemblage from Early and Late Neolithic sites in Bulgaria has also shown the presence of hulled wheat (emmer and einkorn), as being the most numerous finds, as well as naked wheat and hulled and naked barley. The archaeobotanical studies for the Bronze and EIA concerning the region under examination are comparatively rare but nevertheless demonstrate the predominant position of emmer, einkorn, and barley (Попова 2009, 116-133).

The LIA is represented mainly by samples taken from the large number of excavated pit fields as well as from few settlements (Appendix A), peak sanctuaries, and necropolises (Попова 2009, 71-166) (fig. 3). The latter two are, however, not considered in the study as their interpretation is related to the rituals practised. However, the possibility that the pit complexes in Thrace were also used for storage, discussed in detail in chapter III, requires the presentation of the plant remains recorded in these structures.

The LIA settlement sites in Thrace at which archaeobotanical studies have been conducted include Pistiros, Sboryanovo, Cabyle, and the Thracian centre at Halka Bunar. At Pistiros, grains of einkorn, emmer, free-threshing wheat, barley, millet, and rye as well as lentils, bitter vetch, and cultivated grape have been documented in the area around the "clay altar" as well as from the remaining sampled contexts[10] (Popova 1996, 173; 2002, 289-297). The analysis of the carbonised remains has demonstrated that most common among the cereal crops at the settlement is the bread/durum wheat. Barley was another major cereal crop at the site represented by both naked and hulled forms with the naked variant being preferred. The small quantity of einkorn and emmer recorded at Pistiros has led to the suggestion that these species were not sown regularly, but as additional crops in case of failure of the harvest (Popova 2002, 292). The quantity of oats and rye is also insignificant, which may be due to the state of preservation but may also point to the secondary position of these crops as they require a more humid and cooler climate typical for northern areas (Popova 2002, 292). At the remaining investigated sites rye and oats are also represented by single finds which has been interpreted as an indication that these were not cultivated separately, rather they were weeds (Славова 2013, 94-95). Samples for archaeobotanical analysis have been taken from Hellenistic contexts in sector V[11] and sector VIII[12] at Cabyle (Славова 2013, 61). The remains of cereal crops predominate followed by legumes and fruits. Bread/durum wheat and barley prevail followed by millet, while einkorn, although present, was not of great significance (Славова 2013, таблица 10). The cereals at the Thracian centre at Halka Bunar in the region of Chirpan, dated to the end of the fourth – beginning of the third century BC, include einkorn, bread/durum wheat, hulled barley, millet, and sorghum (Попова 2009, 132-133). The pulses are represented by bitter vetch. At the Getic town at Sboryanovo, remains of einkorn and sorghum have been identified (Попова 2009, 131). The finds of sorghum from the pre-Roman period are relatively rare, but its presence at Pistiros, Sboryanovo, and Halka Bunar demonstrates that already in the Early Hellenistic Age this species has reached the Thracian lands (Попова 2009, 76).

The majority of archaeobotanical samples from inland Thrace during the LIA come from pit complexes. The pit sanctuary near the town of Svilengrad had functioned during the second period of the Early Iron and the LIA (the latest materials date to the end of the fourth or the first half of the third century BC) (Нехризов 2006, 397). Thirty five samples from 31 pits have been analysed (Попова 2006, 518-519; 2008, 550-555). In seven of the pits no plant remains have been documented. The results from the remaining pits have shown the presence of 35 plant species, 11 of which represent cereal crops and pulses. Barley in both its forms, hulled and naked, predominates together with spelt wheat and millet. An increase in the spelt production during the Iron Age has been attested, explained by the fact that it is undemanding towards soil type, while at the same time is able to produce high-quality flour (Попова 2008, 550). Its grains get dry very quickly after the harvest which is important in areas with humid climate (Попова 2008, 550). Bread/durum wheat was also grown in the region. The minimal presence in the samples of einkorn and emmer, so characteristic for the prehistoric agriculture, points to their insignificant role during the LIA (Попова 2008, 550).

Archaeobotanical analyses have been conducted also on samples from the pit sanctuary at Malko Tranovo, Chirpan. Most of the pits are dated to the LIA (from the fifth to the first half of the fourth century BC) (Божкова, Ников 2005, 94; 2010, 213-220). The cereals are represented by einkorn and emmer, naked barley, bread/durum wheat, millet, rye, and oats (Попова 2005, 162; 2009, 129-130). Naked barley predominates followed by bread/durum wheat. Smaller is the quantity of rye and millet. The study of 25 samples taken from 13 pits at the site of Vratitsa,

[10] Sq. B7, B22 fire place, sq. B12 south part of a well, sq. B18 context 8, and sector AVII, 3265/1120 and 3270/1120.

[11] Pits No 7 and 12, the space above a clay altar in sq. 43 and 53, and the content of a gutus in sq. 75/74 in a layer below the pavement of pink stones.

[12] One sample from the layer below the wall in sq. 42.

south-eastern Bulgaria, dated to the sixth – fifth century BC (Карайотов, Киашкина 2005, 100-101), has resulted in the distinguishing of 14 plant species. The cereals are represented by einkorn, emmer, hulled barley, and bread/durum wheat, the latter being predominant (Попова 2005, 163). The pits at Kumsala locality near Gledachevo have revealed remains of einkorn, emmer, bread/durum wheat, barley (hulled and naked), and rye (Popova 2001, 215; Попова 2009, 127). The same species, including also millet, have been identified at the pits at Dvora locality, Gledachevo (Popova 2001, 215; Попова 2009, 127). Interesting is the predominance of einkorn. The archaeobotanical samples from the pits at Dana Bunar, municipality of Lyubimets, have demonstrated the presence of einkorn, emmer, barley, millet, rye, and oats (Славова 2013), while at the pits at Krastina, Burgas region, einkorn, bread/durum wheat, and barley have been identified (Попова 2009, 129). The archaeobotanical analyses from the pits in Sector South at Koprivlen have revealed 21 species of cultivated plants among which einkorn, emmer, naked and hulled barley, bread/durum wheat, rye, oats, and millet (Popova 2002a, 282-288; 2005, 99). The latter was predominant which is most probably due to its tolerance to bad weather conditions. It has been pointed out that bread/durum wheat prevailed over einkorn and emmer, as is the case with the majority of sites from the period, and may be explained by the greater yields of the former (Popova 2002a, 284; 2005, 99). The percentage of legumes from Sector South is insignificant in comparison to the cereal species. Samples for archaeobotanical analyses have been taken also from five pits from Sector North at Koprivlen demonstrating again the predominance of millet (Popova 2002a, 288). Among the identified cereal species at the Early Hellenistic pits at Krepost near Dimitrovgrad, millet is predominant followed by einkorn and barley, and small quantity of emmer, while bread/durum wheat is represented only by single finds (Славова 2013, 56-57, таблица 8).

The discovery of plant remains in pits may be the result of deliberate act (if the pits were used for storage, rubbish, or ritual purposes) or deposited by chance (brought by the wind, animals, or as a result of soil erosion). Distinguishing between these is often difficult, and a careful analysis of the character of the recorded plant remains, the state in which they are preserved as well as the processes during the pits' filling and after their disuse, is required. The plant remains recorded at the pit complexes in Thrace are comparatively small in quantity, which is commonly used in support of the hypothesis of the cult character of these structures (Popova 2002a, 284). The plant remains may have been deliberately deposited as part of the performed rituals. However, plant remains will be preserved in the archaeological record only if charred, which may explain their small amount in the samples. Thus, the quantity of plant remains itself is not sufficient to determine the function of the pits.

The results from the conducted archaeobotanical investigations demonstrate the variety of cereal crops grown in Thrace. Einkorn and emmer, characteristic already for the prehistoric periods, continue to be found throughout the entire first millennium BC with einkorn being predominant (Славова 2013, 86). While in some of the investigated pits the quantity of einkorn and emmer is bigger than that of bread/durum wheat (Dana Bunar, Dvora, and Krepost), the opposite is true for the remaining investigated sites. Thus, it has been pointed out that from the middle of the first millennium BC onwards einkorn and emmer, which were predominant in earlier periods, are no longer of major importance in the subsistence as opposed to bread/durum wheat (Попова 1991, 52; 2006a, 509-510; Popova 2002a, 284). A number of ecological factors as well as social ones were the reason for this change. While einkorn and emmer are tolerant of different climate conditions, they produce small yields. On the other hand, bread/durum wheat is vulnerable to drought and requires a more humid climate, but it produces higher yields which with the growth of population was probably the reason for its preference and wider distribution (Попова 2008, 550-552). Barley was distributed already in the Neolithic and became of major importance in the following periods. It is tolerant of poor climatic conditions and poorer soils. The archaeobotanical studies from LIA Thrace demonstrate its presence in all of the sampled

sites except Sboryanovo. It predominates in the samples at Svilengrad (Попова 2008, 550-555), Dana Bunar (Славова 2013, 90), and Malko Tranovo (Попова 2005, 162). Another major cereal crop is millet. It becomes one of the most characteristic crops of the Iron Age as a result of its tolerance to high temperatures, droughts, and poor soils (Славова 2013, 92). It also ripens in a short time and produces a rich harvest. Millet is attested in the majority of the sampled LIA sites and is even predominant at Koprivlen (Popova 2002a, 280-289; 2005, 99-102) and Krepost (Славова 2013, 92).

Rye is a characteristic crop for the temperate climate zone. Its advantage is that it is resistant to bad climate conditions and can grow on sandy soils. The mild climate in the Mediterranean region determines its scarce distribution as opposed to central and northern Europe (Behre 1992, 145). Rye is attested at Koprivlen, Malko Tranovo, Gledachevo (Kumsala and Dvora), Svilengrad, Dana Bunar, Pistiros, and Cabyle, but its quantity is insignificant. It has been pointed out that rye migrated from Anatolia to Europe originally as a weed in the cornfields and only later on, probably in the course of the EIA, achieved the status of a cultivated plant (Behre 1992, 141-156). Thus, the low percentage of rye grains in a sample with other cereals is usually taken to indicate that it was not grown as a separate crop, but rather it was a weed (Behre 1992, 141-156). The same suggestion has been proposed for the LIA findings from Thrace (Славова 2013, 94). The evidence for the cultivation of oats dates to the second – first millennium BC (Zohary, Hopf 2000, 77-82). It is not commonly found during the LIA in Thrace – only at Malko Tranovo, Dana Bunar, Koprivlen, and Pistiros. These represent single finds, and it has been suggested that like rye oats might have not been cultivated separately during this period (Славова 2013, 95). Common in the archaeobotanical samples is the presence of various pulses, but their quantity is smaller compared to cereal crops (Popova 2002a, 280-285; Попова 2006a, 509-510; 2006, 518-519; 2008, 550-552). Lentils, bitter vetch, and peas were grown during the Hellenistic Age in Thrace, characteristic already for the Neolithic period (Маринова 2002, 13-24). Cereals played an important part in the subsistence economy but their predominance over legumes and fruits may be due to the state of preservation as cereals have better chance of charring and are, thus, more visible in the archaeological record.

II.5. ETHNOGRAPHIC AND EXPERIMENTAL STUDIES

The gap in the archaeological data of ancient agriculture may be partially filled with the use of ethnographic and experimental studies regarding models of cereal crop production, storage, and processing. The ethnographic approach, investigating present-day societies and inferring analogies with the past, has been applied in archaeological interpretation for a long time. Theoretical considerations have led to the development of Middle-range Theory in which ethnographic observations are used to determine common behaviour regardless of the cultural context (Binford 1967, 1-12; Johnson 1999, 48-63). It has been pointed out, however, that analogies should be grounded in specific time-space contexts (Hodder 1982, 12-16; Johnson 1999, 60; David, Kramer 2001, 48). A distinction has been made between formal and relational analogies with the latter being stronger (Wylie 1985, 63-111; Hodder 1982, 16-27). Formal analogies rest on the notion that if two objects or situations have some common properties, they probably have other similarities as well. A formal analogy becomes more reasonable as the number of similarities increases. In the construction of relational analogies, on the other hand, emphasis is placed on establishing the relevance of the observed similarities between the archaeological phenomena under analysis and the ethnographic case material used to infer other, non-observable similarities. Interpretation with the aid of analogies is unreliable and non-rigorous when similarities between the things being compared are few in number and when the relevance of the comparison cannot be adequately demonstrated (Hodder 1982, 27).

Recognition of the need for ethnographic material on which to base analogies to assist in the interpretation of archaeological data has led to the development of ethnoarchaeology – the

ethnographic study of living cultures from archaeological perspectives (David, Kramer 2001, 2). According to Kramer, ethnoarchaeology is the "ethnographic fieldwork carried out with the express purpose of enhancing archaeological research by documenting aspects of sociocultural behaviour likely to leave identifiable residues in the archaeological record" (Kramer 1996, 396-399). In regard to agriculture, ethnographic analogs can lead to the development of models of processes that can be tested against the archaeological record. It has been pointed out that when studying a topic like ancient agriculture, one must take into account not only climatic or geographical characteristics but also social, economic, and technological factors as well as the context of the informant data as a whole (Forbes 1992, 87-101). The production of cereal crops can only be performed in certain ways given the available technology and the biological characteristics of the species. Thus, for example, harvesting can only take place during certain times of the year, the wheat must be separated from the chaff, the grain must be dried, etc. Crops require different processing depending upon their biological characteristics (for instance, small versus large seeds, glume wheats versus free-threshing wheats), harvesting methods (which may or may not result in the presence of weeds and stalks), and intended purpose (for fodder or for human consumption). Thus, there is a number of processing stages that the crop passes through before it is consumed or stored. Each step produces a crop product and a by-product, the latter usually used as animal fodder. R. Dennell (1972, 149-194) has created a model of crop processing and defined a sequence of processing stages, each presenting specific composition of grain remains. Later, both Hillman (1984, 1-41) and Jones (1984, 43-61; 1990, 91-96) have conducted ethnographic studies of traditional crop processing in Turkey and Greece respectively and have defined specific stages and contexts in the processing sequence of wheat, barley, and legumes. They have concluded that certain ethnographic sample compositions result from a particular crop processing stage. This has allowed them to make analogies between a given archaeological sample and similar ethnographic samples and suggest the processing method applied in the past. S. Reddy's study of the processing of millet in southern India and of sorghum in western India has demonstrated that even within the same culture there are, depending on crop maturity and quantity, and ephemeral conditions (e.g., wind velocity at the time of winnowing), a variety of processing pathways for any particular crop (1997, 162-187).

The ethnoarchaeological approach in regard to agriculture has been long adopted in Greece and the Aegean. Different publications have appeared, among which the works of P. Halstead (1987, 77-87; Halstead, Tierney 1998, 71-80; Halstead, Jones 1989, 41-55), H. Forbes (1976, 5-11; 1992, 87-101; 1996, 68-97; 1998, 19-34), E. Margaritis (Margaritis, Jones 2006, 784-805), and C. Chang (1993, 687-703) should be mentioned, investigating various aspects of agriculture and stock-breeding. For the territory of Bulgaria, special ethnoarchaeological studies have not been conducted so far for the period under investigation and in regard to agriculture. Drawing analogies with the past and testing the validity of hypotheses by using ethnographic and experimental approaches is of great value when trying to understand the manufacture and use of agricultural tools as well as identifying the natural properties of materials. Functional analysis on grinding stones, flint and bone tools used in the processing of plants has been applied to artefact assemblages from various sites in Europe (Anderson 1999; Dubreuil 2001, 73-87; Procopiou, Treuil 2002; Longo, Skakun 2008; Bofill 2012, 63-84). For the territory of Bulgaria, such studies are again confined to the prehistoric periods (Gyurova 1995, 55-72; 2012, 15-49; Gatsov 1993; 2009; Skakun 1999, 199-210). For the LIA in Thrace, no use-wear or phytolith analyses have been conducted on the recorded agricultural tools. Residue analysis has been carried out only on one Olynthus mill from the region of Akandzhievo village in the vicinity of Pistiros (Катинчарова 2005, 188-189, бел. 3). Thus, again the lack of experimental studies for the period under examination and in regards to agriculture should be pointed out.

II. 6. CONCLUSION

The study of ancient farming practices and tools requires the application of various approaches, incorporating traditional and interdisciplinary methods. Each of these has its own advantages and limitations and only by combining the archaeological data with literary and iconographic sources, archaeobotanical, ethnographic, and experimental studies, we may hope to acquire a better understanding of the past agriculture practices.

The outline of the state of the archaeological record has demonstrated the different tools and structures used in each particular stage of cereal crop production in LIA Thrace. As already noted, these are found in various contexts. The majority of implements come from the better-excavated and published urban centres in the Thracian hinterland. A second group of artefacts related to agriculture are presented by the finds from ritual sites (peak sanctuaries and pit complexes). There is also a number of chance finds, which broaden the distribution map of the investigated implements.

The reconstruction of the palaeoenvironment is of great significance regarding the topic under study. The pollen analyses from Bulgaria are unevenly distributed for the different regions of the country. In addition, there is much more evidence for the prehistoric periods than the historical times. However, the available data demonstrate that during the Iron Age the population in Thrace exploited a wide range of plant species and the human impact on the vegetation becomes clearly pronounced, especially around 500 – 400 BC, and continues on a large scale (the species connected with the human activity are mainly herbaceous-ruderals, weeds, cultivated cereals, and arboreals) (Bozilova, Filipova 1991, 87). This is in accordance with other changes of the period, in particular, population growth, urbanisation, and exploitation of natural resources.

The presentation of the literary and iconographic sources related to the subject under study is another essential approach. The available written references demonstrate the abundance of cereal crops in Thrace and the different ways of their preparation and consumption. The reconstruction of some agricultural implements is possible only after examining the iconographic evidence since many of the tools employed were made of perishable materials.

The archaeobotanical studies for the period under investigation are rare compared to the prehistoric periods. Moreover, the majority of samples is derived from pit complexes and often interpreted as remains of ritual food. While the practice of ritual deposition of food is not ruled out, the evidence for a single cult function of the pit fields is challenged later on in the study. Few settlement sites add to our knowledge of cultivated cereal crops in the region, but the information is often restricted to identification of the species and presentation of percent values. The insufficient evidence of the state of the recorded crops, for instance, distinguishing different stages of crop processing, is a major drawback for the reconstruction of the past crop economy. Finally, there is lack of experimental and ethnoarchaeological studies regarding the topic and the period under examination and the available functional analyses on tools concern mainly earlier periods.

Farming was significant at least in the plains of Thrace, including a pastoral strategy which was of greater importance in the mountainous regions. It should be pointed out, however, that determining the subsistence strategy at a given region requires not only evaluation of the natural resources around a particular site but also demographic analysis and examination of the social organisation. An attempt at reconstructing the agricultural regime of LIA Thrace will be presented in the following chapter – *Production of Cereal Crops.*

CHAPTER III

PRODUCTION OF CEREAL CROPS

The process of cereal crop production encompasses separate stages, each characterised by different activities. Besides the analysis of the archaeobotanical evidence, it can be identified by the employment of diverse agricultural implements. The study of these implements is, however, hampered by the limited number of well-preserved examples which often hinders their proper identification and interpretation. In addition, the majority has been manufactured wholly or partially from wood and has left no traces in the archaeological record. Thus, while the documented iron ploughshares demonstrate the high level of technology employed by Thracian farmers, the construction of the ard, to which the ploughshares were attached, is much more difficult to reconstruct. This gap can be filled by the information provided by the written and iconographic sources regarding agricultural practices. Although the written references concerning Thrace are very limited, the efficient cultivation methods and tools employed in the production of cereal crops and available in a period when there was no industrialised farming, were relatively few. Therefore, the techniques applied should not differ considerably from region to region, although environmental factors should be taken into account. The application of ethnographic studies of modern non-industrialised agricultural systems also assists in the reconstruction of farming practices and tools. Studies of traditionally employed implements from the recent past in Bulgaria demonstrate a variety of terms and local variants – a diversity that most certainly existed also in antiquity.

The agricultural tools and methods are presented following the agricultural year commencing with the implements utilised in the preparation of the soil, those used for sowing, harvest, threshing and winnowing, and initial preparation for storage. It is very difficult to give a precise date for the appearance of the diverse tools, as their development, if any, is very slow, and there is often overlapping of types. Thus, an archaeological discovery demonstrates no more than a *terminus ante quem*. By tracing back the agricultural implements used in the prehistoric periods, we will attempt to outline tradition and innovation in the farming technology of LIA Thrace. Questions regarding the organisation of cereal crop production in Thrace and its position in the ancient economy are presented later on in the chapter.

III.1. CULTIVATION TECHNIQUES AND TOOLS

III.1.1. PLOUGHING

The initial stage of land cultivation is tilling of the soil. The first millennium BC farmers used both manpower itself and the plough which employs animal traction. It has long been recognised that the introduction of the plough was of great economic significance for agricultural production. It was a major component of the "Secondary Products Revolution" model used to explain the changes in economic and political organisation in the Near East and Europe during the Chalcolithic and EBA (Sherratt 1981, 261-305). It marked a new stage in the development of agriculture when, alongside other innovations, animal power started to be used as a source of energy for transport and land cultivation. The appearance of the plough and the use of draught animals increased the area which can be cultivated in a given time and made possible the cultivation of a wider range of soils. This in turn led to changes in the agricultural systems from a localised intensive exploitation of high productivity areas, characteristic for the early stage of agriculture, to a wider use of the terrain for light plough cultivation and extensive grazing as well as to changes in the structure and distribution of settlements (Sherratt 1981, 261-305). Thus, for instance, the EBA in southern Greece is characterised by an increase in settlement numbers, types, and sizes as well as their expansion to areas that were not previously settled. It has also been

pointed out that tillage with an ox-drawn ard is something like 2-15 times faster than manual cultivation, and it permits large-scale surplus production, which in turn enables the emergence of social stratification (Halstead 1995, 11-22). P. Halstead has argued that the main criterion for this is, however, not the use of the ard itself, but the ownership of specialised plough oxen (Halstead 1995, 18). Furthermore, in order for the use of oxen to be practical, a household should possess approximately five hectares of land (Hodkinson 1988, 39; Halstead 1995, 16).

In a recent article, H. Greenfield (2010, 29-54) examines the latest data regarding the "Secondary Products Revolution". Here, we will not discuss the various questions connected to this model but will confine our presentation to the evidence concerning the appearance of the plough. The earliest indication for the plough comes from Mesopotamia in the form of plough marks found in Susa A contexts (*c.* 5000 BC in Iranian Khuzestan) (Greenfield 2010, 39). Representations of ploughs are recognised in pictograms from the Uruk period (fourth millennium BC) and are also common among the impressions on cylinder seals from the Akkadian period (late third millennium BC) in Mesopotamia and Assyria (Sherratt 1981, 266). In the Aegean, the presence of the plough in the EBA is attested by the discovery of terracotta yoked oxen figurines at the site on Tsoungiza Hill, ancient Nemea (Pullen 1992, 45-54). Other early examples include a terracotta table representing a ploughing scene from the necropolis at Vounous, Cyprus, dated to the EBA III or the beginning of the Middle Bronze Age (Karageorghis 1969, 110; 112, pl. 47) as well as the interpretation of Linear A sign 27 as a plough (Evans 1909, 190-191; Hansen 1988, 51, fig. 3). The marks preserved under north European Neolithic barrows have been initially interpreted as ard marks (Sherratt 1981, 261-305; Fowler, Evans 1967, 289-303). These are now understood as connected with the funerary rituals rather than evidence of ploughing (Rowley-Conwy 1987, 263-266). The examples of buried surfaces with clear-cut plough marks in Central Europe are dated to the Chalcolithic period or even later (after 3500 BC) (Greenfield 2010, 39). Zooarchaeological studies demonstrate dramatic shifts in harvest profiles indicating a preference for more adults in cattle herds in Europe during the Chalcolithic, which in turn suggests that cattle were more intensively exploited for traction from this point in time (Greenfield 2010, 46). Thus, the spread of the plough from the Near East into Europe together with the remaining innovations of the "Secondary Products Revolution", although not necessarily as a package, was part of the bigger cultural transformations that occurred with the beginning of the Chalcolithic period in Anatolia (*c.* 6000 BC) and the Balkans (*c.* 4000 BC in Greece; 3500 BC in the central Balkans) (Greenfield 2010, 46). Interesting in this aspect is the faunal evidence from Knossos which indicates the use of adult breeding cows for draught purposes possibly from at least the sixth millennium BC (Isaakidou 2008, 90-114). It has been pointed out that while oxen only provide muscle power, cows are multi-purpose animals able to provide milk and calves as well as labour and were used by recent Mediterranean farmers both to plough and to pull carts or sledges (Isaakidou 2008, 99). Although the pathological evidence from Knossos does not indicate whether draught cows were used for ploughing or transport, or both, the fact that wooden ards and sledges for transport could have been easily made demonstrates that draught cows at Knossos might have been employed for tillage and transport already in the sixth millennium BC (Isaakidou 2008, 101).

The ancient writers do not mention anything about the agricultural tools and cultivation methods employed in Thrace. There are, however, although relatively rare, descriptions of agricultural labour and implements used in Greece (Appendix B.1). These are significant for the reconstruction of the farming activities, and given the level of available technology, we may assume that similar practices and tools were utilised in the Thracian lands to the north. The differences in climate, soil types, relief, available raw materials or the acquisition of ready-made goods should all be taken into account. Both black-figure and red-figure Attic vases show ploughing and sowing scenes which further assists in reconstructing the Archaic and Classical ard (Appendix B.2.3-10) (fig. 4). A terracotta statuette from Boeotia representing a ploughman with a pair of oxen (Appendix B.2.1) (fig. 5) as well as a terracotta statuette of a pair of yoked

oxen discovered at the necropolis of Apollonia Pontica (Appendix B.2.2) are among the other iconographic evidence for tools and methods of tilling during the period under examination. A representation of an ard is recorded on amphora stamps from Thasos (Appendix B.2.11) and the Athenian Agora (Appendix B.2.12) (fig. 6). The obverse of the silver coins of the Thraco-Macedonian tribes Edonoi and Orescoi show a man wearing kausia (flat hat) between two oxen (Тачева 2006, 31-45; Poole 1879, 144-146). The oxen are, however, not yoked, and the depiction has been interpreted as representing the cattle of Apollo, stolen by Hermes. Finally, reliefs on funerary stelae from Thrace dated to the Roman period present pairs of oxen and an ard (Appendix B.2.13-14) (fig. 7).

All early ploughs presented actually an ard, an implement that could only make a shallow furrow but could not turn the soil. The earliest literary evidence of plough and ploughing is found in Homer's *Iliad* and *Odyssey* (*Iliad* 13.702 ff.; *Odyssey* 5.127; 13.31; 18.365-375). In the passages, the work of both the farmer and the animals is described as hard and exhausting. Ploughing is mentioned also in the description of the shield of Achilles (*Iliad* 18.540-550). Another passage refers to mules used as draught animals, as they move faster than oxen (*Iliad* 10.351). Arrian (*Anabasis Alexandri* II.3) mentions that Gordius, the king of the Phrygians, had two oxen: one he used in ploughing, the other to draw a wagon. Hesiod's *Works and Days* gives a detailed description of the plough as well as instructions for its construction and the seasons appropriate for ploughing (383-390; 427-492). Further recommendations regarding the suitable time, manner, and advantages of ploughing are discussed by Xenophon (*Oeconomicus* XVI.10; XVII.10) and Theophrastus (*Enquiry into Plants* VIII.6.3; *De Causis Plantarum* III.20.7-8).

Many scholars have analysed the literary evidence and interpreted the construction of the ard in different ways (Kothe 1975, 1-26 with references). It consisted of a sole (ἔλμα), a beam (*γύης*), and a draught-pole (*ἱστοβοεύς*) on to which the draught-animals were hitched with a yoke (*ζυγόν*) (Isager, Skydsgaard 1992, 47) (fig. 8). The beam presents a curved piece of wood which connects the sole and the draught-pole, and as recommended by Hesiod, it should be made from holm-oak because it is the strongest. The sole may be equipped at the back with a stilt and a handle (ἐχέτλη). A ploughshare made of bronze or iron (*ὖνις*) may be attached to the front of the sole. Hesiod does not mention metal ploughshares, but their use is evident from Homer's text (*Iliad* 23.834 ff.) and archaeological finds from the 12th-11th c. BC Cyprus (Антонова 2013, 349, бел. 2). Hesiod refers to two ploughs: one jointed (*πηκτόν*) and the other made of one piece (*αὐτόγυον*). It has been pointed out, however, that these do not present different plough types rather than different versions of the same implement depending on the material available (Isager, Skydsgaard 1992, 46). Hesiod's advice concerns also the draught animals and the ploughman – nine year old oxen should be used, and the worker should be experienced and old enough not to look towards his fellow ploughmen, but be able to plough in a straight line. In order for the land to regain its fertility before sowing, a period of fallow or a change of crop was necessary. Hesiod recommends three ploughings of the fallow land – one in spring, one in summer, and one in the autumn[13]. Repeated ploughing and digging, according to Theophrastus, is considered the best way to work land for arable crops and for trees (*De Causis Plantarum* III.20.7-8). In addition, repeated ploughing ensured better absorption and moisture retaining of the soil (Forbes 1976, 9).

The construction principle of the plough remained generally unchanged throughout the first millennium BC, although there were modifications in different regions, for instance, the Near Eastern examples had two handles, and some were furnished with a sowing funnel (Storck, Teague 1952, 41, figs. 14-15). Some novelties in the design of the plough appeared in the Roman period. Pliny describes various types of ploughshares suitable for different soils, and he also gives the only evidence for ploughs fitted with wheels referring to Central Europe (*Natural History* 18.48).

[13] For the historical context of Hesiod's *Works and Days* and the agricultural regime he describes, see Edwards 2004.

Varro (*On Agriculture* I.19-20) advises on the proper kind of oxen for ploughing, and Cato (*On Agriculture* 61*)*, Pliny (*Natural History* 18.49), and Columella (*On Agriculture* 1.9.2-3; 2.2.22-28) give recommendations on various aspects of the whole process of ploughing. Ridging boards and vertically-cutting coulters were now added to the plough. The most complete description of the Roman plough is found in Virgil's *Georgics* (I.160-175). Analysing the information given in the poem, R. Aitken (1956, 97-106) has suggested that the type described by Virgil presented a beam-ard, an implement in which the curved plough-beam is the major part, and it is pierced by the sole, as opposed to the sole-ard where the sole is the major part onto which beam and handle are fitted. This view has been challenged by K. White who argued that Virgil's description refers to the sole-ard characteristic for the Greek world and continuing to be the common type of plough in use in Italy throughout Roman history (White 1967, 142). It has been pointed out that Virgil's description of a plough with "ears" may be the prototype of the ploughs with "ground-wrests" attested in modern Greece and Bulgaria whose function is to break up a wider strip of soil (Forbes 1976, 6; Вакарелски 2007, 89, обр. 36). The true mould-board plough that inverted the soil appeared in the Medieval period and was suitable for the damp soils of the temperate climate zone (Forbes 1976, 6).

The only reference to plough used in Thrace is found in Apollonius' *Argonautica* (I. 793-926): "they plough the wheat-bearing fields" and "snowy ploughlands of Thrace". Ethnographic studies in Bulgaria attest the use of the wooden ard (*ralo*) till the end of the 19th century (Вакарелски 2007, 88-93). It has a symmetrical share as opposed to the plough which has an asymmetrical (one-sided) share. Four main types have been distinguished according to the shape of the draught-pole (*voishte*)[14]. The first type is characterised by a straight draught-pole attached to the stilt (*ruchitsa*) and to the sole (*plazitsa*) by a beam (*brudtse*) (fig. 9.1). It is common in the western part of the country. Two variants are distinguished: a) the sole and the stilt are made of one piece, and b) of separate pieces. The ploughshare (*paleshnik*; *lemezh*)[15] has a long tang fixed to the beam with the help of a wooden wedge and to the sole by an iron ring (Вакарелски 2007, 89, обр. 34-35). The second type represents an ard with a curved draught-pole attached to the sole (Вакарелски 2007, 90, обр. 37) (fig. 9.2). The ploughshare has again a long tang fixed to the draught-pole by a wooden wedge and to the sole by an iron ring. This ard is common for the Stara Planina region, the Rhodope, Pirin and southern Strandzha Mountains. Both types have additional components such as "ground-wrests" or a vertically-cutting coulter. The third type represents an ard with a curved draught-pole attached to the stilt or at the angle between the sole and the stilt (Вакарелски 2007, 90, обр. 36) (fig. 9.3). There is also a beam connecting the draught-pole and the sole. The ploughshare is inserted into the sole. It is the most widely distributed type covering the Danubian Plain, the west Black Sea coast, the Thracian plain, Eastern Rhodope, Sakar, and Strandzha Mountains. The major component of the fourth type is the draught-pole. Its back part is massive and curved, and all of the remaining parts – the sole, the stilt, and a ploughshare with a long tang – are attached to it (Вакарелски 2007, 90, обр. 38) (fig. 9.4). It is distributed in the south-western parts of Bulgaria along the middle Struma River valley. Wooden ploughs with asymmetrical ploughshare with or without wheels were also used together with the wooden ard[16]. Small and large wooden ploughs have been distinguished. The first were ubiquitously distributed, including the mountainous areas, while the second were used predominantly in the estates (*chifliks*) of the Upper Thracian and Danubian plains.

[14] For earlier classifications of the wooden ard distributed in Bulgaria made by foreign and Bulgarian scholars, see Вакарелски 1929, 55-109; Obrebski 1929, 10-54; Маринов 1966, 27-31; Холиолчев 1981, 14-23.

[15] The terminology of the different parts of the wooden ard and plough varies to some extent, according to the different regions of the country. It has been suggested that *paleshnik* is used to denote a ploughshare with a long tang, while *lemezh* marks a ploughshare which is inserted into the sole. There are, however, many exceptions to this rule, as the local population does not always make such distinction of terms.

[16] For the wooden plough and its characteristic parts in Bulgaria, see Маринов 1963, 103-118; For the transition from ard to plough, see Атанасов 1986, 24-34.

The most important part of the ard, and the one that is archaeologically visible (if not also made of wood), is the actual ploughshare. Ethnographic studies on agricultural tools in Bulgaria present the different types of iron ploughshares of the wooden ard and plough. There is, however, neither a universally accepted terminology nor classification (Маринов 1970, 24-28). H. Vakarelski divides the iron ploughshares into two main types: with a tang (*paleshnik*) and with a socket (*lemezh*) (Вакарелски 1929, 76-78, обр. 18-19) and gives their geographical distribution and various names (1929, 78, обр. 20). Later, he writes about two types of *lemezh*: with a tang and with a socket (Вакарелски 1936a, 425-429). According to Y. Čangova, there are three types of *lemezh*: the first one is known as *naralnik* distributed in the Balkan Peninsula with the Slavic tribes; the second has a socket and represents a development of the first type; and the third has a tang (Чангова 1962, 22-25, обр. 1-4; 1981, 161-166). The first type (*naralnik*) also has a socket, and it has been pointed out that it is actually a variant of the second type (Маринов 1970, 26). Further typological divisions are based on the length of the tang and the presence of a hook curve at its end (for the *paleshnik*) (Маринов 1970, 27, обр. IIIA). Two main types of the ploughshare with a socket (*lemezh*) are distinguished – symmetrical and asymmetrical – further divided into variants based on the shape of the working part (Маринов 1970, 27, обр. IIIA). The latter is characteristic for the wooden plough alone. St. Vitliyanov examines the ploughshares dated to the Medieval period but uses the term *lemezh* for both ploughshares with a tang and those with a socket (Витлянов 1992, 231-238).

In a more recent study I. Cholakov examines the ploughshares from Bulgaria dated to the Roman and early Byzantine periods (Чолаков 2010, 24-36). He distinguishes seven types based on the shape of the working part and the way of attaching it to the ard (with a tang – type 3, 4, 5, and 7 or with a socket – type 1, 2, and 6) (Чолаков 2010, обр. 14). Type 3 has a spoon-shaped working part and ends with a tang. To this type belong the examples from LIA Thrace. The working part is relatively small and shorter than the tang. The latter narrows towards the top where it may curve like a hook perpendicularly outwards. Some examples have also an iron ring for securing the share to the ard.

The number of securely dated iron ploughshares discovered in Thrace before the Roman period is very small (fig. 10). All examples represent ploughshares with a spoon-shaped cutting edge and a flat tang for attaching to the ard (type 3 in Cholakov's typology). The tang is long, usually ending with a perpendicularly curved hook, but there are also examples with tangs of the same width and without a hook. The tang was attached to the ard by means of a wooden wedge and probably secured with a metal ring. One specimen comes from the Thracian tomb at Kaloyanovo dated to the second quarter of the fourth century BC (Чичикова 1969, 60; обр. 16). It has a small spoon-shaped working part and a long flat tang narrowing towards the top where it curves like a hook perpendicularly outwards (fig. 11a). The ploughshare was found on the left femur, in a place where usually a weapon is placed. The well-built tomb and the rich and various funerary offerings, including weapons and golden objects, demonstrate that it belonged to a member of the Thracian aristocracy. It has been suggested that the iron ploughshare together with the weapons and golden pectoral express the political and military power of the rich proprietor who was also a landowner (Чичикова 1969, 88). Another securely dated example comes from the Getic centre at Sboryanovo discovered in a house (fig. 11b) (Стоянов 2000, 19, обр. 25.2). The settlement was founded at the end of the fourth century BC and destroyed by an earthquake in the middle of the third century BC which gives also a *terminus ante quem* for the materials. The ploughshare from Sboryanovo has a rounded spoon-shaped working part, but the tang does not have a hook, rather it is flat at the end. A ploughshare similar to the specimen from Kaloyanovo, but smaller in size, has been recorded at the pit complex at Kostadin Cheshma, Debelt, dated to the fourth century BC (Балабанов 1999, 69, 71, обр. 12) (fig. 11c). A heavily eroded tool with a spoonlike shape and a flat handle has been recorded at Pistiros, but its bad state of preservation does not allow us to determine it as a ploughshare with certainty (Андонова 2013, 349, бел. 3).

Three spoon-shaped iron ploughshares have been recorded at Uste locality near the village of Mirkovo (Милчев 1961, 417-435) (fig. 12a). They represent chance finds found together with pottery dated to the end of the fourth – beginning of the third century BC. While this date may be accepted, the examples from Seuthopolis (fig. 12b) come from the medieval layer of the site (Чангова 1972, 37-39, обр. 23, 24), and one was found in the periphery of mound No 3 of the necropolis (Čičikova 1968, 120-121, fig. 4) (fig. 12c). Thus, their date remains uncertain. Similar is the case with the spoon-shaped ploughshares discovered at Preslav (Чангова 1962, 24) which may belong to the Thracian period attested at the site. Finally, a spoon-shaped ploughshare discovered by chance in the region of Vratsa (Вакарелски 1936a, 426, обр. 269), although very similar in shape to the LIA examples, remains with uncertain date.

Ploughshares with a spoon-shaped working part and long tangs with a hook have been discovered at the Daco-Getic sites in Romania dated to the second – first century BC (Crişan 1960, 286-301). H. Crişan has suggested that this type of ploughshare was a local Dacian product and has called it Dacian type (1960, 294). The finds from Thrace, however, are earlier in date and do not support the hypothesis of Dacian origin. The spoon-shaped ploughshares continue to be used during the Roman, Late Antique, and Medieval periods[17], although at that time ploughshares with a triangular shape and a tang as well as those with a socket were predominant (Дуков 1965, 181, карта 2; 1972, 268; Венедиков 1981, 85-86).

The available archaeological evidence thus demonstrates the existence of the spoon-shaped iron ploughshares in Thrace at least from the fourth century BC. Although the number of securely dated examples from Thrace is very small, their discovery reveals the high level of agricultural technology employed by the indigenous population in the Early Hellenistic period. The question of the type of ard to which these ploughshares belonged is much more difficult to answer. The available iconographic evidence from the period suggests that the spoon-shaped ploughshares were attached to a wooden ard with a curved draught-pole which was connected to the sole. Whether this ard was introduced to Thrace from Greece or it represents a traditional design already known in the region, is difficult to answer at the moment. I. Venedikov has suggested that the wooden ard with a straight draught-pole represented on third century AD coins of the Roman colony Deultum is characteristic for the Roman period and should be distinguished from the ard with a curved draught-pole "which was typical for pre-Roman Thrace" (Венедиков 1981, 79-83).

III.1.2. THE USE OF A HOE

Tilling of the soil was realised also with a hoe. It has been pointed out that the different terms used by the ancient authors to denote this implement imply that various types existed, differing in weight, size, and shape according to their function (Isager, Skydsagaard 1992, 49). Thus, lighter hoes might have been used for sowing and weeding, while breaking up the fallow required a heavier tool. Xenophon uses the term *skalis* for an implement that was suitable for hoeing the cornfield and weeding (*Oeconomicus* XVII.12-15). Its exact construction is, however, not known. The terms *makele, makella,* and *dikella* (two-pronged hoe) are often used to denote a hoe (Isager, Skydsagaard 1992, 49). A *dikella* is represented on an amphora stamp from Thasos (Appendix B.2.15). Theophrastus mentions that the work with the *dikella* was preferred to that with the plough because it did not leave an untilled space and was better for breaking up the weeds (*De Causis Plantaraum* III.20.8). Hesiod mentions the use of a hoe in sowing (*Works and Days* 469-471), and Homer uses the term *makella* when describing the work of a man irrigating a garden with water (*Iliad* 21.257 ff.). The term *sminye* has also been interpreted as a hoe, but it

[17] For the distribution of iron ploughshares with a spoon-shaped working part dated to the Roman period, see Дуков 1965, 181, карта 2; Чолаков 2010, 238, обр. 23. For specific examples, see Дуков 1965, 159, табло II.1-5; Детев 1950, 265, обр. 49; Серафимов 1973, 77, обр. 1-2; Аладжов 1965, 43-44, обр. 1.1; Чангова 1962, 24.

is not known whether it was used to denote a different type of the same tool (Isager, Skydsagaard 1992, 49). I. Venedikov lists the *dikella* among the agricultural tools used by the Thracians but does not give any archaeological examples (Венедиков 1981, 90). The variety of shapes is evident also from the examples dated to the Roman and early Byzantine periods (19 types have been distinguished) (Чолаков 2010, обр. 74). Thus, it may be assumed that similar diversity existed also in earlier times determined by the intended purpose of the hoe.

Ethnographic studies demonstrate the variety of hoe shapes and names used in modern Bulgaria depending on the soil type and the crop to be cultivated (Вакарелски 2007, 86-88). Two main types exist – a hoe with a wide working part called *motika* and one with a narrow working part called *kopach*. The two-pronged hoe called *dikel* is characteristic predominantly of southern Bulgaria, the Struma River valley, and Strandzha Mountains and is typical for horticulture and viticulture (Вакарелски 2007, 88).

The examples of iron hoes discovered in inland Thrace dated to the Hellenistic Age are restricted to two specimens from Sboryanovo (Стоянов 2000, 19, обр. 25.6; Стоянов и др. 2004, 22, обр. 37; Андонова 2013, 357, обр. 4.3, 362, кат. № 60) and the find from Momina mound, village of Bratya Daskalovi (Тонкова, Иванов 2011, 11, обр. 4; Андонова 2013, 363, кат. № 61)[18] (fig. 13). The specimen from Sboryanovo, dated to the first half of the third century BC, represents fragment of a hoe with a semicircular working part and a perpendicularly curved socket for the handle, separately made and attached by means of a rivet (fig.14a). It finds close parallels to hoes discovered at Olynthus (Robinson 1944, 343-344, pl. CVII-1635, 1636) and Priene where other shapes are also attested (Wiegand, Schrader 1904, Abb. 496/1, 4; Abb. 500-502). The type of hoe with a socket continues to be used during the Roman and Late Antique periods (Чолаков 2010, 272, обр. 74.15). The iron hoe from Momina mound has been discovered in front of the entrance to the tomb together with an iron axe-mattock. The implements are dated to the end of the fourth – beginning of the third century BC. The mattock has a rectangular working part. The handle was attached via a socket.

An iron axe-mattock has been recorded also at the peak sanctuary at Babyashka Chuka and dated to the third – second century BC (Tonkova 2005, 179, tabl. II.12; 2008, 269, fig. 6; Тонкова 2008, 107, табло II.12, 109) (fig. 14b). Similar tools made of copper are recorded already in the fourth millennium BC (Миков 1961, обр. 2-7) and continued to be used in Roman times (Чолаков 2010, обр. 74.9; 13). The part perpendicular to the handle (hoe/pick) has an elongated narrow shape and rounded edge. The tool may have been used for uprooting weeds, but the excavators have interpreted it as connected to metallurgical activities (Тонкова 2008, 109). That the hoe was a multipurpose implement is evident also from its attested use in building activities during later periods (Чолаков 2010, 61).

III.1.3. SOWING

Cereal crops, depending on their biological characteristics, are sown in the autumn or spring. Ethnographic studies in Bulgaria demonstrate that wheat, barley, and rye were autumn sown, while millet and oats were spring sown (Вакарелски 2007, 93-94). It has been pointed out that most crops providing the major part of the diet of traditional farming societies north of latitude 30° N, thus including Thrace, are generally autumn sown if the soil is free of winter water-logging and not subject to sub-zero temperatures for prolonged periods without snow cover, i.e. spring-sown varieties tend to predominate only in areas where these limitations exist (Hillman 1981, 147). Moreover, most wheats yield more grain when sown in autumn than when sown in spring (Hillman 1981, 147). Winter barley was widely cultivated in Classical times, as it has fewer requirements regarding soil quality and weather conditions (Burford 1994, 665). Barley

[18] An iron hoe has been discovered in the fill of a well in the coastal town of Sozopol (Apollonia Pontica) and dated to the end of the third – beginning of the second century BC (Андонова 2013, 357, обр. 4.2, 363, кат. № 62).

can be also spring-sown because it yields grain even when its vegetation period is shortened by late sowing (Hillman 1981, 147). The various species of wheat have different preferences regarding soil fertility and hardiness to cold, which determines their individual time for sowing (Jones 1981, 106-108). Pliny mentions a two-month wheat in Thrace that ripens on the fortieth day after sowing (*Natural History* 18.12.70). Recommendations for the appropriate time of sowing as well as the characteristics and requirements of the different soil types and seeds are found in Hesiod (*Works and Days* 446; 462 ff.) and Theophrastus (*Enquiry into plants* VIII.1; 6). Xenophon recommends sowing over a period of time, so in a case of bad weather, the whole crop would not be destroyed (*Oeconomicus* XVII.1 ff; 4-6). It has been pointed out that the main advantage of mixed autumn and spring sowing is that it spreads the agricultural work of sowing and harvest (Jones 1981, 105).

As Greek vase paintings demonstrate, sowing was carried out by hand – the seed was held in a basket or a sack and broadcast over the prepared ground (Appendix B.2.3-5). The use of a harrow, whose function is to incorporate the seed into the soil and break the lumps, has not been attested. This again may be due to the nature of the material used which in this case is wood. As mentioned by Xenophon (*Oeconomicus* XVII.15), a hoe could have been employed for this purpose. Like ploughing, practice was required in order to sow evenly and at the desired rate (*Works and Days* 446). The sowing density varies to a great extent, as it is specific for each type of cereal crop.

III.1.4. HARVEST

The harvest of cereals is realised in the early summer for the autumn sown crops and in late summer for the spring sown ones. The standard implement for harvesting was the sickle. Homer mentions it also for haymaking (*Odyssey* 18.366 ff.), and the description of Achilles' shield (*Iliad* 18.550 ff.) represents the harvesting of grain in greater detail. Hesiod advises on the time when the harvest should begin (*Works and Days* 383-387; 571-580), and Xenophon (*Oeconomicus* XVIII. 1-3) discusses the proper method of harvesting: cutting the stalk close to the ground or in the middle and the use of the straw. The harvesting methods are also described by the Roman authors: Varro (*On Agriculture* I.50), Pliny (*Nat. Hist.*18.72), and Columella (*On Agriculture* 2.20.1-3) who point out the regional specifics of the process.

In Greek vase paintings, sickles are often depicted as weapons (Appendix B.2.20-38). Thus, the scenes representing the death of Orpheus show Thracian women holding spears, rocks, axes as well as pestles and sickles. The depictions of Perseus beheading Medusa show him armed with a sword or a sickle whose function here is again as a weapon (fig. 15). Among the iconographic evidence, we should mention also the funerary stele discovered in the region of Edirne dated to the second – third century AD (Appendix B.2.14) (fig. 7a). The relief is divided into two parts – the upper represents a funerary feast, while the lower one depicts a pair of oxen, an ard, and a sickle.

The different methods of harvesting: uprooting, reaping the ears, or reaping the ears and straw together can be recognised in the archaeobotanical samples based on the presence or absence of certain extra components such as culm bases and weeds (Hillman 1984, 7; Van Zeist, Bottema 1971, 537-538). Hillman examines the variety of harvesting methods (1981, 148-153) and points out that harvesting the ears together with the straw by sickles is the most common method both in Europe and other areas where crops such as wheat, rye, barley, and oats are or were grown under traditional systems. Although this method is quick as both grain and straw are harvested in one operation, many of the weeds are also collected which requires further cleaning. Such cleaning can take part throughout the rest of the year, and for the glume wheats it is necessary even when the ears have been harvested separately in order to eliminate the fine chaff such as spikelet forks and rachis internodes (Hillman 1981, 150). Uprooting is also a speedy process and is used commonly for barley as well as for other cereals where the soils are damp such as

emmer in the wetter parts of Turkey (Hillman 1981, 148). Finally, cutting the ears and the straw separately is still practised in the Eastern Mediterranean (some villages in Turkey and some Aegean islands), but the need to harvest the straw additionally as well as the often uneven height of the crops make this harvesting method very slow and time-consuming (Hillman 1981, 151).

The harvesting methods depend largely on the intended purpose of the products. L. Foxhall examines the use of different agricultural "waste" products, such as chaff, straw, and stubble of cereals, legume haulms and husks, weeds, leaves, prunings from vines and fruit trees, etc., and argues that keeping of traction animals – cattle, donkeys, and mules – was heavily dependent on such agricultural by-products (1998, 35). Chaff was used for fodder, as a temper in mud-brick, and as fuel. Straw served also as fodder, for thatching, flooring, bedding, packing, and as manure (Fohxall 1998, 36; Hillman 1981, figs. 5-7). The ethnographic studies from Bulgaria have not demonstrated uprooting as a harvesting method, except in a case of low crops as a result of drought (Вакарелски 2007, 97). Both low and high harvest methods are attested for the Chalcolithic period in Thrace based on use-wear analysis of flint inserts for sickles and the absence or presence of weeds among the cereals (Георгиев 1958, 373; Тодорова и др. 1983, 117; Bozilova, Filipova 1991, 89; Радунчева 2003, 42; Tonkov et al. 2007, 313). It may be assumed that both methods of harvesting were practised in the LIA depending on the intended purpose, the available time and labour force.

Ethnographic studies have demonstrated the use of two main types of sickle on the territory of Bulgaria – serrated (known as *surp*) and non-serrated (usually called *kavrama* or *sirma*) (Вакарелски 2007, 96, обр. 49, 50). Both types are recorded already for the Roman period (Чолаков 2010, 51-59). The non-serrated sickle has a blade curved perpendicularly to the handle (fig. 16.1). The serrated sickle is smaller in size and has an open blade with a handle almost parallel to the blade (fig. 16.2). The cutting principle of these two types is also different with the serrated sickle cutting with its whole blade like a saw, and the non-serrated one cutting with one part of the blade by pressing.

The prototype of the serrated sickles might be seen in the prehistoric antler or wooden sickles with flint inserts (Gurova 2014b, 343). The bronze sickles found in the LBA hoards at Pleven (Миков 1933, 97, обр. 55; 1970, 59) and Suvorovo village, Varna district (Мирчев 1953, 113, обр. 134), represent serrated and non-serrated types respectively with the specimens from Suvorovo being interpreted as media of exchange and not as practical agricultural tools. Four iron sickles, two serrated and two non-serrated, come from the Krivodol hoard near Vratsa (Николов 1970, 53-54, обр. 3а-г), dated not later than the sixth century BC. Thus, it is evident that both types of sickle existed simultaneously, and it is impossible to determine whether one preceded the other. It may be suggested that the existence of two types of sickle supposes their use for different crops and according to the density of the sowing (Дуков 1965, 170-171; 182, карта 3), although there is no certain evidence for this.

Fragments or completely preserved iron sickles dated to the LIA come from the urban centres at Sboryanovo (fig. 17) (Стоянов, Михайлова 1995, 42-43; Стоянов 2000, 19, обр. 25.3-5; Андонова 2013, 359, кат. № 11-20) (fig. 18a), Pistiros (Katinčarova-Bogdanova 1996, 107; Андонова 2013, 359-360, кат. № 21-24; Лазов 2017, 155) (fig. 18b), and Seuthopolis (Андонова 2013, 355, обр. 3.8, 361, кат. № 40) as well as from the peak sanctuaries at Babyashka Chuka (Домарадски 1984, 46; 1999, 68, 146, табло XVI.3, 120, обр. 40в; Домарадски и др. 1986, 52; Tonkova 2005, 179, tabl. II.8; Тонкова 2008, 108-109; Андонова 2008, 159-161; 2013, 353, обр. 2.7-9; 360, кат. № 25-33) (fig. 18c) and Ada Tepe[19] (Андонова 2013, 353, обр. 2.2-3, 360, кат. № 34-36) (fig. 18d).

Two examples have been recorded at the pit complexes at Bada Bunar (Камишева, Колева

[19] A PhD dissertation by A. Andonova (Sofia University "St. Kliment Ohridski"), where more examples of iron sickles from Thrace are presented, is in progress.

2008, 160, обр. 2; Андонова 2013, 355, обр. 3.6, 361, кат. № 41) (fig. 19a) and Svilengrad (Нехризов 2006, 441; Андонова 355, обр. 3.5, 361, кат. № 42) (fig. 19b) but are characterised by smaller dimensions unsuitable for harvesting. Therefore, it is possible that these represent knives or pruning hooks (?) and were used in other agricultural activities (Андонова 2013, 352). Three iron sickles have been recorded among other metal tools and artefacts deposited in pits IA and IB in sector I at Halka Bunar and dated to the beginning of the third century BC (Тонкова, Сидерис 2011, 88-89, обр. 20; Андонова 2013, 360-361, кат. № 37-38). An iron sickle, discovered by chance in the village of Chomakovtsi, Lovech region, was most probably part of the grave offerings, as it was found together with armour elements (Николов 1990, 16, обр. 3д; Андонова 2013, 361, кат. № 39).

According to their shape, the sickles recorded at LIA sites in Bulgaria belong to the serrated type. No sickles of the other – non-serrated type are known, which is, however, most probably due to the state of research. The examples from Pistiros are dated to the fourth century BC. However, earlier finds may be anticipated in the future, as the settlement was founded already in the middle of the fifth century BC, and similar sickles have been discovered in Classical Greece – Olynthus (Robinson 1944, pl. CIV), Messembria-Zone, and Abdera (Kostoglou 2008, 40, fig. 17; 46, fig. 20). The finds from Sboryanovo, Seuthopolis, Halka Bunar, Ada Tepe, and Babyashka Chuka are dated to the Hellenistic Age. This type of sickle continued to be in use during the Roman and Late Antique periods when the curve became bigger and the lower part longer (Henning 1987, taf. 40.H2).

The discovery of sickles at ritual sites (peak sanctuaries and pit complexes) in LIA Thrace puts them into a group of artefacts such as jewellery, weaponry, loom weights, spindle whorls, and grinding stones with initial utilitarian function that had acquired some symbolic meaning. The tradition of depositing an instrument connected with fertility and agriculture at ritual sites in LIA Thrace goes back to the Late Bronze and EIA. A bronze sickle has been discovered at the LBA layers of the sanctuary at Dositeevo, Harmanly (Бориславов 1999, 107). The same site has produced also flint inserts for sickles found in EIA context (Бориславов 1999, 113). In Classical Greece, sickles are often discovered in the sanctuaries of gods connected with agriculture and fertility such as Demeter, Hera, Artemis, and Dionysus and are sometimes found as an offering to Athena (Тонкова 2007, 61; 2008, 109). The deposition of sickles at ritual sites in Thrace should be associated with the practice of agricultural cults by the local population for which farming played a substantial economic role.

Two chance finds of probable scythes from the region of Hristo Danovo village, Plovdiv province, (Детев 1968a, 147, обр. 12.1) (fig. 19c) are dated on the basis of the pottery assemblage to the fourth – first century BC (Детев 1968a, 145-146). While their shape resembles that of sickles, their dimensions are bigger – total length of above 40 cm and width of 4,5 cm. It has been pointed out that sickles were initially used for mowing (Венедиков 1981, 88; Isager, Skydsgaard 1995, 52), while the scythe with its characteristic long blade, set perpendicular to the handle, developed later during the Roman period (Дуков 1965, 172; Henning 1987, 91; Чолаков 2010, 56). Thus, it is possible that the specimens from Hristo Danovo were used for mowing.

A number of iron tools have been published as pruning-hooks, but from the fragments preserved it is not always clear whether the implement represents a grain sickle or a pruning-hook used in viticulture. The pruning-hook has a blade that is curved at the end at an almost perpendicular angle to the handle. This is also the working part of the tool, and the cutting is realised by drawing the implement towards the body. Seldom is the entire blade curved in an arch. The pruning-hooks are *c.* 30 cm long and between 3 and 5 cm wide. Two types are distinguished according to the way of attaching the handle. The first one has a thin lower part, while the second ends with a socket, and both types continued to be used during later periods, including the Middle Ages (Андонова 2013, 354).

III.1.5. THRESHING AND WINNOWING

In G. Hillman's reconstruction of traditional processing of glume wheats and free-threshing cereals (1981, figs. 5-6), the step following the harvest is drying of the products. It has been pointed out, however, that drying or not depends upon the method of harvesting – either of the stalk or just the ear (Meurers-Balke, Lüning 1999, 239). Experiments on harvesting einkorn and emmer have revealed that ripe ears can be easily broken off at their bases without loss of grain. In order to harvest by picking the ears, it is necessary for the wheat to be fully ripened. At this stage, the grains have a water content of between 14 and 16% so that a drying process for the threshing and sorting of the grain is unnecessary (Meurers-Balke, Lüning 1999, 239). On the other hand, the best time for harvesting on the stalk is at the waxy stage when the grains are ripe, but the spikelets still sit tight at the rachis and do not fall off during the vibration caused by cutting. The grains at this stage have a water content of 20 to 30% and drying is, therefore, necessary before additional processing and also before storage (Meurers-Balke, Lüning 1999, 240). The grain is normally dried outdoors in the air, but it may be dried also in the house or with the use of an artificial source of heat. It has been pointed out, however, that grain exposed to high temperatures loses its ability to be baked and to germinate and is suitable only for producing porridge (Meurers-Balke, Lüning 1999, 252).

The dried grain is then threshed by which process the ears are broken into separate spikelets (for glume wheats), and the grain and chaff is freed from the rachis of the ear (for free-threshing cereals). The threshing may be performed by stamping with feet which does not require an instrument and is, therefore, archaeologically unrecognisable. Another option is by knocking off the products manually or with the help of animals. The type of threshing is determined by the maturity level and the quantity of the crop. In Bulgaria, threshing with a wooden stick is ethnographically attested in the western parts of the country – in the region of Pirin and Ograzhden Mountains due to the small amount of the produce (Вакарелски 2007, 101). Hillman distinguishes also differences in the threshing methods according to the climate – in areas with dry summers, procedures such as threshing, winnowing, and pounding can be realised on a large scale outdoors as opposed to areas with wet summers (Hillman 1984, 8).

The employment of draught-animals in threshing is mentioned by Xenophon (*Oeconomicus* XVIII.3-9). This is carried out in an area specially prepared for that purpose – the threshing floor. Threshing floors are usually located in open areas, at the field, near the village, or in the yard (Лилова 2006, 111). They are cleaned and well trampled, so their soil is more densely packed than the surrounding area which makes them archaeologically recognisable. They are also sometimes paved with pebbles or potsherds or surrounded with a stone fence. The threshing floor is mentioned frequently in the ancient literature (*Iliad* 5.499; 13.588 ff; 20.495 ff; Hesiod. *Shield of Heracles* 285-295; *Works and Days* 598; Columella. *On Agriculture* 2.20.5; Virgil. *Georgics* 1.175-180) and is also depicted on a red-figure chous (Boardman 1994, 89, fig. 90). The scene shows a bearded man holding a wooden pestle and a mule whose feet have threshed a pile of grain (Appendix B.2.16) (fig. 20). The size of the threshing floor depends on the number of sheaves to be threshed and the wealth of the household. Two threshing floors were only to be found on large estates and were an indicator of prosperity (Demosthenes 42.6). Threshing floors with a diameter of 20-25 m are ethnographically attested at the plain areas of Bulgaria (called *harman* or *gumno*), while in the mountainous regions they have a diameter of 6-7 m (Вакарелски 2007, 99). Usually, in the centre there is a vertical pole to which the draught-animals are tied. By circulating around the pole, they tread the sheaves and as a result the kernels fall out. The sheaves are turned around with the help of long wooden forks and trodden again. Depending on the geographical region, there are variations in the methods of threshing, the construction of the threshing floor, and the terminology used (Вакарелски 2007, 102, карта V).

In Greece, threshing floors have been documented in south Attica at Legraina, Palaia Kopraisia dated to the fourth century BC (Lohmann 1992, 42, figs. 21-24), near the "Princess Tower" at Sounion, and another one not far away near the "Cliff Tower" (Young 1956, 123-5, figs. 1-2). Numerous fragments of grinding stones and hopper-rubbers were recorded scattered around the threshing floor at the "Princess Tower". The dating of the latter two sites is not certain but based on the pottery discovered on the surface, a late fifth – fourth century BC date has been proposed (Young 1956, 124). A circular platform with a maximum diameter of 2,40 m has been recorded during rescue excavations at Nova Zagora, Bulgaria, in 1994 (Кънчева-Русева и др. 1995, 82-83). It has been suggested that it functioned as a space for drying cereal crops and other agricultural produce. The discovered pottery comes from the surface and dates to the EIA. No other similar structures have been reported from the territory of Thrace so far. This may be due to the fact that threshing floors are often constructed close to the field or at the settlement edges and thus difficult to identify when only trench or surface surveys are conducted.

The employment of a threshing sledge is attested in the Roman period (*tribulum*), as evident from the literary sources where flint as well as iron teeth, and the use of both horses and oxen are mentioned (Pliny *Natural History* 18.72.298; Varo *On Agriculture* I.51-52; White 1967, 155; fig. 115). Threshing sledges are ethnographically attested in the Near East, Anatolia, the Balkans, Cyprus, Crete, Syria and the Pyrenees (Ataman 1999, 212; Гюрова 2011, 3; Gurova 2014, 145-146). In Bulgaria the threshing sledge is called *dikanya* (Вакарелски 2007, 100). It is made of wooden boards fitted together with horizontal planks with grooves made on their underside in a check board pattern. Flints are inserted into these grooves which cut the straw and separate the grain from the rachis. A harness is attached to the raised front end of the sledge, set into motion by draught-animals. K. Ataman has pointed out that in Turkey, the function of the threshing sledge has changed recently – it is used to chop straw into small pieces for the production of mudbrick, animal feed, or fuel rather than for threshing grain, although the threshing of pulse crops is still practised in some areas (Ataman 1999, 214).

The exact appearance of threshing sledges is still unclear, but it must have happened after the domestication of draught-animals. Both Hittite references to threshing as well as Egyptian texts and pictorial representations are confined to descriptions of animals trampling over grain (Ataman 1999, 215). The word for an implement used to thresh in Akkadian is *Dajastu* and in Sumerian is *GIS.UR,* and there is little doubt about its interpretation as a threshing sledge, since clear references to the manufacture and use of such implements exists in the Sumerian Farmer's Almanac (Kramer 1963, 342), which dates to the third millennium BC (Ataman 1999, 215). In Bulgaria flint blades discovered at the Drama-Merdjumekia tell are identified as inserts for threshing sledges which suggests the employment of threshing boards at least from the Chalcolithic (Гюрова 2011, 15; Gurova 2014a, 157-160). The use of a threshing sledge in Classical times is not mentioned in the literary sources of the period, but L. Foxhall has suggested that the word *oikistion* of the Attic stelae may be identified with a threshing sledge (Lohmann 1992, 42, n. 39). There are also references to what were possibly toothed threshing sledges in the Old Testament (Isaiah XLI 15) (*morag* or *moreg*) probably dating to the eight or sixth century BC (Ataman 1999, 215). At the present state of research there is no evidence for the employment of threshing sledges in LIA Thrace, though there is also not enough material for systematic use-wear investigation.

The following process, winnowing, includes separating the grain from the light chaff, and it takes place at certain periods, as it needs a light breeze. It employs different tools such as the winnowing fan mentioned by Aristotle (*Meteorology* II.8.23-32), winnowing fork, winnowing shovel, winnowing basket, and a sieve. The grain is thrown up and while the kernels are caught in the basket, the wind blows away the lighter chaff.

The following steps involved in the traditional processing of cereals include coarse and fine sieving in which respectively large and small contaminants are removed, drying followed by

parching and pounding for the glume wheats, and sieving, hand-sorting and dehusking of hulled grains (Hillman 1981, figs. 5-7). It has been pointed out that glume wheats were stored with the husks still on, since first, dehusking was time-consuming, and it was not possible to process the whole harvest prior storage, and second – glume wheat without the husks remains preserved only for a short time because it has only a thin, one-layered epidermis as opposed to free-threshing cereals which have multilayered epidermis and can be stored without husks (Meurers-Balke, Lüning 1999, 240).

The threshing of glume wheats was not enough for the grains to lose their husks. As opposed to the previous operations, dehusking, cleaning, and preparation of the grain for consumption, were part of the domestic activities and realised on a daily basis. In order to determine what types of tools were used in the process of dehusking and whether there was a process of drying or parching prior to it, several experiments have been conducted employing the use of a saddle quern and wooden mortars (Meurers-Balke, Lüning 1999, 238-253). The results have demonstrated that parching of the grain before dehusking was not necessary, and that a wooden mortar was a much more effective tool in comparison to the saddle quern, as the use of the latter required more time and resulted in a high rate of loss – a large proportion of broken grain and a great quantity of heavily ground grain that could no longer be separated from the chaff (Meurers-Balke, Lüning 1999, 238-253). After dehusking, cleaning operations such as winnowing or dunking must have followed in order to separate the mixture of husked and dehusked grains, cracked grains, and chaff from one another (Hillman 1984, fig. 7).

Again we have no data for the employment of certain implements in the process of dehusking in LIA Thrace. As the above mentioned experiment has shown, a wooden mortar might have been used, which has left no trace in the archaeological record.

III.2. ORGANISATION OF CEREAL CROP PRODUCTION IN THRACE

In order to understand the social and economic aspects of cereal crop production in LIA Thrace, we must investigate the organisation of that production. Questions regarding access and ownership of arable land, the export of grain as well as who was involved in the agricultural work itself all have important implications in this respect.

III.2.1. AGRICULTURAL REGIME

The analysis of Hesiod's *Works and Days* has demonstrated the rhythm of agricultural work throughout the year (Edwards 2004, 150-158). Although regional climate conditions should be taken into account, the ethnographic studies in Bulgaria show that the seasonality of farming labour coincides to a large extent to the one described for ancient Greece (Вакарелски 2007, 83-105). We may, therefore, assume similar periods of agricultural activities for LIA Thrace.

The agricultural calendar commences with ploughing and sowing in October. Hesiod warns that if the farmer has not ploughed by the winter solstice, his crop will fail (*Works and Days* 479-484). The implication is that ploughing must be done within a certain time frame even if conditions are not perfect (Edwards 2004, 151). This is the busiest time of the agricultural cycle which puts enormous pressure regarding time and labour resources (Foxhall 2006, 268). From the beginning of October begins the sowing of cereal crops in the plains of Bulgaria: rye, barley, and wheat. The following winter months are too cold and wet for farming tasks. Hesiod's lack of detail suggests that these months represented a slack season for the farmer (Edwards 2004, 151). By February, the weather was usually suitable for planting spring-sown crops. In Bulgaria, this is the time for sowing oats and peas. This is also the season for ploughing of fallow fields. The harvest of cereal crops begins in May (*Works and Days* 571-581) and depending on the type of cereal may last till July. Hesiod recommends avoiding shady siestas and rising at dawn which marks another period of pressure on time (Edwards 2004, 152). Threshing commences with the

rising of Orion (*Works and Days* 597-608) in late June or early July. At this time comes the third ploughing to kill the weeds and conserve soil moisture.

Crop husbandry regimes are usually characterised as "intensive" or "extensive". While "intensive" husbandry refers to regimes involving high inputs of labour per unit area resulting in high area yields, "extensive" regimes involve smaller inputs of labour per unit area resulting in smaller area yields (Bogaard 2004, 21). A. Bogaard's analysis of seeds of arable weeds found in association with crop material in archaeological deposits has demonstrated that the most plausible model for crop and animal husbandry in Neolithic Europe is the intensive mixed farming (small-scale, labour-intensive cultivation integrated with small-scale herding) (2004; 2004a, 49-58). The application of farming technologies such as ard-tillage and ox-traction is associated with an extensification of agriculture, since the scale of cultivation expands due to the greater efficiency of the ox-drawn ard and metal harvesting tools, so input of labour per unit are reduced (Halstead 1992, 105-117). The relationship between extensive plough agriculture and social stratification has already been pointed out: the ox-drawn plough allowed large-scale surplus production to support non-producers and promoted land shortage and unequal access to land (Sherratt 1981, 261-305). The need for harvesting labour, specialised plough oxen, and access to land suggests that social stratification is a precondition as well as a consequence of ox-based cultivation (Halstead 1995, 18). By contrast, intensive cultivation is characterised by high inputs of human labour per unit area through practices such as row-sowing, weeding or hoeing, manuring, and watering as well as close integration of crop and animal husbandry. It involves the production and storage of "normal surplus" which could potentially lead to inequality between households, but social stratification is not a prerequisite (Halstead 1995, 11-22). Analysing Hesiod's text, A. Edwards has argued that the description of the agricultural work in *Works and Days* represents an extensive short fallow regime (Edwards 2004, 127-157). It has been pointed out, however, that the chronological and geographical frames of the narrative should be taken into account, and the description is not applicable to fifth century BC Attica, for instance, with its much denser population and complex social formation (Edwards 2004, 157). Thus, the agricultural regime at a given region should be explored after enough environmental data are collected and compared to site evidence, social and demographic conditions. This, however, has proven very difficult for ancient Thrace, as the available data are scarce.

Palynological analyses from Bulgaria have demonstrated increase in the human impact around 500 BC expressed in woodland clearance for arable and pastoral land (Bozilova et al. 1990, 48-57; Bozilova, Filipova 1991, 92; Filipovitch 1995, 5-11; Lazarova 2003, 245-256; Chiverrell, Archibald 2009, 299). This is in accordance with the developed agricultural technologies such as the employment of iron tools, and the population growth. The investigations at the site at Adzhiyska Vodenitsa in the Upper Thracian plain have revealed a wide range of plant species (with cereals being predominant) and faunal remains, which imply extensive planned cultivation with an integrated pastoral strategy (Chiverrell, Archibald 2009, 297). It is difficult to make similar conclusions for other parts of the region under study, as there are not enough archaeobotanical, archaeozoological, and environmental data. However, the use of plough as well as the political situation after the formation of the Odrysian state implies that the most plausible model for crop husbandry is extensive farming. More intensive regimes may have existed in regions outside the Odrysian state.

III.2.2. QUANTITY OF THE PRODUCE

Using epigraphic, documentary, and ethnographic data different estimates of grain production have been proposed for Attica in the Classical period (Whitby 1998, 99-124; Garnsey 1988; Takeshi 2007, 74-75) complemented by calculations on the yearly cereal requirements (Foxhall, Forbes 1982, 41-90; Gallant 1995, 72-75). It is very difficult to make such estimates for ancient Thrace, as we lack information about a number of factors that should be taken into account.

Thus, we should consider the population size, the area of cultivated land as well as the agricultural productivity which includes the agricultural regime and available technology as well as labour input and the degree of dependence on alternative sources of food. The significance of a yield per unit surface depends also on the size and shape of parcels, the way plants are distributed within it, and soil fertility (Sigaut 1999, 276). The average yield of cereal crops may be calculated by applying data from modern, non-industrialised agriculture, but the approach has been discussed by Halstead, who warns against the uncritical use of traditional practices as analogies for the past (Halstead 1987, 77-87). The biology of the cereal crop and the nature of the ethnographic source itself should all be considered (Forbes 1992, 87-101). Thus, although some figures of probable yield may be reached, we believe that the state of current research in LIA Thrace is insufficient for realistic estimates regarding grain production.

The identification of producer and consumer sites has important implications for reconstructing the ancient economy. Different models for different sites and periods have been developed in order to distinguish these[20]. According to the model suggested by M. Jones (1985, 107-128), by analysing the density of grain, weeds and chaff, it is possible to distinguish between settlements which produced their own crops (sites rich in grain) and those which received crops that had been grown elsewhere (sites poor in grain but rich in weeds and chaff). The model has been critisised as it does not consider the context, stage sampled or species composition (glume wheats versus free-threshing wheats as these differ in the proportion of chaff being represented in the archaeobotanical sample) (Van der Veen, Jones 2006, 219). It has been pointed out that while the day-to-day processing of cereal took place at both producer and consumer sites which implies that the presence of samples consisting primarily of chaff and/or weed seeds is to be expected at all sites, the occurrence of deposits rich in grain is more likely a marker of the scale of production and consumption than an indicator for distinguishing between the two (Van der Veen, Jones 2006, 222).

III.2.3. STATE AND AGRICULTURE

The new political situation in Thrace during the second half of the first millennium BC, namely the foundation of the Odrysian state, had important implications on the economy of the region. The situation of the ordinary population changed considerably. The farmers had to produce not only for themselves but also to support the ruling elite. It should be pointed out, however, that besides the Odrysian kingdom, there were also independent inland territories, for which our information is scarce, as well as Greek communities along the Black Sea and Aegean coasts. The text of Thukydides (*History of the Peloponnesian War* II.97.3) has been quoted in most studies concerning the economy mechanisms in Thrace during the second half of the first millennium BC. In it the author refers to the income of the Odrysian king, which under Sitalkes' successor Seuthes had amounted to about 400 talents in gold and silver from native regions and Greek cities; in addition there were gifts in gold and silver not only to the ruler, but also to the princes and noble Odrysians. The text is significant as it demonstrates two different, yet coexisting, mechanisms applied by the rulers to raise capital (Archibald 2013, 75).

On the basis of the available documentary sources, two main strata of Thracian society are usually distinguished. The upper one included the kings, local tribal chiefs, and elite groups, while the lower consisted of dependent peasants. This distinction in Thracian society was explained in the Bulgarian Thracology literature by the "royal economy" model (Димитров 1958a, 683-701; Фол 1972, 124-129; 1997, 104-110; Fol et al. 2000, 134-143; Венедиков 1981, 39-42; Тачева 1987, 97 ff; 2002, 264-271). According to it, the economy of Odrysian Thrace was a centralised monopoly where the king was the supreme owner of land and produce, and controlled all foreign

[20] For specific examples see Jones (1985, 107-128) for Iron Age sites in the Upper Thames valley and Reddy (1997, 162-187) for sites in India.

commerce. The ruling dynasts resided in royal residences, and all production was concentrated in the countryside from where it was gathered and distributed to the coastal markets to be converted into cash. There were no independent traders and craftsmen, and internal trade was insignificant. The references in the ancient literature to the tribute that the population had to pay not only to the Odrysian king but "also to all the men of authority and Odrysian nobility about him" (Thukydides II.97.3) demonstrate that the new political situation must have put a lot of pressure on the lower classes of the Thracian society. The expenses for the mercenary troops employed by Seuthes II and Kotys I were also a burden for the farmers within the Odrysian state, and the accumulating discontent is visible in the two revolts of the Tini during the reign of Seuthes I, who increased the tribute the most, and during the time of Kotys. The ruler or the relevant dynast was the owner of the land and had the power to distribute it together with its inhabitants who were already dependent. This is evident from Xenophon's story about Seuthes II who promised to the Greek generals land and a fortified place on the seacoast and to Xenophon – Bisanthe, "the very fairest of all the places I have upon the seacoast" (*Anabasis* VII.2.35-38). The Odrysian economy has been recently examined by K. Dimitrov who argues that besides the royal cities, there were also independent polis-type communities, and after the Macedonian conquest the economy did not change but became more centralised and monopolised (Dimitrov 2011, 5-24).

Today, the accumulation of epigraphic and archaeological data has shown that the idea of the "royal economy" in Thracian society should be reexamined. Thus, the so-called Pistiros inscription, dated to the middle of the fourth century BC, demonstrates the existence of regulated marketplaces and the activity of Greek merchants far inland in the valley of the Hebros River. The inscription has the status of an official document issued by an unnamed Thracian ruler, successor of Kotys I (author of the first agreement), and determines the privileges and guarantees to the settlers of Pistiros and to the Greek merchants from Thasos, Maroneia[21], and Apollonia. Thus, a trade network existed between Greek settlers living in Pistiros and in other emporia. The Odrysian authority who issued the document did not participate directly in the exchange but only provided security for the Greeks (Tzochev 2015, 417). Among other legal issues, the inscription guarantees the right of the colonists to possess arable land and pastures, which will not be confiscated or plundered (their properties) by the ruler or his people (lines 10-11; 18-20).

Analysing the information provided by the inscription, M. Tacheva has suggested that the "royal economy" model should be confined to the time before the establishment of Macedonian power in Thrace after which a middle class of traders and craftsmen appeared, and the economy became more market-oriented (Тачева 2006, 180). According to her, the colonists mentioned in the inscription represent a Thracian population reformed in respect to its status – a new class with increased potential and economic prosperity through commercial connections with Maroneia (Тачева 2006, 180). They mark the economic stratification of the class of former Odrysian subjects as protected by the ruler merchants and craftsmen whose previous status of dependency, however, remained. The Thracians, mentioned in lines 7-9, worked the land as tenant farmers and were subject to economic dependency (Тачева 2006, 180).

A recent find testifying to the existence of marketplaces in the Thracian hinterland prior the Macedonian conquest is a lead weight discovered at the fifth century BC site of Krastevich. The lead is marked with a relief astragalos which represents a standard Greek device for the weight of a stater, which together with the foreign coins and transport amphorae discovered implies that the site functioned as an important trading post (Tzochev 2015, 417, fig. 27.2).

The excavations at Seuthopolis, in particular the types of residential structures discovered, have led to the assumption that it represented a "royal residence" distinguished from the socially inferior community living outside the city walls. The investigations at Sboryanovo, however, have demonstrated that there is no difference in the level of material culture recorded within

[21] For the privileges granted to Maroneia, according to the inscription, see Loukopoulou 2005, 13-17.

the fortified area and beyond it at the studied quarters in the vicinity (Стоянов 2006, 83). Thus, besides the members of the ruling dynasty and aristocratic families, the city's inhabitants included also free craftsmen, traders, farmers, etc. whose high standard of life is archaeologically visible.

It has been pointed out as well that while royal monopoly over some commodities (for instance, timber suitable for shipbuilding, and gold and silver mines) is probable, this does not exclude parallel market exchanges ruled by demand and supply (Tzochev 2015, 415; Balabanov 2016, 97). The exchange patterns are best visible by the distribution of imports, especially amphorae, as well as coins. Salt, wine, and ceramic products were among the commodities that traveled inland from coastal areas, while wool, metal ingots and manufactures, hides, timber, cereals and other foodstuffs journeyed in the opposite direction towards coastal ports (Archibald 2013, 135).

The production of grain and its trade was one of the major sources for increasing revenue and thus for maintaining an army. In Thrace, growing corn intended for sale in exchange for cash is described in two cases. From Polyaenus' text we know that Seuthes, who was a lieutenant of Kersobleptes, when in need of money made every one of his farmers to sow five *medimnoi*[22] of seed. The produce was after that sold "on the coast", and for a short time he gathered money for Kersobleptes (*Strategemata* VII.32). While the markets "on the coast" may refer to places on the Aegean, the discovery of the site at Adzhiyska Vodenitsa demonstrates that there were Greek emporia in the Thracian hinterland, and that merchants might have gone there to buy corn for trans-shipment down the Hebros (Archibald 1998, 226). According to Aristotle's story (*Oeconomica* 1351a20), Iphicrates, the Athenian, advised Kotys that in order to collect the money necessary for his army, he should order the men under his command to sow land with three *medimnoi* of seed corn. This was later harvested and the grain transported to the markets and sold. It has been pointed out, however, that the text does not show the form of property rights and land possession (Balabanov 2016, 103). Lysimachus must have had a large amount of agricultural land under his control, since at the end of the fourth century BC he had the resources to send large quantities of grain to various Greek poleis. A gift of 10 000 *medimnoi* of wheat given to Athens by Lysimachus in 299/8 BC is recorded in a decree honouring the comic poet Philippides of Kephale (Oliver 2007, 233).

There is no evidence for an organised corn trade from Thrace in the way we have, for instance, for the Bosporan kingdom in the time of Leucon I (389/88– 349/48 BC)[23]. It should be noted that the grain trade cannot be detected by examination of pottery containers as there is no evidence suggesting the use of specific vessels for the transport of cereals. Grain was most probably carried in sacks or wooden chests that have left no trace in the archaeological record. There are also no discovered shipwrecks from the Classical and Hellenistic periods (only one grain carrier has been excavated at Saint Gervais off southern France, but it dates to the seventh century AD) which can be related with certainty to grain trade (Gibbins 2001, 277). Nevertheless, the distribution of amphorae, carrying mainly olive oil and wine, which is more easily traceable, should be seen as a possible indication for the existing grain trade.

The study of Thasian amphorae distributed in the Black Sea area has shown the highest concentration in the regions of the Bosporan kingdom and present day Dobrudzha during the fourth and the first half of the third centuries BC (Tzochev 2016, 250). Both areas are famous with the production of cereal crops, and it has been suggested that there is a correlation between the import of Thasian amphorae and the export of grain. This, together with other factors, has been used as one of the explanations for the decrease in the import of Thasian amphorae after the

[22] A medimnos is an ancient Greek unit of volume used to measure grain.

[23] Garnsey's analysis has led him to the conclusion that the degree of dependency on imported grain in fourth century Athens was relatively low (1988) as opposed to Whitby's calculations, according to whom, grain from outside Attica was much more important (1998, 99-124). A recent re-examination of Demosthenes' text (20.30-32) regarding the grain from the Bosporan kingdom has demonstrated that although there were large scale movements of grain from the Pontic region, the figures for grain in Demosthenes' text do not offer a realistic indication of the scale of Athenian dependency on imported grain (Oliver 2007, 18-37).

middle of the third century BC, since the territories of these regions were devastated and ceased to export grain to the Aegean (Tzochev 2016, 250). The export of grain from Thrace is thus difficult, though not impossible to trace archaeologically, but requires a comprehensive analysis of the distribution and frequency of the imported goods. It should be pointed out, however, that the archaeological record recognises only the long-distance imports and not the local ones as objects of trade (Tzochev 2015, 415), which hinders the investigation of internal economic practices, including the grain markets.

III.3. CONCLUSION

This chapter has focused on the presentation of implements and methods for land cultivation and initial processing of cereal crops. While much of the literary sources refer to Greece, which in turn has resulted in bigger scholarly interest and ample research on Greek agriculture, the available archaeological and ethnographic evidence from Bulgaria provide some insight on the farming practices in the Thracian hinterland during the LIA. The discovery of iron ploughshares and sickles in Thrace, although very few in number, demonstrates the high level of agricultural technology employed by the local population. The data come from some of the major urban centres and ritual sites including also a few chance finds. Our knowledge about the Thracian countryside is still very limited, and the picture of spatial distribution of agricultural implements is certainly incomplete. Iron ploughshares with a spoon-shaped working part and a long tang, with or without a hook, represent the only type used in pre-Roman Thrace. These were most probably attached to a wooden ard with a curved draught-beam. The iron hoe was another tilling implement archaeologically attested in the region from the Hellenistic period. The variety of terms, shapes, and dimensions evident from literary sources, the Roman examples as well as ethnographic studies probably reflects diverse functions. The evidence for sowing is confined to documentary, iconographic, and ethnographic sources. Cereal crops were sown both in autumn and in spring depending on their biological characteristics. The simultaneous existence of serrated and non-serrated sickles already in the LBA supposes their use for different crops and according to the density of sowing. Depending on the intended purpose, available time and labour force, both low and high harvest methods were applied. The following processes of threshing and winnowing involved a small number of implements, the majority of which were made of perishable materials. Neither threshing floors nor threshing sledges have been archaeologically attested for the period and region under study, but their existence is very plausible. With the exception of the sickles from Krivodol, the majority of metal agricultural tools from the region belong to the middle of the fourth – second century BC. No implements dated to the first century BC have been attested so far, but the recorded types of sickles, ploughshares, and hoes continue to exist during the Roman Age.

The abundance of cereal crops in Thrace, as attested in the ancient literature as well as the references to crops for cash, demonstrate the economic importance of cereals during the second half of the first millennium BC. Grain was also probably one of the main commodities in exchange for imported goods but is still difficult to recognise archaeologically. Not all exchange transactions were realised under the control of the central authorities. Besides dependent producers, private craftsmen and traders existed as well and urban market exchange in inland Thrace is evident already from the fifth century BC.

CHAPTER IV

STORAGE OF CEREAL CROPS

A natural continuation of the processes of cereal crops cultivation, harvesting, and initial processing is the storage of grain. The spatial analysis of finds of processed grain and storage vessels or structures sheds light on the internal settlement layout and aspects of social organisation. The diverse methods of food storage reveal the level of technological knowledge. The form in which crops are being stored as well as the character of the storage container itself, whether an underground pit, a ceramic vessel, a building, etc., indicate the intended purpose of the produce. Moreover, the investigation of storage patterns is of great significance for the reconstruction of past socio-political organisation attested in the control of agricultural production and distribution[24].

This chapter aims to explore the tradition and innovation, if any, in the models of grain storage in LIA Thrace and discuss their social and economic aspects. As already pointed out, the research has been hindered by the insufficient archaeobotanical material from the period which often precludes any further discussion regarding the state of the stored produce and its intended purpose. Other important issues include the uncertainty regarding the nature of the produce stored in pithoi as well as the correct identification of subterranean pits as storage structures. Again, the majority of data come from the better documented urban centres, while our knowledge about non-urban settlements is very limited. Despite all these caveats, the careful examination of the available archaeological, literary, ethnographic, and experimental evidence reveals the characteristic storage methods and sheds some light on the organisation of storage practices in LIA Thrace.

IV.1. MODELS OF CERAL CROP STORAGE

The choice of a particular storage method depends on a number of factors such as climate and relief, the nature of the soil, the water table as well as on the intended purpose of the stored product: for sowing or for everyday consumption. This is demonstrated by the recommendations on storage provided by the ancient authors as well as by ethnographic and experimental studies. Columella (*On Agriculture* 1.6.9-19), Pliny the Elder (*Natural History* 18.73), Varro (*On Agriculture* 1.57), Cato (*On Agriculture* 1.92), and Vitruvius (*The Ten Books on Architecture* 6.6.4) describe above-ground and subterranean constructions for grain storage and emphasise on their suitability for short-term period for the former and long-term for the latter. It is further noted that a drier climate is suitable for subterranean storage as opposed to above-ground storage suitable for areas with greater humidity. Pliny repeats Varro's recommendations that pit storage was to be preferred where soil conditions were suitable. Another important factor for the successful conservation of food supplies is the proper sealing of the underground granaries thus keeping an anaerobic atmosphere, while above-ground structures should have ventilation.

F. Sigaut's study on grain storage techniques has allowed him to distinguish three methods for storing unprocessed grain: a) storage with ventilation, i.e. the permanent or frequent use of the outer air to renew the atmosphere surrounding the grain; b) hermetic storage, i.e. storage made as airtight as possible to preclude contact between the grain and outer air; c) no-control storage, i.e. without apparent devices for ensuring ventilation or air tightness (Sigaut 1988, 6-18). He has also noted the correlation between the state in which cereal crops are being stored and the nature of the storage method. While the available archaeological, literary, and ethnographic evidence demonstrates the long tradition in the use of subterranean hermetic storage in Thrace, the existence of specially constructed granaries for the period under investigation is scarce. Other storage devices include ceramic vessels and containers made of perishable materials.

[24] For specific examples, see Jones et al. 1986, 96-103; Hole 1999, 267-283; Fairbairn, Omura 2005, 15-23.

IV.1.1. SUBTERRANEAN PITS

The use of earthen pits lined with plaster and straw situated inside the dwellings or in their immediate vicinity was a common practice of storage in Thrace during the prehistoric periods (Тодорова и др. 1975, 24-25; 1983, 37; Тодорова 1986, 177; Георгиев 1960, 332; Георгиев и др. 1979, 103; Boyadziev 2006, 363-369; Лещаков 2010, 45-46; Асланис, Бояджиев 2004, 370-378 for the storage of meat). Storage pits have been recorded also in Anatolia (Fairbairn, Omura 2005, 15-23), Britain, and many parts of Europe (Cunliffe 2003, 98-102; Fenton 1983, 567-588) as well as North America, Africa, and Australasia (Marshall 2011, 81-82). Ethnographic studies have demonstrated the wide variety in their construction and shape (Buttler 1936, 26-31; Bowen, Wood 1967, 1-14; Fenton 1983, 567-588; Sigaut 1988, 3-32; Marshall 2011, 81-82). Since the 1960s, many experiments have been carried out to determine the effectiveness of grain-storage in sealed underground pits involving a variety of environmental conditions, rock substrates, pit forms, linings, and types of grain (Reynolds 1974, 118-131; 1976; Bowen, Wood 1967, 1-14; Fenton 1983, 567-588; Marshall 2011, 80-164; Ollich-Castanyer et al. 2012, 214-216). The successful preservation of grain for a considerable period of time in a sealed pit is due to the anaerobic atmosphere inside the pit which results in sustaining a constant moisture content and low temperature thus restraining microflora activity (Reynolds 1974, 119). There are various methods of sealing the pit represented by different sequence combinations of layers of earth, straw, chaff, pounded material, and sprouted grain (Fenton 1983, 584-585). In addition, there is evidence from Iron Age Britain of pits that were not sealed, but rather were weatherproof covered and more easily accessible (Marshall 2011, 105-107).

The suitability of a sealed pit for the storage of grain compared to an unsealed, but covered one, has been recently re-examined by experimentation at Guiting Power, southern Britain (Marshall 2011, 80-164). While P. Reynolds (1974, 118-131) has pointed out that the semi-hermetic conditions are essential for successful subterranean storage, as grain reaches full dormancy only when the atmosphere is sufficiently anaerobic, according to A. Marshall, the increased ventilation achieved by unsealing a pit helps to maintain the grain dry thereby adding continued dormancy, suppression of mould, and promoting successful storage (2011, 117). The results of the experiments conducted with sealed and unsealed rock-cut pits at Guiting Power have demonstrated that the most effective way for keeping the grain dry and uncontaminated is its storage in an unsealed covered pit which also allows monitoring and easier access to the pit's content. Less effective is the type of unlined sealed pit and less still is the pit which is both sealed and straw-lined (Marshall 2011, 119). Whilst sealed pits work because they keep water out, they also retain it, as evident by the increased moisture content of trapped air and condensation over the underside of the sealing layer (Marshall 2011, 120). Allowing ventilation through the surface of bulk grain at the top of the pit prevents any build-up of moisture and achieves low levels of grain moisture even under conditions of heavy rainfall (Marshall 2011, 120).

Ethnographic and experimental studies have demonstrated that although certain linings offer better conservation, the lining of the pit is not essential for the successful storage of grain (Reynolds 1974, 127). It has been noted that while basketry needs to be replaced regularly and provides good condition for microflora activity, firing the pit removes the moisture and kills the microorganisms (Reynolds 1974, 127-128; Fenton 1983, 574). Experimental studies have also shown that underground pits are unsuited to storage of grain for daily use, as both edibility and germination qualities of the grain deteriorate if the pits are repeatedly opened (when sealed) (Reynolds 1974, 124). It has been suggested, therefore, that subterranean pits were used for storing large quantity of grain for extend periods of time, for instance, between harvesting and sowing, while grain for domestic consumption was stored in other containers such as vessels, baskets, or wooden chests (Reynolds 1974, 124-125). This is supported by both ethnographic parallels and the archaeological record. M. Makal has observed storage patterns in Turkey where

seed grain was stored in outdoor underground pits, while seed for daily consumption was kept within the farmers' houses (Makal 1954, 19-21). Re-examination of the materials from the prehistoric levels at Aphrodisias has demonstrated that the capacity of the pithoi discovered in room 1, complex II, could not have supported a household for more than a few months which implies that more grain must have been stored elsewhere, particularly, in the small earthen pits recorded at the site (Greaves 2008, 259-260). At Kaman-Kelehöyük in central Turkey, occupied during the second and first millennia BC, pots containing small quantities of grain were found within houses, while storage pits were situated in adjacent outdoor spaces (Fairbairn, Omura 2005, 20). The function of the stone-lined pits (*koulouras*) recorded at Knossos, Phaistos, and Mallia has been a matter of discussion with some scholars agreeing that these were either cisterns or granaries, while others have questioned such interpretation, particularly, for the underground pits at Knossos and Phaistos (Strasser 1997, 73-100). Among the main arguments are their large volume and subterranean character as well as the lack of plastering and direct evidence for the storage of grain (the *koulouras* at Mallia are smaller, constructed above ground, and have plastered interior). However, as mentioned above, the lining of the pit is not essential, subterranean pits were suitable for long-term storage and, unless in cases of sudden catastrophic abandonment, storage facilities are likely to be found containing refuse thrown after their disuse. In addition, grain will survive only if charred. Thus, Halstead has convincingly argued that the *koulouras* at Knossos and Phaistos served to hold grain needed in large volumes and at infrequent intervals (Halstead 1997, 103-107).

Underground pits for food storage have been used till recently in the Bulgarian countryside (Колева 1974, 37). They are situated close to the house and usually have a depth of 1,20 – 1,50 m. The pits are initially layered with straw on which the sacks with grain are put, covered with a woolen rug, chaff, and earth. The storage of smaller amounts of grain and the processed flour was realised in baskets made of willow or hazel branches, plastered with chaff and manure. The archaeobotanical samples from pits recorded at prehistoric settlements in Bulgaria has not shown considerable quantities of cereals or other plant remains. A possible explanation for the absence of any great amount of grain in the prehistoric pits in Bulgaria is that it might have burnt completely as a result of periodical firing of the pits (Popova 2010, 88). It should be noted that grain would be preserved only if charred and even in this case charred plant remains are not normally observed during excavation unless they achieve high densities (Halstead 1997, 104 with references).

IV.1.2. STORAGE CONTAINERS AND STRUCTURES

Other storage devices must have included wicker baskets and wooden chests which are rarely preserved in the archaeological record but whose existence may be assumed on the basis of ethnographic parallels (Герджикова 1984, 223; Колева 1974, 37). Both were in use till the middle of the twentieth century in many villages in Bulgaria. Wicker baskets plastered with clay were made with different capacity with the largest ones being capable of storing 600 kg. The function of the plastering is both for disinfection and for filling in the holes. Wicker baskets plastered with clay are attested at Karanovo I settlements with height of 0,50 m and diameter of the base 0,30 m (Георгиев 1960, 318). Wicker baskets plastered with clay with remains of threshed grain have been recorded at Ovcharovo tell (Тодорова и др. 1983, 37). At the Chalcolithic site of Hotnitsa, several heaps of different mixtures of cereals have been documented which were stored in cloth pouches that later burnt (Popova 2010, 67). Cereal crops were stored also in ceramic vessels including large pithoi, as evident from the recovery of plant remains from them at prehistoric sites in Bulgaria (Детев 1968, 58-59; Popova 2010, 11-44). Storing the threshed grain indoors in ceramic vessels is also recommended by Hesiod (*Works and Days* 600). Other storage devices include clay compartments with oval, ellipsoid, or rectangular shape, built immediately on the floor of the dwelling (Николов 1975, 26; Николов 1992, 65-74; 2001, 11), sunken structures (Велков

и др. 2010, 163) as well as a free standing wattle-and-daub storage structure (Детев 1968, 59, обр. 10) recorded at sites form the Neolithic and Chalcolithic periods. The variety of storage methods is further illustrated by the finds from Bronze Age Assiros where wicker baskets plastered with clay, smaller free standing containers of chaff and clay as well as pithoi have been discovered (Wardle, Wardle 2007, 461). There is no evidence in Thrace for the existence of above-ground granaries with ventilation, as recommended by the Roman authors, prior to the Roman period[25].

Storage in contemporary Bulgarian villages is realised in store rooms known as *hambar* (sg.), *hambari* (pl.), usually with a stone or wooden support set at around 0,30-0,40 m above the ground to avoid humidity (Герджикова 1984, 223-232; Колева 1974, 35-59). They may be situated within the house constructed of wood and plastered with earth and manure or form a separate room or even a free-standing structure. The grain stored in the *hambari* is winnowed and cleaned. The structures consist of separate compartments for the different types of cereal crops. The flour is stored in wicker baskets plastered with clay, in wooden chests, or sacks (Георгиев 1983, 291).

The contemporary existence of diverse storage methods attested in prehistoric Bulgaria (clay compartments, underground pits, ceramic vessels, and wicker baskets within one settlement) is not surprising given the different intended functions of the stored produce – for sowing or for consumption. In addition, this variety may be a risk-minimising practice against accidental burning, theft, or any other unexpected damage. Such diversity of storage practices existed most probably during the LIA presented further in this chapter (IV.2.)

IV.1.3. STATE OF THE STORED PRODUCE

The state in which cereal crops are stored may provide valuable information about their intended purpose and thus, reveal aspects of the past economy. While there are studies in the neighboring areas of Bulgaria, namely Greece and Turkey, which demonstrate the variety of forms of the stored produce, the evidence from inland Thrace is scarce.

Hillman's experimental and ethnographic work in Turkey has resulted in the identification of regional variations in storage patterns (Hillman 1981, 138). When threshed, the ears of the free threshing cereals (for example, bread/durum wheat and naked barley) break up and release the grain from the ear, while threshing of glume wheats (einkorn, emmer, and spelt) serves to break up the ear into individual spikelets each containing grains still enveloped in their protecting husks. Thus, glume wheats may be stored as whole spikelets or as free grains. Hillman has pointed out that in areas with wet summers storage as spikelets is more likely, and the final processing of spikelets is carried out indoors, as opposed to areas with dry summers where pounding, winnowing, and sieving are done outdoors, and the storage product is semi-clean grain (Hillman 1981, 138). Furthermore, in wet areas the grain of glume wheats is less likely to spoil if stored as spikelets rather than naked grain and is also protected from insect and fungal attack (Hillman 1981, 138; Jones 1987, 120). The evidence from storage complexes at Neolithic sites in Bulgaria suggests that glume wheats were stored in an unthreshed state as spikelets (Marinova 2006, 192), and at the Late Neolithic dwelling at Karanovo, part of the produce was preserved in the form of sheaves, i.e. ears with culms bound together (Маринова 2002, 13-24). While grain in sheaves is protected against heating and insect damage in a temperate climate, it has larger volume than threshed grain and requires more space (Sigaut 1988, 6). The archaeobotanical studies from the Hellenistic building at "St. Marina" in Sozopol have also demonstrated that a large part of the produce was stored in an unthreshed state as spikelets (Славова 2013, 120).

The state in which glume wheats were stored provides information about the intended purpose of the produce. Jones' investigations at Assiros Toumba in Macedonia and at the Unexplored

[25] The evidence for above-ground granaries and models of such in the Eastern Mediterranean dated from the Bronze to the Hellenistic Age are summarised in Curtis 2001, 262-3; 276-9 with references.

Mansion at Knossos present a good example of this aspect (Jones 1987, 115-123; Jones et al. 1986, 84-91). At both sites, the glume wheats were stored as spikelets but while the crops from the Unexplored Mansion had been hand sorted for weed seeds as well as sieved, the material from Assiros had shown the presence of weed species which implies that the crops had been sieved but not hand cleaned (Jones 1987, 118). This, together with the variety of crop species recorded and their spatial distribution as well as the estimated storage capacity (the produce at Knossos would have supported two to three individuals per year, but 50 from room 9 alone at Assiros), has important implications about the purpose of the stored produce (Jones 1987, 118; Wardle, Wardle 2007, 461). It has been suggested that the Assiros storerooms represent long-term, communal storage, while the storeroom at the Unexplored Mansion contained small quantities of crops prior to their processing as food.

Recent archaeobotanical investigations at two EBA sites in northern Greece, Mesimeriani Toumba and Archondiko, have revealed evidence of einkorn and barley respectively, stored in a processed form (Valamoti 2002b, 17-22; 2011, 19-39). The experimental analyses, supported by ethnographic parallels, have led to the conclusion that the cereals from Mesimeriani, discovered in a pot inside a house, were boiled and then ground (Valamoti 2011, 24). A similar case has been documented at the Neolithic site of Kapitan Dimitrievo, south-western Bulgaria, where the structure of the cereal fragments corresponds to boiled cereal grains (Valamoti et al. 2008, 265). At Archondiko, fragments of barley have been examined demonstrating that the grain was ground and shaped into lumps probably with the aid of a liquid (Valamoti 2011, 25). Parboiling (the soaking of the whole grain in hot water and its drying previously to pounding or milling) is standard in Turkey and neighboring areas of the Near East as well as in Eastern and Central Europe (Sigaut 1988, 5).

Distinctions between cereals for human consumption and those intended for fodder are not easy to recognise, since they depend on cultural specifics, social rank, and the availability of food – what in a year with rich yield might have been used as fodder, in a bad year was used as food (Halstead, Jones 1989, 41-42; 51; Jones 1996, 95-98; Forbes 1998, 23). There is also no difference in the storage facilities used for food and fodder, and these can be found in identical conditions and even in the same room (Jones 1996, 96). It has been pointed out, however, that different degrees of processing of cereals may indicate their intended use. The evidence of einkorn and emmer dehusking at some prehistoric sites in northern Greece suggests that these cereals were used primarily for human consumption, as the removal of the glumes would have been unnecessary if they were intended as animal fodder (Valamoti 2002a, 6; 2008, 526).

The state in which cereal crops are being stored as well as the purity of the stored production can provide evidence for the sowing and harvest techniques applied. Thus, an EBA sample from a granary at the site of Yunatsite, represents about 50 kg of barley stored as whole ears (Popova 2010, 34; 66). This reveals a "high" harvesting technique in which only the ears are being collected but not the stems. This method of harvesting implies that the straw, so necessary for fodder, thatching, flooring, and bedding, must have been harvested separately. A reason behind this choice may be the need for a faster gathering and processing of the ripened grain. It has also been pointed out that in the majority of investigated Neolithic settlements in Bulgaria einkorn and emmer were grown together, while wheat and barley separately (Маринова 2002, 17). Jones and Halstead (1995, 103-114) call such deliberate grain mixtures "maslins" and point out that both monocrops and maslins contain low-level contamination by other cultigens, which were mainly introduced with the seed grain and not through crop rotation or mixing on the threshing floor.

The methods of grain conservation presented as well as the state in which cereal crops are being stored demonstrate that much information can be derived regarding the intended purpose of the stored produce: for long- or short-term storage, for fodder or human consumption as well as sowing and harvesting techniques. All these in turn may reveal subsistence potential (the quantity of the stored produce), technological knowledge (the granary's construction), economic choices

(for instance, "high" harvest and less interest of the straw or sowing particular cereals together), and finally social complexity (communal versus individual storage). The archaeobotanical investigations at prehistoric and Hellenistic sites in Bulgaria have demonstrated that large part of the produce was stored in an unthreshed state as spikelets. This implies long-term storage as the grain is better protected from insect and fungal attack, and it may also reflect the low capacity of the available labour force to work on the harvest. The final processing of spikelets was probably realised indoors prior consumption.

IV.2. STORAGE OF CEREAL CROPS IN LATE IRON AGE THRACE

The literary sources regarding storage in Thrace are very scarce (Appendix B). Xenophon (*Anabasis* VII.1.13) mentions the abundance of barley and wheat in the Thracian villages which implies established storage practices. Demosthenes (10.16) refers to the rye and millet of the Thracian store-pits, while Varro (*On Agriculture* 1.57), quoted also by Pliny (*Natural History* 18.73) and Columella (*On Agriculture* 1.6.15), mention underground granaries called *siri* (*sirus* sg.) used to store grain. Finally, in a lost comedy Anaxandrides mocks the feast that was held for Iphicrates' wedding when he married the daughter of Kotys I (Nesselrath 1993, 190). The story is described also by Athenaeus in his *Deipnosophistae* (IV.7). Besides other things, the dowry of the Thracian princess included an underground pit, 12 cubits[26] deep. Thus, although very limited, the information provided by the ancient authors demonstrates the existence of underground storage practices in Thrace. A great number of pits dated to the first millennium BC have been excavated and, while some of these have been interpreted as used for storage, the majority are seen as connected to ritual activities. Storage was also realised in ceramic vessels including the large pithoi. The pithoi were, however, all-purpose containers which represents a major problem when trying to investigate the storage patterns of cereal crops alone. The use of other storage devices such as vessels of wood, basketry, and wickerwork may be assumed on the basis of ethnographic parallels (Герджикова 1984, 223; Колева 1974, 37; Christakis 2005, 65), and such are listed in the Attic stelae (Amyx, Pritchett 1958, 264-275). There is no evidence for the construction of large-scale grain storage facilities during the LIA in Thrace, but small and light constructions with farm functions might have existed, and there are references to such in the archaeological record.

IV.2.1. SUBTERRANEAN PITS AND ABOVE-GROUND STRUCTURES

The visibility of storage is influenced by post-depositional processes, cultural factors (storage methods, geography) and archaeological practice (aim, methods, and interpretation) (Groenewoudt 2011, 187). Thus, what does or does not end up in the archaeological record is determined to a large extent by variability of preservation and of post-depositional site formation (Groenewoudt 2011, 187). While the number of subterranean pits recorded in Thrace and dated to the first millennium BC is great, their identification for storage purposes is far from certain, as in the majority of cases they are discovered filled with various objects. It has been pointed out, however, that storage facilities are likely to be found containing the intended produce only in cases of sudden abandonment of the site, while otherwise they may include unrelated materials as a result of change in their function or disuse (Halstead 1997, 103). Thus, the function of underground pits is a question that requires primary use to be separated from secondary re-use, which however, has proven difficult, as it depends on the potential variability in the archaeological visibility of ancient storage methods. In Thrace, two main types of pit have been initially distinguished based on their location: a) pits in and under tumuli related to the practised funerary rites and the cult of the dead, and b) pits situated outside necropolises (Геор-

[26] A unit based on the forearm length from the middle finger tip to the elbow.

гиева 1991, 1-11). The second group includes pits within settlements, the pit fields representing numerous densely clustered pits located far from settlements, and pits within sanctuaries. The latter represent depots for dumped temple inventory similar to the Greek *bothroi*, so their function is different from the rest of the pit types (Nekhrizov, Tzvetkova 2012, 178).

Pits within settlements have been recorded at both EIA and LIA sites. In one of the explored dwellings at Sboryanovo (house No 4), dated to the first half of the third century BC, agricultural implements including an iron ploughshare and two sickles have been discovered (Стоянов, Михайлова 1995, 43). In the centre of the house several pits have been documented, and it has been assumed that their function was for storage. Similar use has been proposed for some of the pits recorded at Pistiros (Юрукова и др. 2002, 51). In sq. D19, six pits plastered with clay, nine unplastered, and seven small and shallow pits have been excavated. The first group is represented by relatively large (from 1,15/1,24 m in diameter to 1,80/2,15 m) and deep pits (2,4 m maximum depth). Their content includes grey ashy soil with layers of sand, gravel, clay soil, charcoal, and various artefacts: roof tiles, fine and coarse pottery fragments, coins, and animal bones. It has been pointed out that a darker and softer layer is found close to the pits' bases which may represent traces of organic material. The second group of pits possess similar features with the only differences being that they are unplastered, shallower, and contain fewer materials. Both groups of pits, plastered and unplastered, might have been used for storage of cereal crops. The last group of pits are very small (0,24/0,27 m to 1 m in diameter) and shallow (0,06 to 0,71 m deep) and without any finds. It has been pointed out that at least one of these represents a post hole which indicates that a light construction, probably with farm functions, existed in the area (Юрукова и др. 2002, 51). During the excavations in 2016 a 4,30 m deep pit has been investigated in the northeast part of sq. A4 which functioned for the storage of grain (Лазов 2017, 155). Its walls are plasterd with clay and on the bottom a lower stone of an Olynthus mill (Appendix C.47) and a sickle have been found. After its disuse the pit was filled with the debris of a burnt building including tiles. Six pits have been excavated north of the central building at the site of Knyazhevo filled with pottery sherds and animal bones and interpreted as related to cult activities (Агре, Дичев 2016, 270)[27]. However, a large negative structure (1,40 m deep and 3,80 m wide), dug into the bedrock in one of the dwellings of the central building, functioned as a cellar, according to the excavators (Агре 2013, 143-144). It was discovered filled with pottery sherds and debris from the dwelling's walls. Twelve pits probably with a storage function have been recorded at the LIA settlement at Yasatepe tell near Cabyle (Илиев 1988, 49). At a certain moment, the pits were relocated outside the settlement. It should be pointed out, however, that not all of the pits recorded at settlements were used for storage of foodstuffs: some were related to pottery production, there are examples for such at Cabyle (Гетов и др. 2008, 425) and Pistiros (Танева 2010, 205-206), while others might have been used as rubbish dumps.

Rescue excavations in the last few years have revealed some evidence for light constructions with probable farm functions. The remains of two light wattle-and-daub constructions have been recorded from the site at Zavoi village, situated in the immediate hinterland of the urban centre of Cabyle. The structures have been interpreted as seasonal dwellings with farm functions and dated to the seventh – sixth centuries BC (structure B) and to the fifth – fourth centuries BC (structure A) (Бакърджиев 2009, 207-209; 2010, 149-152). Two structures of oval shape dug into the ground have been explored at the site at Bozduganovo village, Radnevo, and interpreted as seasonally occupied farm buildings dated to the second quarter of the fifth century BC (Ников и др. 2009, 165-168; 2010, 160-161). In the centre of one of the structures a storage pit has been recorded. Traces of three dwellings as well as 37 pits filled with pottery, animal bones, and grains of millet, dated to the second stage of the EIA and the LIA (first half of the fourth century BC), have been documented at Zagortsi village, Nova Zagora (Кръстева 2010, 171-172).

[27] Throughout the excavations more pits have been investigated both within and outside the recorded buildings.

Most common in Thrace are the pit fields which number has grown considerably in recent years[28]. These complexes represent numerous densely clustered pits located in a rural landscape with no indication of contemporaneous settlement in their immediate vicinity and demonstrating common features such as the pits' shapes, sizes, and content. Their fill includes usually pottery fragments, animal bones, loom-weights, spindle whorls, daub fragments, charcoal, and stones of different shape and size including grinding stones. There are also cases with human skeletons, Greek imported vessels, and anthropomorhic and zoomorphic figurines. Pit fields have been recorded already for the Neolithic[29], but the majority belong to the first millennium BC. Different interpretations have been suggested regarding the function of the pit complexes such as food and vessel storage, funerary, or rubbish dumps. While remains of cereal crops and other plants have been attested in many of the recorded pits, the lack of traces of clay coating is used as an argument against their function for storage (Nekhrizov, Tzvetkova 2012, 190). At present, most scholars are convinced of the ritual character of these structures (Георгиева 1991, 9; Балабанов 1999, 74-75; Tonkova 2003, 479-483; Нехризов 2006, 422-423) based on the character of the pits' fill including votive objects, evidence of animal and human sacrifices as well as on their location outside settlements, their continuous use, and the presence of recurring features. The pit complexes in Thrace have been interpreted as related to a cult to the Thracian Great Mother Goddess, i.e. a cult of fertility and domesticity (Tonkova, Savatinov 2001, 103).

Identifying the storage function of a pit is difficult, as there are no firm criteria for this. While the discovery of a basal layer of carbonised grain in a pit may be interpreted as evidence for its storage function (after burning the pit interior for disinfection and reuse), it may also indicate refuse (cleaning of hearts and cooking areas), and finally, the finds of carbonised grain might have been the result of deliberate ritual offerings. The latter two options, however, do not exclude an initial storage function of the pit[30]. As already pointed out, the quantity of plant remains recorded in the pit fields in Thrace is not big, but this does not necessarily imply that they were not used for storage. A storage pit is usually emptied at some point, and the plant remains will be preserved only if charred. The type of the recorded plant species should also be considered. In some cases, the archaeobotanical samples from pits recorded in Thrace demonstrate a variety of plant remains within a single pit and even within the same layer (Popova 2002a, 282-286; Попова 2005, 99-102; 2008, 554-555). This may indicate common storage of different species which is, however, unlikely, as the range of species is great (single grains of grape, oats, rye, millet, peas, and bread wheat have been recorded in the same layer in pit S10 at Koprivlen) and more likely points to refuse function or again be the result of ritual offerings. That the pit fields were connected with some rituals is very plausible based on the nature of the materials discovered, but the question whether this was their only and primary function requires more attention. By re-examining the arguments in support of this, we will attempt to demonstrate that a storage function at the initial stage of the pits' lifetime or repeatedly later on should not be ruled out. Thus, a dual function of the pits is suggested with storage being their primary purpose, which required also the performance of specific rituals. That some pits were used for rubbish dumps is also very probable. Again a primary storage function should not be excluded.

One of the main arguments against the storage function of the pit complexes is the lack of traces of clay coating of the pits. As already pointed out, the clay coating or lining of the pit's interior is not a compulsory element when intended for grain storage (Reynolds 1974, 127). Unplastered pits interpreted as used for storage have been discovered at Pistiros. Plastering the pit is furthermore connected to technological knowledge and depends on characteristics of the terrain, for instance, ground water levels and the type of soil into which the pit is dug. Plastering

[28] In recent years more than 50 sites containing over 2000 pits have been recorded (Hawthorne et al. 2011, 61).

[29] For specific examples and reinterpretation of some sites as pit sanctuaries see Nikolov 2011, 91-119.

[30] See, for instance, the storage pits discovered at the L'Esquerda site in Catalonia, Spain, which were used for rubbish when being out of use for storage (Ollich-Castanyer et al. 2012, 207).

will be essential in sandy soils thus keeping the walls from falling down and in terrain with high ground water protecting the content from moisture. There are also few examples of pits within the pit complexes that are plastered or with trace of firing the pit's interior for hardening the structure (or as part of the performed rituals)[31].

The recorded pits demonstrate a wide range of shapes: cylindrical, hemispherical, hour-glass, truncated cone, pear-shaped, beehive-shaped, barrel-shaped, asymmetrical, and resembling the shape of specific vessels. Such diversity is also attested in the ethnographically recorded storage pits (Fenton 1983, 567-588). Examining the dimensions of the pits within the pit complexes also demonstrates a great variety but, excluding some examples of very shallow pits (0,30 – 0,40 m), the majority have dimensions which are in accordance with the size of ethnographically attested storage pits.

The location of the pits outside settlements is used as another argument to support their single ritual function. It has been suggested that in the hierarchy of the Thracian cult places the pit fields should be defined as ritual shrines connected with nearby settlements where the people from the vicinity occasionally but repeatedly performed ritual activities dedicated to chtonic deities (Nekhrizov, Tzvetkova 2012, 194). In a recent review of the pit complexes in Thrace their location far from any dwellings is seen as an indication that the pits were not used initially for storage or rubbish (Hawthorne et al. 2011, 65). Underground pits are best suitable for long-term storage, usually keeping seed for sowing. Thus, their location within the borders of the settlement is not essential. However, they should be situated in its close proximity. As noted above, the pits recorded at Yasatepe tell near Cabyle were relocated at a certain moment outside the settlement. With the exception of Koprivlen (Vulcheva 2002, 103-123) and Pistiros (Domaradzki 1996, 29, fig. 1.16; 1.17; Archibald 2002, 112), so far there are no registered contemporary settlements in the vicinity of the remaining pit complexes. This, however, may be due to the state of research and mostly preservation, as traces of light constructions are difficult to recognize and often destroyed by modern activity[32]. The remains of light wattle-and-daub structures recorded at the pit complex at Kapitan Andreevo might be connected with the pits (Попов, Грозданова 2008, 165). The same has been assumed for the structures dug into the ground documented at the pit complex at Shihanov Bryiag (Игнатов, Кънчева-Русева 2007, 124). Finally, the hypothesis that the pit complexes represent rural shrines also assumes the existence of adjacent settlements.

The character of the pits' fill including votive objects and evidence of animal and human sacrifices are all in support of their ritual character. Evidence for ritual activities expressed in deposits placed on pits' bottoms or low down in the pits' fills including pottery, iron implements, animal and human remains have been attested in the storage pits at Danebury in Hampshire (Cunliffe 2003, 146-149). It has been suggested that at the end of the storage period when the pit had been emptied and the seed was being sown, the gods had to be propitiated with ritual offerings in order to preserve and ensure the fertility of the crops stored in the ground (Cunliffe 2003, 147). The discovery of deposits of pottery, iron tools and animal bones in different layers of the pits' fill has been interpreted as the result of repeated ritual acts during a single growing cycle: after the seed was taken out of storage and sown (to ensure fertility), and later, after the harvest, thus acknowledging the help of the deity in securing a successful yield (Cunliffe 2003, 149). While the majority of the registered pits in Thrace have been filled in a single act, there

[31] The bottom and 20 cm of the walls of one pit at Bada Bunar are plastered with clay (Момчилов, Христова 2010, 153-156, обр. 1), while another has reddish colour of the walls which implies firing its interior (Момчилов, Христова 2009, 168). Plastered pits are documented also at Pistiros (Domaradzki 1996, 19; Archibald 2002, 114; Юрукова и др. 2002, 51), Bagachina (Бонев, Александров 1989, 39) and at Koprivlen (Vulcheva 2002, 105).

[32] See, for example, the site at Svilengrad where, although no remains of an Iron Age settlement have been recorded in the vicinity, it is possible that such existed to the east of the site and were destroyed during an alteration of the Maritsa River bed (Nekhrizov, Tzvetkova 2012, 180). Also, H. Popov's remark that mechanized ploughing in the last decades has disturbed the topsoil (Popov 2015, 120). The examples of settlements described as "pit fields" from the Northwest Iberian Peninsula consist of perishable structures (post holes and trenches) and large storage pits, the latter being one of the most characteristic features for the period between 1200-800 BC in the region (Parcero Oubiña, Graido Boado 2013, 256).

are examples where sealings have been recorded, which mark the continuous act of filling the pit. Such are some of the pits at Sarnevo (Бъчваров и др. 2010, 50), Malko Tranovo (Тонкова, Лозанов 2004, 58), pit No 1 at Bada Bunar (Момчилов, Христова 2009, 168) and the EIA pits at Polski Gradets (Ников 2005, 92). This further supports the idea that the ritual activities were realised on specific occasions – after sowing, after harvest, or even at times of stress.

The pit complexes in Thrace are usually seen as having ritual function which is evident mainly from the nature of the finds and their deliberate deposition. It is suggested, however, that even when the filling of the pit was a single act, an initial storage function of the pit should not be ruled out[33]. The liminal period between harvest and the next year's sowing required ritual offerings in order to ensure fertility.

IV.2.2. PITHOI

Little attention has been paid to the examination of the pithoi in Thrace. This is probably due to their common formal characteristics and manufacture techniques which cannot indicate a precise chronology and development of shapes. Fragments and completely preserved pithoi are among the most common finds at archaeological sites in LIA Thrace. They were ubiquitously distributed and are discovered in a variety of contexts – domestic, ritual, and connected to metal production. The pithoi were usually dug into the ground to the level of the shoulders or the rim and closed with a lid or a stone slab. This ensured a suitable environment for the long-term conservation of agricultural products and at the same time protected the vessel from breaking and saved space (Christakis 1999, 9). While Greek texts (e.g. Homer *Odyssey* 2.340; 23.305; Aristophanes *Peace* 703; Plato *Gorgias* 493b; Euripides *Cyclops* 217) describe only wet storage in pithoi, primarily wine as well as olive oil, honey, and the like, there is archaeological evidence (Jones et al. 1986, 96-103) that grain and other goods were stored in pithoi, and it is now accepted that they were used to store both liquids and dry foodstuffs. Christakis' study on Cretan Bronze Age pithoi demonstrates the variety of products, both organic and inorganic, that are stored in pithoi. These include olive oil, wine, dairy products as well as different domestic implements such as pottery, tools, and valuable objects (Christakis 2005, 53). Furthermore, in pottery workshops pithoi may contain water and clay (Christakis 2005, 56). While solid residues such as carbonised seeds can be detected by naked eye, a residue analysis is required to determine the liquid content of a vessel. No such analyses have been conducted on the pithoi from Thrace which is a serious drawback to the purpose of this study. It has been pointed out that Bronze Age Cretan pithoi with spouts were used for storing liquids (Christakis 2005, 51). A pithos can still contain liquids without the necessity to pour directly from it. An attempt at distinguishing liquid from dry content has been made for the pithoi recorded at Olynthus based on their location – sunk into the ground or set above floor level (Cahill 2002, 228). It has been suggested that pithoi sunk into the ground would be more suitable for storing oil, wine, or other liquids rather than grain, as these were more liable to damp and, therefore, mould and insect attack. This is, however, not a firm rule, as pithoi set above floor level could also have been used for liquids, and there is evidence for buried ones used for grain[34]. Nevertheless, it has been pointed out that in the cases when more than one pithos was preserved at Olynthus, they tend to be placed differently which probably reflects different content (Cahill 2002, 228). Finally, one and the same vessel might have been used for storing different commodities through time until its disuse. Thus, the available data do not allow us to make a firm distinction between containers used for cereal food or other products. Nevertheless, their use in the Thracian hinterland demonstrates the continuation of

[33] See also Archibald (2002, 118; 2013, 282) who suggests the re-use of storage pits for other, ritual purposes.

[34] The content of three pithoi in room j of the Villa of Good Fortune at Olynthus has been examined by J. Walter. One of these "was probably set into a shallow pit" and contained "traces of straw – evidently from some kind of grain" (Cahill 2002, 227).

long-established storage practices. The signs and stamps recorded on some pithoi may indicate intended purpose and shed light on the organisation behind their production.

The excavations at Koprivlen have revealed numerous fragments of pithoi including several completely preserved vessels or parts of their lower half found *in situ*, partially or totally embedded in the ground and covered with stone slabs (Hadjiangelov 2002, 163-166; 2005, 91-97). The detailed examination of the pithoi from Koprivlen has shown that the vessels were locally produced with the mouth rim and shoulders made on a wheel, and the body added by plastering vertical or horizontal bands of clay with the surface smoothed on a slow wheel (Hadjiangelov 2002, 163). The different colours of the vessels, brick red, light brown or greyish brown, resulted from the different temperatures at which they have been fired. The pithoi from Koprivlen have a rounded body of biconical shape, sharply narrowing towards the bottom which is flat or with a solid foot. The height of the completely preserved examples is about 1,5 m, and the average maximum body diameter is about 0,85 m. The mouth diameters vary between 0,38 and 0,55 m, and the thickness of the walls – between 1,5 and 2,5 cm. Traces of repairs from cracking, lead braces fixed in holes bored on both sides of the crack, have been recorded on some of the vessels from the site (Hadjiangelov 2002, 164). Mended pithoi have been documented also at Pistiros (Lazov 1999, 340), Seuthopolis (Чичикова 1984, 54), and Sboryanovo (Stoyanov, Mihaylova 1996, 72, fig. 16) which suggests that they were highly valued vessels. The repaired examples from Olynthus, some with marks on the rim indicating their price varying between 31 and 53 drachmae, further support this (Cahill 2002, 228). The small number of intact pithoi and the fragmentary character of the majority of vessels from Koprivlen have allowed the construction of a typology using only two criteria – the shape of the mouths and the shape of the bases (Hadjiangelov 2002, 164-166). However, since only a few of the pithoi come from contexts with clear stratigraphy, no firm conclusions about the dates and thus the development of shapes can be made at the present state of research (Hadjiangelov 2002, 166).

Samples for archaeobotanical analysis have been taken from intact pithoi closed with stone slabs in Sector "South" at Koprivlen – the so-called sacrificial complex which represents a pit field. No remains of cereal crops have been recorded (Popova 2002a, 288). The pithoi were filled with carbonised material and pottery sherds including walls from the vessels themselves (Vulcheva 2002, 113). The storage of liquids has been suggested for some of the pithoi from Koprivlen: the inner and partially the outer sides of two of the vessels found together in Sector "South" bear traces of a dark brown to black slip, probably intended to improve their impermeability (Hadjiangelov 2002, 163). A horizontal stripe of black paint, 2 cm wide, runs on the inner side of one of the vessels some 25 cm under the mouth rim and thus marks a certain level or volume. Residue analysis is required to confirm the character of the content. That grain was also stored in the pithoi from Koprivlen, however, is evident from the stamped motif on some of the vessels' mouths. It represents a hastate ornament with its middle part fashioned like an ear of wheat (Hadjiangelov 2005, fig. 2/3) (fig. 21a). It was usually stamped before firing and on one example additionally engraved after firing (Hadjiangelov 2005, fig. 2/4) (fig. 21b). It has been pointed out that marks made before firing imply a presupposed use of the vessels (Christakis 2005, 59) which in the case of Koprivlen is for storing grain. Thus, the storage of cereal crops at the settlement must have been realised in pithoi and probably in containers that have left no traces in the archaeological record. The possibility that the numerous pits recorded at Sector "South" and "North" might have been used for storage purposes before they were part of the performed rituals has already been discussed. On the basis of the available data, it is impossible to make conclusions about the state in which cereal crops were stored. Even if we attempted to calculate the number of pithoi in use at the settlement at Koprivlen, we still would not know how many of these were used for storing cereals rather than liquids and thus the quantity of the stored grain.

Fragments of pithoi or intact examples have been reported at a number of recently discovered and still not fully explored sites. Among these is the the centre at Vasil Levski (Кисьов 2009,

239, обр. 30), the site at Golata Niva locality near the town of Sinemorets (Агре, Дичев 2009, 215; 2013, 146, обр. 2), the settlement at Dragoyna peak (Кисьов, Божинова 2006, 123), the Early Hellenistic settlement at Stryama (Кисьов 2004, табло XXXV.2) and many others. The excavations at the centre at Pamuk Tepe and the cult site connected to it have revealed fragments of pithoi, some of which bearing stamps, and one with the letters A and Y (Маджаров, Танчева 2008, 151). A pithos dug into the ground has been found in the western room of building A which was most probably connected to the attested metallurgical activity in this area (Маджаров и др. 2007, 163). The analyses of the pithoi fragments (no intact vessels have been found) at the site under the Kozi Gramadi peak has demonstrated the use of similar technique as the examples from Seuthopolis and Koprivlen (Иванов 2011, 163-167). The vessels' shapes and dimensions are also comparable. The analysis of the clay has demonstrated their local manufacture.

The excavations at Pistiros have revealed many fragments and completely preserved pithoi, in most cases discovered *in situ*, lacking mouths and shoulders (Lazov 1999, 339-348). The pithoi from Pistiros have an ovoid body, short neck, wide mouth, and massive cylindrical bottom. The rim is massive with a sloping inner side and projecting outer side which is flat or profiled (fig. 22). Decoration occurs rarely and is usually in the form of relief bands situated on the upper visible part of the pithos body. The largest pithoi reach a height of about 1,5 m with a diameter of more than 1 m and a capacity exeeding 500 litres (Lazov 1999, 340). They were built of separate horizontal sections, coated with additional layers of clay and further shaped on the potter's wheel.

Marks stamped before firing on the top of the rim and representing an arrow, rosette, an ivy, palmettes, or zoomorphic motifs have been recorded on some of the pithoi from Pistiros (Lazov 1999, fig. 3) (fig. 23). Marks incised after firing include numbers rendered with letters of the Attic acrophonic system and correspond to the vessel's volume or its weight (without the goods stored inside or with them), the price, the nature of the content, or the number of vessels in a batch (Domaradzka 1996, 93; 2005, 302) (fig. 24). The signs are applied in different combinations, for instance, ΔΠΙΙΙ=17, ΠΙΙΙ=7, ΔΔ=20, etc. and are most commonly found on storage vessels. On pithoi, they are usually situated on the mouths and walls but appear also on amphorae, fine and domestic pottery. These numerical notations are put by craftsmen who produced the vessels, by merchants, or by owners of the vessels (Domaradzka 1996, 93; 2005, 302). As opposed to the examples from Seuthopolis, where identical vessels and marks have been observed, the analysis of the pithoi from Pistiros has not demonstrated evidence of standardised produce (Lazov 1999, 340).

Most of the better preserved pithoi from Pistiros have been discoverd in layers belonging to the third phase of its existence. Their concentration in the zones where there were traces of metallurgical operations has suggested that the pithoi may be associated with these activities (Lazov 1999, 339). Such are the situations south of the eastern gate where a ditch, wells, and pithoi have been discovered and in the southern part of sq. A5, northwest of Building No 1. Another pithos concentration has been registered in Building No 1 (Lazov 1999, fig. 4) (fig. 25). It has been pointed out that the Building's location at the beginning of the street leading from the monumental eastern gate into the city, the open character of its rooms, the numerous coins, weights and lead tokens as well as the absence of objects typical of residential structures all suggest that Building 1 was initially used for commerce during the second phase of the site's existence (Lazov 1999, 342). The pithoi referring to this stage were used for storage of foodstuffs and liquids. A change in the Building's function occurred during phase III when the large amount of metallurgical slag and half-finished metal articles suggest metallurgical activity (Lazov 1999, 342). The pithoi were now employed as water containers.

Several hundred fragments as well as 15 completely preserved pithoi have been recorded during the excavations at Seuthopolis (Чичикова 1958, 475-487; 1984, 54-65; Čičikova 1958, 466-481; Dimitrov, Čičikova 1978, 19-23). They are found scattered over the whole city, in the houses, the palace, and within the citadel. Thus, the spatial distribution of pithoi in Seuthopolis does not demonstrate a communal storage, rather it was realised in every household. The intact

vessels are usually found sunk into the floor up to their belly or mouth in the storage rooms of the houses, and covered with rounded stones or clay lids. The pithoi have an ovoid form with a short neck, wide mouth, and a short cylindrical or conical foot (fig. 26). The mouth rim is thick and has different profiles (Dimitrov, Čičikova 1978, 19; Чичикова 1984, 54; 57, обр. 30-31). The dimensions vary from 0,95-1,45 m in height and 0,71-1,05 m maximum diameter of the body. The pithoi from Seuthopolis were made in a way similar to the examples from Koprivlen and Pistiros. The surfaces are well smoothed and rarely decorated with relief horizontal bands or incisions. The lack of archaeobotanical analysis from Seuthopolis does not allow us to comment on the form in which cereals were being stored.

A total number of 143 stamps have been recorded on the mouth rims of pithoi from Seuthopolis thus forming the largest collection of this kind in Thrace (Dimitrov, Čičikova 1978, 19). The excavators have distinguished two main groups of stamps: the first one, representing the majority of examples, encompasses stamps placed before the vessels were fired; the second group includes vessels with signs incised after firing (Dimitrov, Čičikova 1978, 20; Чичикова 1984, 56; табла X-XIII). The stamps of the first group contain incised or stamped letters as well as symbols and emblems (Dimitrov, Čičikova 1978, figs. 50-51). The letters Σ, K, H, and Ψ are stamped or incised on respectively three, four, one, and two fragments. It has been pointed out that the profiles and the clay of the vessels within the first two groups (i.e. Σ, K) are the same (Dimitrov, Čičikova 1978, 20; Чичикова 1984, табло X.II.1-2). The same is true for the six fragments bearing a W sign. The remaining stamps represent emblems showing a great variety of depictions: a circle with an incised cross in it, rosettes, a rectangle with two semicircles inside it, or a rectangular shape with two diagonally crossing lines (Чичикова 1984, табла X.II.42-64; XI. II.48-69) (fig. 27). Another group of stamps represents jewellery – pendants from earrings as well as fibulae (Чичикова 1958, 475-487; 1984, табло XI.II.73-82).

The stamps with letters on pithoi from Seuthopolis have been interpreted as representing abbreviations of names which should be connected with the owner of a pottery workshop and intended to distinguish the different manufacturers. The same has been suggested for the stamp-emblems (Dimitrov, Čičikova 1978, 21; Чичикова 1958, 483). The assumption that the stamp with the letter Σ may represent the initial letter of the king's name Σεύθης, is of great interest, as it suggests the existence of state pottery workshops and/or may signify that the contents of the pithoi, i.e the agricultural produce as a whole, belonged to the ruler. It may be assumed that the W sign recorded on some pithoi may actually represent an alternative form of sigma. The letter Σ has been also attested on bricks from Seuthopolis. Furthermore, it has been pointed out that the double axe and the eight-leaf rosette, depicted on the coins of the Odrysian kings and present among the stamps from Seuthopolis, were used as royal symbols and thus stamps of the royal workshops (Dimitrov, Čičikova 1978, 22). At the same time, identical stamps occur on vessels with the same dimensions and profiles which implies the production of individual, private workshops.

The second large group of stamped pithoi includes sixteen fragments with letters incised after the firing of the vessels (Чичикова 1984, табло XIII) (fig. 28). Some of these represent numbers of different value – HPΔΓ (165), EΨΔIII (163), HΨΓ (155), PΔΔI (71), (20), ΔI (11), (10), ΓII (7), IIII (4). The detailed analysis and calculations have led to the conclusion that the first four numbers indicate the capacity of the vessels, and the measurement unit in use equals 3,24 l which may correspond to the Greek liquid measure χοϋς used in indicating the capacity of amphorae and pithoi from the Athenian Agora (Чичикова 1984, 65). The second group of letters represents numbers with a smaller value which may indicate either the price of the vessels or their capacity using a larger measure unit such as μέδιμνος or μετρητής.

The examples of pithoi from Seuthopolis demonstrate the existence of state and private workshops for their production. The available data regarding storage practices are, however, inadequate, as no archaeobotanical remains have been reported. In addition, although we may

calculate the capacity of some vessels based on the incised letters on their mouths, or from the vessels' dimensions, the nature of the content and thus the quantity of the stored grain remains uncertain.

Fragments or intact pithoi are often found in secondary contexts. At Pistiros, pithoi or parts of them were used in the construction of wells (sq. B12 and B22) (Домарадски 1995, 19; Lazov 1999, 339). Much more common, however, is their deposition in the so-called ritual pit complexes. There are also cases in which parts of pithoi or the whole vessels were used as constructional elements of the pit itself and not as offerings. Such pit-pithoi have been recorded already in the EIA as evident from the examples from Polski Gradets (Ников 2005, 92) and Svilengrad (Нехризов 2006, 433, табло 10) (fig. 29) and continued to be used during the LIA. Such have been documented at the pit sanctuaries at Malko Tranovo (Божкова, Ников 2005, 96) and Koprivlen (Vulcheva 2002, 104-118). They are filled with earth, charcoal, and pottery sherds including fragments from the vessels themselves. Two pit-pithoi have been recorded at the settlement at Vasil Levski (Кисьов 2007, 140). They were filled with alternating layers of pebbles and earth, and in the smaller pithos seven fragments of different vessels have been recorded. The presence of pit-pithoi is in accordance with the suggestion of initial utilitarian function of the pit fields in Thrace. In addition, the pithoi were an important element in the practised rituals. Pithoi are found also at peak sanctuaries such as Djenvera cult site (Кисьов 2004a, 76), Tsigansko Gradishte (Кисьов 2008, 154), Golyam Kosoman (one example with stamped rosette) (Катинчарова 2005a, 123), Babyashka Chuka (Димчева 2008, 154-158), and many others. The fragmentary state of the majority of the recorded pithoi often does not allow a full reconstruction of the vessels.

IV.2.3. OTHER STORAGE CONTAINERS

In addition to pithoi, other ceramic vessels of smaller size as well as amphorae could have been used to hold grain[35]. As in the case of the pithoi, there is no firm indication of the character of the stored produce in the various vessels termed as "store-jars". Containers made of perishable materials were most certainly also employed given their cheaper manufacture which required less skill. This is further confirmed by the discovery of charred remains of a basket used for storage of wheat at the Hellenistic building at "St. Marina" in Sozopol (Славова 2013, 50). While the deterioration in quality after storage over long periods is inevitable, grain kept in sacks or baskets will keep for an extended length of time, as long as the room remains absolutely dry and Forbes and Foxhall' studies have demonstrated that in modern Greece farmers successfully keep storage on hand for many years (1995, 69-86).

IV.3. SOCIOECONOMIC IMPLICATIONS OF STORAGE PRACTICES IN LATE IRON AGE THRACE

The importance of storage in the emergence and collapse of complex, hierarchically-ranked societies has been widely discussed for different cultures and time periods from the emergence of the Aegean palatial centres (Halstead 1981, 187-213) to the rise of chiefdoms in North America in around 1000 AD (Wesson 1999, 145-164). The idea of "social storage" – exchange as an indirect storage which functions as a buffer against food shortages has been proposed as a factor favouring the concentration of population or the development of centralised distribution under a ruling elite (O'Shea 1981, 167-183; Halstead 1981, 187-213; Halstead, O'Shea 1982, 92-99). Grain was stored for times of drought or famine when durable tokens could be exchanged for it which would result in the emergence of elite, since those who would eventually control the grain would also accumulate these tokens. A similar scenario has also been suggested for Iron Age Thrace. It has been argued that agricultural intensification expressed in woodland clearance

[35] A Thasian amphora filled with grains has been discovered in dwelling C of building II at the site of Knyazhevo (Агре, Дичев 2014, 169-170, обр. 2).

for larger arable fields and pastures during the EIA was one of the necessary, though insufficient factors, which led to the emergence of the social complexity and monumentality in Thrace during the LIA, as it allowed the accumulation of surplus produce and its exchange for prestige goods (Chapman et al. 2009, 179; 181).

A variety of environmental (drought, flood, hail, etc.) and social (for instance, war, overpopulation) factors may have a catastrophic effect on the crop yields. Different strategies were and are still being applied by farmers to minimise the risk and assure stable food supplies. Among these are planting a variety of crops, land fragmentation, movement, exchange, overproduction, and storage (O'Shea 1981, 167-183; Forbes 1989, 87-97; Halstead 1981, 187-213; 1989, 68-80; Garnsey, Morris 1989, 98-105). Already Hesiod mentions the overproduction and storage as issues of primary importance (*Works and Days* 30-32), and Xenophon points out that one of the most important duties of a wife is to see that "provisions stored up for a year are not spent in a month" (*Oeconomicus* 7.36).

Most agricultural activity takes place in the countryside but, besides some indications for light constructions with possible farm functions and the pit fields whose probable storage function has been discussed, we know very little about the countryside in LIA Thrace. The evidence from the urban centres which are better excavated and published in greater detail, however, sheds some light on the storage practices during the period under investigation. A variety of storage containers including pithoi, smaller storage-jars, containers made of perishable materials as well as subterranean pits existed simultaneously. These might have been used to store different foodstuffs accordingly or represent a minimising risk strategy. Although in the majority of cases the nature of the stored produce is not certain, there are both archaeological and ethnographic indications that cereal crops were among the stored materials. The LIA society in Thrace continued to use long-established storage practices. The predominance of pithoi within the urban centres implies that they served for storage of foodstuffs for immediate consumption. Subterranean pits were most certainly also used for storage but are more commonly found outside settlements and probably served for long-term storage. There is also evidence for above-ground light constructions which were probably used as granaries. Storage in LIA Thrace was realised on a household level, as evident from the discovery of pithoi and storage vessels within houses, but the amount of this produce was most certainly not enough to support the population for long period of time. Distinct storage areas have been identified at Pistiros (Building 1 and the 12 pits already mentioned). It has been suggested that Building 1 was initially used for commerce and the pithoi there were used for storage of foodstuffs. During the third phase of the site's existence, the pithoi were connected to the metallurgical activities, as is the case with the examples from Building A at Pamuk Tepe. If we accept that the pit fields outside settlements were initially used for storage, this might represent long-term communal storage on a regional level (storing the produce of one or more nearby settlements). This, however, does not imply the direct control of the elite groups over the stored produce.

Ancient farmers had to store food to supply the household for one year or more. Ethnographic studies in modern Greece (Methana) also demonstrate that farmers aim to maintain two years of grain and four of olive oil in order to cope with crop failure (Forbes, Foxhall 1995, 69-86). Calculations on the yearly cereal requirements in Greece have demonstrated that a household of six people would require about 1419 kg of wheat or about 1838 litres (Foxhall, Forbes 1982, 71-72). A model of a smaller household which cyclically increases and decreases in size, composed in different phases of two to four adults, up to three children, and two adolescents has been proposed by T. Gallant (1995, 27-33). According to his calculations, the yearly amount of wheat would require from about 480 to more than 1200 litres of storage (Gallant 1995, 72-75). Barley which has a higher yield per hectare than wheat but provides fewer calories per kilogram was proportionally more bulky to storage. These calculations demonstrate that in order to maintain supplies for a year or more, a household would require thousands of litres of storage capacity.

The data from the urban centres in Thrace do not demonstrate the existence of storage facilities able to store so much produce. Although with different dimensions, the volume of the recorded intact pithoi rarely exceeds 500 litres. Even if all the pithoi were used for grain storage, which is unlikely, there would still be not enough storage capacity to support the population of the urban centres for an entire year[36]. This has important implications for the economic strategy of the inhabitants of the Thracian towns. The population of the cities must have relied on the market or stored more produce in the countryside.

IV.4. CONCLUSION

The chapter has presented the various storage methods and their characteristics. A number of factors are significant for the choice of the appropriate storage model. These include environmental conditions, the intended purpose of the produce – for sowing or for everyday consumption as well as socio-political aspects which determine individual versus communal storage. Storage in subterranean pits is one of the most widely distributed food preservation practices and is both ethnographically and archaeologically attested. It has been suggested that subterranean pits were used for storing large quantity of grain for extend periods of time while grain for domestic consumption was stored in other containers such as vessels, baskets, or wooden chests. Different experiments demonstrate the various factors which determine the effectiveness of grain storage in subterranean pits. The pit complexes in Thrace dated to the first millennium BC have been usually interpreted as ritual sites. While the cult character of these structures is plausible, the possibility that they were also used for storage is re-examined. The ubiquitous distribution of pithoi at both settlement and ritual sites demonstrates their importance for both everyday storage tasks and religious practices. The uncertainty regarding the nature of the produce stored in pithoi is, however, a major impediment to the study of ancient agriculture. Stamps and incisions on some of the pithoi reveal the existence of both private and possibly state workshops involved in the manufacture of this category of vessels. The pithoi recorded in Thrace were locally produced, sharing common manufacture techniques. The state of current research, however, does not allow us to distinguish development of shapes through time. Finally, the spatial and quantitative distribution of pits and pithoi in Thrace demonstrates that the bulk of cereal food was kept in the countryside, and the population at the investigated urban centres must have relied on the market or stored more produce elsewhere.

[36] The population at Sboryanovo has been estimated between 6 and 12 thousand people (Стоянов 2006, 83).

CHAPTER V

GRAIN PROCESSING DEVICES

The necessity of processing seeds and grains before human consumption, which makes them easier to digest and more nourishing and tasteful, has resulted in the invention of a variety of methods for both mechanical (grinding and pounding) and thermal (different means of cooking) processing. This chapter will present the development of grinding stones from prehistoric to Roman times, when animal power was applied for the first time in operating a mill. Although comparatively slow, the technological improvement through time led to the appearance of more advanced mills, which increased the quantity and quality of the produce and reduced the effort involved in its preparation. The following presentation is confined to devices whose major function was the grinding of cereal crops. The advantage of the mortar and pestle used for pounding in order to remove the husks of glume from wheat has already been mentioned (see chapter III.1.5). This device does not demonstrate development through time and will not be presented here. The main emphasis in the chapter falls on the distribution of the so-called hopper-rubbers or Olynthus mills, since their appearance in the fifth century BC presents a major innovation in the development of grain processing. A number of examples from Greece, the Aegean, and Central Europe have been published, and some of them have been the subject of scientific analyses aimed at determining their provenance. The territory of ancient Thrace, however, has remained peripheral to such studies. A major problem encountered during the investigation of hopper-rubbers from Thrace is the lack of enough detailed information about their discovery context. As will become clear, a large number of the specimens represent chance finds. Nevertheless, they provide additional information about the variety of types and subtypes and broaden the known distribution territory of the Olynthus mill in general. By examining the grain processing devices used in Thrace during the LIA, we aim at a better understanding of their function in both everyday life and in practised rituals as well as an understanding of their significance in the agricultural economy.

V.1. DEVELOPMNET OF GRINDING TECHNOLOGY

V.1.1. PREHISTORIC GRINDING STONES

The hand mill is the only prehistoric appliance used for grinding cereals. It consists of two stones: a lower (stationary) and an upper (mobile). The material was ground by placing it on the lower stone and then holding the upper stone and rubbing it on the lower one. The earliest examples present stones with different shapes and sections. At the beginning, the movement of the upper stone was circular and random, which led to the hollowing of the lower stone's working surface. A refinement in the development of prehistoric hand mills is represented by the saddle quern. The lower stone of the saddle quern has an elongated shape and a concave working surface which may be a result of the back-and-forth movement of the upper stone, However, this shape may be deliberately made before the stone was used as a mill.

References to mills in ancient literature are found in two passages of Homer's *Odyssey* (7.104; 20.105 ff.), while "crushed in a mill/ground" (μυλήφατος) is used as an epithet for meal (2.355). Mills and milling are mentioned also in the Old Testament (Genesis xviii.6; Numbers xi.8; Deuteronomy xxiv.6; Exodus xi.5) where, as in the case of the *Odyssey,* there is no information about the type of grinding stone. In his study *Grain Mills and Flour in Classical Antiquity*, L. Moritz (1958, 1-9) examines the Homeric text as well as the myths about the invention of the quern and the references in the Old Testament and argues that there is no indication that these mills were rotary, as previously thought, but rather they represented saddle querns[37].

[37] Moritz has noted that while in Roman literature from at least the first century BC onwards there are verbs of turning applied to grain mills which implies the use of a rotary mill, no such verbs are found in Greek literature before that time suggesting that the mills in use then were non-rotary.

Depictions in Egyptian tombs as well as on wooden, stone, and terracotta figurines from Egypt and Greece show the way the saddle quern operated (Moritz 1958, pl. 1a, 2a; Bennett, Elton 1964, 38-52; Sparkes 1962, 125, 134). The work was usually done by a woman, kneeling behind the stone (fig. 30). For more stability, the front part of the lower stone can be set in the ground or against a fixed stone. Depictions in Egyptian tombs dated to *c*. 2700 BC show a saddle quern set on a base in such a way that its long axis slopes so the ground corn pours into the vessel below (Forbes 1955, 139). In this case, the miller is no longer kneeling behind the quern but is standing, which allows more energetic movements. A standing figure grinding or kneading dough is depicted on a black-figure Boeotian lekythos of the middle sixth century BC (Sparkes 1962, pl. VII.2; Boardman 1994, 92, fig. 94). It has been pointed out, however, that distinguishing between grinding and kneading is often difficult. Thus, the identity of the original object in the hands of the Rhodian figurine dated to the middle of the fifth century BC is unknown; it could have been a grinder or a lump of dough for kneading (Sparkes 1962, 126, pl. VII.3, app. No 26). The same is true for a terracotta figurine discovered at the necropolis at Apollonia Pontica and dated to the end of the fourth – beginning of the third century BC (Дремсизова-Нелчинова, Тончева 1971, 48) (Appendix B.2.17). It represents a woman standing in front of a vessel. Her hands are missing, and it is unknown whether she is pounding, grinding or kneading (fig. 31).

Detailed description of the discovered saddle querns is given in the reports from the excavations at Olynthus where by 1938 fourteen examples had been documented (Robinson, Graham 1938, viii, 326). The shape of the lower stones is more regular than that of earlier examples, and their size is constant. The upper stones are flat on one side and convex on the other. In some cases, the wear of the central part of the grinding surface leaves the ends projecting like handles. The saddle querns from Olynthus show an important innovation: the working surfaces of both lower and upper stones, although not on all of the examples, are striated with incised lines. Lines forming a herringbone pattern or arranged at right angles to the length, sometimes in both directions, are visible on the lower stones. Longitudinal striations are present on the grinding surfaces of some upper stones. These striations give the stones a better grip on the grain and enable the mill to cut rather than to crush the grain. They also regulate the flow of the grist, especially when the stones are no longer set at a slope (Moritz 1958, 37).

The grinding stones were necessary for everyday tasks and are among the common finds at archaeological sites, especially settlements. Besides being used for domestic purposes, they played an important role in the rituals practised in Thrace throughout the entire first millennium BC. The deposition of saddle querns at both peak sanctuaries and pit complexes is attested already in the EIA (Нехризов 2010, 190; Божкова, Петрова 2009, 155). The practice continues during the LIA when, besides saddle querns, hopper-rubbers are also present (Нехризов, Миков 2002, 42-44; Нехризов 2003, 67-68; 2008, 331-493; Домарадски 1999, 66, 68, табло xvi.5; Тонкова 2007, 51-85).

Saddle querns[38] are ubiquitous in the prehistoric periods, but they also continue to be used and predominate after the appearance of the more advanced lever-operated hopper-rubber in the fifth century BC. A possible explanation is that the more elaborate hopper-rubbers were more expensive in terms of required skills and time for manufacture and that thus, they were not available to every household.

V.1.2. OLYNTHUS MILL AND ROTARY QUERN

An important development in grinding technology is marked by the appearance of a new type of millstone known in the literature as a hopper-rubber or Olynthus mill. The term "hopper-rubber" was used for the first time by V. G. Childe (1943, 22), while L. Moritz (1958) designates this type

[38] The number of saddle querns is great and althoug there are some typlogical studies on examples from prehistoric sites, such as the EBA tell of Ezero (Георгиев и др. 1979, 157), there are no statistical analyses on the distribution of saddle querns within and among settlements and other sites. We believe, however, that future investigations should emphasise on provenance and functional analysis of these tools in order to determine the nature of the processed materials which will shed light on economic aspects.

of grinding stone as the Olynthus mill, since such querns had been discovered and discussed in detail in the excavation report of Olynthus (Robinson, Graham 1938, 327-334). The identification of this device as a mill for grinding corn belongs to W. M. Flinders Petrie (1988). Further insight into the operation method comes from the reliefs on two Megarian bowls, manufactured in the same mould (Appendix B.2.18; 19). The first bowl, now in the National Museum in Athens, was published by F. Versakis (1914, 50-57), while the second one, found at Thebes, is part of the Louvre collection and was published by M. Rostovtzeff (1937, 86-96). The bowls are dated to the late third or the early second century BC (Parsons 1936, 87). The relief presents a scene in a flour mill: at the ends of the frieze two millers are grinding grain using hopper-rubbers, and another miller is sieving the flour or the grain to drain water from it[39] (fig. 32). The millers and the master of the mill are designated as such by inscriptions (μυλωθροί; μυλωνάρχης). The donkey depicted in the centre has been interpreted as operating a Pompeian mill. Moritz has argued, however, that there is no clear indication for such interpretation – no harness is visible on the donkey, and if it operated a mill, the latter would have been clearly visible (1958, 12-15). Five strangers wearing pointed caps are also designated with inscriptions (κίναιδοι). The detailed examination of the scene by Rostovtzeff has led him to the suggestion that it does not represent a realistic scene, but rather it is an illustration of a play (1937, 90). This interpretation puts the two Megarian vessels in the class of bowls termed as Homeric depicting episodes from famous literary works. Significant is the fact that while the scene is presented from the side, the hopper-rubbers are shown seen from above, which makes their recognition easier.

The scene on the Megarian bowls has allowed K. Kourouniotes to suggest a reconstruction of the hopper-rubbers' working principle (1917, 152). Compared to the prehistoric querns, the Olynthus mill has a completely new shape and different mode of operation. The device consists again of two stones. The upper stone of the standard Olynthus mill has a rectangular or square shape of the stone and the hopper with sides sloping inwards which lead to a slit (fig. 33). Two slots are usually situated opposite one another cut into the rim. A long wooden handle was placed across the top of the stone and attached into the slots. Often on the external sides there are small hollows situated below the slots. In some cases, lead and iron rods have been found in them (Runnels 1981, 296; Robinson, Graham 1938, 329, fig. 33). R. Frankel explains the function of the small holes as additional devices that helped in fixing the handle – it was tied with a wire embeded into the lead (2003, 6). The handle was attached to a vertical pivot at one end and held by the miller at the other end. The grinding was realised by moving the handle back and forth in an arc[40] (fig. 34). It has been pointed out that in the majority of cases there is a small hole on only one of the short sides of the upper stone. That was the side situated close to the pivot where the moment of force was the greatest and thus, it was necessary to secure the handle (Runnels 1981, 121). An advantage of the Olynthus mill is that thanks to the hopper and the slit on the upper stone, there was no more need to stop the work in order to put more grain between the stones. In addition, the handle increased the efficiency. In Kourounites' reconstruction, the hopper-rubber is situated on a table to which the vertical pivot was also fixed (Kourouniotes 1917, 154, fig. 3). Another possibility is to fix the handle in a niche in the wall or in the corner of the room, as evident from examples discovered in Israel (Frankel 2003, 6, figs. 5-6) – the mills were found *in situ* on raised platforms close to the buildings' walls (fig. 35).

Thirty one upper stones of hopper-rubbers have been discovered at Olynthus (Robinson, Graham 1938, 327-334, pl. 80). The excavators have observed uniformity in the dimensions and

[39] A. Parsons has pointed out that since the miller is holding a sieve above a basin on a stand and not a table, he is using the sieve to drain the water from the wet grain (1936, 87, n. 2). Washing the grain before it is ground is still practised.

[40] Although the side to side oscillating motion of the Olynthus mills has been generally accepted, a recent examination by D. Peacock (2013, 39-43, fig. 3.6) suggests that at least some of the examples (both with slots for a handle and without) might have been used in a to-and-fro motion like the saddle querns. The arguments include the small dimensions of the lower stones and the lack of arc-like striations across the grinding surfaces.

basic characteristics of the upper stones – they all were manufactured from hard black porous lava, and their dimensions vary from 42 to 57 cm in length, from 36 to 47 cm in width, and from 8 to16 cm in thickness. The original thickness must have been greater, as the stones wore out in the process of continuous use. The length of the slit in the middle ranges from 15 to 42 cm and when it is not worn out or broken, from 1,5 to 3 cm in width. The slots on the rim are 5,5 to 7 cm wide and from 2 to 3 cm deep (Robinson, Graham 1938, 328).

The lower stone of the hopper-rubber is also rectangular in shape. Twelve completely preserved examples have been recorded at Olynthus. It has been pointed out that some might have been used with saddle querns, as these were also discovered at the site (Robinson, Graham 1938, 327-334). Their dimensions – length ranging from 45 to 59 cm and width from 30 to 45 cm, show that they were not much bigger than the upper stones. In one case, both upper and lower stones have been found together – their length is the same (51 cm), while the whole width of the lower stone is not preserved. One lower stone has a trapezoid shape, and the short side was most probably set close to the vertical pivot, where the arc of the upper stone is shorter (Robinson, Graham 1938, 329). Frankel mentions examples from Israel on which there is a small raised semicircular ridge on the edge of the lower stone in the middle of one of the long sides, which probably helped in guiding the movement of the upper stone (Frankel 2003, 6, figs. 7j; 7l).

Deliberate striations on the working surfaces of both lower and upper stones are common for the Olynthus mills (fig. 36). Such grooves have been recorded already on saddle querns, as evident from examples at Olynthus (Robinson, Graham 1938, pl. 79.1-4) and Delos (Deonna 1938, pl. 49.372). The striations assured better grinding and regulated the flow of the ground corn. They show a variety of patterns: parallel lines – such stones have been discovered at Delos (Deonna 1938, 128, fig. 155.1-3); a herringbone pattern – Delos (Deonna 1938, 128, fig. 155.4), Priene (Wiegand, Schrader 1904, 394, abb. 525), Olynthus (Robinson, Graham 1938, pl. 79.5); or a combination of both – Delos (Deonna 1938, 127, unnumbered fig., 128, fig. 155.5) and Priene (Wiegand, Schrader 1904, 394, abb. 524). There are also examples that show more unusual patterns. On the basis of similarities in the striation patterns, Frankel suggests common origin for some of the stones and isolates local variants (Frankel 2003, 13-17). In some cases, however, these furrows are not visible which may be due to their initial absence or to wearing out the surface of the stones after continuous use.

Mapping the geographical distribution of the hopper-rubber and its subtypes will help us understand its origin, development, and the ways it penetrated into new regions. The development of grinding devices, as well as examples of hopper-rubbers from the Italian Alps and Sicily, is presented by L. Dal Ri (1994, 51-66), M. Donner and C. Marzoli (1994, 73-98), and D. Francisci (2011). A detailed analysis of the finds from the northern Black sea region is published by T. Arnăut (2003-2005, 221-247, fig.10). In his article on the distribution of the Olynthus mill, Frankel presents a comprehensive list of sites throughout Europe, western Asia and northern Africa where such mills have been recorded (Frankel 2003, 1-21). Among these are Greece, Anatolia, the Levant, Egypt, Cyprus, Crete, Sicily, southern and northern Italy, southern France, the Czech Republic, Slovakia, Romania, the Crimea, and Ukraine (fig. 37). Recently, T. Takaoğlu has published fragments of upper stones from Asia Minor which further adds to the geographical distribution of the Olynthus mill (2008, 537-679) and D. Peacock (2013, 51) has made additions to Frankel's map. The blank spaces are due to the state of research and publication, as evident from the subsequent presentation of examples from Thrace, the majority of which are unpublished or are only briefly mentioned in the archaeological reports. While this explanation seems plausible for Eastern Europe, the absence of hopper-rubbers in the western part of the continent reflects a more realistic picture of their distribution. No examples of Olynthus mills have been recorded in Sardinia (Williams-Thorpe 1988, 261) and Majorca (Williams-Thorpe, Thorpe 1991, 152-153), or in the British Isles and Spain (Frankel 2003, 7). The only exception is the cargo of the Sec wreck off Majorca which included hopper-rubbers and appeared to have attempted an unsuccessful trade

of Olynthus mills to the Western Mediterranean (Williams-Thorpe, Thorpe 1991, 153). That the distribution of hopper-rubbers was confined to the territory east of Sicily is due to the fact that another type of hand mill was already common for Western Europe, namely, the rotary quern.

The earliest references to rotary hand mills appear in the Roman literature. Vergil (*Moretum* 16-29, 39-51) describes the early-morning activities of the rustic Roman farmer Simylus, and Aulus Gellius (*Attic Nights* 3.3.14) mentions *trusatiles* "push-mills" in a bakery driven by man-power. Cato (*On Agriculture* X.4; XI.4) distinguishes between ass-driven (*mola asinaria*) and the reciprocating push-mill (*mola trusatilis*). Animal-driven mills are frequently mentioned in Roman texts, as they were a common device in the bakeries (Appendix B.1). Several Greek authors of the fourth and third century BC use the word for "donkey" (*ὄνος*) in connection with grinding (Xenophon *Anabsis* I.5.5; Aristotle *Problems* XXXV 964b. 38; Herodas *Mimes* 6.83). The word, however, was used not to denote the employment of an actual donkey in the process of grinding but to designate the upper stone.

The rotary quern has a stationary lower stone and a rotatable upper stone with convex and concave grinding surfaces respectively. The upper stone has a centered perforation, called an "eye" used to fix the upper stone on the perforated lower stone which incorporated a spindle. The eye serves for feeding the mill. On the upper stone there is a handle slot (fig. 38). Different attempts at constructing a typology of these querns have been made, initiated by C. Curwen for examples form Britain (1937, 133-151; 1941, 15-32). A recent summary by Peacock (2013, 65-71) on the pre-Roman querns in Europe distinguishes several groups based on the shape of the stones (cylindrical, hemispherical, conical, and Iberian) and proposes regional distribution.

The question of the origin of the rotary quern has been initially examined by Curwen (1937, 133-151; 1941, 15-32). He put forward the hypothesis that the rotary principle was first applied for the donkey and slave mills, while the rotary hand mills appeared subsequently "for the benefit of the peasants who lived far from the towns, and still had to grind their corn at home" (Curwen 1937, 141). First Childe realised that the rotary hand mill appeared early in Spain and suggested that this was Cato's *mola hispaniensis* (Cato X.4), but he doubted if it existed before the second century BC (Childe 1943, 20-21). Examining the existing literary and archaeological evidence for the donkey-mill and the rotary hand mill, Moritz (1958, 105) has concluded that it is impossible to decide which was prior, since the dates of the first certainly dated rotary mills (from the besiegers' camp at Numantia in Spain – early second half of the second century BC) are close to the first certain occurrence of the donkey-mill in the literature (Cato X.4; XI.4). According to him, the rotary mill originated at yet unidentified place in the Mediterranean. The present data show that rotary hand mills existed in Carthage and northern Spain already in the fifth century BC with one example dated to the end of the sixth century BC (Wefers 2011, 69). Such have also been found in south-eastern England in contexts of the fifth (Peacock 2013, 57) and fourth century BC (Buckley 1979, 89), and in France, Germany and the Czech Republic from the fourth century BC onwards (Wefers 2011, 71). Investigating their advent in Europe, and having in mind the same dates of the examples in Britain and Spain, it has been suggested that the idea for the rotary quern developed independently in different areas (Wefers 2011, 71).

That smaller and lighter hand mills were used as portable querns, especially for the needs of the army, is evident from Xenophon's *Cyropedia* (VI. 2.31) and is later attested in Frontinus' *Strategemata* (IV.1.6). Both passages, however, do not give detailed information about the type of the mills. It has been assumed that the passage in *Cyropaedia* refers to rotary querns[41], which, however, cannot be inferred from the text. Given the time and geographical position of Xenophon's text, it would be more convincing to assume that the mill represented a simple saddle quern or a type, not necessarily earlier, of the hopper-rubber with handle-grips and driven directly by hands, as examples from Priene, Delos, and Thera demonstrate (Frankel 2003, 8).

[41] See discussion and references in Moritz 1958, 17.

The passage by Frontinus, written in the first century AD, probably refers to the time of Philip V of Macedon (221–179 BC), and the possibility that the portable mills mentioned in the text were rotary should not be ruled out.

Already Moritz has pointed out that there is no conclusive evidence for the use of the rotary hand mill in Classical Greece (Moritz 1958, 52-60). The rotary motion was, however, used for crushing olives, perhaps as early as the fifth century BC. The earliest securely dated parts of an oil crushing mill come from Olynthus and have been dated to the late fifth or early fourth century BC (Robinson, Graham 1938, 338). A crushing stone has also been found at Pindakas on the island of Chios in a middle fifth century BC context (Curtis 2001, 305). These artefacts have been identified as belonging to a type of rotary oil crusher called by Cato *trapetum* (XX-XXII). Thus, at a time when in Greece the hopper-rubber was the typical mill for corn grinding, the *trapetum* was used for olive crushing[42].

The earliest example of hopper-rubber known from Greece is dated to the last quarter of the fifth century BC (Runnels 1981, 296). A clay model of a bakery reported as discovered in the region of Tyre, Israel, shows an Olynthus mill operated by two people (Frankel 2003, 7, n. 36, fig. 9). The model is dated on stylistic grounds to the seventh century BC, which if accepted, gives an earlier date for the appearance of the hopper-rubber. R. Frankel investigates the diverse types of Olynthus mills and concludes that its origin should be seen in the Eastern Mediterranean – Anatolia or the Greek mainland from where it spread westwards most probably by the Greek colonists (2003, 17-18). Opposite is the direction of the rotary quern. The available data show that it originated in Central or Western Europe from where it was diffused most probably by the Roman legions (Runnels, Kardulias 1995, 127). It reached Greece only in the first century BC (Runnels 1990, 147; Runnels, Kardulias 1995, 127) and gradually replaced the Olynthus mill as it was technically superior. This replacement did not happen at one and the same time in the different regions. It has been pointed out, for instance, that in Israel the rotary quern, which appeared in the first century AD, replaced the Olynthus mill only in the Byzantine period (fourth – seventh century AD) (Frankel 2003, 18). That there was an overlap in the use of the different types of querns is evident also from Morgantina in Sicily where saddle querns have been found in layers in which Olynthus mills are more common and belonging to the latest occupation of the site in the first century BC (White 1963, 204). At Morgantina, the rotary motion for grain mills was used already in the third century BC (White 1963, 205). Other examples for the continuous use of the Olynthus mill in Roman times come from the Athenian Agora and Isthmia, dated to the first and second centuries AD (Runnels 1981, 127), as well as at Montalto in eastern Sicily – a site where only prehistoric and Roman levels have been recognised (Williams-Thorpe 1988, 261). No examples of Olynthus mills from Greece can be dated with certainty later than the second century AD (Runnels 1981, 127), which gives an approximate date for their complete replacement by the rotary quern.

V.2. OLYNTHUS MILLS FROM THRACE. DISTRIBUTION AND TYPOLOGY

The discovery of hopper-rubbers on the territory of Thrace has been, with few exceptions, neglected by the scholars. In the majority of cases, the presence of grinding stones is only mentioned in the archaeological reports without further information about their type or context of discovery. This is most probably due to the fact that this class of artefact is characterised by similar shapes and dimensions that do not provide good basis for constructing a typology as well as with longevity of forms which makes them unsuitable for secure dating. The preceding discussion, however, has shown that grinding stones underwent changes through time resulting in the appearance of more advanced types. A main feature in this development was decreasing

[42] Besides the *trapetum,* simpler and less expensive equipment had also been used for crushing olives such as the "roller and bed" type of crusher – a cylindrical stone was rolled repeatedly over the olives set on a stone base (Foxhall 1993, 183-4, fig. 7; 2007, 178-181).

the effort necessary for operating the mill, while at the same time increasing its productivity. Thus, the application of the rotary motion for grinding allowed the use of animal power and the later appearance of water- and windmills.

The hopper-rubber was the typical grain processing device in Classical and Hellenistic Greece, as evident from its wide distribution. The knowledge of this technologically superior mill penetrated into the neighbouring Thracian lands to the north as a result of the intensified contacts between Greeks and Thracians during the second half of the first millennium BC. The sites that have produced hopper-rubbers in Thrace include settlements, among which major urban sites, as well as cult places such as peak sanctuaries and pit complexes. There is also a number of surface finds with no information about their discovery context (fig. 39).

The hopper-rubbers described here and in Appendix C present both upper and lower stones. Only one example, the chance find from the village of Pet Mogili, however, represents a pair of both upper and lower stone. The much smaller number of recorded lower stones (only 8) becomes instantly apparent. They are interestingly missing from both archaeological reports and museum collections. One explanation may be that they have remained unidentified (if used till completly broken and present only fragments difficult to recognise). Another possibility is their reuse as a building material after wearing out, as their rectangular shape makes them suitable for such function. This is further supported by a fragment of a hopper-rubber from the site of Kale in Krševica (south-eastern Serbia) discovered in the wall of a building (Popović, Kapuran 2007, 86, fig. 2). An upper stone reused in a wall of a house is recorded at Olynthus (Robinson, Graham 1938, pl. 80.8). It should be pointed out, however, that it is the upper stone of the hopper-rubber that demonstrates different features used as a basis for typology. It is also the one that possesses all the new elements compared to the saddle quern and that required knowledge and skills to manufacture.

V.2.1. FINDS FROM SETTLEMENTS

The investigations at Seuthopolis between 1948 and 1954 have revealed both fragments and completely preserved upper stones of four hopper-rubbers. The excavators have correctly identified the finds as examples of grinding stones of a more advanced type (Чичикова 1955, 49; 1970, 20; Димитров 1958, 177-178) and have pointed out their close parallels to specimens from Olynthus, Priene, Delos, and the north Black Sea coast (Dimitrov, Čičikova 1978, 15). Already in the first year of the excavations two upper stones of hopper-rubbers have been discovered: one completely preserved (Димитров 1958, 177, обр. 45; Dimitrov, Čičikova 1978, 15, fig. 35) (Appendix C.7) and the other only a fragment (Димитров 1958, 177, обр. 44) (Appendix C.26). The finds come from domestic buildings. Both examples present the standard type of Olynthus mill with rectangular or square shape of the stone and the hopper. Besides slots cut on the rim of the short side, the completely preserved mill is also furnished with an additional device for attaching the handle. On one of the lateral short sides, under the slot, there is a small depression of irregular shape. This specimen is of further interest, as it has visible marks on the working surface – short horizontal lines, starting from the slit and perpendicular to it (Димитров 1958, 178, обр. 47). These marks do not cover the whole width of the stone, as is the case with the deliberately cut striations, and might have resulted from the movement of the mill. Two more fragments of one upper stone resembling the standard type of Olynthus mill (Appendix C.14) as well as a completely preserved example with irregular shape (Appendix C.40) are reported from Seuthopolis. Another specimen with a more peculiar form should be mentioned here as well (Appendix C.41). It represents a completely preserved upper stone. While the stone and the hopper are square in shape, the slit in the middle is ellipsoid. Interesting is also the fact that the quern is reported as discovered in tumulus 93 of the Shipka necropolis located in the vicinity of Seuthopolis.

The last two hopper-rubbers (C.40 and C.41) stand out from the rest with their rough manufacture and irregular shapes. Upper stones with irregular shapes have been recorded in the

Italian Alps (Battisti et al. 2000, 57-60, fig. 1). In some of the cases the stones are round and such examples have been reported also from Romania (Frankel 2003, 11). The Olynthus mills from Greece and the Aegean islands are similar in material, shape, dimensions, and manufacture. On the other hand, the examples discovered at sites outside the Aegean are characterised by a lower quality of manufacture and were most probably local imitations of the Greek prototypes. Thus, the irregular shapes of the hopper-rubbers from Seuthopolis and Shipka should be explained by the abilities of the ancient craftsmen and may also be due to the qualities of the raw material itself.

Examples of upper stones of Olynthus mills have been discovered at Pistiros (Appendix C.4; 12; 15; 30-33). The first one (C.4) has two horizontal grooves situated on the lateral short sides. They served as an additional device for keeping the handle in place, similar to the small depressions hollowed at the lateral sides on some of the examples (such as C.12 again from Pistiros). In White's reconstruction, a rod is situated in each of these grooves, held in position by cords, tightened by twisting, running along the long sides of the stone. The handle is held in the slot by straps connected to the rods (White 1963, 202, n. 28, pl. 48, fig. 9) (fig. 40). While the majority of the finds from Pistiros represent only fragments, there are two better preserved examples – C.4 and C.15 – the latter of which also stands out with its good quality of manufacture. Finaly the excavations at the site have yielded two examples of lower stones (C.46, 47).

The systematic excavations at Sboryanovo have also revealed examples of both upper (Appendix C.22) and lower stones (Appendix C.48; 49) of hopper-rubbers. The upper stone is almost completely preserved. It has a rectangular shape but no slots or any additional devices for securing a handle. Its rough appearance and bad quality of manufacture should be pointed out. Traces of the operation process, small pits with irregular shapes, are clearly visible on the working surface on one of the lower stones (C.49). Chisel marks, result of the shaping of the stone, are observed on the lateral and lower sides.

Trench excavations at "Manastira" locality, situated at 5 km west from Zornitsa village, Western Rhodope, have revealed destructions of three buildings (Кисьов 2004, 16-19). The site is situated on the southern slope of a hill on a broad terrace, close to a river. A fragment of a hopper-rubber, has been recorded in Building 2 (Кисьов 2004, 17, табло. XIII.2). The example has been discovered in the northeast corner of the building together with two pottery vessels and a clay loom weight. On the basis of the pottery assemblage, the site has been dated to the fourth – second century BC. Among the other finds, we should mention pieces of iron slag in high concentration as well as fragments of crucibles. One of the largest and richest iron ore deposits in the Rhodope Mountains is situated in the region. All these confirm the character of the settlement as connected to metalworking (Кисьов 2004, 19). A fragment of an upper stone of an Olynthus mill (Appendix C.20) has been discovered also at the site of Dragoyna Peak, among the destructions of the surrounding wall, dated to the Early Hellenistic Age (Божинова, Андонова 2010, 138). A completely preserved upper stone is published among the finds from the uppermost layers at Banyata tell at the village of Kapitan Dimitrievo, municipality of Peshtera (Детев 1950a, 19-20, обр. 38). It belongs to the standard type of mills with slots on the rim on two of the sides and a horizontal groove for securing the handle. According to the excavators, the mill was found in layers belonging to a Thracian settlement from the Roman period. Five more fragments of upper stones are reported from the settlement at the Lazova kashla locality, municipality of Batak, part of which has been excavated, but is now under the waters of the Batak Dam (Цончев, Милчев 1970, 159-160, обр. 19).

An upper and a lower stone of a hopper-rubber have been recorded at Istria, south-eastern Romania (Coja, Dupont 1979, 44, fig. 14) dated to the fourth century BC. The upper stone has a more unusual form of the hopper. In this case, the rims on the two short sides are in the shape of triangles pointing inwards and thus resemble a butterfly. Olynthus mills with hopper in the shape of a butterfly are known from southern Ukraine (Граков 1954, обр. 15.2), the Crimea, Western

Anatolia (Frankel 2003, 9-10), Athens (Runnels 1981, 296), and Thasos (Muller 1979, 335, fig. 23). Except the example from Athens, all remaining specimens have two adjacent projections between which the pivot was attached. It has been pointed out that this type of hopper-rubber is distributed in regions north and east of Greece, as only one example has been recorded on the mainland (Frankel 2003, 10).

V.2.2. FINDS FROM BURIAL AND RITUAL CONTEXT

Evidence for the use of grinding stones in funerary contexts in Thrace comes from the necropolis at Kragulevo, north-eastern Bulgaria, dated to the end of the seventh – the first half of the fourth century BC (Василчин 2002-2003, 135-249). In some of the graves the urns with the cremated remains were set on stone slabs, and fragmentary grinding stones were used as such in four cases. The querns in the necropolis at Kragulevo were not set as grave offerings, and their use had solely practical character. Among other stones, grinding stones were used in the construction of one of the mounds recorded in St. Bogoroditsa locality at the town of Belitsa, and dated to the sixth – fifth century BC (Гоцев 1996, 46). However, no burial was discovered. The lack of detailed information about the discovery of the hopper-rubber at Shipka does not allow us to reach firm conclusions about the character of the find. It might have been part of the rituals performed in the process of constructing the burial mound, or at a later period, or it might have found its way there by chance. The presence of grinding stones at ritual sites in Thrace, which will be discussed in the following paragraphs, does not allow us to rule out the possibility that they might have been used in connection with burial rites. To prove this assumption, however, more examples within secure contexts are required.

Fragments or completely preserved examples of both saddle querns and hopper-rubbers had been deposited as votives and are among the finds at ritual sites in Thrace – pit complexes[43] and peak sanctuaries. During the excavations in 2004–2006 at the pit complex at Svilengrad, south-eastern Bulgaria, a total number of 213 pits have been investigated (Нехризов 2007, 176-180). Fragments of upper stones of hopper-rubbers have been recorded in five of them (pits No 8, 32, 58, 29, 78) (fig. 41). The pits show a similar fill which most often consists of dark brown or black soil mixed with charcoal, ash, pieces of fired plaster, animal bones, and river stones. Among the finds are also pottery sherds, spindle whorls, loom weights, round-shaped sherds from vessel walls, and flint tools. On the basis of the discovered materials, the functioning of the pit complex at Svilengrad has been dated to the second period of the EIA and the LIA.

Pit No 32 has revealed an upper stone of Olynthus mill (Appendix C.42) as well as four other fragments of grinding stones (Нехризов 2006, 442-443). The hopper-rubber from pit No 29 is interesting, as it shows incisions on the lateral side – a horizontal and a zigzag lines, 1 cm wide (Appendix C.34). While the horizontal groove might be seen as an additional locking device for the handle of the stone, the purpose of the zigzag line is not clear. Decoration is not a characteristic feature for this class of artefacts. The position of the incisions on the side of the stone does not offer good visibility. It may be a mason's mark, but the fragmentary state and small dimensions of the stone do not allow us to make any further conclusions about the purpose of the zigzag incision.

Examples of grinding stones discovered in pit complexes dated to the LIA are reported from Gerena locality, municipality of Dimitrovgrad (Агре, Дичев 2006, 71), Gledachevo (Тонкова 1995, 58-60; Tonkova 2003, 488; Тонкова, Георгиева 2006, 165) and Staroto Selishte, municipality of Radnevo (Саватинов 1997, 9-53), Shihanov Bryag at Harmanli (Игнатов, Кънчева-Русева 2007, 123) and Soldzhaka locality at Ovchartsi village (Георгиева и др. 2008, 167), the latter dated to the second period of the EIA – LIA.

[43] The possibility for initial storage function of the pit complexes in Thrace has been already discussed in chapter IV. The practice of rituals at the pit fields is, however, supported by the nature of the finds.

The discovery of grinding stones together with other artefact types such as daub fragments, hearth pieces, charcoal, and ashes in the pit complexes in Thrace has been interpreted as reflecting rituals related to the home and/or fertility (Георгиева 1991, 7; Нехризов 2006, 408). The discovery of plant remains of cereals and pulses in the pits' fill (Попова 2005, 161-162; 2008, 550-555; Тонкова, Георгиева 2006, 165) has led to the suggestion that the grinding stones were deposited not only as offerings but were also used in the performed rituals, involving preparation of meals served in the pits (Нехризов 2006, 408). It has been pointed out also that the Thracian ritual pits find parallels in those Greek festivals that emphasise female presence, and it is also likely that mainly women preformed the rituals in Thrace (Nekhrizov, Tzvetkova 2012, 194).

In addition to pit complexes, hopper-rubbers have been discovered also at peak sanctuaries. The investigations at the site of Ada Tepe, Eastern Rhodope, has produced three completely preserved upper stones (Нехризов, Миков 2002, 42-44; Нехризов 2003, 67-68; 2006a, 140-142). Three fragments of one example (Appendix C.39) show a stone with rectangular form and a hopper with the shape of a butterfly (fig. 42) like the one discovered at Istria. The remaining two upper stones (Appendix C.23; 24) have rectangular shape of the stone and no slots or any additional device for securing a handle. The hopper of the latter one (C.24) is relatively shallow. It is also more roughly manufactured compared to the remaining examples from the site.

The investigations at the peak sanctuary at Babyashka Chuka, Western Rhodope, have revealed two completely preserved (Appendix C.17; 19) and one fragmentary (C.18) upper stones of hopper-rubbers. They come from the stone heap on the western periphery of the site (Тонкова 2007, 51-85, обр. 11; Tonkova 2008, 270, fig. 7). The objects deliberately deposited as gifts at sanctuaries are usually divided into two main groups: items directly connected with the cults practised and manufactured for this purpose such as stone, bone, and clay amulets as well as miniature objects; and items with utilitarian function, which acquired some symbolic meaning and were eventually used as offerings (Osborne 2004, 2). The second group includes personal objects, tools, agricultural implements, and weapons. The Olynthus mills fit into this second group. The deposited materials discovered in the stone heap at the sanctuary at Babyashka Chuka are dated to the second half of the third century BC and mainly to the second and the first century BC.

The mills from Babyashka Chuka are visibly less well made compared to other examples discovered in the territory of Thrace. Most probably, these differences in the appearance are due to the abilities of the craftsman. An unusual feature of the specimens from the site is that the slots on the rim are situated not on the short sides of the stone, as is in the majority of cases, but on the long sides. Another such example is C.39 from Ada Tepe. Although the slots are situated on the long sides, they are still on the same axis as the slit. Examples from Delos (Deonna 1938, 129, n. B 5707, pl. 380), southern Lebanon, and northern Israel (Frankel 2003, 11) show slots perpendicular to the slit. The effort necessary for operating the mill would have been greater when the slots were situated on the long sides. However, the most important element on which depends the degree of effort for operating the mill is the length of the handle. Less effort is necessary in the case when the upper stone is situated close to the vertical pivot, while the distance between the stone and the miller is greater. The examples from Babyashka Chuka, furthermore, show a hopper with a smaller capacity in comparison with the remaining querns from Thrace. This was most probably again due to the skills of the craftsman. Nevertheless, the specimens from Babyashka Chuka fit the criterion of the standard type of Olynthus mills with a rectangular or square shape of the stone and the hopper.

Seven examples of upper stones of Olynthus mills, kept in the Historical Museum of Velingrad, are discovered during field survey or excavations on several sites in the region of the city. Four of them come from the site of Shumane-Mane, situated southwest of the town of Rakitovo, discovered during field survey (Appendix C.5; 6; 29; 45). The site is recorded as a sanctuary, settlement and necropolis dated from the EIA to the Roman period (Салкин и др. 2012, 560).

Two of the better preserved examples (C.5; 6) have horizontal grooves on the exterior of one of the short sides, but only one slot preserved. Two fragments of an upper stone with horizontal groove, but no preserved slots on the rim, as well as another, probably rotary mill, come from the Thracian sanctuary at Kaleto peak, near Kostandovo station (Салкин, Байраков 2009, 198-200; 2010, 19-20, обр. 11, 11а) (Appendix C.28). A fragment with a hole on the exterior of the short side has been discovered during field survey in the region of Mikroyazovira (Appendix C.11) (Салкин и др. 2012, 560). Finally, a small fragment has been found during excavations at the sanctuary at St. Ilia peak (Appendix C. 44).

V.2.3. OLYNTHUS MILLS AND ORE PROCESSING

The primary function of the grinding stones is food processing and, particularly, the production of flour. Their use in the processing of other materials is, however, attested already in the prehistoric periods – querns and pounders were used for the production of pigments. There is also evidence that grinding stones were used for the crushing of metal ores (Muller 1979, 315-344; Jones 1984, 68). Residue analysis has been conducted on one upper stone from the region of Akandzhievo village, in the vicinity of Pistiros (Appendix C.8), proving its use for crushing metal ore (Катинчарова 2005, 188-189, бел. 3). Evidence for metallurgical activity has been recorded not only for the last habitation phase when the site functioned as a production centre (Домарадски 1995, 61; Katinčarova-Bogdanova 1996, 103-107) but also for the period when it appeared as a trading post and, particularly, its second phase (end of the first quarter of the fourth – beginning of the third century BC) (Katinčarova 2002, 33). The region is one of the richest in metal ores in the Balkan Peninsula, and it has been suggested that one of the reasons for the foundation of Pistiros was the organisation of metal ore extraction and the production and distribution of the manufactured goods (Домарадски 1995, 61; Катинчарова 2005, 188-193).

The hopper-rubbers from the sanctuary at Babyashka Chuka have been discovered in one deposit with mining tools – an iron axe and an axe-mattock (Тонкова 2007, 58). Investigations in the mine galleries and shafts in the vicinity have revealed mining tools dated to the Middle Ages used in the extraction of gold and probably lead (Георгиев 1987, 99-100). The possibility that the metals were exploited in an earlier period should not be ruled out. Metallurgy was a traditional activity for the population in the Rhodope Mountains, and it has been suggested that the function of the sanctuary at Babyashka Chuka might have been related to the extraction of gold (Тонкова 2007, 59; Tonkova 2008, 270).

Traces of ancient mine working have been documented also on the slopes of Ada Tepe (Попов, Илиев 2006, 154-156; Йокенхьовел, Попов 2010, 133-135), where there is gold extraction today. Among the materials discovered are saddle querns used for ore processing. On the basis of the pottery assemblage, the exploitation of the gold mine at Ada Tepe has been dated from the LBA till the second half of the EIA (eight – seventh century BC). At the same time, the hopper-rubbers (C.23; 24; 39) discovered at the sanctuary on the top of the hill, with strata from the LBA to the end of the first millennium BC, were most probably laid as a gift and might be connected with the ancient miners.

Other sites with evidence for ancient mine working have also produced Olynthus mills: such are found at the mines on the acropolis of Thasos (Muller 1979, 335, fig. 23), in Egypt (Lethbridge 1946, 222, figs. 5-6), and Lavrion (Conophagos 1980). Upper-stones with a butterfly-shaped hopper come from both Ada Tepe and Thasos. Both sites, however, have produced mills of other types. Thus, although we may assume that some differences between mills for grinding grain and those for crushing ores may have existed, such as the hardness of the raw material and the dimensions of the hopper, no specific type can be distinguished at present.

The majority of the evidence for the exploitation of metal ore deposits in Thrace before the Roman period is indirect. This includes dense settlement and road networks in a given

area that is rich in metal and a concentration of archaeological monuments in general. More detailed information and direct evidence for actual ore extraction can be obtained only after the combination of archaeological excavations and geological studies. The necessity of processing the ore after its extraction, which involves the use of grinding stones, puts them into the group of artefacts that can be seen as direct evidence for the exploitation of metal ores at a given site.

V.2.4. SURFACE FINDS

The list of hopper-rubbers from Thrace grows significantly when the surface finds from the region are included. Although we lack detailed information about their discovery context, mapping these examples broadens the territory of distribution of the Olynthus mill. Fragments and completely preserved examples of upper stones have been recorded in the regions of Trigrad (Appendix C.13) (Делчев и др. 2005), Madzharovo (C.27), Orlova Chuka (Haskovo region) (C.36), Haskovo (C.10), Cheshnegirovo (C.9; 25), Yablanitsa (C.3; 21), Debnevo (C.16), Nova Zagora (C.38), and Akandzhievo (C.8). Two fragments have been discovered during field survey in the Poleto locality near the village of Brestnitsa, Lovech region, where a site from the EIA, the Roman period and Late Antiquity has been recorded (Чукалев и др. 2016, 821).

A completely preserved device including both upper and lower stones of a hopper-rubber is exhibited in the collection of the Historical Museum at Shumen, north-eastern Bulgaria. The find comes from Pet Mogili village (Атанасов 1982, 45), but there is no further information about the context of its discovery. The upper stone resembles the standard type of Olynthus mill and stands out for its good quality of manufacture (Appendix C.1). On the lateral short sides there are horizontal grooves running through the whole length of the sides. The grinding platform (C.2) has a rectangular shape and slightly trapezoidal cross and longitudinal sections. It is only a few centimetres larger than the upper stone. The Pet Mogili village is situated in the north-eastern part of Shumen district. A few sites have been registered in the region after a field survey conducted in the late 1970s (Антонова, Атанасов 1979, 28-31). These include a fortified settlement with traces of buildings beyond the enclosed area, probable remains of a Roman villa, and four mound necropolises. G. Atanasov (Атанасов 1982, 41-48) has published lower grinding stones discovered in the region of Shumen. On the basis of the striation pattern visible on two of the examples, he assumes that these represented lower stones of hopper-rubbers (Атанасов 1982, 45, табло II, обр. 2, 5). The examples described by the author as lower stones of non hopper-rubbers, however, also have striations (Атанасов 1982, 43-44, табло I, обр. 1-6). This is not surprising as the practice of forming deliberate incisions on the working surfaces is attested already on saddle querns. The latter is evident from examples discovered at Olynthus (Robinson, Graham 1938, pl. 79.1-4) as well as from an upper stone with ellipsoidal shape from Smyadovo, Shumen region (Атанасов 1982, табло II.1). Therefore, it is difficult to distinguish the type to which a lower grinding stone belonged only on the basis of the presence or absence of striations. The better preserved examples of lower stones from the region of Shumen are rectangular in shape and resemble the grinding platforms of the Olynthus mill (Appendix C.50-52). Rectangular lower stones, however, could have been used with grinders of various shapes (Runnels 1981, 118). Operating with a hand grinder in a random or back-and-forth motion will result in producing a concavity on the working surface of the lower stone, as the level of exerted pressure and friction is highest in the middle and lowest at the periphery of the grinding platform. No such apparent concavity will be formed when using a hopper-rubber operated by a handle. The lower stones from Shumen region show flat rather than concave grinding surfaces, and we may assume that they were part of hopper-rubbers. This is further supported by the dimensions of the two completely preserved examples: l./w. – 40/26 cm and 37/28 cm, which are similar to those of the Olynthus mills.

The majority of the surface finds present well preserved or even complete upper stones. This allows us to determine their type.

V.2.5. TYPOLOGY

In his article on the origin and distribution of Olynthus mills, Frankel suggests a typology of the upper stones operated by a handle using three main criteria: the shape of the stone and the hopper – type I; the way the handle was attached to the stone – type II; and the striation patterns – type III (Frankel 2003, 1-19). According to this classification, however, the same upper stone can be determined as type I1 and type II1 at the same time. Here, we suggest another typology that uses the criteria for defining type I and II proposed by Frankel, but type II is set as a lower level – subtype. Variants are further distinguished. The suggested typology considers only the handle-operated upper stones, since the lower stones do not posses distinguishable features, and the quantity of the recorded examples is not big enough. Visible striations on the working surfaces of the hopper-rubbers from Thrace are confined to only three of the upper stones (C.3; 9; 21). On the working surfaces of the two upper stones from Yablanitsa (C.3; 21) and on one of the examples from Cheshnegirovo (C.9) there are visible striations. The first two present single grooves on the same axis as the slit, situated on both sides. The specimen from Cheshnegirovo shows incisions forming a herringbone pattern clearly visible around the slit. The lines on the example from Seuthopolis (C.7) cannot be determined with certainty as deliberate incisions, but rather they resemble traces from the movement of the mill. Arch-shaped lines, result of the movement of the upper stone, are visible on the lower stones from Pistiros (C. 46, 47). On their working surfaces there are also parallel striations perpendicular to the long sides. In the present state of research, the small number of recorded stirations on hopper-rubbers from Thrace cannot be used as a typological criterion.

The major criterion for determining the type is the shape of the upper stone and the hopper. The present examples are divided into four types marked with Roman numbers. It should be noted, however, that the difference in the shape did not alter the working principle of the mill. The variety of methods by which the handle was attached to the upper stone determines the subtypes of the hopper-rubbers. Three subtypes have been distinguished marked with small Latin letters. The presence or absence of any additional devices for attaching the handle to the stone determines the lowest level in the typology – variant. Three variants are defined marked with Arabic numbers (fig. 43).

Type – Determined by the shape of the stone and the hopper

Type I – Characterised by a rectangular or square shape of the stone and the hopper with sides sloping gradually inwards. V-shaped cross section

Type II – Characterised by a rectangular or square shape of the stone and the hopper; the sides are sloping steeply inwards

Type III – Characterised by a rectangular or square shape of the stone and a hopper with the shape of a butterfly. In this case the rims of two of the sides are triangular in shape with edges pointing inwards towards one another

Type IV – Characterised by an irregular shape of the stone and the hopper

Subtype – Determined according to the methods of attaching the handle

Subtype a – With slots on the rim on two of the sides

Subtype b – The upper stone has no slots or any other device for attaching the handle

Subtype c – A slot on only one of the sides

Variant – Determined according to the presence or absence of additional devices for attaching the handle to the upper stone

Variant 1 – A horizontal groove on one or two of the lateral short sides

Variant 2 – A hole on one or two of the lateral short sides

Variant 3 – With no additional devices

According to the suggested typology, the hopper-rubbers from Thrace are determined as follows:

Type	Site	Cat. N
Ia1	Pet Mogili	1
Ia1	Yablanitsa	3
Ia1	Pistiros	4
I(a?)1	Shumane-Mane	5, 6
Ia2	Seuthopolis	7
Ia2	Akandzhievo	8
Ia2	Cheshnegirovo	9
Ia2	Haskovo	10
Ia2	Mikroyazovira	11
I(a?)2	Pistiros	12
Ia3	Trigrad	13
Ia3	Seuthopolis	14
Ia3	Pistiros	15
Ia3	Debnevo	16
Ia3	Babyashka Chuka	17, 18, 19
Ia	Dragoyna	20
Ib1	Yablanitsa	21
Ib3	Sboryanovo	22
Ib3	Ada Tepe	23, 24
Ib3	Cheshnegirovo	25
I	Seuthopolis	26
I	Madzharovo	27
I	Kaleto	28
I	Shumane-Mane 1	29
I	Pistiros	30
I	Pistiros	31
I	Pistiros	32
I ?	Pistiros	33
II	Svilengrad	34, 35
II	Orlova Chuka	36
IIb	Svilengrad	37
IIb3	Nova Zagora	38
IIIa3	Ada Tepe	39
IVc3	Seuthopolis	40
IVa3	Shipka	41

The level of preservation of the specimens from Dragoyna (C.20), Seuthopolis (C.26), Madzharovo (C.27), Kaleto peak (C.28), Shumane-Mane (C.29) and Pistiros (C.30-33) allows us to define them only as Type Ia for Dragoyna and Type I for the remaining mills. On one of the lateral sides of the stones from Madzharovo (C.27) and Kaleto peak (C.28) there is a horizontal groove. Its function as an additional device for securing the handle leads to the conclusion that most probably there were slots on the rim. However, a complete example from Yablanitsa (C.21) has grooves on the exterior short sides but no slots on the rim. It is determined as type Ib1. The state of preservation of the remaining examples does not allow us to determine their type.

On the basis of the upper stones presented, we can conclude that the most common type of hopper-rubber distributed in Thrace is the standard one (type I), characterised by rectangular or square shape of the stone and the hopper (total number of 32), followed by type II (five examples), and one and two specimens of types III and IV respectively (figs. 44; 48). The quantitative distribution of subtypes and variants is shown on fig. 45. It becomes clear that the majority of the upper stones represent type Ia3 – with rectangular or square shape of the stone and the hopper, slots on the rim, and no additional devices for attaching the handle. It should be pointed out, however, that the overall number of hopper-rubbers is not big. The chart on fig. 45 shows also that not all of the subtypes are represented. Hopper-rubbers with steeply sloping sides (type II) always have no slots on the rim, as opposed to type III. Hopper-rubbers with an irregular shape of the stone and the hopper (type IV) show both a stone with slots on both sides of the rim (IVa3) and a more unusual example – with only one slot (IVc3).

According to the discovery context, the upper stones of hopper-rubbers from Thrace are almost equally distributed between settlements, ritual sites, and surface finds (20:14:15) (fig. 46) with the four examples from Shumane-Mane not included here as it is unknown whether they come from the recorded settlement or sancturay. The grinding stones were utilitarian objects used in everyday life. Their deposition as offerings at cult sites is most probably a later phase in their use, after their initial domestic one. They were not primarily and solely manufactured as votive objects; instead, they acquired some symbolic value, as a consequence of their function and in the process of their use. The small difference in the quantity of recorded hopper-rubbers at settlement and ritual sites shows that they were equally important for both domestic and cult purposes. The example from the necropolis at Shipka is so far unique in coming from a burial context. The uncertainties about its discovery as well as the possibility that it was part of the post-burial rituals have already been mentioned.

We also tried to determine whether there was a correlation between the type of hopper-rubber and the context of its discovery (fig. 47). Leaving aside the surface finds and the burial context which is under question, it becomes obvious that hopper-rubbers with steeply sloping sides (type II) are missing from settlements. Their distribution is confined to ritual sites and, particularly, the pit complex at Svilengrad (plus two surface finds), which may imply local preferences of shape. However, ritual sites have produced upper stones of other types as well (Babyashka Chuka – type I; Ada Tepe – types I and III). Therefore, a correlation between the ritual character of a given site and the presence of an upper stone of type II cannot be proven at the moment. Hopper-rubbers of type III are discovered equally at both settlement and cult sites but are present with only one example at each of the two sites. Hopper-rubbers with irregular shape are also not widely distributed in Thrace, especially when compared to other regions such as the Italian Alps, Austria, Slovakia, Germany, the Czech Republic, Crimea and Ukraine (Peacock 2013, 50-53). Upper stones with an oval or round hopper, discovered at Olynthus (Robinson, Graham 1938, 333-334, pl. 80.5,6), are not found in Thrace. It has been pointed out that these are contemporary with the standard type of hopper-rubber. Runnels has reported three examples from Corinth, Athens, and Isthmia with oval hoppers (1981, 296). Hopper-rubbers lacking or almost lacking a hopper have been discovered in the Czech Republic and the Prikubanya region, north-east of the Black Sea (Frankel 2003, 11).

The methods of attaching the handle to the stone show a great variety. These include stones with notches in the corners and no rim, presented by examples from northern Africa and the El Sec wreck; stones with a vertical hole for the pivot distributed in Anatolia and Syria; stones with two adjacent projections between which the pivot was fixed, found in Anatolia, southern Ukraine, the Crimea, and Thasos; and finally, stones with projections at two opposite sides, represented by examples in the Italian Alps (Frankel 2003, 12-13). None of these has been discovered in Thrace.

The upper stones from Thrace with no slots for the handle or any of the above mentioned methods for attaching it to the stone raise the question about the way the mill operated. It may be

suggested that the upper stones with no slots are simply unfinished. Runnels has pointed out that the slots might have been cut at a later stage to fit specific handles (1981, 122). If we assume that the hopper-rubbers with no slots were deliberately manufactured like that, the question remains how the handle was attached to the stone, since there are also no alternative devices for securing it.

The earliest hopper-rubber from Greece comes from the Athenian Agora and also lacks handle slots (Runnels 1981, 122). This has led to the suggestion that the slots might have been a later addition in the development of the Olynthus mill (Robinson, Graham 1938). Frankel points out that the hopper-rubbers from southern France dated to the middle of the fourth century BC are all without slots. This might be explained by their early spread from the Eastern Mediterranean: at a stage when the slotless upper stones must have been the norm (Frankel 2003, 18).

In the territory of Thrace, the examples with no slots coming from secure contexts are represented by the upper stones from Sboryanovo (C.22), Ada Tepe (C.23; 24), and Svilengrad (C.37). At the same period, however, there are specimens with slots. The mills discovered in the El Sec wreck, Majorca, also include upper stones with and without slots (Arribas 1987, 563-588). Even if the hopper-rubber without slots was a predecessor of the standard one, the first continued to be used after the emergence of the latter. The examples from Olynthus, destroyed in 348 BC, are furnished with slots which may serve as a *terminus ante quem* for the appearance of slots on the rim.

Another variant of the Olynthus mill is represented by an upper stone that is operated directly by hand. Two projections at opposite ends of the stone served as hand grips. Such examples have been discovered at Delos (Deonna 1938, 126, No B5626, pl. 368), Priene (Wiegand, Schrader 1904, abb. 523), and Thera (Frankel 2003, 8). No such hopper-rubbers have been recorded in Thrace so far. It has been suggested that the mills with hand grips might have been a prototype of the standard handle-operated rubber since their shape closely resembles the shape of the saddle querns or that this type of mill served as a smaller, portable variant of the standard Olynthus mill (Frankel 2003, 8). Both suggestions are plausible, and we need more securely dated examples in order to better understand the position of the mill with hand grips in the evolution of the hopper-rubber.

Determining the exact time when the hopper-rubber penetrated into the Thracian lands is hindered by a number of factors. In the first place is the overlapping of types of grinding stones already discussed. The technologically advanced Olynthus mill did not replace the saddle quern at once. The latter continued to be used well into Classical and Early Hellenistic times, as evident from the discovery of saddle querns at Olynthus destroyed in 384 BC together with hopper-rubbers (Cahill 2002, 163-166). Both saddle querns and hopper mills were found in houses at Halieis that had been abandoned between 300 and 280 BC (Runnels 1981, 117-127) as well as at the ritual complexes and urban centres in the Thracian interior. Another problem is the small number of securely dated hopper-rubbers from Thrace. The earliest example from Greece is dated to the last quarter of the fifth century BC (Runnels 1981, 122), and this may be accepted as a *terminus post quem* for the examples from Thrace. The novelty spread quickly reaching Sicily (White 1963, 205) and southern France (Frankel 2003, 7) already in the middle fourth century BC. The hopper-rubbers discovered in the north and north-west region of the Black Sea are dated to the late fourth century BC (Arnăut 2003-2005, 239).

The finds from Sboryanovo, founded around 325 BC and destroyed by an earthquake in the middle of the third century BC (Stoyanov 2002, 207-221) as well as at Seuthopolis, founded at the end of the fourth century BC, show that already in the Early Hellenistic Age the knowledge and use of the Olynthus mill had reached the Thracian lands. The latest pits from the ritual complex at Svilengrad contain materials from the end of the fourth or the first half of the third century BC (Нехризов 2007, 176-180). Finally, two of the hopper-rubbers from Pistiros (C.31, 32) comes from contexts dated between the first quarter of the fourth and the beginning of the third century BC (Лазов 2010, 204). The specimens from the sanctuary at Babyashka Chuka are dated to the second – first century BC and show the continuous use of the hopper-rubber.

V.3. PROVENANCE AND TRADE OF OLYNTHUS MILLS

Literary references on the provenance of raw materials for the manufacture of grinding stones are found in the texts of Xenophon (*Anabasis* I.5.5), Pliny (*Natural History* 36.29.135; 36.30.136), Antipater of Thessalonica (*Greek Anthology* 9.418), and Strabo (*Geography* 10.5.16; 6.2.3). Both Strabo and Antipater mention the island of Nisyros as location of millstones provenance, which has also been scientifically proven as a source for a number of querns including hopper-rubbers.

The identification of the geological source of the raw material used for grinding stones enables us to determine manufacture centres or workshops (if there were any) and to define possible trade routes. Much work in this direction has been done in the last two decades of the twentieth century by Olwen Williams-Thorpe and Richard S. Thorpe. Their studies on the provenance of different types of grinding stones: saddle querns, Olynthus mills, rotary querns and donkey mills distributed in different parts of the Mediterranean (Williams-Thorpe 1988, 253-305; Williams-Thorpe, Thorpe 1989, 89-117; 1990, 115-137; 1993, 263-320) and Roman Britain (Williams-Thorpe, Thorpe 1988, 275-289) has contributed to the better understanding of the existing trade routes. Archaeological samples have been analysed for major and trace elements using X-ray fluorescence and after that compared to geological samples which has allowed the identification of the source.

The island of Nisyros has been identified as one of the major sources of raw material for the production of Olynthus mills during the second half of the first millennium BC (Williams-Thorpe, Thorpe 1993, 293). Samples from three sites in Greece have proved to be of Nisyros lava. At least one of these samples is an Olynthian style hopper-rubber (from Nekramenton), and Williams-Thorpe has noted that it is possible that the other Greek samples may also be of this type. Nisyros also exported millstones to Egypt and to several sites in southern Cyprus (Williams-Thorpe, Thorpe 1993, 291). In Greece, Kimolos lava was used for a hopper-rubber at Athens, while Santorini lava hopper-rubbers were exported to Western Anatolia (Ephesus and Bodrum) (Williams-Thorpe, Thorpe 1993, 291). West Anatolian lavas were used at Ephesus. Cyprus imported an Aegina handstone as well as Nisyros products (Williams-Thorpe, Thorpe 1993, 291). The provenance analyses on hopper-rubbers discovered at the Halasarna site on the island of Kos demonstrate again Nisyros origin but the use of Koan raw material for their manufacture has also been identified (Katerinopoulos et al. 2016, 161-196).

Nisyros is also the source used for the manufacture of the 29 hopper-rubbers found in the Kyrenia shipwreck off the north coast of Cyprus (Williams-Thorpe 1988, 301). The cargo included also 11 different types of amphora (Green et al. 1967, 47-56; Katzev 1972, 50-52). Coins show that the ship wrecked about 310–300 BC, possibly attacked by pirates who left eight iron spearheads embedded in the outer hull (Gibbins 2001, 288). The millstones were found lying beneath the lowest level of amphorae. They vary in size and finish and do not match into usable pairs. Therefore, it has been suggested that they had served as ballast (Katzev 1972, 51). A similar wreck has been partly excavated in 1978–80 at Serçe-Limani in south-western Turkey (Pulak, Townsend 1987, 31-49). The wreck has been dated to *c.* 300–270 BC (Gibbins 2001, 288). Three millstones (one lower and two upper stones) were found, two of which formed a complete hopper-rubber mill. It is difficult to say whether the millstones were intended for personal use by the sailors or were part of the cargo.

Provenancing of igneous rock millstones by geochemistry has been used to reconstruct the route of a fourth century BC Greek merchant vessel wrecked on the island of Sec in Palma Bay, Majorca, Spain (Williams-Thorpe, Thorpe 1990, 115-137). The cargo consisted of amphorae, bronze vessels, and millstones. The millstones include two early rotary (Pompeian style) mills together with 42 flat hopper-rubbers and show typological affinities with contemporaneous millstones from Sicily and Tunisia (Arribas 1987, 563-588). Stylistically, the hopper-rubbers are divided in two types. The first type (only two upper stones) presents well-made and smoothly

finished querns with a raised ending on the upper surface of the upper stone and, on one of the examples, striations on the bottom of the stone. The second type includes less-well made querns with no raised edges, grooves, and slots for handles. While the first type of hopper mill from Sec is stylistically close to the mills of Greece and the Aegean, the second type is similar to the less-well-made querns characteristic for the periphery of the Graeco-Roman world. The date of the Sec wreck, 375–350 BC, fits in well with the dates of the Olynthus mills. The most interesting thing in this case is, however, their geographical position, since no other hopper-rubbers have been reported west of Sicily and Tunisia. The analysis of the millstones from the Sec wreck has shown that from the 42 hopper-rubbers at least 27 are of Pantellerian lava, one is of Nisyros lava, and one rotary mill is of Mulargia (Sardinian) rock (Williams-Thorpe, Thorpe 1990, 131). In addition, 10 further hopper-rubber samples (thin-sectioned only) are likely to be Pantellerian. The analysed Pantellerian hopper-rubbers present the less-well-made type of mills. Their discovery together with the better-finished type of mills at the Sec wreck testifies again that the difference between the cruder mills with no slots for attaching a handle and the better manufactured ones with slots is not always chronological but may be related equally to geological source and the knowledge and skill of the millstone makers (Williams-Thorpe, Thorpe 1990, 131). Most certainly other sources existed besides Nisyros (and Etna mentioned by Strabo) as evident form the identification of imported mills at sites in Egypt, Italy, and Crimea (Peacock 2013, 48).

Samples for petrological analysis have been taken from six querns discovered at the pit complex at Svilengrad (Нехризов 2006, 397-501). One of the samples is from Olynthus mill. The source of the raw material has been identified north and north-west of the region of the archaeological site, at a distance of not more than 20 km. The materials could have been taken from the coasts of the nearby Maritsa River and its tributaries. The types of rocks used for the manufacture of grinding stones (rhyodacite tuff for the hopper-rubber and granite, rhyodacite, and sedimentary rocks (sandstones) for the remaining samples) were carefully chosen – they posses better physicomechanical properties such as hardness and good resistance to abrasion. Some of the upper stones discovered during the excavations at Seuthopolis (C.7; 14) as well as the specimens from Pet Mogili (C.1), Ada Tepe (C.39) and Pistiros (C.15) stand out with their good quality of manufacture which may suggest import. The possibility that there was trade of hopper-rubbers from the Aegean to the Thracian hinterland should not be ruled out, as the main rivers passing through this territory were navigable at that time (Bouzek 1996, 221-222) and served as main communication routes. Another route is through the Hellespont, the Bosporus, and alongside the west Black Sea coast. Even if the rock was with local origin, the hopper-rubbers mentioned above must have been manufactured by an experienced craftsman who had the necessary knowledge and skills to produce high quality querns, similar to those discovered in Greece and the Aegean. A petrological analysis is, however, required to confirm the origin of the raw material used for the specimens from Thrace.

V.4. CONCLUSION

The necessity of processing grain prior consumption determines the ubiquitous distribution of grinding devices required in this everyday task. The desire to reduce the effort and increase the quality of the produce resulted in the continuous, though comparatively slow, development of grinding technology and the appearance of more advanced grinding devices. The emergence of the hopper-rubber in the Classical period marks one such innovation, although it did not replace the prehistoric saddle quern at once, which continued to be used most probably as a cheaper variant. While the Olynthus mill originated in the Eastern Mediterranean from where it spread westwards, the rotary mill was characteristic for the Western Mediterranean and reached the East with the Roman conquest.

The discovery of Olynthus mills in Thrace already at the beginning of the fourth century BC demonstrates the quick penetration and adoption of this advanced grinding technology. This is in accordance with other aspects of life in the region as Thrace was now part of the Hellenistic world, open to the movement of ideas, people, and goods. Olynthus mills have been recorded at settlement sites among which the major Early Hellenistic centres in the Thracian hinterland such as Seuthopolis, Sboryanovo, and emporion of Pistiros. Besides their utilitarian function for grain processing, the Olynthus mills played an important role in the rituals practised, as evident from their discovery at both pit complexes and peak sanctuaries. Their use in connection to metallurgical activities and, particularly, ore crushing, attested in the Aegean, is confirmed also by the examples from Thrace. No difference in the shape and material of the grinding stone used for cereal crop and ore processing can be distinguished at the moment. While outside Thrace there is a great variety of shapes and additional devices for securing the handle, the hopper-rubbers recorded in the region demonstrate the existence of only four major types. This, of course, may be due to the current state of research – future discoveries may reveal new shapes – or may reflect actual local preferences and manufacture skills. The typology suggested for the upper stones of Olynthus mills discovered in Thrace demonstrates that the most common type distributed in the region is the standard one (type I), and the majority represent type Ia3 – with rectangular or square shape of the stone and the hopper, slots on the rim, and no additional devices for attaching the handle. According to the discovery context, the Olynthus mills from Thrace are almost equally distributed between settlements and ritual sites. Some correlation between type of Olynthus mill and the context of discovery may be assumed, but more examples with secure context are required in order to prove this. The suggested typology of upper stones of Olynthus mills does not demonstrate a chronological development of shapes nor a conclusive spatial distribution but is, nevertheless, a good starting point in the investigation of these commonly neglected artefacts.

While the island of Nisyros has been identified as one of the main sources of raw material for the production of Olynthus mills during the second half of the first millennium BC, it is suggested that most of the examples from Thrace were locally produced, based on the quality of manufacture, and confirmed by petrological analyses for the specimens from Svilengrad. At the same time, possible import of the ready-made mills or the work of an experienced craftsman should not be ruled out. By initiating the research on Olynthus mills from Thrace, we hope that more data will become available in the future, which should also be combined with residue and provenance analyses.

CHAPTER VI

CONCLUSIONS

The preceding presentation has explored the available archaeological, documentary, iconographic, archaeobotanical, and ethnographic evidence in an attempt to reconstruct the operation sequences of the production, processing, and storage of cereal crops. This chapter summarises the main questions addressed in the study and further evaluates the importance of cereal crop production. The possible perspectives for future work are presented at the end of the chapter.

VI.1. SUMMARY

The second half of the first millennium BC marks a new stage in the history of Thrace with major changes in political, social, and economic organisation. This period saw the rise of tribal states, the appearance of urban centres in the Thracian hinterland, the intensification of contacts expressed in the imported pottery, amphorae and metal ware, and the adoption of foreign techniques. The production of cereal crops formed a significant share in the ancient economy – both securing daily requirements of food and as a trade commodity. The study of agriculture in Thrace, however, has remained to a large extent peripheral in the academic literature. This is most probably due to the unappealing character of agricultural tools and the conservatism of shapes which in turn hinders the construction of a typology and reliable chronology. The role of agriculture during the prehistoric and Roman periods has been explored in greater detail. The most comprehensive study on Thracian agriculture authored by I. Venedikov (Венедиков 1981) presents the available literary evidence, but the archaeological record available at that time is confined largely to Roman and later periods. The agricultural implements from LIA Thrace have been a subject of a recent study (Андонова 2013, 349-366). This has added to the current research by providing information about some of the unpublished finds. However, a detailed analysis of the entire process of cereal crop production, commencing with land cultivation, storage and grinding, and its implications has not been realised till now.

The natural vegetation has been influenced by human activity for thousands of years. The accumulated data on pollen analysis, palaeoethnobotany, and archaeology assists in reconstruction of the agricultural activity. The investigations have shown that due to the variety of climate, soils and relief, agriculture played different role in the subsistence during different periods. Thrace as a geographical entity is characterised with great topographic variety including fertile plains, high and low mountains, and littoral zones, each possessing different agricultural potential. Four regions stand out as most favourable for the cultivation of cereal crops – the Danubian Plain and, particularly, its eastern part, the Upper Thracian Plain, the Burgas lowlands, and the plains south of the Rhodope Mountains. The conducted palynological analyses have demonstrated that woodland clearance for arable and pasture land increased during the second half of the first millennium BC. The Iron Age is marked by a considerable increase in the amount of Cerealia pollen in diagrams from the mountainous and lowland areas, particularly due to the use of iron tools with a subsequent increase in crop production. The attested increase in human impact on vegetation during the LIA is in accordance with the bigger changes characterising the period such as urbanisation, growth of population and exploitation of natural resources on a larger scale. Archaeobotanical studies from the prehistoric periods show the presence of almost all the crop plants typical for the early agriculture with emmer and einkorn being predominant. A major change occurred during the LIA when bread/durum wheat became the most preferred crop probably due to its higher yields. Barley and millet continued to be important crops, while the smaller quantity of rye and oats suggests their secondary position. During the Iron Age, the production of spelt increased due to its tolerance of poor soils, while at the same time producing

high-quality flour. The predominance of cereal crops over legumes and fruits implies their major role in subsistence. That cereals were staple food is also supported by the analyses on bone materials from Sboryanovo and Gledachevo aimed at reconstructing the palaeodiet (Златева-Рангелова 2003).

The abundance of cereal crops in Thrace is mentioned by the ancient authors, who further discuss the variety of ways in which these were prepared and consumed. Thus, cereals were consumed as porridge and bread but were also used for the preparation of drinks. Food was and continues to be a factor determining cultural differences and social status. For the LIA in Thrace this is attested by the literary references, for instance, the epithet "millet-eating" used to portray the population around Salmydessus as well as the established difference in the diet of the individuals at Sboryanovo – vegetarian for the women, and a diet that includes also the consumption of meat for the men (Златева-Рангелова 2003).

Thrace during the second half of the first millennium BC had both favourable conditions and available technology for developed agriculture. Farming was significant at least in the plains of Thrace, most probably integrated with a pastoral strategy, which possibly had a predominant position in the mountainous regions. The agricultural technology is reflected by the employed tools and methods. The majority of implements come from the better-excavated and published urban centres in the Thracian hinterland. A second group of artefacts related to agriculture are presented by the finds from ritual sites (peak sanctuaries and pit complexes). In few cases agricultural implements are found in funerary context. There is also a number of chance finds, which broaden the distribution map of the examined implements.

The investigation of tools and structures connected to cereal crop production in LIA Thrace has revealed the high level of agricultural technology employed by the local population. This is expressed by the attested use of the plough, iron hoes and sickles. In addition, the quick adoption and broad distribution of the Olynthus mill is in accordance with other changes during the Early Hellenistic Age when Thrace was open to foreign influence and the movement of goods, ideas, and knowledge. The variety of storage methods, including subterranean pits, pithoi, and other containers demonstrates retained traditions and knowledge about the appropriate preservation method according to environmental conditions and the intended purpose of the produce.

The agricultural implements were valuable objects which is evident from the examples of mended pithoi and the continued use of Olynthus mills after they were worn out. Iron tools were of great importance in everyday subsistence, but the small number of preserved implements is probably due to the chemical structure of iron blades and thus the poor survival of this metal (Archibald 2013, 104). In addition, the production of agricultural implements required the acquisition of proper raw materials as well as skills and time for manufacture. The discovery of an iron ploughshare among the rich offerings in the tomb at Kaloyanovo, including weapons and golden objects, further demonstrates the value of the implement. It also indicates the high status of the proprietor who was a landowner. As with other classes of artefacts, cheaper options existed. Thus, the saddle quern continued to be used long after the appearance of the Olynthus mill, as it did not require special manufacturing techniques. Sacks, baskets, wooden chests, and other smaller clay containers were most probably used for storage. Wooden sickles with flint inserts, characteristic for earlier periods, continued to be used. The employment of the animal-driven plough required the ownership of specialised oxen and was thus, not affordable to every farmer, although other animals might have been used as well.

The pithoi recorded in Thrace were locally produced sharing common manufacture techniques and shapes. Several attempts for constructing a typology have been made, but these do not demonstrate development of shapes through time. The stamps with the letter Σ on pithoi from Seuthopolis, attested also on bricks, may represent the initial letter of the king's name Σεύθης and thus, the existence of state pottery workshops. At the same time, identical stamps occur on vessels with the same dimensions and profiles which implies the production of individual, private

workshops. The majority of the Olynthus mills were also most probably locally produced, judging by their rough appearance. However, some specimens are very well made and resemble examples from Greece. This suggests possible import of grinding stones to the Thracian hinterland or the work of a skillful craftsman.

The importance of agriculture is evident also from the rituals practised to ensure fertility. The tradition of depositing agricultural tools at ritual sites, attested already in the LBA, continues during the LIA. Iron implements, fragmentary pithoi as well as grinding stones are discovered at both peak sanctuaries and pit complexes. This puts them into a group of initially utilitarian objects that have acquired some symbolic meaning. At present, most scholars are convinced of the ritual character of the so-called pit fields based on the character of the pits' fill including votive objects, evidence of animal and human sacrifices as well as on their location outside settlements and their continuous use. The arguments in support of this are examined and it is suggested that while the ritual character of the pit complexes should not be ruled out, a storage function at the initial stage of the pits' lifetime or repeatedly later on is very plausible. Thus, a dual function of the pits is proposed with storage being their primary purpose, which required also the performance of specific rituals.

Grinding stones and pithoi were also used in connection to metallurgical activities. The pithoi discovered at Pistiros (belonging to the third phase) and Pamuk Tepe (Building A) were probably employed as water containers and associated with metallurgical operations. Metallurgy was a traditional activity for the population in the Rhodope Mountains, and it has been suggested that the hopper-rubbers discovered at the sanctuaries at Babyashka Chuka and Ada Tepe were related to ancient mine working and ore processing. The iron axe-mattock, deposited together with the Olynthus mills at Babyashka Chuka, has also been interpreted as connected to metallurgical activities. The discovery of numerous iron tools, among which three sickles, discovered in pits at the centre of Halka Bunar, together with the remaining data from the site's investigation, has been used in support of its function as a metallurgical centre. While it has been suggested that with the beginning of the Iron Age the production of basic iron tools became available to every community (Childe 1944), the evidence for metallurgical activities at centres with attested exchange practices raises the question whether there was a market in iron agricultural implements. Although the hypothesis is plausible, there is still not enough evidence to support it.

The necessity of processing grain prior consumption determines the ubiquitous distribution of grinding devices in settlements. Grinding was an everyday task, as flour deteriorates more easily than unprocessed grain and is thus more difficult to store. The analysis of the Olynthus mills recorded in Thrace has demonstrated that already in the Early Hellenistic period the knowledge of this advanced grinding technology has reached the Thracian lands. Four major types of hopper-rubbers have been distinguished based on the shape of the upper stone and the hopper. These are further divided into subtypes and variants according to the way of attaching the handle and the presence or absence of additional devices for securing it to the stone. The most common type of hopper-rubber distributed in Thrace is the standard one (type I), and particularly type Ia3 – with rectangular or square shape of the stone and the hopper, slots on the rim, and no additional devices for attaching the handle. At the moment, the recorded types of Olynthus mills cannot be distinguished in chronological terms, nor can any certain spatial distribution be proposed. More secure data about their provenance is necessary as to be able to make correlations between type and context of discovery.

The spatial distribution of Olynthus mills in inland Thrace demonstrates their presence at the major urban centres. Their quantity is, however, not comparable to the large number of specimens recorded at Olynthus, for example. The discovery of the Olynthus mills within houses implies that grinding was a domestic activity, realised in every household. There are no indications for areas for communal grinding. Storage in LIA Thrace was also realised on a household level, as evident from the discovery of pithoi and storage vessels within houses.

The concentration of pithoi found *in situ* in Building 1 at Pistiros together with the building's location and the character of the remaining finds has led to the suggestion that it was used for commerce during the second phase of the site's existence. The pithoi belonging to this stage were used for storage of foodstuffs and liquids. The spatial and quantitative distribution of pits and pithoi in Thrace demonstrates that the bulk of cereal food was kept in the countryside, and the population at the investigated urban centres must have relied on the market or stored more produce elsewhere. After the foundation of the Odrysian state, the position of the farmer changed considerably as he had to supply the ruling elite with agricultural produce. The literary refernces to crops for cash demonstrate the economic importance of cereals. However, the long suggested "royal economy" model has been challenged by the growing evidence for market exchange in the Thracian hinterland already in the fifth century BC. Thus, besides dependant producers, private craftsmen, traders, and farmers also existed and the economy was more market-oriented than previously thought. Various goods traveled to the coastal cities and vice versa and and one of the things that rulers could provide was the safe passage (Archibald 2013, 48). Grain was probably one of the main commodities in exchange of imported goods but is still difficult to recognise archaeologically.

After the Roman conquest, agriculture retained its leading economic position. The Roman colonisation brought new agricultural methods and a new system of land division and ownership.

VI.2. FUTURE RESEARCH

The investigation of ancient agricultural tools from the territory of Bulgaria has been largely confined to the creation of catalogues of the discovered implements combined with typological, contextual, and statistical analyses. A similar approach has been applied in the present study. It should be pointed out, however, that, although of great importance, it represents only the initial stage in a broader investigation of farming implements. One of the apparent perspectives for future research is the application of interdisciplinary studies on agricultural tools from the historical period. A use-wear approach to agricultural tools can identify evidence of manufacture, use, and maintenance of the implements. The surface damage produced on the working surface of the tool, combined with the experimental sequences, generates a series of use-wear traces (striations, fractures, polishes, etc.) that can be compared to archaeological surfaces. In addition, recovery of botanical remains from the working surfaces of tools provides direct evidence of specific use.

The grain grinding implements have been commonly regarded as non indicative in chronological terms and, therefore, largely neglected by the scholars. This has resulted in the lack of detailed description and information about their stratigraphical position. The examples of hopper-rubbers from Thrace represent the only attempt at exploring the distribution, chronology, function, and typology of this advanced grinding device for the region under study. One of the apparent tasks for future research is determining the geological source of the raw material. A chemical study of grinding stones, integrated with archaeological data, may indicate the origin of the raw material which in turn will allow the reconstruction of ancient trade routes, cultural links, manufacture centres, and economic choices. The functional study of grinding stones requires use-wear and microfossil (pollen, phytoliths, and starch grains) residue analyses. This will demonstrate the various food plants processed and may indicate the predominance of one species over another, which again has important implications for the ancient economy. While a direct association between grinding as a technology and cereal processing is often made in archaeological interpretation, grinding of other organic (wild plants and animal resources) and non organic (mineral) materials is evident from both the archaeological and ethnographic record. The use of grinding stones in connection with ore processing, attested in the Aegean, is confirmed also for the examples from Thrace. Again, residue analysis will shed more light on this aspect of their use. Experimental studies regarding the manufacture and working process of the Olynthus mill can provide information on various aspects such as choice of suitable raw material,

manufacture techniques and tools, time and labour input, time/quantity of processed grain ratio, and quality of the processed flour.

Storage vessels are also commonly regarded as non indicative in terms of chronology and only few attempts at typological classification have been published so far. Although grain was certainly among the commodities stored in pithoi, residue analysis is required to determine with certainty the nature of their content. In addition, the identification of subterranean pits as storage structures is very difficult and calls for constructing a methodological approach for distinguishing storage from other purposes.

The discovery of imports in the Thracian hinterland has been usually restricted to interpretations regarding the economic importance of the site they come from and the established trade contacts. The nature of the commodities exported from Thrace in exchange for, for instance, the great number of amphorae carrying wine and olive oil, is difficult to recognise. It may be assumed that grain was among the main exchange goods for both internal and external markets, but this hypothesis requires a comprehensive analysis of the trade patterns, which itself presents another vast topic.

The majority of available data for cereal crop production in Thrace comes from urban centres, ritual sites, and the large number of excavated pit complexes whose function is, however, open to further discussion. We still know very little about the countryside in ancient Thrace, in particular, settlements with non-urban characteristics – their structure and relation to other sites, density, and longevity of existence. In addition, the available archaeobotanical data come predominantly from pit complexes and, although there is a growing tendency of collecting samples from sites from the historical periods, the analyses are often restricted to identification of the plant species and their quantitative distribution. Finally, palaeoenvironmental studies in conjunction with archaeological investigations for the second half of the first millennium are still very limited.

The study of ancient farming is a vast topic which requires a comprehensive understanding of the political, economic, social, technological, and environmental context of the relevant period and region. The study has focused on the theoretical and technological aspects regarding the production, storage, and processing of cereal crops and setting these within the broader socioeconomic landscape of ancient Thrace. There is ample space for future research, but further discussions should await the collection and analysis of additional data.

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РЕЗЮМЕ

Социални и икономически аспекти на производството на зърнени култури във вътрешна Тракия през късножелязната епоха

ГЛАВА I. ВЪВЕДЕНИЕ

В античната писмена традиция древна Тракия е описвана като плодородна земя, притежаваща добри условия за земеделие и богата на дървен материал, метали и зърно. Въпреки че античните автори не представят траките като земеделци, разполагаме с писмени и археологически данни, за да предположим, че земеделието е заемало основна роля в прехраната на населението и икономиката на древна Тракия. За разлика от големия брой изследвания за класическа и елинистическа Гърция, разглеждащи въпроси, свързани със земеделските практики и инструменти, собственост и контрол на земята, и търговията със зърно, то територията на Тракия е останала до голяма степен периферна за подобни дискусии.

Основна цел на настоящето изследване е да проследи процеса на производство, съхранение и обработка на зърнени култури във вътрешна Тракия през втората половина на I хил. пр. Хр. и да дискутира връзката между използваните земеделски практики и икономическата и социална организазия. Задълбоченото изследване на производството на зърнени култури може да разкрие стратегиите за препитание, нивото на технологични умения, вътрешни и междурегионални комуникации.

I.1. ТЕРИТОРИАЛЕН И ХРОНОЛОГИЧЕН ОБХВАТ

Границите на древна Тракия са били променливи, като най-често се приема, че областта е обхващала територията между Егейско море на юг, река Дунав на север, Черно и Мраморно море на изток. Западната граница е била маркирана от долините на реките Вардар и Струма на югозапад и река Морава на северозапад. По време на управлението на Лизимах западната граница се премества на изток до река Места. Фокусът на изследването попада върху хинтерланда на Тракия в рамките на границите на днешна България (fig. 1). Това е обусловено от основната цел – да се проследи организацията на производство на зърнени култури при местните тракийски общества, както и поради състоянието на проучванията и достъпната информация.

В хронологичен аспект късножелязната епоха (КЖЕ) обхваща периода между средата на VI до късния I в. пр. Хр. или първите десетилетия на I в. сл. Хр., когато Тракия е анексирана от Римската империя. Късножелязната епоха обикновено е разделяна на класически и елинистически период, като последният термин се използва, за да обозначи историческия период след военните кампании на Филип II и Александър III, чиято продължителност е била различна в отделните райони.

I.2. КЪСНОЖЕЛЯЗНАТА ЕПОХА В ТРАКИЯ

Късножелязната епоха в Тракия се характеризира с появата на първите племенни обединения, между които това на трибалите на северозапад, на гетите на североизток и на одрисите в Югоизточна Тракия. Археологическите изследвания показват нарастване на броя на селищата в сравнение с ранножелязната епоха, както и съществуването на значителни центрове с градски характеристики още от втората половина на VI в. пр. Хр. Част от земеделските сечива, дискутирани в настоящата работа, произхождат именно от тези центрове. Сред характерните за периода обекти, където се откриват артефакти, свързани със земеделието, са също така светилищата на върхове и ямните комплекси (fig. 2).

Периодът до началото на III в. пр. Хр. в Тракия се характеризира с голям материален, културен и политически разцвет. Социалната стратификация на тракийското общество е ясно видима в появата и разпространението на монументални гробници за аристократичния елит, както и в селищната йерархия. Находките от градските центрове, проуче-

ни във вътрешността, показват активните връзки на местното население с обществата от Егейския свят и Източното Средиземноморие. Много малко са обаче данните за селища от неградски тип. Малкият брой обекти, които могат да бъдат идентифицирани като села, е в остър контраст с тези, определени като ямни комплекси. Възможно обяснение за това е краткият период на обитаване на тези селища, както и леките конструкции на сградите, които не са оставили видими следи в археологическия запис.

I.3. ПРОИЗВОДСТВО НА ЗЪРНЕНИ КУЛТУРИ

Зърнено-житните култури принадлежат към семейство Житни (*Gramineae*), култивирани предимно заради техните ядливи плодове (зърна), богати на скорбяла. Терминът "производство на зърнени култури" в широкия смисъл на думата е използван тук, за да отбележи целия процес на производство – от оран, сеитба, жътва, вършитба и веене до пресяване, изсушаване, счукване, съхранение и стриване на зърнените култури. Вариациите в последователността, както и в използваните инструменти и методи, зависят от климатични фактори, културни предпочитания, технологични умения и биологичните характеристики на вида зърнени култури. Процесът на производство на зърнени култури е разделен на три основни етапа: а) *Производство*, използван в тесния смисъл на думата, за да отбележи първоначалния етап на обработка на земята до съхранението на продукцията (глава III); б) *Съхранение* (глава IV) и в) *Обработка* (глава V) – термин, използван в случая като синоним на смилане.

I.4. ИСТОРИЯ НА ПРОУЧВАНИЯТА

Броят на изследванията, посветени на земеделието в разглеждания район, е неравномерно разпределен за различните периоди. Така, докато ролята на земеделието, използваните инструменти и прилаганите техники през праисторическите периоди са проучвани в по-голям детайл, това не се отнася за втората половина на I хил. пр. Хр. Публикациите върху земеделски сечива от района, датирани в по-късните римски и средновековен периоди, също са значително повече. Не липсват и етнографски изследвания, представящи традиционните земеделски техники и инструменти, използвани в днешните български земи.

От изключително значение за темата са археоботаничните и палинологични проучвания. Отново анализите на археоботанични останки от обекти от КЖЕ са значително по-малко в сравение с тези от по-ранни периоди. В последните десетилетия основен принос в тази насока има Ц. Попова. Тук трябва да се спомене и работата на И. Славова, която представя резултатите от археоботанични анализи от обекти от Югоизточна България от средата на V в. пр. Хр. до VI в. сл. Хр. и по този начин допринася за проучването на растителните останки от историческите периоди. Въпреки несъмнената значимост на наличните изследвания, резултатите са често ограничени до идентифициране на видовете и количествено представяне на растителните останки, като липсват по-задълбочени заключения за икономическото значение на регистрираните растения. Палинологични изследвания от различни райони в страната правят възможна реконструкцията на палеосредата и антропогенното влияние върху нея. В по-голямата си част тези проучвания представят по-детайлна информация за праисторическите периоди, като данните за КЖЕ са отново ограничени.

Началото на проучванията, посветени на земеделието през КЖЕ, е поставено от Г. Кацаров в началото на XX в., който събира и анализира писмените сведения, свързани с темата. Следва изследването озаглавено "*Развитие на земеделието по българските земи*", под редакцията на И. Венедиков, което проследява развитието на земеделието от праисторическите периоди до XVII в. За КЖЕ обаче липсват достатъчно археологически данни. Темата за храната и нейната консумация в древна Тракия е разгледана от Р. Георгиева в "*Етнология на траките*". Отделни публикации представят описание и типология на конкретни артефакти от дадени обекти – питоси и хромелни камъни. От особено значение е статията на А. Андонова върху метални сечива от територията на България, датирани

в VI – I в. пр. Хр., тъй като представя непубликувани материали от музейни колекции и обекти в процес на проучване.

Настоящето изследване представя единственият пълен синтез на данните, свързани със земеделските практики във вътрешна Тракия през КЖЕ. Чрез анализ на резултатите от различни дисциплини, проучването допринася за по-детайлно познаване на процеса на производство на зърнени култури в периода и свързаните с него социални и икономически аспекти.

ГЛАВА II. ВЪЗСТАНОВКА НА ЗЕМЕДЕЛСКИТЕ ПРАКТИКИ

Земеделските практики в древността могат да бъдат изучени на базата на четири категории свидетелства: стопанисваните растения и животни, средата, в която са отглеждани, палеодиетата и земеделските инструменти и структури. От друга страна, въпроси като достъп до и собственост на земеделска земя, както и позицията на земеделеца, могат да бъдат изследвани единствено след анализ на писмените сведения. Реконструкцията на земеделските практики може да бъде допълнена с етнографски и експериментални проучвания.

II.1. АРХЕОЛОГИЧЕСКИ ЗАПИС

Арехологическите данни, с които разполагаме, са представени от инструменти и структури, използвани в различните етапи от процеса на производство на зърнени култури. Земеделски инструменти са откривани в различен контекст. От първостепенно значение са примерите, открити в градските центрове във вътрешна Тракия, както и в култови места – светилища на върхове и ямни комплекси. Малка част от земеделските инструменти произхождат от погребален контекст. На последно място, голям брой от включените артефакти представляват случайни находки. Земеделските сечива, дискутирани в изследването, са разделени на три основни групи според първичната им функция:

1) ***Инструменти, свързани с обработка на земята и жътва.*** Голяма част от земеделските инструментите са били изработени от нетраен материал и не са достигнали до нас. Макар и малко като брой и често във фрагментирано състояние, откритите железни лемежи, мотики и сърпове показват високото технологично ниво на земеделските инструменти, използвани от местното население.

2) ***Съдове и структури за съхранение.*** През КЖЕ за съхранение на продукцията са използвани питоси, керамични съдове с по-малки размери и други контейнери, които не са оставили следи в археологическия запис, но чието съществуване може да се предположи на базата на етнографски паралели. Въпреки повсеместното разпространение на питосите, характерът на съхраняваната в тях продукция невинаги е сигурен. Питоси са употребявани също и в металургични дейности, а фрагменти от тях са сред задължителните елементи, откривани на култови обекти. Ямите представляват алтернативни съоръжения-хранилища, подходящи за съхранение на продукция за по-дълъг период от време.

3) ***Съоръжения за смилане.*** Появата на Олинтската мелница през класическата епоха и нейното широко разпространение във вътрешна Тракия демонстрира бързото проникване и усвояване на тази нова технология. В настоящето изследване са включени 44 горни и 8 долни камъка от Олинтски мелници (Приложение С), открити на територията на Тракия. Не всички споменати в изложението екземпляри са описани в каталога, поради липсата на достатъчно информация. Предложената типология на горни камъни от ръчни мелници цели да изследва пространственото и количествено разпространение на типове и подтипове и да установи дали съществува зависимост между контекста на депониране и типа хромел.

II.2. ЗЪРНЕНИ КУЛТУРИ И ПАЛЕОСРЕДА

Комбинацията от географски фактори – климат, релеф, водни ресурси, почви и растителна покривка са от изключително значение за определяне на поминъка в даден район. Това прави реконструкцията на палеосредата необходимо условие при изследването на

земеделските практики в древността. Разглежданата територия се характеризира с преходния характер и разнообразие на всички географски фактори, което определя икономическите специфики в отделните подрегиони, всеки притежаващ различен земеделски потенциал. Някои географски особености в Тракия са описани от античните автори, но в повечето случаи се споменават само изключителни климатични условия. К. Иречек, S. Casson и И. Венедиков описват природните характеристики на района и експлоатацията на природни ресурси на базата на писмени сведения и лични наблюдения.

Най-подходящи за отглеждането на зърнени култури са почви, богати на хумус, като чернозем и алувиално-ливадни почви. Четири района се открояват като най-благоприятни за това: Дунавската равнина и особено източната й част, Горнотракийската низина, Бургаската низина и равнините южно от Родопите. Зърнени култури са били и продължават да се отглеждат и в планинските райони, но тези територии са запазени за видове като ръж и овес, поради специфичните климатични и почвени условия.

Резултатите от проведените през последните 30 години палинологични изследвания в различни екологични зони в България показват развитието на растителната покривка и човешкото влияние върху нея. Установено е увеличение на антропогенната активност през прехода къснобронзова – желязна епоха, видимо в намалените стойности на дървесни видове. Периодът съвпада с активна миграция на тракийските племена в търсене на богати на метал райони в планините (Фол, Спиридонов 1983). Регистрирано е и значително повишение на количеството полен от зърнени растения, вероятно резултат от употребата на железни инструменти и увеличение на продукцията (Tonkov et al. 2007, 314). Докато палинологичните данни са използвани при реконструкцията на околната среда за някои праисторически обекти, по-детайлна възстановка на природната среда през КЖЕ във вътрешна Тракия е предложена само за Пистирос и региона около Сборяново.

II.3. ПИСМЕНИ И ИКОНОГРАФСКИ СВЕДЕНИЯ

Гръцките автори, които описват по-детайлно теми, свързани със земеделието, са Хезиод ("Дела и дни"), Ксенофонт ("Икономика") и Теофраст със своите ботанични изследвания. Конкретна информация за Тракия откриваме в "Анабазис" на Ксенофонт, който посещава южните райони на връщане от Персийската експедиция. Различни аспекти от земеделската работа и препоръки са описани и в по-късните произведения на редица римски автори (Приложение B.1). Писмените сведения показват изобилието на зърнени култури в Тракия и разнообразните начини за тяхното приготвяне и консумиране. Диетата е включвала също бобови храни, зеленчуци, месо и млечни продукти.

Иконографските данни (Приложение B.2) са представени от рисувана керамика, теракоти, надгробни плочи, амфорни печати и монети. Нумизматичният материал включва монети на някои от гръцките крайбрежни градове и някои от тракийските царе. Реконструкцията на земеделски сечива, които не са достигнали до нас, е възможна единствено след внимателно изследване на илюстративните сцени.

II.4. АРХЕОБОТАНИЧНИ ИЗСЛЕДВАНИЯ

Значението на археоботаничните анализи за разграничаване на различните степени на обработка на зърното, идентифициране на методи за съхранение и по този начин реконструкция на икономически модели, е отдавна посочено в литературата. Археоботаничните изследвания от праисторически обекти в България и Северна Гърция показват присъствието на почти всички зърнени растения, типични за ранното земеделие. Късножелязната епоха в Тракия е представена основно от проби, взети от големия брой проучени ямни комплекси, няколко селища (Приложение A) (fig. 3), светилища на върхове и некрополи. Ограниченото количество растителни останки, откривани в ямните полета, често е използвано като един от аргументите в подкрепа на ритуалния характер на тези комплекси. Малкият брой растителни останки обаче може да се дължи на степента на запазеност – те биха се запазили единствено в случай, че са овъглени.

Резултатите от проведените археоботанични изследвания показват разнообразието от зърнени култури, отглеждани в Тракия. Еднозърнестият и двузърнест лимец, характерни за праисторическите периоди, продължават да присъстват през цялото I хил. пр. Хр. Въпреки това, от средата на хилядолетието е установена значителна промяна – за разлика от по-ранните периоди, през КЖЕ се наблюдава превъзходство на твърдата пшеница над еднозърнестия и двузърнест лимец (Попова 1991, 52; 2006a, 509-510; Popova 2002a, 284). Други широко разпространени култури са ечемик и просо. Ръж и овес се срещат в ограничено количество. Различни бобови култури присъстват често в археоботаничните проби, но в по-малко количество в сравнение със зърнените.

II.5. ЕТНОГРАФСКИ И ЕКСПЕРИМЕНТАЛНИ ИЗСЛЕДВАНИЯ

Резултатите от етнографски и експериментални изследвания относно моделите на производство на зърнени култури, съхранение и обработка, предоставят допълнителни данни за изучаването и възстановката на земеделските практики в древността. Необходимостта от етнографски данни, върху които да се базират аналогии с миналото, е довела до възникването на етноархеологията – етнографското изследване на съвременни култури от археологическа гледна точка.

Производството на зърнени култури може да бъде осъществено само по няколко определени начина, имайки предвид наличната технология и биологичните характеристики на растителните видове. Така например, жътвата се извършва само в определени сезони от годината. Съществуват и установени етапи и последователност при обработката на зърнените култури, преди тяхното съхранение или консумация. Всеки етап се характеризира с наличието на специфични растителни останки. Етнографските наблюдения позволяват да бъдат направени аналогии между дадена археоботанична проба и подобни етнографски такива, което позволява идентифицирането на метода на обработка, приложен в миналото.

Експерименталните изследвания правят възможно идентифициране на предназначението и употребата на земеделските инструменти. В България липсват специални етноархеологични и експериментални изследвания за късножелязната епоха и във връзка със земеделието.

II.6. ЗАКЛЮЧЕНИЕ

Изучаването на земеделските практики и инструменти в древността изисква прилагането на традиционни и интердисциплинарни методи. Всеки от описаните подходи притежава своите предимства и недостатъци и единствено чрез комбинирането на всички данни можем да се опитаме да възстановим земеделските практики в миналото.

ГЛАВА III. ПРОИЗВОДСТВО НА ЗЪРНЕНИ КУЛТУРИ

Процесът на производство на зърнени култури може да бъде идентифициран на базата на анализ на археоботаничните данни и документираните земеделски инструменти. Изучаването на тези инструменти обаче е затруднено от малкия брой добре запазени екземпляри и от факта, че част от тях са били изработени от нетраен материал. Земеделските дейности и инструменти са представени според аграрния календар, започвайки с оран, сеитба, жътва, вършитба и веене. Във втората част на главата са дискутирани проблеми, свързани с организацията на производството на зъренни култури в Тракия и неговата роля в древната икономика.

III.1. ТЕХНИКИ И ИНСТРУМЕНТИ ЗА ОБРАБОТКА НА ЗЕМЯТА

III.1.1. ОРАН

През I хил. пр. Хр. при първоначалния етап на обработка на земята – оран – е използвана както човешка сила, така и рало с впрегатни животни. Появата на ралото е от голямо икономическо значение за развитие на земеделието, тъй като употребата на животинска

сила позволява увеличаване на култивираната площ за определено време и обработката на повече видове почви. Най-ранните свидетелства за употребата на рало произхождат от Месопотамия и датират от ок. 5000 пр. Хр. (Greenfield 2010, 39). Разпространението му в Европа е част от по-мащабни културни промени от началото на халколита. Античните автори не споменават земеделските инструменти и методи на култивиране в Тракия. Съществуват обаче, макар и малко, описания на земеделския труд и сечива, използвани в древна Гърция (Приложение В.1), както и иконографски свидетелства, представящи методи и инструменти за оран (Приложение В.2) (figs. 4-7).

Най-ранното рало представлява инструмент, който не обръща почвата, а прави само плитка бразда. В конструктивно отношение ралото се състои от плазица, бръдце и воище, към което се прикрепя ярема (fig. 8). За предната част на плазицата е закрепян бронзов или железен лемеж. Някои новости в конструкцията на ралото се появяват през римската епоха. Същинският плуг, който обръща почвата, възниква през средновековието.

Етнографски проучвания показват употребата на дървеното рало на територията на България до края на XIX в. В зависимост от формата на воището са разграничени четири основни типа (fig. 9). Най-важната част от ралото и тази, която може да бъде документирана археологически, е лемежът. Въпреки че съществуват различни типове железни лемежи, засвидетелствани етнографски, липсва универсално приета терминология и класификация. В своето изследване върху металните инструменти от I – началото на VII в. в днешните български земи, И. Чолаков разграничава седем типа лемежи на базата на формата на работната им част и метода на закрепяне към ралото (Чолаков 2010, обр. 14).

Броят на сигурно датираните железни лемежи, открити в Тракия и датирани преди римската епоха, е много малък (fig. 10). Всички екземпляри имат работна част във формата на лъжичка и дълга плоска част, която обикновено завършва с перпендикулярна извивка подобно на кука (figs. 11, 12). Тази част е била закрепяна за ралото чрез дървен клин и вероятно допълнително укрепвана с метален пръстен. Археологическите данни показват употребата на този тип лемеж поне от IV в. пр. Хр. На базата на иконографски сведения от периода може да се предположи, че лемежите от този тип са били прикрепяни към дървено рало с криво воище, закрепено за плазицата.

III.1.2. УПОТРЕБА НА МОТИКА

Друг инструмент, използван за обработка на земята, е мотиката. Различните термини, използвани от античните автори за обозначаването му, предполагат съществуването на типове, различаващи се по тегло, размер и форма в зависимост от тяхната функция (Isager, Skydsagaard 1992, 49). Така например, по-леки мотики са използвани вероятно при сеитба и плевене, докато разбиването на буците угар е изисквало по-солиден инструмент. Подобно разнообразие на форми е засвидетелствано и през римската и византийска епохи, а етнографските изследвания в днешните български земи показват използването на различни форми и термини в зависимост от вида почва и отглеждана култура.

Примерите на железни мотики от вътрешна Тракия, датирани в елинистическата епоха, са ограничени до два екземпляра от Сборяново и находката от Момина могила при с. Братя Даскалови, последната открита заедно с кирко-брадва (fig. 13, 14). Желязна мотико-брадва е открита и в светилището на връх Бабяшка чука (fig. 14b). Проучвателите свързват употребата на този инструмент с металургични дейности (Тонкова 2008, 109).

III.1.3. СЕИТБА

В зависимост от своите биологични характеристики, зърнените култури могат да бъдат засяти през есента или пролетта. Античните автори дават указания за подходящото време за сеитба, както и за характеристиките на различните видове почви и култури. Изображения върху гръцка рисувана керамика показват, че сеитбата се е извършвала с ръце, като зърното е съхранявано в кошница и разпръсквано върху обработената земя.

III.1.4. ЖЪТВА

Жътвата се извършва в началото на лятото за културите, засяти през есента и в края на лятото за тези, засяти напролет. Омир, Хезиод и Ксенофонт, а по-късно и римските автори, описват процеса и дават препоръки за правилните методи на жътва.

Различните начини на жътва: изкореняване, жънене на класовете или на класовете заедно със стъблата може да бъде разпознато след археоботаничен анализ. Изборът на един или друг метод зависи от предназначението на продукцията – от необходимостта от определени "остатъчни" продукти, например плява, слама, листа, люспи, както и от наличното време и работна ръка. Жънене на класовете или на класовете заедно със стъблата е засвидетелствано на територията на България още за периода на халколита. Предполага се практикуването на двата типа жътва и през КЖЕ.

Стандартният инструмент за жънене е сърпът. Върху гръцка рисувана керамика сърпът е изобразяван, използван като оръжие, в сцени с Персей или Орфей (fig. 15). На територията на днешните български земи етнографски са документирани два типа сърпове – назъбен, наречен *сърп* и неназъбен, наречен *каврама* или *сирма* (fig. 16). Работният принцип на двата типа също се различава – докато назъбеният реже с цялото си острие подобно на трион, неназъбеният сърп реже с една част от острието чрез натиск. И двата типа съществуват едновременно още в КБЕ, като за момента не е възможно да се установи дали единият тип предхожда другия. Предполага се употребата им за различни култури и в зависимост от гъстотата на засяване, въпреки че липсват сигурни данни за това.

Според своята форма сърповете, датирани в КЖЕ и открити в Тракия, принадлежат към назъбения тип. Липсата на примери от втория тип вероятно се дължи на степента на проучвания. Освен в селищни обекти, сърпове са откривани и в ритуален контекст – светилища и ямни комплекси (figs. 17-19). Депонирането им на обекти с култов характер се свързва с практикуването от местното население на ритуали, свързани със земеделието.

III.1.5. ВЪРШИТБА И ВЕЕНЕ

В традиционната обработка на зърнени култури след жътвата продукцията трябва да бъде изсушена. Изсушеното зърно е след това овършавано чрез удряне на продукцията ръчно, чрез тъпчене с крака или с помощта на животни. Използването на впрегатни животни при вършитбата е споменато от Ксенофонт и изобразено върху атически червенофигурен съд (fig. 20). Вършитбата се извършва на специално подготвено място – харман. Харманите са разположени обикновено на открити пространства, на полето, близо до селището или на двора.

Употребата на диканя при вършитба е етнографски засвидетелствана в Близкия Изток, Анатолия, Балканите, Крит, Сирия и Пиринеите (Gurova 2014, 145-146). Сигурни данни за използването на диканя на територията на българските земи има поне от халколита (Gurova 2014a, 157-160). За момента липсват данни за употребата на дикани през КЖЕ в Тракия, но това се дължи вероятно на липсата на достатъчно материал, който да бъде подложен на систематични трасологични изследвания. Следващите процеси – веене, грубо и фино пресяване, сушене и счукване са археологически трудно разпознаваеми.

III.2. ОРГАНИЗАЦИЯ НА ПРОИЗВОДСТВОТО НА ЗЪРНЕНИ КУЛТУРИ В ТРАКИЯ

III.2.1. ЗЕМЕДЕЛСКИ РЕЖИМ

Земеделската година започва с оран и сеитба през месец октомври. От февруари времето обикновено е подходящо за засяване на пролетни кулутури. Това е и сезонът за оран на угарта. Жътвата на зърнени култури започва през май и в зависимост от техния вид може да продължи до месец юли. Вършитбата започва в края на юни или началото на юли. В този период се извършва и третата оран, която цели да унищожи плевелите и да запази почвата влажна (Edwards 2004, 150-158).

Режимът на отглеждане на зърнени култури може да бъде интензивен или екстензивен. Докато при интензивното земеделие единица площ се обработва възможно най-много, което води до по-голяма реколта, при екстензивното земеделие вложеният труд в обработката на единица площ е по-малко, което води до по-нисък добив (Bogaard 2004, 21). Използването на впрегатни животни, рало и метални земеделски инструменти обикновено се свързва с втория, екстензивен режим на земеделие (Halstead 1992, 105-117).

За територията на вътрешна Тракия през КЖЕ, с изключение на обекта при Аджийска Воденица, липсват достатъчно данни, които да разкрият режима на ползване на земята. Въпреки това, употребата на ралото, както и политическата ситуация в Тракия през периода подсказва, че най-вероятният модел на отглеждане на зърнени култури е бил екстензивното земеделие. Интензивни режими може да са практикувани в райони извън Одриското царство.

III.2.2. КОЛИЧЕСТВО НА ПРОДУКЦИЯТА

За да се направят реалистични изчисления на количеството зърнена продукция е необходимо да се вземат предвид редица фактори – брой население, площ, която се обработва, земеделски режим и технология, работна ръка и степен на зависимост от алтернативни източници на храна. Въпреки че е възможно да се посочат вероятни стойности на количеството зърнена продукция, за момента не разполагаме с достатъчно сигурни данни за подобни изчисления.

III.2.3. ДЪРЖАВАТА И ЗЕМЕДЕЛИЕТО

На базата на писмените извори, в тракийското общество обикновено са разграничавани два основни пласта: единият включва владетелите и аристокрацията, а другият – зависимото население. Според предложения в литературата икономически модел, царете са били собственици на земята и продукцията, и цялата външна търговия е била под техен контрол. Днес, натрупаното количество епиграфски и археологически материал показва, че този модел трябва да бъде ревизиран. Надписът от Пистирос, датиран в средата на IV в. пр. Хр., свидетелства за съществуването на регулирани пазари и дейността на гръцки търговци далеч във вътрешността на Тракия. В допълнение, проучванията в Сборяново показват, че освен членове на управляващата династия и аристократични фамилии, населението на града е включвало също и свободни занаятчии и земеделци, чийто висок стандарт на живот е археологически проследим.

Продукцията на зърно и търговия с него са били едни от основните източници за увеличаване на приходите и поддръжка на армията. За Тракия липсват сведения за организирана търговия със зърно, с каквито разполагаме например за Боспорското царство по времето на Левкон I. Зърното е било транспортирано вероятно в чували и дървени контейнери, които не са достигнали до нас. Въпреки това, разпространението на амфори, използвани за транспорт на зехтин и вино, което е по-лесно проследимо, може да послужи като предполагаема индикация за съществуващата търговия със зърно (Tzochev 2016, 250).

III.3. ЗАКЛЮЧЕНИЕ

Главата представя земеделските сечива и дейности, свързани с обработката на земята и първичната обработка на зърнените култури. Откритите малък брой железни инструменти – лемежи, мотики и сърпове, показват високото ниво на технологични умения сред местното население. За голяма част от използваните инструменти и прилагани техники можем да съдим само на базата на писмени, иконографски и етнографски сведения. Най-вероятно зърното е било една от стоките, използвана за обмен на вносна продукция, но този процес е все още трудно разпознаваем археологически. Освен зависими производители, във вътрешна Тракия са съществували също и частни занаятчии и търговци, а наличието на пазари е засвидетелствано още в V в. пр. Хр.

ГЛАВА IV. СЪХРАНЕНИЕ НА ЗЪРНЕНИ КУЛТУРИ

Естествено продължение на процеса на култивиране, жътва и първоначална обработка на зърнените култури е тяхното съхранение. Пространственият анализ на останки от обработено зърно, съдове и структури за съхранение хвърля светлина върху вътрешната селищна планировка и аспекти на социалната организация. Разнообразните методи на съхранение разкриват нивото на технологично познание. Състоянието, в което се съхраняват зърнените храни, както и видът на самото хранилище – яма, керамичен съд или постройка, е показател за предназначението на продукцията. Не на последно място, изследването на прилаганите практики за съхранение е от голямо значение за възстановката на политическата и социална организация в миналото, засвидетелствани в контрола и разпространението на земеделска продукция.

IV.1. МОДЕЛИ ЗА СЪХРАНЕНИЕ НА ЗЪРНЕНИ КУЛТУРИ

Изборът на определен метод за съхранение зависи от редица природни фактори, както и от предназначението на продукцията – за посев или за ежедневна употреба.

IV.1.1. ЯМИ

Употребата на ями, обмазани с глина и слама, разположени в рамките на жилището или в неговата непосредствена близост, е често практикуван метод за съхранение в днешните български земи още от праисторическите периоди. Успешното съхранение на зърно за дълъг период от време в запечатана яма се дължи на анаеробната среда в ямата, като в резултат се поддържа постоянно ниво на влажност и ниска температура.

Резултатите от експерименти, проведени в Guiting Power, Южна Великобритания, показват, че най-ефективният начин за запазване на зърното сухо и незамърсено е съхраняването му в незапечатана, покрита яма, което също така позволява наблюдението му и осигурява по-лесен достъп до съдържанието на ямата (Marshall 2011, 80-164). Етнографски и експериментални проучвания демонстрират, че обмазването на ямата не е от съществена необходимост за успешното съхранение на зърното (Reynolds 1974, 127). Многократното отваряне на запечатана яма води до влошаване на качествата на зърното. Следователно ямите са подходящи за съхранение на голямо количество зърно за дълги периоди, например между жътва и сеитба. Продукцията за всекидневна употреба е съхранявана в съдове, кошници или дървени сандъци. Това се подкрепя както от етнографски примери, така и от археологическите открития.

IV.1.2. СЪДОВЕ И СЪОРЪЖЕНИЯ ЗА СЪХРАНЕНИЕ

Едновременното съществуване на различни методи за съхранение на зърнени продукти (керамични съдове, съоръжения с различна форма и конструкция, плетени кошници и дървени сандъци) е обусловено от специфичното предназначение на продукцията – за посев или консумация и е използвано с цел да се намали риска от непредвидени инциденти – пожар, кражба и т.н.

IV.1.3. СЪСТОЯНИЕ НА ПРОДУКЦИЯТА

Състоянието, в което се съхраняват зърнените култури дава ценна информация за тяхното предназначение – съхранявани за кратък или дълъг период, за фураж или за консумация и посев, и свидетелства за практикуваните методи на жътва. Тези данни от своя страна могат да разкрият потенциала на средствата за препитание (количество на продукцията), нивото на технологични умения (конструкция на зърнохранилищата) и решения, продиктувани от икономически причини (например "висока" жътва и следователно по-малка необходимост от употребата на слама или засяването на определени култури заедно). Резултатите от археоботанични изследвания от обекти от праисторически периоди и елинис-

тическата епоха на територията на България показват, че по-голяма част от продукцията е била съхранявана в неовършано състояние. Това предполага съхранение за дълъг период, но може да отразява и недостиг на работна ръка по време на жътва. По-нататъшната обработка на класовете е била осъществявана най-вероятно преди консумация.

IV.2. СЪХРАНЕНИЕ НА ЗЪРНЕНИ КУЛТУРИ В ТРАКИЯ ПРЕЗ КЪСНОЖЕЛЯЗНАТА ЕПОХА

Макар и много малко (Приложение B1), писмените сведения, които споменават хранилища в Тракия, показват съществуването на подземни съоръжения с такава функция. Проучени са голям брой ями, датирани в I хил. пр. Хр., като според мнозинството изследователи функцията на т. нар. ямни полета е свързана с ритуални практики. Повсеместното разпространение на питоси ги нарежда сред характерните методи за съхранение през КЖЕ, но характерът на тяхното съдържание невинаги е сигурен.

IV.2.1. ЯМИ И НАЗЕМНИ СТРУКТУРИ

Докато броят на ямите, регистрирани в Тракия и датирани в I хил. пр. Хр., е голям, тяхното идентифициране като зърнохранилища далеч не е сигурно и в повечето случаи запълнителят им включва разнообразни матеирали. Трябва да се има предвид обаче, че подобни съоръжения за съхранение се откриват с продукция в тях само при внезапното изоставяне на обекта. В Тракия са разграничени две основни групи ями на базата на местоположението им: а) ями под могили и б) ями извън некрополи (Георгиева 1991, 1-11). Втората група включва ямите в рамките на селища, ямните полета и тези, разположени в светилища.

Докато функция на ямите, регистрирани в рамките на селища, както и на някои от документираните леки конструкции като съоръжения със стопанско предназначение е по-сигурна, то мнозинството проучватели интерпретират документираните в последните години повече от 50 ямни комплекса като структури с ритуална функция. Това се дължи на характера на запълнителя на ямите, свидетелствата за животински и човешки жертвоприношения, разположението на ямите извън селища, дългата им употреба и повтарящи се черти. Разглеждайки отново аргументите в подкрепа на тази интерпертация, в настоящето изследване е предложена хипотезата, че първичната функция на ямите е била за съхранение, което е довело до практикуването на специфични ритуали.

Един от основните доводи срещу функцията на ямните комплекси като хранилища е липсата на обмазване на стените на ямите. Етнографски паралели обаче демонстрират, че обмазването не е задължително. Сред ямните полета съществуват и примери на ями, които са обмазани или чиято вътрешност е опалена. Проучените ями показват голямо разнообразие на форми и размери, което също е етнографски засвидетелствано при ями-зърнохранилища. Местоположението на ямните полета извън селища е друг основен аргумент в подкрепа на ритуалната им функция. Ямите са най-подходящи за съхранение за дълъг период от време – за зърно, предназначено за посев. Следователно, тяхното местоположение в рамките на селищата не е задължително. Липсата на регистрирани селища в близост до ямните комплекси, с изключение на Копривлен и Пистирос, може да се дължи на степента на запазеност – в случай на леки постройки, трудни за регистриране или разрушени от модерна дейност. Характерът на запълнителя на ямите е следващ аргумент в полза на култовия им характер. Възможно е обаче ритуалните дейности да са извършвани в определени моменти от земеделския календар – при изпразване на ямата от зърно за посев, след жътва, в периоди със слаба реколта и др. Преходният период между жътва и сеитба е изисквал принасянето на дарове, за да се осигури плодородие.

IV.2.2. ПИТОСИ

През КЖЕ питосите са повсеместно разпространени и се откриват в различни контексти –стопански, ритуален и свързан с обработката на метал. Обикновено питосите са вкопани до нивото на раменете или устието и покрити с капак или каменна плоча. Пи-

тосите са служели за съхранение както на течности и хранителни продукти, така и на различни неорганични материали. Употребата на питоси във вътрешна Тракия през разглеждания период показва продължаване на установени традиции за съхранение. Регистрираните знаци и печати върху някои от съдовете може да служи като индикатор за тяхното предназначение и да даде информация за организацията на тяхното производство.

Анализът на питосите, открити в Копривлен, показва тяхното местно производство. Въпреки това, малкият брой изцяло запазени екземпляри, както и фактът, че голяма част от тях произхождат от контекст без ясна стратиграфия, не позволява да се проследи развитие на формите във времето. Съществуват примери на печати върху устията на съдовете, представляващи житен клас (fig. 21). Върху някои от питосите са установени следи от поправки – оловни скоби, фиксирани в дупки от двете страни на пукнатината. Поправки на питоси са регистрирани също в Пистирос, Севтополис и Сборяново, което предполага тяхната висока стойност.

В резултат на проучванията в Пистирос се открити множество фрагменти и изцяло запазени питоси (fig. 22). Върху устийния ръб на някои съдове, преди изпичането, са нанесени печати, представящи разнообразни мотиви (fig. 23). Сред знаците, врязани след изпичането на съда, има такива, които представят числа, обозначаващи обем, тегло, цена или брой на съдове в една партида (fig. 24) (Domaradzka 1996, 93; 2005, 302). Установено е разграничение между функцията на питосите от Пистирос през различните етапи на съществуване на обекта. Така, докато питосите от Сграда 1 са служели за съхранение на течности и хранителни продукти през втората фаза на обекта, то в следващата трета фаза те са съдържали вода и са функционирали във връзка с металургичната дейност, извършвана на това място (Lazov 1999, 342) (fig. 25).

Питосите, открити в Севтополис (fig. 26), са изработени по начин, подобен на екземплярите от Копривлен и Пистирос. Регистрираните общо 143 печата върху устийните ръбове са разграничени в две основни групи. По-голямата първа група включва печати, нанесени преди изпичане на съдовете (fig. 27), които според проучвателите са предназначени да означат различни производители. Идеята, че буквата Σ може да маркира името на владетеля Севт III, предполага съществуването на керамична работилница под негов контрол. В същото време, идентични печати, нанесени върху съдове с едни и същи размери и профили свидетелства за функционирането на частни работилници. Втората голяма група включва питоси с букви, врязани след изпичане на съдовете (fig. 28). Според М. Чичикова част от тези букви представляват числа с различни стойности, които маркират обема на съдовете или тяхната цена (Чичикова 1984, 65). Въпреки че е възможно да бъде изчислен капацитетът на някои съдове на базата на тези знаци или обема на запазения питос, видът на тяхното съдържание и следователно количеството съхранявано зърно остава несигурен.

Фрагменти от питоси се откриват често сред запълнителя на ями от ямните полета, а в някои случаи целият съд е служел като конструктивен елемент на ямата (fig. 29). Питоси присъстват също и сред материалите, откривани в светилища.

IV.2.3. ДРУГИ СЪОРЪЖЕНИЯ ЗА СЪХРАНЕНИЕ

Освен питоси, за зърнохранилища са служели и други керамични съдове с по-малки размери, както и контейнери, изработени от нетраен материал, чиято направа е била поевтина и е изисквала по-малко умения.

IV.3. СОЦИАЛНИ И ИКОНОМИЧЕСКИ АСПЕКТИ НА ПРАКТИКИТЕ ЗА СЪХРАНЕНИЕ ПРЕЗ КЪСНОЖЕЛЯЗНАТА ЕПОХА В ТРАКИЯ

Ролята на съхранението на хранителни продукти за възникването и колапса на йерархични общества е широко дискутирана за различни култури и периоди. Разнообразни природни и социални фактори могат да причинят недостиг или загуба на реколтата. С цел да се намали този риск и да се осигурят необходимите хранителни запаси, са прилагани и

продължават да се практикуват различни методи – засаждане на различни култури, фрагментация на земята, преселване, размяна и съхранение.

През КЖЕ в Тракия е засвидетелствано едновременното използване на различни съоръжения за съхранение – питоси, по-малки керамични съдове, контейнери, изработени от нетраен материал и ями. Наличието на такова разнообразие може да се дължи на необходимостта от намаляване на риска от загуба на реколтата, както и на различното предназначение на продукцията в отделните съоръжения. Голямото количество питоси, открити в проучените градски центрове показва, че те са служели за съхранение на хранителни запаси за директна консумация. Ямите в повечето случаи се откриват извън селищата и вероятно са служели за съхранение за по-дълги периоди. Съхранението на зърнени култури в Тракия се е реализирало на домашно ниво. Изчисленията за необходимото количество зърно за една година както и капацитетът на регистрираните в градските центрове съоръжения за съхранение показва, че населението в градовете вероятно е разчитало на пазара или е съхранявало повече продукция извън рамките на селището.

IV.4. ЗАКЛЮЧЕНИЕ

Описани са различните методи на съхранение и техните специфики. Съхранението в ями е една от най-разпространените практики, засвидетелствано етнографски и археологически. Разгледани са предлаганите от редица проучватели аргументи против функцията на ямите в т. нар. ямни полета в Тракия през КЖЕ като хранилища. Без да се изключва практикуването на ритуални действия, е изказана хипотезата за първичното предназначение на ямите именно за съхранение на продукция за дълъг период от време. Зърнени култури, предназначени за всекидневна консумация, са съхранявана в питоси, по-малки керамични съдове и съоръжения, изработени от нетраен материал.

ГЛАВА V. СЪОРЪЖЕНИЯ ЗА СМИЛАНЕ НА ЗЪРНО

Необходимостта от обработка на зърното преди консумация е довела до изобретяването на различни методи за неговата механична и термична обработка. Настоящата глава представя развитието на хромелните камъни от праисторията до римския период, когато при работа с мелницата за първи път започва да се използва животинска сила. Макар и сравнително бавно, хромелните камъни търпят технологично развитие във времето, изразено в появата на мелници, при работата с които се увеличава количеството и се подобрява качеството на продукцията, като в същото време се намаляват необходимите усилия за работа. През КЖЕ такава иновация представляват т.нар. Олинтски мелници.

V.1. РАЗВИТИЕ НА ХРОМЕЛНИТЕ КАМЪНИ

V.1.1. ПРАИСТОРИЧЕСКИ ХРОМЕЛНИ КАМЪНИ

Ръчната мелница се състои от два камъка – долен (неподвижен) и горен (подвижен). При седловидния хромел долният камък е с издължена форма и конкавна работна повърхност. Изображения в египетски гробници, както и фигурки и теракоти от Египет и Гърция, показват начина на работа със седловиден хромел (fig. 30). Понякога характерът на извършваното действие не е сигурен, както е в случая с теракотата от Аполония Понтика, чиито ръце липсват (fig. 31).

Ръчните мелници са били необходими във всекидневието и се откриват често при археологически проучвания на селища. Освен използвани в ежедневието, те играят важна роля и в практикуваните ритуали в Тракия през цялото I хил. пр. Хр. Депонирането на хромели на светилища на върхове и ямни комплекси е засвидетелствано още през РЖЕ. Практиката продължава и през КЖЕ, когато освен седловидни хромели се откриват и Олинтски мелници. Седловидните хромели са разпространени повсеместно през праисторическите периоди и продължават да се използват и преобладават и след появата на Олинтската мелница през V в. пр. Хр. Възможно обяснение за това е, че последните са

били по-скъпи от гледна точка на необходими умения и време за изработка и следователно не са били достъпни за всяко домакинство.

V.1.2. ОЛИНТСКА МЕЛНИЦА И РОТАЦИОНЕН ХРОМЕЛ

Появата на Олинтската мелница бележи нов етап в развитието на технологията на смилане. Терминът е въведен в обръщение от L. Moritz, тъй като този тип хромели са открити при проучванията на Олинт. Идентифицирането им като мелнични камъни принадлежи на W. M. Flinders Petrie, а изображенията върху две Мегарски купи показват метода на работа с тях (Приложение B.2.18; 19) (fig. 32).

Горният камък на Олинтската мелница е най-често с правоъгълна или квадратна форма и вдлъбнатина, с плавно спускащи се навътре стени, които водят до тесен отвор (fig. 33). Обикновено на перваза са разположени два жлеба, в които се закрепя дървена дръжка. Дръжката е закрепяна в единия си край за вертикален прът, а другият е служел за захващане. Смилането се е осъществявало чрез дъговидно движение на горния камък наляво и дясно (figs. 34, 35). Долният камък на Олинтската мелница е с правоъгълна или квадратна форма. Върху работните повърхности на двата камъка често присъстват врязвания (fig. 36). Възможно е и наличието на допълнителни дупки или жлебове на някоя от външните страни на горния камък, служели за допълнително фиксиране на дръжката към камъка (fig. 40).

Олинтски мелници са открити на редица места в Източна и Централна Европа, Западна Азия и Северна Африка. Картата на разпространението им показва липсата им в Западна Европа (fig. 37). Това се дължи на факта, че в тази част на континента е бил използван ротационният хромел. Той се състои от неподвижен долен и подвижен горен камък със съответно конвексна и конкавна работни повърхности. Горният камък има в центъра си отвор, използван за закрепянето му към долния и за изсипване на зърното, както и жлеб за дръжката (fig. 38). Кръгли хромели са документирани в Картаген и Северна Испания в обекти още от V в. пр. Хр. Откривани са също в Югоизточна Англия, Франция, Германия и Чехия от IV в. пр. Хр. насетне.

Най-ранният пример на Олинтска мелница е открит в Гърция, датиран в последната четвърт на V в. пр. Хр. Според R. Frankel произходът на този тип хромели трябва да се търси в Източното Средиземноморие – Анатолия или континентална Гърция, откъдето се разпространява на запад най-вероятно чрез гръцките колонисти (Frankel 2003, 17-18). Обратна е посоката на ротационната мелница. Наличните данни показват нейния произход в Централна или Западна Европа, откъдето се разпространява на изток с римското завоевание (Runnels, Kardulias 1995, 127). Кръглият хромел достига Гърция в I в. пр. Хр. и плавно заменя Олинтската мелница. Липсват примери на Олинтски мелници от Гърция, датирани след II в. сл. Хр.

V.2. ОЛИНТСКИ МЕЛНИЦИ ОТ ТРАКИЯ. РАЗПРОСТРАНЕНИЕ И ТИПОЛОГИЯ

В Тракия Олинтски мелници се откриват в селища, сред които основните градски центрове във вътрешността, както и на култови обекти – светилища на върхове и ямни комплекси. Не липсват и случайни находки (fig. 39). Възможно е малкият брой на регистрирани долни камъни да се дължи на факта, че те не са археологически разпознати (ако са във фрагментирано състояние) или са били преизползвани като строителен материал. Трябва да се отбележи обаче, че горният камък на Олинтската мелница е този, който притежава нови черти, дава възможност за изграждане на типология и чиято изработка е изисквала умения.

V.2.1 НАХОДКИ ОТ СЕЛИЩА

Фрагментирани и изцяло запазени горни камъни от Олинтски мелници са открити при разкопките на Севтополис между 1948 и 1954 г. Още тогава проучвателите правилно идентифицират находките с хромелни камъни от по-напреднал тип и посочват близките

им паралели с примери от Олинт, Прине, Делос и Северното Причерноморие. Олинтски мелници са открити също в Пистирос и Сборяново.

V.2.2. НАХОДКИ ОТ РИТУАЛЕН И ПОГРЕБАЛЕН КОНТЕКСТ

Депонирането на хромелни камъни на култови обекти – светилища на върхове и ямни полета (fig. 41) е интерпретирано във връзка с практикуваните ритуали, свързани с домашното огнище и/ или плодородието (Георгиева 1991, 7; Нехризов 2006, 408). Горен камък на Олинтска мелница с неправилна форма и груба изработка произхожда от могила № 93 от некропола на Шипка. Възможността хромелните камъни да са използвани в погребални практики, обаче, се нуждае от привеждането на повече примери със сигурен контекст на откриване.

V.2.3. ОЛИНТСКИ МЕЛНИЦИ И ОБРАБОТКАТА НА РУДА

Първичната функция на хромелните камъни е смилането на зърно и производството на брашно. Използването им за стриване на други материали, например за получаване на пигменти, е засвидетелствано още от праисторическите периоди. Ръчни мелници са служели и за стриване на руда. Възможно е екземплярите от светилищата на връх Бабяшка чука и Ада тепе (fig. 42) също да се свържат с практикуваните там металургични дейности.

V.2.4. СЛУЧАЙНИ НАХОДКИ

Броят на регистрираните във вътрешна Тракия Олинтски мелници нараства значително когато се добавят случайно откритите находки. Картирането им позволява да се разшири териториалният обхват на разпространение на този вид хромели, а описанието им допълва типологичното разнообразие.

V.2.5. ТИПОЛОГИЯ

Предложената в настоящето изследване типология разглежда горните камъни на Олинтски мелници от територията на България. Основен критерий за определянето на типове е формата на камъка и вдлъбнатината. Разграничени са четири типа. Различните методи за закрепяне на дръжката (с един, два или без жлебове върху перваза на горния камък) са използвани за определянето на три подтипа. Наличието или отсъствието на допълнителни начини за закрепяне на дръжката към камъка (хоризонтален жлеб или дупка) служи за разграничаването на три варианта (fig. 43).

Най-често срещаният тип Олинтска мелница от разглеждания район е тип I, характеризиращ се с правоъгълна или квадратна форма на камъка и вдлъбнатината, чиито стени се спускат плавно навътре, последван от тип II (с правоъгълна или квадратна форма на камъка и вдлъбнатината и стени, спускащи се перпендикулярно навътре), един екземпляр от тип III (с вдлъбнатина с форма на пеперуда) и два от тип IV (с неправилна форма на камъка и вдлъбнатината) (figs. 44, 45, 48). Според контекста на откриване преобладават Олинтски мелници от селища, но разликата в броя на тези, регистрирани на култови обекти, е незначителна и се дължи най-вероятно на степента на проучване (fig. 46). За момента не е възможно да се посочи зависимост между характера на обекта (селище, светилище) и типа Олинтска мелница както и връзката на определени типове със специални дейности (смилане на руда или зърно) (fig. 47).

Определянето на точното време на проникване на Олинтската мелница в Тракия е затруднено от малкия брой сигурно датирани примери, както и от факта, че съществува застъпване на видовете мелници – седловидният хромел продължава да се използва и след появата на Олинтската мелница. Най-рано датираният екземпляр в Гърция се отнася към последната четвърта на V в. пр. Хр. Олинтската мелница се разпространява бързо, достигайки Сицилия и Южна Франция в средата на IV в. пр. Хр. Находките от Сборяново, Севтополис и Пистирос показват, че в ранноелинистическия период знанието за и употре-

бата на Олинтската мелница е достигнало тракийските земи. Примерите от светилището на връх Бабяшка чука, датирани във II – I в. пр. Хр., свидетелстват за продължителната употреба на този вид хромели.

V.3. ПРОИЗХОД И ТЪРГОВИЯ НА ОЛИНТСКИ МЕЛНИЦИ

Идентифицирането на източниците на суровина за изработката на мелнични камъни позволява да се определят центрове на продукция и да се проследят възможни пътища на разпространение. В резултат на изследванията на Olwen Williams-Thorpe и Richard S. Thorpe върху различни видове хромелни камъни, остров Нисирос е идентифициран като един от основните източници на суровина за направата на Олинтски мелници. Мястото е споменато и в античната литература. Суровина от остров Нисирос е използвана за изработката на 29 Олинтски мелници, пренасяни от Киренийския кораб, потънал близо до северния бряг на о. Кипър. Извършеният геохимичен анализ върху хромелни камъни, сред които и Олинтски мелници, част от товара на търговски кораб, потънал в залива Палма, Испания, позволява да се проследи неговия маршрут. Това е и единственият случай на Олинтски мелници, открити западно от Сицилия.

Петрографски анализи на хромели от ямния комплекс при Свиленград посочват, че източникът на суровината е разположен северно и северозападно от археологическия обект, на разстояние не повече от 20 км. Местният произход на повечето Олинтски мелници от територията на вътрешна Тракия е предположен на базата на външни белези – тяхната небрежна изработка в сравнение с малкия брой примери, които се отличават с добра изработка и наподобяват тези от Гърция. Възможно е втората група хромели да представляват внос или да са дело на опитни майстори, притежаващи необходимите знания и умения. За да се потвърди произхода на дискутираните мелници обаче са необходими интердисциплинарни изследвания.

V.4. ЗАКЛЮЧЕНИЕ

Главата представя развитието на хромелните камъни от праисторическите периоди до римската епоха, като акцентира върху появата и разпространението на Олинтската мелница. Предложената типология на горни камъни от Олинтски мелници не показва развитие на формите във времето, нито заключителна картина на разпространието им, но бележи началото в проучването на този тип хромели за територията на Тракия. Употребата на Олинтски мелници за смилането на руда, установено при примери извън България, е потвърдено и за екземплярите от Тракия. На базата на качеството на изработка са направени предположения за произхода им, които обаче се нуждаят от допълнителни анализи.

ГЛАВА VI. ЗАКЛЮЧЕНИЕ

В тази глава са обощени основните въпроси, засегнати в изследването, и са представени възможностите за бъдещи проучвания.

VI.1. ОБОБЩЕНИЕ

Втората половина на I хил. пр. Хр. бележи нов етап в историята на Тракия, през който настъпват значителни промени в политическата, социална и икономическа организация. Производството на зърнени култури е заемало значителен дял в древната икономика – осигурявайки необходимата прехрана и изпълнявайки ролята на търговски продукт. Темата за земеделието в Тракия е привлякла научен интерес още в началото на XX в. Въпреки това, тя не е широко изследвана в българската литература. Възможна причина за това е консерватизмът на формите на земеделските инструменти, което от своя страна затруднява изграждането на типология и сигурна хронология. Настоящето изследване представлява единственият до момента подробен преглед на целия процес на производство на зърнени култури през КЖЕ във вътрешна Тракия и неговите социални и икономически

аспекти. Единствено чрез съчетаването на археологическите свидетелства с данни от палинологични и археоботанични изследвания, писмени и иконографски сведения, етнографски паралели и експериментални проучвания, е възможно да се възстановят земеделските практики и инструменти, използвани през разглеждания период.

През втората половина на I хил. пр. Хр. антропогенното влияние върху околната среда се увеличава, което е в съответствие с други големи промени, характерни за периода, като урбанизация и нарастване на броя на населението. Зърнените култури са формирали основната прехрана, като от средата на хилядолетието преобладава твърдата пшеница. Земеделската технология е отразена в използваните инструменти, откривани както в добре проучените градски центрове от вътрешността, така и в култов контекст – свидетелство за практикуваните ритуали с цел да се осигури плодородие. Свидетелствата за ритуални дейности, регистрирани в проучените ямни комплекси, не изключва възможността ямите да са възникнали като хранилища. Земеделските инструменти са имали висока стойност, както показват поправките по питоси и продължителната употреба на Олинтски мелници. За направата им са били необходими подходящи суровини, умения и време. Съществували са и техни по-евтини варианти. Пространственото и количествено разпространение на ями и питоси в Тракия показва, че за да си осигури необходимото за прехрана количество зърно, населението в проучените градски центрове трябва да е разчитало на пазара или да е съхранявало продукция извън града. Различни стоки са пътували до крайбрежните градове и обратно. Зърното е било вероятно един от основните продукти за износ, но е все още трудно проследимо археологически.

VI.2. ПЕРСПЕКТИВИ ЗА ПРОУЧВАНЕ

Една от належащите перспективи за проучване е прилагането на интердисциплинарни методи при изследването на земеделски сечива от КЖЕ. Трасологичните анализи могат да идентифицират следи от производство и употреба на сечивата. Регистрирането на ботанични останки върху работната повърхност на инструмента разкрива специфичната му употреба. Установяването на произхода на суровината за направата на хромелни камъни позволява идентифицирането на производствени центрове, както и реконструкцията на търговски пътища, културни връзки и икономически решения. Прилагането на анализи върху мелници и питоси, които да определят характера съответно на обработваните и съхранявани материали, е от съществена необходимост.

Настоящето изследване разглежда теоретичните и технологични аспекти на процеса на производство на зърнени култури на фона на социално-икономическата обстановка в Тракия през КЖЕ. Изучаването на древното земеделие е обширна тема и съществуват много възможности за бъдещи изследвания, но по-нататъшни дискусии трябва да изчакат събирането и анализа на допълнителни данни.

APPENDIX A

Cereal remains from Bulgaria – second half of the first millennium BC

SPECIES		einkorn (*Triticum monococcum* L.)	emmer (*Triticum dicoccum* Shrank)	mild/compact wheat (*Tr. aestivum* L./*durum* L.)	spelt wheat (*Tr. spelta* L. Thell)	barely (*Hordeum vulgare* L.)	millet (*Panicum miliaecum* L.)	rye (*Secale cereale* L.)	sorghum (*Sorghun bicolor* (L.) Moench. *var bicolor*)	oats (*Avena sativa* L.)	
SITE/PERIOD											**References**
Svilengrad	LIA pits	+	+	+	+	+	+	+			Попова 2005; 2006; 2008
Dana Bunar	LIA pits	+	+			+	+	+		+	Славова 2013
Vratitsa	LIA pits	+	+	+		+					Попова 2005; 2009
Malko Tranovo	LIA pits	+	+	+		+	+	+		+	Попова 2005; 2009
Kumsala	LIA pits	+	+	+		+		+			Popova 2001; Попова 2009
Dvora	LIA pits	+	+	+		+	+	+			Popova 2001; Попова 2009
Koprivlen	LIA pits	+	+	+		+	+	+		+	Popova 2002a; 2005
Krastina	LIA pits	+		+		+					Попова 2009
Krepost	LIA pits	+	+	+		+	+				Славова 2013
Halka Bunar	Hellenistic settlement	+		+		+	+		+		Попова 2009
Pistiros	V-II c. BC settlement	+	+	+		+	+	+	+	+	Popova 1996; 2002; Попова 2009
Sboryanovo	Hellenistic settlement	+							+		Попова 2009
Cabyle	Hellenistic settlement	+		+		+	+	+			Славова 2013

APPENDIX B

Documentary and Iconographic Sources
B.1. Table of literary sources
Cereal crops in Thrace

cereal crops in Thrace	• Xenophon. *Anabasis* VII.1.13; VII.5.12; VII.4.5 • Demosthenes 10.16 • Theophrastus. *De Caus*is *Plant*arum III. 23.4; IV.11.5 • Apollonius of Rhodes. *Argonautica* I. 793-828 • Pliny the Elder. *Natural History* 18.12 • Pseudo-Aristotle. *De Mirab. Ausc*. 116 • Arrian. *Anabasis Alexandri* I.4.1 • Galen. *On the Properties of Foodstuffs* 13.514 ff.
barley drinks in Thrace	• Athenaeus. *Deipnosophists* X. 447 b-d
bread in Thrace	• Xenophon. *Anabasis* VII.3.21 ff. • Pseudo-Aristotle. *De Mirab. Ausc*. 116
Thracian grain for cash	• Aristotle. *Oeconomica* 1351a20 • Polyaenus. *Strategemata* VII.32

Agricultural practices and tools

plough and ploughing	• Homer. *Iliad* 10. 351; 13.702 ff; 18.540-550; 23.834 ff. • Homer. *Odyssey* 5.127; 13.31;18.365-375 • Hesiod. *Works and Days* 383-390; 427-492 • Hesiod. *Shield of Heracles* 285-290 • Pindar. *Pythian* 4. 400 • Pausanias. *Description of Greece* I.32.5 • Aristophanes. *Plutus* 515 • Xenophon. *Oeconomicus* XVI.10; XVII.10 • Theophrastus. *Characters* IV.11 • Theophrastus. *De Causis Plantarum* III.20.7-8 • Theophrastus. *Enquiry into Plants* VIII.6.3 • Cato. *On Agriculture* 61 • Apollodorus. *The Library* I.9.23. • Varro. *On Agriculture*. I. 19-20 • Virgil. *Georgics* 1.160-175 • Pliny the Elder. *Natural History* 18.48; 49 • Columella. *On Agriculture* 1.9.2-3; 2.2.22-28 • Arrian. *Anabasis Alexandri* II.3
plough in Thrace	• Apollonius of Rhodes. *Argonautica* I. 793-926
hoe	• Homer. *Iliad* 21.257 ff. • Hesiod. *Works and Days* 469-471 • Aeschylus. *Agamemnon* 526 • Sophocles. *Antigone* 250 • Xenophon. *Oeconomicus* XVII.12-15 • Xenophon. *Cyropaedia* 6.2.34 • Aristophanes. *Peace* 570 • Theophrastus. *De Causis Plantarum* III.20.8 • Theocritus 16.32
sowing	• Hesiod. *Works and Days* 446; 462 ff. • Xenophon. *Oeconomicus* XVII.1 ff; 4-6 • Theophrastus. *Enquiry into Plants* VIII.1; 6

harvest	• Homer. *Odyssey* 18.366 ff. • Homer. *Iliad* 18.550 ff; 11.67 ff. • Hesiod. *Works and Days* 383-387; 571-580 • Hesiod. *Shield of Heracles* 285-295 • Xenophon. *Oeconomicus* XVIII. 1-3 • Varro. *On Agriculture* I.50 • Pliny the Elder. *Natural History* 18.72 • Columella. *On Agriculture* 2.20.1–3
threshing and winnowing	• Homer. *Iliad* 5.499 ff; 13.588 ff; 20.495 ff. • Hesiod. *Shield of Heracles* 285-295 • Hesiod. *Works and Days* 598 • Xenophon. *Oeconomicus* XVIII.3-9 • Aristotle. *Meteorology* II.8.23-32 • Demosthenes. 42.6. • Varro. *On Agriculture* I.51-52 • Virgil. *Georgics* 1.175-180 • Pliny the Elder. *Natural History* 18.72 • Columella. *On Agriculture* 2.20.5
saddle querns	• Homer. *Odyssey* 7.104; 20.105 ff. • *Genesis* xviii.6; *Numbers* xi 8; *Deuteronomy* xxiv.6; *Exodus* xi.5
rotary mills	• Cato. *On Agriculture* X. 4; XI. 4 • Virgil. *Moretum* 16-29, 39-51 • Aulus Gellius. *Attic Nights* 3.3.14
upper stone called “donkey”	• Aristotle. *Problems* XXXV 964b. 38 • Herodas. *Mimes* 6.83
portable querns	• Xenophon. *Cyropaedia* VI.2.31 • Frontinus. *Strategemata* IV.1.6
mills, driven by animal power	• Cato. *On Agriculture* X. 4; XI 4 • Plautus. *Comedy of Asses* 707-709 • Varro. *On Agriculture* I.19 • Suetonius. *Caligula* 39.1 • Apuleius. *The Golden Ass* 7.15; 9.10-11
provenance of raw material for querns	• Xenophon. *Anabasis* I.5.5 • Antipater of Thessalonica. *Greek Anthology* 9.418 • Pliny the Elder. *Natural History* 36.29.135; 36.30.136 • Strabo. *Geography* 10.5.16; 6.2.3
storage in Thrace	• Xenophon. *Anabasis* VII.1.13 • Demosthenes. 10.16 • Varro. *On Agriculture* 1.57 • Pliny the Elder. *Natural History* 18.73 • Athenaeus. *Deipnosophistae* IV.131

B.2. Table of iconographic sources
Land cultivation

No	object type/collection	ware/origin/date	decoration	reference
1	Terracotta statuette, Musée du Louvre: luv8104	Thebae, Boeotia, 600 – 575 BC	Terracotta statuette – ploughman with a pair of yoked oxen.	Isager, Skydsgaard 1992, 48, pl. 3.1
2	Terracotta statuette	Discovered at the necropolis of Apollonia Pontica; 5th – beginning of the 3rd century BC	A terracotta statuette of a pair of yoked oxen.	Цанева 1976, 38
3	Kylix, Musée du Louvre: F77	Attic black-figure, Italy, 575 – 525 BC	Side A: Agricultural labour: men ploughing and sowing, oxen, mules. Side B: Agricultural labour: youths, some draped, man ploughing, pithoi (?) on cart drawn by mules.	*CVA,* No164, Paris, Louvre 9, III.H.E.69, III. H.E.70, pl. 82.4.6-10; Beazley 1986, pl. 91.2
4	Cup, Berlin, Antikensammlung: F1806	Attic black-figure, Vulci; Nikosthenes as potter; 550 – 500 BC	I: Ploughmen and sower, youth using a pole. Oxen, lizard, youths, deer, lizard, locust, turtle. Huntsman crouching. Sides A, B: Siren between palmettes.	*CVA*, No 302815; Beazley 1956, 223.66
5	Cup Siana, London, British Museum 1906.12-15.1	Attic black-figure, Rhodes, 575 – 525 BC	Side A: Youth and women dancing, woman with basket at altar, goddess (Demeter ?) seated on stool with scepter, between palmettes. Side B: Agricultural labour: man ploughing, youth sowing.	*CVA*, No 300834, London, British Museum 2, III He.4, pl. (68) 10.6A-B; Beazley 1956, 90.7
6	Neck amphora**,** New York (NY), Shelby White & Leon Levy Collection: XXXX14902	Attic black-figure; 525 – 475 BC	Side A: Agriculture, man ploughing with oxen. Side B: Birds, tree, owl on post, draped men.	*CVA,* No 14902; Boardman 1993, 72, fig. 67.A, B
7	Lebes, Eleusis, Archaeological Museum: 1231	Attic black-figure; Eleusis, 575 – 525 BC	Side A: Agriculture, youths, one with pick, one ploughing (?), man with sack, mule or ox. Side B: Capture of silenos, Midas (?) seated, draped man with spear.	*CVA,* No 15555

B.2. Continuation

No	object type/collection	ware/origin/date	decoration	reference
8	Bell krater, Cambridge (MA), Harvard Univ., Arthur M. Sackler Museum 1960.345	Attic red-figure, Attica; Hephaistos as potter; 475 – 425 BC	Side A: Agriculture, man (Bozyges?) ploughing, old man leaning on staff, woman with spear and sheaf of corn, tree, inscription. Side B: Draped youths. Inscription: DIOKLE[S] HAL[AIE]Y[S] KEKROPIAS	*CVA*, No 214755; Baltimore, the Robinson collection 2, 35-36, pl. (291) 48.2 A-B; Beazley 1963, 1115.30
9	Pelike, Athens, National Museum 16346	Attic red-figure; Orestes as potter; 475 – 435 BC	Side A: Ploutos with cornucopia, Demeter with scepter and plough. Side B: Draped youths with strigil.	*CVA*, No 214719, Athens, Musée National 2, III.ID.15, pl. (085) 27.1-3; Beazley 1963, 1113.11
10	Bell krater, Paris, Cabinet des Medailles: 424	Attic red-figure; Italy, Cumae 475 – 425 BC	Side A: Godesses, one holding plough, one holding torches, triptolemos with corn and sceptre mounting winged chariot, Demeter, Persephone. Side B: Drapped youths, one with staff, one with lyre.	*CVA*, No 213483, Beazley 1963, 1036.12
11	Amphora stamp, Th. 6952	Thasos, end of 270s BC*	Amphora stamp representing an ard.	Amouretti 1986, pl. 9a
12	Amphora stamp, SS 6133	Thasian stamp discovered at the Athenian Agora, last quarter of the 3rd century BC*	Amphora stamp representing an ard	Tzochev (personal communication)
13	Part of a relief of the Thracian horseman	Kadjkeui, Selimvria	Under the galloping horseman three pairs of oxen are represented. Preserved dimensions: h. – 0,13 m; w. – 0,15 m; t. – 0.01 m.	Seure 1912, 591, fig. 29
14	Funerary stele, National Archaeological Museum Sofia	Edrine, 2nd – 3rd century AD	A relief stele representing a funerary feast, below it – a pair of oxen, an ard, and a sickle. H. – 0,57 m; w. – 0,37 m; t. – 0,05 m.	Кацаров 1938, обр. 185; Венедиков1981, 87ff, обр. 28
15	Amphora stamp, Th. 342	Thasos, end of the 4th century BC*	Amphora stamp representing a dikella.	Amouretti 1986, pl. 13a

* The dating of the amphora stamps is according to Ch. Tzochev (personal communication)

Threshing and winnowing

No	object type/collection	ware/origin/date	decoration	reference
16	Chous, Hamburg, Museum für Kunst and Gewerbe: 1962.124.	Attic red-figure, Niobid as potter, 475 – 425 BC	Mule on a threshing floor, man with a pestle.	CVA, No 3649; Boardman 1994 (ed.), 89, fig. 90

Grinding

No	object type/collection	ware/origin/date	decoration	reference
17	Terracotta statuette, Archaeological Museum Sofia No 7268	Discovered at the necropolis at Apollonia Pontica; end of the 4th – beginning of the 3rd century BC	A terracotta statuette of a standing woman in front of a vessel (mortar?) with a tall base, presumably grinding, pounding or kneading. The hands and part of the head are broken. Traces of red paint on the dress and the vessel, yellow on the hand. H. – 5,5 cm. Local production.	Дремсизова-Нелчинова, Тончева 1971, 48
18	Megarian bowl, Paris, Musée du Louvre C.A. 936	Discovered at Thebes, late 3rd – early 2nd century BC; diam. – 0,12 cm; h. – 0,08 cm.	A scene in a flour mill: two millers are grinding grain using hopper-rubbers. In the centre a donkey (operating a mill ?). A miller is sieving the flour (or the grain to drain it from water). The millers and the master of the mill are designated as such by inscriptions. Five strangers wearing pointed caps and lion-cloths are also designated with inscriptions.	Rostovtzeff 1937, 86-96; Moritz 1958, 12-14
19	Megarian bowl, Athens National Museum 11797	late 3rd – early 2nd century BC	Made in the same mould.	Versakis 1914, 50-57; Kourouniotes 1917, 151-157; Rostovtzeff 1937, 86-96; Moritz 1958, 12-14

Scenes with agricultural tools used as weapons

No	object type/collection	ware/origin/date	decoration	reference
20	Column krater, Ferrara, Museo Nazionale di Spina 2795	Attic red-figure, Italy, 500 – 450 BC	Side A: Death of Orpheus, with lyre, Thracian women with pestles (?). Side B: Draped youths, one with staff, woman.	*CVA*, No 206135; Ferrara, Museo Nazionale 1, 15, PL.(1680) 36.1-3

B.2. Continuation

No	object type/collection	ware/origin/date	decoration	reference
21	Cup fragment, Jena, Friedrich-Schiller-Universitat: 813A	Attic red-figure	Side: Death of Orpheus in Thracian cap with stone and kithara, woman with sickle.	*CVA*, No 43959
22	Cup, Cincinnati (OH), Art Museum: 1971.1	Attic red-figure, 500 – 450 BC	Side A, B: Death of Orpheus with lyre, Thracian women with rock, spears, hammer, sickle, sticks. Inside: Thracian women, with rock and sickle.	*CVA*, No 204533; Beazley 1963, 416.2
23	Stamnos, Paris, Musée du Louvre G416	Attic red-figure, Italy, Nola, 500 – 450 BC	Sides A and B: Death of Orpheus, with lyre, Thracian women with spears, rock, axe, and sickle.	*CVA*, No 205400; Paris, Louvre 3, III. ID.10-11, pl. (180)19.1.4.6-7; Beazley 1963, 484.17, 1655
24	Hydria, Boston (MA), Museum of Fine Arts: 90.156	Attic red-figure, Italy, 475 – 425 BC, Niobid as potter	Death of Orpheus, Thracian women, with swords, spears, sickle, youths in chitoniskoi, with spears, one with Scythian cap, trees.	*CVA*, No 207002; Beazley, 1963, 267
25	Bell krater, Cambridge (MA), Harvard Univ., Arthur M. Sackler Mus: 60.343	Attic red-figure, 475 – 425 BC	Side A: Satyr seated on rock playing pipes, Dionysos with thyrsus and kantharos, maenad with snakes in hair playing tympanon. Side B: Thracian woman with spear, Orpheus falling with lyre, woman with sickle.	*CVA*, No 213539; Baltimore, Robinson Collection 2, 33-34, pl. (289, 290) 46.1A-C, 47.1; Beazley 1963,1042.2
26	Bell krater, New York (NY), Metropolitan Museum: 24.97.30	Attic red-figure, 475 – 425 BC	Side A: Orpheus seated with lyre, woman with sickle, man in Thracian costume, with spears. Side B: Women, one with phiale, some seated, man and youth, both draped, with staffs, post, strigil suspended.	*CVA*, No 214496; Beazley 1963, 1079.2
27	Hydria, Paris, Musée du Petit Palais 319	Attic red-figure, Italy, Nola, 475 – 425 BC	Body: Orpheus on rock with lyre, draped man in Thracian costume, satyr, women, one with pestle, one with spear.	*CVA*, No 214705; Paris, Musée du Petit Palais, 19, pl. (658)18.2-6; Beazley 1963, 1112.4
28	Stamnos, Basel, Antikenmuseum und Sammlung Ludwig: BS1411	Attic red-figure, 500 – 450 BC	Sides A, B: Death of Orpheus, fallen with lyre, Thracian women, one half naked, bleeding, some with pestles, one with sword, some with rocks, one with spit.	*CVA*, No 275231; Beazley 1963, 1652

B.2. Continuation

No	object type/collection	ware/origin/date	decoration	reference
29	Calyx krater, Naples, Museo Archeologico Nazionale: H2889	Attic red-figure, 475 – 425 BC	Side AB1: Orpheus seated on rock with lyre, men in Thracian costume, some leaning on spears, one seated, one in chitoniskos with pilos (cap ?), draped youth, horses. Side AB2: Thracian women with pestles, axe, spear and stick, youths, one draped, one in chitoniskos, chlamys and cap, with spears.	*CVA*, No 216061; Beazley 1963, 1096
30	Hydria, Musée du Louvre CA1853	Attic red-figure, Campania, 475 – 425 BC	Body: Birth of Erichthonios (?), youth on altar with snakes, Herakles with sickle, Athena, woman fleeing.	*CVA*, No 214836; Paris, Louvre 9, III. Id.40, III. Id.42, pls. 52.4.6, 53.2; Beazley 1963, 1121.18
31	Amphora B, London, British Museum B162	Attic black-figure, Etruria, 550-500 BC	Side A: Herakles (without lion skin) with boar, and Eurystheus, in pithos, youth, old man, Athena, device, flower. Side B: Men, one with sickle (?), one with sword or club attacking the chimaera, draped youth, cloth suspended.	*CVA*, No 301509; London, British Museum 3, III.He.5, pl. 28.2a-c, vase number 301509; Beazley 1956, 306.29
32	Calyx krater, Basel, Antikenmuseum und Sammlung Ludwig BS403	Attic red-figure, Italy, 475 – 425 BC	Side A: Andromeda in oriental costume tied to poles between Kepheus (old man with Thracian cap leaning on staff) and Perseus with sickle and winged cap and boots. Side B: Draped youths, one with staff, bag and halters suspended.	*CVA*, No 275473; Basel Antikenmuseum und Sammlung Ludwig 3, 26-27, Beilage 3.2, pl. (322) 10.1-6; Beazley 1963, 1684.15BIS, 1708
33	Neck amphora, Paris, Musée du Louvre F218BIS	Attic black-figure, 550 – 500 BC	Side A: Perseus with sickle, Gorgo running. Side B: Frontal chariot	*CVA*, Paris, No 301559; Louvre 4, III. He.23, pl. (207) 41.2.4; Beazley 1956, 308.80
34	Skyphos, Paris, Musée Auguste Rodin 492	Attic black-figure, 525 – 475 BC	Sides A and B: Perseus with sickle, pursuing Medusa, Hermes, Athena, Ivy, Heron.	*CVA*, No 330723; Paris, Musée National Rodin, 17-18, pl. 12.7.9.10; Beazley 1956, 521.1
35	Neck amphora, Münich, Antikensammlungen 1546	Attic black-figure, Etruria, 550 –500 BC	Side A: Perseus fleeing with sickle and a bag, Medusa falling, Athena. Side B: Ilioupersis, Aineias carrying Anchises, Askanios, women fleeing.	*CVA*, No 302926; Münich Antikensammlungen 9, 15-17, beilage B1, pls. 6.5, 7.1, 8.1-2; Beazley 1956, 392.10

B.2. Continuation

No	object type/collection	ware/origin/date	decoration	reference
36	Squat lekythos, Tübingen, Eberhard-Karls-Univ., Arch. Inst. E134	Attic red-figure, Athens, 475 – 425 BC	Body: Head of Perseus with Scythian cap and sickle.	*CVA*, No 214131; Tübingen, Antikensammlung der Universität 5, 91-92, pl. 43.6v7; Beazley 1963, 1009.8
37	Hydria, London, British Museum E181	Attic red-figure, Italy, 500 – 450 BC	Shoulder: Perseus running with sickle and head of Medusa in bag, Medusa decapitated, Athena running.	*CVA*, No 206339; London, British Museum 5, III.Ic.13, pl. 80.1; Beazley 1963, 555.96, 1659
38	Hydria, Rome, Mus. Naz. Etrusco di Villa Giulia 3556	Attic black-figure, Italy, 550 – 500 BC	Body: Perseus (named) with sickle killing Medusa, with snakes, Athena (named), Gorgons running. Shoulder: Chariot race.	*CVA*, No 320045; Roma, Museo Nazionale Etrusco di Villa Giulia 3, III.H.E.28, pls. 53.1-4, 54.1-3; Beazley 1956, 269.35

Coins of the Thracian rulers

No	object type	description	reference
39	Bronze coins of Hebryzelmis	obverse: Female head (Hera ?) r. wearing turreted crown reverse: Two-handled cylindrical vessel. Beneath ear of barley. On the vessel countermark, monogram HP. Around it EB/PY	Youroukova 1976, pl. VI.33; Тачева 2006, 130
40	Bronze coins of Hebryzelmis	obverse: Head of Apollo l., laureate with long hair reverse: Two-handled cylindrical vessel. Beneath ear of barley. Around it – E/B/P/Y	Youroukova 1976, pl. VI.36; Тачева 2006, 131
41	Bronze coins of Kersobleptes	obverse: Female head r. with hair tied at the back. reverse: K E P Two-handled vessel, beneath, barley corn	Youroukova 1976, pl. VIII.54-57
42	Bronze coins of Seuthes III	obverse: An eagle with folded wings, r. Border of dots reverse: Σ E Y Θ O Y Surrounded by wreath of barley ears	Youroukova 1976, pl. XIII.95-97; Димитров, Пенчев 1984, 27, обр. 36; No. 469-575; табло XIV.15-18; табла XV-XVIII; XIX.1-11
43	Bronze coin of Rhoemetalces I	obverse: ΚΑΙΣΑΡΟΣ Σ---- Bear headed bust of Augustus r. In front two countermarks. Above ear of barley; above it male head within linear square reverse: ----P—H--- ; Bust of Rhoemetalces I r.	Youroukova 1976, pl. XXII.176

APPENDIX C

CATALOGUE OF OLYNTHUS MILLS

The catalogue includes 52 examples of both upper and lower stones of Olynthus mills discovered in inland Thrace. The upper stones are arranged according to their type commencing with type I, followed by types II, III, IV and those in fragmentary state which type cannot be determined. The lower stones are presented at the end except for the specimens from Pet Mogili which form a pair. Each entry includes the discovery place, a description, dimensions, references, date, and type, when available. The plate number refers to the illustration and picture of the corresponding example. The abbreviations used for the measurements are: l. – length; w. – width; t. – thickness; h. – height; b. – base, d. – depth.

№ 1 **Plate I.1; XIV.1-2**

Site: Pet Mogili village, Shumen district; chance find; Regional Historical Museum Shumen, inv. No 2603

Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the short sides there are shallow slots situated opposite one another. On the exterior of the short sides, at 8,5 cm from the base, there is a horizontal groove, 2 cm wide. It passes through the whole length of the short sides.

Dimensions: l. b. – 46 cm; l. – 45 cm; w. b. – 32,5 cm; w. – 31 cm; t. – 13 cm; w. rim long side – 4 cm; w. rim short side – 7 cm; w. slot – 4 cm; l. slit – 25 cm; w. slit – 2 cm

Date: unknown

Type: **Ia1**

References: Атанасов 1982, 41-48

№ 2 **Plate I.2; XIV.1-2**

Site: Pet Mogili village, Shumen district; chance find; Regional Historical Museum Shumen, inv. No 2603

Description: A complete lower stone of a hopper-rubber with rectangular shape and slightly trapezoidal cross and longitudinal sections.

Dimensions: l. b. – 48 cm; l. – 49 cm; w. b. – 39 cm; w. – 40 cm; t. – 9,5 cm

Date: unknown

Type: **lower stone**

References: Атанасов 1982, 41-48

№ 3 **Plate II.3; XV.3**

Site: Discovered in the region of Yablanitsa; chance find; Museum collection Yablanitsa, inv. No 957a

Description: A completely preserved upper stone with almost square shape of the stone and the hopper, rounded edges. The sides are sloping inwards leading to a narrow slit. On the rim of the short sides there are shallow slots situated opposite one another. Below them, on the external sides, at 6 cm from the base, there is one horizontal shallow groove on each side. On the working (lower) surface, at one axis with the slit at its both sides there are grooves, each 6 cm long. Other striations are not visible.

Dimensions: l. – 38 cm; w. – 33 cm; t. – 12 cm; w. rim long side – 8 cm; w. rim short side – 7,5 cm; w. slot – 8,5; l. slit – 7 cm; w. slit – 1 cm; t. slit – 4 cm; l./w. side groove – 22/2 cm

Date: unknown

Type: **Ia1**

References: unpublished

№ 4 **Plate II.4; XV.4**

Site: Pistiros, no information about the context; Archaeological Museum "Prof. M. Domaradzki", Septemvri

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping gradually inwards. On the rim of two of the (short?) sides there are slots situated opposite one another. Below them, on the external sides, at 5,5 cm from the base, there is a horizontal groove on each side.

Dimensions: preserved l. – 46 cm; w. – 30 cm; t. – 16,5 cm; w. rim – 7 cm; w. side groove – 1 cm

Date: middle of the fifth – beginning of the second century BC[1]

Type: **Ia1**

References: unpublished

№ 5 **Plate III.5; XVI.5**

Site: Shuman***e***-Man***e***, Rakitovo; Historical Museum Velingrad

Description: Two fragments of an upper stone with square or rectangular shape of the stone and the hopper and sides slopping gradually inwards. On the rim of one of the short sides there is a partially preserved slot on the exterior of the short side, at approximately 3,5 cm from the base, there is a shallow horizontal groove.

Dimensions: preserved dimensions 22 x 38 cm; t. – 9,5 cm; w. rim – 11 x 5,5 cm; d. slot – 2 cm; w. groove – 1,5 cm;

Date: LIA

Type: **I(a?)1**

References: unpublished

№ 6 **Plate III.6; XVI.6**

Site: Shuman***e***-Man***e***, Rakitovo; Historical Museum Velingrad

[1] These are the dates of the site's existence. The same applies for N 12, 30 and 46.

Description: Small fragment of an upper stone with sides slopping gradually inwards and a partially preserved slot on the rim on the exterior of the preserved side, approximately 2 cm below the rim, there is a horizontal groove.

Dimensions: preserved l. – 17,5 cm; preserved w. – 10, 5cm; t. – 8 cm; w. rim – 7,5 cm; d. groove – 0,2 cm; w. groove – 1,7 cm; d. slot – 0,6 cm

Date: LIA

Type: **I(a?)1**

References: unpublished

№ 7 **Plate IV.7; XVII.7**

Site: Seuthopolis; discovered in a house; Historical Museum "Iskra", Kazanluk

Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the two short sides there are slots situated opposite one another. On the exterior of one of the short sides, below the slot, there is a depression with irregular shape. On the working (lower) surface there are visible striations. They present short horizontal lines, starting from the slit and perpendicular to it.

Dimensions: l. – 50 cm; w. – 44 cm; t. – 11,5 cm; w. rim short side – 10 cm; w. rim long side – 6 cm; w. slot – 7 cm; w. slit – 1,8 cm; l. slit – 23 cm

Date: end of the fourth – middle of the third century BC

Type: **Ia2**

References: Димитров 1958, 177, *обр*. 45, 47; Dimitrov, Čičikova 1978, 15, fig. 35

№ 8 **Plate IV.8; XVII.8**

Site: Akandzhievo village, Pazardzhik district; chance find; Archaeological Museum "Prof. M. Domaradzki", Septemvri, inv. No 1.1651

Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the two short sides there are slots situated opposite one another. On the exterior of the short sides, below the slots, at 1 cm from the base, there is a trapezoidal depression, one on each side.

Dimensions: l. – 48 cm; w. – 42 cm; t. – 17 cm; w. rim short side – 8 cm; w. rim long side – 6 cm; w. slot – 3 cm; l. slit – 17 cm; w. slit – 3 cm; side depression: h. – 2 cm; w. 2,5/2 cm

Date: unknown

Type: **Ia2**

References: Катинчарова 2005, 188-193

№ 9 **Plate V.9; XVII.9**

Site: Cheshnegirovo village, Plovdiv district; chance find; Regional Archaeological Museum Plovdiv, inv. No 4138a

Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the two short sides there are slots situated opposite one another. On the exterior of one of the short sides, below the slot, at 4 cm from the base, there is a small depression (w. – 3 cm; h. – 2 cm; 2 cm deep). On the working (lower) surface there are herringbone striations, visible around the slit.

Dimensions: l. b. – 40 cm; l. – 39 cm; w. – 35 cm; t. – 14 cm; w. rim short side – 6,5 cm; w. rim long side – 3 cm; w. slot – 6 cm; l. slit – 20 cm; w. slit – 2 cm

Date: unknown

Type: **Ia2**

References: unpublished

№ 10 **Plate V.10; XVIII.10**

Site: Haskovo region; chance find; Regional Historical Museum Haskovo

Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the two short sides there are slots situated opposite one another. On the lateral short side beneath the slot, at 2 cm from the base, there is a depression with trapezoidal shape.

Dimensions: l. – 53 cm; w. – 36 cm; t. – 9 cm; w. rim short side – 8 cm; w. rim long side – 5 cm; w. slot – 5 cm; w. slit – 1 cm

Date: unknown

Type: **Ia2**

References: unpublished

№ 11 **Plate VI.11; XVIII.11**

Site: Mikroyazovira; Historical Museum Velingrad

Description: Fragment of an upper stone with rectangular shape of the stone and the hopper. The sides are slopping gradually inwards. On the rim of the two short sides there are two slots situated opposite one another, partially preserved. On the exterior of one of the short sides, 2 cm from the base, there is a hole.

Dimensions: preserved l. – 20 cm; w. – 29,5 cm; t. – 8,7 cm; w. rim – 6 x 8 cm; d. slot – 1,5 cm; w. hole – 1,5 cm; d. hole – 1,5 cm

Date: LIA

Type: **Ia2**

References: unpublished

№ 12 **Plate VI.12; XVIII.12**

Site: Pistiros, ABI, from sifting, Archaeological Museum "Prof. M. Domaradzki", НСФ 3248

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper, granite. The sides are sloping gradually inwards leading to a slit. On the rim there is one preserved slot. On the exterior side, below the slot, 4,5 cm from the base, there is a hole for securing the handle.

Dimensions: preserved dimensions 23x15,5x14 cm; w. rim – 5; 7 cm; d. slot – 1 cm; d. hole – 3 cm

Date: middle of the fifth – beginning of the second

century BC
Type: **Ia(?)2**
References: unpublished

№ 13 **Plate VI*I*.13**
Site: Trigrad, Devin district; chance find; Museum collection Trigrad
Description: Fragment of an upper stone with square shape of the stone and the hopper. Rounded edges. The sides are sloping gradually inwards leading to a slit. On the rim of the two short sides there are slots situated opposite one another. Between the rim and the hopper there is a positive edge.
Dimensions: l. – 40 cm; w. – 32 cm; t. – 7,5 cm; w. rim – 5 cm; w. slot – 4,5 cm; l. slot – 5 cm
Date: unknown
Type: **Ia3**
References: Делчев и др. 2005

№ 14 **Plate V*II*.14; XIX.14**
Site: Seuthopolis, Historical Museum "Iskra", Kazanluk
Description: Two fragments of an upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the two short sides there are slots situated opposite one another.
Dimensions: l. – 37 cm; w. – 35 cm; t. – 10,5 cm; w. rim short side – 8,5 cm; w. rim long side – 9,5 cm; w. slot – 10,5 cm; w. slit – 3 cm; l. slit – 20, 5 cm
Date: end of the fourth – middle of the third century BC
Type: **Ia3**
References: unpublished

№ 15 **Plate VII.15; XIX.15**
Site: Pistiros, ABI, sq. A13, in the pithos, Archaeological Museum "Prof. M. Domaradzki", Septemvri, НСФ 4400
Description: Preserved half of an upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards. On the rim of the two short sides there are slots situated opposite one another. Parallel to the rim on the preserved long side there is a 1 cm wide shallow incision running along the rim.
Dimensions: preserved w. – 23,5 cm; l. – 46 cm; t. – 9 cm; w. rim - 8 cm; d. slots – 1,5 cm
Date: second half of the fourth century BC
Type: **Ia3**
References: unpublished

№ 16 **Plate XIX.16**
Site: Debnevo, Troyan district; chance find; Museum collection Debnevo
Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit. On the rim of two of the sides there are slots situated opposite one another.
Dimensions: not available
Date: unknown
Type: **Ia3**
References: unpublished

№ 17 **Plate VIII.17; XX.17**
Site: Babyashka Chuka peak sanctuary, Babyak, municipality of Belitsa; discovered in the stone heap in the western periphery; Museum collection Belitsa
Description: A completely preserved upper stone with rectangular shape. The hopper has an almost square shape and is very shallow. The sides are sloping gradually inwards leading to a narrow slit. On the rim of the two long sides there are slots situated opposite one another. Roughly made.
Dimensions: l. – 48 cm; w. – 32 cm; t. – 9,5 cm; w. rim short side – 13 cm; w. rim long side – 9 cm; w. slot – 3 cm; w. slit – 0,5 cm
l. slit – 11, 5 cm
Date: second – first century BC
Type: **Ia3**
References: Тонкова 2007, 51-85, обр. 11; 2008, 102

№ 18 **Plate VIII.18; XX.18**
Site: Babyashka Chuka peak sanctuary, Babyak, municipality of Belitsa; discovered in the stone heap in the western periphery; Museum collection Belitsa
Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping gradually inwards. On the two long sides there are slots situated opposite one another.
Dimensions: preserved l. – 23 cm; w. – 34,5 cm; t. – 7,5 cm; w. rim short side – 13 cm; w. rim long side – 7/11 cm; w. slot – 3 cm
Date: second – first century BC
Type: **Ia3**
References: Тонкова 2007, 51-85; 2008, 102

№ 19 **Plate VIII.19; XX.19**
Site: Babyashka Chuka peak sanctuary, Babyak, municipality of Belitsa; discovered in the stone heap in the western periphery; Museum collection Belitsa
Description: A completely preserved upper stone with rectangular shape and rounded edges. The sides are sloping gradually inwards leading to a narrow slit. The hopper has an almost square shape and is very shallow. On the rim of the two long sides there are slots situated opposite one another. Roughly made.
Dimensions: l. – 48 cm; w. – 36 cm; t. – 10,5 cm; w. rim short side – 14 cm; w. rim long side – 9 cm; w. slot – 3 cm; w. slit – 1 cm; l. slit – 11 cm
Date: second – first century BC
Type: **Ia3**
References: Тонкова 2007, 51-85; 2008, 102

№ 20
Site: Dragoyna peak, Purvomai district; discovered in the destructions of the surrounding wall

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping gradually inwards. On the rim there are slots situated opposite one another.

Dimensions: l. – 43 cm; preserved w. – 19 cm; t. – 11 cm; w. rim – 6 cm

Date: fourth – middle of the third century BC

Type: **Ia**

References: Божинова, Андонова 2010, 138

№ 21 **Plate IX.21; XXI.21**

Site: Discovered in the region of Yablanitsa; chance find; Museum collection Yablanitsa, inv. No 957b

Description: A completely preserved upper stone with almost square shape of the stone and the hopper. Rounded edges. The sides are sloping gradually inwards leading to a narrow slit. On the exterior of the two short sides, at 4 cm from the base, there is a shallow horizontal groove, one at each side. On the working (lower) surface, at one axis with the slit at its both sides there are grooves, 8 and 9 cm long. No other striations are visible.

Dimensions: l. b. – 36 cm; l. – 33 cm; w. – 33 cm; t. – 9 cm; w. rim – 8 cm; l. slit – 7 cm; w. slit – 1,5 cm; t. slit – 3 cm; l. side groove – 18 cm; w. side groove – 2 cm

Date: unknown

Type: **Ib1**

References: unpublished

№ 22 **Plate IX.22**

Site: Sboryanovo, 107/24; inv. No 67

Description: Almost complete upper stone with rectangular shape of the stone and the hopper and rounded edges. The sides are sloping gradually inwards forming a shallow hopper and leading to a slit.

Dimensions: l. – 27 cm; w. – 22 cm; t. – 4 cm; w. rim – 3 cm; l. slit – 7 cm; w. slit – 1,5 cm; t. slit – 2 cm

Date: end of the fourth – middle of the third century BC

Type: **Ib3**

References: unpublished

№ 23 **Plate IX.23**

Site: Ada Tepe peak sanctuary, Krumovgrad; Regional Historical Museum Kurdzhali

Description: Two fragments of an upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a slit.

Dimensions: l. – 24 cm; w. – 21,5 cm; t. – 5 cm; w. rim long side – 3 cm; w. rim short side – 2,5 cm; l. slit – 10 cm; w. slit – 3,5 cm

Date: end of the fourth century BC

Type: **Ib3**

References: unpublished

№ 24 **Plate IX.24**

Site: Ada Tepe peak sanctuary, Krumovgrad; Regional Historical Museum Kurdzhali

Description: A completely preserved upper stone with rectangular shape of the stone and the hopper. The sides are sloping almost perpendicularly inwards forming a shallow hopper.

Dimensions: l. – 24 cm; w. – 19 cm; t. – 7,5 cm; w. rim – 2,5 cm; l. slit – 9 cm; w. slit – 2 cm

Date: end of the fourth century BC

Type: **Ib3**

References: unpublished

№ 25 **Plate IX.25; XXI.25**

Site: Cheshnegirovo, Plovdiv district; chance find; Regional Archaeological Museum Plovdiv, inv. No 4138b

Description: A completely preserved upper stone with square shape of the stone and the hopper. The sides are sloping gradually inwards leading to a narrow slit.

Dimensions: l. – 35 cm; w. – 34 cm; t. – 13 cm; w. rim – 5 cm; l. slit – 14 cm; w. slit – 1,5 cm

Date: unknown

Type: **Ib3**

References: unpublished

№ 26 **Plate X.26; XXII.26**

Site: Seuthopolis; discovered in a house; Historical Museum "Iskra", Kazanluk

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping gradually inwards. Made from gritstone.

Dimensions: l. – 47 cm; preserved w. – 22 cm; t. – 11,2 cm; w. rim short side – 7 cm; w. rim long side – 6,5 cm

Date: end of the fourth – middle of the third century BC

Type: **I**

References: Димитров 1958, 177, обр. 44

№ 27 **Plate X.27; XXII.27**

Site: Madzharovo, Haskovo district; chance find; Museum collection Madzharovo

Description: Fragment of an upper stone with rectangular shape of the stone and the hopper. The sides are sloping gradually inwards. On the exterior of the preserved short side, at 5 cm from the base, there is a horizontal groove 2 cm wide.

Dimensions: preserved l. – 26 cm; w. – 16 cm; t. - 10, 5 cm; w. rim – 3 cm

Date: unknown

Type: **I**

References: unpublished

No 28 **Plate X.28; XXII.28**

Site: Kaleto peak, Kostandovo; Historical Museum Velingrad

Description: Two fragments of an upper stone with almost square shape of the stone and the hopper. The sides are slopping gradually inwards. On the

exterior of one of the short sides, at approximately 3 cm from the base, there is a shallow horizontal groove.

Dimensions: l. – 33,5 cm; preserved w. – 17 cm; t. – 8,2 cm; w. rim – 5,6 x 10 cm; d. groove – 0,2 x 0,7 cm; w. groove – 2 cm

Date: LIA

Type: **I**

References: Салкин, Байраков 2009, 198-200; 2010, 20, обр. 11.

No 29 **Plate X.29; XXII.29**

Site: Shuman***e***-Man***e***, Rakitovo; Historical Museum Velingrad

Description: Fragment of an upper stone with possible square or rectangular shape and sides slopping gradually inwards. No preserved slots on the rim.

Dimensions: preserved dimensions 32,5 cm x 19 cm; t. – 7,2 cm; w. rim – 12 x 6,2 cm

Date: LIA

Type: **I**

References: unpublished

No 30 **Plate XI.30; XXIII.30**

Site: Pistiros, ABI, sq. A14, on the surface, Archaeological Museum "Prof. M. Domaradzki", Septemvri, НСФ 2542

Description: Fragment of an upper stone with square or rectangular shape and sides slopping gradually inwards, volcanic tuff. No preserved slots on the rim.

Dimensions: preserved dimensions 19,6 x 18,7 cm; t. – 12,2 cm

Date: middle of the fifth – beginning of the second century BC

Type: **I**

References: unpublished

No 31 **Plate XI.31; XXIII.31**

Site: Pistiros, sq. A3, SW part, context 302, negative structure in the SW corner, between the stones, Archaeological Museum "Prof. M. Domaradzki", Septemvri, НСФ 6925

Description: Fragment of an upper stone with possible square or rectangular shape and sides slopping gradually inwards. No preserved slots on the rim.

Dimensions: preserved dimensions 19 x 17 x 10 cm

Date: end of the first quarter of the fourth – beginning of the third century BC

Type: **I**

References: unpublished

No 32 **Plate XI.32; XXIII.32**

Site: Pistiros, sq. A3, SE part, 4th layer, Archaeological Museum "Prof. M. Domaradzki", Septemvri, НСФ 6923

Description: Fragment of an upper stone with possible square or rectangular shape and sides slopping gradually inwards. No preserved slots on the rim.

Dimensions: preserved dimensions: 14 x 24 cm; t. – 19,4 cm; w. rim – 6 cm; t. at the slit – 6 cm

Date: end of the first quarter of the fourth – beginning of the third century BC

Type: **I**

References: Лазов 2010, 204

No 33 **Plate XI.33; XXIII.33**

Site: Pistiros, sq. A8, 5th layer, Archaeological Museum "Prof. M. Domaradzki", Septemvri, НСФ 5131

Description: Fragment of an upper stone with possible square or rectangular shape and sides slopping gradually inwards. No preserved slots on the rim.

Dimensions: preserved dimensions 23,5 cm x 17,5 cm; t. – 11 cm

Date: fourth century BC

Type: **I ?**

References: unpublished

№ 34 **Plate XII.34; XXIV.34**

Site: Pit complex at Svilengrad; sq. J 70, pit No 29, W half; depth – 0,75 m; Museum collection Svilengrad

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping steeply inwards. On the exterior of one of the sides there is one horizontal and one zigzag incised line, 1 cm wide.

Dimensions: preserved dimensions – 19/15 cm; t. – 8,1 cm; w. rim – 5,1 cm

Date: LIA

Type: **II**

References: Нехризов 2006, табло 22/4, кат. No 18

№ 35 **Plate XII.35; XXIV.35**

Site: Pit complex at Svilengrad; sq. K 81, pit No 58, SW half; depth – 0,30 m; Museum collection Svilengrad

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping steeply inwards.

Dimensions: preserved dimensions – 33,5/20 cm; t. – 10 cm; w. rim – 2,5 cm

Date: LIA

Type: **II**

References: Нехризов 2006, табло 37/1, кат. No 19

№ 36 **Plate XII.36; XXIV.36**

Site: Orlova Chuka, Haskovo district; chance find

Description: Fragment of an upper stone with rectangular or square shape of the stone and the hopper. The sides are sloping steeply inwards.

Dimensions: preserved dimensions – 16/ 10,5 cm; t. – 4,6 cm; w. rim – 3,5 cm

Date: unknown

Type: **II**

References: unpublished

№ 37 **Plate XII.37; XXIV.37**

Site: Pit complex at Svilengrad; sq. J 60, pit No 78; Museum collection Svilengrad

Description: Fragment of an upper stone with square shape of the stone and the hopper. The sides are slopping almost steeply inwards leading to a narrow slit.

Dimensions: l. – 30 cm; w. – 28 cm; t. – 6,5 cm; w. rim – 7,5 cm; t. slit – 2 cm; w. slit – 1 cm

Date: LIA

Type: **IIb**

References: Нехризов 2008, 369, табло 23.3, кат. No 11

№ 38 **Plate XII.38; XXIV.38**

Site: Nova Zagora region, surface find; Regional Historical Museum Nova Zagora, inv. No 3228

Description: A completely preserved upper stone with almost square shape of the stone and the hopper. The sides are sloping steeply inwards. A small rectangular slit in the middle. One corner broken.

Dimensions: l. – 22 cm; l. b. – 23 cm; w. b. – 22 cm; w. – 21 cm; t. – 4,5 cm; w. rim – 4,25 cm; l. slit – 2,8 cm; w. slit – 1,5 cm

Date: unknown

Type: **IIb3**

References: unpublished

№ 39 **Plate XIII.39**

Site: Ada Tepe peak sanctuary, Krumovgrad; one fragment discovered in the Hellenistic stratum; the others come from the destructions of the wall; Regional Historical Museum Kurdzhali

Description: Three fragments forming an upper stone with rectangular shape. The hopper is butterfly-shaped. The sides are sloping gradually inwards leading to a slit. On the rim of the two long sides there are slots situated opposite one another.

Dimensions: l. – 27,5 cm; w. – 23,5 cm; t. – 4,8 cm; w. rim short side – 2,5 cm; w. slot – 2 cm; l. slot – 5 cm; l. slit – 11 cm

Date: end of the fourth century BC

Type: **IIIa3**

References: unpublished

№ 40 **Plate XIII.40; XXV.40**

Site: Seuthopolis, Historical Museum "Iskra", Kazanluk

Description: A completely preserved upper stone with irregular shape of the stone and the hopper. The sides are sloping gradually inwards leading to a short and narrow slit with ellipsoidal shape. On the rim on one of the long sides there is a shallow slot.

Dimensions: l. – 47 cm; w. – 30 cm; t. – 8,2 cm; w. rim short side – 12 cm; w. rim long side – 6 cm; w. slot – 6 cm; l. slot – 7 cm; l. slit – 5 cm; w. slit – 1,5 cm

Date: end of the fourth – middle of the third century BC

Type: **IVc3**

References: unpublished

№ 41 **Plate XIII.41; XXV.41**

Site: Shipka necropolis, tumulus 93; Historical Museum "Iskra", Kazanluk inv. No 1591

Description: A completely preserved upper stone with almost square shape. On the rim on two of the opposite sides there are slots. The sides are sloping almost perpendicularly inwards forming a square hopper. The slit is with round shape. On the exterior of the sides, below the slots there are shallow grooves (l. – 23 cm; w. – 2 cm).

Dimensions: l. – 27,5 cm; w. – 26 cm; t. – 10 cm; w. rim – 9 cm; w. slot – 4 cm; diam. slit – 6 cm

Date: LIA

Type: **IVa3**

References: unpublished

№ 42

Site: Pit complex at Svilengrad; sq. K 91, pit No 32, S half; depth – 1,11 m; Museum collection Svilengrad

Description: Fragment of an upper stone. The sides are sloping perpendicularly inwards.

Dimensions: preserved dimensions – 12,3/8,7 cm; t. – 4,6 cm; w. rim – 7 cm

Date: LIA

Type: fragmentary state

References: Нехризов 2006, 433, табло 24/4, кат. No 17

№ 43

Site: Pit complex at Svilengrad; sq. K 83/ K 84, pit No 8, E half; depth – 0,29 m.; Museum collection Svilengrad

Description: Fragment of an upper stone with square shape of the stone and the hopper. The sides are sloping gradually inwards.

Dimensions: preserved dimensions – 12,4 / 12,6 cm; t. – 5,1 cm

Date: LIA

Type: fragmentary state

References: Нехризов 2006, 425, кат. No 16

№ 44 **Plate XXV.44**

Site: St. Ilia peak; Historical Museum Velingrad

Description: Small fragment of an upper stone with a rim and sides slopping gradually inwards.

Dimensions: preserved l. – 15,8 cm; preserved w. – 18 cm; t. – 8,5 cm; w. rim – 6 cm

Date: LIA

Type: fragmentary state

References: unpublished

№ 45 **Plate XXV.45**

Site: Shuman***e***-Man***e***, Rakitovo; Historical Museum Velingrad

Description: Small fragment of an upper stone with a rim and sides slopping gradually inwards.

Dimensions: preserved l. – 18 cm; preserved w. – 14 cm; t. – 6 cm; w. rim – 6 cm

Date: LIA

Type: fragmentary state

References: unpublished

№ 46

Site: Pistiros, ABI, sq. A4, Archaeological Museum "Prof. M. Domaradzki", Septemvri, НСФ 4399

Description: Almost completely preserved lower stone with rectangular shape. On the working surface there are parallel striations perpendicular to the long sides. They are almost completely erased by the working process. There are arch-shaped lines, result of the movement of the upper stone, crossing the parallel striations.

Dimensions: l. – 58 cm; w. – 42 cm; t. – 16,5 cm

Date: middle of the fifth – beginning of the second century BC

Type: **lower stone**

References: unpublished

№ 47

Site: Pistiros, sq. A4, pit K444, layers 12-14, Archaeological Museum "Prof. M. Domaradzki", Septemvri

Description: Lower stone in the shape of rectangular flat prism. The upper surface has parallel lines perpendicular to the long sides. There are also arch-shaped incisions, result of the movement of the upper stone.

Dimensions: 64 x 44 cm; t. – 12 cm

Date: second quarter of the fourth century BC

Type: **lower stone**

References: Лазов 2017, 155.

№ 48

Site: Sboryanovo, central trench, 106/20

Description: Fragment of a lower stone

Dimensions: not available

Date: end of the fourth – middle of the third century BC

Type: **lower stone**

References: Стоянов и др. 2009, 233, обр. 3.20.

№ 49

Site: Sboryanovo, central trench, 106/9

Description: Fragment of a lower stone. Only one corner is preserved. It has a rectangular shape. On the working (upper) surface there are small pits with irregular shape - traces from use. On the lateral and lower surfaces there are traces of chisel used in the shaping of the stone. Made of volcanic rock.

Dimensions: preserved l. – 19, 5 cm; preserved w. – 13 cm; t. – 7 cm

Date: end of the fourth – middle of the third century BC

Type: **lower stone**

References: unpublished

№ 50

Site: Lovets village, Shumen region; discovered in a pit with LIA materials

Description: Two fragments forming a complete lower stone with rectangular shape. The edges are well smoothened. The working surface is flattened and shows furrows made with an awl. The striations are crosswise to the corners of the stone forming a rhomb in the middle. Slightly convex in the middle, result of wearing out.

Dimensions: l. – 40 cm; w. – 26 cm; t. – 2 cm

Date: LIA

Type: **lower stone**

References: Атанаосв 1982, 43, табло I.1

№ 51

Site: Dragoevo village, Shumen region, discovered during field survey

Description: Half of a lower stone with rectangular shape. The edges are well smoothened. Striations in herring-bone pattern divided in the centre by a vertical line.

Dimensions: preserved l. – 13 cm; w. – 26 cm; t. – 2,5 cm

Date: unknown

Type: **lower stone**

References: Атанасов 1982, 43, табло I.4

№ 52

Site: Dragoevo village, Shumen region, discovered during field survey

Description: A completely preserved lower stone with rectangular shape. The edges are well smoothened. Striations on the working surface situated crosswise to the corners of the stone forming a rhomb in the middle.

Dimensions: l. – 37cm; w. – 28 cm

Date: unknown

Type: **lower stone**

References: Атанасов 1982, 43, табло II.5

FIGURES



Fig. 1. Map of Thrace with the main geographical features



Fig. 2. Major archaeological sites mentioned in the text



Fig. 3. Sites with archaeobotanical samples from LIA Thrace

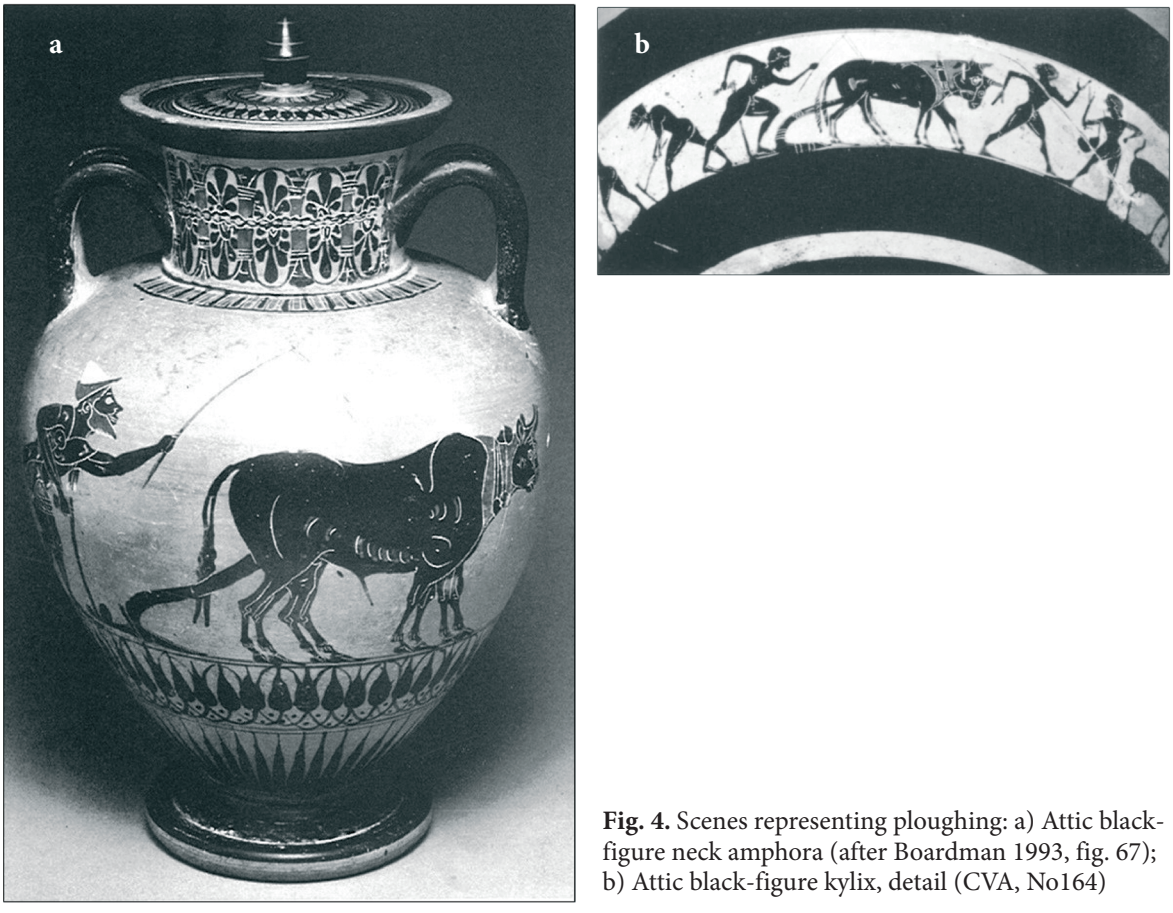


Fig. 4. Scenes representing ploughing: a) Attic black-figure neck amphora (after Boardman 1993, fig. 67); b) Attic black-figure kylix, detail (CVA, No164)

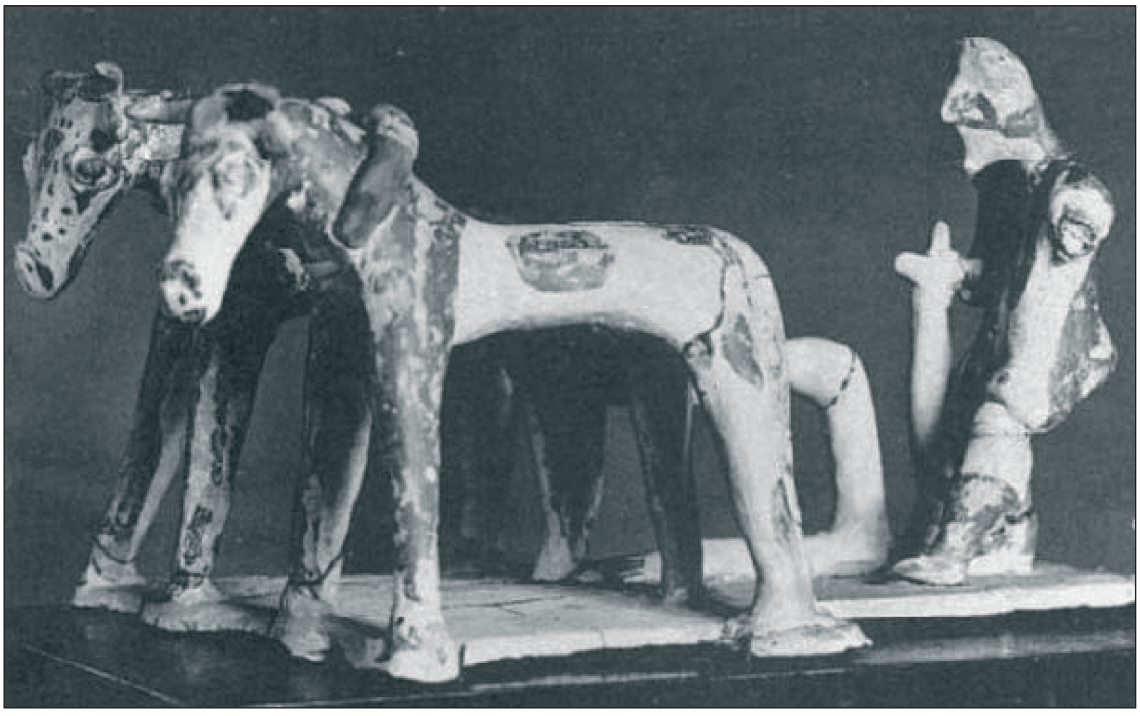
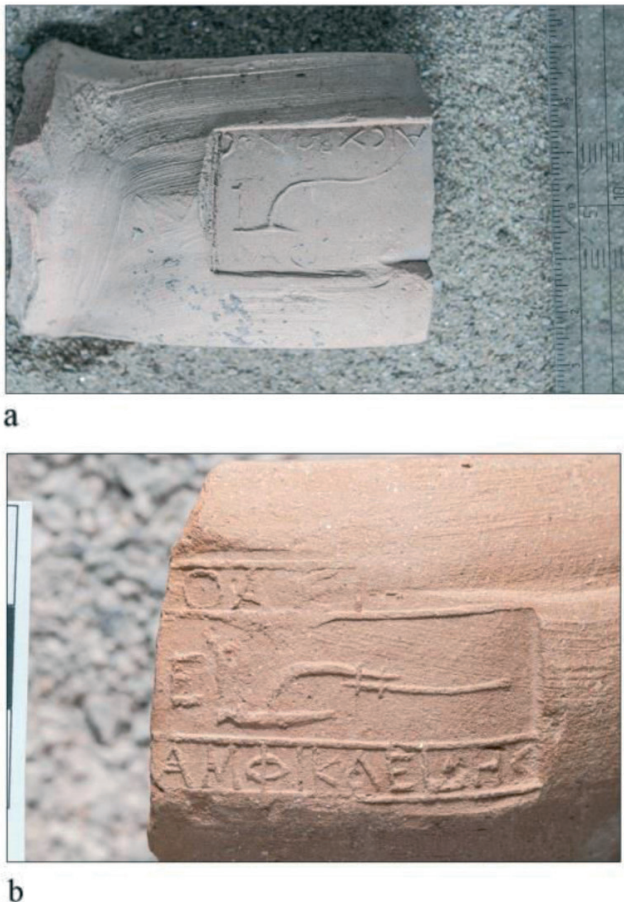


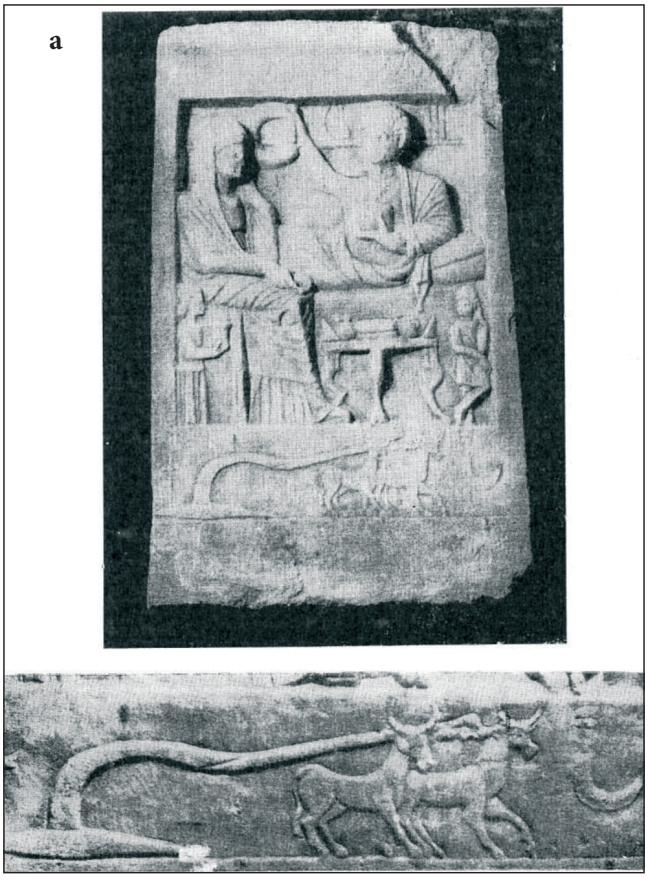
Fig. 5. A terracotta statuette from Boeotia representing a ploughman with a pair of oxen (after Isager, Skydsgaard 1992, pl. 3.1)

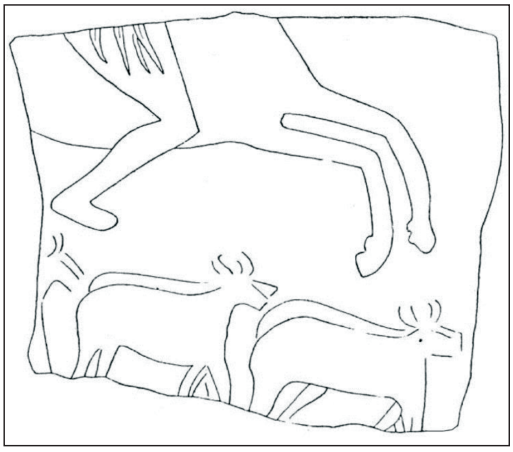


a

b

Fig. 6. Amphora stamps representing an ard: a) Thasos; b) the Athenian Agora (photo Ch. Tzochev)





b

Fig. 7. Reliefs on funerary stelae from Thrace: a) funerary feast (after Венедиков 1981, обр. 28); b) part of a relief of the Thracian horseman (after Seure 1912, fig. 29)

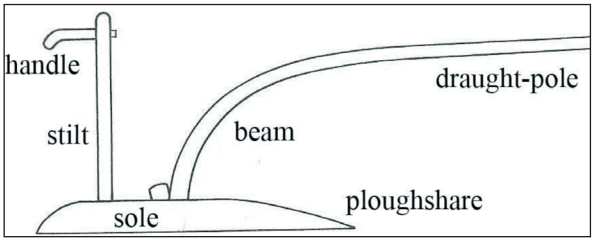


Fig. 8. Construction elements of an ard (after Isager, Skydsgaard 1992, fig. 3.1)

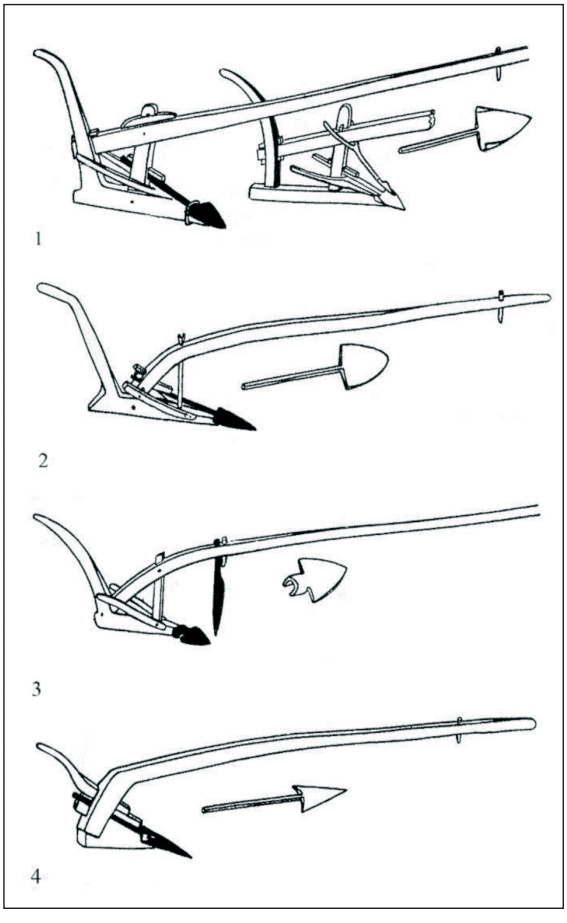


Fig. 9. Types of wooden ard in Bulgaria (after Вакарелски 2007, обр. 34-38)



Fig. 10. Finds of spoon-shaped iron ploughshares in inland Thrace

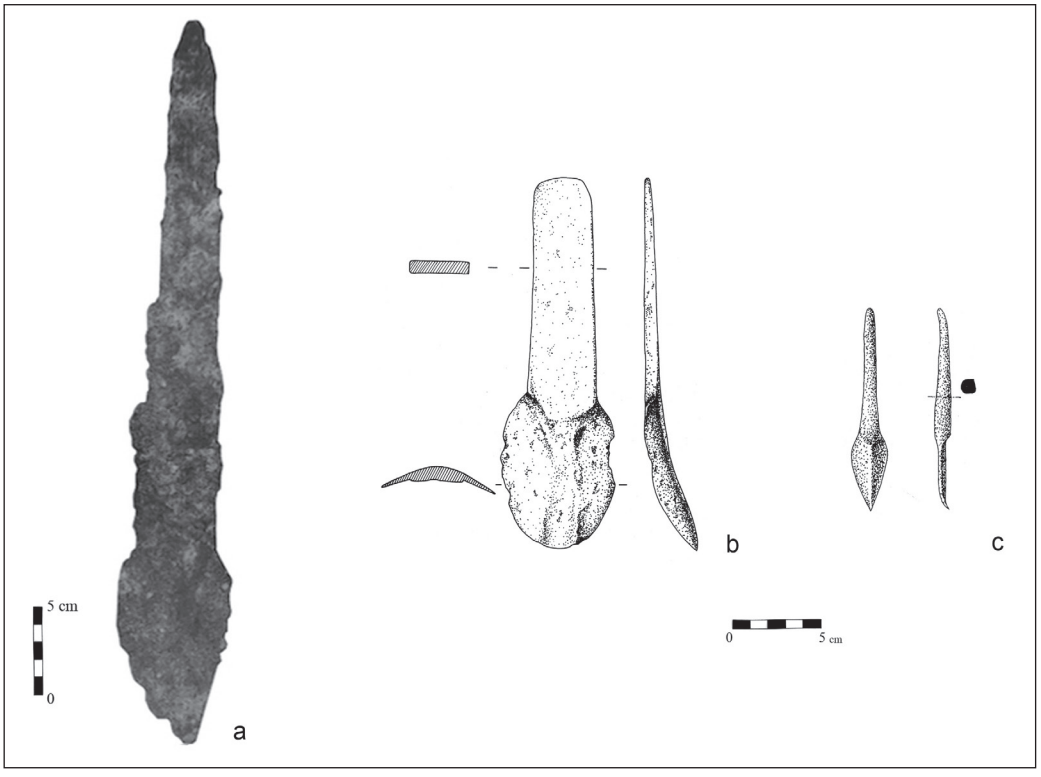


Fig. 11. Iron ploughshares from: a) Kaloyanovo (after Чичикова 1969, 60, обр. 16); b) Sboryanovo (after Стоянов 2000, 19, обр. 25.2); c) Debelt (after Балабанов 1999, 69, 71, обр. 12)

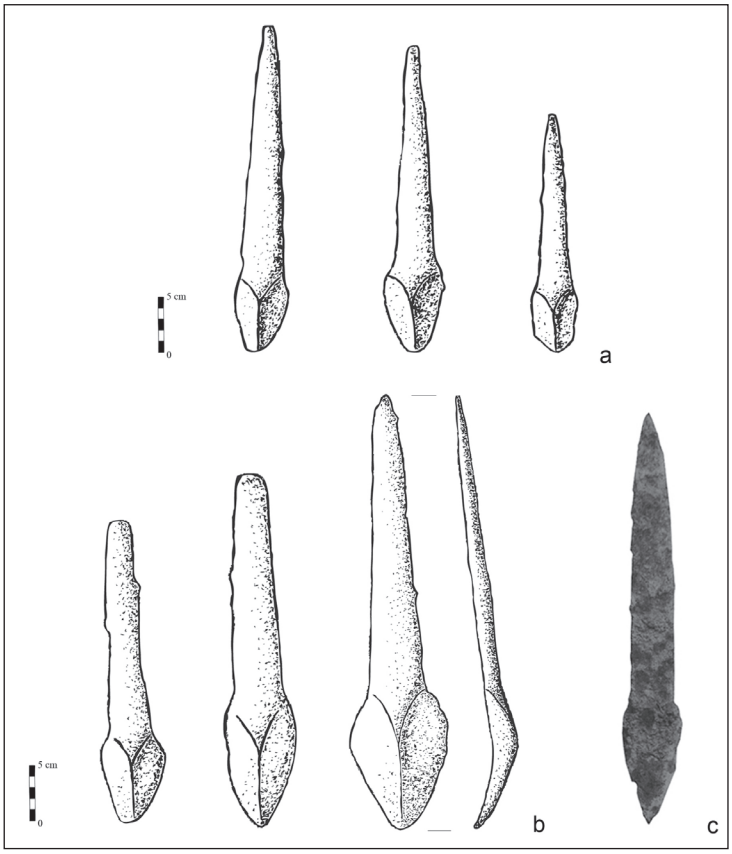


Fig. 12. Iron ploughshares from: a) Uste (after Милчев 1961, 421, обр. 5); b) Seuthopolis (after Чангова 1972, 38-39, обр. 23, 24); c) Seuthopolis necropolis (after Čičikova 1968, 120-121, fig. 4)



Fig. 13. Finds of hoes in inland Thrace

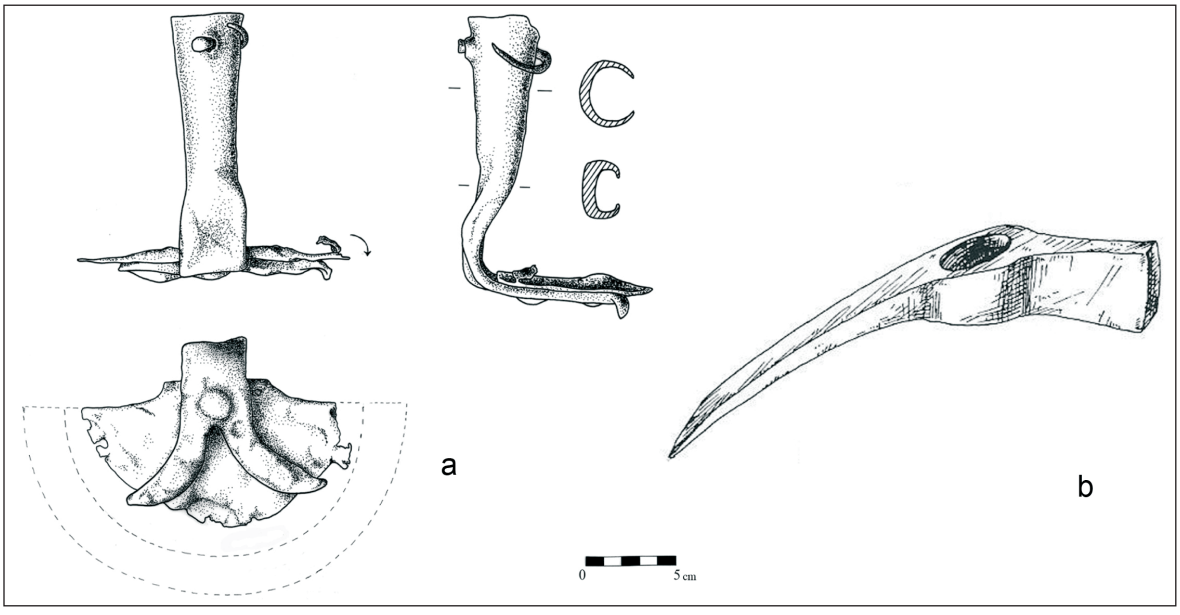


Fig. 14. Hoes from: a) Sboryanovo (after Стоянов 2000, 19, обр. 25.6); b) an axe-mattock from Babyashka Chuka (after Tonkova 2005, 179, tabl. II.12)



Fig. 15. Scene on an Attic black-figure amphora representing Perseus with a sickle (CVA, No 302926)

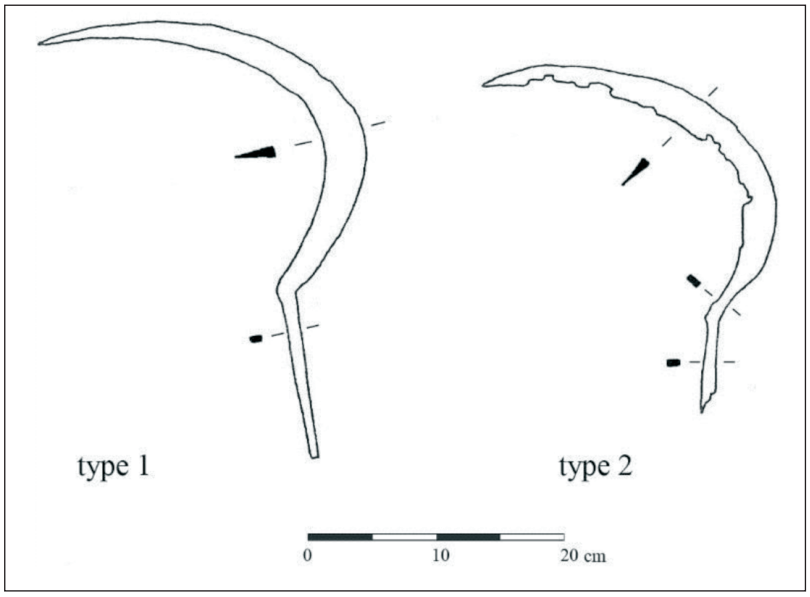


Fig. 16. Sickles: 1 – non-serrated; 2 – serrated (after Чолаков 2010, обр. 58)



Fig. 17. Finds of iron sickles in inland Thrace

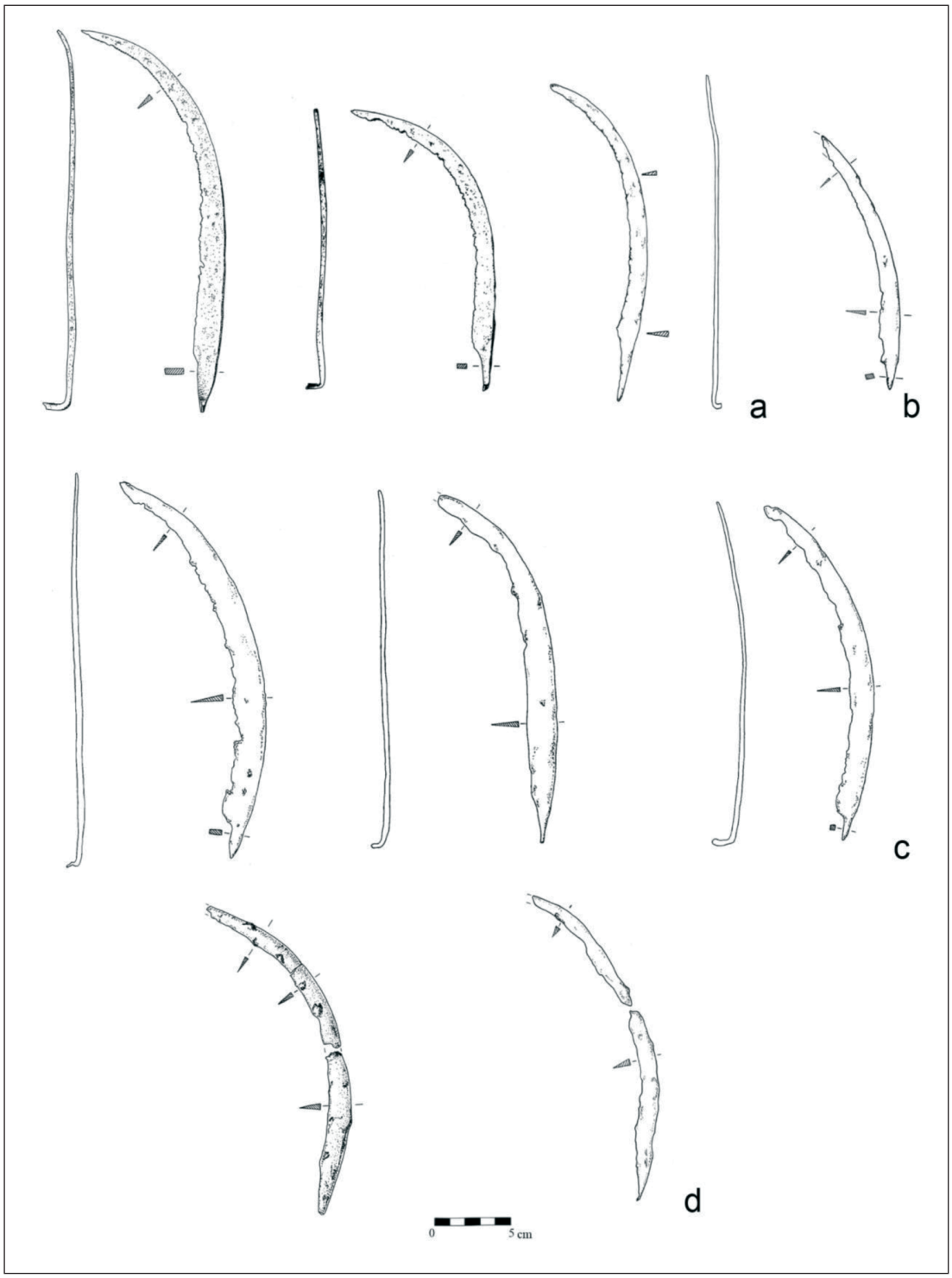


Fig. 18. Sickles from: a) Sboryanovo (after Андонова 2013, 353, обр. 2.4-6); b) Pistiros (after Андонова 2013, 353, обр. 2.1); c) Babyashka Chuka (after Андонова 2013, 353, обр. 2.7-9); d) Ada Tepe (after Андонова 2013, 353, обр. 2.2-3)

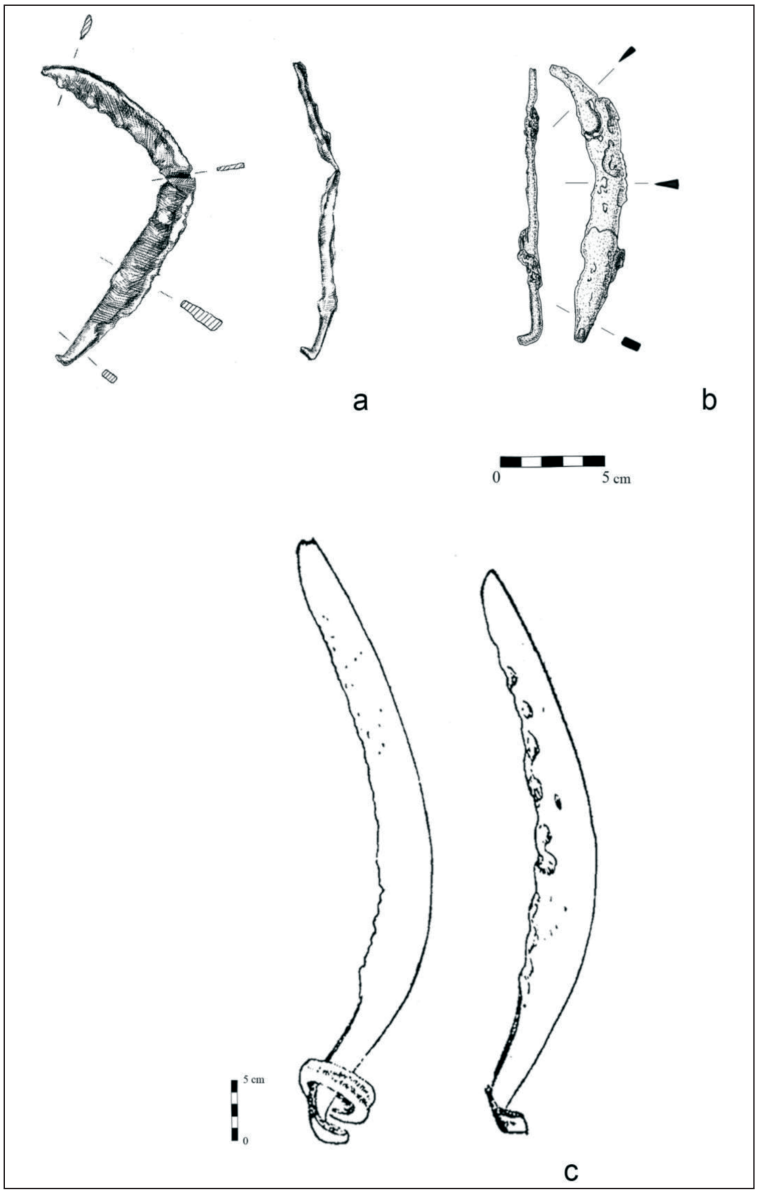


Fig. 19. Sickles from: a) Bada Bunar (after Камишева, Колева 2008, 160, обр. 2; b) Svilengrad (after Нехризов 2006, 494, табло 34/1); c) Hristo Danovo (after Детев 1968a, 147, обр. 12.1)

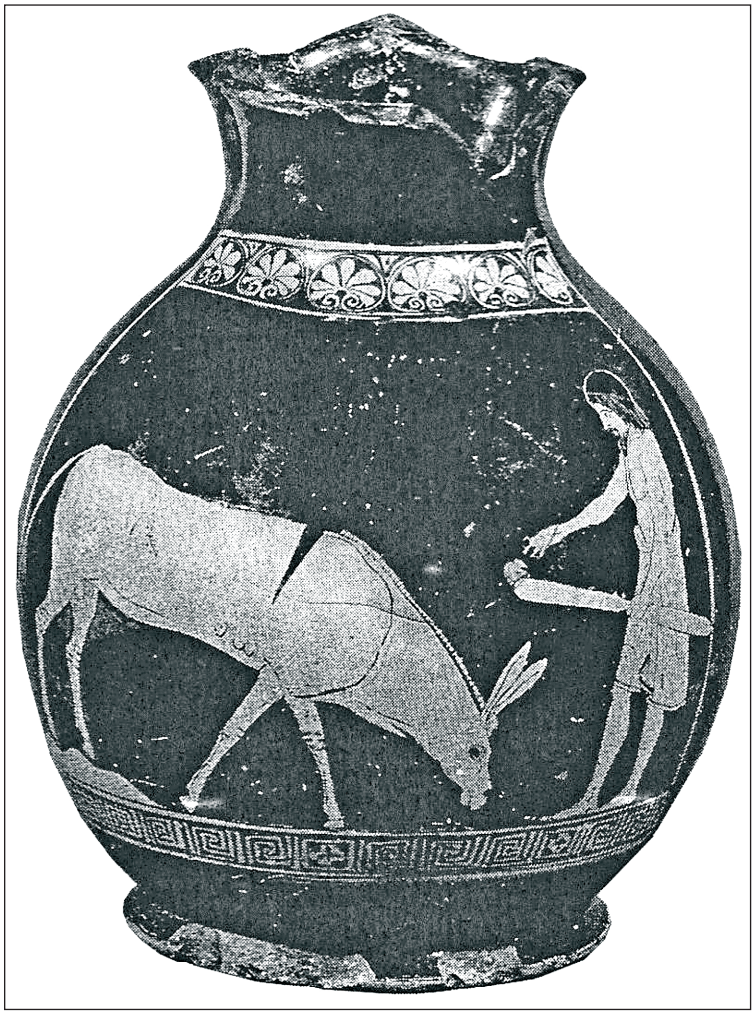


Fig. 20. Attic red-figure chous representing a mule on a threshing floor (after Boardman 1994, fig. 90)

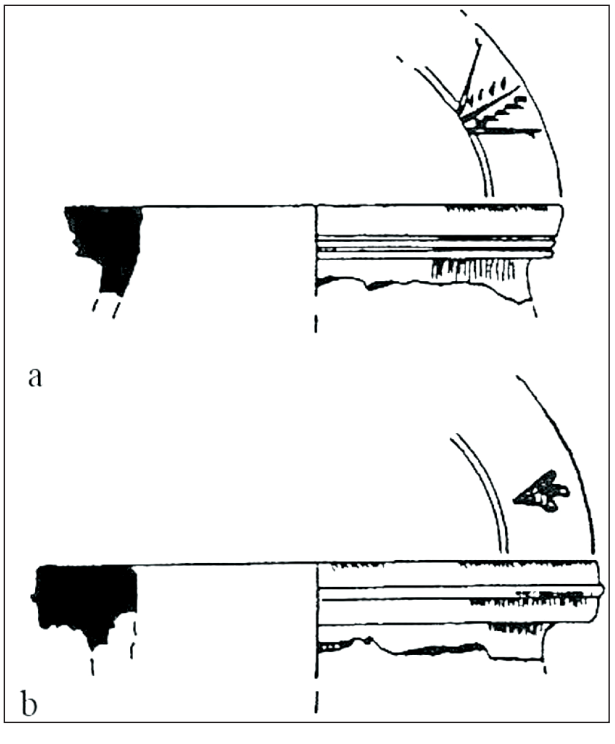


Fig. 21. Pithoi from Koprivlen with stamped motif representing an ear of wheat (after Hadjiangelov 2005, figs. 2/3; 2/4)

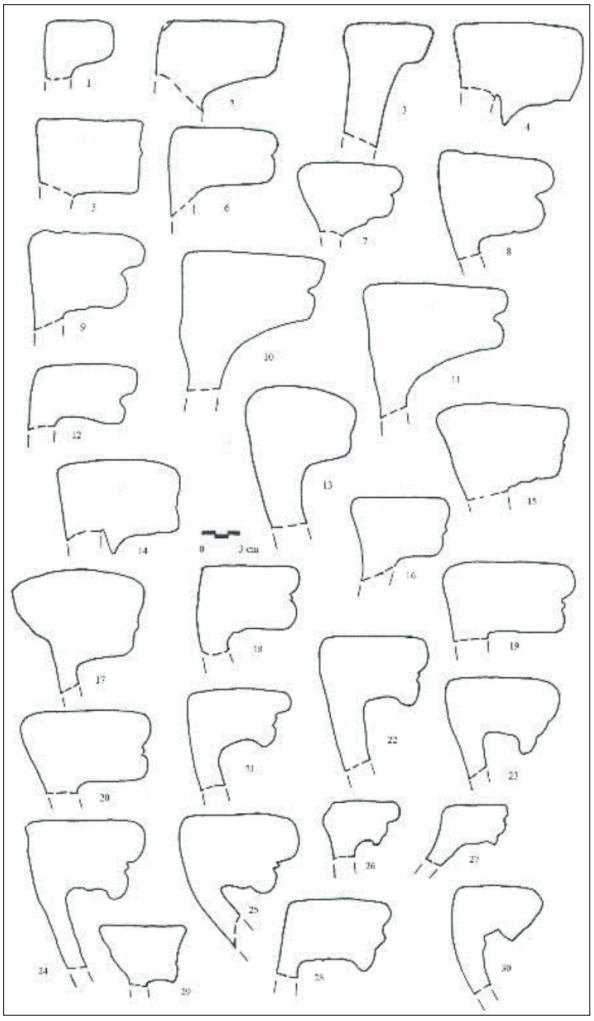


Fig. 22. Profiles of mouths of pithoi from Pistiros (after Lazov 1999, fig. 1)

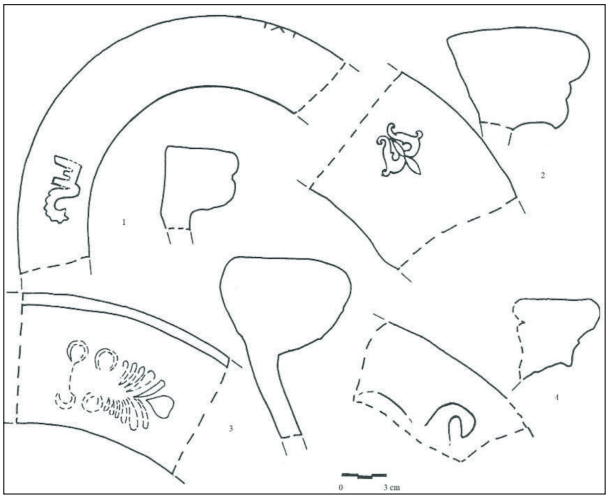


Fig. 23. Stamps on mouths of pithoi from Pistiros (after Lazov 1999, fig. 3)



Fig. 24. Signs on mouths of pithoi from Pistiros (after Lazov 1999, fig. 2)

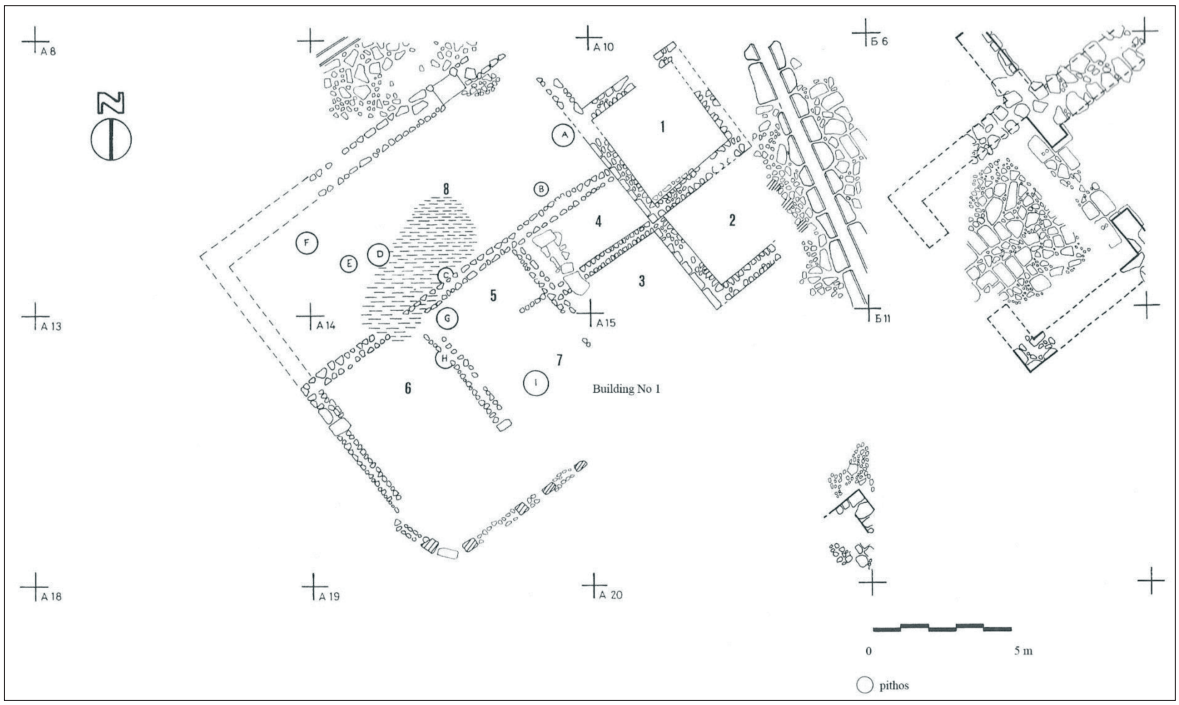


Fig. 25. Plan of Building No 1 at Pistiros showing the concentration of pithoi (after Lazov 1999, fig. 4)





Fig. 26. Pithoi from Seuthopolis (after Čičikova 1958, figs. 1-2)



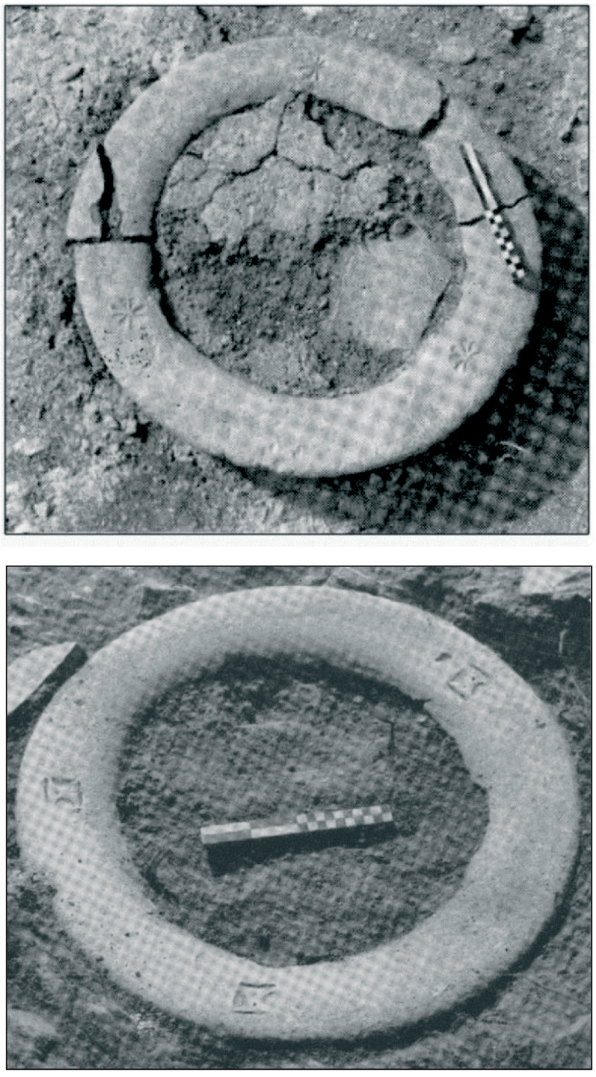


Fig. 27. Stamps on pithoi from Seuthopolis representing various depictions: a) rosettes (after Čičikova 1958, figs. 11; 13); b) rectangular with incised semicircles (after Čičikova 1958, fig. 14)

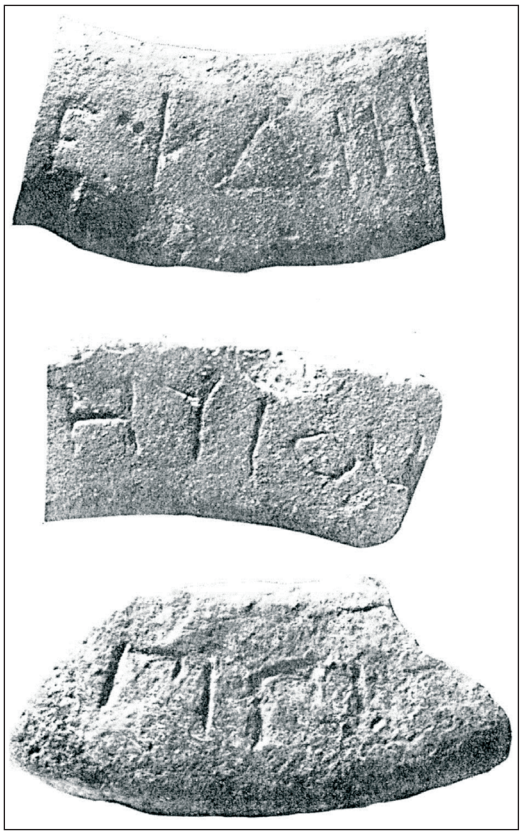


Fig. 28. Incised letters on pithoi – Seuthopolis (after Чичикова1984, табло XIII)

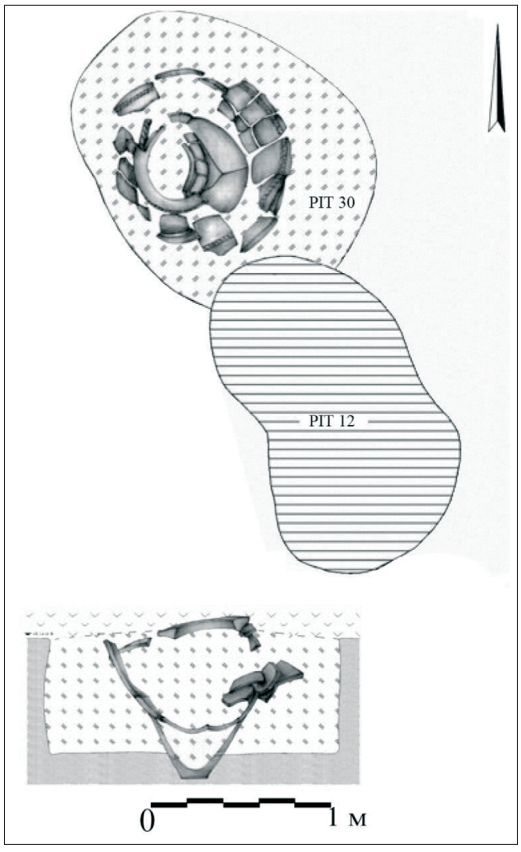


Fig. 29. Pit-pithos from Svilengrad (after Нехризов 2006, табло 10)

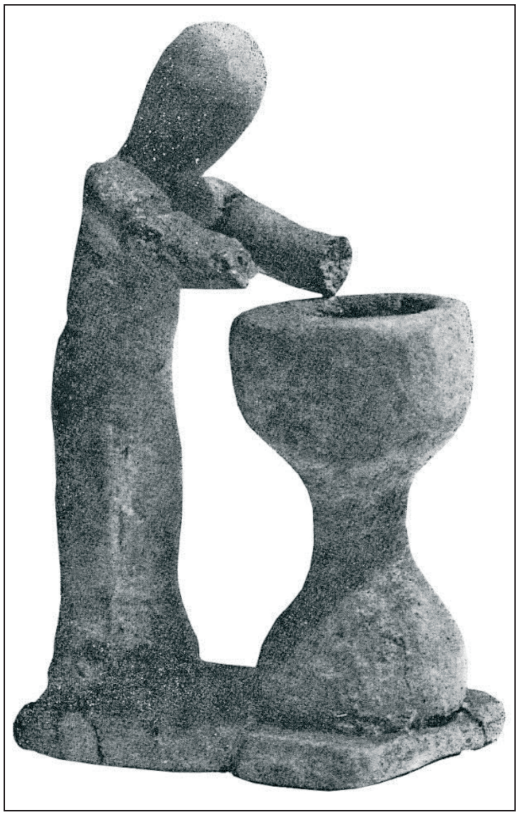


Fig. 31. A terracotta statuette of a standing woman grinding, pounding or kneading, Apollonia Pontica (after Дремсизова-Нелчинова, Тончева 1971, обр. 50)



Fig. 30. Limestone statuette of a woman grinding on a saddle quern, Gizeh necropolis, 23th c. BC (after Роков 2007, обр. 5)

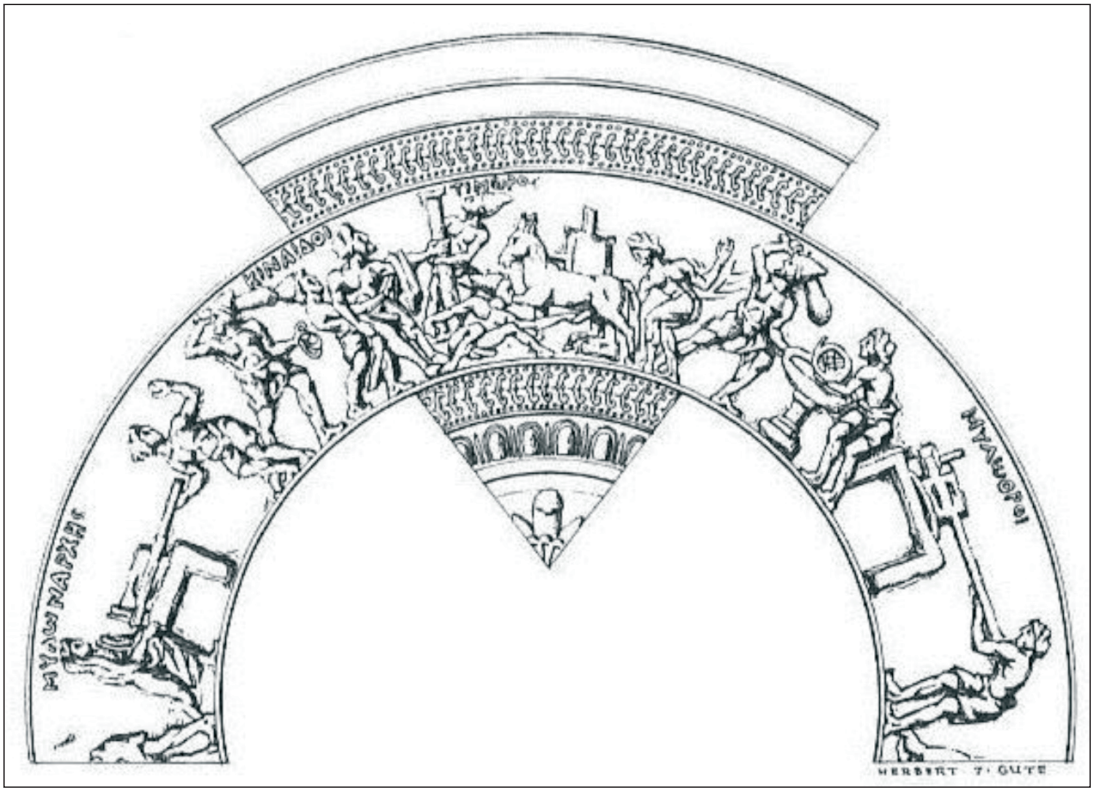


Fig. 32. Relief on a Megarian bowl (after Rostovtzeff 1937, fig. 1)

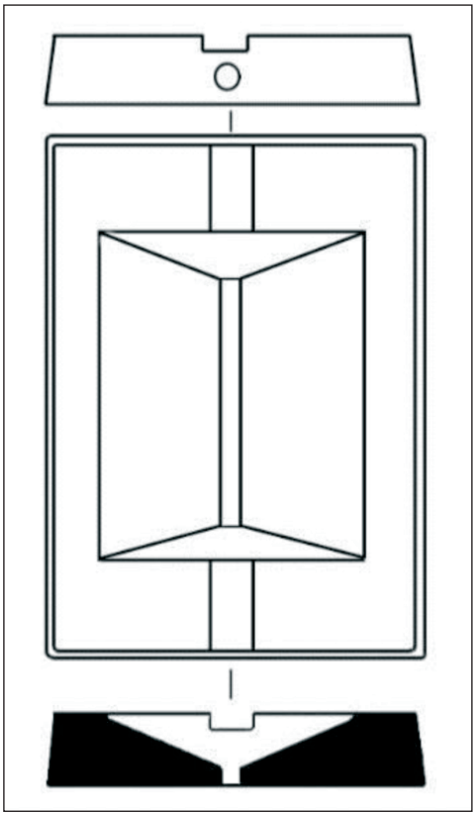


Fig. 33. Olynthus mill – upper stone

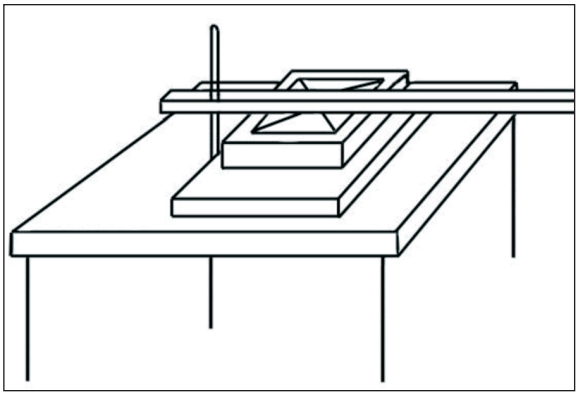


Fig. 34. Olynthus mill – working principle (after Kourounites 1917, fig. 3)

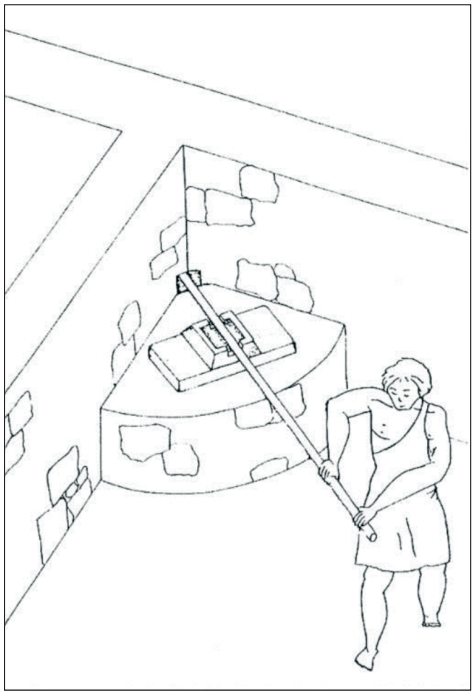
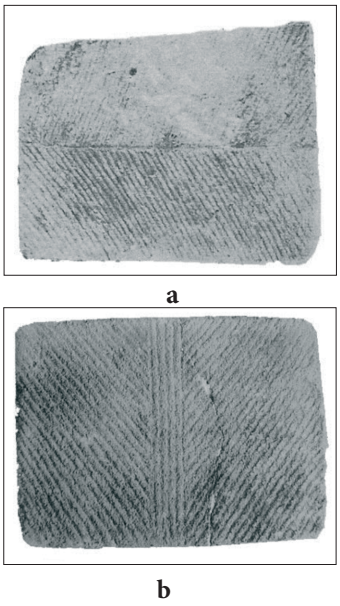


Fig. 35. Operation of Olynthus mill as at Gamla (after Frankel 2003, fig. 6)



a

b

Fig. 36. Striations on the working surface: a) herringbone pattern – Olynthus (after Robinson, Graham 1938, pl. 79.5); b) herringbone and parallel lines – Delos (after Deona 1938, pl. XLVIII. 366)

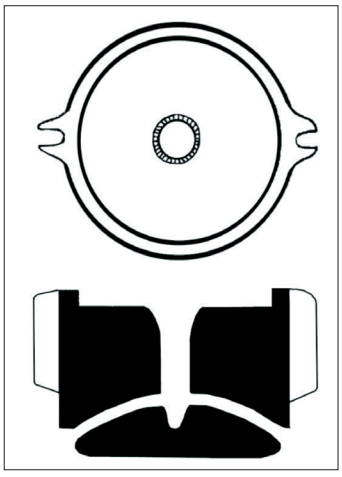


Fig. 38. Spanish mill (after Childe 1943, fig. 1)

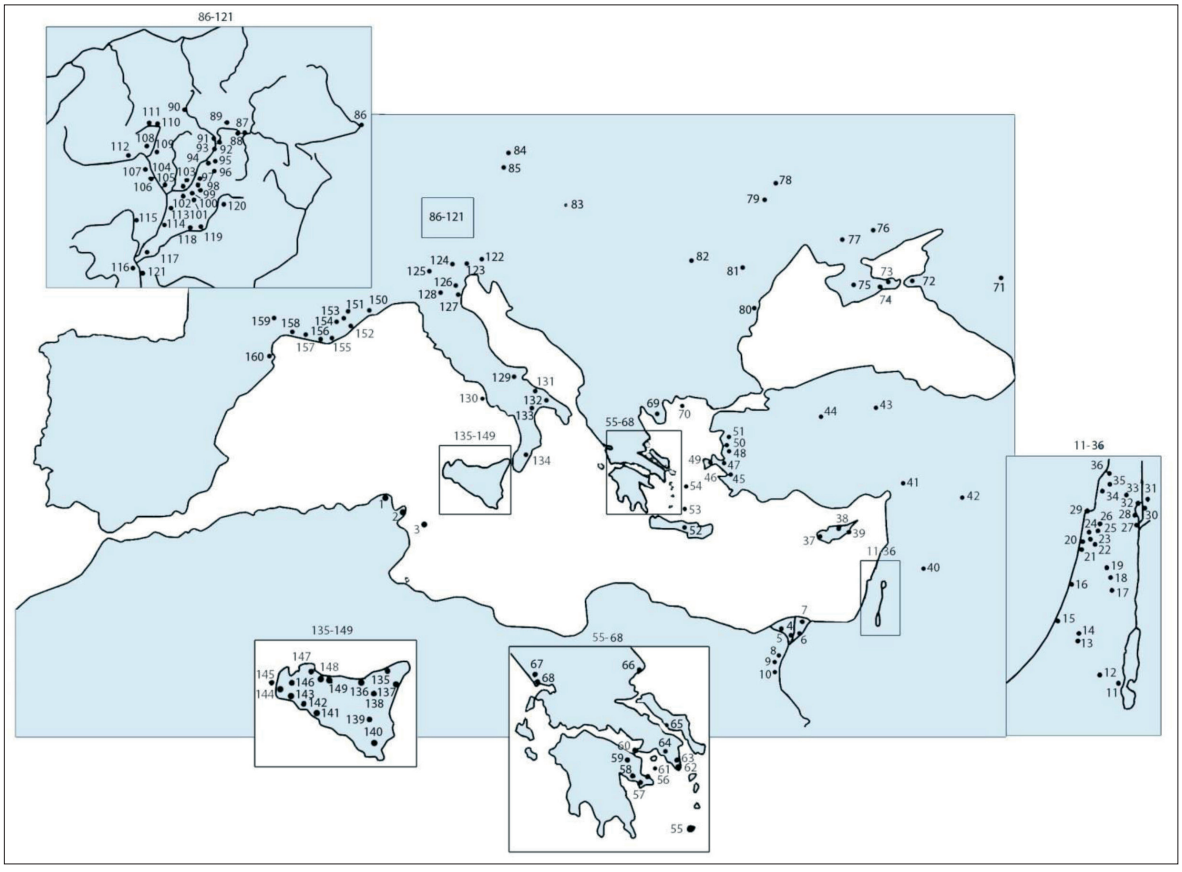


Fig. 37. Distribution of hopper-rubbers (after Frankel 2003, fig. 1)



Fig. 39. Distribution of hopper-rubbers in inland Thrace

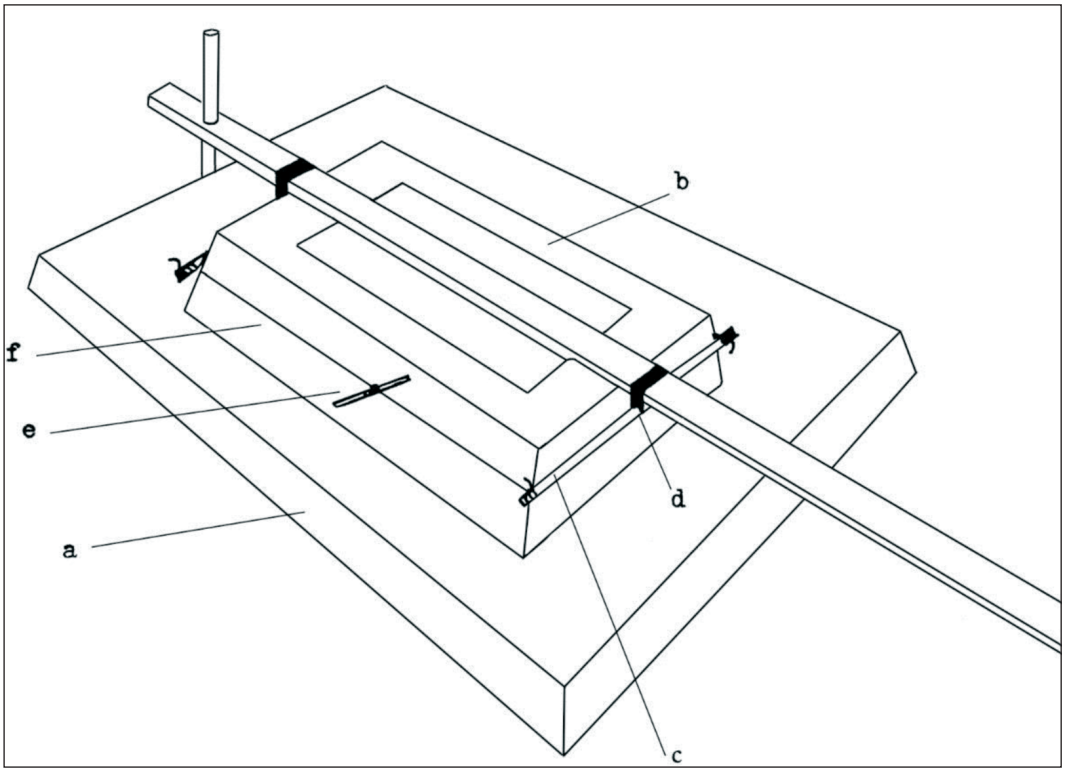


Fig. 40. Additional devices for securing the handle (after White 1963, fig. 9)



Fig. 41. Upper stone of Olynthus mill from pit No 78 at Svilengrad



Fig. 42. Olynthus mill and saddle querns from Ada Tepe

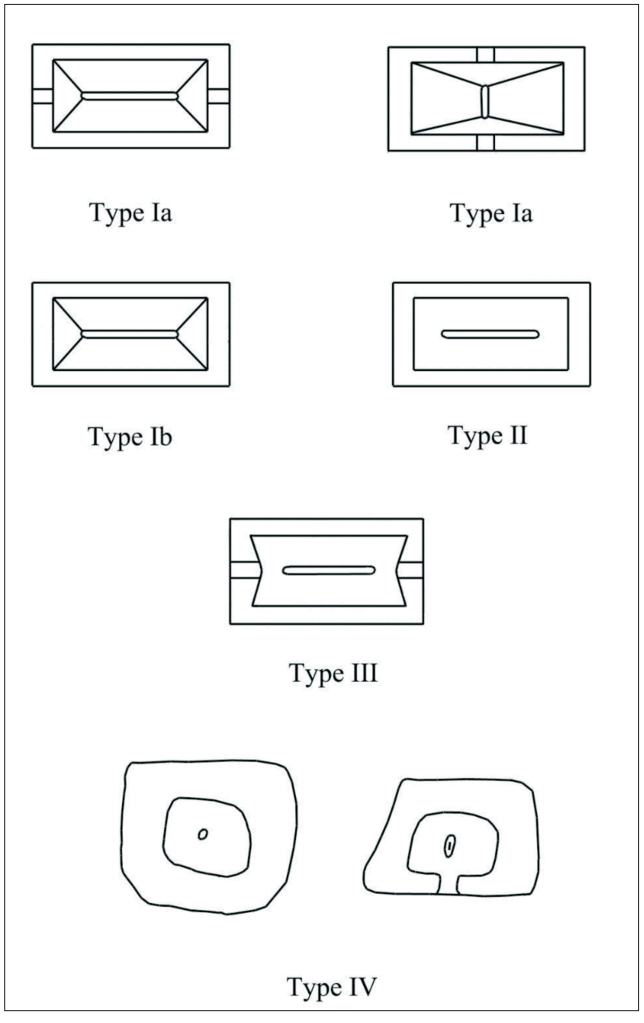


Fig. 43. Types of upper stones of hopper-rubbers in Thrace

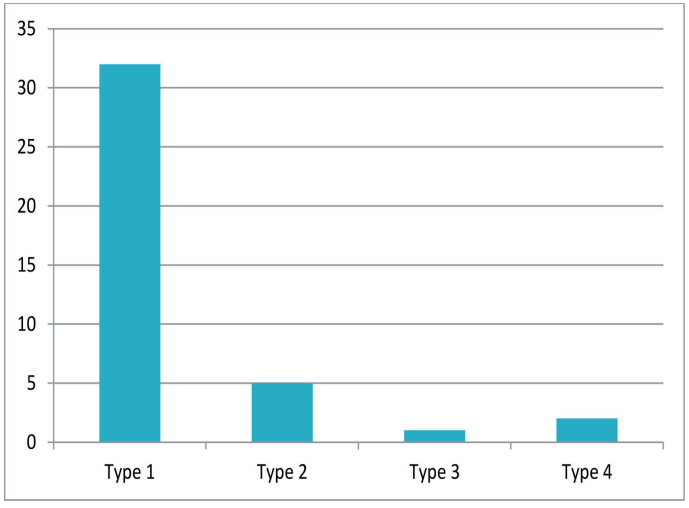


Fig. 44. Quantitative distribution of types of upper stones in Thrace

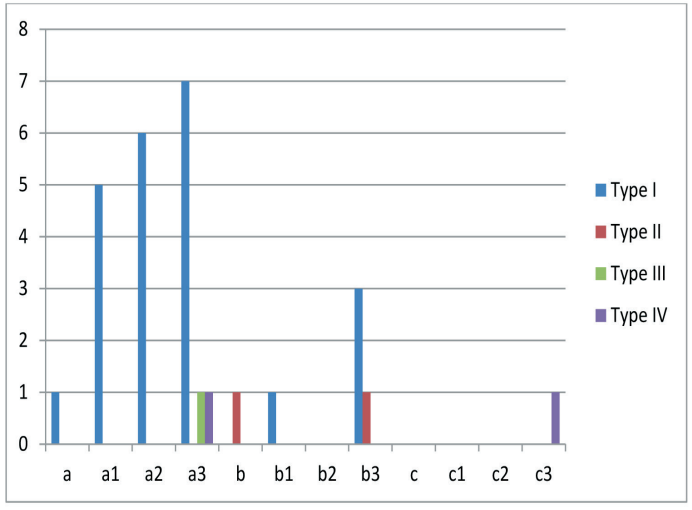


Fig. 45. Quantitative distribution of subtypes and variants

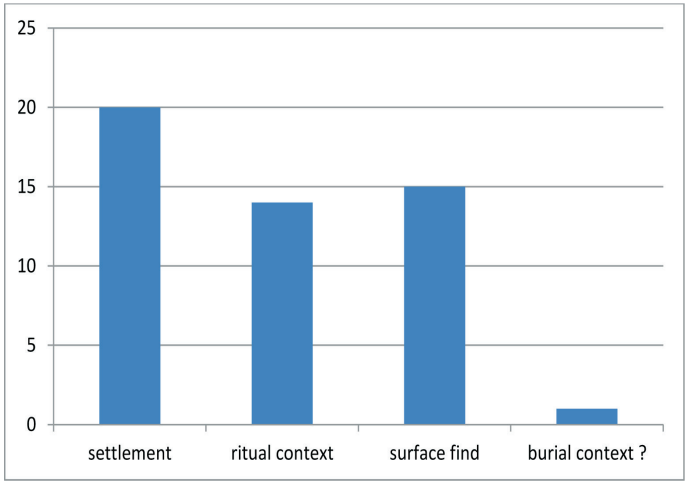


Fig. 46. Quantitative distribution of upper stones according to the discovery context

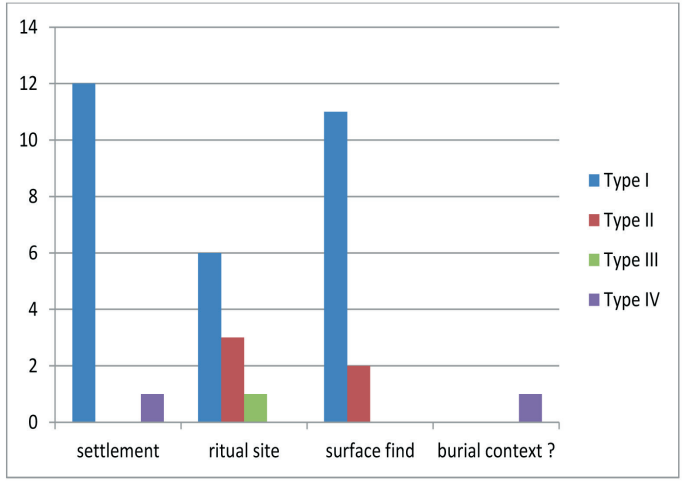


Fig. 47. Quantitative correlation between discovery context and types of upper stones

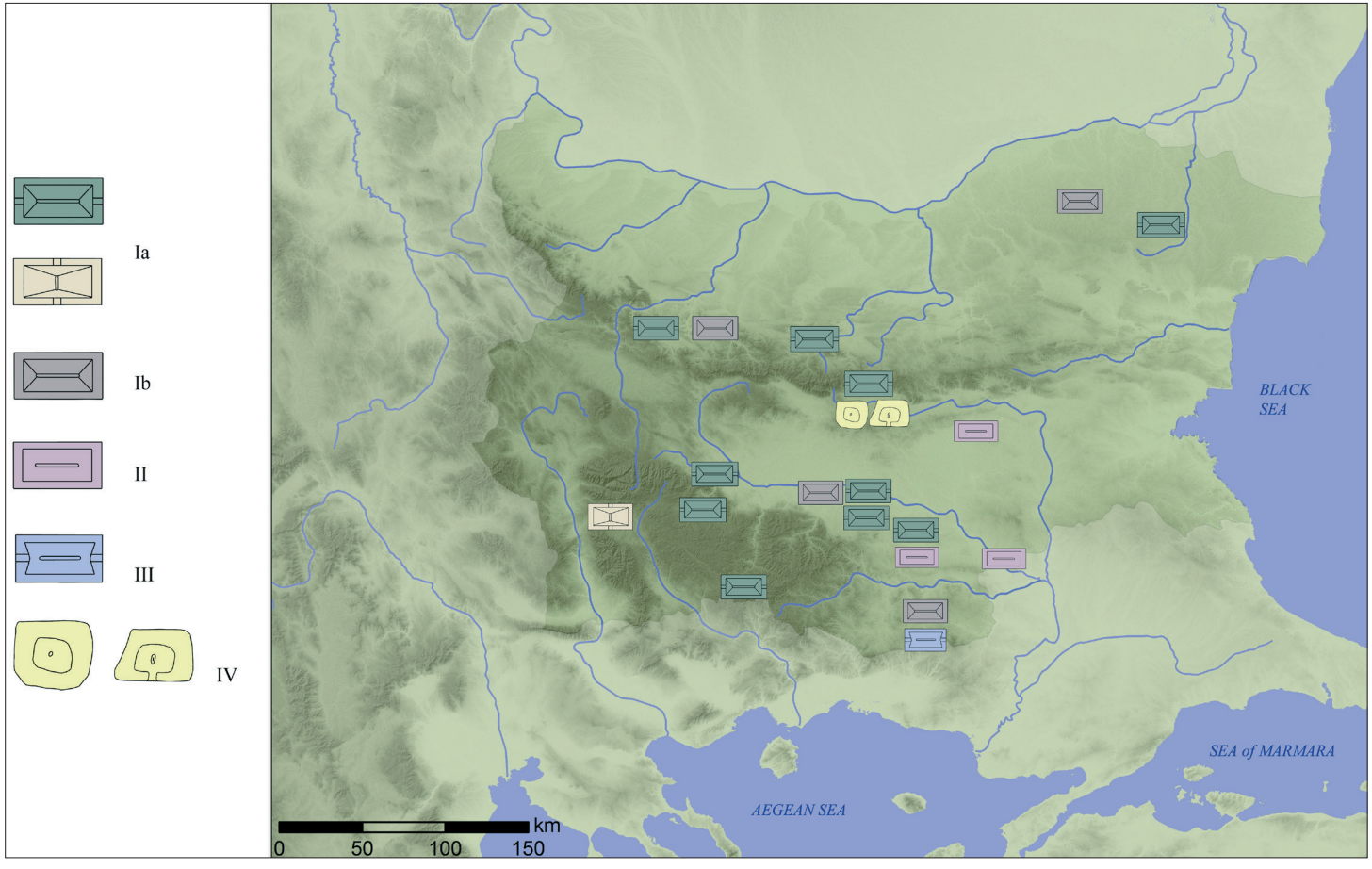
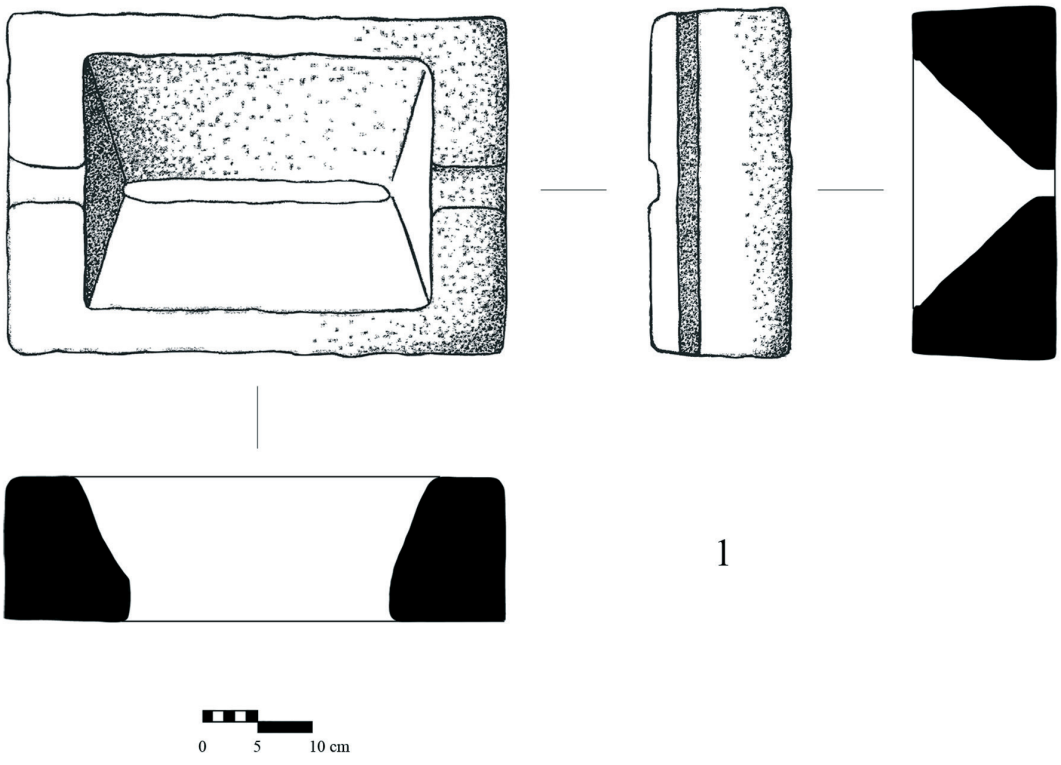


Fig. 48. Distribution map of hopper-rubbers according to their type

PLATES



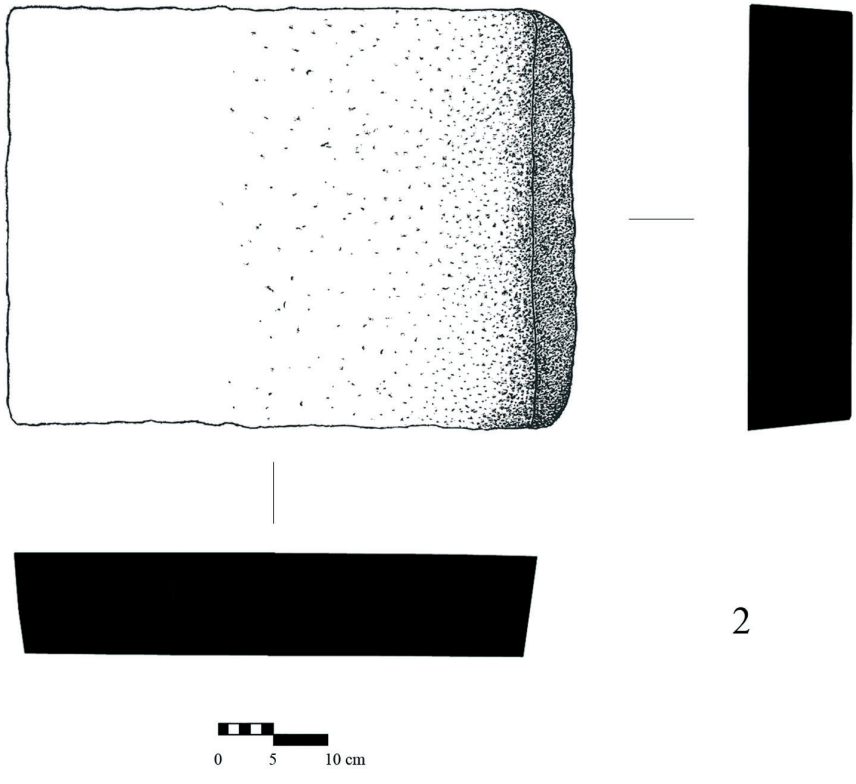
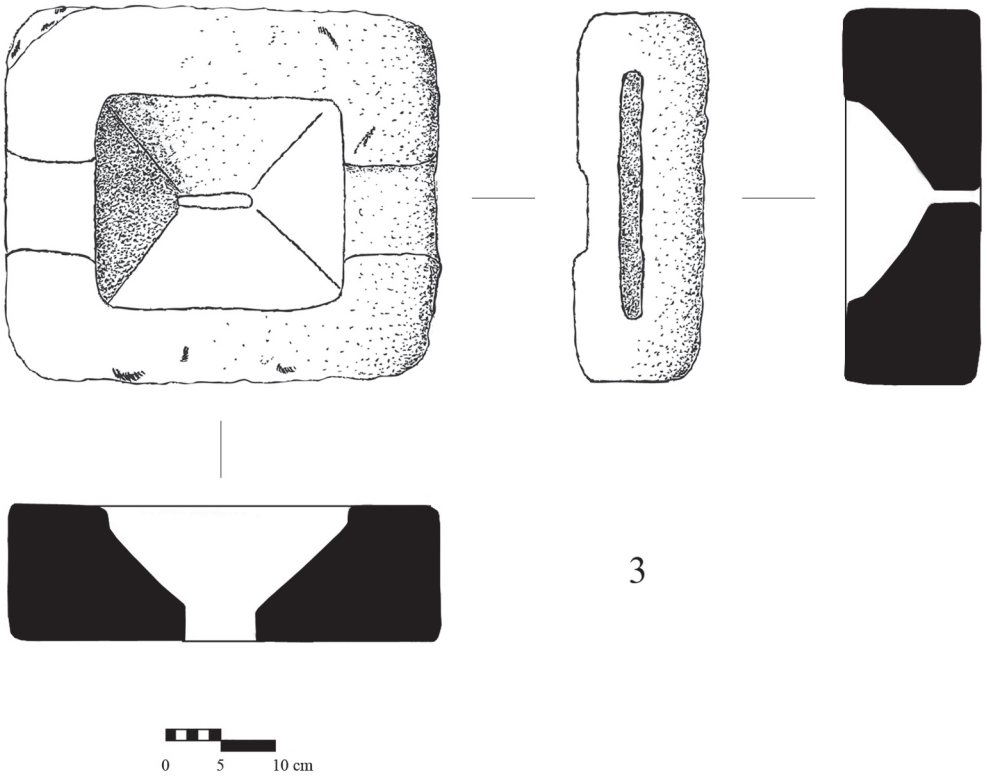


Plate I. 1-2 – Pet Mogili



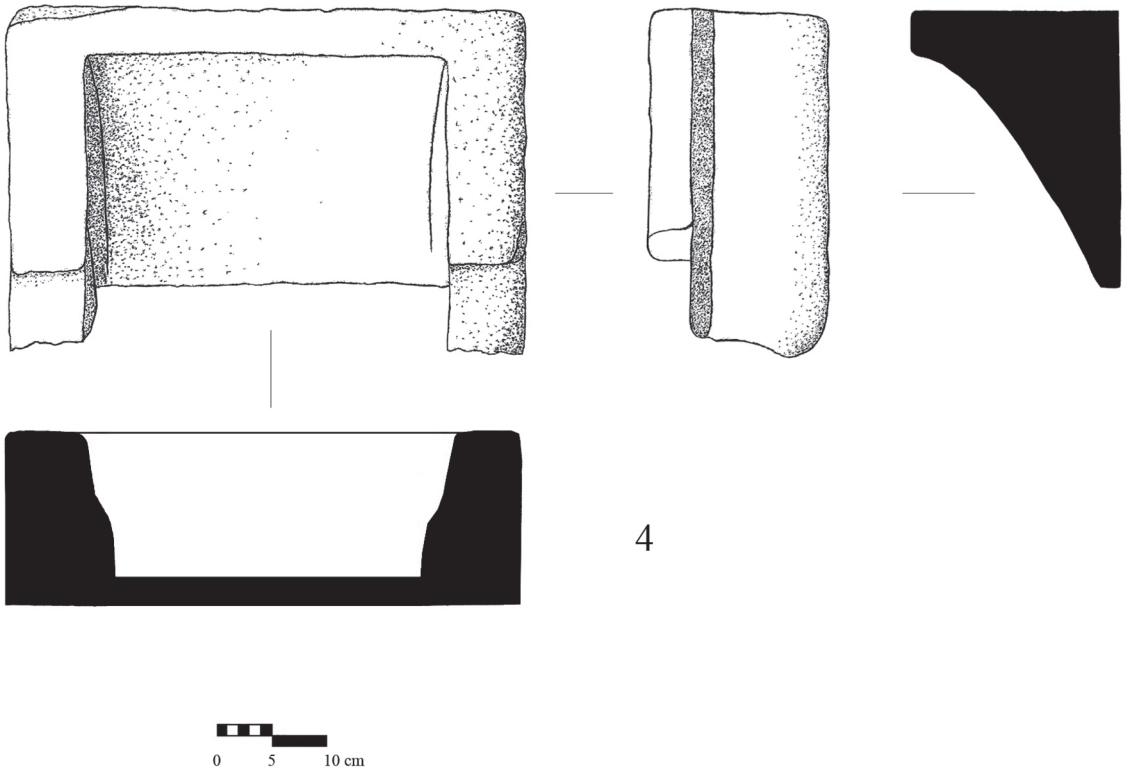
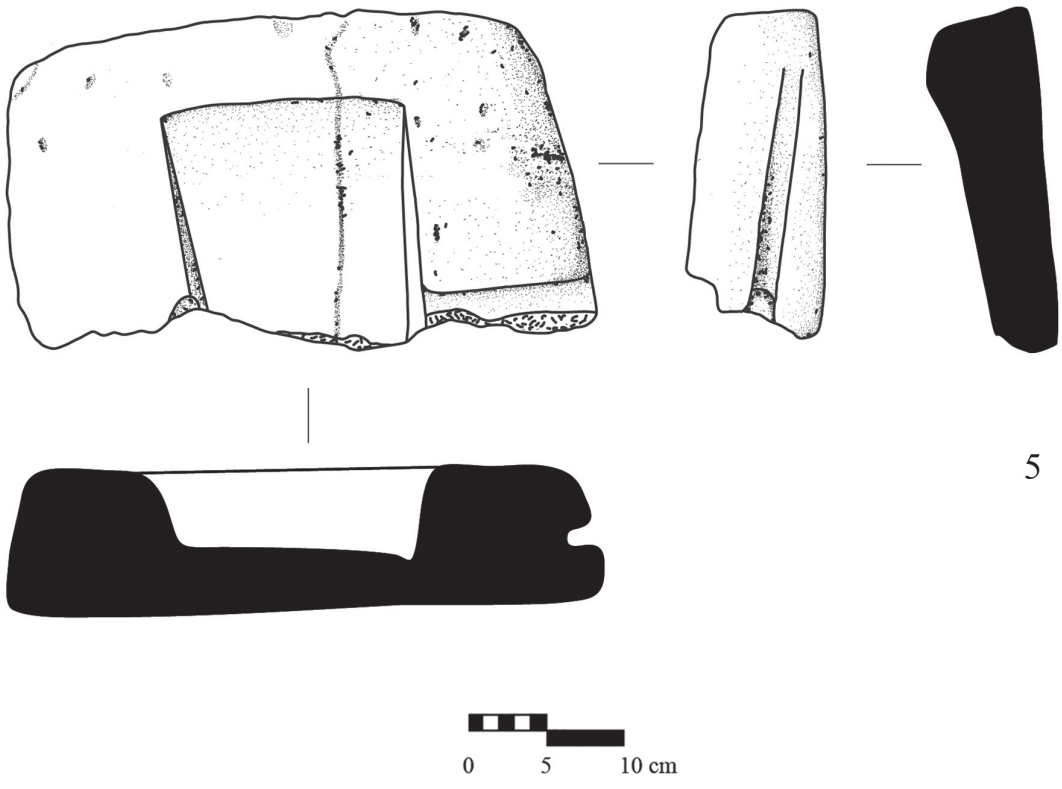


Plate II. 3 – Yablanitsa; 4 – Pistiros



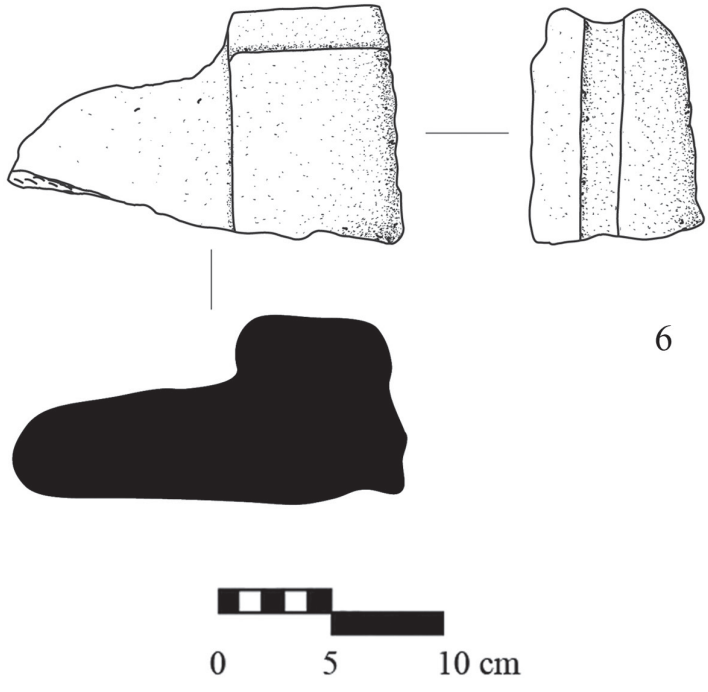
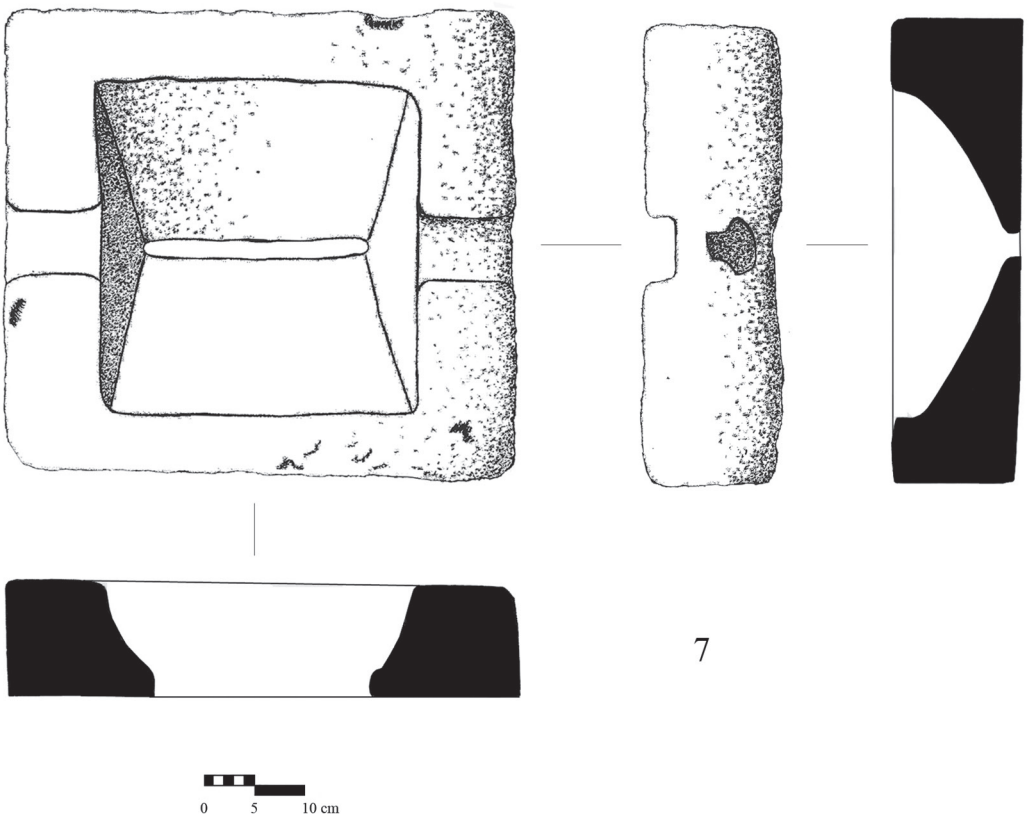


Plate III. 5-6 – Shumane-Mane



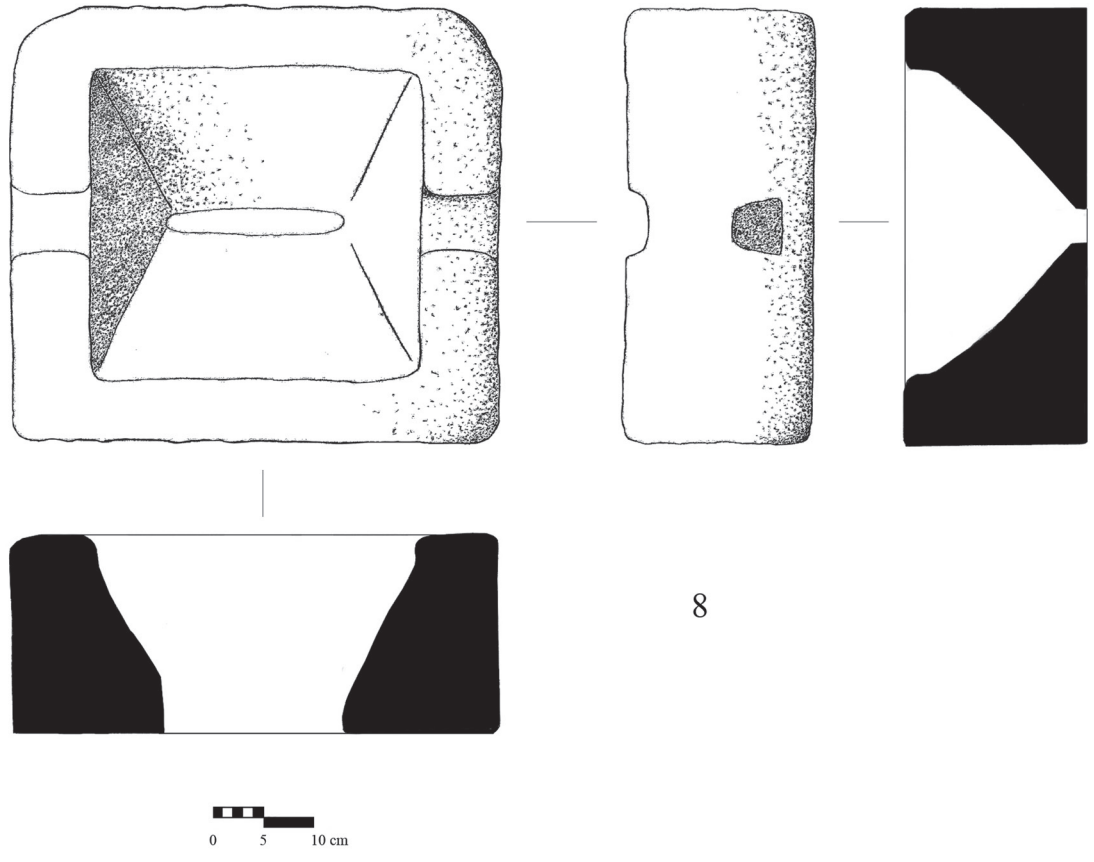
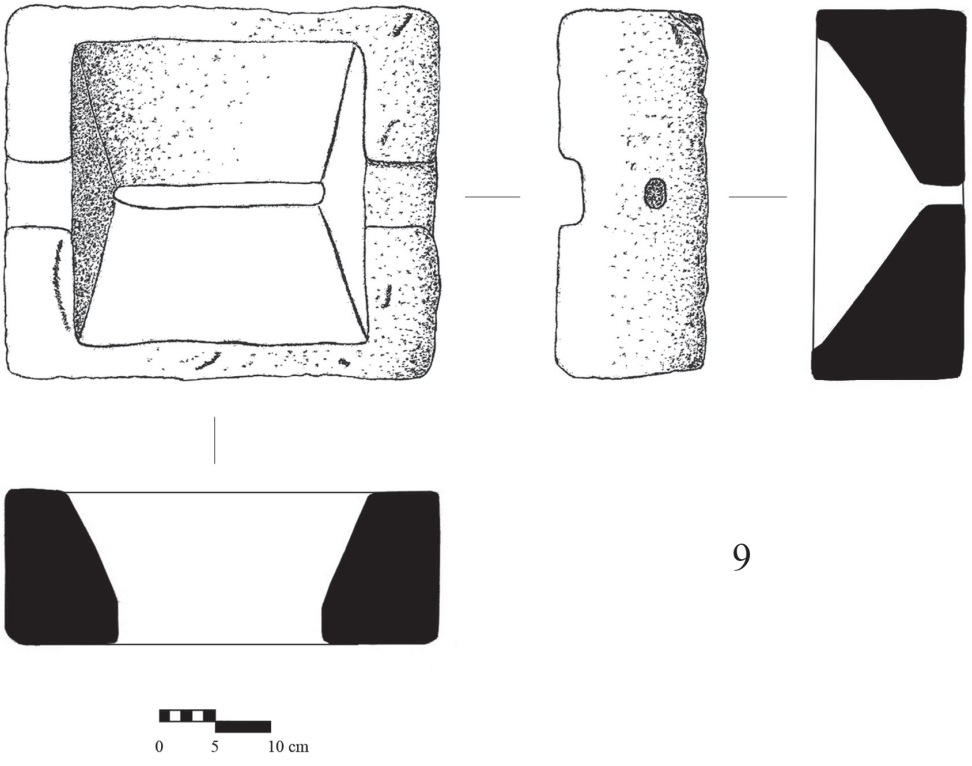


Plate IV. 7 – Seuthopolis; 8 – Akandzhievo



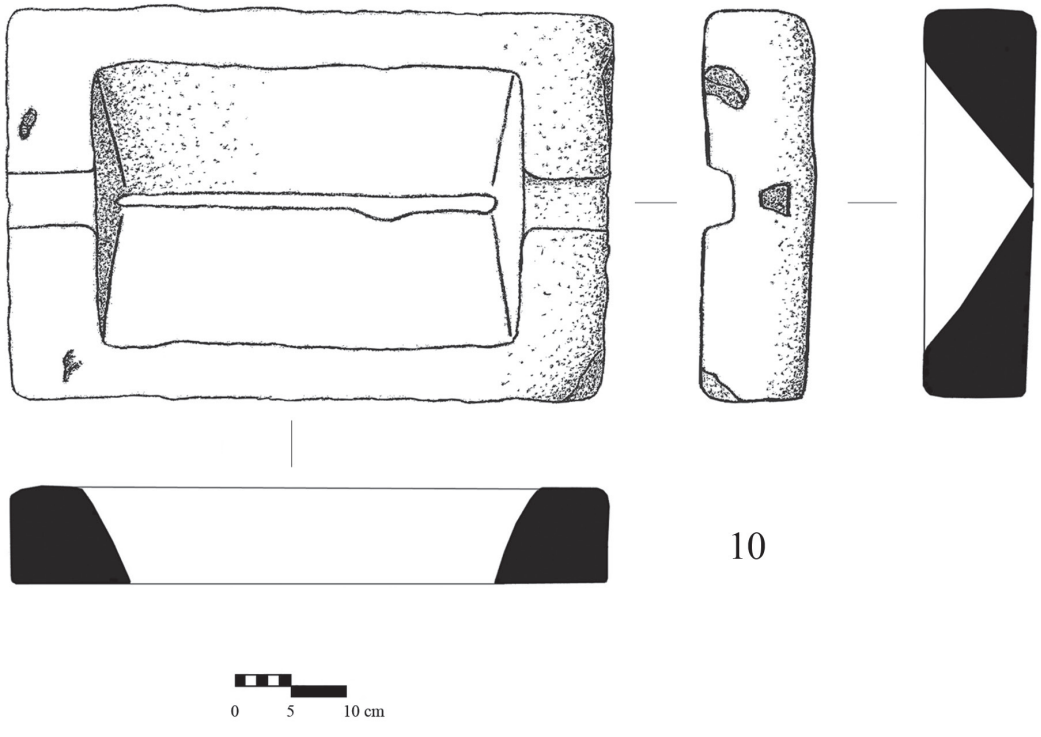
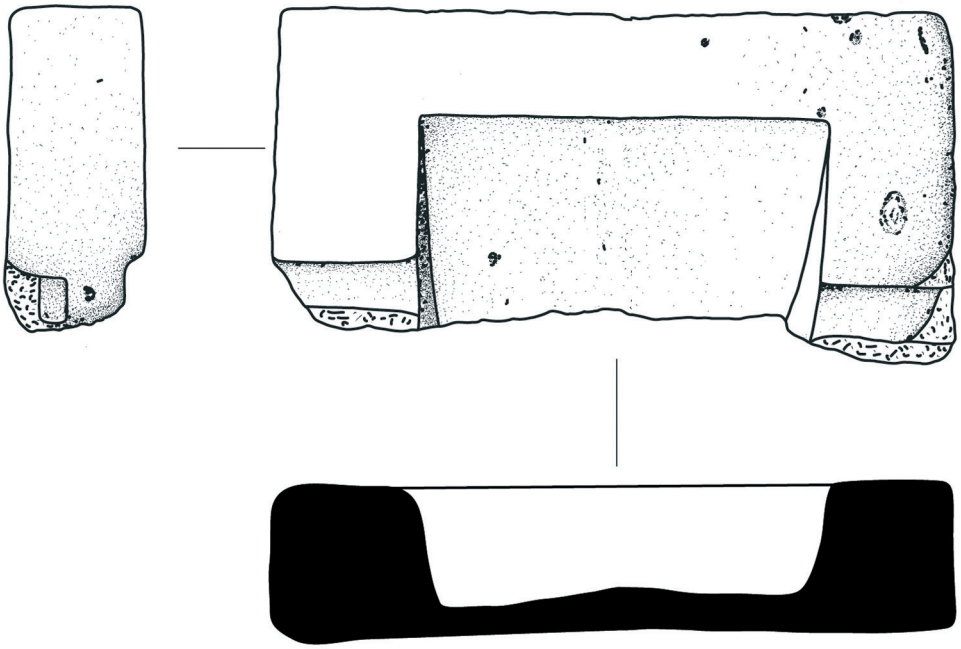
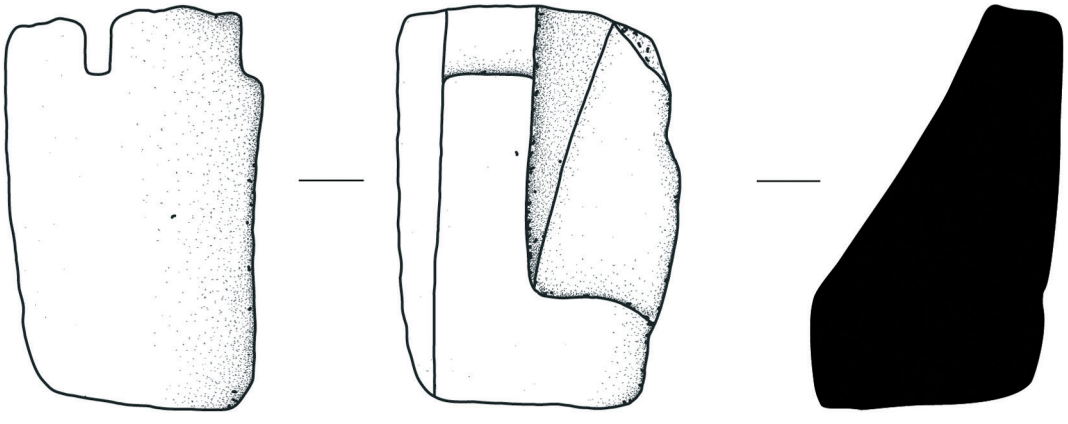


Plate V. 9 – Cheshnegirovo; 10 – Haskovo



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Plate VI. 11 – Mikroyazovira; 12 – Pistiros

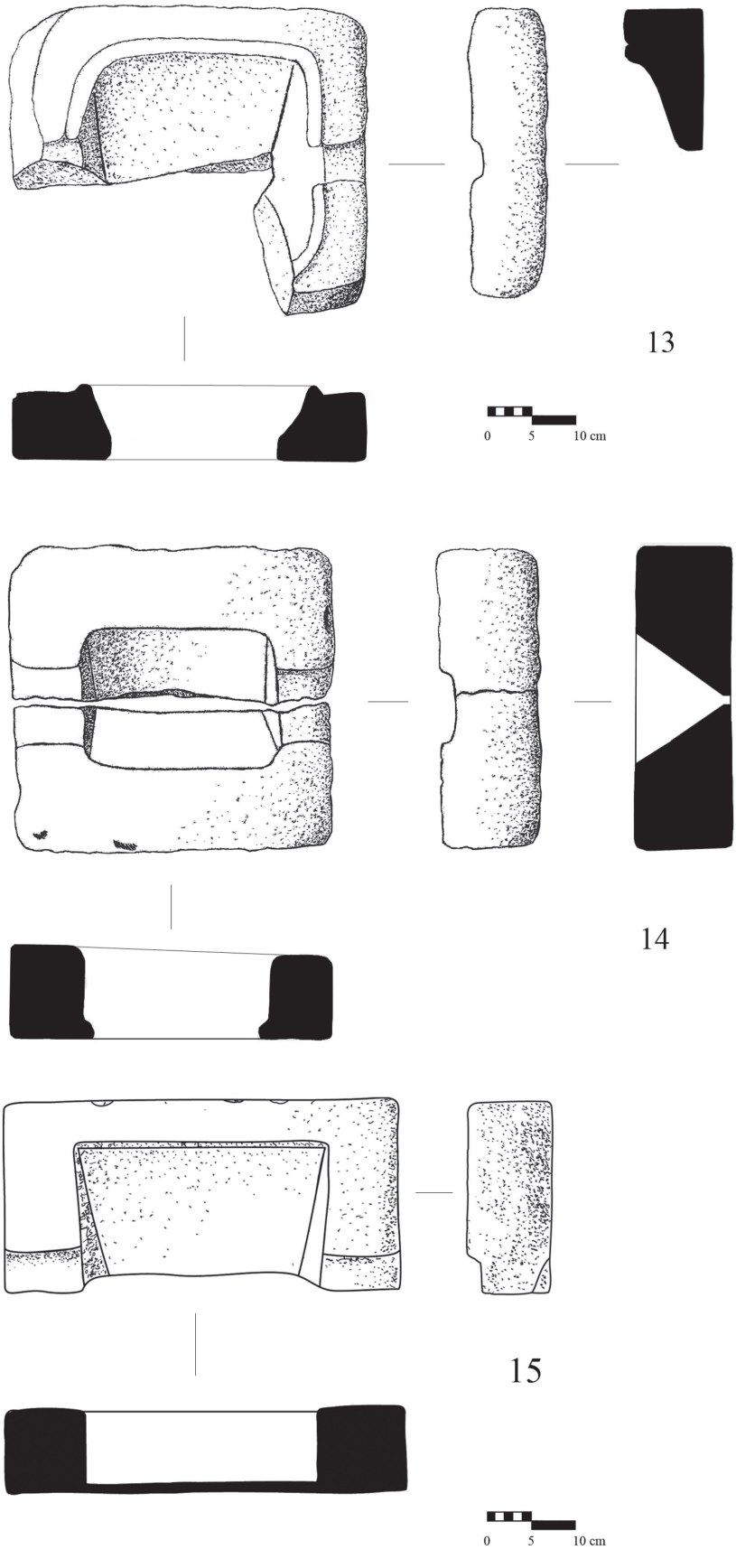


Plate VII. 13 – Trigrad; 14 – Seuthopolis; 15 – Pistiros

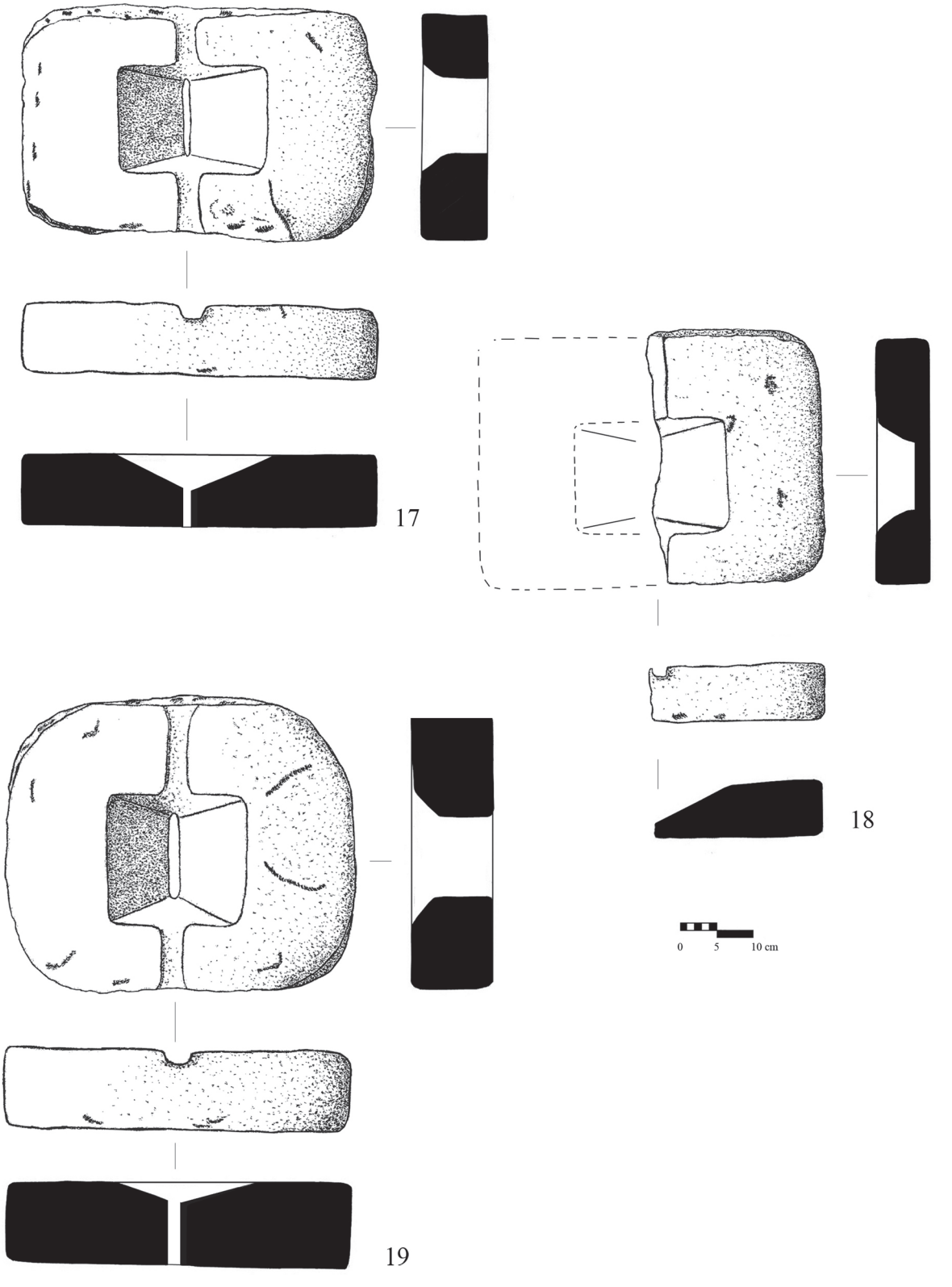


Plate VIII. 17-19 – Babyashka Chuka

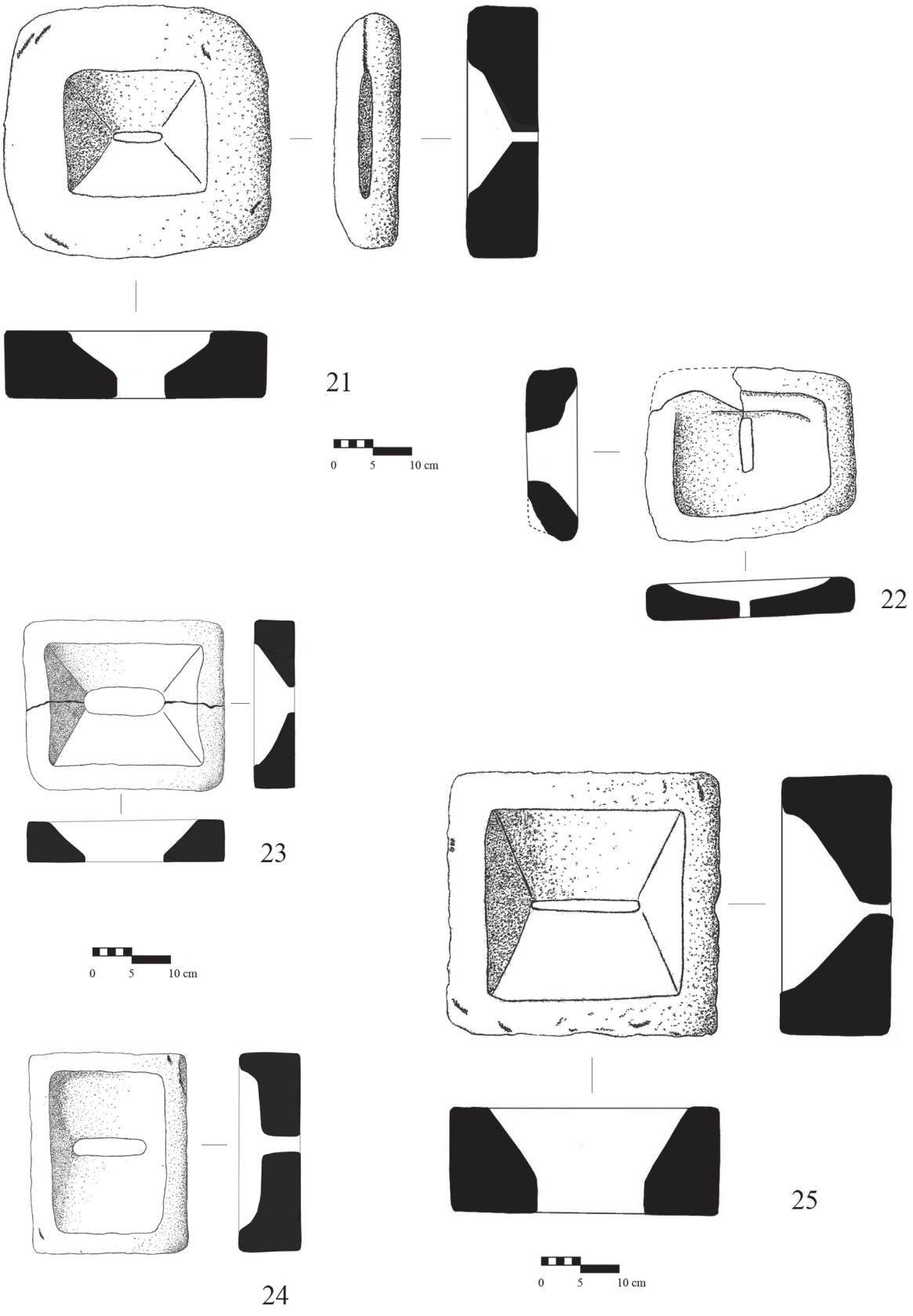


Plate IX. 21 – Yablanitsa; 22 – Sboryanovo; 23-24 – Ada Tepe; 25 – Cheshnegirovo

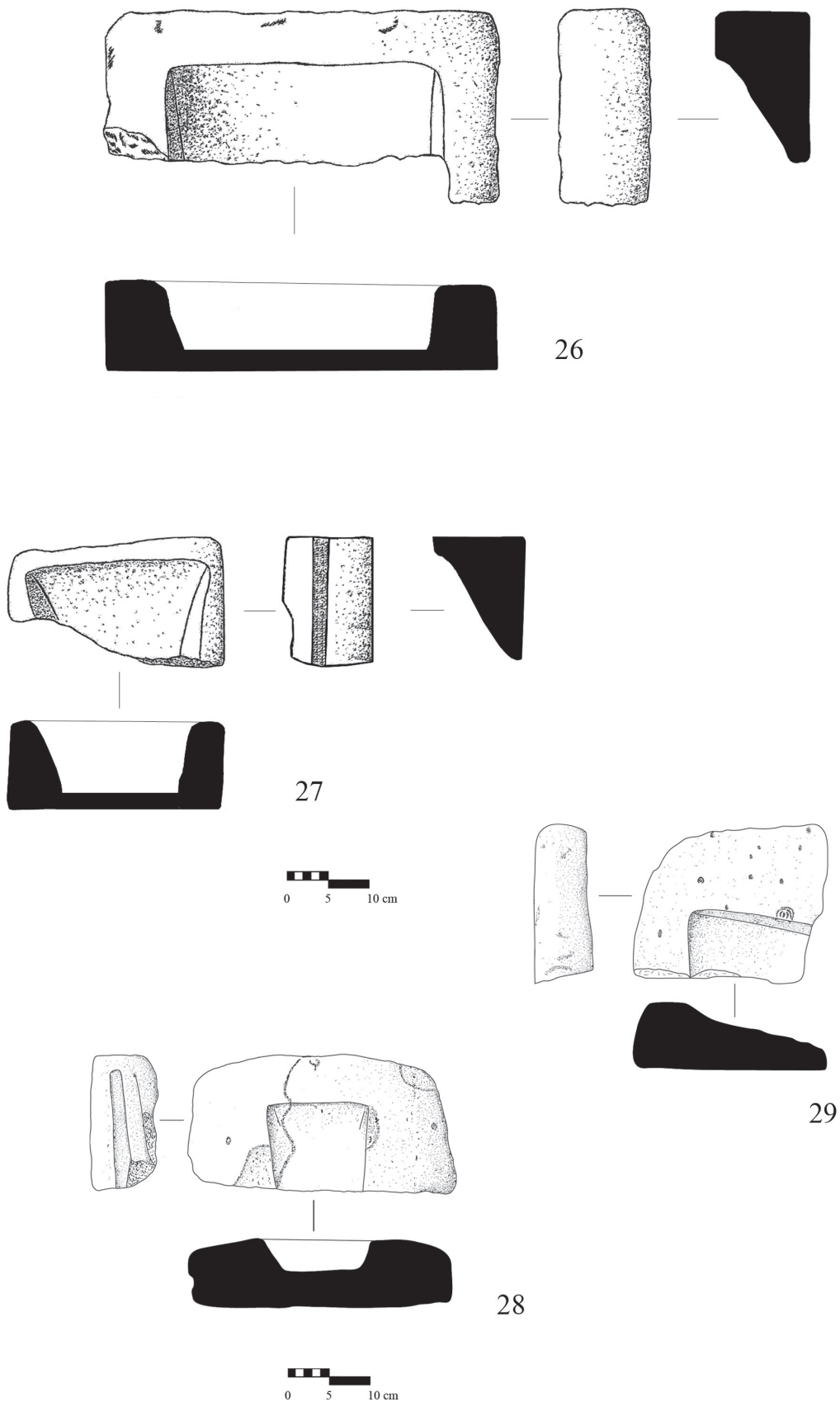


Plate X. 26 – Seuthopolis; 27 – Madzharovo; 28 – Kaleto; 29 – Shumane-Mane

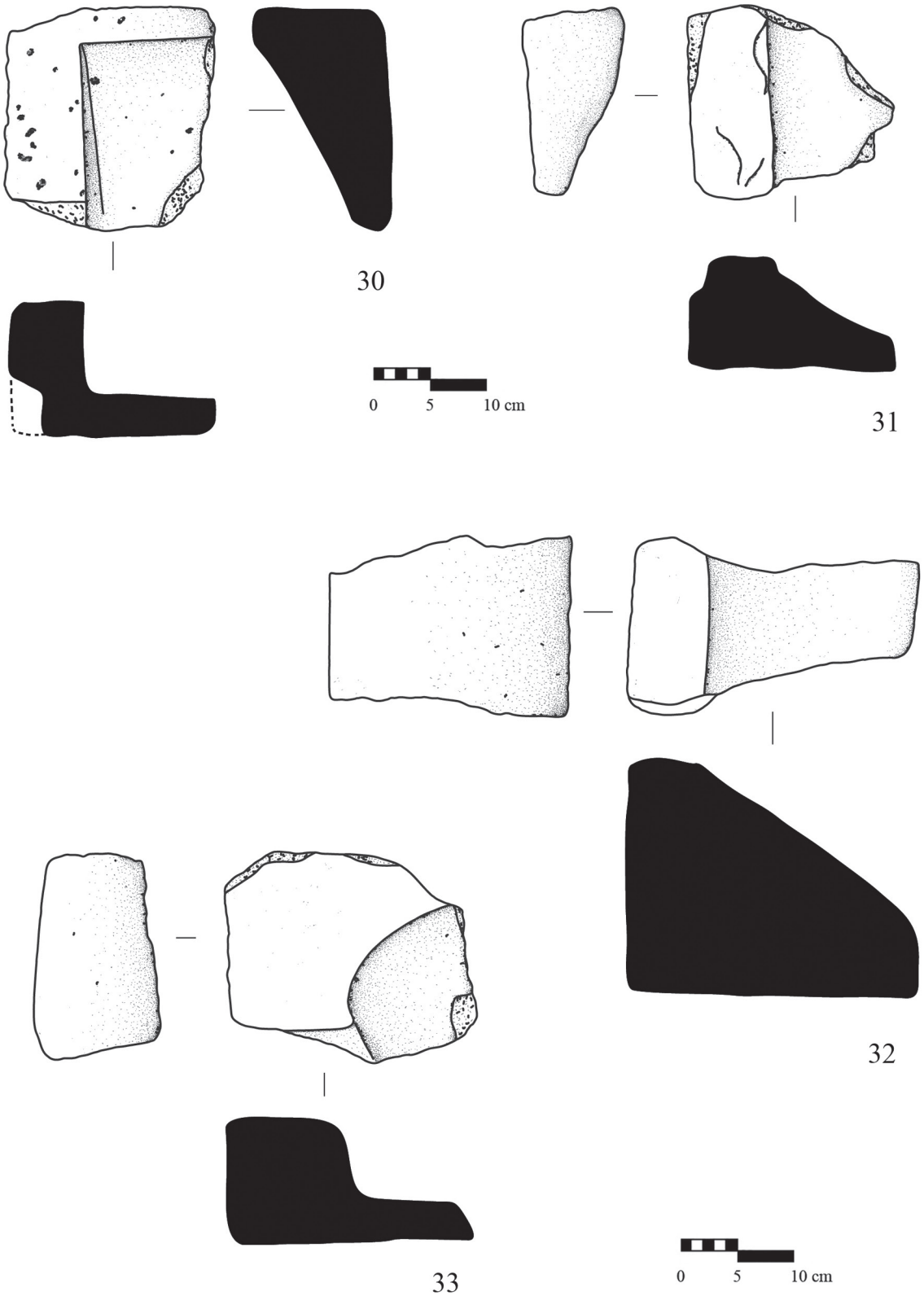


Plate XI. 30-33 – Pistiros

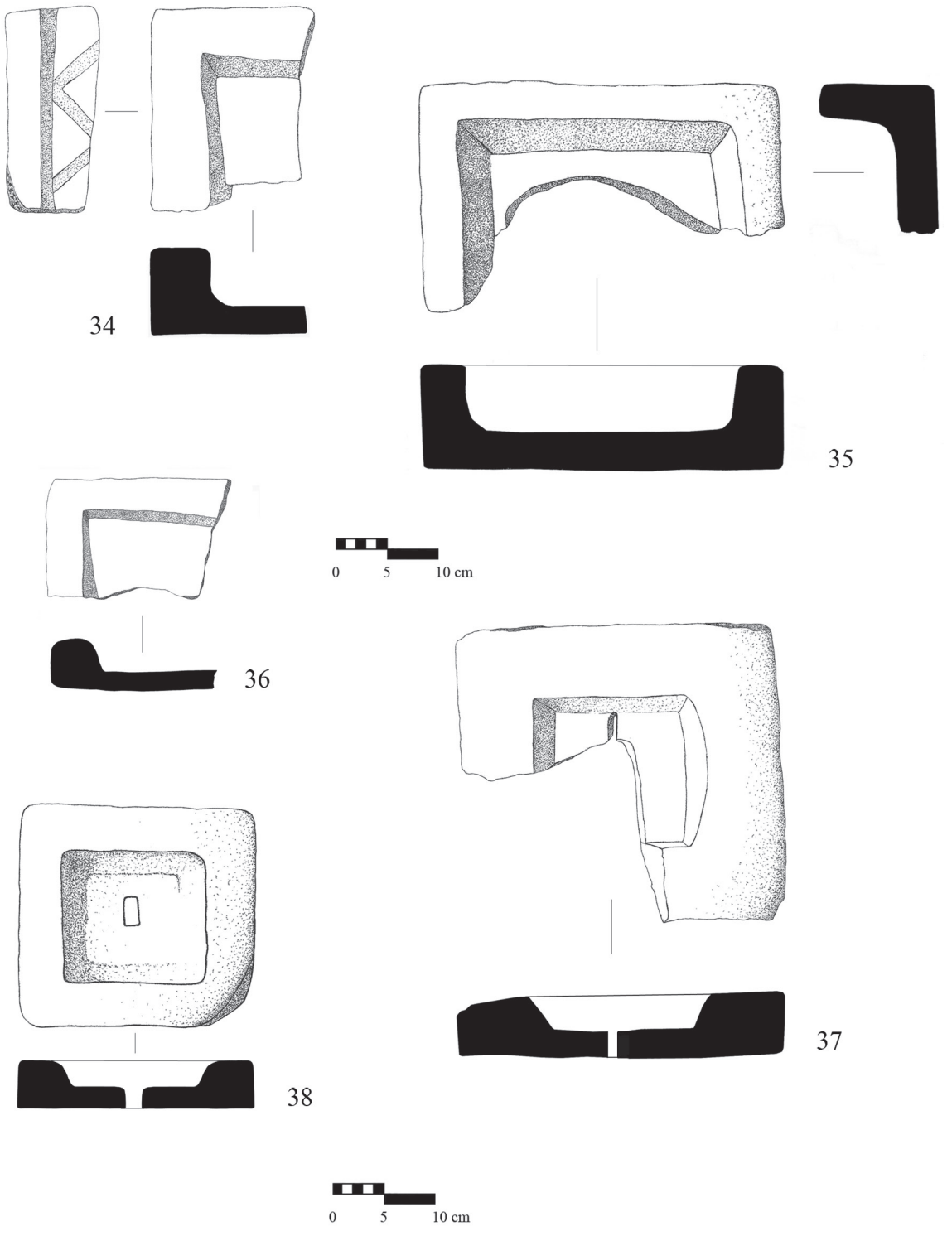


Plate XII. 34-35 – Svilengrad; 36 – Orlova Chuka; 37 – Svilengrad; 38 – Nova Zagora

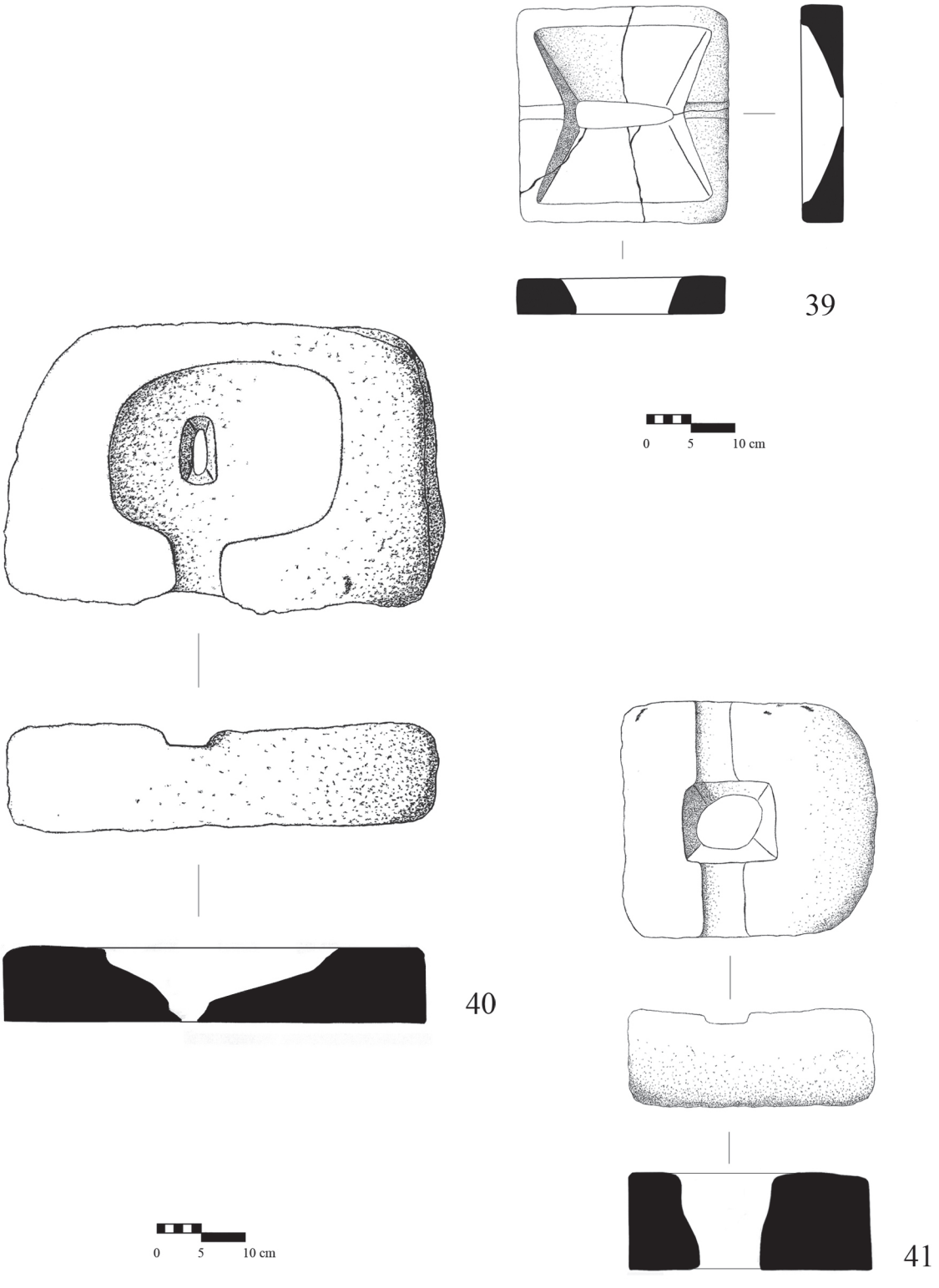


Plate XIII. 39 – Ada Tepe; 40 – Seuthopolis; 41 – Shipka



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Plate XIV. 1-2 – Pet Mogili







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Plate XV. 3 – Yablanitsa; 4 – Pistiros



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Plate XVI. 5-6 – Shumane-Mane





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Plate XVII. 7 – Seuthopolis; 8 – Akandzhievo; 9 – Cheshnegirovo



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Plate XVIII. 10 – Haskovo; 11 – Mikroyazovira; 12 – Pistiros



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Plate XIX. 14 – Seuthopolis; 15 – Pistiros; 16 – Debnevo



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Plate XX. 17-19 – Babyashka Chuka







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Plate XXI. 21 – Yablanitsa; 25 – Cheshnegirovo



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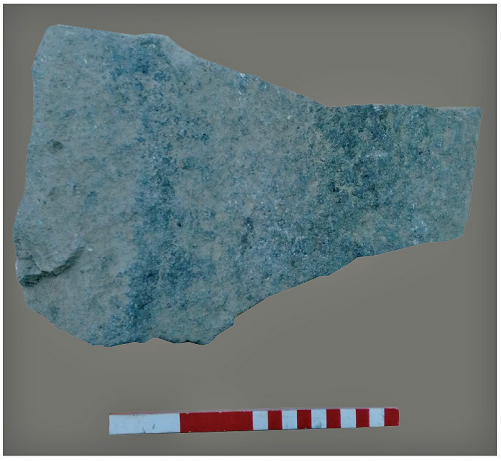
Plate XXII. 26 – Seuthopolis; 27 – Madzharovo; 28 – Kaleto; 29 – Shumane-Mane



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Plate XXIII. 30-33 – Pistiros



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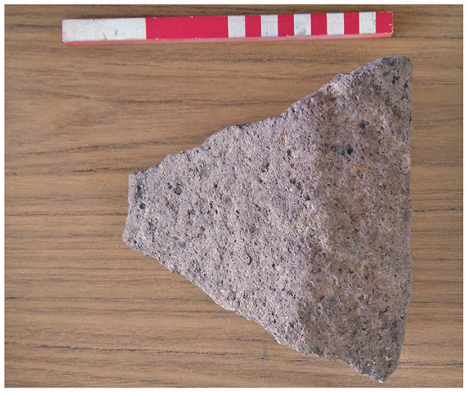
Plate XXIV. 34; 35; 37 – Svilengrad; 36 – Orlova Chuka; 38 – Nova Zagora



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Plate XXV. 40 – Seuthopolis; 41 – Shipka; 44 – St. Ilia peak; 45 – Shumane-Mane

DISSERTATIONS / ДИСЕРТАЦИИ
VOLUME 13 / ТОМ 13

Nataliya Ivanova
SOCIOECONOMIC IMPLICATIONS OF CEREAL CROP PRODUCTION IN INLAND THRACE DURING THE LATE IRON AGE

Наталия Иванова
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