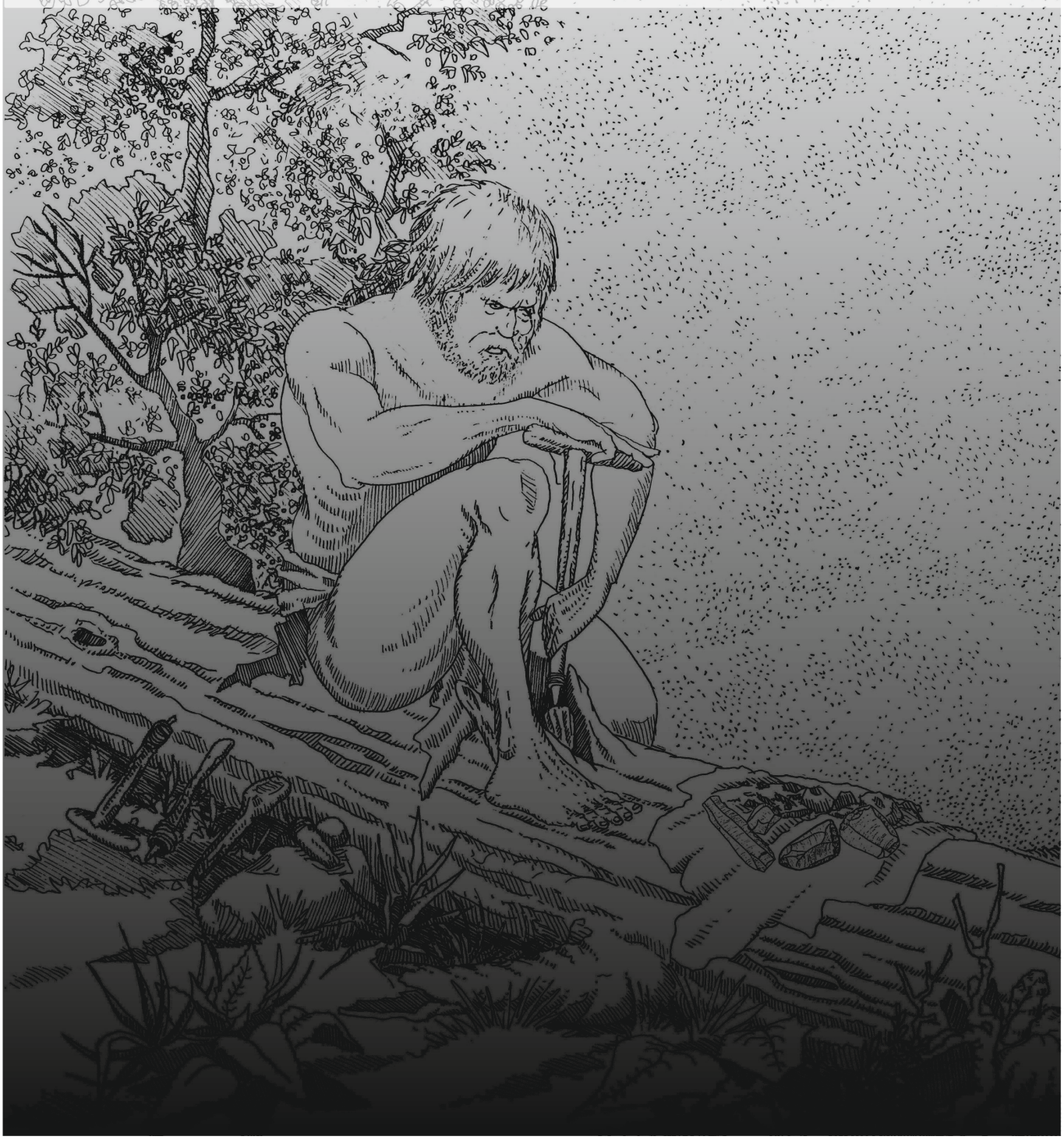
Lucyna Domańska

CHANGE AND CONTINUITY

TRADITIONS OF THE FLINT PROCESSING FROM THE PERSPECTIVE OF THE TĄŻYNA RIVER VALLEY



Lucyna Domańska

CHANGE AND CONTINUITY

Traditions of the flint processing from the perspective of the Tążyna river valley

INSTYTUT ARCHEOLOGII UNIWERSYTETU ŁÓDZKIEGO
FUNDACJA UNIWERSYTETU ŁÓDZKIEGO
ŁÓDZKA FUNDACJA BADAŃ NAUKOWYCH

Lucyna Domańska

CHANGE AND CONTINUITY

Traditions of the flint processing from the perspective of the Tążyna river valley

Łódź 2016

INSTYTUT ARCHEOLOGII UNIWERSYTETU ŁÓDZKIEGO
FUNDACJA UNIWERSYTETU ŁÓDZKIEGO
ŁÓDZKA FUNDACJA BADAŃ NAUKOWYCH

This volume has been reviewed by prof. dr hab. Aleksander Kośko

Cover design: Monika Michałowicz-Urbaniak
Image on the cover: Marcin Wiechno

Drawings of the flint artefacts: Marcin Wąs

Translation: Małgorzata Piątkowska
Linguistic consultation: Caroline Cosgrave

Technical editors: Monika Golańska, Witold Kowalczyk

The publication is financed by Fundacja Uniwersytetu Łódzkiego & Łódzka Fundacja Badań Naukowych

ISBN: 978-83-944066-4-6

Printed by ARSA Druk i Reklama, Łódź

Table of Contents

1. Introduction 9

2. The flint and flint technology of the Mesolithic hunters 15
2.1. The site presentations 15
2.1.1. Dąbrowa Biskupia 71, Dąbrowa Biskupia commune 15
2.2. Discussion 21
2.3. Conclusions 22

3. The flint and flint technology of the Linear Band Pottery culture 25
3.1. The site presentations 26
3.1.1. Chlewiska 132, Dąbrowa Biskupia commune 26
3.1.2. Grabie 4, Aleksandrów Kujawski commune 32
3.1.3. Podgaj 32, Aleksandrów Kujawski commune 37
3.1.4. Przybranowo 3, Aleksandrów Kujawski commune 40
3.2. Discussion 46
3.2.1. Flint processing in the area of the settlements situated in the black earths zone 46
3.2.2. Flint processing at atypical sites 47
3.3. Conclusions 50

4. The flint and flint technology of the Funnel Beaker culture – the Early Wiórek horizon 53
4.1. The site presentations 53
4.1.1. Poczałkowo 38, Aleksandrów Kujawski commune 53
4.1.2. Podgaj 7A, Aleksandrów Kujawski commune 59
4.1.3. Przybranówek 43, Aleksandrów Kujawski commune 63
4.2. Discussion 73
4.3. Conclusions 75

5. The flint and flint technology of the Funnel Beaker culture – the Classic Wiórek horizon 77
5.1. The site presentations 77
5.1.1. Wilkostowo 23/24, Aleksandrów Kujawski commune 77
5.2. Discussion 90
5.3. Conclusions 92

6.. The flint and flint technology of the Globular Amphora culture 95
6.1. Characteristic of the materials 95
6.2. Discussion 96
6.3. Conclusions 97

7. Changes in the flint processing among the communities of the Tążyna river valley 99

Figures 105

References 163

Appendix 1 (Małgorzata Winiarska-Kabacińska) 169

Appendix 2 (Katarzyna Pyżewicz) 193

I dedicate this book
to my son – Przemysław and my daughter-in-law – Aneta

1. Introduction

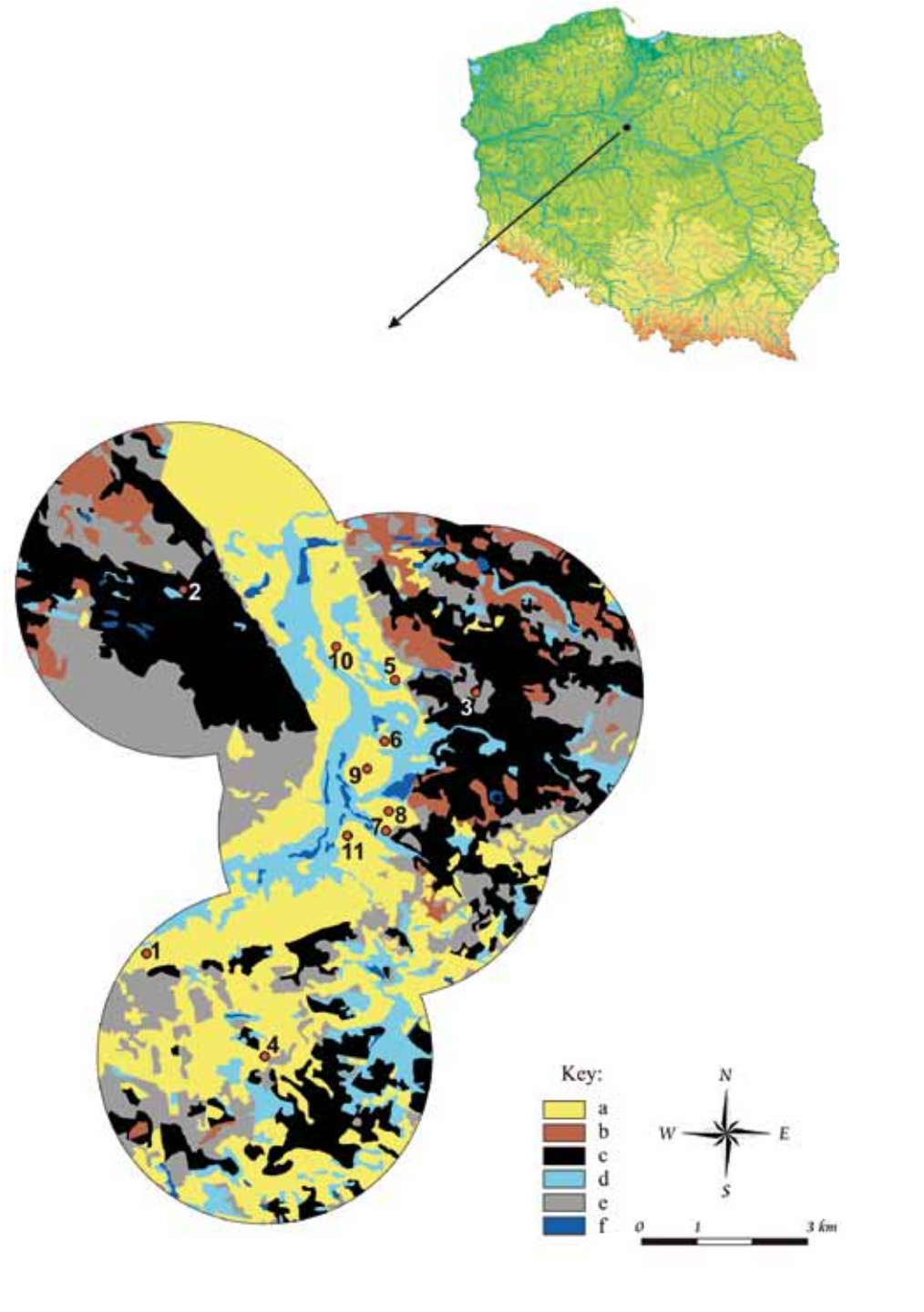
The Tążyna valley is one of the characteristic elements of the northern part of Kuyavia. This region is located in the central part of the Polish Lowlands, between two marginal stream valleys: Toruń--Eberswalde to the north and Warsaw-Berlin to the south (J. Kondracki 1981; 1994). The Vistula River constitutes its eastern boundary.

The Tążyna river flows through two sub-regions of Kuyavia: the Kuyavian Plataeu and the Toruń Basin, which forms the eastern part of the Toruń-Eberswalde marginal stream valley. Black earths are characteristic feature of the first region whereas sandy soils dominate in the Toruń Basin. In its upper and middle courses, the Tążyna river crosses the Kuyavian Plateau, then it flows into the Toruń Basin, turns eastward and flows into the Vistula river. The Tążyna river was used as natural waterway leading from the valley of the Vistula to the central part of Kuyavia. This route was already known in the early phase of colonization of the Polish Lowlands by the first farmers, and further on it was also used in the Late Neolithic (A. Cofta-Broniewska, A. Kośko 2004).

The main feature of the environmental context of the Tążyna river valley is the close vicinity of the best and the poorest (Map 1), in terms of agriculture, types of soils (L. Czerniak 1994; L. Domańska, J. Forysiak, S. Rzepecki, J. Twardy 2013; M. Szmyt 2013). The middle part of the valley is surrounded by very fertile black earths whereas agriculturally poor podzols are a characteristic feature of the bottom of the valley.

The middle section of the Tążyna River basin is one of the best archaeologically researched areas in Kuyavia (L. Czerniak 1994; L. Domańska, J. Forysiak, S. Rzepecki, J. Twardy 2013; S. Rzepecki 2015). Flint materials obtained during the excavations carried out in this part of the valley will be the subject of further analysis in this study (Map 1).

The zone of black earths show abundant traces of settlement by the Danubian communities (L. Czerniak 1994). On the other hand, the sandy



Map. 1. Location of the sites in the area of research.
Key: 1 – Dąbrowa Biskupia 71; 2 – Grabie 4; 3 – Przybranowo 3;
4 – Chlewiska 132; 5 – Podgaj 32; 6 – Poczałkowo 30; 7 – Przybranówek
4; 8 – Przybranówek 43; 9 – Poczałkowo 38; 10 – Podgaj 7A;
11 – Wilkostowo 23/24.
Soil types in the area of research: a – podzols; b – brown soils;
c – black earths; d – fluvisols; e – luvisols; f – waters.

areas of the middle section of the Tążyna valley revealed numerous concentrations of settlements by the populations of the Funnel Beaker culture (L. Domańska, J. Forysiak, S. Rzepecki, J. Twardy 2013; S. Rzepecki 2015). Discovery of the sites of the Linear Band Pottery culture recorded on the sandy bottom of the Tążyna valley, which environment is atypical of those communities, distinguishes that region (L. Czerniak 1994; S. Rzepecki 2013).

The aim of this study is to characterize flint production by the communities occupying the central part of the Tążyna valley from the end of the Boreal until the Subboreal climatic periods. The vast majority of the flint materials falls in the period from about 5400 BC to 3500 BC. The first date is determined by an appearance of a group of farmers representing the Linear Band Pottery culture in the black earths surrounding the Tążyna river valley (L. Czerniak 1994; J. Pyzel 2010). The other date corresponds with a rise of the extensive settlement of the community representing the Funnel Beaker culture in Wilkostowo, Aleksandrów Kujawski commune (S. Rzepecki 2015).

The oldest traces of occupation of the Tążyna river valley are dated to the Late Paleolithic. It is implied by, among other things, an arch-backed piece (Fig. 36: 1) recorded at the site Wilkostowo 23/24 (L. Domańska 2013). Another stage is connected with the appearance of hunters representing the Maglemose culture (chapter 2). Dąbrowa Biskupia 71, Dąbrowa Biskupia commune, is one of the best researched sites of this cultural unit in the study area (L. Domańska, M. Wąs 2007; 2009).

Another phase of settlement of the valley relates to the occupation of that area by the communities of the Linear Band Pottery culture (chapter 3). Since about 5400 BC, these communities started to establish permanent settlements on fertile black earths surrounding the valley (the site Grabie 4, Aleksandrów Kujawski commune) and continued the process in their later phases (e.g. the site Przybranowo 3, Aleksandrów Kujawski commune). Probably not a long time later (about 5300 BC), they make an attempt at using the sandy bottom of the Tążyna river valley. From this area, four Linear Band Pottery culture sites are known: Chlewiska 132, Dąbrowa Biskupia commune, Poczałkowo 30, Podgaj 32, Przybranówek 4, Aleksandrów Kujawski commune (L. Czerniak 1994; L. Domańska, S. Rzepecki 2009; S. Rzepecki 2013).

The situation changed fundamentally around 4200 BC. The Tążyna valley became occupied by the communities of the Funnel Beaker culture, who were using the valley intensively during the whole of the next millennium (4000-3000 BC). The intensity of this settlement is evidenced by, inter alia, a number of registered sites (over 150) and an onset of the first stable form of settlement in that area. The use of such modernizations as the slash-and-burn and scratch plough economy enabled an adaptation of extensive grain agriculture to the ecological conditions of the sandy bottom of the valley (S. Rzepecki 2015).

The vast majority of the sites related to the Funnel Beaker culture in that region became known solely from surface surveys. Only a small number of them were excavated. From the perspective of the research into flint production by the study communities, the following sites should be considered as of prime importance: Przybranówek 43, Początkowo 38, Podgaj 7A, Aleksandrów Kujawski commune (chapter 4) and particularly Wilkostowo 23/24, Aleksandrów Kujawski commune (chapter 5).

The enumerated sites represent two phases of the Funnel Beaker culture: the Early Wiórek phase (phase II) and the Classic Wiórek phase (phases IIIA–IIIC). The classification of the sites into various phases and their sub-phases was based on the stylistic analysis of pottery and, above all, identifiers of various types of relations between the analyzed communities (A. Kośko 1981; 1988; 2000; L. Czerniak, A. Kośko 1993; A. Kośko, A. Przybył 2004; A. Kośko, M. Szmyt 2006; 2007; 2007a; M. Szmyt 2013; S. Rzepecki 2004; 2015). Nevertheless, the sophisticated taxonomies of pottery proved to be difficult in an application to the analyses of the flint inventories. Flint artefacts were not as sensitive as pottery to the cultural processes taking place within the community of the Funnel Beaker culture.

In these circumstances, it was decided to classify the flint materials obtained from the analyzed sites into two horizons: the Early Wiórek and the Classic Wiórek. This somewhat abbreviated approach seems to better reflect on the diversity of this type of production.

The flint materials excavated from the sites: Przybranówek 43, Początkowo 38, Podgaj 7A, were classified into the Early Wiórek horizon, identified with phase II (A. Kośko 1981; L. Czerniak, A. Kośko 1993; L. Czerniak 1994; S. Rzepecki 2004). The prime characteristic of that phase (c. 4200-3700 BC) was a state of total polylinearism observed in the development of the Funnel Beaker culture, which was concatenated with the process of a dynamic expansion of the „Beaker ecumene" (S. Rzepecki 2004). One of its potential aspects was the „beakerisation" of a part of the population representing the late Linear Pottery culture (L. Czerniak 1994).

The Classic Wiórek horizon, identified with the phases IIIA–IIIC, is represented by the site Wilkostowo 23/24 (S. Rzepecki 2015). The long period of development of that trend in Kuyavia (c. 4000-2900 BC – A. Kośko, A. Przybył 2004; S. Rzepecki 2004) included i.a. an integration of the eastern group (A. Kośko 1981; S. Rzepecki 2004) and an intensification of relations between the neighbouring populations (A. Kośko 1981; 1988; 2006; A. Kośko, A. Przybył 2004).

Chapter 6 focuses on the flint artefacts representing the Globular Amphora culture. They were found together with a small concentration of pottery of that culture in the western part of the site Wilkostowo 23/24 (S. Rzepecki 2015). This small amount of information allows only

for a strongly abbreviated description of the flint production of those communities. The researches currently undertaken should significantly enrich this base, though.

The last chapter summarizes the deliberations over the flint production by the inhabitants of the Tążyna valley. Its main objective is to characterize the transformation of this type of production.

An analysis of the general structure of the investigated inventories was conducted on the grounds of dynamic technological classification rules. This enabled the full reconstruction of the whole of technical interventions connected with blanks and tools production, as well as defining the rules of raw material economy (R. Schild 1980).

Morphological classification of tools was based on criteria assumed in the paper entitled *Geneza krzemieniarstwa kultury pucharów lejkowatych na Kujawach* (*The Origin of the Flint Industry of the Funnel Beaker Culture in Kuyavia* – L. Domańska 1995). In comparison with the cited paper, the division of this group was only modified. Within it, conventional (typological) tools and atypical ones i.e. atypically retouched blades, flakes, and products of a group of splintering technique were distinguished. The type, character and intensity of the retouches as well as a degree of side surfaces transformations of the specimens were used as diversifying criteria. In distinguishing of both subgroups, solutions present both in foreign (e.g. J. Conolly 1996; 1999; W. Andrefsky 2001) and Polish literature (J. Lech 1997) were followed.

Also, an analysis of the raw material structure of the inventories was an important element of their characteristics. In the area of the Tążyna river and the whole Polish Lowlands, erratic Baltic flint was the only locally available flint raw material. Other materials (chocolate, Jurassic, Świeciechów, banded, and Volhynian flint) belong to a group of non-local raw materials in relation to the Lowlands. Their outcrops are located in the south of Poland. Volhynian flint forms an exception here as its outcrops occur in the area of the western Ukraine.

Dąbrowa Biskupia 71.

2. The flint and flint technology of the Mesolithic hunters

In the course of surface surveys conducted in the 1980s, 1990s and then repeated at the beginning of the 21st century in the area of the middle Tążyna river valley, single Mesolithic artefacts – mainly microliths were discovered at many sites. Unfortunately, at most of these sites, the remains of Mesolithic campsites were destroyed by the later, intensive Funnel Beaker culture occupation.

The only exception is the site Dąbrowa Biskupia 71. The traces of a Mesolithic campsite discovered there were only contaminated to a small degree by the later Neolithic occupation (L. Domańska, M. Wąs 2007; 2009).

2.1. The site presentations

2.1.1. Dąbrowa Biskupia 71, Dąbrowa Biskupia commune

The area of the site and its closest vicinity is a sandy terrain. Around 3 km west of the site there are vast sand-drift terrains and, in the nearest neighbourhood, covers of aeolian sands dominate. The site is situated at the relatively low height. The south-east foot of the height adjoins the edge of the valley bottom.

In the year 2001, sondage excavations were conducted by digging 4 trenches of 1 m^2 each in the area of the site. They yielded single Mesolithic artefacts – exclusively microliths and bladelets. During the following two seasons in the years 2002-2003, broader excavations were conducted with the aim to possibly fully recognize the site and to define a character of spatial distribution of the artefacts.

On the course of excavations, 482 flint artefacts and 73 crumbled fragments of the Funnel Beaker culture pottery were discovered.

The artefacts were concentrated mainly in the central part of the explored area, not making up distinctive concentrations.

The raw material structure of the inventory

The raw material that definitely prevailed at the site was Baltic flint. 478 specimens were made of it, which constitutes 99.2% of the entire material (Tab. 1). All Mesolithic products were made of this raw material.

Tab. 1. Dąbrowa Biskupia 71.

Raw material structure of the inventory	**N**	**%**
Baltic	478	99,2
Chocolate	3	0,6
Świeciechów	1	0,2
Total	482	100

Moreover, among the materials from Dąbrowa Biskupia 71, three specimens of chocolate flint were distinguished (a splintered piece flake and 2 blade-flakes) and a splintered piece flake of Świeciechów flint. These specimens should be connected with the fragments of the Funnel Beaker culture pottery discovered at the site.

The quantitative-qualitative structure of the inventory

The quantitative specification of the flint products (Tab. 2) includes almost exclusively Mesolithic artefacts. Among the products two categories predominate: tools (39.8% of the entire inventory) and blades (32% of the materials). Within the group of tools, microliths are the most numerous group of products, 189 such specimens were distinguished, which is 98.5% of the tools (Tab. 3).

12 specimens were excluded from further analyses (10 splintered piece flakes and 2 blade-flakes of chocolate flint), they are most probably connected with the Neolithic occupation.

Characteristics of the inventory

Cores

No cores were registered at the site. Whereas, as a result of the refitting method used to analyze the flakes (L. Domańska, M. Wąs 2007;

2009), at least 2 fragments of microlithic blade cores were successfully reconstructed. The best preserved specimen can be identified as a core fragment with flat, unprepared sides (Fig. 1: 1). It had a narrow flaking surface and 10 mm wide platform which was rejuvenated by a one-way removal from the left side. The core was exploited – at least at the final stage – by the striking technique. Numerous hinged negatives, situated stepwise in the upper part of the flaking surface, are effects of that technique. Originally, it was probably a blade core exploited by the use of the punch or pressure technique. However, most probable is the use of the latter one, which is indirectly testified by the morphology of most blades and microliths (M.L. Inizan, H. Roche, J. Tixier 1992). The final phase of the blade production took place at the site, a relic of which is present in the conjoining of blade-flakes with a hinge-shaped tip. Then, the core was used to produce flakes which led to its complete exploitation.

Tab. 2. Dąbrowa Biskupia 71.

Quantitative-qualitative structure of the inventory	**N**	**%**
Flakes	68	14,1
Blades	154	32,0
Blade-flakes	2	0,4
Core tablets	2	0,4
Splintered piece flakes	10	2,1
Chunks	8	1,6
with negative scars	8	
burnt		
Chips	26	5,4
Tools	192	39,8
Microburins	20	4,2
Total	482	100

A refit group of two other flakes probably comes from a blade core of very similar morphology as the one described above.

Further information about blade cores is provided by 2 core tablets discovered at the site. The first specimen (26 x 19 x 6 mm) comes from a blade core with a flat unprepared platform and an abraded flaking edge (Fig. 1: 20). Another core tablet (20 x 17 x 7 mm) comes from a core with a striking platform prepared from the side and an abraded flaking edge. It obliterates also a fragment of cortical core side with traces of abrasion

(blunting from the flaked surface). The width of the core platform from which it was removed was ca. 10 mm.

Tab. 3. Dąbrowa Biskupia 71.

Tools	**N**	**%**
Microliths	189	98,5
Blades retouched	1	0,5
Flakes retouched	2	1,0
Total	192	100

Flakes

At the site, 68 flakes were discovered which is 14.1% of the entire inventory. Three classes of flake sizes were distinguished: 5-10 mm (31 items), 11-20 mm (19 items), 25-35 mm (18 items). There are no specimens to be placed in a metrical section 20-25 mm. In general, it is a group of small products for which a technological definition is not possible.

Blades

These artefacts are the second frequent category of products in the inventory under consideration – 154 specimens were distinguished which is 32% of the whole inventory.

Among them, there are complete blades – 34 specimens (Fig. 1: 5-9), proximal fragments – 48 specimens (Fig. 1: 10-12), medial fragments – 27 specimens and distal ones – 45 specimens (Fig. 1: 13-18). Nearly 10% of the blades have a cortex covering over more than half of the dorsal face.

All the blades, regardless of their completeness, show similar morphological features, which makes it possible to treat them as a technologically homogeneous assemblage. Among them (both complete and proximal ones), the frequency of flat butts and abrasion is almost the same as among the microburins and the microliths. However, there were more blades with a bulbar scar and, at the same time, fewer blades with a lip. This indicates that microliths are a bit more delicate than blanks, although the differences are little. Slight differences in blades and microliths parameters are also visible.

Tools

Microliths

They constitute the most characteristic and most numerous group of products from the site under consideration.

Seven types of microliths were distinguished (Tab. 4). Microliths of the Nowy Młyn type dominated – 52 specimens (Fig. 2: 1-12). Some of them have a claw-shaped tip by retouching both edges up (Fig. 2: 2).

Tab. 4. Dąbrowa Biskupia 71.

Microliths	**N**	**%**
Microliths of the Nowy Młyn type	52	27,5
Scalene triangles	50	26,5
Small scalene triangles	9	4,8
Microliths with retouched base	26	13,7
Lanceolate backed points	3	1,6
Equilateral triangles	1	0,5
Fragments of the microliths	48	25,4
Total	189	100

The second most numerous group of microliths is made up by scalene triangles – 50 specimens (Fig. 2: 14-20), sometimes similar to the rectangular ones (Fig. 2: 13). Likewise in the latter group, a retouch of two edges at the tip can be seen (Fig. 2: 21-24).

Apart from the above mentioned large triangles, 9 small scalene triangles were distinguished (Fig. 2: 31-33). Among them, specimens with a preserved butt prevail.

Microliths with a retouched base (26 specimens) are the most morphologically differentiated group, which results from a small degree of blank processing – mainly of distal parts of blades (Fig. 2: 25-26).

The rest of the distinguished types are: 3 lanceolate backed points (Fig. 2: 28-30), 1 equilateral triangle (Fig. 2: 27) and 48 fragments of the Nowy Młyn type or scalene triangles.

Despite the proved typological differentiation, the discussed group of artefacts is marked out by a considerable stylistic similarity. All the specimens of the Nowy Młyn type, scalene triangles, and microliths with a retouched base were made of slender, regular bladelets. Their shaping was limited to retouches of a slightly oblique base, and, in the case of the Nowy Młyn microliths and scalene triangles, additionally – one of the edges was retouched. The range of the retouch was probably dependent

on the width of the blanks. It is the feature that may have determined the final form of the microlith. Confirmation of this unification is the quite similar parameters of all the microliths, especially their thickness (1-3 mm) and width (3-8 mm). The length of the microliths, in spite of being dependent of the parameters of blanks, also reveals a certain standardization.

However, a morphological analysis of the microliths shows that the majority of them have their tips in proximal parts of the blades, and at the same time, their significant differentiation in shapes was observed. It is not, however, connected with a certain type of microlith. The exceptions are the small scalene triangles which have a characteristic tip with a preserved butt.

In general, the most popular way of shaping the tip was the retouch which suppresses the proximal part. Microburin blow activity has been observed in more than 30% of microliths. It was applied both to proximal and distal parts of blades whose relics are basic microburins and tip ones (Fig. 1: 21-24). Almost 10% of the microliths demonstrate tips with preserved butts.

The most interesting results of the refitting method are the conjoinings of overlapping microliths (Fig. 3). Five refit groups were obtained including 2 microliths in each, one refit group including 3 microliths and one including a microlith and a bladelet fragment. This group also includes a reconstructed broken microlith of the Nowy Młyn type.

Retouched blade

It is a blade with a flat butt and a delicate bulb with a scar (Fig. 1: 19). In one of the edges a notch was formed with a retouch on the lower side. The blade was also damaged in the distal part which is similar to a burin blow.

Retouched flakes

The first specimen (15 x 15 x 2 mm) is a flake with an edge butt and a scar on the bulb. It has an abrupt retouch on one of the edges and a micro-retouch on the distal part.

Another flake (32 x 16 x 4 mm) has a flat butt, a big bulb with a scar and a lip. The tool was formed by retouching half of one of the edges on the upper side.

Microburins

Three groups of microburins have been distinguished: basic – 11 specimens (Fig. 1: 21-22), middle – 1 specimen and with tip – 8 specimens (Fig.

1: 23-24). One middle specimen is a relic of a renewed microburin activity, which indirectly testifies metrical qualities of blades whose length enables such activities.

Basic microburins together with the group of microliths with preserved butts show the proximal features of blade fragments that were selected to be turned into tools. Totally, in 25 analyzed microliths and microburins, the exclusive presence of flat butts were noticed. Moreover, in 23 cases, some traces of abrasion and a lack of bulbar scars were registered. Bulbs of all the specimen are delicate and the lip appears on 21 artefacts.

2.2. Discussion

The most intriguing finds at the study site belong to microliths. They represent c. 40% of all the finds and almost 100% of the tools. Blades occupy the second position in terms of quantity – 32%.

The microwear analysis of this inventory was conducted by M. Winiarska-Kabacińska (appendix 1). The study embraced more than 80% of all the artefacts. 76 specimens had transformations which allowed them to be classified as used. Among the used specimens, microliths prevailed. M. Winiarska-Kabacińska noted that the vast majority of the microliths were used for hunting equipment.

The inventory can be dated to the Boreal period, which is partially confirmed by the share of typical Maglemosian elements (scalene triangles, microliths with retouched bases, truncated blades), the entire absence of trapezes and the presence of the middle Mesolithic stylistics of blanks (S.H. Andersen 1983).

Single artefacts, mainly the microliths – referring to the finds in Dąbrowa Biskupia 71, were recorded in at least several sites in the Tążyna valley. The Mesolithic specimens obtained in Wilkostowo 23/24 may serve as examples here. From among the flint products discovered at this site, about 5 specimens may be connected with the Mesolithic period.

Microliths are the most distinct artefacts within this group. Altogether, 3 forms were discovered which, in respect of typology, make up quite a homogeneous collection, typical of the Maglemose culture. Among them, the following may be distinguished: 1 slender triangle with the tip broken off (Fig. 36: 2), 1 small elongated scalene triangle (Fig. 36: 3) and a microlith with retouched base (Fig. 36: 4).

The remaining part of the Mesolithic collection is made up of at least 1 microlithic bladelet (Fig. 36: 5) and a microlithic single platform blade core (Fig. 36: 6).

Identifications of the described chronological group, despite the scarcity of the materials, is well supported by verifiable sources. Such an opinion does not raise concerns in the case of microliths. It also seems

that technological traits and the morphology of the core and an only bladelet fragment puts these products closer to the Mesolithic flint production.

A small amount of Mesolithic artefacts is conditioned by two factors. The first of them is the original function of the site – connected with an episodic stay of the hunting-gathering population in the site area. Whereas, the other factor is related to the intensity of the Neolithic occupation relics which probably destroyed some older traces of occupation.

2.3. Conclusions

An unusual typological structure of the inventory from the site Dąbrowa Biskupia 71 (an impressive quantity of microliths and blades and an almost complete absence of other artefacts) and similar finds obtained from other sites (e.g. Wilkostowo 23/24), raises a question of the role of the Tążyna river valley in the hunting economy of the local Mesolithic groups.

However, it should be noted that quite a different situation was observed in the neighbouring Toruń Basin. In this area, numerous sites of different Mesolithic cultural tradition have been recorded. They confirm the constant presence of hunter-gatherer groups in the discussed region during the early Holocene. Most of the sites yielded thousands of flint artefacts occurring in very unreadable arrangements. Most probably, they were large multiseason camps utilized by various groups of the Mesolithic hunters (L. Domańska 1995).

So, the question arises: how to explain the differences of exploitation of both regions by the Mesolithic hunters?

No animal bones were discovered at the Mesolithic sites in both areas. On the other hand, some remains of fauna were recorded at the sites situated in the western part of the Toruń-Eberswalde marginal stream valley. The site Krzyż Wielkopolski 7, dated to the first half of the Boreal period, can serve an example here (J. Kabaciński, E. David, D. Makowiecki, R. Schild, I. Sobkowiak-Tabaka, M. Winiarska-Kabacińska 2008; J. Kabaciński 2009). A workshop was discovered there, in which tools from the antlers from deer and, to a lesser extent – from the limb bones of aurochs were manufactured.

Presumably, deer and aurochs occurred also in the Toruń Basin in large numbers, which is the eastern part of the Toruń-Eberswalde marginal stream valley. That faunal assemblage was arguably complemented by deer, wild boars, elks, aurochs and numerous predators (M. Kobusiewicz 1999). Most probably, the same animals occurred in the Tążyna valley as well.

What then encouraged the hunters representing the Maglemose culture to hunt in the middle section of the valley? Perhaps, it was a mere

curiosity as the landscape of that part of the Tążyna valley differed substantially from the landscape of the Toruń Basin – which was caused by the presence of patches of black earths surrounding the valley in the section where the river flowed through the Kuyavian Plateau. Another purpose of those ventures could be hunting certain species of fauna or, perhaps, the hunting expeditions did not result from the desire for food but from some, unknown to us, hunting rituals. Perhaps the area of the valley was a place of initiation or was used for hunting rituals, which aimed at ensuring food for the shamans.

At this stage of the research, the aforementioned questions cannot be univocally answered. Hopefully, the further research in this area will allow for more precise hitherto observations.

Chlewiska 132 (at the top), Przybranowo 3 (at the bottom).

3. The flint and flint technology of the Linear Band Pottery culture

The primary aim of this chapter is to characterize the flint inventories associated with the community of the Linear Band Pottery culture, acquired in the course of excavations which were carried out in the middle section of the Tążyna river basin. The field work in this part of Kuyavia was performed in the 1980s of the previous century by the Kuyavian Expedition from the Adam Mickiewicz University in Poznań and, at the beginning of the 21st century, by the Institute of Archaeology at the University of Łódź. The research works – mainly surveys, encompassed six sites (L. Czerniak 1994; L. Domańska, S. Rzepecki 2009).

The features of locality of the sites belong to special characteristics describing the settlement of the community of the Linear Band Pottery culture in the study area. They were discovered in environment, which was typical of these communities, of fertile soils, i.e. black earths and in the area of sandy soils that fill the bottom of the Tążyna river valley. The latter group of the sites, situated in an environment typical of the Mesolithic groups, is particularly important for the study of the relationship between the flint processing performed by hunters and the flint processing by the settlers representing the Linear Band Pottery culture.

Flint artefacts were recorded at 4 sites of the Linear Band Pottery culture. Two of them (Grabie 4 and Przybranowo 3) represent classical, permanent sites occupying the areas which were most suitable for farming – the black earths (L. Czerniak 1994). The other two sites (Chlewiska 132 and Podgaj 32) represent an atypical trend in the settlement, usually located in the poorest soil context (L. Czerniak 1994; L. Domańska, S. Rzepecki 2009; S. Rzepecki 2013).

The present chapter will further present an attempt to compare flint working associated with the communities of the Linear Band Pottery culture based in these two different environments.

3.1. The site presentations

3.1.1. Chlewiska 132, Dąbrowa Biskupia commune

The site Chlewiska 132 is located on the sandy bottom of the Tążyna river valley (L. Domańska, S. Rzepecki 2009; S. Rzepecki 2013). It occupies a relatively small part of a vast sandy flattening, neighbouring on the north and north-east with an unnamed flow.

The site was excavated in the years 2001-2003 within a broader project of recognition of the Mesolithic and Neolithic occupations in the Tążyna river basin. In the course of three short research actions, trenches of a total area of 2.70 acres were explored. Only in the central part of the site, were the poorly preserved remains of a cultural layer with one pit discovered.

The site yielded 520 pottery fragments. According to S. Rzepecki, among the excavated fragments – thin-walled pottery decidedly prevails and it constitutes about 76.6% of the assemblage. Generally, S. Rzepecki refers the collection of pottery from Chlewiska 132 to the early note stylistics connected with phase II of the Linear Band Pottery culture (S. Rzepecki 2013).

What is worth emphasizing is, first of all, a considerable cultural homogeneity of the obtained materials – except for the Linear Band Pottery culture ceramics, where only several fragment of vessels of the Globular Amphora culture were obtained.

A vital importance should be ascribed to the large planigraphic coherence between the Linear Band Pottery culture ceramics and flint artefacts. Therefore, it seems that with a great probability, we can talk about an affiliation of the vast majority of the flint artefacts to this unit. Only one specimen (a flake from the polished axe made of banded flint – Fig. 4: 5) is surely not connected with the Linear Band Pottery culture. Axes of this raw material were produced by the Globular Amphora culture societies (L. Domańska 2013).

At the study site, 104 flint artefacts were discovered. Three of them were recognized in the feature, the other occurred in the layer surrounding the mentioned feature.

The raw material structure of the inventory

The dominating raw material in the inventory from Chlewiska 132 is local Baltic flint (Tab. 5). Its percentage is 45.2% of the entire material (47

specimens). The second place in respect of quantity is occupied by the products of imported chocolate flint. 36 specimens produced from this raw material were distinguished, which is 34.6% of all the artefacts.

Tab. 5. Chlewiska 132.

Raw material structure of the inventory	**N**	**%**
Baltic	47	45,2
Chocolate	36	34,6
Świeciechów	3	2,9
Banded	1	0,9
Burnt	17	16,4
Total	104	100

Moreover, single specimens of Świeciechów flint (3 items) and of banded flint (1 item) were registered at this site.

It should also be added that a relatively high percentage in this inventory is reached by the artefacts thermally deformed to a degree foreclosing their precise identification in terms of raw material. They were generally classified as overheated specimens (17 items – 17.5% of all the products).

The quantitative-qualitative structure of the inventory

The general structure of the inventory consists of products classified within 7 categories of flint artefacts (Tab. 6). Most of them are technologically connected with flake exploitation and the splintering technique. Not taking blade tools into account, only 5 other specimens are the products of blade exploitation.

Tab. 6. Chlewiska 132.

Quantitative-qualitative structure of the inventory	**N**	**%**
Flakes	22	21,2
Blades	5	4,8
Splintered pieces	11	10,6
Splintered piece flakes	18	17,3
Chunks	11	10,6
with negative scars	4	
burnt	7	
Tools	36	34,6
Flakes from axes	1	0,9
Total	104	100

The group of flake exploitation includes 22 flakes (21.2% of the inventory). After taking the flake tools into consideration (15 items), the group would be the most numerous in this assemblage. Together, these artefacts make up about 35% of all the products.

Moreover, the group of products of the splintering technique is distinguishable in respect of quantity; it includes 11 splintered pieces and 18 splintered piece flakes. They, together, make up 27.9% of all the materials. It is supplemented by 3 atypical splintered-based tools.

The products of blade exploitation occurred a little less numerously. They form a group of 5 blades and 18 blade tools (together 22.1% of all the artefacts).

The least numerous group, to form part of the inventory is made up of the specimens defined as chunks (10.6%). The group includes 4 negative chunks and 7 intensively overheated ones.

In terms of quantity, tools have a significant share in the general structure of the inventory from Chlewiska 132. Totally, 36 tools were identified which make up 34.6% of the entire inventory (Tab. 7). They were divided into two subgroups: conventional and atypical tools, i.e. blades, flakes and products of the splintering technique with traces of use in the form of the so-called use retouch and polish.

Tab. 7. Chlewiska 132.

Tools	**N**	**%**
End-scrapers	3	8,4
Borers	1	2,7
Truncated blades		
with single truncation	6	16,6
Blades		
retouched	1	
micro-retouched	1	30,5
with use retouch	8	
with polish	1	
Flakes		
retouched	1	
micro-retouched	4	33,4
with use retouch	7	
Splintered-based tools		
retouched splintered pieces	1	8,4
splintered piece flakes with use retouch	2	
Total	36	100

Together, only 10 conventional specimens were distinguished amongst which two types prevail in respect of quantity: truncated bla-

des (6 items) and end-scrapers (3 items). Also 1 borer was distinguished.

The other part of the tools comprises atypical forms (26 items). These specimens were grouped on the grounds of the blanks within three subsets: blade, flake and splintered-based ones. Among them, flake (12 items) and blade tools (11 items) prevail.

Moreover, 1 flake of banded flint removed from a polished axe was distinguished; it should be connected with the few numerous fragments of the Globular Amphora culture pottery discovered at the same site.

Characteristics of the inventory

Flakes

Flakes made of local Baltic flint prevail (10 items), the other group is made up of flakes of chocolate flint (8 pieces) and intensively overheated specimens (4 pieces).

In an analysis of metric features, 17 complete flakes and 6 flake tools were used. Specimens of length placed in a metric class 12-30 mm, 5 to 30 mm wide, and 2 to 8 mm thick predominate. Only single specimens exceed these values.

Among the complete flakes specimens with a single-directional arrangement of scars on the dorsal face and with faceted butts are predominant. Bulbs of these flakes are most often flat with bulbar scars. As far as the longitudinal section is concerned, straight specimens prevail.

A technological background of most of the flakes is impossible to determine. Only 2 specimens of chocolate flint (a flake and a flake tool) and 1 specimen of Baltic flint (a flake tool) have blade scars on the upper face, connecting their occurrence with the process of blade cores transformation.

Blades

Only 5 fragments of blades were distinguished (Fig. 5: 1). They were made of different kinds of raw material: one of each of Baltic, chocolate and Świeciechów flint, the other 2 specimens were intensively overheated.

The sizes of 4 fragments of blades are similar, their width is placed in a metric interval 12-13 mm, and thickness ranges from 3 to 5 mm. The latter blade fragment is considerably smaller, its width is 9 mm, and thickness less than 2 mm.

More data for the metric characterisation of blades is provided by the tools (18 specimens). The length of 6 complete blade tools show some differentiation and ranges from 30 to 60 mm. The width of most speci-

mens is placed in a metric interval 10-20 mm, and the thickness in an interval 2-4 mm.

Among the complete blades and proximal fragments of blades and blade tools (together 10 items), specimens with faceted butts (6 items) and flat bulbs without bulbar scars predominate.

Splintered pieces and splintered piece flakes

Products of the splintering technique in terms of quantity are only slightly inferior to products of flake exploitation. 11 splintered pieces (Fig. 6: 10) and 18 splintered piece flakes were distinguished. A considerable part of them were made of Baltic flint: 7 splintered pieces and 12 splintered piece flakes. From among the non-local raw materials, the following were distinguished: 3 splintered pieces and 6 splintered piece flakes of chocolate flint. The group of splintered pieces is supplemented by 1 intensively overheated specimen.

Among the splintered pieces, double-faced bipolar specimens prevail; 7 such products were distinguished. Other splintered pieces were included to a group of multi-polar specimens. On their surfaces, only splintered scars or natural surfaces of concretions occur.

Among the splintered piece flakes, the specimens with a bi-directional arrangement of scars on the upper face (10 items) are most numerous, less numerous are the flakes coming from the multi-polar splintered pieces (4 items) and flakes with a single-directional arrangement of scars (3 items). Moreover, 1 completely cortical splintered flake was distinguished. On the dorsal faces of flakes, splintered scars occur; blade scars were observed only in two cases. The genesis of these specimens is connected with the transformations of blade cores of Baltic flint.

The height of most splintered pieces is placed in an interval 20-35 mm, the width ranges from 15 to 25 mm, and the thickness 5-10 mm. The sizes of the flakes are similar to the sizes of the splintered pieces. Specimens 15-30 mm long, 5-20 mm wide and 4-9 mm thick prevail.

Tools

Tools were divided into two subgroups: conventional and atypical tools. The first subgroup includes end-scrapers, a borer and truncated blades, the others were atypically retouched specimens and the ones with the so-called use retouch. It is a clearly predominant group among the analyzed materials. 26 such specimens were distinguished, which makes up 72.2% of all tools.

End-scrapers

3 end-scrapers were distinguished (Fig. 4: 1-3), 2 from among them were made of chocolate flint, and 1 is an intensively overheated specimen. All the end-scrapers were included to short specimens. Their height is placed in an interval 20-23 mm. The width of specimens of chocolate flint is 25 mm, and thickness 7 mm, the sizes of the overheated end-scraper are a little smaller: width – 20 mm, thickness – 5 mm. The height of the end--scraper fronts ranges from 5 to 7 mm.

Morphological features of the end-scrapers suggest their connection with blade blanks, although – because of the scale of transformations – this cannot be undoubtedly stated.

Borer

The specimen was made of Baltic flint and was formed as a result of the truncated blade transformation (Fig. 4: 4).

Truncated blades

This category includes 6 single truncated blades (Fig. 4: 6-11). Specimens made of chocolate flint prevail among them (3 items), 2 were made of Baltic flint, and 1 is an intensively overheated specimen.

Most truncated blades have their proximal ends broken off, only 2 specimens are completely preserved. The lengths of the complete specimens are respectively 32 and 38 mm. The truncated blades of width between 15 and 20 mm and 4 mm thick predominate.

Only 2 truncated blades have clear polish, and in both cases it is arranged diagonally to the axis of the blank.

Atypical blade tools

11 such tools were identified. They were divided into retouched blades (Fig. 5: 7), blades with micro-retouch (Fig. 5: 11), blades with use retouch (Fig. 5: 2, 4-6, 8-10), and a blade with polish (Fig. 5: 3).

Most of the discussed tools were made of chocolate flint (7 items). Moreover, 3 specimens of Baltic flint were distinguished, and in the case of 1 specimen the raw material remained undetermined because of intensive overheating.

Within this group, complete specimens (4 items) and medial fragments (4 items) prevail, moreover – 2 proximal fragments and 1 distal fragment were distinguished. The sizes of blades with a use retouch are very diverse, the lengths of the complete specimens range from 28 to 63 mm, the widths of all specimens are between 9-21 mm and the thickness ranges from 2 to 9 mm.

Atypical flake tools

A group of atypically retouched flake tools includes 12 specimens. Flakes with use retouch prevail among them, 7 such specimens were distinguished (Fig. 6: 1, 4, 8). Moreover, 4 flakes with micro-retouch (Fig. 6: 2-3, 5-6) and 1 retouched flake were recognized.

Within the group of flakes under consideration, the specimens made of chocolate flint prevail (6 items); the share of other raw materials in this group of tools is as follows: Baltic flint – 4 specimens, Świeciechów flint – 2 specimens.

Atypical splintered-based tools

This group includes one retouched splintered piece and 2 splintered piece flakes with use retouch (Fig. 6: 9). Two from among them are made of Baltic flint and 1 – of chocolate flint.

3.1.2. Grabie 4, Aleksandrów Kujawski commune

The site is located in the area of the black soils, near the edge of the Tążyna river valley. It belongs to the group of the oldest Linear Band Pottery culture sites in the Polish Lowlands (about 5400 BC – L. Czerniak 1994; J. Pyzel 2010). The Linear Band Pottery culture ceramics was scattered on the site surface in an area measuring about 30 by 20 meters. A pottery concentration, 14 by 9 meters, was discovered in this area and explored by means of a 68 square meter sondage (L. Czerniak 1990).

The excavations of the study site resulted in a discovery of 75 flint artefacts (L. Domańska 1995).

The raw material structure of the inventory

In the presented inventory, a predominance of raw materials imported from the southern Poland over local Baltic flint is observed (Tab. 8). Within the group of imports, products of Jurassic flint prevail. 31 specimens of this raw material were registered. On the other hand, specimens made of chocolate flint were in the minority (7 pieces).

31 products were made of local erratic Baltic flint. In 6 cases, due to a high degree of thermal transformations, the kind of flint raw material could not be determined.

Tab. 8. Grabie 4.

Raw material structure of the inventory	N	%
Baltic	31	41,3
Chocolate	7	9,4
Jurassic	31	41,3
Burnt	6	8,0
Total	75	100

The quantitative-qualitative structure of the inventory

The general structure of the inventory is made up of products classified within 8 categories of flint artefacts (Tab. 9). In quantitative terms, products of flake exploitation prevail. They include one flake core and 24 flakes. Together, they make up 33.3% of the whole inventory. A blade group comprises only 2 blades (2.7% of all products). The quantitative share of both groups would definitely grow if tools were included. Both groups would then constitute about 85% of all products.

Tab. 9. Grabie 4.

Quantitative-qualitative structure of the inventory	N	%
Flake cores	1	1,3
Flakes	24	32,0
Blades	2	2,7
Technical waste	1	1,3
Splintered pieces	2	2,7
Splintered piece flakes	5	6,6
Chunks	3	4,0
with negative scars		
burnt	3	
Tools	37	49,4
Total	75	100

Only 7 specimens were included to a group of the splintering technique. Among them, 2 splintered pieces and 5 splintered piece flakes were distinguished, which totally makes up 9.3% of the materials.

The tool group is the predominant group within the analyzed materials (Tab. 10). Generally, 37 specimens were identified, which constitutes almost half of all artefacts discovered at the site (49.4% of the whole

inventory). Tools were divided into two subgroups: conventional tools and atypical ones. The first subgroup includes 17 specimens, whereas the other – 20 tools.

Tab. 10. Grabie 4.

Tools	**N**	**%**
End-scrapers	8	21,7
Perforators	1	2,6
Truncated blades with single truncation with double truncation	 6 2	21,7
Blades retouched with use retouch	 1 9	27,0
Flakes retouched with use retouch	 3 7	25,0
Total	37	100

Within the group of conventional tools, end-scrapers (8 items) and truncated blades (8 items) prevail, moreover – one perforator was distinguished.

Among 20 atypical tools, blade and flake specimens occurred in equal quantities (10 items each). In both groups, tools with use retouch definitely prevail.

Except for the above-mentioned categories in the general structure of the discussed inventory, also 1 technical flake (overpassed flake from a single platform core) and 3 overheated chunks were distinguished.

Characteristics of the inventory

Cores

At the site, 1 flake core of Baltic flint was identified. It belongs to a group of cores with changed orientation and is 23 mm high.

Whereas, the overpassed flake from a single platform core of Jurassic flint is connected with a group of blade exploitation. It was separated from one-platform blade core with a narrow flaking surface (22 mm) and cortical sides.

Flakes

In the inventory from the site of Grabie 4, 24 flakes were distinguished. 11 specimens from among them were made of Baltic flint, 10 of Jurassic flint, 1 of chocolate flint and in the case of 2 flakes due to their intensive overheating, the raw material was not determined.

Flakes the length of which is placed in an interval 20-40 mm, and the width between 15-35 mm prevail, the thickness of most specimens ranges from 4 to 8 mm.

19 complete flakes were subjected to a detailed analysis. Specimens with a single-directional scar arrangement (11 items) prevail over flakes with a multi-directional arrangement of scars on the dorsal face (8 pieces). Flakes with flat butts, distinct bulbs, straight in longitudinal section or incurved in the top part dominate.

The technological genesis of most flakes in the discussed inventory is difficult to determine. The presence of flake core of Baltic flint indicates intentional production of at least part of the specimens from this raw material. Moreover, a specimen of Jurassic flint with blade scars on the upper side was distinguished. The formation of this artefact can be connected with a process of blade core transformation.

Blades

Only 2 proximal fragments of blades were distinguished. A fragment of blade of chocolate flint (width – 13 mm, thickness – 2 mm) is characterized by a faceted butt, distinct bulb with scar and trapezoidal cross-section. The other blade was made of Baltic flint, it is 19 mm wide, and 5 mm thick. This specimen has a faceted butt, flat bulb and is triangular in cross-section.

Blade tools provide much more information. The length of 4 complete specimens can be placed between 37-40 mm. The width of most blade tools ranges from 12 to 16 mm, and thickness from 3 to 4 mm.

Among blade tools, specimens with faceted butts, flat bulbs and cross-sections in the shape of a trapeze are most numerous.

Splintered pieces and splintered piece flakes

A group of products of the splintering technique includes 2 splintered pieces and 5 splintered piece flakes. Specimens made of Baltic flint (6 items) and intensively overheated ones (1 item) predominate.

All splintered pieces are double-faced and bipolar, and their height is accordingly 25 and 35 mm.

Most flakes were removed from bipolar splintered pieces (4 specimens), 1 specimen was removed from a multi-polar splintered piece. The

length of the flakes ranges between 20 and 30 mm, the width is placed between 12-18 mm and thickness from 4 to 8 mm.

Tools

As it has been mentioned above, tools constitute the most numerous group in the analyzed inventory (37 specimens, which makes up 49.4% of all products). Among them specimens made of imported raw materials prevail (25 items).

End-scrapers

8 end-scrapers were identified (Fig. 7: 1-8). Specimens made of Jurassic flint (5 specimens) predominate among them; additionally, 1 specimen of chocolate flint and 2 of local Baltic flint were recorded.

The analyzed group of tools contains mainly blade specimens, and first of all, it is represented by end-scrapers made of Jurassic flint. End-scrapers on flakes are also genetically connected with blade exploitation. This indicates the presence of blade scars on the upper parts of these specimens.

Both slender and chunky specimens were distinguished. The length of complete specimens is placed between 20-40 mm, the width of all end--scrapers ranges from 15 to 28 mm, and the thickness from 4 to 7 mm. The height of the end-scraper fronts is placed between 4 and 6 mm.

Perforator

It is a quite massive specimen of Baltic flint. It was made from a thick splintered piece flake (Fig. 7: 9).

Truncated blades

This category of tools includes 6 single specimens and 2 truncated pieces with double truncation (Fig. 8: 10-17). Specimens made of Jurassic flint (5 items) prevail, the others are truncated blades of local Baltic flint (2 items) and of chocolate flint (1 item).

The length of 2 complete specimens is 35 mm, the width of most products is placed between 13-14 mm, and the thickness is 4 mm. Most truncated blades have oblique truncations in the distal part of the blade.

One of the truncated blades with double truncation is also a blade specimen in the type of an amorphous trapeze (Fig. 8: 16) with traces of use in the form of breakages on one edge, the other specimen was made of a massive flake (Fig. 8: 17) The truncation in the distal part of the latter artefact is slightly arch-shaped in which it resembles the end-scraper front.

Atypical blade tools

10 tools of this type were distinguished. They were divided into retouched blades (1 item – Fig. 8: 1) and blades with use retouch (9 items – Fig. 8: 2-9). Among them products of Jurassic flint prevail (4 items), also 3 specimens of chocolate flint, and 3 of Baltic flint were distinguished.

The retouched blade is completely preserved. Its dimensions are respectively: length 39 mm, width 12 mm, and thickness 3 mm. Among the blades with use retouch blade fragments prevail. The width of most specimens is placed between 10 and 14 mm, and thickness is almost uniform and ranges from 3 to 4 mm. Only 1 specimen is completely preserved, its dimensions are as follows: length 38 mm, width 12 mm, and thickness 4 mm.

Atypical flake tools

This group includes 3 retouched flakes (Fig. 7: 10-11) and 7 flakes with use retouch. Specimens made of Jurassic flint prevail (6 specimens), other tools are products of Baltic flint (4 items).

Among specimens of Baltic flint a platform rejuvenation flake with use retouch was distinguished.

3.1.3. Podgaj 32, Aleksandrów Kujawski commune

The site was discovered on the sandy bottom of the Tążyna river valley. The excavations explored only a small part of the site (L. Czerniak 1988) and yielded 237 fragments of pottery, with an undisputed advantage of fragments of thick-walled pottery (97.9%). L. Czerniak on the grounds of the technology of thick-walled pottery associates the site with the note phase (L. Czerniak 1994).

The flint inventory from the site is extremely poor and consists of 30 specimens.

The raw material structure of the inventory

At the site most probably only local Baltic flint was used. 27 specimens of this raw material were distinguished (Tab. 11). The other 3 specimens show signs of strong thermal transformations preventing a determination of what type of flint was used.

Tab. 11. Podgaj 32.

Raw material structure of the inventory	**N**	**%**
Baltic	27	90
Burnt	3	10
Total	30	100

The quantitative-qualitative structure of the inventory

Most products in the analyzed inventory are connected with two methods of exploitation: flake (11 items) and blade (7 items) methods. Only 1 specimen belongs to the splintering technique group (Tab. 12). 5 tools were delimited from the enumerated specimens (Tab. 13).

Tab. 12. Podgaj 32.

Quantitative-qualitative structure of the inventory	**N**	**%**
Blade cores	3	10,0
Flakes	9	30,0
Blades	2	6,6
Chunks	11	36,7
with negative scars	9	
burnt	2	
Tools	5	16,7
Total	30	100

Tab. 13. Podgaj 32.

Tools	**N**
Microlith	1
Blades	
with use retouch	1
Flakes	
retouched	1
with use retouch	1
Splintered-based tools	
retouched splintered pieces	1
Total	5

The remaining part of the inventory is constituted by specimens defined as chunks (11 items). They include overheated chunks (2 items) and negative chunks (9 items). Among the latter, 5 form a refit group which

reduces not only the group of chunks but also the general amount of the inventory.

Characteristics of the inventory

Cores

The inventory of Podgaj 32 includes 3 blade cores. All of them were made of Baltic flint (Fig. 9: 4-6). An arrangement and parameters of scars on flaking surfaces as well as strongly reduced sizes suggest that they are vestigial cores. It is also worth noting that they maintained single-platform features without traces of a change of orientation. All specimens have prepared, rejuvenated platforms and partly natural sides. Two cores show evident traces testifying their probable tool re-utilisation (Fig. 9: 4, 6). These are changes in the form of strong abrasion and the crunching of platform edges especially intensive on a specimen of so-called Pomeranian flint – one of Baltic flint varieties (Fig. 9: 4).

Flakes

In the inventory of Podgaj 32, 9 flakes were distinguished. This group is very differentiated in terms of sizes: the length of the flakes ranges from 14 to 47 mm, width is placed between 8 and 29 mm, and thickness ranges from 2 to 9 mm.

Among the flakes negative specimens prevail (7 items), moreover, a completely patinated specimen and a cortical flake were distinguished. In a group of negative flakes specimens with a single-directional arrangement of scars (4 items) prevail over specimens with a bi-directional arrangement of scars (3 items). 6 flakes presented faceted butts, and 3 specimens – natural butts.

Blades

One complete specimen and a proximal fragment were distinguished. Sizes of the complete blade are respectively: length – 23 mm, width – 11 mm, and thickness – 3 mm. Both specimens were removed from single platform cores, they have faceted butts and concave bulbs without bulbar scars.

Tools

A group of tools includes a fragment of a triangle (Fig. 9: 3), a blade with use retouch (Fig. 9: 1), a retouched flake (Fig. 9: 2), a flake with use retouch and a retouched splintered piece. All specimens were made of Baltic flint.

The blade with use retouch in terms of micromorphology refers to cores discovered at the discussed site. Like the cores, it has a slightly rejuvenated butt without traces of platform edge trimming. Whereas, the retouched flake has three edges retouched giving it its triangular shape. This specimen in categories of the Mesolithic tools classification can be determined as a side-scraper with an alternate retouch.

3.1.4. Przybranowo 3, Aleksandrów Kujawski commune

This site is dated to the beginning of phase III and determines the youngest period of the Linear Band Pottery culture development in Kuyavia (L. Czerniak 1994; J. Pyzel 2010). A collection of flint artefacts obtained during excavation includes 218 specimens.

The raw material structure of the inventory

The raw material that definitely prevails in the inventory from Przybranowo 3 is non-local chocolate flint (Tab. 14). Its percentage is 75.7% of the entire material (165 specimens).

Tab. 14. Przybranowo 3.

Raw material structure of the inventory	**N**	**%**
Baltic	41	18,8
Chocolate	165	75,7
Burnt	12	5,5
Total	218	100

Products made of local Baltic flint are in the minority – 41 specimens (18.8%).

About 5.5% of the raw material structure of Przybranowo inventory is made up of artefacts which were subjected to a degree of thermal transformation, preventing a diagnosis of what raw material was used. They were generally classified as overheated specimens (12 artefacts).

The quantitative-qualitative structure of the inventory

The general structure of the inventory comprises products classified within 8 categories of flint artefacts (Tab. 15). Most of them are technologically connected with two exploitation methods: flake and blade methods.

Tab. 15. Przybranowo 3.

Quantitative-qualitative structure of the inventory	**N**	**%**
Flake cores	1	0,5
Flakes	57	26,1
Blades	22	10,1
Splintered pieces	9	4,1
Splintered piece flakes	22	10,1
Chunks	4	1,8
with negative scars	2	
burnt	2	
Chips	4	1,8
Tools	99	45,5
Total	218	100

The most numerous forms belong to a group of flake exploitation (together 58 specimens). The group comprises of 57 flakes and a vestigial flake core (together 26.6% of the entire inventory). After taking flake tools into account (41 specimens), the percentage of this group would further increase and the group would constitute almost half of all the products.

The group of blade exploitation includes 22 blades which make up over 10% of all products. In the discussed inventory blade tools are unusually numerous – 54 specimens of them were distinguished. Together blades and blade tools make up 34.9% of all products. It needs to be emphasised that there are no other elements of blade component, especially so-called technological forms connected with the exploitation, preparation and repair of blade cores (i.e. crested blades or rejuvenation flakes).

The smallest group in terms of quantity is constituted by products of the splintering technique. This group includes 9 splintered pieces and 22 splintered piece flakes which together constitute 14.2% of the whole inventory. What is more, in the inventory under discussion 4 tools made on splintered piece flakes were distinguished.

A small part of the inventory is made up by specimens determined as chunks (1.8%); 2 overheated chunks and 2 negative ones were distinguished.

Micro-debitage in the form of chips, i.e. flakes of sizes smaller than 5 mm (4 items) also took up a small part of the inventory.

What is significant, in terms of quantity, is the percentage of tools in the general structure of the inventory from Przybranowo 3. Totally, 99 tools which constitute 45.5% of the entire inventory (Tab. 16) were identified.

Tab. 16. Przybranowo 3.

Tools	**N**	**%**
End-scrapers	7	7,1
Borers	1	1
Truncated blades with single truncation with double truncation	 5 3	8,1
Trapezes	2	2
Blades micro-retouched with use retouch with polish	 1 35 1	37,3
Flakes retouched micro-retouched with use retouch	 4 1 35	40,4
Splintered-based tools splintered piece flakes with use retouch	4	4,1
Total	99	100

Characteristics of the inventory

Core

At the site, a vestigial flake core made of chocolate flint was discovered (Fig. 10: 10). It is a single platform specimen, 15 mm high.

Flakes

In the inventory from Przybranowo 3, 57 flakes were distinguished. Most of them were definitely made of chocolate flint (37 specimens), the remaining group of flakes includes 16 specimens of Baltic flint and 4 intensively overheated specimens.

This group is quite differentiated in respect of sizes. Flakes of length that can be placed between 25 and 40 mm, and of width that ranges from 15 to 25 mm prevail. Specimens whose both sizes are placed between 10 and 20 mm are also relatively numerous. The thickness of most of them ranges between 2 and 6 mm.

Flakes made of chocolate flint were subjected to a detailed analysis. Among them 14 specimens whose dorsal face was covered, at least 90%, with cortex was distinguished. Among the remaining flakes specimens with a multi-directional arrangement of scars on the upper face prevail

(15 items), moreover, specimens with a single-directional (7 items) and bi-directional (1 item) arrangements of scars were distinguished. Flakes with flat butts and bulbs, straight in longitudinal section or with medial turn-ups prevail.

Technological genesis of the vast majority of flakes is difficult to estimate. On a few specimens (1 flake and 3 flake tools) blade scars were observed which testifies their connection with the transformation of blade cores.

The presence of the vestigial flake core of chocolate flint in the inventory may indicate the local production of flakes from this raw material. The scale of this process is, however, difficult to estimate.

Blades

22 blades were distinguished (Fig. 11: 1-5). Most of them were made of chocolate flint (18 specimens), the others are 3 blades of Baltic flint and 1 intensively overheated specimen.

This group includes only 2 complete blades. Among the fragments proximal parts of blades are most numerous (18 specimens), moreover, one medial and one distal fragment were distinguished.

From the analysis of blades and blade tools it results that as far as sizes are concerned the group is quite homogeneous. The length of complete specimens (2 blades and 8 blade tools) is placed between 35 and 50 mm. The thickness of most specimens ranges from 2 to 5 mm, and width from 12 to 18 mm.

Complete specimens and proximal fragments of blades and blade tools made of chocolate flint were subjected to a detailed analysis. Specimens with faceted butts prevail among them. Blades with small and clear bulbs, most often without bulbar scars occurred roughly in the same proportions. Specimens that prevail are trapezoid in cross-section, and straight in longitudinal section.

Splintered pieces and splintered piece flakes

Products of the splintering technique includes 9 splintered pieces (Fig. 10: 11) and 22 splintered piece flakes. Most of them were made of chocolate flint (5 splintered pieces and 15 flakes), others were produced of Baltic flint.

Among splintered pieces bipolar specimens slightly prevail (5 items) over multi-polar ones (4 items). Surfaces of all specimens are covered with splintered scars which makes it impossible to determine their genesis. The height of splintered pieces ranges from 30 to 50 mm.

On the dorsal faces of the splintered piece flakes bi- and multi-directional splintered scars prevail (8 items). The dorsal faces of 6 flakes

of chocolate flint are covered with cortex. Only on one flake of this raw material were blade scars registered.

The sizes of most splintered piece flakes are placed in two metric classes. The first group includes flakes the length of which is placed between 15 and 25 mm, and width from 20 to 25 mm. The other group comprises flakes of length placed between 25 and 35 mm and width between 10 and 20 mm. The thickness of nearly all flakes ranges from 4 to 10 mm.

Tools

Tools definitely prevail on the discussed site. They were divided into two subgroups: conventional and atypical tools. The first of them includes 7 end-scrapers, 8 truncated blades, 2 trapezes and 1 borer. The other group consists of 81 specimens (81.8% of all tools).

End-scrapers

The group includes 7 specimens (Fig. 10: 1-6) the majority of which are end-scrapers made of chocolate flint (6 items). 6 blade specimens and 1 end-scraper on a flake were distinguished. In the group of blade specimens short end-scrapers made on proximal parts of blades prevail (5 items). The length of these specimens ranges from 18 to 30 mm, width from 13 to 20 mm, and thickness is placed between 3 and 7 mm.

All blade end-scrapers have arch-shaped end-scraper fronts. Their height of the end-scraper fronts ranges from 4 to 8 mm. The end-scraper on a flake is a double specimen, the height of its fronts is 13 mm. Only on the edge of one end-scraper, was a retouch registered.

Borer

A distinguished borer is an overheated specimen (Fig. 11: 9), only the upper part of the artefact is preserved.

Truncated blades

This category of tools includes 5 single specimens (Fig. 11: 13-17) and 3 double truncated blades (Fig. 11: 10-12). 7 from among them were made of chocolate flint and 1 truncated blade is intensively overheated. On two double specimens, intensive polish was registered, whereas on the side edges of all truncated pieces, use retouches were recorded. Specimens with oblique truncation prevail.

One specimen has a broken-off base, others are completely preserved. The lengths of complete specimens are placed between 25 and

40 mm. The thickness of most truncated blades is 4 mm (6 items), and the width ranges from 11 to 18 mm. 14-15 mm wide specimens prevail.

Trapezes

Two trapezes were identified – they were both made of chocolate flint (Fig. 11: 6-7). To produce these specimens, blades 11 and 13 mm wide and 3 mm thick were used.

Atypical blade tools

37 such specimens were registered, which makes up 37.3% of all tools. They were classified as: micro-retouched blades (Fig. 11: 8), blades with use retouch (Fig. 12: 1-12) and blades with polish (Fig. 12: 13). Blades with use retouch definitely prevail (35 items).

Most of the analyzed tools were made of chocolate flint (29 items), 3 of them of Baltic flint, and the other 3 blades were intensively overheated. 8 specimens were completely preserved, their length ranges from 35 mm to 50 mm. Other tools were fragments – proximal parts prevailed (16 items). Moreover, 7 medial fragments and 6 distal parts were recorded.

The sizes of the distinguished tools were quite uniform, the widths of the vast majority of them ranged from 13 to 18 mm, and the thickness was 4 mm.

Atypical flake tools

This subgroup includes 40 specimens, which makes up 40.4% of all tools. Among them, retouched flakes (Fig. 10: 7-8), micro-retouched flakes (Fig. 10: 9) and flakes with use retouch were distinguished. The latter category dominates: 35 specimens – 87.5% of atypical flake tools.

Specimens of chocolate flint are most numerous (38 items), the other 2 were made of Baltic flint. Sizes of the described tools are quite various. Specimens 20-35 mm long, 10-35 mm wide, and 4-8 mm thick prevail.

Atypical splintered-based tools

An assemblage of atypical tools was complemented by 4 splintered piece flakes with use retouch. Three of them were made of chocolate flint and 1 was a specimen of Baltic flint.

3.2. Discussion

3.2.1. Flint processing in the area of the settlements situated in the black earths zone

Two sites were excavated in the area of the black earths, near the edge of the Tążyna river valley: Grabie 4 – representing the oldest sites of the Linear Band Pottery culture in the Polish Lowlands (about 5400 BC) and Przybranowo 3, dated to about 5000 BC (L. Czerniak 1994; J. Pyzel 2010).

The inventories of the study sites show a different structure of raw materials. In the case of both of these sites, the raw materials imported from southern Poland to the Lowlands prevail, however, they differ in terms of the structure of the imports. Considering the matter of materials from the site in Grabie 4, a presence of artefacts made from Jurassic flint is clearly distinguishable (41.3% of all specimens). In turn, the site in Przybranowo 3 is distinctive by its high share in chocolate flint materials (over 75%).

In terms of technological structure, both inventories are close to each other. The group of flake core exploitation prevails, the least numerous is the group of blade core exploitation and the products of the splintering technique occupies a middle position here. It should be noted, however, that the quantitative share of the groups associated with the classical core exploitation would rise substantially if the group of tools would be included. The blade and flake tools clearly dominate in this group. The splintered-based tools were recorded only in the inventory of Przybranowo 3 and these specimens comprised of not more than just over 4% of all the tools.

At both sites, the largest group of artefacts consist of tools – which cover almost half of all the specimens (Grabie 4 – 49.4% and Przybranowo 3 – 45.5%). Among the tools, atypical tools prevail. In the inventory from the site of Grabie 4 they represent over 50% of all tools and in materials obtained from the site Przybranowo 3, the ratio for these specimens exceeds 80%. This group of tools is formed out of the atypically retouched blades and flakes. The group of typological tools is dominated by end--scrapers and truncated blades.

To sum up the comparative analysis, it is worth re-emphasizing the elements linking the two inventories; these are: (1) a clear prevalence of products made of imported raw materials; (2) a dominance of classical methods of core exploitation; (3) a clear advantage of atypical tools over conventional ones; (4) a dominance of end-scrapers and truncated blades in the group of conventional tools.

The distribution of raw materials as well as technological and typological structures of analyzed flint materials are entirely consistent

with the flint production of the Linear Band Pottery culture on the territory of the Polish Lowlands (L. Domańska 1995; J. Kabaciński 2010). Particular attention should be paid to the role of the chocolate flint imported into the Lowlands. At some sites, the share of this raw material is almost 100% (L. Domańska 2004) whereas at other sites a lower proportion was recorded: Miechowice 7 – 50% (L. Domańska 1995), nevertheless it belongs to the most important raw material used in the production of tools.

All the study sites share a dominance of the classical methods of core exploitation. The total index for the blade and flake methods is 80-90% (J. Kabaciński 2010). Also, at all the sites, almost identical tool groups occur – dominated by end-scrapers, truncated blades as well as retouched blades and flakes (L. Domańska 1995; J. Kabaciński 2010).

3.2.2. Flint processing at atypical sites

Based mainly on the characteristics of pottery obtained from the Linear Band Pottery culture sites located in areas incorporating the sandy bottom of the Tążyna river valley, two major types of sites have been distinguished: the Podgaj type (L. Czerniak 1994) and the Chlewiska type (L. Domańska, S. Rzepecki 2009; S. Rzepecki 2013).

The assemblages of the Podgaj type are entirely different from the long-term settlements of the Linear Band Pottery culture from the area of black earths in Kuyavia. These differences are noticeable primarily in the character of the settlements (small encampments), in their location (sandy bottom of the Tążyna river valley), in the technological structure of the pottery (almost total domination of thick-walled pottery) and an absence of flint tools made of imported raw materials (e.g. chocolate flint, which is commonly used by the Linear Band Pottery culture communities in Kuyavia).

In turn, the Chlewiska type is characterized by a form of pottery structure which is typical of the long-term settlements of the black earths zone (a high share of thin-walled pottery – about 76% of the assemblage), the presence of flint products made from raw materials imported from the southern part of Poland as well as the presence of stone artefacts. Another distinguishing feature is the diversity of forms (encampments) and zones of the settlement (sandy bottom of the Tążyna river valley), which stands in opposition to the traditional Linear Band Pottery culture sites.

Three sites have been classified as the group of Podgaj type: Podgaj 32, Poczałkowo 30 and Przybranówek 4 (L. Czerniak 1994). Only test excavations were carried out at these sites. The assemblages of pottery, obtained in their effect, were rather modest – in Podgaj 32 – 237 frag-

ments of vessels, in Poczałkowo 30 – 150 fragments and in Przybranówek 4 – 90 fragments (L. Czerniak 1994; S. Rzepecki 2013).

The characteristics of flint production connected with the study sites is based solely on the materials discovered at the site Podgaj 32. No flints artefacts were noted at the other sites.

Among the artefacts derived from the site Podgaj 32, the following artefacts deserve particular attention: 3 microlithic blade cores, 2 blades, a fragment of a microlithic triangle as well as a retouched blade and flake. These specimens may be deemed as an assemblage of Mesolithic artefacts. The following features of the proposed study assemblage seem to support this option: the local raw material from which they were made, the presence of a triangle, the retouched flake which can also be counted as a Mesolithic side-scraper as well as the retouched blade referring in terms of technology to the cores present in this assemblage. These observations became the basis for the recognition of the study inventory as an example of the cultural changes taking place within the Linear Band Pottery culture. This was probably associated with an attempt to colonize the sandy areas of the Tążyna river valley and establishing, during this process, some closer contacts with the local Mesolithic population (L. Czerniak 1994; L. Domańska 1995; 2003).

In the hitherto studies (L. Czerniak 1994; L. Domańska 1995; S. Rzepecki 2013), the inventory of flint collected from the site Podgaj 32 was considered homogeneous. The main argument in favour of such an interpretation of the study materials was, among other things, the overlapping ranges of pottery and flint in the area of the site and their planigraphic interdependence with a series of post-holes forming a structure defined by L. Czerniak as a hut (L. Czerniak 1988). The flint products occurred in a pit in the eastern part of that structure and in the western part of the hut – where a pottery concentration from the Linear Band Pottery culture was recorded and with it – a small amount of flint artefacts.

A microwear analysis of the materials described above showed that two of the microlithic cores possess intense traces of secondary use as tools. One of these specimens was probably used for striking a fire and was mounted on an undefined holder or stored in a sheath made of soft material (appendix 2). This flint tool was the only artefact made of Pomeranian flint, which is sometimes referred to as a variety of Baltic flint. Unfortunately though, it is not possible to clearly define the user of the tool. Perhaps the artefact was employed for striking fire by a dweller of the study encampment or, alternatively, it might have been abandoned there by an undefined user.

The remaining Mesolithic specimens from the study site seem to show the closest analogies to the site in Wilkostowo 23/24 (chapter 5). The extensive territory of the Funnel Beaker culture settlement yielded

a relatively small assemblage of the Mesolithic artefacts, which includes a microlithic core blade, at least one blade, 2 triangles and a microlith with a retouched base. These products can be associated with the Maglemose culture of the early Mesolithic period. Similarly, some small groups of Mesolithic artefacts were discovered in other parts of the Tążyna river valley (flint materials from the field surveys by the Kuyavian Expedition from the Adam Mickiewicz University). All these findings point to an intensive penetration of the Tążyna river valley bottom by the communities representing the early Mesolithic period.

Given the foregoing observations, the hypothesis stating that the Linear Band Pottery culture community, that colonized the Tążyna river valley, utilized the experiences of the local Mesolithic groups in the processing of flint, does not seem plausible. The Mesolithic group of artefacts obtained from Podgaj 32 suggests that the early Mesolithic hunters had a relatively short presence at the study site – which occurred before the groups of farmers representing the Linear Band Pottery culture appeared there.

The observations carried out at the site Chlewiska 132 are utterly different. This site, similarly to the previously discussed encampment, is located at the sandy bottom of the Tążyna river valley.

In the inventory obtained from this site, almost half of the flint artefacts were made of local Baltic flint (45.2%), next – in terms of the quantity share – were specimens of imported chocolate flint, representing 34.6% of all the products.

The products made using the splintering technique constitute the prevailing group (27.9%) in terms of the technological structure of the inventory. The products of classical methods of core exploitation occupy second place (26%) and they are only slightly inferior to the group of products of the splintering technique. It should be noted, however, that the quantitative share of the groups associated with the classical methods of core exploitation would rise clearly after taking the group of tools into account, among which the specimens made of blades and flakes predominate.

Tools constitute the most numerous group of artefacts (34.6%). This group is dominated by atypical specimens (72.3%) and it consists of retouched blades and flakes as well as the specimens with use retouch. Also, 3 splintered-based tools were recorded. The group of conventional tools is dominated by end-scrapers and truncated blades.

A comparative analysis of flint materials obtained from the site in Chlewiska 132 and two classical sites of the Linear Band Pottery culture, located in the zone of black soils i.e. the site in Grabie 4 and Przybranowo 3, allows for the formulation of several conclusions.

First, the inventories from these sites differ in terms of use of raw materials imported from southern Poland – i.e. chocolate and Jurassic

flint. The former strongly prevails in the inventory from Przybranowo 3 (75.7%), while at Grabie 4, Jurassic flint was mostly used (41.3%). In the materials from Chlewiska 132, products made from local Baltic flint were the most frequent finds (45.2%), while specimens of chocolate flint quantitatively took second position (34.6%).

It must be clearly noted, though, that the perceived differences are purely quantitative. At all three sites, the imported raw materials played a vital role in the production of tools.

Secondly, the inventory from Grabie 4 and Przybranowo 3 far outweigh the products made using classical methods of core exploitation (respectively 36% and 36.7%). The products of the splintering technique occupy second position and their quantitative share is: Grabie 4 – 9.3%, Przybranowo 3 – 14.2%. A different proportion was observed at the site of Chlewiska 132. In this inventory, the products of the splintering technique slightly outweigh the products of classical methods of core exploitation (respectively 27.9% and 26%).

It should be noted, though, that after reckoning the blades and flakes and tools made of the flake or blade blanks, the role of the classical methods of core exploitation will be similar at all three study sites.

Thirdly, all three sites are very similar with respect to the structure of the groups of tools. They are characterized by a clear predominance of atypical tools and a similar assemblage of conventional tools.

Additionally, microwear analysis of the selected artefacts gave nearly identical results for the study sites (appendix 2). Among the tools from all three sites were harvesting tools and the specimens used in the processing of animal carcasses strongly prevailed.

3.3. Conclusions

The flint inventories presented herein before show a remarkable consistency of the flint production of the Linear Band Pottery culture (L. Domańska 1995; J. Kabaciński 2010). In the whole period of the existence of this culture in Kuyavia, regardless of the location of the sites (black earths or sandy bottom of the Tążyna river valley), the production of flint tools represent the same model that can be described as a „Linear" model of flint processing. This model is characteristic of: (1) a universal use of raw flint materials of high quality, imported from southern Poland to the Lowlands, among which a special role is played by chocolate flint; (2) a dominance of classical methods of core exploitation; (3) a clear predominance of atypical tools over conventional tools; (4) a dominance of end-scrapers and truncated blades in the group of conventional tools.

Nevertheless, the assemblages of the Podgaj type cannot be subsumed into this model. The inhabitants of the encampments representing

the „Linear" community presumably did not use flint tools. If they did – it must have been a very small collection of products – limited to barely a few flakes produced from local raw materials.

Przybranówek 43 (at the top), Poczałkowo 38 (at the bottom).

4. The flint and flint technology of the Funnel Beaker culture – the Early Wiórek Horizon

The characteristic of the flint production from the Early Wiórek horizon was based on flint artefacts derived from three sites: Początkowo 38, Podgaj 7A and Przybranówek 43 (Aleksandrów Kujawski commune). Two inventories are of particular value here – the flint materials obtained from Początkowo 38 and Przybranówek 43. Culturally both sites appear to be almost completely homogeneous, with well-preserved cultural layers filled with numerous and well-documented assemblages of artefacts. The situation was slightly less satisfying in the case of Podgaj 7A, where there were numerous recordings of modern activities destroying prehistoric remains.

4.1. The site presentations

4.1.1.Początkowo 38, Aleksandrów Kujawski commune

Excavations of the site took place in the years 1997-1998 (L. Domańska 2000; 2013; S. Rzepecki 2004). As a result, the area around a relatively small, farmstead settlement was investigated, in the centre of which a partly dug-in dwelling structure was discovered. In its context, over 3 thousand of the Funnel Beaker culture pottery fragments and 254 flint artefacts were recorded. The artefacts occurred mainly in the western part of the site and grouped nearby the presumed hut entrance and around the hearth localized to the west of it. The chronology of the complex may be connected with the period c. 4000-3800 BC on the grounds of the stylistic analyses of the pottery (S. Rzepecki 2004).

The raw material structure of the inventory

Local Baltic flint is, in terms of quantity, a prevailing raw material in the inventory from Poczałkowo 38 (Tab. 17). Its percentage is 67.7% of the entire material (172 specimens). Generally, within this raw-material group several varieties may be distinguished, but no preferences of these varieties were observed in the context of technological differentiation of the inventory.

Tab. 17. Poczałkowo 38.

Raw material structure of the inventory	**N**	**%**
Baltic	172	67,7
Chocolate	22	8,7
Volhynian	7	2,7
Świeciechów	3	1,2
Burnt	50	19,7
Total	254	100

In the minority, a little over 12% there are products made of three kinds of flint, which, from the perspective of the Tążyna river valley, may be defined as exotic ones. Among them, in terms of quantity, chocolate flint is distinguishable – of which 22 specimens (8.7%) were made. Other non-local flints in the raw-material structure is Volhynian flint, 7 specimens (2.7%) of which were found, and 3 products of Świeciechów flint (1.2%).

About 20% of the inventory from Poczałkowo 38 is constituted by artefacts, in the case of which the degree of thermal transformations makes it impossible to determine the kind of raw-flint material. They were generally classified as overheated specimens (50 pieces).

The quantitative-qualitative structure of the inventory

The general structure of the inventory is composed of the products classified within 8 categories of flint artefacts (Tab. 18). Most of them are technologically connected with the flake method of exploitation and the splintering technique. Excluding blade tools, only 7 other specimens are products of blade exploitation.

Definitely, the quantitatively prevailing group is constituted by the products of the splintering technique. Altogether, they make up nearly 40% of the inventory. This group includes: most numerous in the entire inventory splintered piece flakes (74 pieces, i.e. 29.1% of the inventory) and splintered pieces (26 specimens).

Tab. 18. Poczałkowo 38.

Quantitative-qualitative structure of the inventory	**N**	**%**
Flakes	46	18,1
Blades	6	2,4
Technical waste	1	0,4
Splintered pieces	26	10,2
Splintered piece flakes	74	29,1
Chunks	40	15,8
with negative scars	14	
burnt	26	
Chips	8	3,1
Tools	53	20,9
Total	254	100

The group of flake exploitation includes only flakes (46 specimens). Totally, they constitute slightly more than 18% of the inventory. Taking flake tools into account, the percentage of these forms would increase a little in the scale of the whole assemblage.

A considerable part of the inventory – only a little smaller than the amount of flakes, is constituted by the specimens defined as chunks (15.8%); this category includes overheated chunks and negative chunks.

Micro-debitage in the form of chips (i.e. flakes smaller than 5 mm) makes up just over 3% of the inventory (8 specimens).

Altogether, 53 tools were identified, amounting to over 20.3% of the inventory (Tab. 19). Due to the degree of retouching, two subgroups of tools may be distinguished. The first of them includes conventional tools. The other includes atypical tools, i.e. flakes and blades with traces of use in the form of the so-called use retouch and polish.

Only 8 conventional specimens were recorded; half of them are projectile points with flat retouch (4 specimens). The other part includes atypical tools, prevailing in terms of quantity, 45 of which were distinguished. These specimens were grouped together due to the type of blanks within three subsets: blade, flake and splintered-based ones.

Tab. 19. Początkowo 38.

Tools	N	%
End-scrapers	1	1,9
Truncated blades with single truncation with double truncation	 1 1	3,8
Blades with continuous retouch	1	1,9
Projectile points	4	7,5
Blades retouched with use retouch	 2 10	22,7
Flakes retouched with use retouch	 12 13	47,1
Splintered-based tools retouched splintered pieces retouched splintered piece flakes splintered piece flakes with use	 1 2 5	15,1
Total	53	100

Characteristics of the inventory

Flakes

The vast majority of flakes were made of Baltic flint (33 specimens), the remaining group includes the following: 6 specimens of chocolate flint, 1 of Świeciechów flint, and in the case of 6 flakes the raw material was not recognized because of intensive overheating.

Generally, this group includes smaller sized specimens, which may be related to the use of Baltic flint. The lengths and widths of all the flakes are placed between 10-30 mm, and the thickness ranges from 2 to 8 mm.

Part of the flakes (21 complete ones and 9 proximal fragments) were subjected to a detailed analysis. Specimens with a single-directional arrangement of flake scars on the dorsal face (16 items) prevailed and flakes with bi- and multi-directional arrangements of scars occurred in the same amounts, i.e. 7 pieces. Flakes with linear butts, distinct bulbs, straight or centrally bent prevailed.

It is difficult to determine the technological genesis of the flakes within the study inventory. At the site – no flake cores which may indicate their intentional production were registered. Flake tools, especially these of non-local raw materials, relatively often have blade scars on the

upper face, which may indicate their connection with blade core transformations.

Blades

The group of blade exploitation is not numerous and includes 6 blades (Fig. 13: 1-3) and 1 crested blade (Fig. 13: 4). Blades transformed into tools are definitely more numerous in the inventory of Poczałkowo 38 (15 specimens).

Most of the blades were made of Baltic flint (5 specimens), also, the crested blade was made of the same raw material. This set is supplemented by one intensively overheated blade. Among the blade tools, two nearly complete blades of Volhynian flint – 47 and 76 mm long – were discovered. The width of the blades and blade tools ranges from 5 and 25 mm, and the thickness – from 1 to 6 mm.

In the group of blades and blade tools, specimens with flat and faceted butts predominate; bulbs are clear without bulbar scars. Specimens with a blade central bent prevail.

Splintered pieces and splintered piece flakes

Products of the splintering technique are the most numerous group in the discussed inventory. Totally, splintered piece flakes and splintered pieces make up 39.3% of all the materials. The vast majority of them were made of local Baltic flint (80% of all the products of this group). In the other group of specimens, the following were distinguished: 7 of chocolate flint, 2 of Świeciechów flint and 11 intensively overheated specimens.

The sizes of splintered pieces and splintered piece flakes are very differentiated; the length and width of most of them is placed between 5 and 35 mm, rarely exceeding these values. Whereas, the thickness of the splintered pieces ranges from 3 to 17 mm, and of splintered piece flakes from 1 to 10 mm.

Among the splintered pieces (Fig. 17: 1-5), bipolar specimens prevail (23 specimens), also 3 multi-polar were distinguished. In the case of 12 specimens, it was impossible to determine the genesis because of the fact that their surfaces were entirely covered with splintered scars. In other cases of this group, 3 specimens were distinguished for which the initial material was lumps of Baltic flint, in 11 cases the splintering technique was used to transform blanks, including one blade of chocolate flint.

On the upper faces of splintered piece flakes single- and bi-directional splintered scars prevail. Only on 6 flakes were blade scars stated.

Tools

As it was mentioned above, the tools were divided into two subgroups: conventional tools and atypical ones, i.e. atypically retouched blades, flakes and products of the splintering technique. The first subgroup includes: 1 end-scraper, 1 blade with continuous retouch on both edges, 2 truncated blades and 4 projectile points. Atypical tools constitute a prevailing group in the analyzed materials. Flake tools (together 25 specimens) are most numerous among them.

End-scraper

The distinguished end-scraper (Fig. 14: 8) is a flake specimen, made of Baltic flint.

Truncated blades

Both truncated blades (Fig. 14: 6-7) were made of Baltic flint. One of them is a short double truncated blade, the other – a single find. The latter was made of a blade, which was transformed by using the splintering technique.

Blades with continuous retouch

This specimen (Fig. 14: 5) was made of Volhynian flint. It is 67 mm long, 25 mm wide, and 5 mm thick. One side is retouched with an abrupt retouch, the other side is partially processed with a semi-abrupt retouch. In the distal end the blade is narrowing.

Projectile points

Four projectile points were recorded, they were all made of Baltic flint (Fig. 14: 1-4). Laurel leaf points prevail (3 specimens), also 1 tanged point was registered. Three of them may be included to slender forms. Their length ranges from 36 to 38 mm, the width – from 13 to 16 mm, and the thickness from 4 to 5 mm. The latter is a short projectile point 20 mm long, 10 mm wide, and 3 mm thick.

All the points were processed with flat retouch, covering a considerable part of their upper and bottom surfaces.

Atypical blade tools

Within this group, specimens made of Baltic flint prevailed (7 pieces), moreover 4 artefacts of chocolate flint and 1 of Volhynian flint were iden-

tified. Only 1 specimen is preserved in whole, the other are fragments (Fig. 13: 5-12). The width of most blades with a use retouch ranges from 10 to 20 mm, and the thickness ranges from 2 to 6 mm.

Atypical flake tools

They make up almost half of all tools (Fig. 15: 1-8; 16: 1-9). Specimens made of Baltic flint prevail (17 specimens), the group of tools of Volhynian flint is also relatively numerous (5 specimens), moreover – 3 artefacts of chocolate flint were distinguished. Only 9 specimens are preserved in whole. Among atypical flake tools, 30-40 mm long specimens dominate; the width of most of them ranges from 10 to 30 mm, and their thickness – from 2 to 8 mm.

Atypical splintered-based tools

Eight specimens were included to the group of atypical tools made from products of the splintering technique (Fig. 17: 6-8). Only one of them was made of chocolate flint, whereas the others – of Baltic flint. Apart from one specimen, their sizes do not exceed 20 mm.

4.1.2. Podgaj 7A, Aleksandrów Kujawski commune

In the years 1979 and 1982, rescue excavations connected with its destruction by intensive exploitation of sand were carried out at the site (L. Czerniak, A. Kośko 1993). The most significant discovery was the so-called unchambered tomb of the Niedźwiedź type (S. Rzepecki 2011). This structure destroyed earlier traces of occupation, and most of the materials were obtained from a foundation trench fill. Pottery analyses indicate the assemblage connection with the period of c. 4200-3800 BC (S. Rzepecki 2004).

The raw material structure of the inventory

Among 127 artefacts registered at the site of Podgaj 7A, products of Baltic flint predominate. Their qualitative indicator is 55.9%. The second place is occupied by specimens of chocolate flint (29.9%); the others are strongly overheated, unidentified artefacts (Tab. 20).

Tab. 20. Podgaj 7A.

Raw material structure of the inventory	**N**	**%**
Baltic	71	55,9
Chocolate	38	29,9
Burnt	18	14,2
Total	127	100

The quantitative-qualitative structure of the inventory

The general structure of the inventory consists of specimens classified within 9 categories (Tab. 21). Most of them are technologically connected with the splintering technique. Products of this technique (16 splintered pieces and 25 splintered piece flakes) constitute 32.2% of the whole inventory.

Tab. 21. Podgaj 7A.

Quantitative-qualitative structure of the inventory	**N**	**%**
Blade cores	1	0,8
Flake cores	2	1,6
Flakes	27	21,2
Blades	18	14,2
Splintered pieces	16	12,6
Splintered piece flakes	25	19,7
Chunks	17	13,4
with negative scars	10	
burnt	7	
Flakes	21	16,5
Total	127	100

Products of classical methods of core exploitation reach together a ratio of 37.8% of all artefacts. At the site, 2 flake cores and 27 flakes were discovered (22.8% of all materials). The blade group includes 1 core, 17 blades and 1 crested blade, which makes up 15% of the inventory.

The tool group includes 21 specimens, i.e. 16.5% of the inventory. This group was divided into two subgroups: conventional tools and atypical tools (Tab. 22). The first of them includes 5 end-scrapers, 2 perforators and 5 truncated blades. Whereas, the group of atypical tools is composed of 2 retouched blades, 1 blade with micro-retouch, 4 blades with use retouch and 2 retouched flakes.

Tab. 22. Podgaj 7A.

Tools	**N**	**%**
End-scrapers	5	23,8
Perforators	2	9,5
Truncated blades with single truncation	5	23,8
Blades retouched micro-retouched with use retouch	2 1 4	33,4
Flakes retouched	2	9,5
Total	21	100

The above set of products is complemented by some specimens determined as chunks. Among them, 10 negative chunks and 7 intensively overheated ones were distinguished.

Characteristics of the materials

Cores

Two flake cores and 1 blade core were recorded (Fig. 18: 1). One of the flake cores was made of Baltic flint, whereas the other specimen was intensively overheated. The specimen of Baltic flint is a double platform core 45 mm high. The blade core was made of the same raw material; it is a single platform core with a narrow flaking surface, 35 mm high.

Flakes

In the inventory 27 flakes were distinguished. Most of them were made of Baltic flint (14 items). Moreover, 10 flakes of chocolate flint and 3 intensively overheated specimens were identified. The sizes of most flakes are placed between 10 and 30 mm, and specimens with a single-directional arrangement of scars on the dorsal faces and with flat butts prevailed.

A technological interpretation of the group of flakes is of a clearly syncretic character. The presence of flake cores indicates an intentional production of at least part of this group of artefacts. Moreover, some specimens of chocolate and Baltic flint were identified which had blade scars on the upper face. Their genesis can be connected with a process of blade cores transformation.

Blades

17 blades (Fig. 18: 5-9) and 1 crested blade (Fig. 18: 4) were discovered at the site. Six of them were made of chocolate flint, 11 of Baltic flint, and 1 blade was overheated. Only 1 blade of Baltic flint is completely preserved, the others are fragments among which proximal parts prevail.

The width of the blades of chocolate flint is placed between 11 and 15 mm, and their thickness ranges from 4 to 6 mm. The blades of Baltic flint are more differentiated. Their width ranges from 6 to 25 mm, and thickness from 2 to 10 mm. It is worth noting that the length of the completely preserved specimen is 38 mm.

Splintered pieces and splintered piece flakes

Most splintered pieces are made of Baltic flint (11 items), also 4 of chocolate flint and 1 overheated specimen were identified. Among the splintered pieces, double-faced bipolar specimens of sizes between 20 and 50 mm prevailed. Most of the splintered pieces of Baltic flint are connected with the exploitation of lumps of this raw material. Only 2 from among them (Fig. 18: 2-3) have blade scars on their upper and lower faces, which connects them with a process of blade core transformations. On the other hand, splintered pieces of chocolate flint have only splintered scars – which hinders a reconstruction of their genesis.

In the group of splintered piece flakes, specimens made of Baltic flint prevailed (16 items), moreover, 7 flakes of chocolate flint and 2 intensively overheated specimens were distinguished. Except for 1 specimen of chocolate flint, other flakes have only splintered scars on their upper faces. The flake of chocolate flint is distinguishable because of blade scars.

The splintered piece flakes were decidedly smaller than the splintered pieces and their sizes did not exceed 30 mm. Specimens with single-directional arrangement of scars on the upper face prevailed.

Tools

In the group of tools, conventional tools prevailed (12 specimens) over atypical ones (9 specimens).

End-scrapers

Among the end-scrapers (Fig. 19: 7-8), 3 flake specimens and 2 blade ones were distinguished. They all have arch-shaped end-scraper fronts, most often of medium height and steeply retouched. Their sizes were various.

Perforators

Two perforators were identified – one made from the proximal part of a blade with a slightly separated sting, whereas the other was a blade perforator made of chocolate flint (Fig. 19: 6).

Truncated blades

Five truncated blades were distinguished (Fig. 19: 1-3). They were all made of chocolate flint, and were classified to a group of single truncated blades with oblique truncation.

Atypical tools

Within the distinguished group (Fig. 19: 4-5), blade specimens clearly prevailed (7 specimens) over flake ones (2 specimens). No atypical tools made on products of the splintering technique were recorded.

4.1.3. Przybranówek 43, Aleksandrów Kujawski commune

A settlement of the Funnel Beaker culture population at Przybranówek 43 was discovered in 1980 by the Kuyavian Expedition from the Adam Mickiewicz University in the course of surface surveys of the middle part of the Tążyna river basin. In the same year, excavations of the site started. They were carried out in the western part of the site, where the remains of a house and relatively numerous archaeological materials were found (L. Czerniak, A. Kośko 1993). Later, research continued in the years 1994-1997 by the Institute of Archaeology, University of Łódź. At that time, an area of over 800 m² was excavated and further relics of the Neolithic occupation were discovered. They proved to be of great importance for the specificity of the Middle Neolithic Funnel Beaker culture (L. Domańska, S. Rzepecki 2001; S. Rzepecki 2004). Flint artefacts occurred within clearly isolated concentrations, identified with houses – farmyards. Stylistic analyses of the pottery suggest that the Funnel Beaker culture settlers in a period 4200-3800 BC repeatedly occupied the area of the site on rotation.

The result of the mentioned excavations was obtaining 1,045 flint artefacts. They served to characterize flint production of the oldest Funnel Beaker culture phases in Kuyavia (L. Domańska 1995; 2013). In the following publications the problems of planigraphic relations were mostly focused on, and precisely – the possibilities of associating the flint assemblages with the arrangements of the features (houses). Such reconstructed arrangements were subjected to spatial and functional analyses

(L. Domańska, S. Rzepecki 2001; L. Domańska 2003a). An analysis of quantitative-qualitative structure of individual flint concentrations revealed that they are almost identical (L. Domańska 2013).

In the present publication, the flint assemblage from Przybranówek 43 will be discussed as a whole, providing an example of the Early Wiórek horizon.

The raw material structure of the inventory

The prevailing raw material in the inventory from Przybranówek 43 is chocolate flint from southern Poland (Tab. 23). Its percentage reaches 55.6% of the entire material (581 items).

Tab. 23. Przybranówek 43.

Raw material structure of the inventory	**N**	**%**
Baltic	216	20,7
Chocolate	581	55,6
Volhynian	1	0,1
Świeciechów	3	0,3
Jurassic	2	0,2
Burnt	242	23,1
Total	1045	100

The second place is occupied by the products for which a degree of thermal transformations precludes a univocal identification of the raw material. They were included to a group of the so-called overheated specimens (242 items). They make up 23.1% of the raw material structure of the inventory. With some probability, it may be thought that most of the discussed products were made of chocolate flint; it would raise the percentage of this flint in the whole of the inventory.

The third place is occupied by specimens made of local Baltic flint. 216 such artefacts were recorded, which makes up 20.7% of the raw material structure of the materials under discussion.

Moreover, one specimen of Volhynian flint and 2 products of Jurassic flint from the Cracow area were distinguished. Also, 3 artefacts made of Świeciechów flint were discovered at the site surface.

To summarize, the role of chocolate flint in the flint production of the settlement inhabitants is a specific feature of the discussed materials. Artefacts made of this raw material made up over 70% of all the products. This proportion concerns the raw material structure supplemented with, most probably, some overheated specimens.

The quantitative-qualitative structure of the inventory

The general structure of the inventory of Przybranówek 43 constitutes 13 categories of flint artefacts (Tab. 24). A considerable part of them are specimens technologically connected with flake exploitation. Products of the splintering technique and blade exploitation occurred in similar proportions.

Artefacts of flake exploitation make up together 31.4% of the whole inventory. Chocolate flint was a raw material for making 217 flakes and 1 core. Within the group of specimens made of Baltic flint, 2 cores and 80 flakes were identified. Less numerous were the overheated flakes (25) and flakes of Świeciechów flint (3).

The products of blade exploitation include 3 blade cores and 122 blades. This group constitutes 12% of the materials. Specimens made of chocolate flint were most numerous – 86 blades made of this raw material were identified (68.8% of all specimens of this group), whereas, 15 artefacts (12%) were made of Baltic flint. Among them, 3 cores and 9 blades were distinguished. Likewise, in the case of the other groups, overheated specimens were relatively numerous (24-19.2%); in the majority of cases they were originally made of chocolate flint.

Products of classical methods of exploitation constitute nearly half of all the flint artefacts from Przybranówek 43. Their percentage is 44.3% of the entire materials.

The group of products of the splintering technique includes 71 splintered pieces and 56 splintered piece flakes, which makes up 12.1% of the inventory. Specimens made of chocolate flint (52%) inconsiderably prevail over these made of Baltic flint (44%), moreover, one splintered piece of Jurassic flint from the Cracow area was discovered.

Specimens defined as chunks were relatively numerous in the study material (16.2% of the whole inventory). Micro-debitage in the form of chips (flakes smaller than 5 mm) constitutes 5.3% of the inventory (54 items).

Within the group of tools from this site, 17 categories were created (Tab. 25). Totally, 232 tools were identified, which make up 22.2% of the whole inventory. Within this group, specimens made of chocolate flint decidedly prevailed: 158 tools, which makes up 68.1% of the group. Actually, the index was even higher. It seems to be indicated by numerous overheated specimens, from among which some were probably made of chocolate flint. Tools made of Baltic flint only – occupy the third place, 33 such specimens were recorded. Moreover, 1 example of a tool of Jurassic flint from the Cracow area and 1 tool of Volhynian flint were recognized.

Tab. 24. Przybranówek 43.

Quantitative-qualitative structure of the inventory	House 1	House 2	House 3	House 4	House 5	Surface of the site	Total	%
Blade cores			1		1	1	3	0,3
Flake cores	1		1			1	3	0,3
Flakes	97	53	83	7	37	48	325	31,1
Blades	35	29	15	5	18	20	122	11,7
Technical waste	2		2		6		10	0,9
Splintered pieces	13	18	15	4	12	9	71	6,8
Splintered piece flakes	18	9	15	1	6	7	56	5,3
Chunks	58	19	42	6	16	28	169	16,2
with negative scars	1		10	3	4	3		
burnt	57	19	32	3	12	25		
Chips	10	14	24		2	4	54	5,2
Tools	58	37	44	13	39	41	232	22,2
Total	292	179	242	36	137	159	1045	100

Tab. 25. Przybranówek 43.

Tools	House 1	House 2	House 3	House 4	House 5	Surface	Total	%
End-scrapers	8	6	7	5	3	8	37	15,9
Perforators		1	1			5	7	3,0
Borers	1		1				2	0,9
Truncated blades with single truncation with double truncation	7	4	2 2	2	3	6	26	11,3
Blades with continuous retouch	2	1				2	5	2,1
Trapezes	1				1	1	3	1,3
Burins			1				1	0,4
Blades retouched micro-retouched with use retouch	 2 5 13	 6 6 4	 7 5 10	 2 	 5 5 9	 1 2 2	84	36,2
Flakes retouched micro-retouched with use retouch	 8 4 5	 2 3 2	 2 2 1	 1 	 2 3 5	 5 5	50	21,6
Splintered-based tools splintered pieces retouched splintered piece flakes retouched splintered piece flakes with use retouch	 3	 1 2	 3 	 3 	 2 1 	 2 	17	7,3
Total	58	37	44	13	39	41	232	100

The group of tools was divided into two subgroups. The first of them includes conventional tools with 81 specimens. Among them, end-scrapers (37 items) and truncated blades (26 items) prevailed. The other group includes the so-called atypical specimens. This group of tools decidedly prevailed at the site. 151 such specimens were distinguished, which makes up 65.1% of the tools group. Atypical blade tools were most numerous – 84 specimens, flake tools were less numerous – 50 specimens. The least numerous were atypical tools technologically associated with the splintering technique. Only 17 such tools were recorded. Within this group, retouched splintered pieces were most numerous.

Characteristics of the inventory

Cores

6 cores were registered at the site – 3 blade cores and 3 flake cores. All the blade cores are made of Baltic flint. Only one of them is preserved in whole, the other are fragments. The complete specimen is a single platform core 27 mm high.

2 flake cores were made of Baltic flint and one – of chocolate flint. All the cores are multi-platform cores; 2 from among them are fragments, and one is preserved in whole. The height of the latter artefact is 40 mm.

Flakes

325 flakes were discovered at the site. Among them, flakes made of chocolate flint decidedly prevailed. This group includes specimens, sizes of which (length and width) rarely exceed 35 mm, and the thickness of most of them ranges from 2 to 7 mm.

147 wholly preserved flakes were subjected to a detailed analysis. Among them specimens with one- and multi-directional arrangements of scars on the dorsal face occurred in similar proportions. Specimens with faceted butts, with clear bulbs and a bent or straight tip dominated.

The technological genesis of the flakes is, in most cases, very difficult to determine. It may surely be stated that part of them were not connected with the exploitation of flake cores. On several flakes, blade scars were observed, which confirms their relationship with blade cores transformations.

The presence of single flake cores of Baltic flint and 1 core fragment of chocolate flint at the site may indicate the intentional production of flakes at the discussed site. The range of these activities, especially in relation to chocolate flint is difficult to determine, though.

Blades

122 blades were distinguished. Among the blades, fragments definitely prevail, only in 27 cases they were preserved in whole (Fig. 20). Within the group of fragments, medial and proximal parts prevail.

The complete specimens were subjected to a detailed analysis, that is – 27 blades and 15 blade tools. They were all made of chocolate flint. What they also have in common is metric features; as far as sizes are concerned, both described groups do not show differences, whereas blades c. 50-60 mm long, are most numerous. Longer blades were rare and only 4 specimens were registered the length of which attained an interval 75-80 mm. In addition the width of the blades ranged from 12 to 20 mm, and the thickness from 3 to 5 mm. Among the 42 complete blades, that were analyzed, specimens with flat butts (26 items) prevailed over blades with faceted butts (16 items). Also, blades with trapezoid cross section were more numerous than specimens with a triangular section. Most blades had clear bulbs with bulbar scars.

The high percentage of chocolate flint leads to considerations on the technological genesis of this group of products. An additional impulse to take up such considerations is the fact that the products defined as technical forms – connected with the specific production activities within the blade technology, are present in the inventory made of this raw material. Several such specimens were registered at the site as for instance rejuvenation flakes (Fig. 21: 1, 5) and platform rejuvenation flakes (Fig. 21: 3, 7-8) as well as flakes with blade scars on the dorsal face (Fig. 21: 2, 4, 6).

Two observations seem to speak against the local blade production of chocolate flint. Firstly, on the edges of most rejuvenation flakes, platform rejuvenation flakes and flakes with blade scars – use retouches were observed. Secondly, the number of such forms was noted rather rarely. Several registered specimens are in fact not a large enough number, taking into account the facts that blade exploitation involves a relatively intensive preparation and repair activities on the core platform. As it is known, this generates a considerable amount of specific production waste. Therefore, an assumption may be formulated that the analyzed technological forms were treated as ordinary flakes and, in this order, they were brought to the site area.

Splintered pieces and splintered piece flakes

Products of the splintering technique constitute 12.1% of the entire inventory. Splintered pieces (Fig. 32-35) inconsiderably prevailed over splintered piece flakes within this group. It is also the only group in which the products of Baltic flint almost equal in terms of quantity with the specimens made of chocolate flint.

The height of most splintered pieces is placed between 20 and 40 mm, the width ranges from 10 to 25 mm, and the thickness from 4 to 10 mm. Splintered piece flakes are a little smaller; the length of most of them ranges from 15 to 30 mm, the width – from 10 to 20 mm, and the thickness – from 2 to 6 mm.

In the group of splintered pieces, bipolar specimens and multi-polar splintered pieces definitely prevailed. Splintered scars dominate on their surfaces, which makes it difficult to reconstruct the genesis of these products.

Within the group of splintered piece flakes, 31 items are complete specimens, whereas the other (25 flakes) are preserved in fragments. On the surfaces of the flakes, bi-directional scars occur most frequently, only in several cases, blade scars genetically connected with blade exploitation, were observed. Flakes with edge butts decidedly prevail and bulbs occur sporadically.

Tools

The tools registered at the site were divided into two subgroups: conventional and atypical tools. The first subgroup includes end-scrapers, perforators, borers, truncated blades, macro-blades with continuous retouch, trapezes and a burin.

Atypical tools dominated in the inventory of Przybranówek 43. They constituted 65.1% of all the tools. They were divided into blade, flake and splintered-based atypical tools.

End-scrapers

Among the conventional subgroup, 37 end-scrapers were identified (Fig. 22-23). Specimens made of chocolate flint prevail – 25 items (67.6% of all end-scrapers). Moreover, 4 specimens of Baltic flint were distinguished, as well as one end-scraper of Volhynian flint and, in 7 cases, strong overheating made the raw material identification impossible.

Within the analyzed group, end-scrapers with arch-shaped end-scraper fronts prevailed. The height of end-scraper fronts made of chocolate flint ranged from 4 to 6 mm.

All the end-scrapers were made of classical blanks: flakes and blades. It seems that flakes were more frequently used. However, a precise definition of its role is hampered because of considerable transformations („shortening" of the blanks) to which short end-scrapers – which prevailed at the site – were subjected.

Perforators

Seven perforators were identified. 3 from among them were made of chocolate flint, 2 of Baltic flint, 1 of Jurassic flint from the Cracow area (Fig. 26: 1), and one specimen was strongly overheated.

Borers

This group includes 2 specimens made of chocolate flint (Fig. 26: 2-3). They were made on blades, and have well separated working edges.

Truncated blades

Within a conventional group of tools, truncated blades are placed second with respect to the quantity (Fig. 24-25). This category includes 24 single truncated blades and 2 doubled ones. From among them, 19 were made of chocolate flint, which constitutes about 73% of the tools of this group. Moreover, 2 truncated blades made of Baltic flint and 5 intensively overheated specimens were distinguished. It may be thought with high probability that the latter were made of chocolate flint. This may be supported by their sizes and general shape of blades they were made on.

The length of the complete specimens of chocolate flint is placed between 38 and 45 mm, the thickness of most of the truncated blades is 3 mm, and the width ranges from 10 to 23 mm. Part of the truncated blades have polish – in most cases situated diagonally towards the axis of a blank. Only 1 specimen has a straight truncation, whereas the others – diagonal ones.

Blades with continuous retouch

5 such specimens were recorded (Fig. 26: 4-5). 3 of them were made of chocolate flint, 1 of Baltic flint, and 1 specimen was made of some raw material undefined due to its intensive overheating.

Specimens made of chocolate flint are medial fragments of the blades, one of them has continuous retouch on both sides, whereas the other specimens have one edge retouched. Their sizes are as follows: width – 17 mm, thickness – 5 mm. The blade with continuous retouch on one edge of the Baltic flint is a fragment of the proximal part of a blade, its sizes are: width – 9 mm, thickness – 4 mm.

Trapezes

3 trapezes, all of them ordinary specimens made of chocolate flint were recorded.

Burin

One truncation burin made of chocolate flint was recorded.

Atypical blade tools

84 atypical blade tools were discovered at the site – they appeared to be a dominating group among the discovered atypical tools. They were classified into: retouched blades, blades with micro-retouch (Fig. 27: 1-5; 29: 1-5; 30: 1-2; 31: 1-3) and blades with use retouch (Fig. 27: 6-10; 28: 1-8; 29: 6-7; 30: 3-8; 31: 4-11). Within the materials under analysis blades with use retouch prevail (38), next place is occupied by blades with micro-retouch (25) and retouched blades (21).

The vast majority of the discussed tools were made of chocolate flint – 53 specimens. The second place is occupied by intensively overheated specimens of undefined raw material (19 items). Atypical blade tools of Baltic flint are least numerous – 12 tools.

Among the discussed artefacts, proximal fragments prevailed. Only 15 complete specimens were excavated. The length of most of them is placed between 40 and 60 mm, the width ranges from 14 to 18 mm, and the thickness – from 3 to 5 mm.

Atypical flake tools

Flake tools are placed second with respect of their number among the atypical tools. 50 such specimens were distinguished (Fig. 21: 1-8; 26: 6-10). Also among them, artefacts made of chocolate flint prevail – 34 specimens.

Within this group retouched flakes are most numerous (19), less numerous are flakes with micro-retouch (18), and flakes with use retouch are least numerous (13).

Atypical splintered-based tools

Only 17 such specimens were registered (Fig. 32: 4, 6; 33: 6-7; 34: 6-8; 35: 3). Most of them were made of chocolate flint – 14 specimens, the other 3 are products of Baltic flint.

Retouched splintered pieces prevailed among them (11), moreover – retouched splintered piece flakes were recorded (4) as well as splintered piece flakes with use retouch (2).

4.2. Discussion

First of all, what needs an analysis is the raw material structure of the sites discussed in the present chapter, and especially – the percentage of raw materials, which, from the perspective of the Polish Lowlands, may be considered as exotic. In Początkowo 38, local Baltic flint prevails. Its percentages reaches 67.7% of all the products, whereas products of imported flint are in the vast minority. Chocolate flint is most numerously represented among them (8.7%), moreover, several specimens of Volhynian and Świeciechów flint were distinguished. Flint material from Przybranówek 43 has a completely different raw material structure. The leading trait of this inventory is the prevailing percentage of artefacts of chocolate flint, which is over 55% of all the products.

Raw material differences are accompanied by other symptoms of individual character. And so, the products of classical methods of exploitation (blade and flakes ones) in Przybranówek 43, make up together 43.4% of the entire material. On the other hand, within the inventory from Początkowo 38, the products of the splintering technique dominate. Their percentage in the general inventory structure reaches 39.3%.

Both inventories also differ in respect of the structure of the tool group. In the materials from Początkowo 38, conventional tools make up c. 15% of all the tools, whereas in the inventory from Przybranówek 43, this group reaches a ratio of 35%. Let us add that among the atypical tools in Początkowo 38, flake forms decidedly prevail (47.1%), whereas in Przybranówek – blade tools (36.2%).

In the above drafted context, the inventory from Podgaj 7A reveals a number of specific features. The products made of chocolate flint comprise about 30% of all the materials and hold second place after the specimens produced of Baltic flint. Although the products of classical methods of exploitation dominate, their advantage over the products of the group of the splintering technique is not so clear as in the inventory obtained from Przybranówek 43. Moreover, in the group of tools – conventional specimens prevail over atypical tools.

What is especially important is that each of the cited sites represents different raw material and the technological strategy. The differences are particularly visible while comparing flint inventories from Początkowo 38 and Przybranówek 43. In the former, the flint production was mainly based on local raw material i.e. Baltic flint, in the latter – on chocolate flint imported from the southern Poland.

A fact that both sites are located in the same part of the Tążyna river valley additionally hinders formulating clear conclusions. It seems that reasons of the described differentiation should be searched for the factors going beyond a simple „geographical determinism" (cf. J. Kabaciński 2010). It should be emphasized one more time that both sites were loca-

ted within the same segment of „the Tążyna river route" coming from the Vistula river into the Kuyavian Upland. As it is known, it was one of the main arteries of supplies of the local farming societies in imported raw materials. Therefore, it is difficult to clearly state from what the observed differences result. We may refer to the functional or the cultural reasons. In the first case, an attention should be paid to the possibility of an irregularity of chocolate flint inflow to Kuyavia or forming different adaptation strategies for the realization of „early beaker flint production". On the other hand, what needs emphasizing is the possibility of co-existence of micro-locally differentiated stylistic „versions" of the early Funnel Beaker culture (S. Rzepecki 2004). The differences commented here in the raw material structure would, in this case, be the natural consequences of maintaining different structures of ties by the societies.

As regards the raw material, the inventory from Przybranówek 43 clearly corresponds with the materials from the Sarnowo site, Lubraniec commune. And so, at the site Sarnowo 1A, 73% of products were made of chocolate flint and in the inventory of finds found beneath grave no. 8 – 81.7% (E. Niesiołowska-Śreniowska 1980; 1983). At Przybranówek 43, the indicator of the percentage of this raw material is lower. However, if numerous overheated specimens were taken into account, from which a considerable part are probably products of chocolate flint, the indicators for this raw material at both sites would be similar.

The settlement in Sarnowo (the site Sarnowo 1A) yielded one precore and 2 blade cores of chocolate flint (E. Niesiołowska-Śreniowska 1983), which confirms a local production of at least part of the blades using this raw material. Whereas, there is no such univocal evidence of local chocolate flint blade production within the inventory from Przybranówek 43.

On the other hand, the raw material structure of the inventory from Poczałkowo 38 refers to the classic Wiórek materials from Wilkostowo 23/24. At both sites, Baltic flint prevails and its percentage is about 65%. From among the imported raw materials at the site in Wilkostowo 23/24, the raw material which is distinguishable in terms of quantity is Volhynian and chocolate flint; Świeciechów flint occurs in trace amounts. In the inventory from Poczałkowo 38 – chocolate flint prevails in the group of imported raw materials; only several specimens were made of Volhynian and Świeciechów flint.

At the settlement in Sarnowo, a group of flake exploitation prevails. The products of this group dominate over the products of blade exploitation almost four times (E. Niesiołowska-Śreniowska 1983). The group of flake exploitation also prevails within the inventory from Przybranówek 43.

In respect of technology, the materials from Przybranówek decidedly differ from the inventory of Poczałkowo 38. At the latter site, the products of the splintering technique are clearly more numerous. This is connected with the common use of Baltic flint at this settlement. The

splintering technique was most often used for its processing. Such a situation also takes place at the settlement of Wilkostowo 23/24.

A special trait of the discussed early Wiórek inventories is the predominance of atypical specimens in the group of tools. They are atypically retouched blades, flakes and products of the splintering technique, as well as specimens with traces of use in the form of the so-called use retouch and polish. Tools of this type occurred especially numerously in the inventory of Poczałkowo 38. They constitute about 85% of all the tools there. Also in the materials from the Classic Wiórek site of Wilkostowo 23/24, the discussed group of tools dominates; it reaches an indicator of 70%. An additional element that joins the inventories Poczałkowo 38 and Wilkostowo 23/24 is the presence of blades with continuous retouches of Volhynian flint as well as projectile points. What is different for them is a lack of flint axes at Poczałkowo 38 and their presence within the materials from Wilkostowo 23/24.

4.3. Conclusions

On the grounds of the conducted comparative analysis of the Early Wiórek inventories from the middle Tążyna river basin, the following conclusions may be drawn:

1. Flint materials from the site Przybranówek 43 show a continuation of traditions of flint production recognized in the oldest settlements by the communities of the Funnel Beaker culture in Sarnowo, Lubraniec commune. This may be seen in the raw material structure of inventories from Przybranówek and Sarnowo (predominance of chocolate flint), the technological structure (predominance of classical methods of core exploitation) and within the group of tools (numerous end-scrapers, truncated blades and retouched blades and flakes).

On the other hand, the analyzed assemblages differ in the use of chocolate flint. Chocolate flint got to „Sarnowo" knappers, apart from the finished products, also in the form of pre-cores and blade cores. It enabled its local exploitation (B. Balcer 1983; E. Niesiołowska-Śreniowska 1983). The scale of this process is difficult to estimate due to numerous transformations, to which products of imported raw material were subjected.

At the settlement of Przybranówek 43, no unambiguous evidence indicating the local processing of chocolate flint was registered. Probably, it was the finished or semi-finished products that got to the settlement.

2. Flint materials from Poczałkowo 38 were an anticipation of norms known from the Classic Wiórek flint production, best documented at the settlement in Wilkostowo 23/24. What joins both inventories is a similar strategy as regards to the raw materials, identical methods of flint processing, and the presence of macro-blades with continuous retouch of Volhynian flint and projectile points within the group of tools.

Wilkostowo 23/24.

5. The flint and flint technology of the Funnel Beaker culture – the Classic Wiórek horizon

Flint artefacts from the site Wilkostowo 23/24, Aleksandrów Kujawski commune are currently the most important point of reference for the characterization of the flint industry associated with the community of the Classic Wiórek horizon.

5.1. The site presentations

5.1.1. Wilkostowo 23/24, Aleksandrów Kujawski commune

The destruction of the site area caused by the present-day agro-technological activities as well as plans of afforestation of the area became the starting point for the realization of a wide-scale exploration works. Generally, in the years 1999-2003 and in 2011, an area of 10,120.5 m² was excavated (S. Rzepecki 2015). Relics of a multi-farmstead settlement of the Funnel Beaker culture and traces of short-term stay of the Globular Amphora culture population were recognized. What should be emphasized is a clear disproportion of sources of both mentioned cultural units. Weight proportion between the Funnel Beaker and Globular Amphora cultures pottery may be estimated at c. 434 kg : 15 kg that is about 1 : 0.035. What is more, the Funnel Beaker culture pottery occurred mainly within the local terrain culmination, whereas the Globular Amphora culture materials form a concentration in the slope zone. Therefore, an opinion that, in mass, the flint sources obtained at the site should be associated with the Funnel Beaker culture from the period c. 3500 BC is justified.

The raw material structure of the inventory

The obtained collection of artefacts includes 1,031 products. Local Baltic flint prevails in the inventory (Tab. 26), 685 pieces of this raw material were identified, which comprises 66.4% of the whole material.

Tab. 26. Wilkostowo 23/24.

Raw material structure of the inventory	**N**	**%**
Baltic	685	66,4
Chocolate	82	8,0
Volhynian	89	8,6
Świeciechów	10	1,0
Banded	1	0,1
Burnt	162	15,7
Unidentified	2	0,2
Total	1031	100

Generally, several varieties and their variants can be distinguished within this group of raw materials, including several products of Pomeranian flint (the latter raw material is considered by many researchers as a variety of Baltic flint – cf. B. Balcer 1983; L. Domańska 1983). This state of matters does not, however, reflect on the nature of the local industries in terms of technology. In other words, there is no evidence that may indicate any preferences connected with a specific purpose for one of the Baltic flint varieties in the whole of the local flint production.

The imported raw material should be obviously considered as visibly less important than the other types of flint. Among them, Volhynian flint and chocolate flint can be distinguished quantitatively. Respectively, 89 and 82 artefacts were produced from them. Also, 10 pieces made of Świeciechów flint were registered.

Approximately, 15.7% of the raw material structure of the inventory from the site of Wilkostowo 23/24 belong to the artefacts which are thermally deformed to such an extent that it was impossible to analyze the composition of the raw materials. Generally, they were classified as burnt pieces (162 artefacts). It can be suggested that, in the vast majority, they are probably burnt pieces of Baltic flint. An acceptance of this diagnosis would additionally increase an occurrence rate of this raw material in the structure of the discussed inventory. Only in some isolated cases, it seems that the burnt pieces belonged

to chocolate flint and Volhynian flint (in the latter case, the form of product itself works as an indirect argument e.g. a fragment of macrolith).

In addition, two forms of non-siliceous rocks were distinguished, whose petrographic composition is not determined.

The quantitative-qualitative structure of the inventory

The general inventory structure includes products classified within 12 categories of artefacts (Tab. 27). Most of them are technologically connected with the splintering technique. The group of flake exploitation takes the second place. Only 23 specimens are products of blade exploitation.

Tab. 27. Wilkostowo 23/24.

Quantitative-qualitative structure of the inventory	**N**	**%**
Blade cores	2	0,2
Flake cores	4	0,4
Blade-flake cores	1	0,1
Flakes	155	15,0
Burins	21	2,0
Splintered pieces	153	14,8
Splintered piece flakes	293	28,5
Chunks	158	15,3
with negative scars	80	
burnt	78	
Chips	44	4,3
Tools	181	17,6
Axes	2	0,2
Flakes from axes	17	1,6
common	13	
splintered	4	
Total	1031	100

The products of the splintering technique form a decidedly dominating group in respect of quantity. Totally, they constitute nearly a half of the inventory (43.3%). This group includes most numerous splintered piece flakes (293 specimens, i.e. 28.5% of the whole of the inventory) and splintered pieces (153 items – 14.8%). Taking into consideration tools

from splintered piece flakes and splintered pieces, the percentage of this group additionally increases.

The distinguished group of flake exploitation includes mainly flakes – 155 items. Four flake cores and, with high probability, 1 blade – flake core are genetically connected with them. Altogether, this group constitutes 15.5% of the whole inventory, and, at the same time, flake tools should also be taken into account. This measure would considerably increase a percentage of these forms in the inventory.

A group of blade exploitation includes 21 blades and 2 blade cores, which constitutes merely 2.2% of the whole inventory.

A considerable part of the inventory – comparable with the amount of flakes – is made up by specimens defined as chunks (15.3%); this category is composed of overheated chunks and negative chunks. Micro-debitage in the form of chips (i.e. flakes of sizes smaller than 5 mm) constitutes slightly over 4.3% of the inventory (44 items).

Besides the above mentioned categories in the general structure of the inventory from Wilkostowo 23/24, a tool group was distinguished (Tab. 28). Altogether, 181 tools which constitute over 17.6% of the whole of the inventory, were identified.

Two subgroups of tools were distinguished according to the degree of retouching. The first includes conventional tools. The other is made up of atypical tools, i.e. atypically retouched blades, flakes and products of the splintering technique group.

Conventional tools in the inventory from Wilkostowo 23/24 were classified within 8 types. Altogether, 50 such specimens were distinguished, among which two types prevail in respect of quantity: end-scrapers (22 items) as well as single and doubled truncated blades (altogether 12 items). Secondly, projectile points (6 items), perforators and borers (together 5 items), macro-blades with continuous retouch on both edges (4 items) and a trapeze should be listed.

The so-called „others" is distinguished as an independent group of typological tools. It includes 3 Mesolithic insets (2 triangles and a microlith with a retouched base) and an arch-backed point which may be connected with the Palaeolithic.

The remaining part of tools is made up with atypical tools, dominating in respect of quantity – 127 items (i.e. c. 70% of all tools).

Atypical flake tools are most numerous among them: 26 retouched flakes, 18 with use retouch and 8 micro-retouched ones. Altogether this group includes 52 specimens.

Blade specimens are considerably less numerous (39 products). Among them, the following were distinguished: retouched blades (7), blades with micro-retouch (10), blades with use retouch (20) and blades with polish (2).

The collection of atypical tools is supplemented by the artefacts which are technologically connected with the splintering technique. Ge-

nerally, 36 specimens were identified. Atypically retouched splintered piece flakes were registered most numerously (17). The second place is taken by splintered piece flakes with use retouch (9). What is more, some retouched splintered pieces (10 items) were recorded.

Polished axes (2 items) and flakes from such forms (17 items) were distinguished as a separate group.

Tab. 28. Wilkostowo 23/24.

Tools	**N**	**%**
End-scrapers	22	12,2
Perforators	3	1,6
Borers	2	1,1
Truncated blades with single truncation with double truncation	 9 3	6,6
Blades with continuous retouch	4	2,2
Trapezes	1	0,6
Projectile points	6	3,3
Blade retouched micro-retouched with use retouch with polish	 7 10 20 2	21,5
Flakes retouched micro-retouched with use retouch	 26 8 18	28,8
Splintered-based tools retouched splintered pieces retouched splintered piece flakes splintered piece flakes with use retouch	 10 17 9	19,9
Other tools	4	2,2
Total	181	100

Characteristics of the inventory

The total amount of flint products discovered at the site, as it was mentioned above, is 1,031, from among which 109 were recorded on the surface of the site, 197 pieces were derived from fills of features, and the

remaining 725 specimens were discovered in the exploration layer. Out of these, 98 items were recorded in the humus layer and 627 were connected with the cultural layer (L. Domańska 2013; 2015).

Flint artefacts were recorded in the fills of 54 features. In 3 features exclusively, a higher number than 10 artefacts were recorded, whilst the other features revealed only single finds or, less frequently, sporadic occurrences of artefacts.

The structure of the inventory coming from the fills of features corresponds with general proportions between the particular categories included in the general structure for the whole collection. Similar trends can be recorded in respect of quantity between the general specification of the products and the artefacts found in features.

In total, 24 tools occurred in the features, with the prevalence of atypical tools. Against this background, only feature 49 distinguished itself with 9 tools recorded, where 3 end-scrapers and one macro-blade with continuous retouches made of Volhynian flint were identified.

In conclusion, the inventory derived from the features and evaluated from the quantitative perspective, shows no significant trends, such as those related to the intentional deposition of tools with distinct forms or functional purposes.

The aforementioned premises justify the aggregated analysis of the inventory, which perfectly characterizes the flint production of the Classic Wiórek horizon in the Polish Lowlands.

Cores

The Funnel Beaker culture collection is composed of 6 cores representing 3 types: blade core (1 piece – Fig. 37: 4), blade-flake core (1 piece – Fig. 37: 2) and flake core (4 pieces – Fig. 37: 1).

The former specimen is a damaged piece of Baltic flint with preserved platform (Fig. 37: 4). The pattern of flake scars on the flaking surface indicates the vestigial character of the core. Its technical characteristics inform about the processes of preparation of the striking platform by chipping off the platform edge and a lack of activity aimed at an elimination of overhangs on the flaking edge. With a high probability, the core was exploited by the indirect percussion technique.

The blade-flake core, also made of Baltic flint, is a re-utilised blade core. Its secondary stage of exploitation served for obtaining of lamellar flakes by the bi-directional reduction method. As a result, its final form is seemingly similar to that of blade double platform cores. An indirect premise highlighting this course of production is confirmed by the presence of a massive overpassed blade (Fig. 37: 3). It removes a wider fragment of the core flaking surface, with similar characteristics

to those described above. Micro-morphological characteristics of the proximal end clearly reveal its Neolithic origins.

The subsequent 4 cores belong to the flake forms. Among them, the most spectacular piece is a relatively massive chocolate flint core (Fig. 37: 1). Due to its size, but also the presence of numerous natural surfaces, this form should be evaluated as the initial core. At this stage of exploitation, the piece is regarded as a lenticular cross-sectional piece with two surfaces which, interchangeably, had a role of a platform or a flaking surface. That was probably an exploitation method by the hard hammer technique, producing an effect similar to Clactonian notches.

Flakes

155 flakes were identified in the inventory from Wilkostowo. The vast majority of them were made of Baltic flint (112 items), the other flakes were made of several species of extra-regional flint (among other things: 14 pieces of Volhynian flint, 10 pieces of chocolate flint and 2 pieces of Świeciechów flint). In the case of 15 flakes, due to intense burning, the raw material was not identified. Two flakes were made of some unspecified non-siliceous rocks.

In total, the group contains pieces whose dimensions do not exceed 3.5 cm. Only a few flakes have a length of even up to 5 cm. In terms of width, the pieces which share similar metric properties (being within the range of 10-30 mm) prevail in the assemblage; their thickness, however, reveals a greater diversity.

A detailed analysis was provided to 116 complete flakes. The majority of them are the pieces with multi-directional scar patterns on the dorsal face, with faceted butts and distinct bulbs, in the longitudinal section – they are straight or with a bend in the distal part.

Unfortunately, the technological origin of the majority of the flakes is impossible to determine. Rather, a technological syncretism of the discussed group of artefacts can be indicated here. A large part of the flakes indirectly point to the existence of a multiplicity of trends in the flint production within the area of the discussed site, resulting in the occurrence of flake debitage.

This can be evidenced by flakes having flake scars and blade-flake scars on their dorsal faces. This is particularly evident on several stately flakes of Volhynian flint (Fig. 49: 1, 3; 50: 1, 6-7). The pieces are clearly related to the transformation of blade cores. Therefore, flakes, which are certainly not the results of flake core exploitation, deserve mentioning here in the first place.

Another group of flakes is probably connected with the process of shaping and the repairing of the quadrilateral forms (Fig. 49: 2, 4-6; 50: 4).

The presence of flake cores in the inventory, including a core of chocolate flint, also indicates an intentional production of flakes using different raw materials. The scale of the process is, however, difficult to estimate.

Blades

Only 20 blades made of various raw materials were determined (in total, 21 blades were identified – one of them was classified as Mesolithic). As many as 7 of them are burnt pieces (Fig. 38: 2; 46: 4). The others are 8 blades of Baltic flint (Fig. 38: 1, 3-7), 4 blades of chocolate flint (Fig. 53: 12-14), and one specimen of Volhynian flint (Fig. 46: 3).

This group includes only fragments of blades. Medial parts prevail (9 pieces), then also proximal (8 pieces) and distal ends (3 pieces) occur. In terms of size, this group is fairly well diversified. The thickness of the majority of the blades varies between 2 and 5 mm and their width varies between 12 and 17 mm. The tool analysis reveals occurrences of some macro-blades at the site (Fig. 46). Their thickness reaches 8 mm and the width exceeds 25 mm. The length of the blades can be reconstructed only in the case of some well-preserved blade tools. The dominant group comprises the blades with the length ranging between 30 and 50 mm, whilst the blades with the length of 70-110 mm presented a lower proportion.

The analysis of the blades and the blade tools shows that faceted butts slightly outweigh the finds of blades with flat butts. Roughly the same proportions present the blades with the triangular and trapezoid transverse section. Most of the blades possess small bulbs with bulbar scars.

A fragment of blade core made of Baltic flint was discovered at the site. More evidence for the presence of blade cores made of this raw material is a piece of blade-flake core and a massive overpassed blade. In addition to the enumerated artefacts made of Baltic flint, at the site no cores or technical forms related to the exploitation, preparation or repairing of blade cores, i.e. crested blades or tablets made of chocolate flint, were recorded. Although some flakes with blade scars on the dorsal face occurred in the inventory, it is difficult to consider them as an evidence of the transformation of the blade cores at the site.

In conclusion, there were no occurrences of any artefacts made of chocolate flint in Wilkostowo which might indicate an existence of a local production of blades using this raw material.

Splintered pieces and splintered piece flakes

This is the largest group in the entire inventory of Wilkostowo and also the most technologically and functionally complex one. Although it con-

tains the artefacts related to the simplest technique of exploitation of flint, its components carry the most essential information for determining the nature and the direction of the local production.

In the analyzed materials, 153 splintered pieces were identified (Fig. 42: 1-6). They represent 14.8% of all artefacts. Among them, splintered pieces made of Baltic flint – 121 pieces – prevail (79.1% of all splintered pieces). Also, 6 of chocolate flint, 14 of Volhynian flint and 12 intensely burnt pieces were identified.

The group of the splintered pieces is complemented with the splintered piece flakes, which prevail in the group: 293 flakes were discovered, which represents 28.5% of all the products from the site. The specimens made of Baltic flint occurred in majority – 237 such flakes were discovered, which represents 80.9% of all the finds of splintered piece flakes.

The height in the majority of the splintered pieces ranges between 18 and 35 mm, the width ranges from 10 to 25 mm, and the thickness – from 4 to 12 mm. Only the sporadic occurrences of some pieces whose size exceeds 40 mm are noted. Bipolar splintered pieces occur in a prevailing number – 146 pieces (95.4%), while unipolar ones and the so called cross splintered pieces (three-and four-pole) occur sporadically.

A diverse starting material was used for the production of splintered pieces. A precise determination of the quantitative share in each category of the half-raw material (concretions, blades, flakes, tools) is not possible, though. The bifacial specimens in which both faces (dorsal and ventral) are covered with splintered scars, prevail among the splintered pieces (64.7%). Only in about 35% of splintered pieces, the surfaces which can be used to determine their origin are preserved. In this group, the most interesting specimens are those whose origin should be connected with the process of scaling macroliths (blades and tools). This in particular applies to the products of Volhynian flint (Fig. 47: 1-10); to a lesser extent it applies to the products made of other raw materials.

The analysis of the splintered piece flakes shows that entirely preserved pieces prevail in the discussed inventory and single-directional and bi-directional negative scars outweigh on their dorsal faces. The splintered piece flakes butts are in the majority edge butts; a considerable proportion of them have no bulbs or, if any, they are either markedly large or of insignificant size. The prevailing splintered piece flakes have the thickness ranging from 2 to 8 mm, with the width within the range of 10-25 mm and the length between 15 and 35 mm.

The main focus of the splintering technique application was work of the local Baltic flint. About 80% of all splintered pieces and splintered piece flakes were made of that type of raw material.

The splintering technique was commonly used for scaling artefacts. As was stressed before, the process encompassed macroliths predominantly of exotic raw materials. As a result of their scaling, some splintered

pieces (Fig. 47: 1-4, 6-7) or splintered piece flakes were created (Fig. 47: 8-10). In some cases, the scaling process was in its initial phase, which allowed for a determination of the original form of the tool to the discussed transformations e.g. end-scraper (Fig. 43: 1-2), retouched blade (Fig. 47: 5), retouched flakes (Fig. 48: 4-5), projectile point (Fig. 48: 6), polished blade (Fig. 48: 8). Also, blanks were subjected to scaling (Fig. 43: 4-5; 48: 7; 55: 8).

The scale of the discussed transformations is difficult to evaluate. Most often, products made of imported raw materials were subjected to scaling, to a lesser degree this process concerned products of Baltic flint (Fig. 43). The most likely aim of the application of the splintering technique was to maximize the use of imported raw materials.

Tools

The tools were divided into two subgroups: conventional tools and atypical ones. In the first place, the conventional tools will be characterized, with the atypical tools to follow.

In the inventory from Wilkostowo 23/24, conventional tools were classified within eight types, among which two types prevail in respect of quantity: end-scrapers (22 items) and truncated blades (12 items).

The group of atypical tools in the study materials was divided into 3 subsets. The type of blank was a criterion for the division. The following specimens were identified by this method: atypical blade tools, atypical flake tools and atypical splintered-based tools.

End-scrapers

This group contains 22 pieces, whose vast majority include end-scrapers made of imported raw materials: 13 pieces made of Volhynian flint (Fig. 41: 1-3; 45: 1-10) and 6 pieces made of chocolate flint (Fig. 51: 1-6). Only one piece was made of Baltic flint, and two end-scrapers are intensely burnt (Fig. 41: 4; 51: 7).

The morphological characteristics of short end-scrapers suggest their relationship to blades. However, this can be treated as a suggestion only, as the advanced scale of transformations preclude the ambiguousness of the interpretations. In comparison, this issue seems far better evidenced in relation to the tools made of Volhynian flint (Fig. 45); almost all the pieces were made of blades.

The four end-scrapers are slender pieces with the length ranging between 45 and 68 mm (Fig. 41: 3; 45: 9-10; 51: 3), the others belong to relatively short end-scrapers, preserved in parts. The height of the end-scraper fronts in the specimens made of Volhynian flint is from 7 to 12 mm, and in the end-scrapers made of chocolate flint – from 4 to 6 mm.

Regardless of the blank type (blade or flake), the metric criteria applied to the blades which were utilized in the production of end--scrapers seems far more important. It must be assumed, however, that the majority of the pieces reveal the limit values for the exploited end--scrapers. Generally, the end-scrapers occur within the range: 4-8 mm as for the thickness and 15-35 mm as for the width. A comparison of the metric characteristics between the end-scrapers made of Volhynian flint and chocolate flint reveal certain differences, though. Most of the end-scrapers of Volhynian flint were produced from blades with the thickness of 7-8 mm. In terms of width, the end-scrapers are classified into two metric groups: 20-25 mm and 30-35 mm. Among the end-scrapers made of chocolate flint, the pieces produced on the blades with the thickness of 4-5 mm and the width limited to between two metric classes: 15-20 mm and 30-35 mm, prevail.

Perforators and borers

3 perforators (Fig. 41: 9; 51: 8-9) and 2 borers (Fig. 41: 8, 10) were recorded at the site. Together, they represent 2.7% of all the excavated tools. Two perforators were made of chocolate flint and one was made of Baltic flint. In turn, one borer was intensely burnt, and the other was identified as made of Baltic flint.

All the perforators possess poorly identifiable stings and the pieces made of chocolate flint are carefully developed.

Truncated blades

This category of tools includes 9 single specimens (Fig. 41: 7; 52: 1-4, 7-8, 10) and 3 double truncated blades (Fig. 41: 5; 52: 6, 9). In total, the specimens represent 6.6% of the whole group of tools. Among them, truncated blades made of chocolate flint prevail (9 pieces – Fig. 52: 1-4, 6-10); only 2 specimens made of Baltic flint (Fig. 41: 5, 7) and 1 piece was intensely burnt.

In four pieces of single truncated blades, the proximal ends are broken off, the others are completely preserved specimens. The length of the complete pieces ranges between 30 and 50 mm. The thickness of the majority of the truncated blades equals 4 mm and the width ranges from 10 to 20 mm; the pieces with the width between 12 and 17 mm prevail. The analysis of the metric characteristics of the truncated blades indicate that the blanks used for their production were very carefully selected, which predominantly concerns the specimens made of chocolate flint.

Some of the truncated blades reveal traces of polish, in the majority of them – an oblique arrangement of polish in relation to the axis of the

blank is observed. Four specimens are truncated pieces with convex truncation and the others are truncated pieces with oblique truncation.

Blades with continuous retouch

Four pieces were identified and categorized as blades with continuous retouch (Fig. 44); all of them were made of Volhynian flint. One piece has both the proximal and distal ends broken off, due to which its precise classification is not possible. The remaining 3 specimens were classified as „convergent blades with continuous retouch on both edges" (B. Balcer 1983; L. Domańska 2006). Two of them possess spiky distal ends whose shape resembles the tips of perforators (e.g. Fig. 44: 2). The discussed pieces were made by the steep retouch and only one of them has a lateral low angle retouch. All of the specimens have polish on their longer sides. A microwear analyses shows (appendix 1) that the discussed tools were used to cut crops (Fig. 44: 1) or generally, for harvesting plants (Fig. 44: 2); in one case, the traces of use pointed to the probability of cane cutting (Fig. 44: 3).

The thickness of the convergent macro-blades with continuous retouch remains within the range of 5 to 6 mm, and their width ranges from 24 to 29 mm; the length of the specimen with a small fragment broken off is 86 mm.

Projectile points

Six projectile points were recorded at the site, 3 of which were made of Baltic flint (Fig. 56: 3-5) and 3 – of Volhynian flint (Fig. 56: 1-2, 6). This assemblage should probably include an item (Fig. 56: 7) classified into the group of splintered pieces. This artefact might also be regarded as a semi-finished projectile point. Therefore, it can be assumed that the original number of those tools was larger.

Four projectile points were complete finds and 2 occurred in fragments. The length of the complete pieces varies from 31 to 47 mm, and their widths remain in the range between 11 and 16 mm while their thickness ranges between 5 and 6 mm.

This group shows a significant diversity in terms of their form. Among them, a slender piece of laurel leaf bifacial projectile point, probable 3 projectile points with the distinguished handles and two pieces with a concave base can be distinguished.

The discussed group of projectile points, discovered in Wilkostowo, creates the largest so far known collection of these type of tools in Kuyavia.

Trapeze

One trapeze made of Baltic flint was identified (Fig. 41: 6). This specimen is regarded as problematic, as it can also be classified as a double truncated blade.

Atypical blade tools

At the site 39 tools of this type were identified and divided into: retouched blades (Fig. 38: 11; 46: 2, 10; 53: 4-5), micro-retouched blades (Fig. 38: 8-10, 12; 46: 6; 53: 8-11), blades with use retouch (Fig. 39: 2-8; 46: 1, 4, 8-9; 53: 1-3, 6-7) and blades with traces of polish (Fig. 39: 1; 52: 5).

The vast majority of the tools were made of Baltic flint (12 pieces) and chocolate flint (11 pieces), 9 out of them were produced of Volhynian flint, where as many as 5 pieces were retouched blades. The other artefacts representing this group were intensely burnt tools.

Proximal parts of the blade tools prevail in the study material. In the majority of the complete pieces, their length ranges between 30 and 50 mm, and only in two artefacts made of Volhynian flint, it exceeds 100 mm. The widths, in the majority of the pieces, ranges between 12 and 20 mm, and the thickness is between 3 and 6 mm.

Atypical flake tools

This is the prevailing collection among the atypical tools with 52 finds of this type. Their further classification was based on the same criteria as that used for the classification of blade tools. The retouched flakes constitute the most numerous part among them all (Fig. 40: 1-6, 8-9, 11-12; 50: 3; 54: 1-4, 8) with 26 pieces identified, followed by the ones with use retouch – 18 pieces (Fig. 39: 9-11; 49: 7; 54: 5-6) and the micro-retouched flakes – 8 pieces (Fig. 40: 7, 10; 50: 1-2, 4-5).

Among the retouched flakes, the specimens made of Baltic flint prevail – 16 pieces. The share of other raw materials in this group is as follows: chocolate flint – 6 pieces, Volhynian flint – 1 piece and 3 specimens were intensely burnt pieces. In the group represented by the flakes with use retouch: 10 pieces were made of Baltic flint, 2 of chocolate flint and 6 of Volhynian flint. In the group represented by the micro-retouched specimens, 4 pieces of Baltic flint and 4 pieces of Volhynian flint were identified.

Atypical splintered-based tools

This assemblage includes retouched splintered pieces – 10 specimens (Fig. 42: 7-9; 48: 1-3; 55: 2-4), retouched splintered piece flakes – 17 specimens

(Fig. 43: 7; 55: 6), micro-retouched splintered piece flakes (Fig. 55: 9-11) and splintered piece flakes with use retouch – 9 flakes (Fig. 55: 5, 7).

The further classification of the retouched splintered pieces was not based on the same determinant criterion of retouch as it was used for the blades and the flakes. It was assumed that the type of blank was paramount in this matter. Out of the specimens in question, 5 were produced of Baltic flint, 3 – of Volhynian flint, and 2 – of chocolate flint.

Among the retouched splintered piece flakes, the specimens produced of Baltic flint clearly predominate (12). Also, there were identified: 2 flakes of Volhynian flint and 1 – of chocolate flint; however 2 splintered piece flakes were intensely burnt. A diverse situation was observed in only a few splintered piece flakes with use retouch. The majority of them are pieces made of chocolate flint (4) followed in number by flakes made of Baltic flint (3) and also, respectively, one piece of Świeciechów flint as well as one intensely burnt specimen were noted.

An analysis of the blanks which were used for the production of the discussed tools suggests no precise preferences as for the tools dimensions. The width of the flakes ranges between 5 and 28 mm, and their length stays within 10-50 mm. In respect of the metric characteristics, they are referred to the common splintered flakes.

Axes and flakes from axes

Two complete axes and 17 flakes from axes, including 13 common flakes and 4 splintered piece flakes, were registered at the site. Out of the two complete axes, one was made of Baltic flint (Fig. 58: 1), whilst the other – of Volhynian flint (Fig. 57: 1). The specimen made of Volhynian flint is a fragment of an axe with a quadrilateral section, with the width of 35 mm and the thickness of 12 mm. The specimen made of Baltic flint is a tranchet, whose working edge proves the only well elaborated part of the tool. The dimensions of the tranchet are: length – 60 mm, width – 25 mm and thickness – 15 mm.

Among the flakes from axes, the pieces made of Baltic flint prevail – 8 specimens (Fig. 58: 2, 4-8, 10); also, 5 flakes of Świeciechów flint (Fig. 57: 4-8), 2 of Volhynian flint (Fig. 57: 2-3) and 1 intensely burnt specimens were excavated (Fig. 58: 9). A flake of banded flint had been classified into Globular Amphora culture (Fig. 57: 9).

5.2. Discussion

Discoveries at the site of Opatowice 33, Opatowice commune, constitute a good analogy to the materials from Wilkostowo 23/24, Aleksandrów

Kujawski commune (A. Kośko, M. Szmyt 2006; L. Domańska 2013; 2015; M. Szmyt 2013). The site is located in the south-western part of Kuyavia, in the areas of the so-called Prokopiak Hill, which is part of the Radziejów Heights. The beginnings of the occupation of the Funnel Beaker culture population in Opatowice 33 may be dated to about 3650 BC. The form of this occupation is not much visible due to the later devastations. Much more data is provided by a younger settlement established after 3400 BC. Two farmsteads are dated to this period, one of which was almost completely excavated. The decided majority of flint artefacts from among 277 specimens discovered at the site are connected with the younger phase of the settlement.

Comparative analyses of the flint inventories from Wilkostowo 23/24 and Opatowice 33 (L. Domańska 2013) showed a lot of similarities between them.

The analyzed inventories present a slightly different structure of raw materials. Baltic flint (Wilkostowo 23/24 – 66.4%, Opatowice 33 – 55.9%) prevails in the case of both sites, but they differ in terms of the structure of the imported raw materials. Artefacts made from Volhynian flint (8.6%) clearly mark in the materials derived from Wilkostowo 23/24. In turn, at the site in Opatowice 33 a high share in the structure of raw materials of chocolate flint is distinctive, which is more than 30% of the total inventory.

In terms of the technological structure, both inventories are close to each other, where the group of splintered pieces prevails and the group of blades is least numerous. In turn, the group of flakes occupies the middle position here. However the analyzed groups reveal some differentiation in the share of the analyzed assemblages. And so, in Wilkostowo the group of splintered pieces prevails (over 40% of all artefacts) and the group of blades accounts for barely over 2% of the total structure of the inventory. In turn, in Opatowice 33 the differences between the groups are not significant and do not exceed several percent.

The splintering technique was predominantly employed for processing the local raw material – Baltic flint. In was also used while re-utilising the macrolithic artefacts made from imports.

For the processing of Baltic flint, more rarely, though – the classic method of coring was used. Flaking was the only classical method used in the case of exploitation of the imported flint at the study sites; it was mainly used to repair or transform the finished artefacts.

The materials obtained from Wilkostowo also yielded an initial chocolate flint flake core, which may indicate an intentional production of flakes in the settlement, using this material.

In contrast – no technical forms connected with the exploitation, preparation or repairing of blade cores made from imported materials were recorded at any site.

The inventories of Wilkostowo 23/24 and Opatowice 33 contain mainly atypical tools, i.e. atypically retouched blades, flakes and products of the splintering technique. In the group of tools derived from Wilkostowo, a share of atypical tools amounts to 70.2%. In the materials from Opatowice 33 the share is lower and amounts to 53.5%.

Both sites differ in terms of structure of this group of tools. In Wilkostowo 23/24, flake tools slightly prevail over the blades and the products of the splintering technique; in the inventory from Opatowice 33, blade tools strongly prevail.

Among the conventional tools in both Wilkostowo 23/24 and Opatowice 33, end-scrapers are most numerous, followed by truncated blades, blades with continuous retouch and projectile points. It seems that macro-blades with continuous retouch occupied a special position among the conventional tools made of Volhynian flint – they were discovered both in Wilkostowo 23/24 and in Opatowice 33. The fully preserved specimens belong to the group of convergent blades with continuous retouch (Fig. 44). The microwear analyses (appendix 1) performed for these artefacts obtained in Wilkostowo 23/24 show that they were harvesting tools.

5.3. Conclusions

The aforementioned analogies seem to indicate the possibility for the determination of the „Classic Wiórek model of flint production". The most important features of this model can be considered: (1) decided predominance of products of local Baltic flint; (2) the presence of imports of Volhynian and chocolate flint; (3) predominance of the splintering technique; (4) distinct predominance of atypical tools over conventional ones; (5) permanent presence of end-scrapers, truncated blades, macro-blades with continuous retouch made of Volhynian flint, projectile points in the group of conventional tools, and (6) the occurrence of flint axes.

The distinguished model of flint production finds its full representation in the Funnel Beaker culture flint inventories from other parts of the Polish Lowlands (L. Domańska 2013) – flint assemblages obtained from the site Annopol 1 in the Gostyńskie Lakeland (P. Papiernik, M. Rybicka 2002) and Komorniki 42, in the Greater Poland Lakeland, may serve as examples (J. Kabaciński, I. Sobkowiak-Tabaka 2004).

In the technological structure of the inventory from Annopol 1, the group from the splintering technique prevails, the products of this group make up about 30% of the entire of the materials. Also, the products of flake exploitation are relatively numerous (about 24%), whereas merely several specimens were included to the group of blade exploitation. Within the group of tools – atypical tools prevail with about 70% of the group of tools.

An element that joins the inventories from Wilkostowo 23/24 and Annopol 1 is also Volhynian flint, which played a significant role at both sites.

At the site Komorniki, 272 flint artefacts were registered. They occurred in three features, whereas the vast majority of them were discovered in a hut (feature 12) and in a pit dug in the hut's bottom (cellar – feature 12A).

Local Baltic flint was used almost exclusively at the site. Except for the local raw material, only 2 products of Cracow Jurassic flint were registered. The basic technique used for Baltic flint processing was the splintering technique. This group makes up 78.8% of the whole inventory. Classical methods of core processing were of secondary significance at this site. Within the group of tools from Komorniki, 42 atypical tools made on products of the splintering technique decidedly predominate and they constitute over 70% of all the specimens of this group.

The above mentioned analogies confirm a possibility of distinguishing the „Classic Wiórek model of flint production". It was obviously flexible and subjected to adaptation to differentiated ecological and cultural circumstances. This is the reason of noticeable differences in its realization at individual sites. At the same time, this does not weaken its coherence.

6. The flint and flint technology of the Globular Amphora culture

At the Wilkostowo 23/24 site, contemporarily with the Funnel Beaker culture settlement, a short term occupation of the Globular Amphora culture took place. The Globular Amphora culture camp was located on the slope, clearly outside the area exploited by the Funnel Beaker culture settlers (S. Rzepecki 2015).

The distribution patterns of pottery belonging to the Globular Amphora culture varies throughout the whole site, the ratio by weight can be estimated at circa 1 : 0.035. Some fragments of vessels referring to the Globular Amphora culture form the only clear concentration in the western part of the site. The ratio was slightly more balanced within the analyzed part of the site, and it is about 1 : 0.97 in favour of the pottery material referring to the Funnel Beaker culture.

6.1. Characteristic of the materials

In the concentration of the Globular Amphora culture pottery, 26 flint artefacts were recorded; 21 of them were specimens made of Baltic flint, 1 piece was made of chocolate flint and 4 artefacts were intensely burnt.

The flakes and tools were prevailing groups of the excavated artefacts. Out of the 4 pieces of flake cores distinguished at the site – 2 specimens occurred in the discussed assemblage. A single find of a flake-blade core was also registered in that part of the site.

The collection of tools reveals an absence of any conventional tools, however 1 micro-retouched blade, 1 blade with use retouch, 3 retouched flakes and 2 flakes with use retouch were distinguished. Additionally, a burnt specimen of flake removed from an axe was discovered.

6.2. Discussion

The analyzed assemblage does not significantly differ in terms of the quantitative and qualitative structure from the flint inventory derived from the remaining parts of the site – where the pottery related to the Funnel Beaker culture prevails. In this situation, there exists no possibility to unambiguously classify the flint products referring to the Globular Amphora culture. With some degree of likelihood, the members of that population could apparently utilize some of the tools registered at the site, still it is feasible to establish an unambiguous criteria for the classification of the material. Probably, the only exception to the described situation is the discovery found on the eastern part of the site, where a flake from an axe made of banded flint was recorded.

A similar situation was observed at the site in Opatowice 36, Opatowice commune (L. Domańska 2015a). The site at issue is situated in the area of the Radziejów Heights in the south-western part of Kuyavia. It was where the traces of Funnel Beaker culture settlement dating to the period of 3700-3500 BC with clearly dominant remains of settlement of the Globular Amphora culture population from the period 2900-2600 BC were discovered (A. Kośko, M. Szmyt 2015).

Based on the planigraphic analysis, two flint concentrations were identified – one of them associated with the Funnel Beaker culture and the other with the Globular Amphora culture. The cluster connected with the Funnel Beaker culture contained 71 specimens of flint, while the other cluster contained mostly Globular Amphora culture pottery – 199 artefacts were recorded (L. Domańska 2013). In total, it was 270 specimens representing approximately 20% of the total inventory. The remaining 80% of the flint artefacts co-occured with the pottery representing the two cultures.

A comparison of the products from the recorded clusters reveals that they have very similar quantitative and qualitative structures. In both clusters, the group of splintered pieces and the group of flakes prevail, and atypical tools predominate in the group of tools.

Only the presence of single specimens made from exotic materials constitute the differentiating features. In the case of the Funnel Beaker culture, these are the specimens made of Volhynian and Świeciechów flint and, in turn, there is an association of 3 specimens made of banded flint with the Globular Amphora culture pottery.

In summary, the study concentrations of flint materials do not differ either in terms of quantity or quality of the structure from the flint inventory obtained from the rest of the site. The comparative analysis did not provide arguments allowing for an unambiguous (with few exceptions) classification of the flint products representing the Funnel Beaker and Globular Amphora cultures at the study site. The exceptions include:

a convergent macro-blade with continuous retouch made from Volhynian flint, which shows the closest analogies in the assemblages representing the Classic Wiórek horizon, related to the Funnel Beaker culture in Kuyavia (Wilkostowo 23/24 and Opatowice 33) and 3 flakes obtained from axes made from banded flint, which in turn can be associated with the Globular Amphora culture.

6.3. Conclusions

Flint artefacts obtained from the clusters of the Globular Amphora culture pottery in Wilkostowo 23/24 and Opatowice 36 show many similarities with the flint industry representing the Classic Wiórek horizon. These similarities include: (1) domination of the Baltic flint; (2) domination of the chocolate flint in the group of imported raw materials; (3) significant quantitative advantage of artefacts associated with the splintering technique; (4) dominance in the group of tools specimens representing atypical tools; (5) in the group of typological tools characterized by an advantage of end-scrapers and truncated blades.

It seems that the observed similarities between the flint production typical of the population representing the Classic Wiórek horizon related to the Funnel Beaker culture and the Globular Amphora culture should not be interpreted as a problem resulting from the analysis of the sources, connected with the difficulties in defining the cultural identifiers of the cultural traditions, but as the processual issue – resulting from the convergence of these traditions.

7. Changes in the flint processing among the communities of the Tążyna river valley

The first clear occupation traces recorded in the middle section of the Tążyna valley are associated with the hunting communities of the Maglemose culture. Taking into account the results of excavations at Dąbrowa Biskupia 71, it can be assumed that the valley had a unique status for the Early Mesolithic communities (L. Domańska, M. Wąs 2009; L. Domańska 2010). A lack of osteological materials related to the Mesolithic flint inventories, precludes a clear identification of the purpose of hunting. The Tążyna Valley could create favorable conditions for hunting a certain species of animals or, perhaps, this activity was of non-economic significance, connected rather with the magic of hunting.

Change...

Around 5400 BC, the areas of black earths surrounding the valley became inhabited by the settlers of the Linear Band Pottery culture arriving from the south (L. Czerniak 1994). Soon after, (probably around 5300 BC), the sandy bottom of the valley become a direction of expansion made by those communities (L. Czerniak 1994; S. Rzepecki 2013).

The reasons for the occurrence of groups of communities representing the Podgaj-type cultural groups in the Tążyna valley are outlined in the publications by L. Czerniak (L. Czerniak 1988; 1994). The main causes of this phenomenon he sees in the attempts to colonize the Kuyavian podzolic areas under conditions of human overpopulation as well as in the economic practices related to an exploitation of that type of habitats by the pastoral and hunting-gathering practices.

It seems that despite undertaking numerous attempts of colonization of the Tążyna valley by the communities of the Linear Band Pottery

culture, the process was not successful and the groups failed to adapt their economies to the conditions existing in the valley (S. Rzepecki 2013). Also, it is worth noting that the colonization ventures concerned only those parts of the Tążyna valley which bordered with the areas of black earths – where were permanent settlements were located. The communities, however, did not take attempts to exploit the territory of the valley or the areas located within the Toruń Basin.

A comparative analysis of the flint inventory obtained from the sites of the Linear Band Pottery culture situated in the Tążyna valley (Chlewiska 132, Poczałkowo 30, Podgaj 32, Przybranówek 4) as well as the classical long-term settlements located in the area of black earths, near the edge of the valley (Grabie 4 and Przybranowo 3) confirmed an existence of two different strategies in the use of flint tools by those communities. One of them is represented in both the classical, permanent sites (Grabie 4 and Przybranowo 3) and also at the site Chlewiska 132, from the sandy bottom of the valley. Flint production by the communities inhabiting those settlements is characterized by: (1) a widespread use of raw flint materials of high quality imported from southern Poland to the Lowlands, among which a special role is played by chocolate flint; (2) a dominance of classical methods of core exploitation; (3) a clear predominance of atypical tools over conventional tools; (4) a dominance of end-scrapers and truncated blades in the group of conventional tools.

The assemblages of Podgaj type seem to represent a different strategy (Poczałkowo 30, Podgaj 32, Przybranówek 4). Single flakes of flint and a splintered piece of Baltic flint were discovered only at the site Podgaj 32. Some specimens from this site revealed a use retouch but the microwear analysis did not indicate any activities for which these tools could be used.

In summary, flint materials obtained from the sites of the Linear Band Pottery culture inhabiting the sandy bottom of the Tążyna valley do not share common characteristics with the flint industry by the Mesolithic communities inhabiting Kuyavia (L. Domańska 1995). The Late Mesolithic flint industry from the Toruń Basin is characterized by: (1) production of microlithic blades within the range: 10-30 mm as for the length, 6-10 mm as for the width and 1-4 mm as for the thickness; (2) in the group of conventional tools, side-scrapers and also short and squat end-scrapers prevailed, for the production of which small flakes were used; (3) the presence of tranchets as well as; (4) the use of the microburin technique for the manufacture of microliths.

On the other hand, what links the study communities is the exploratory expeditions into the Tążyna valley undertaken at different times, although, as it seems, for each of the study communities that area was atypical almost to the same extent. Further attempts made to use the valley did not lead to its permanent settlement. The Linear Band Pottery

culture communities did not move beyond their technological limitations and the atypical environment was not conducive of the cultivation of their traditional economies (S. Rzepecki 2013). In turn, the Mesolithic groups, due to some unknown reasons, did not establish any base camps in that area and they were using the valley only for hunting. Nevertheless, it cannot be excluded that the valley had a unique status for the Early Mesolithic communities, reaching beyond strictly utilitarian functions.

And continuity...

Around 4200 BC the Tążyna valley became inhabited by the communities of the Funnel Beaker culture. The settlement was extremely intense through the innovations which enabled those communities an agricultural use of the sandy areas (A. Kośko 1981; L. Czerniak 1994; J. Kruk, S. Milisauskas 1999; S. Rzepecki 2004; 2011). Some remains of small camps and large settlements as well as megalithic cemeteries were discovered in the valley (L. Domańska, J. Forysiak, S. Rzepecki, J. Twardy 2013).

The remains of the oldest settlement of this population in the valley was discovered at the site Przybranówek 43 (L. Czerniak, A. Kośko 1993; L. Domańska, S. Rzepecki 2001).

A specific feature of the flint inventory from this site is a position of chocolate flint. Artefacts produced from this raw material made up over 70% of all the artefacts. This proportion concerns the raw material structure supplemented with, most probably, overheated specimens.

The products of classical methods of exploitation (blade and flake ones) definitely prevail in the analysed inventory. The rate for the group of splintering technique only slightly exceeds 10%.

Totally, 232 tools were identified, which make up 22.2% of the inventory. Within this group, specimens made from chocolate flint decidedly prevail: 158 tools – which makes up for 68.1% of the group. Actually, the index was even higher. It seems to be indicated by numerous overheated specimens from among which some were probably made from chocolate flint. Tools made from local Baltic flint only occupy the third place, 33 such specimens were distinguished. Moreover, 1 example of a tool of Jurassic flint from the Cracow area and 1 tool of Volhynian flint were recognized.

The group of tools was divided into two subgroups. The first of them includes conventional tools. It includes 81 specimens. Among them end-scrapers (37 items) and truncated blades (26 items) prevail. The other group includes the so-called atypical specimens. They are atypically retouched blades, flakes and products of splintering technique, as well as some specimens with traces of use in the form of the so-called use retouch and polish. This group of tools decidedly prevails at the site. 151 of such specimens were distinguished, which makes up 65.1% of the tools group.

As demonstrated in chapter four, the Early Wiórek flint inventory from Przybranówek 43 clearly refers to the oldest materials of the Funnel Beaker culture on the Polish Lowlands recorded at the site in Sarnowo, Lubraniec commune (E. Niesiołowska-Śreniowska 1980; 1983). Among the flint inventories of the Tążyna valley, the materials obtained in Przybranówek 43 have the closest analogies in the artefacts recorded at one of the youngest sites of the Linear Band Pottery culture in Kuyavia – the site Przybranowo 3, Aleksandrów Kujawski commune (chapter 3).

A special characteristic of the flint artefacts obtained from Przybranowo 3 (the Linear Band Pottery culture) and Przybranówek 43 (the Funnel Beaker culture) is their composition of raw materials. Chocolate flint imported from southern Poland was primarily used for the production of tools at each of those sites. The volume share of that material in the raw material structure of both inventories is over 70%. Another common feature of the analyzed inventories is a dominance of classical methods of core exploitation, while a share of products of the splintering technique does not exceed 15% in the case of both sites. Among the tools, atypical pieces belong to the most numerous ones, and they account respectively for 3 – 81.8% of all the tools obtained from the site in Przybranowo, while at Przybranówek 43 they had a slightly lower rate – between 43 and 65.1%. Among the atypical tools, blades and flakes with use retouch are the most numerous specimens. In the group of conventional tools, end--scrapers and truncated blades prevail. Their ratio ranges from 15% to 30% of all the tools.

To sum up, the inhabitants of Przybranówek continued local traditions of the flint production. This is indicated by the following characteristics of the study inventory: (1) a clear preponderance of artefacts made from chocolate flint; (2) a dominance of classical methods of core exploitation; (3) a clear predominance of atypical tools over conventional tools; (4) a dominance of end-scrapers and truncated blades in the group of conventional tools.

Another change...

At around the same time, other groups of communities of the Funnel Beaker culture in the Tążyna river valley undertake attempts to introduce modifications into the local model of flint production (L. Domańska 2013). Probably, it is associated with the period of 4000-3800 BC. This thesis is supported by the results of the research carried out at the site Poczałkowo 38, Aleksandrów Kujawski commune (chapter 4). The main purpose of this modification was to better adapt the flint processing to the local conditions in the Lowlands. This is primarily observed in the wider use of the local raw material – Baltic flint and the splintering technique in processing the aforementioned raw material.

The described transformations are fully reflected in the flint materials obtained from the site Wilkostowo 23/24, Aleksandrów Kujawski commune, which is dated to about 3500 BC (chapter 5).

The most important features characterizing the flint production in the case of this settlement include: (1) decided predominance of artefacts made of local Baltic flint; (2) selective occurrences of exotic raw materials; (3) dominance of the splintering technique; (4) distinct predominance of atypical tools over conventional ones; (5) permanent presence of end-scrapers, truncated blades, blades with continuous retouch made of Volhynian flint and projectile points in the group of conventional tools and (6) findings of flint axes.

The described characteristics became recognized as the determinant criteria for the so called the Classic Wiórek model of the flint production (L. Domańska 2013; 2015).

A comparative analysis of the assemblages in Kuyavia (e.g. Opatowice 33 – L. Domańska 2006; 2013) related to the Classic Wiórek horizon as well as derived from the outside of the territory, i.e. in the Great Valley zone of Polish Lowlands (e.g. Annopol 1 – P. Papiernik, M. Rybicka 2002; Komorniki 42 – J. Kabaciński, I. Sobkowiak-Tabaka 2004) reinforce the belief, that the model in question represents an over-regional character.

It can be also suggested that the essential elements of the model were (co-)created other Late Neolithic traditions of flint production (L. Domańska 2013; 2015).

An attempt to distinguish the flint tools – associated with the Globular Amphora culture population in the inventory derived from Wilkostowo 23/24 – appears as an indication to the aforementioned suggestion. In the result of the attempt, the only artefact which presumably might be classified as associated with the discussed societies is the axe made of banded flint. However, it may be doubted whether the societies in question were to utilise that type of equipment exclusively. The problem with defining the determinant criteria for the flint production associated with the population of the Globular Amphora culture at the discussed site, seems to result from the potential overlapping of the flint production traditions related to all the inhabitants of the site in Wilkostowo.

To sum up the characteristics of the flint industry of the inhabitants of the Tążyna river valley in the period 5400-3500 BC, it should be emphasized that:

1. The Linear Band Pottery culture community which colonized the Tążyna river valley about 5300 BC, did not utilize the experiences of the local Mesolithic groups in the flint processing.
2. An adaptation of the flint processing to the range of raw materials accessible in the Polish Lowlands led to the development of the Late Neolithic model of flint production. This model was

characteristic not only among the communities of the Funnel Beaker culture but also in other Late Neolithic groups inhabiting the Polish Lowlands.

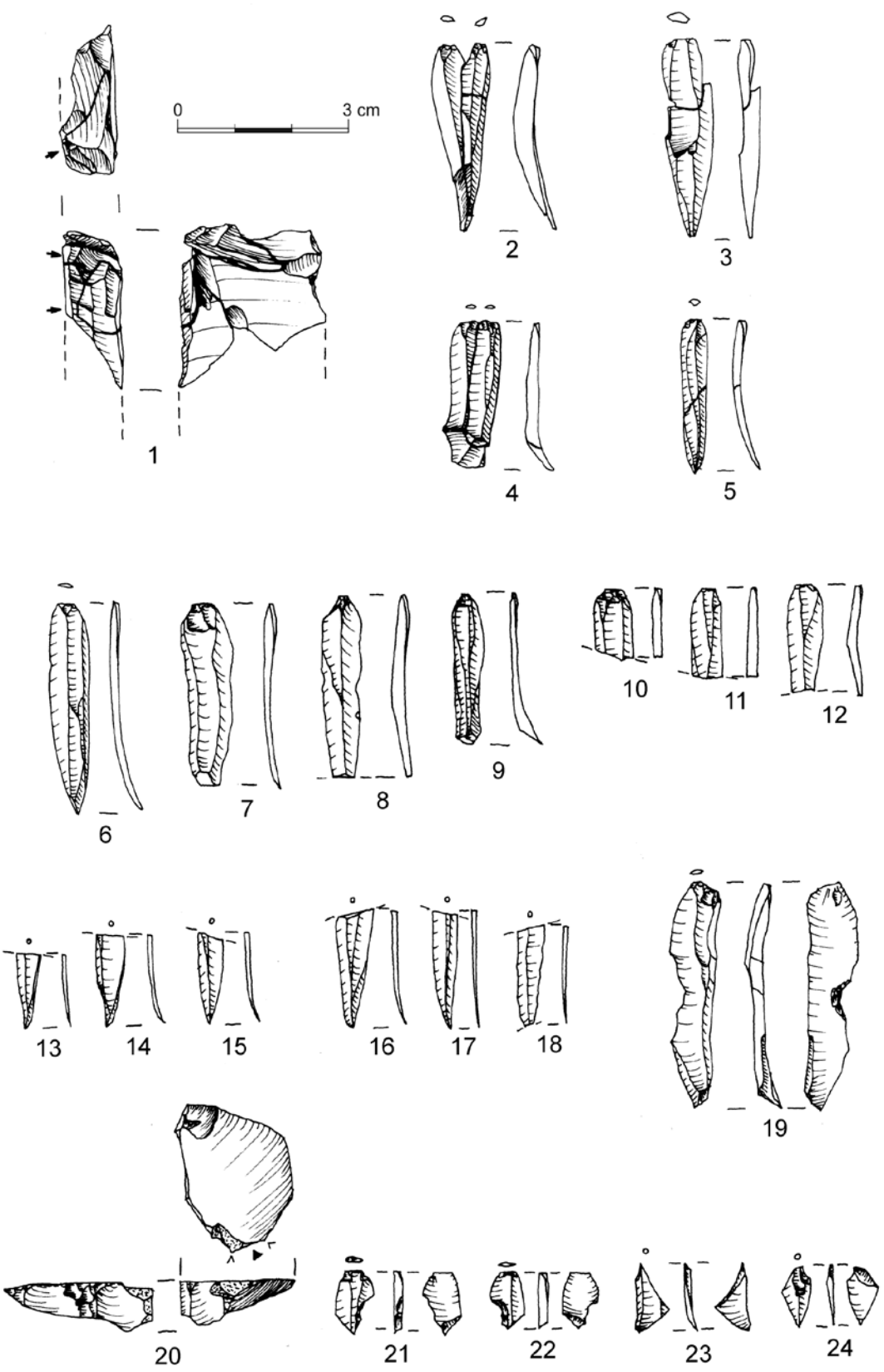


Fig. 1. Dąbrowa Biskupia 71. Refit groups (1-5); blades (6-18); retouched blade (19); core tablet (20); microburins (21-24).

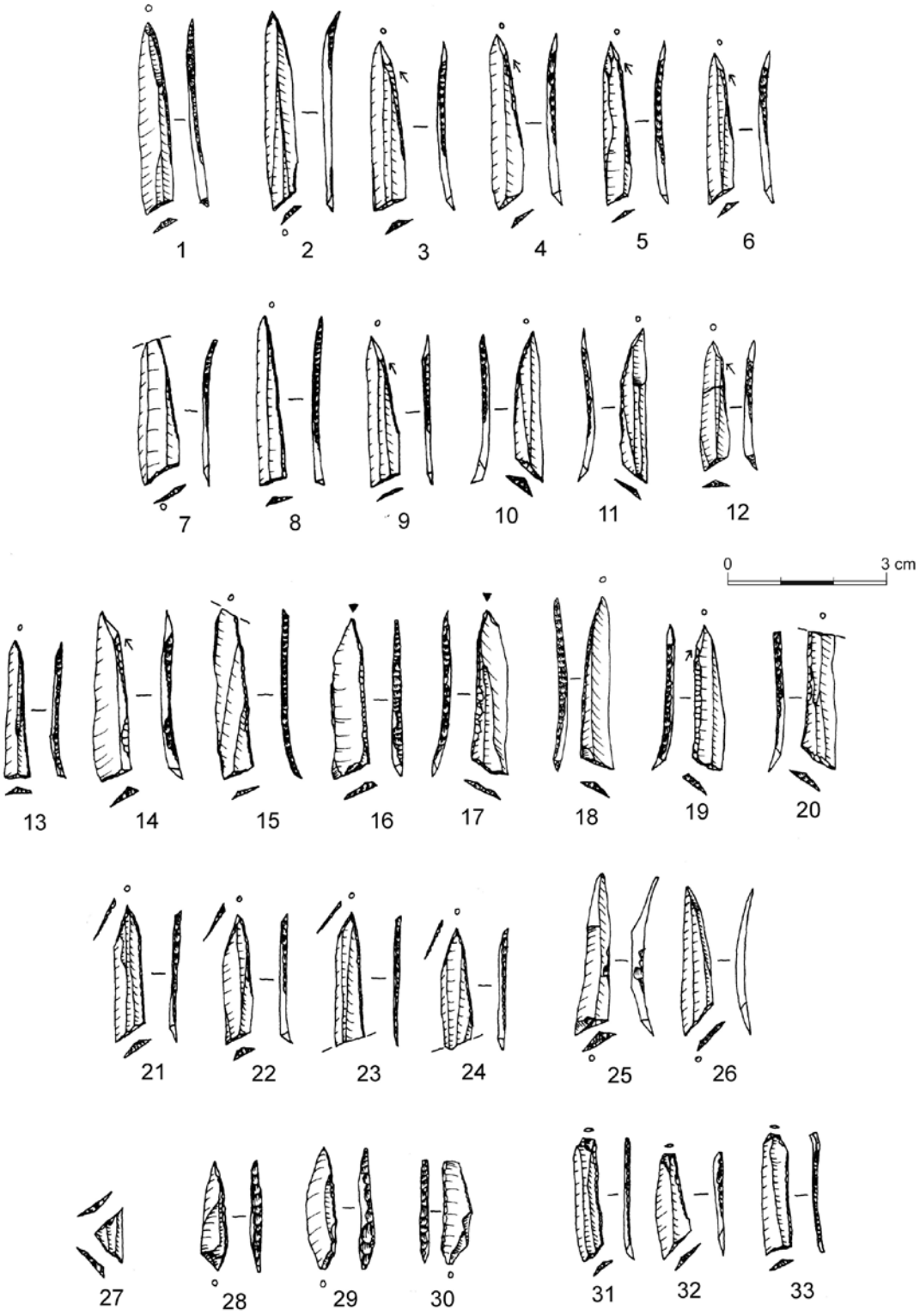


Fig. 2. Dąbrowa Biskupia 71. Microliths (1-33).

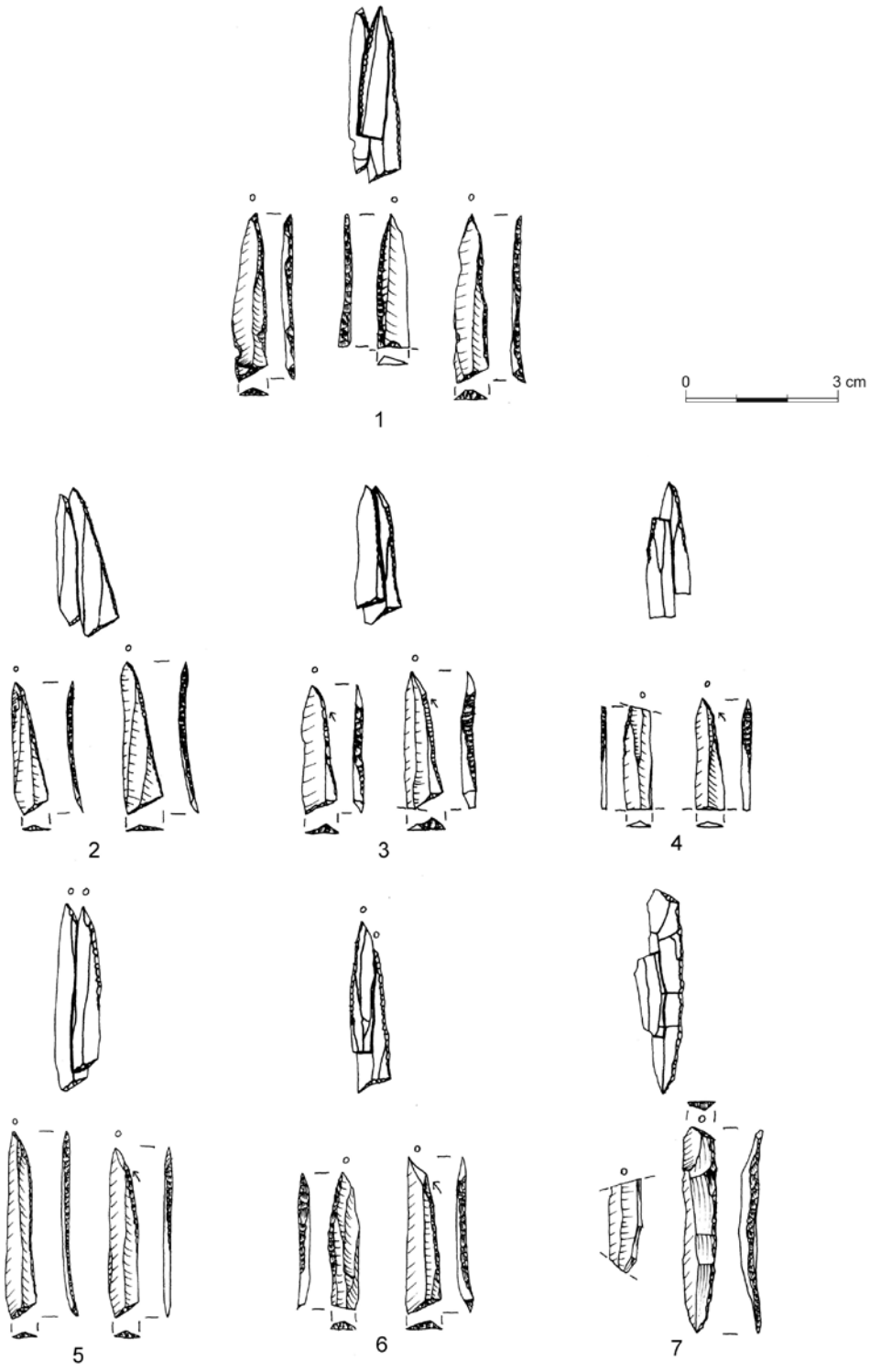


Fig. 3. Dąbrowa Biskupia 71. Refit groups of the microliths (1-7).

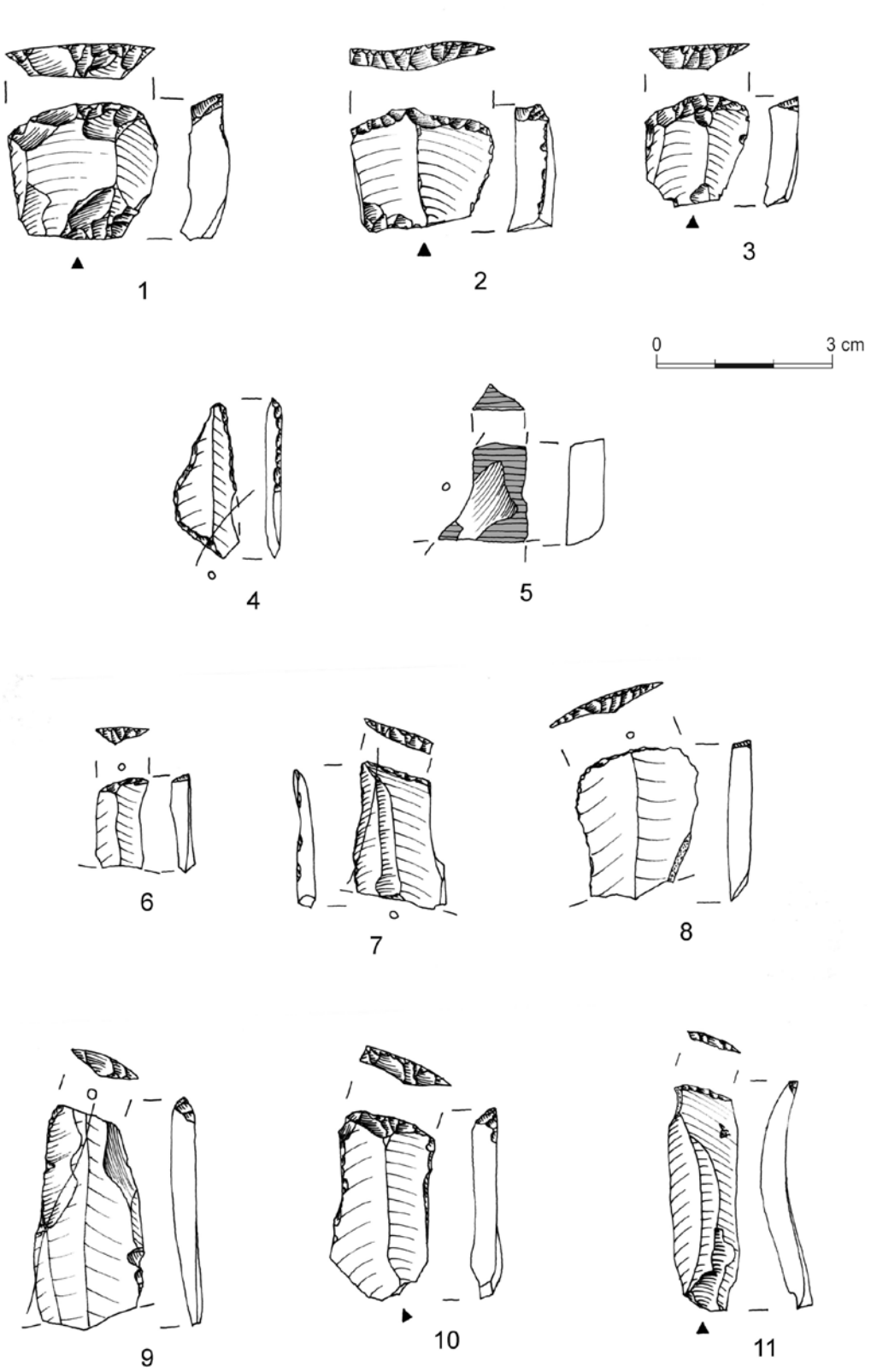


Fig. 4. Chlewiska 132. End-scrapers (1-3); borer (4);
flake from the polished axe made of banded flint (5); truncated blades (6-11).

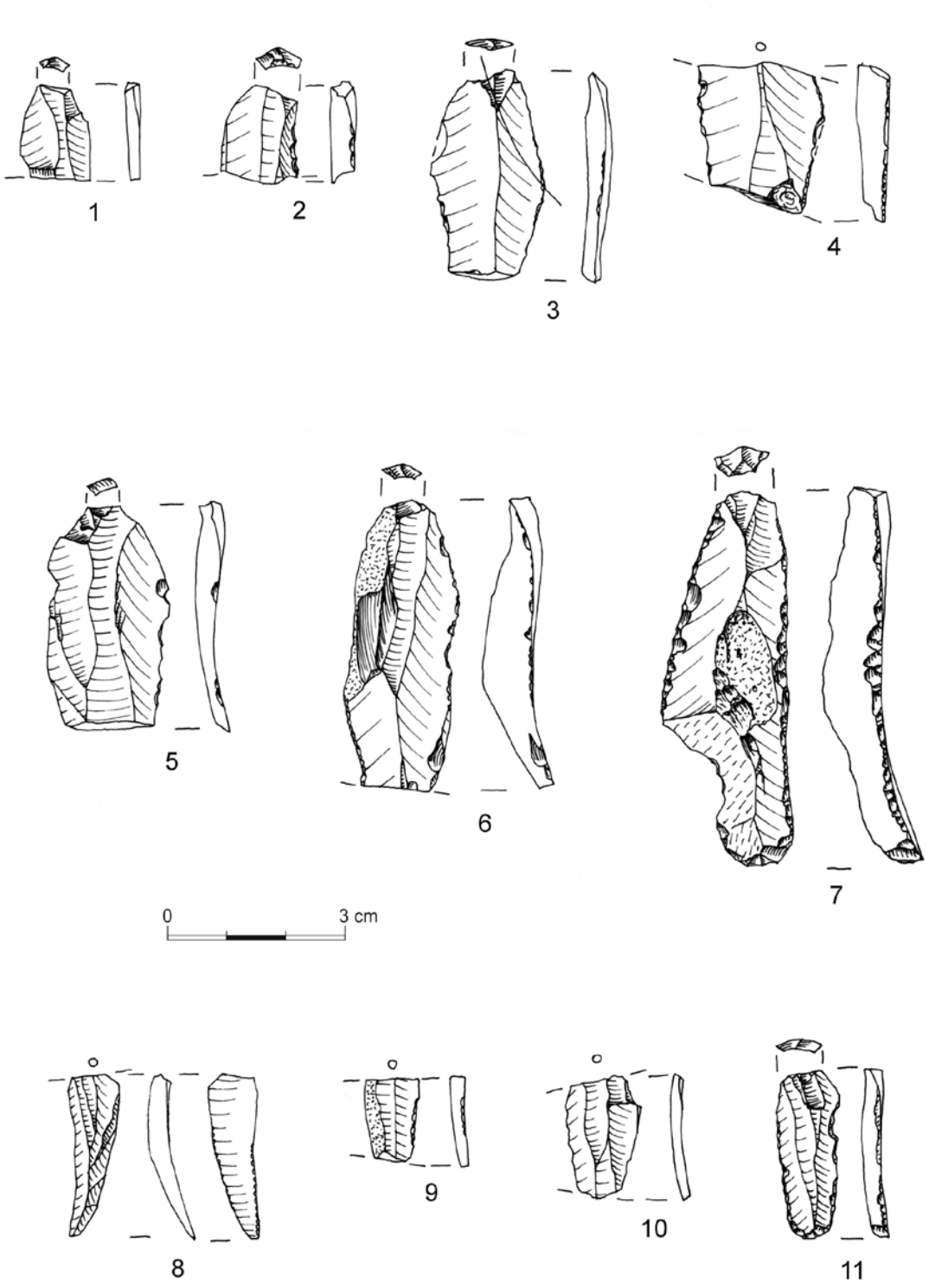


Fig. 5. Chlewiska 132. Blade (1); blades with use retouch (2, 4-6, 8-10); blade with polish (3); retouched blade (7); blade with micro-retouch (11).

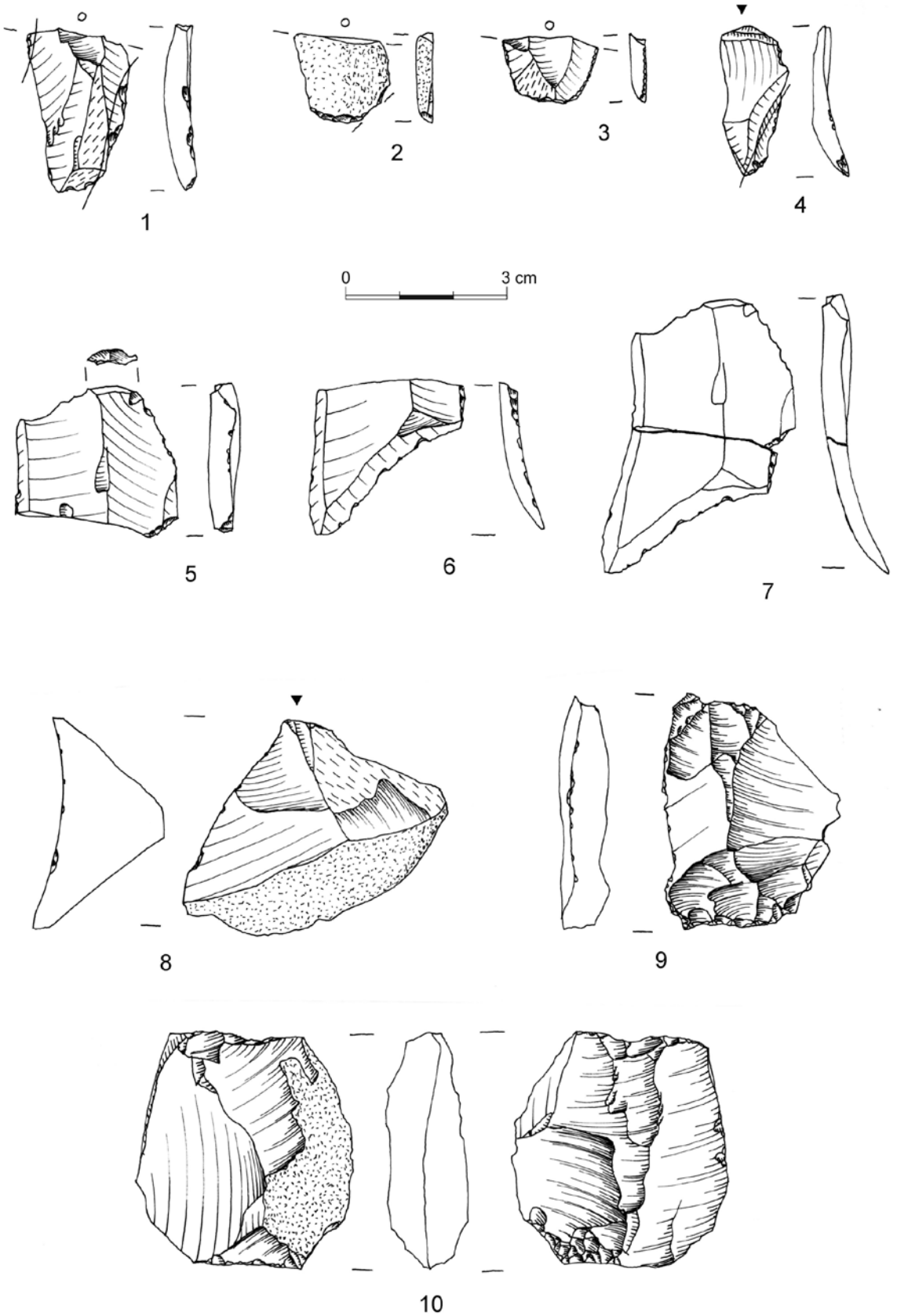


Fig. 6. Chlewiska 132. Flakes with use retouch (1, 4, 8); flakes with micro-retouch (2-3, 5-6); refit group of flakes with micro-retouch (7); splintered piece flake with use retouch (9); splintered piece (10).

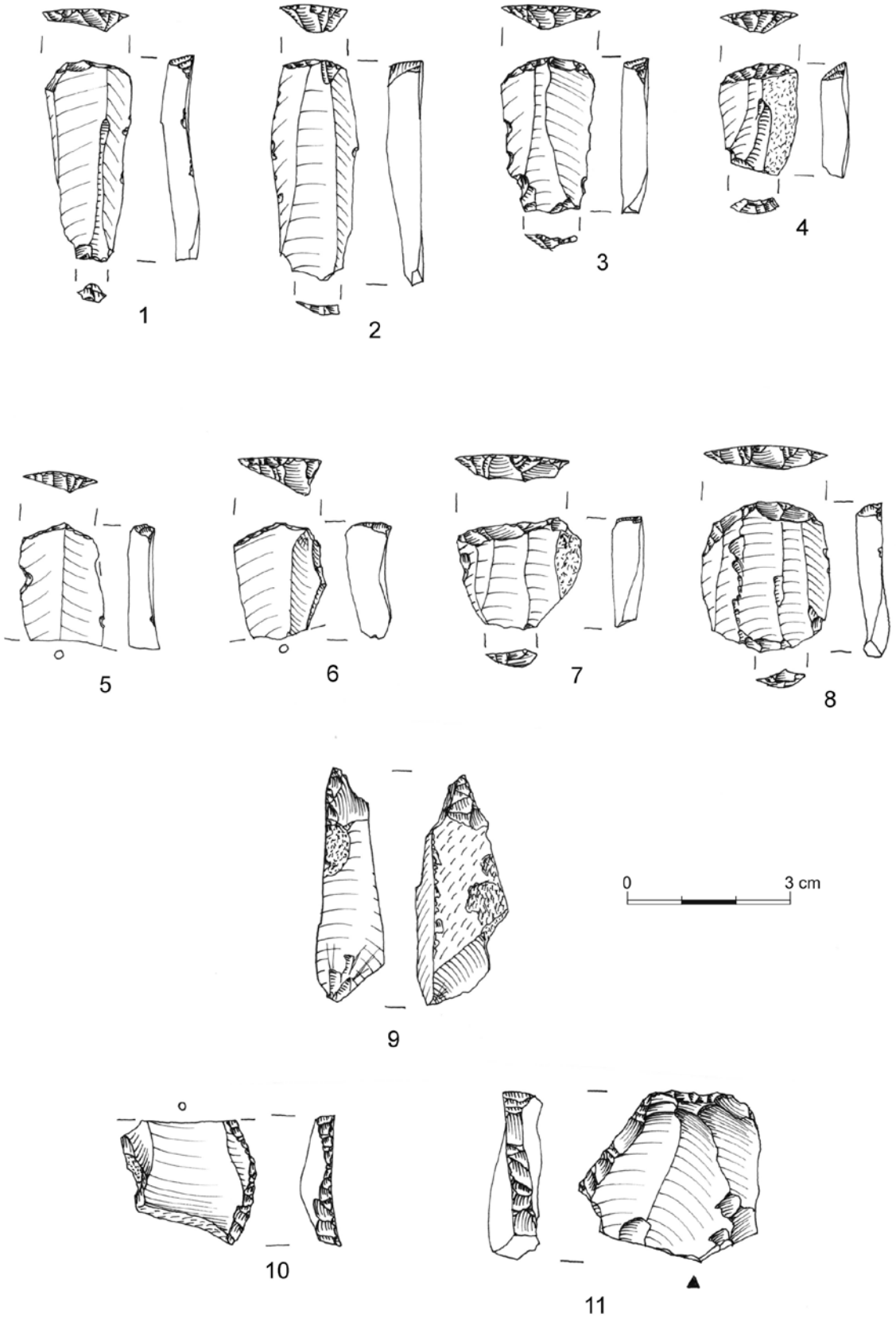


Fig. 7. Grabie 4. End-scrapers (1-8); perforator (9); retouched flakes (10-11).

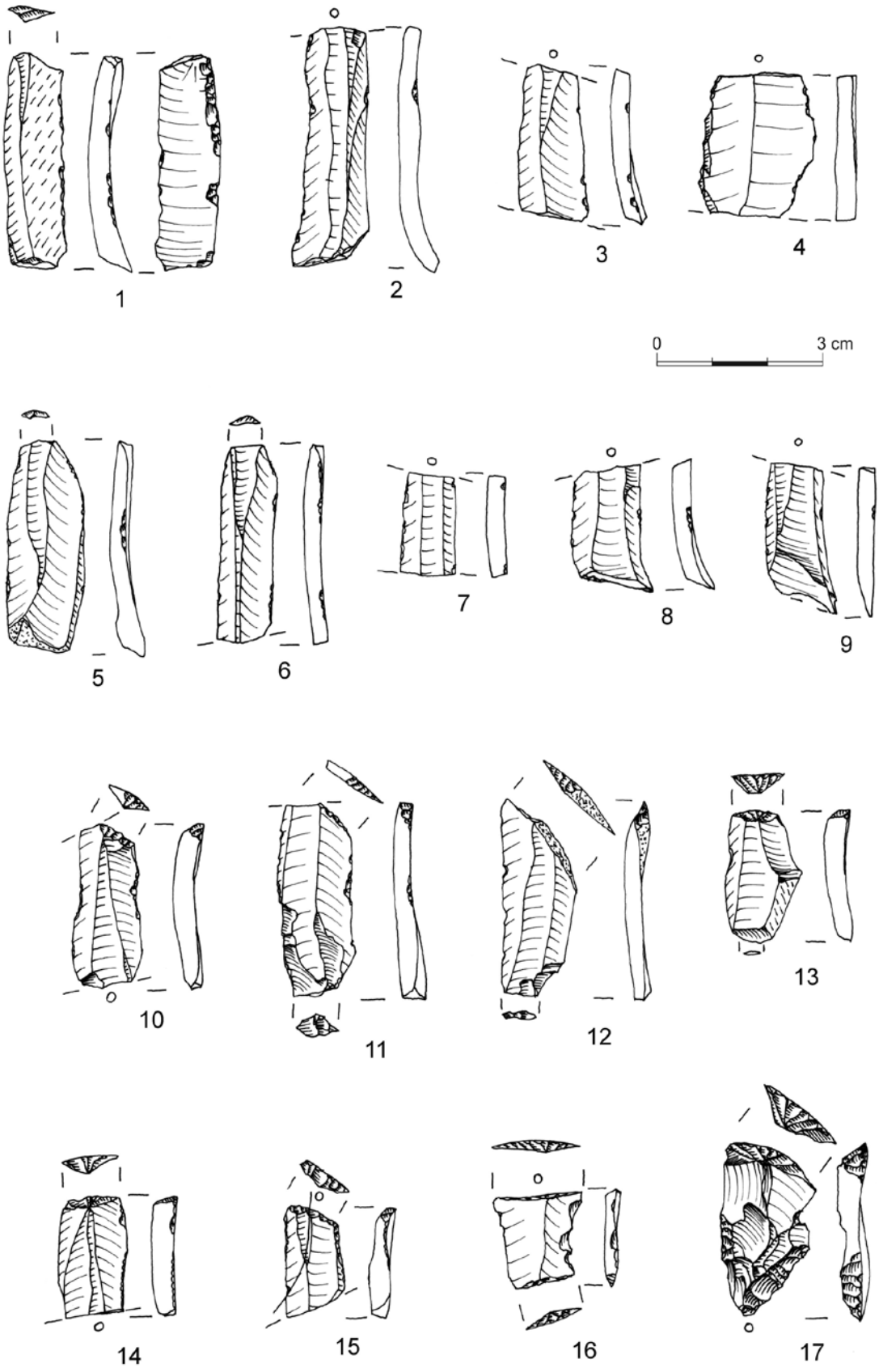


Fig. 8. Grabie 4. Retouched blade (1); blades with use retouch (2-9); truncated blades (10-17).

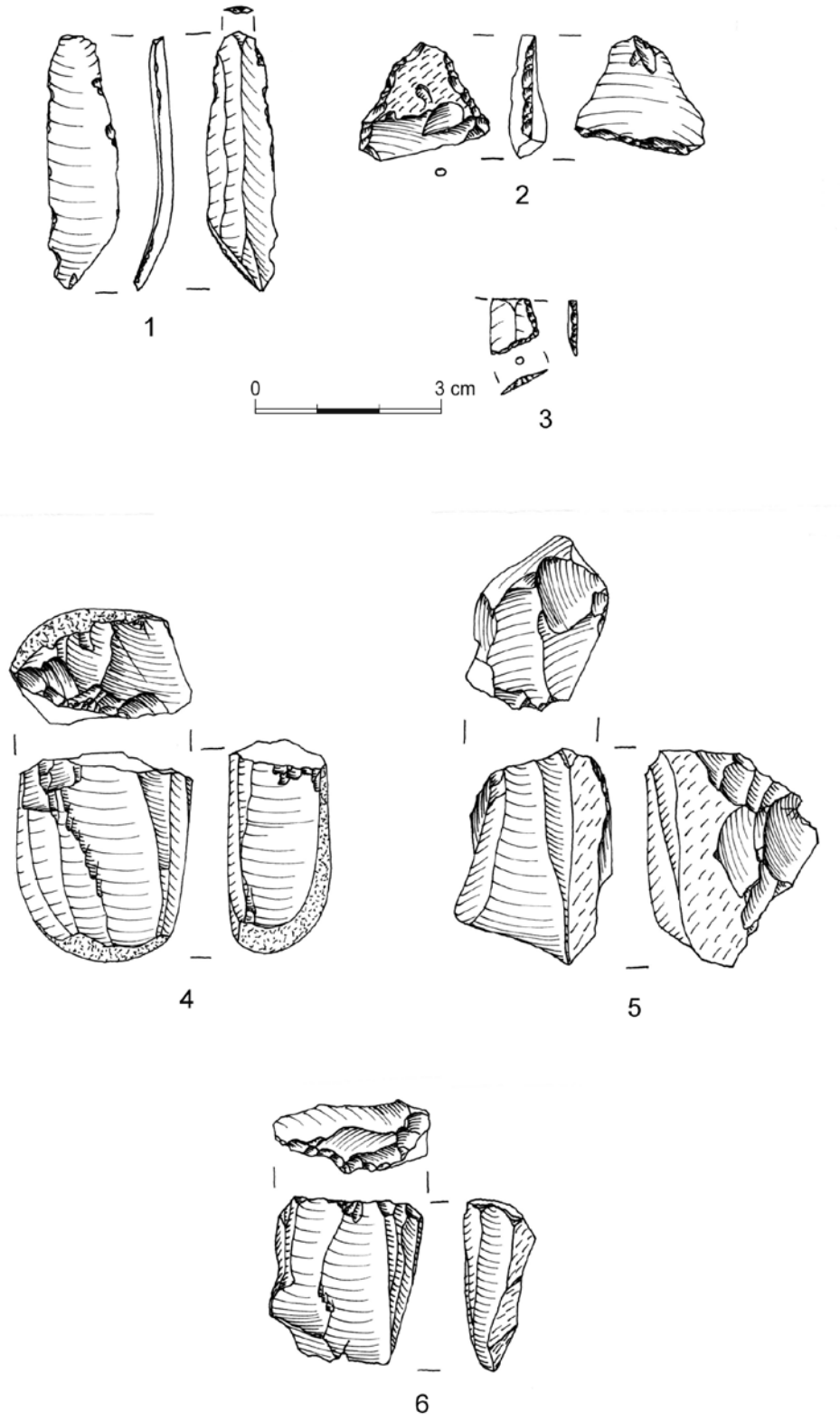


Fig. 9. Podgaj 32. Blade with use retouch (1); retouched flake (2); triangle (3); blade cores (4-6).

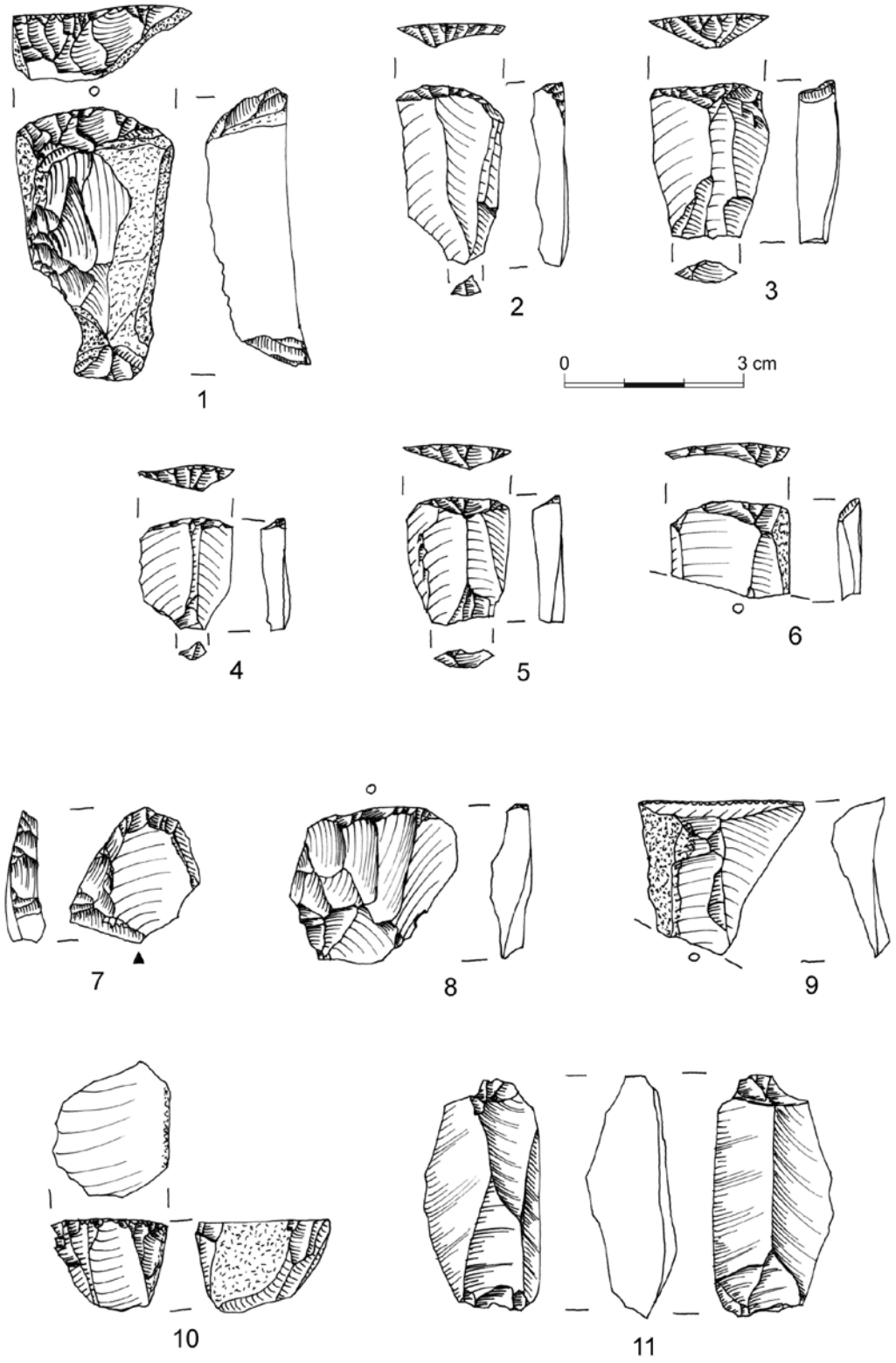


Fig. 10. Przybranowo 3. End-scrapers (1-6); retouched flakes (7-8); micro-retouched flake (9); core (10); splintered piece (11).

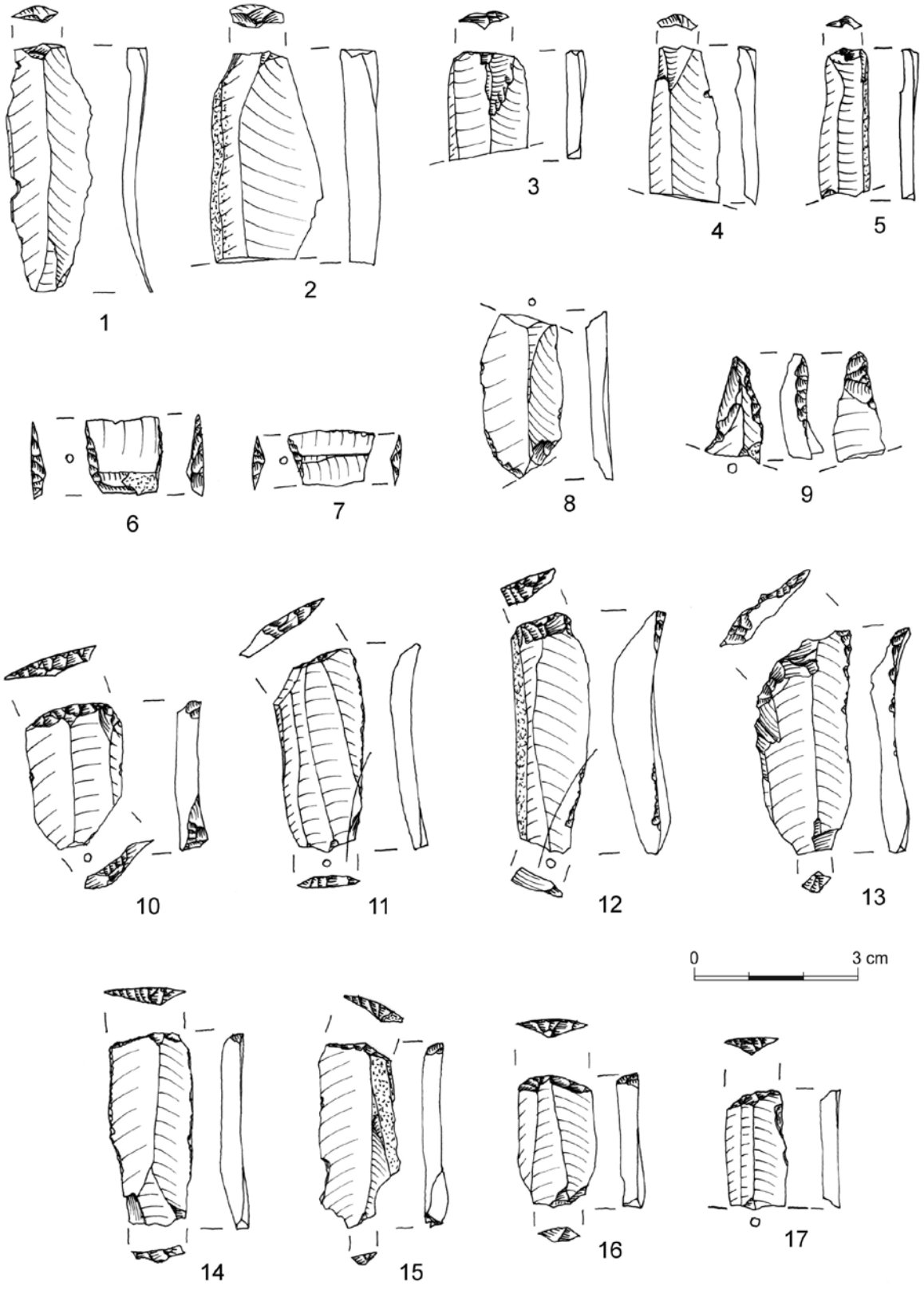


Fig. 11. Przybranowo 3. Blades (1-5); trapezes (6-7); micro-retouched blade (8); borer (9); truncated blades (10-17).

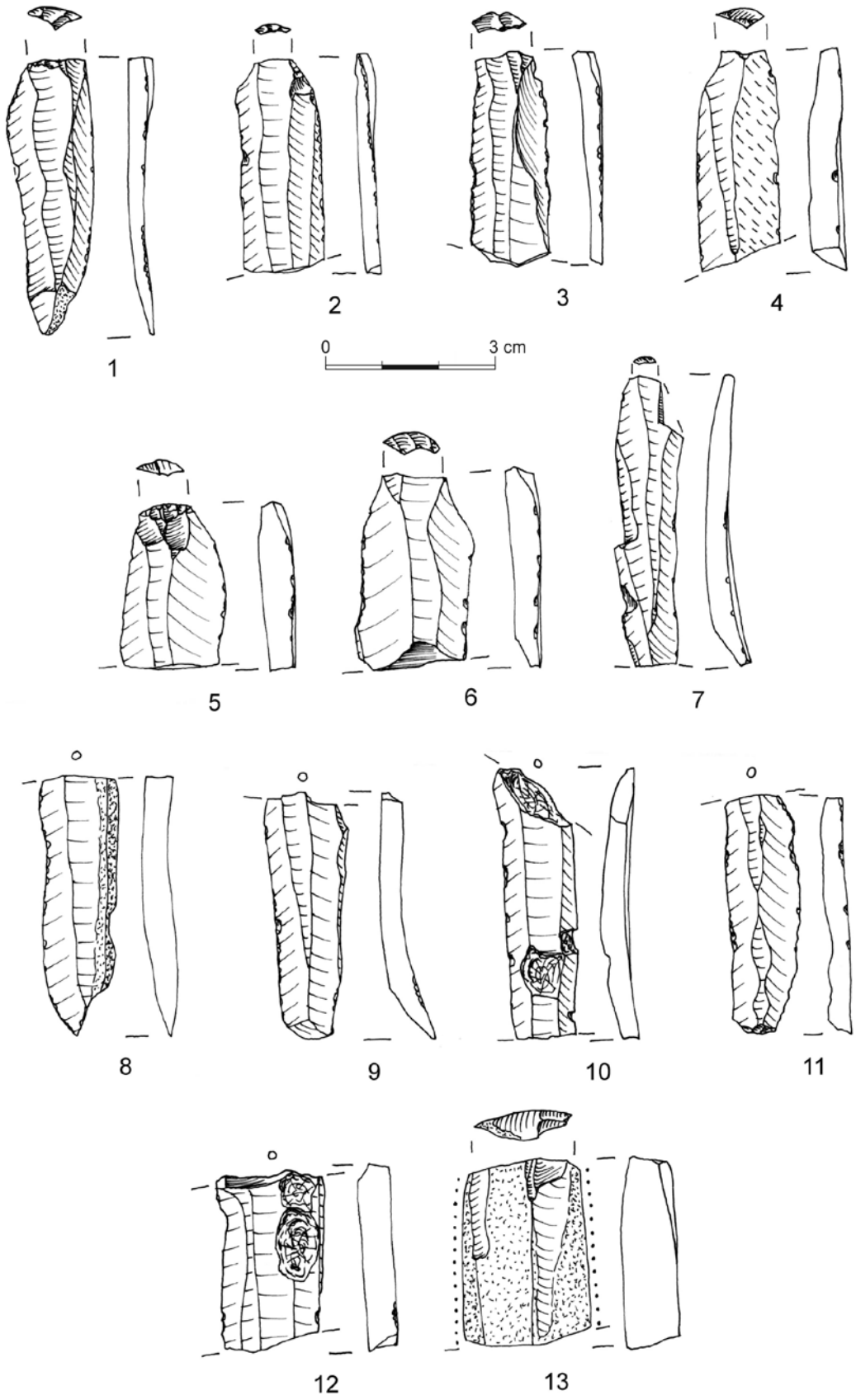


Fig. 12. Przybranowo 3. Blades with use retouch (1-12); blade with polish (13).

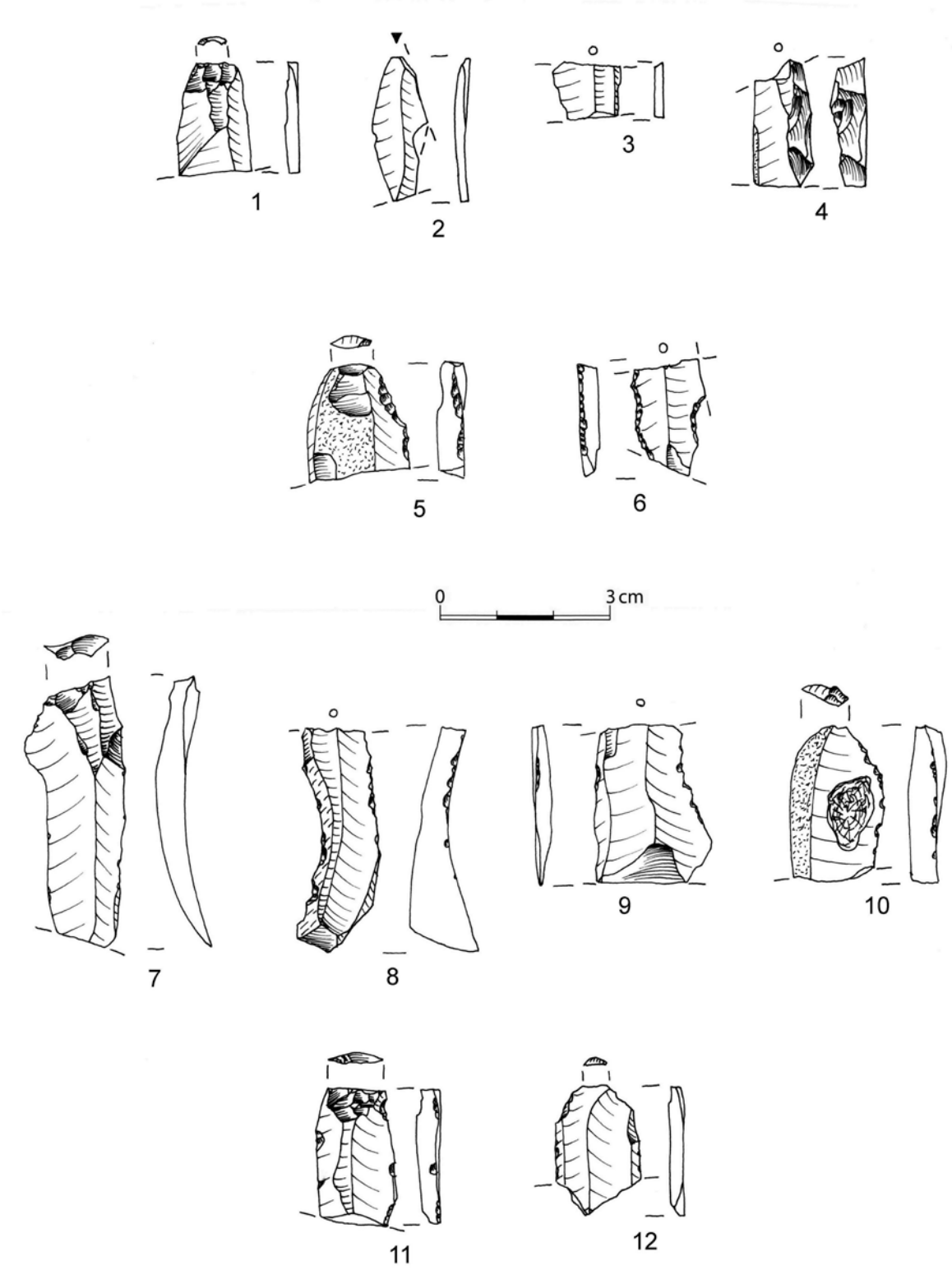


Fig. 13. Poczałkowo 38. Blades (1-3); crested blade (4); retouched blades (5-6); blades with use retouch (7-12).

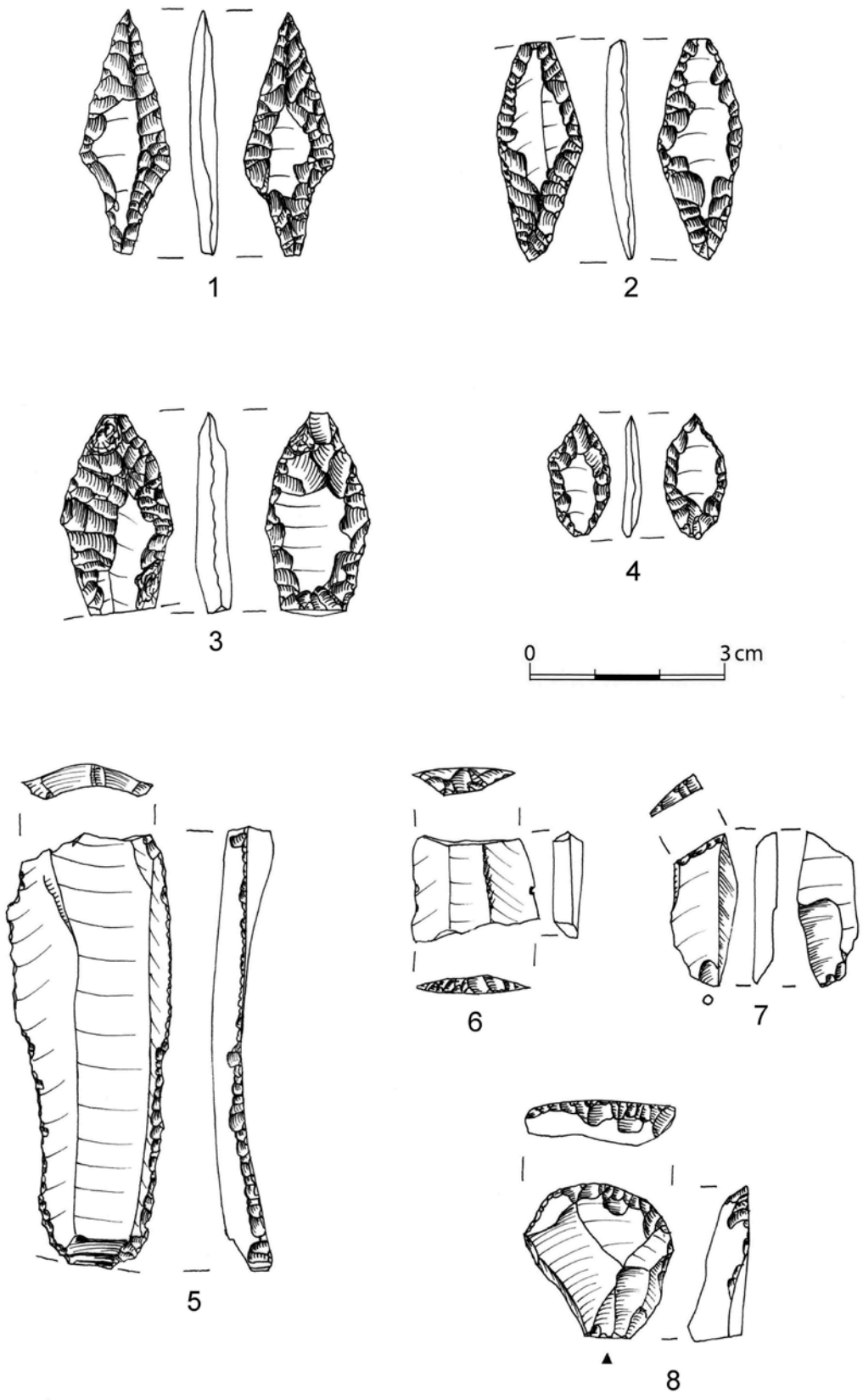


Fig. 14. Poczałkowo 38. Projectile points (1-4); blade with continuous retouch (5); truncated blades (6-7); end-scraper (8).

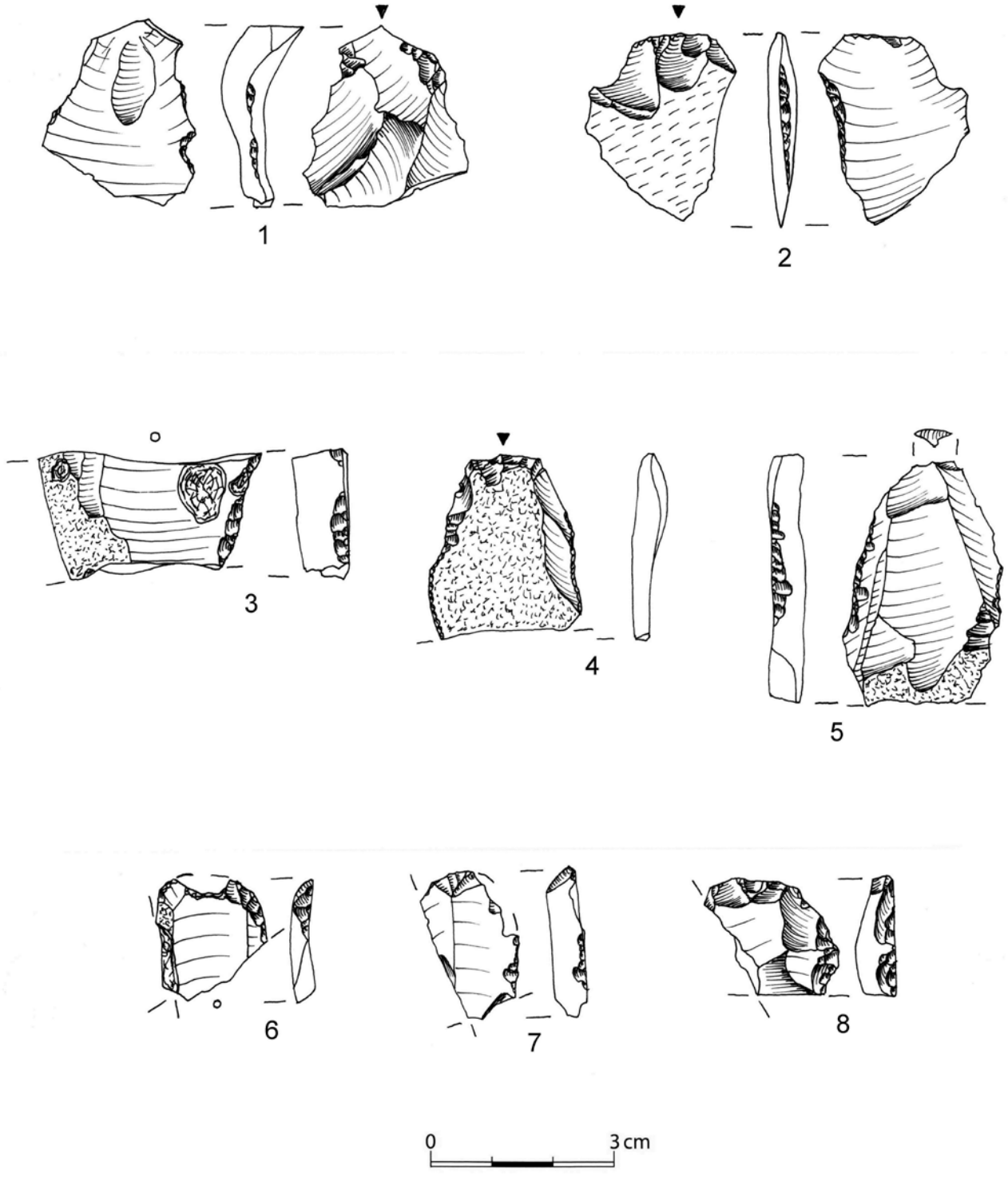


Fig. 15. Począłkowo 38. Retouched flakes (1-8).

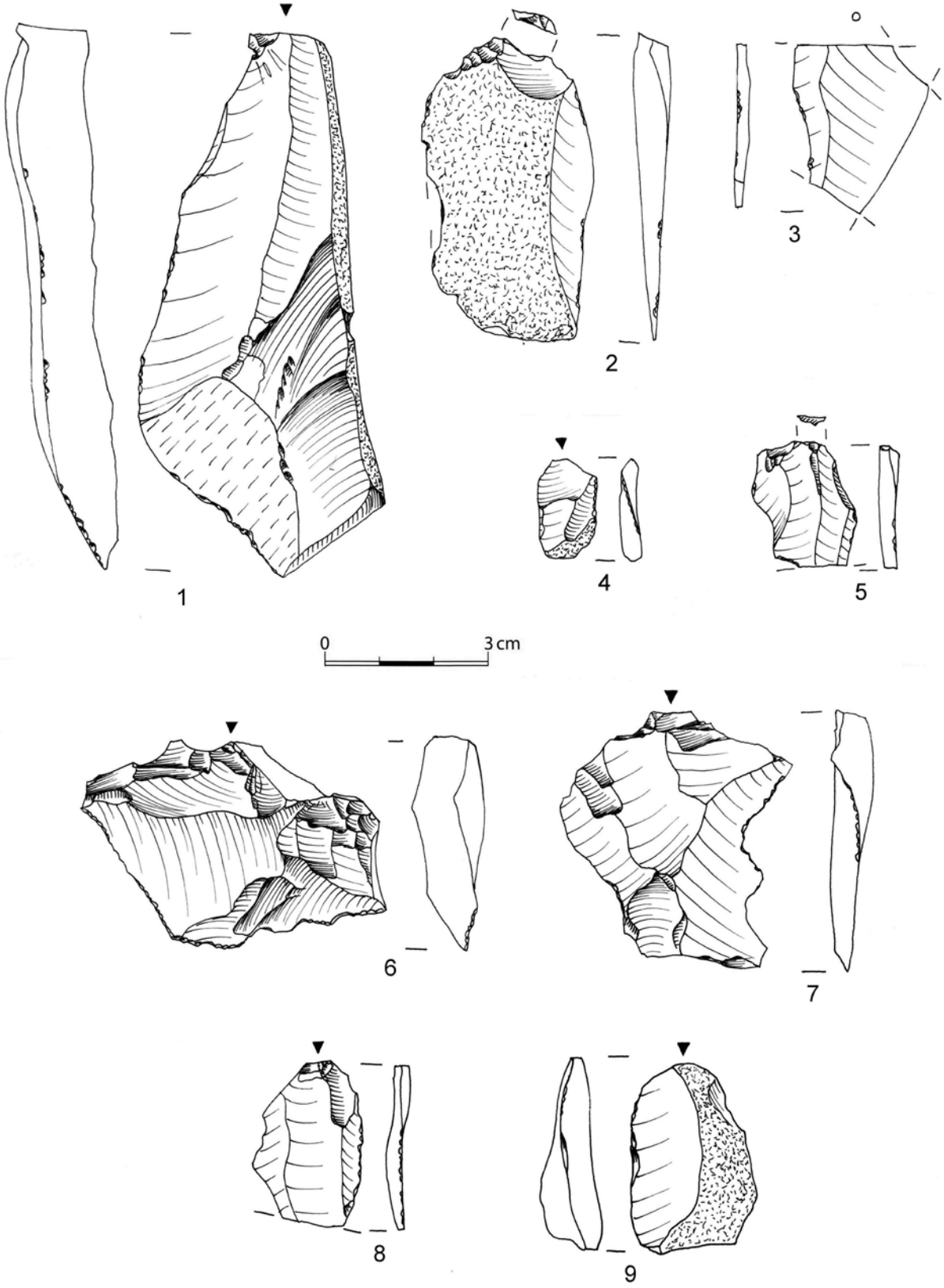


Fig. 16. Początkowo 38. Flakes with use retouch (1-9).

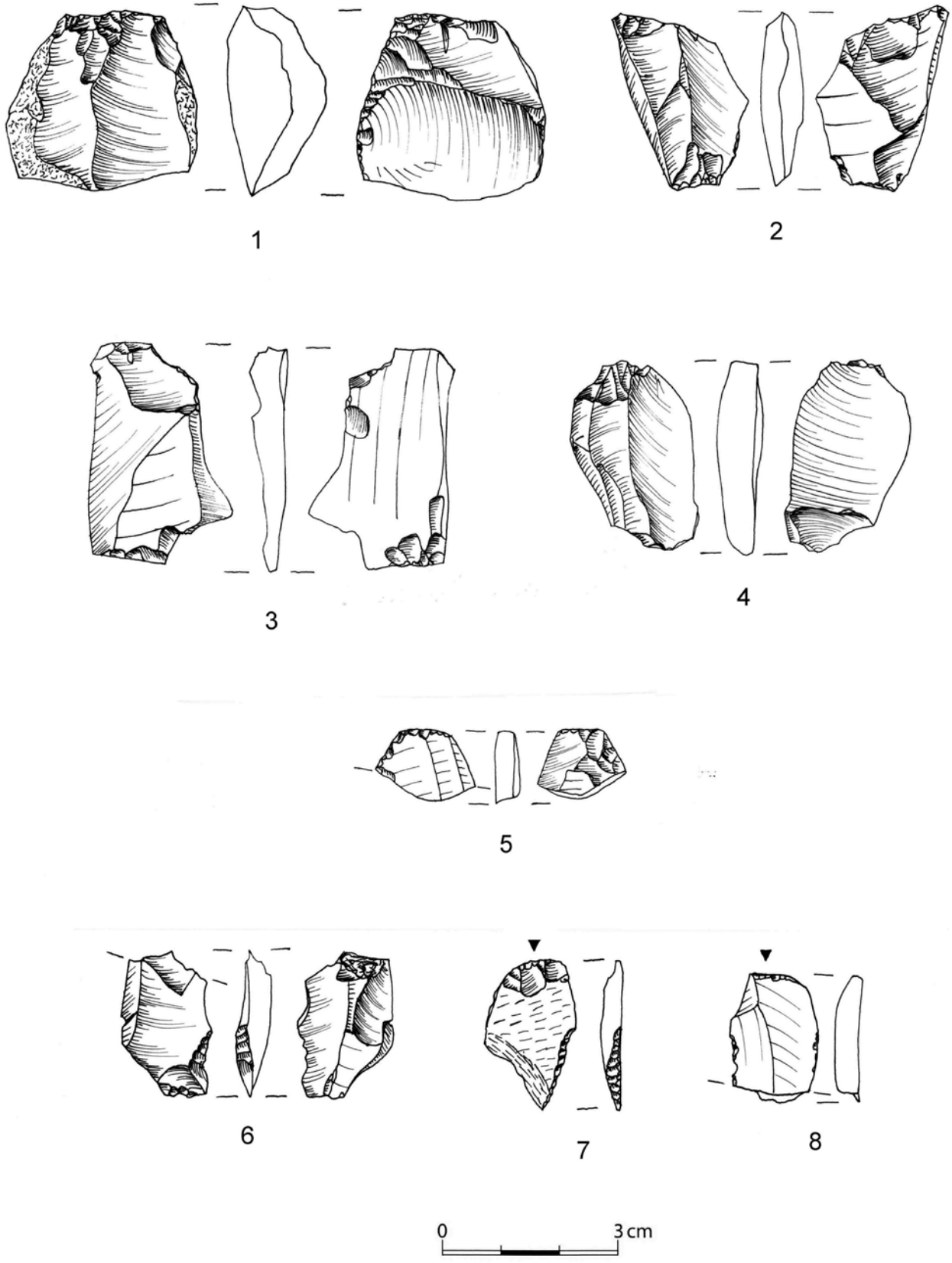


Fig. 17. Początkowo 38. Splintered pieces (1-5); retouched splintered piece (6); retouched splintered piece flake (7); splintered piece flake with use retouch (8).

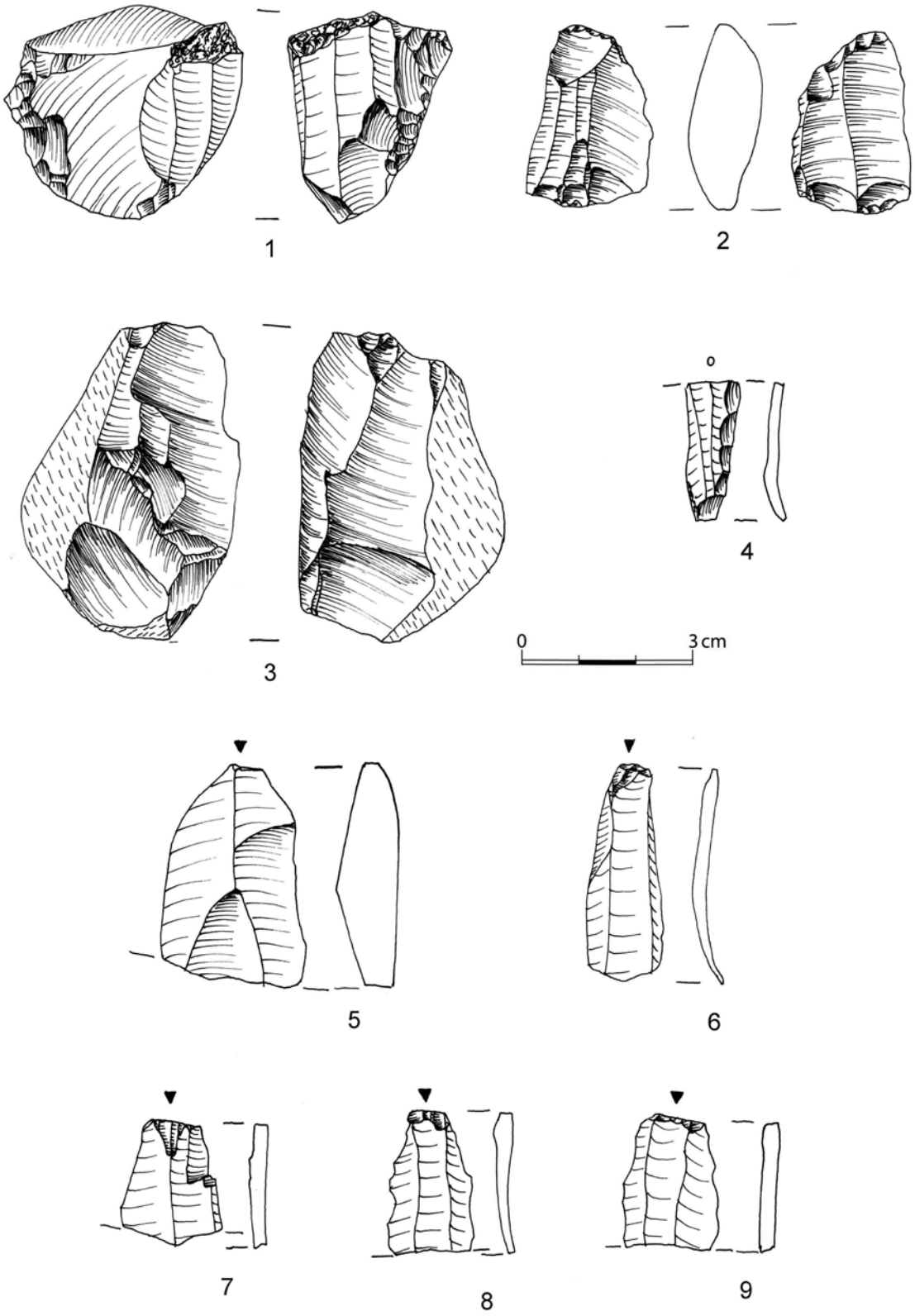


Fig. 18. Podgaj 7A. Blade core (1); splintered pieces (2-3); crested blade (4); blades (5-9).

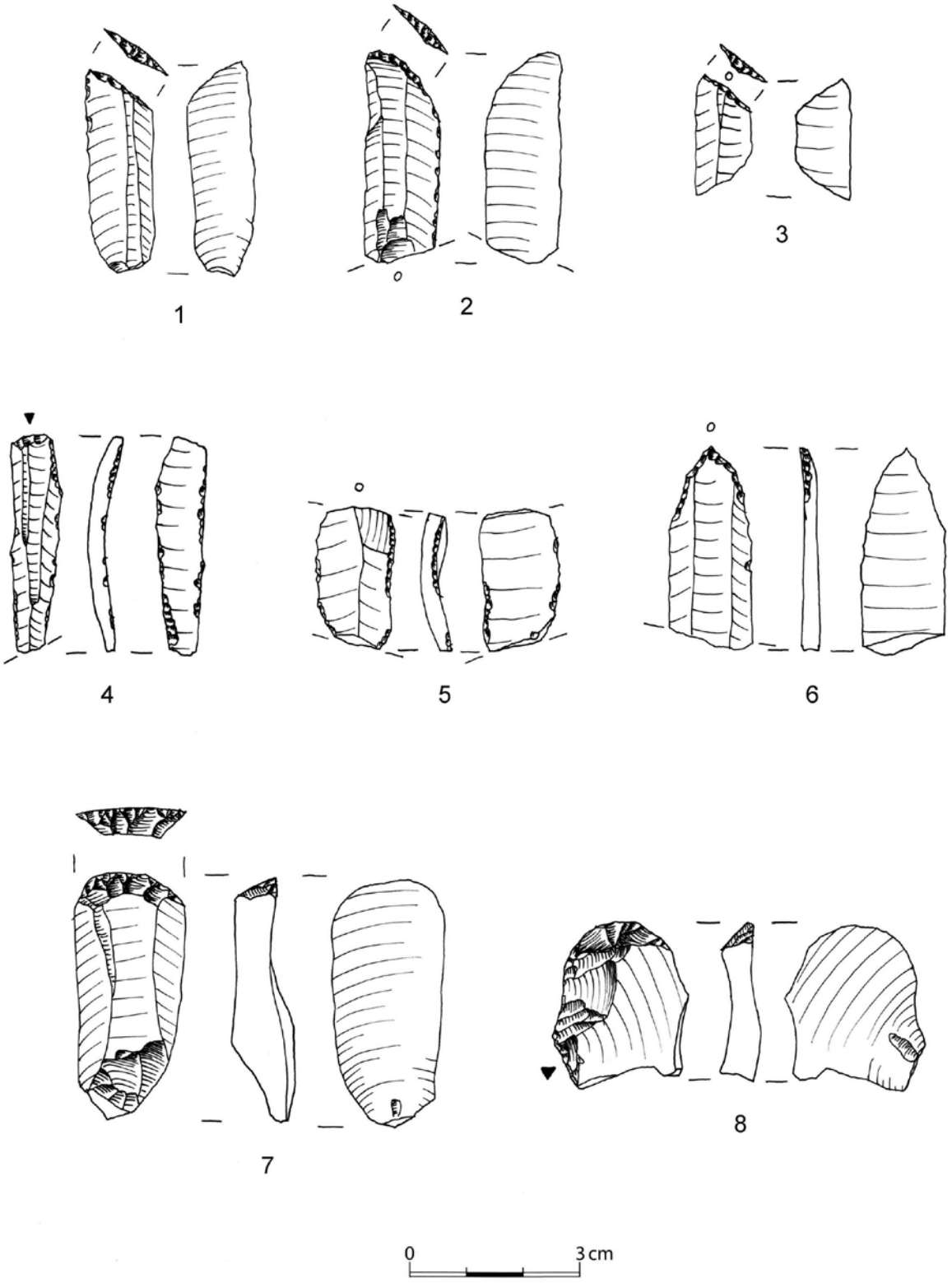


Fig. 19. Podgaj 7A. Truncated blades (1-3); retouched blades (4-5); perforator (6); end-scrapers (7-8).

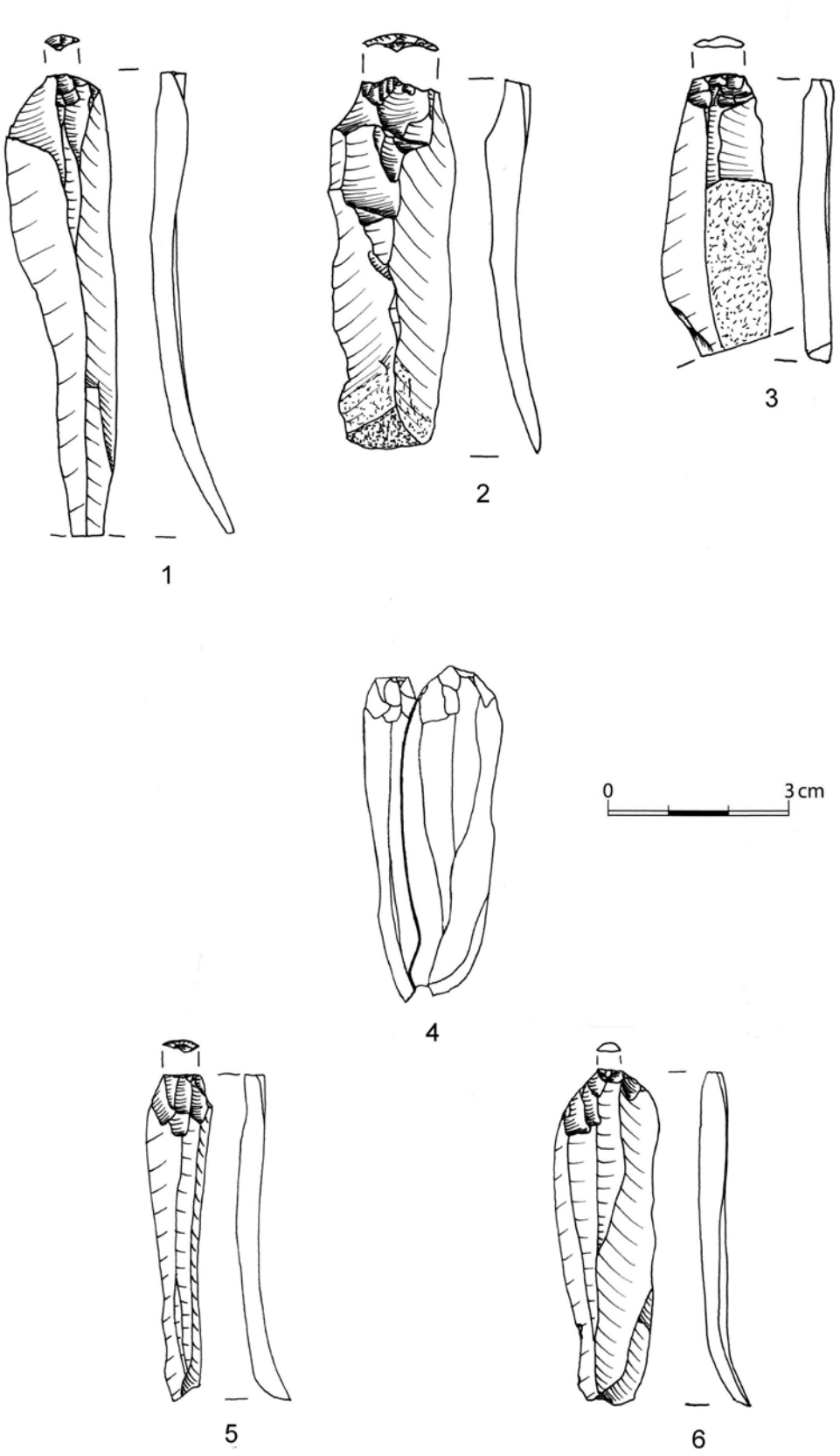


Fig. 20. Przybranówek 43. House 2 (1-6). Blades (1-3, 5-6); refit group of two blades (4).

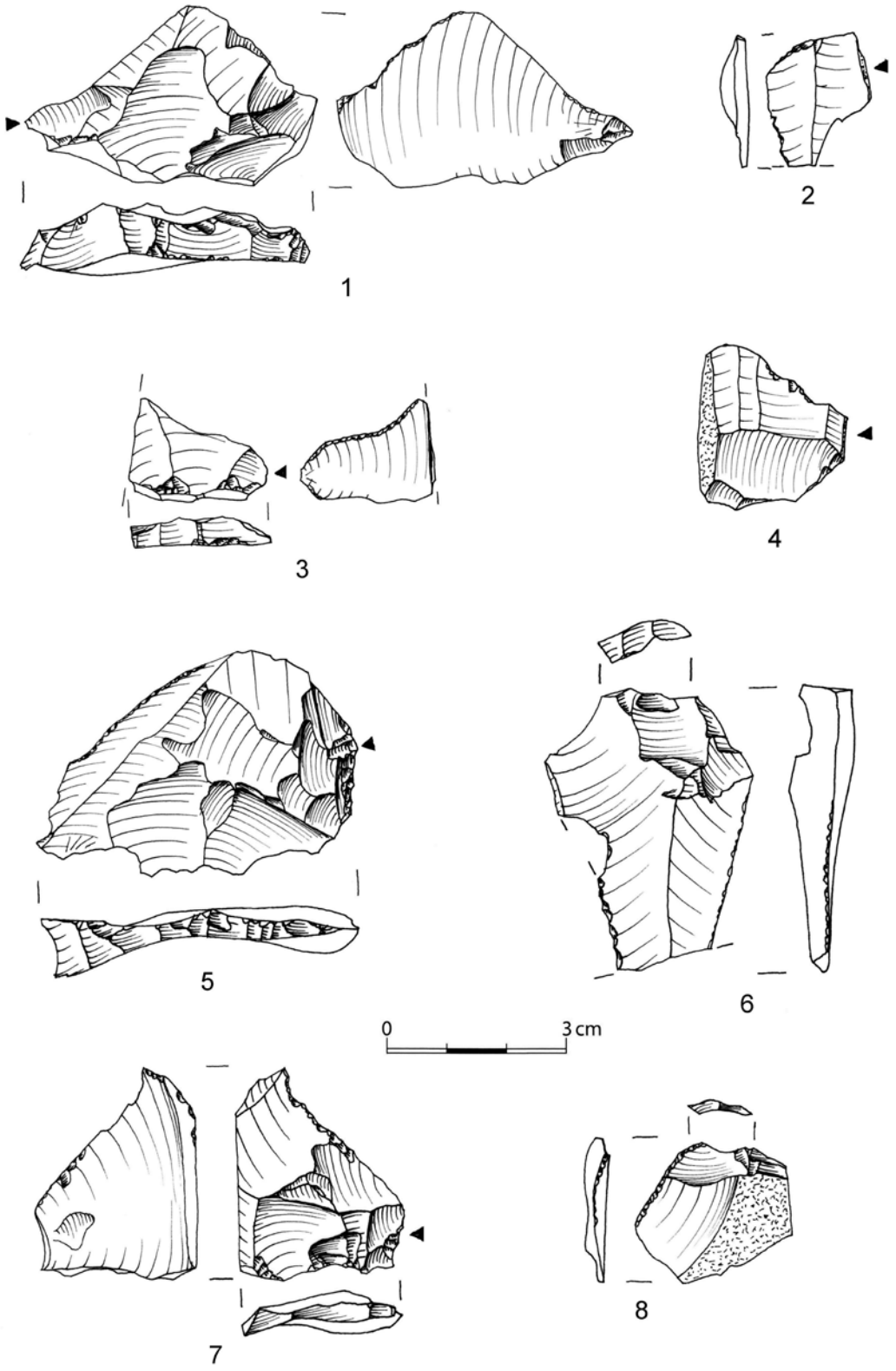


Fig. 21. Przybranówek 43. House 1 (1-4); house 2 (5, 7); house 3 (6, 8).
Rejuvenation flakes with use retouch (1, 5); flakes with blade scars and with use retouch (2, 4); micro-retouched platform rejuvenation flake (3); micro-retouched flake with blade scars (6); retouched platform rejuvenation flakes (7-8).

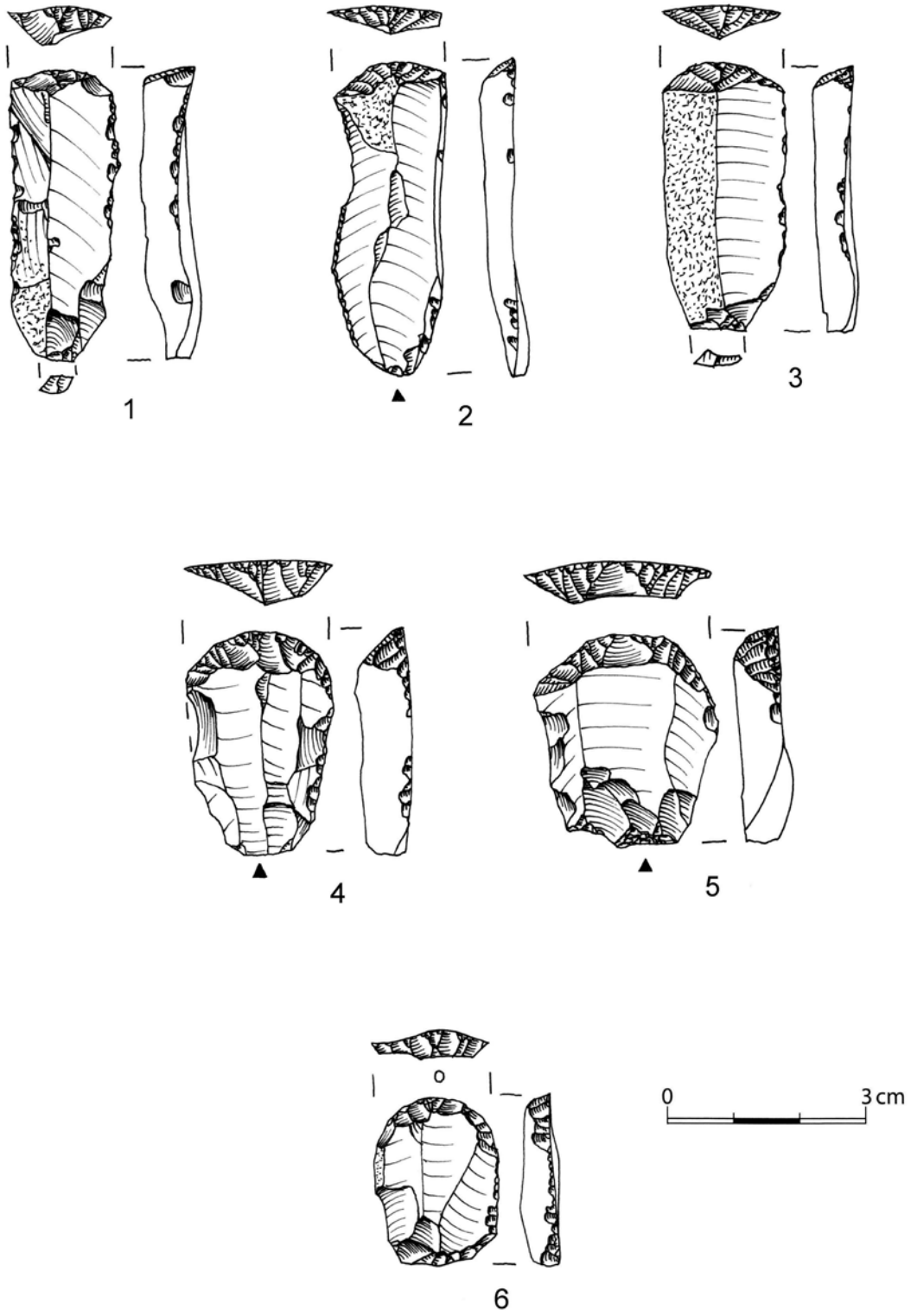


Fig. 22. Przybranówek 43. House 1 (1-6). End-scrapers (1-6).

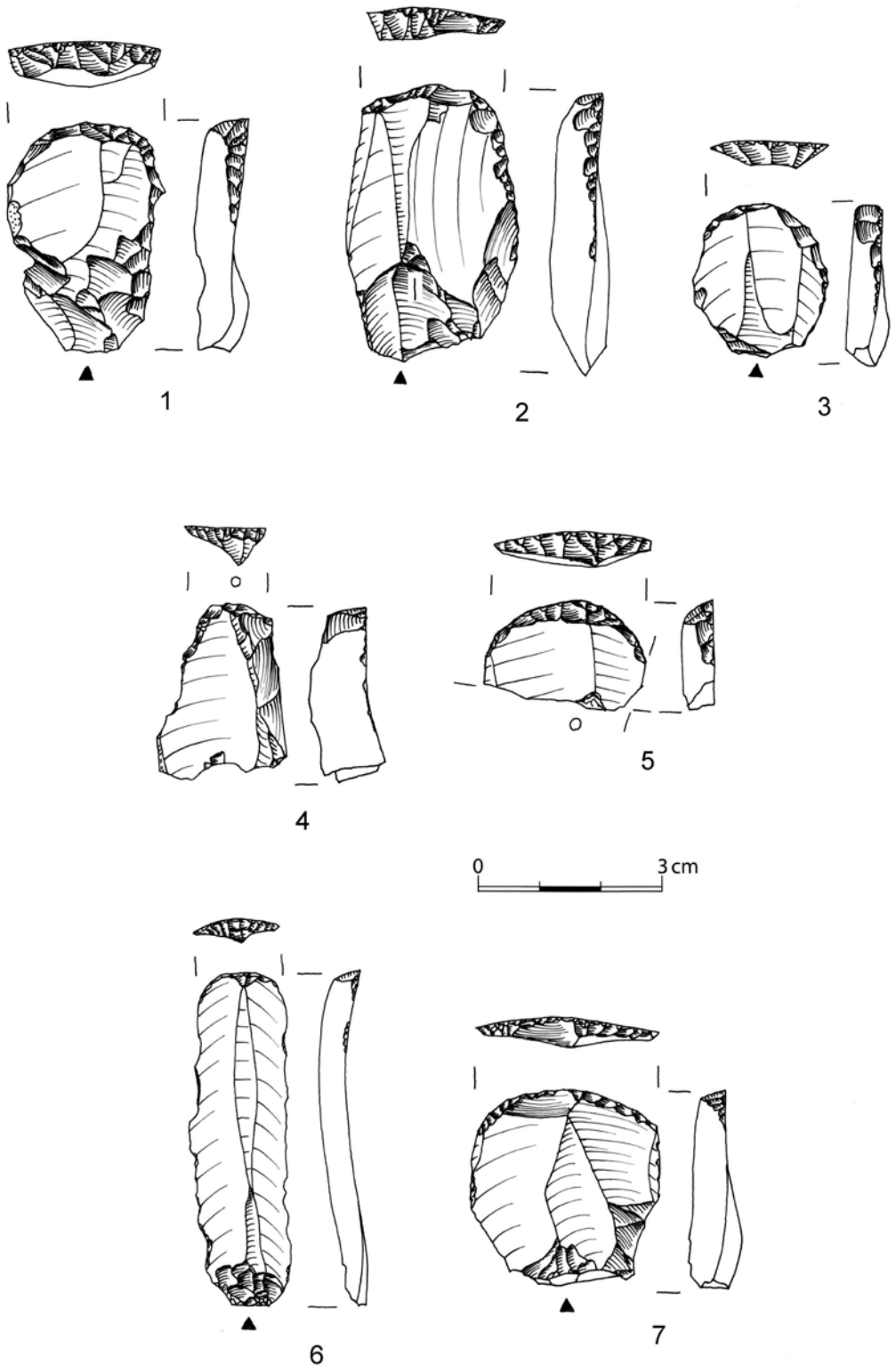


Fig. 23. Przybranówek 43. House 2 (1-3); house 3 (4-5); house 4 (6-7). End-scrapers (1-7).

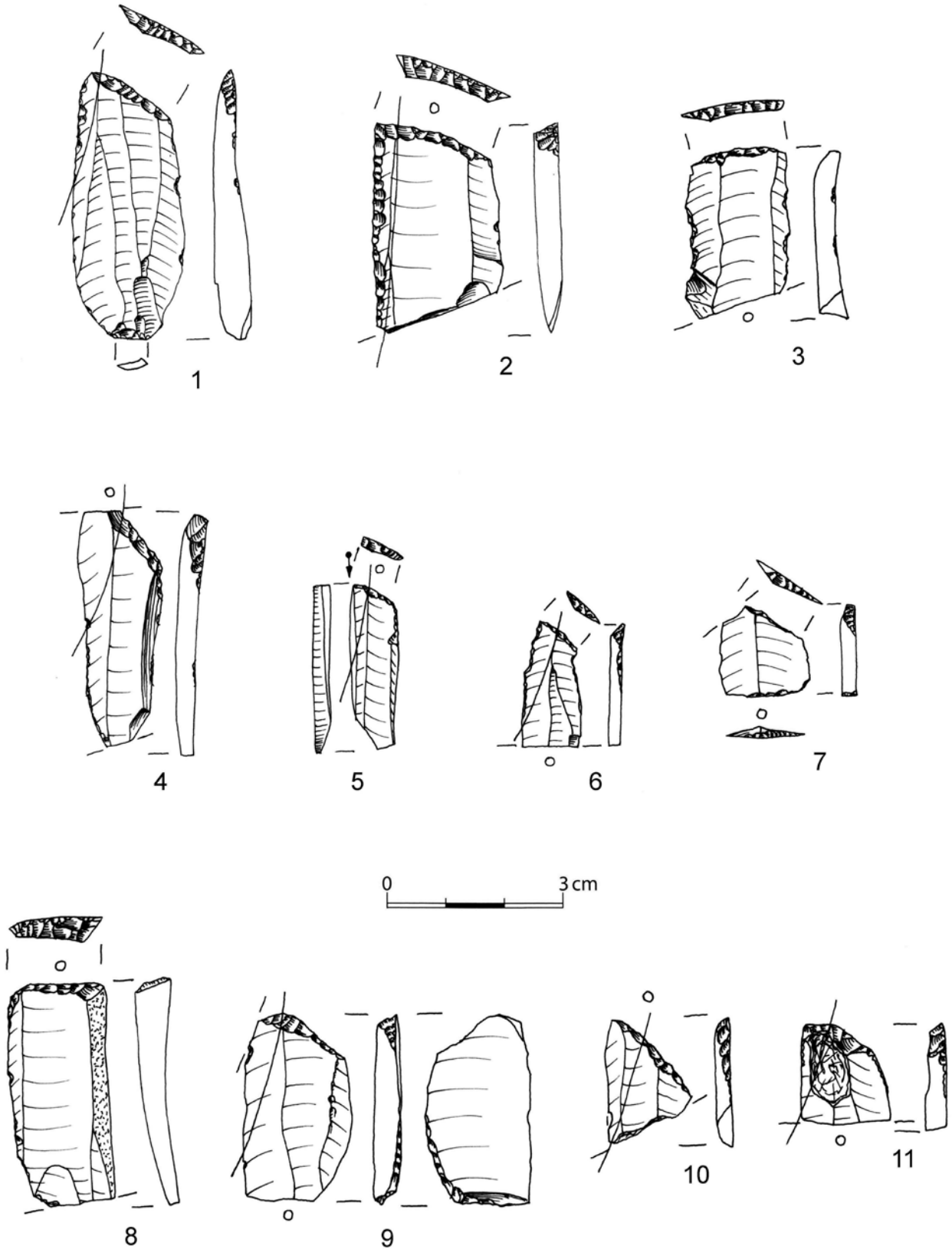


Fig. 24. Przybranówek 43. House 1 (1-7); house 2 (8-11). Truncated blades (1-11).

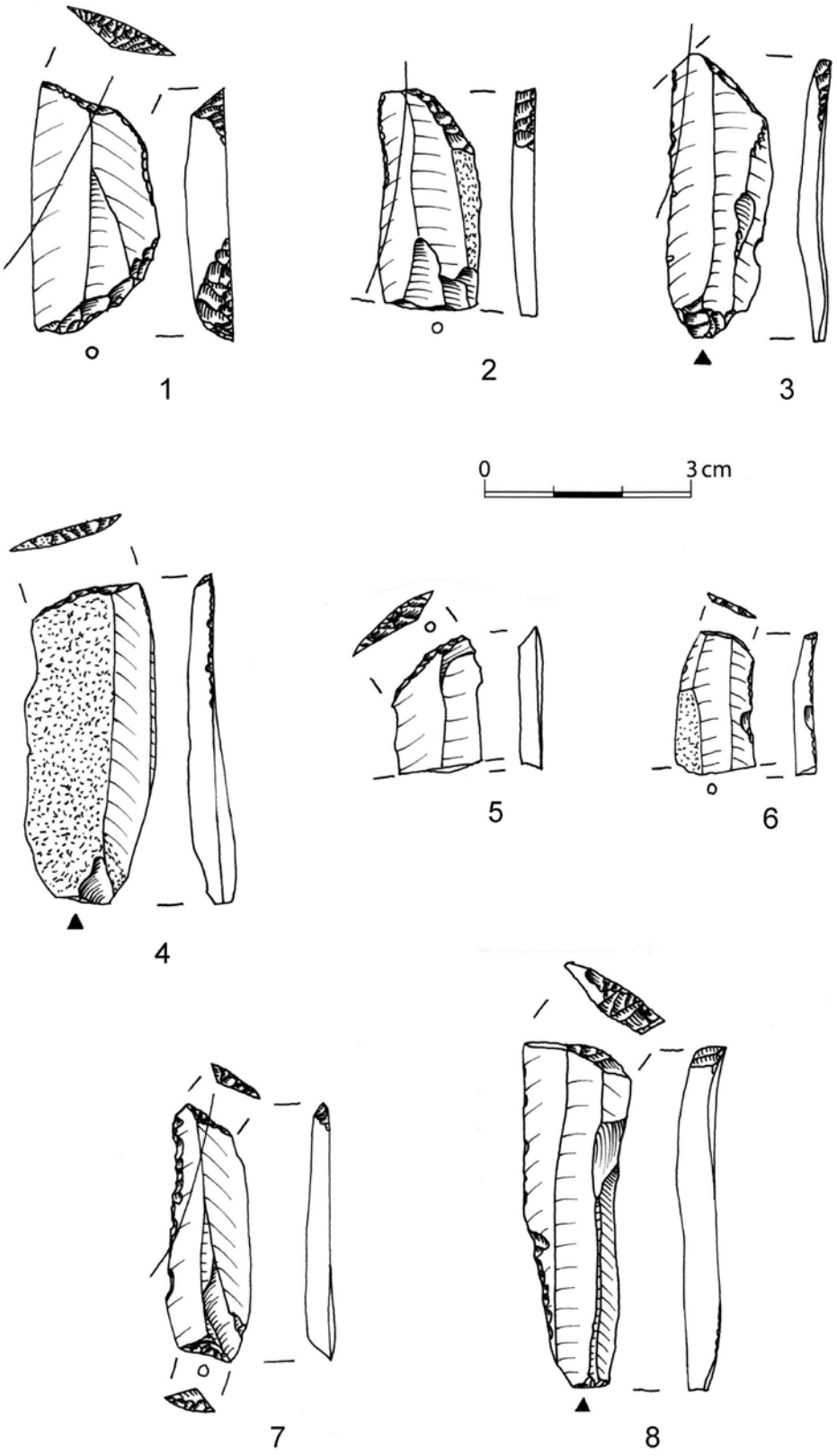


Fig. 25. Przybranówek 43. House 3 (1-4); house 4 (5-6); house 5 (7-8). Truncated blades (1-8).

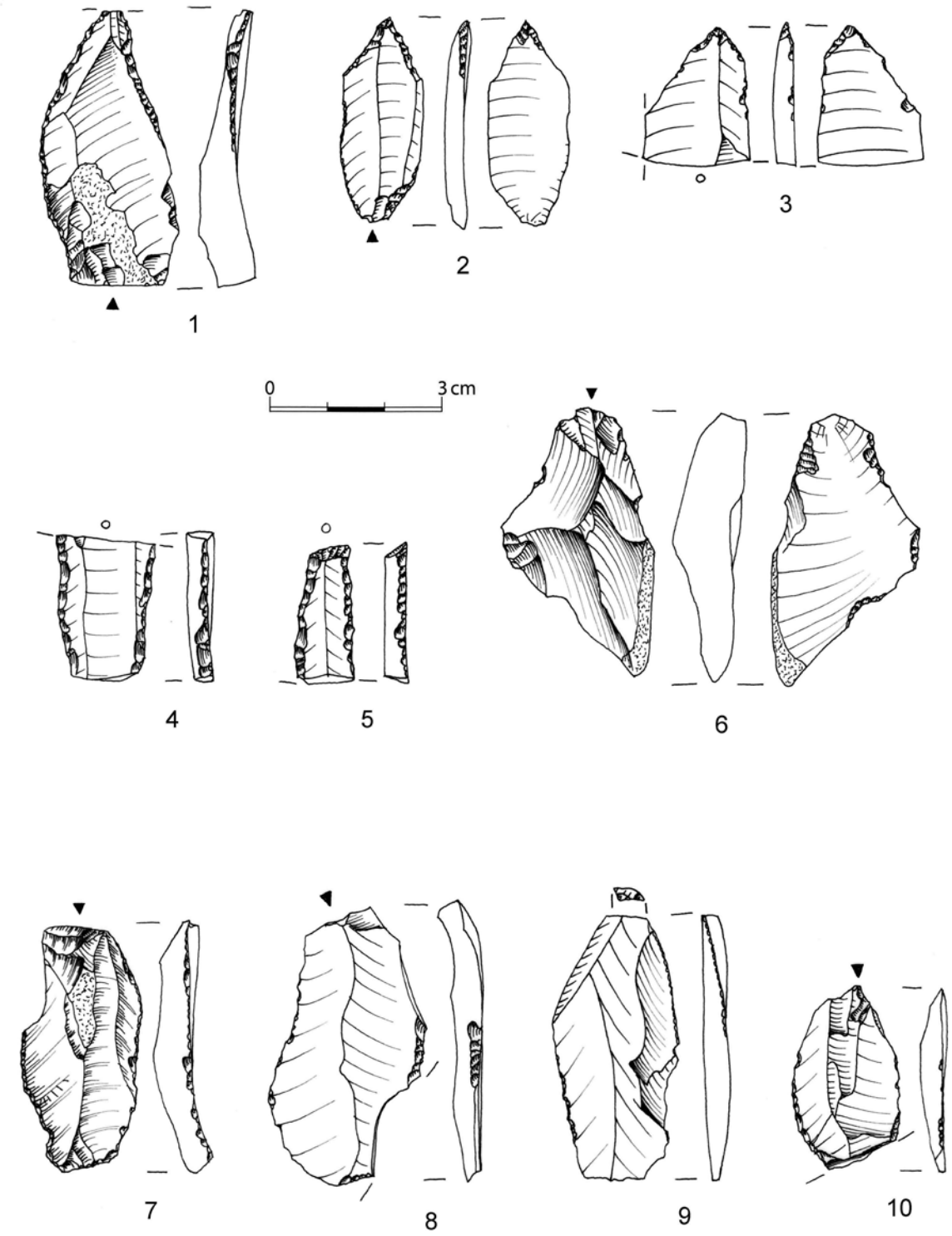


Fig. 26. Przybranówek 43. House 1 (3-4, 7-8); house 2 (5, 10); house 3 (1-2); house 4 (9); house 5 (6). Perforator (1); borers (2-3); blades with continuous retouch (4-5); retouched flakes (6, 8, 10); micro-retouched flakes (7, 9).

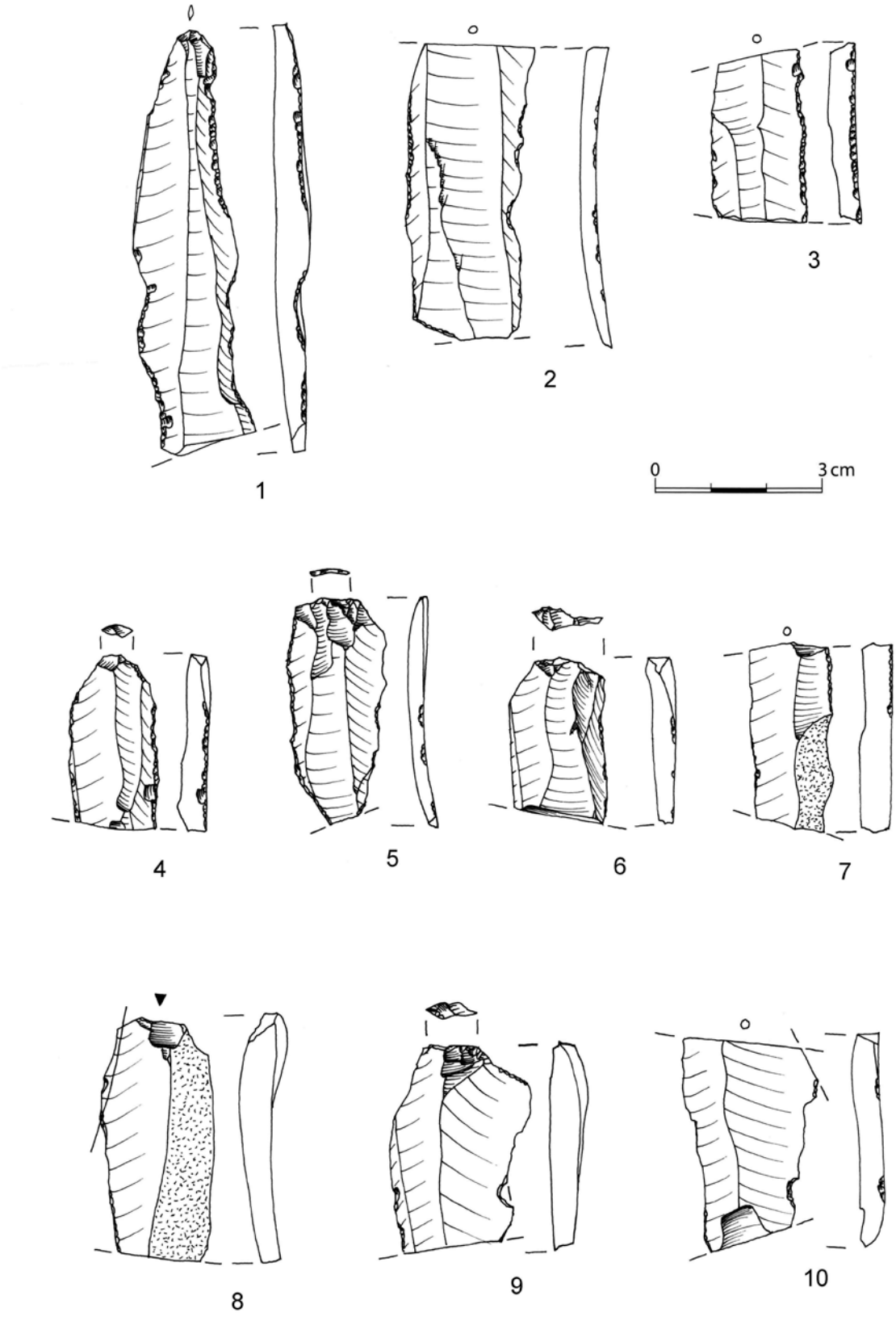


Fig. 27. Przybranówek 43. House 1 (1-10). Micro-retouched blades (1-5); blades with use retouch (6-10).

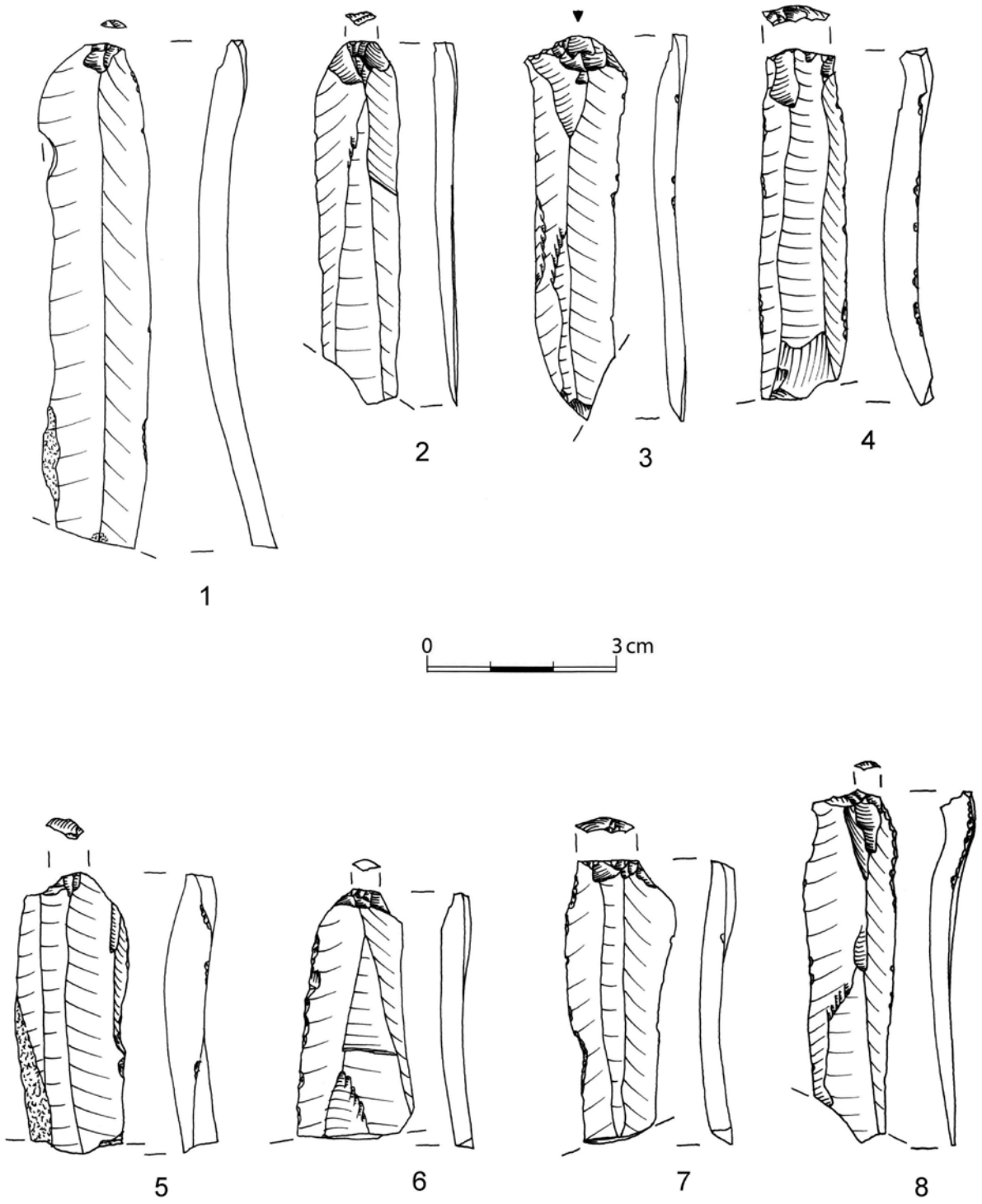


Fig. 28. Przybranówek 43. House 1 (1-8). Blades with use retouch (1-8).

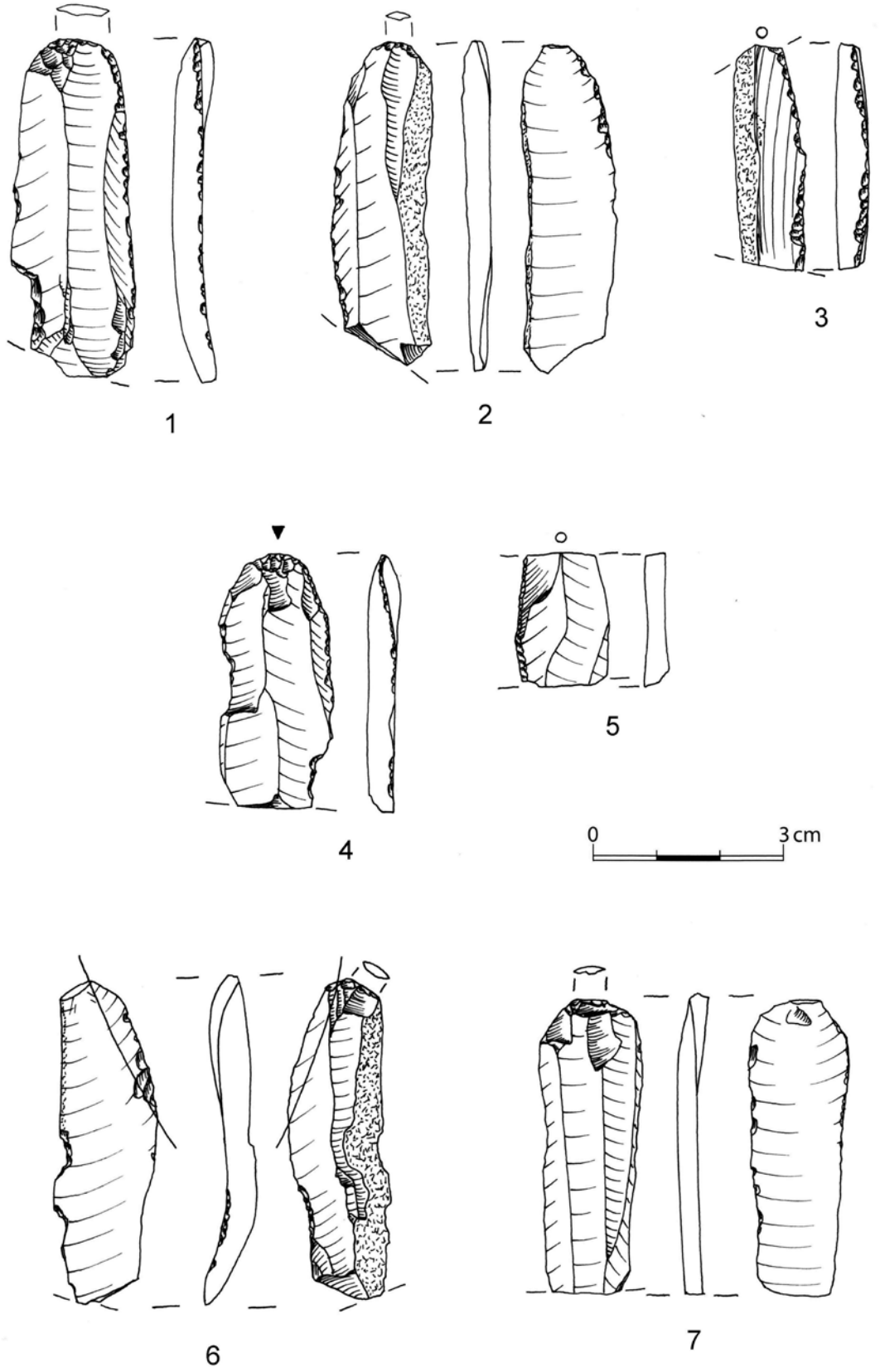


Fig. 29. Przybranówek 43. House 2 (1-7). Micro-retouched blades (1-5); blades with use retouch (6-7).

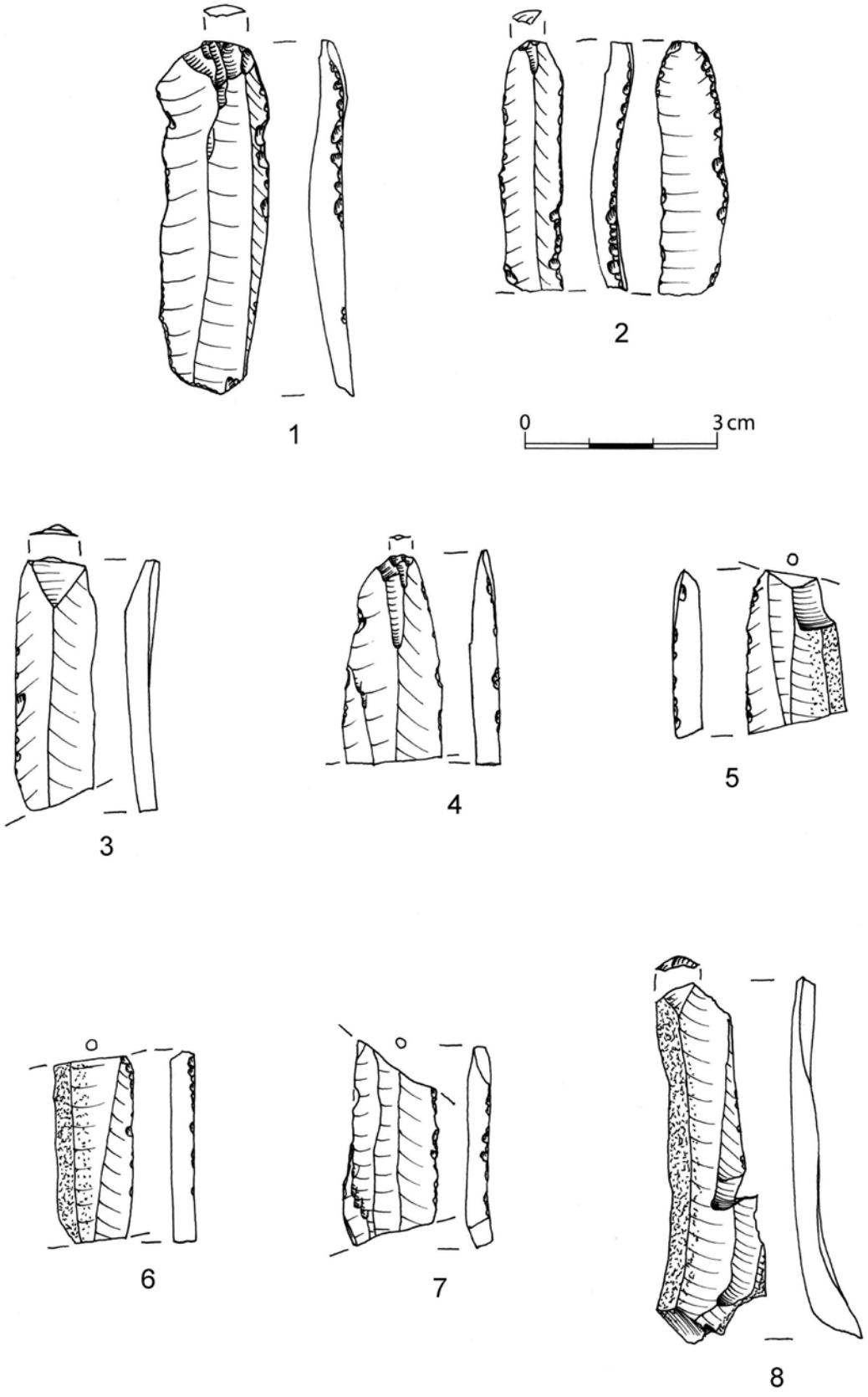


Fig. 30. Przybranówek 43. House 3 (1-7); house 4 (8). Micro-retouched blades (1-2); blades with use retouch (3-8).

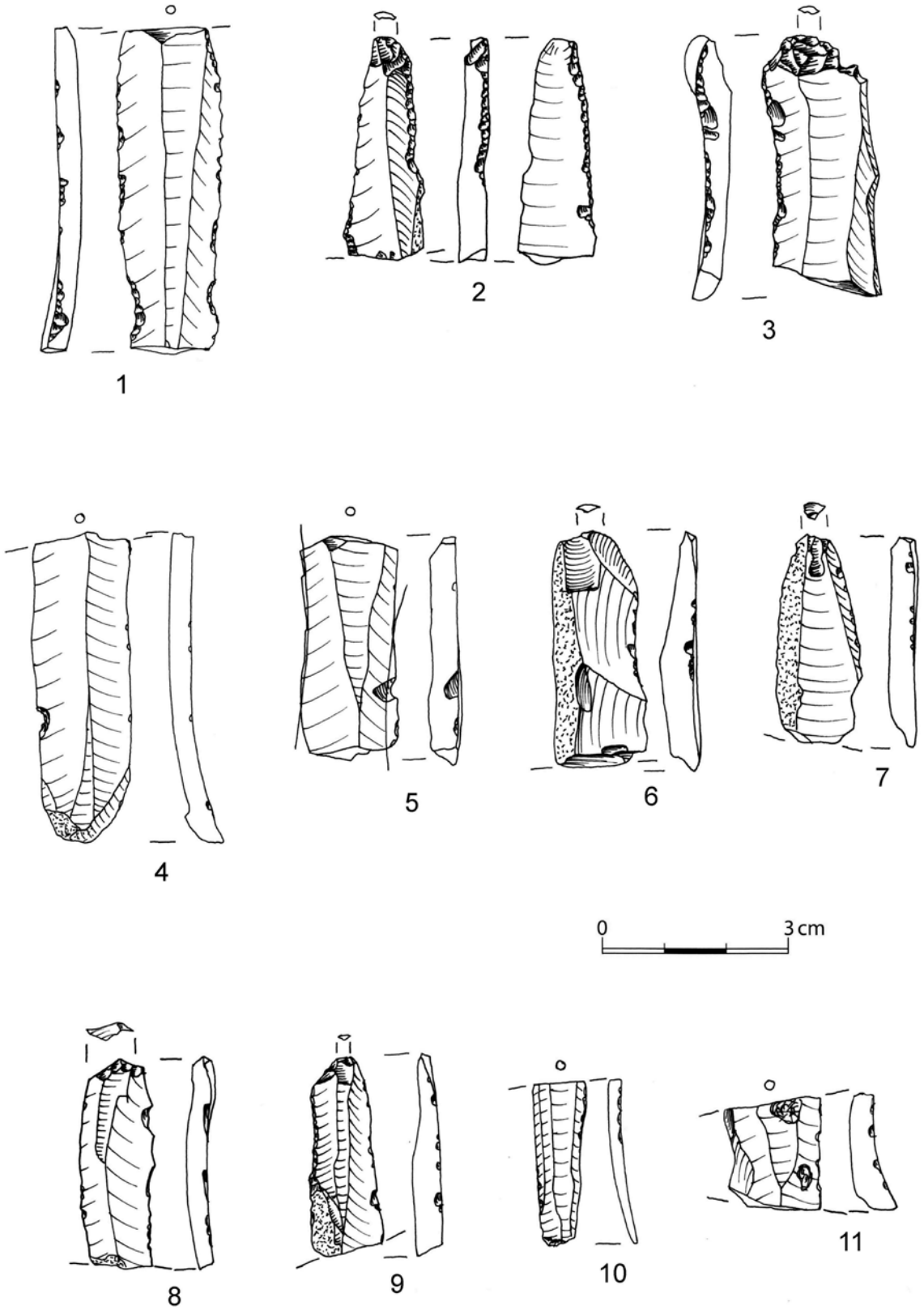


Fig. 31. Przybranówek 43. House 5 (1-11). Micro-retouched blades (1-3); blades with use retouch (4-11).

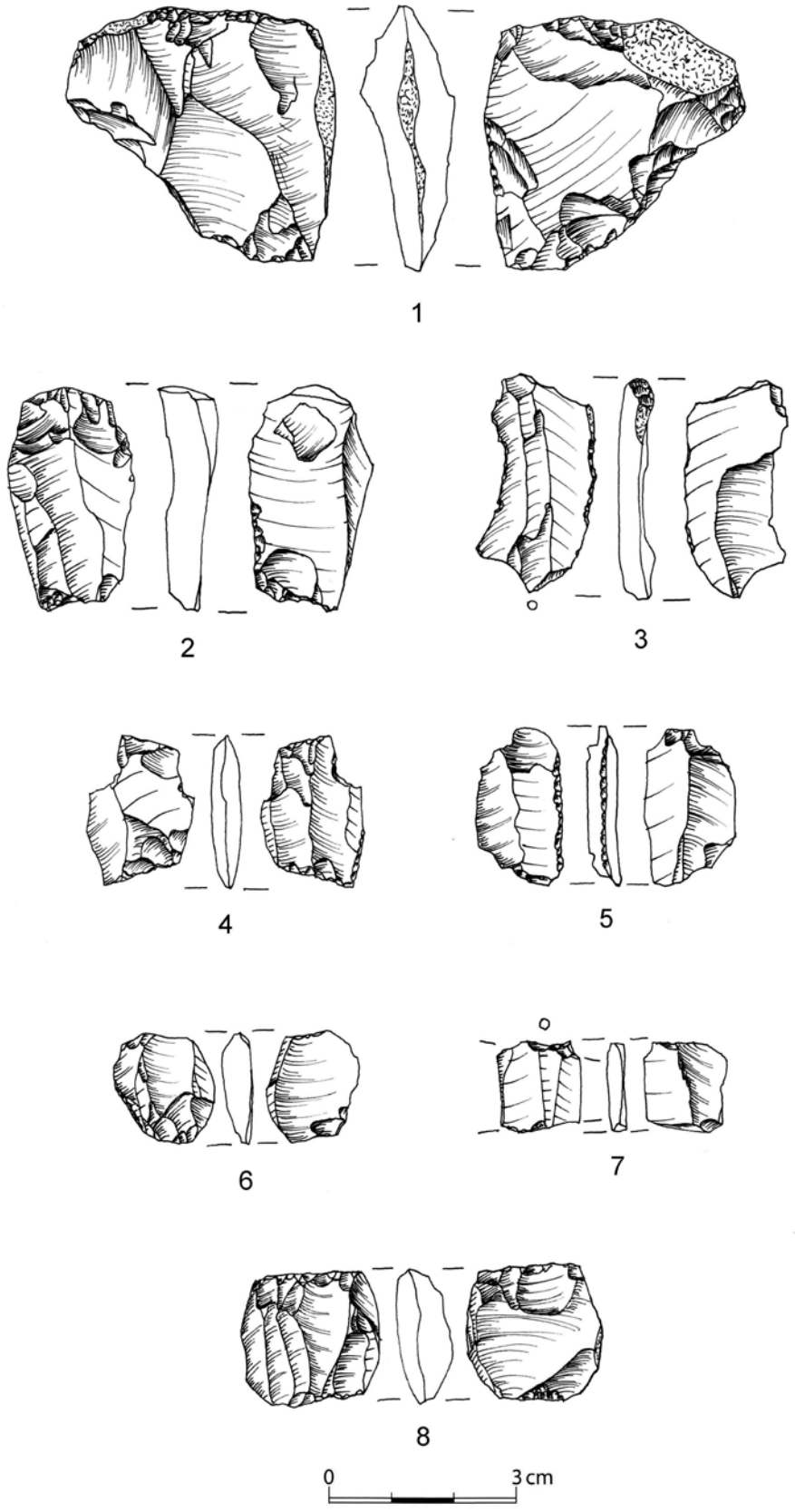


Fig. 32. Przybranówek 43. House 1 (1-8). Splintered pieces (1-3, 5, 7-8); retouched splintered pieces (4, 6).

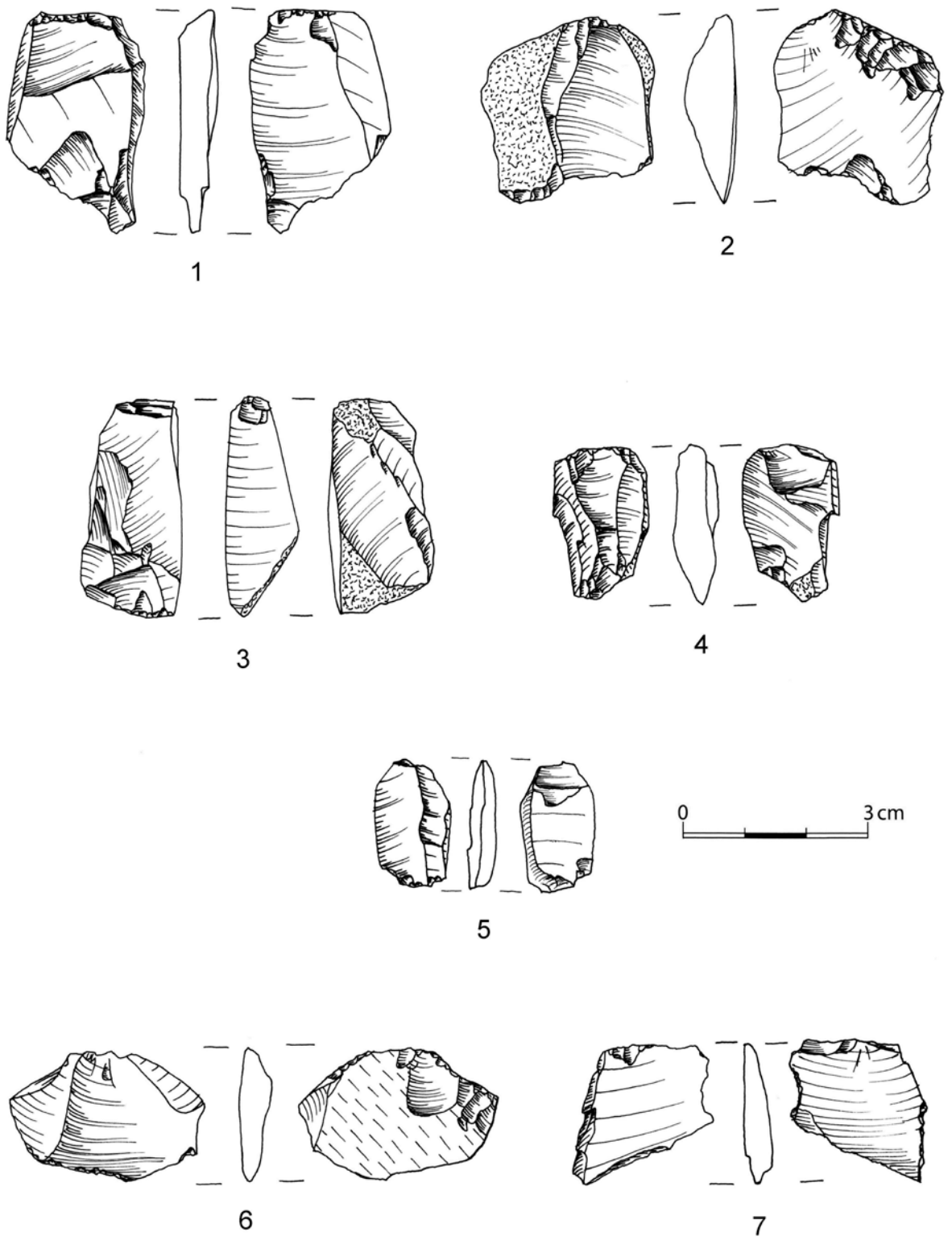


Fig. 33. Przybranówek 43. House 2 (1-7). Splintered pieces (1-5); splintered piece flakes with use retouch (6-7).

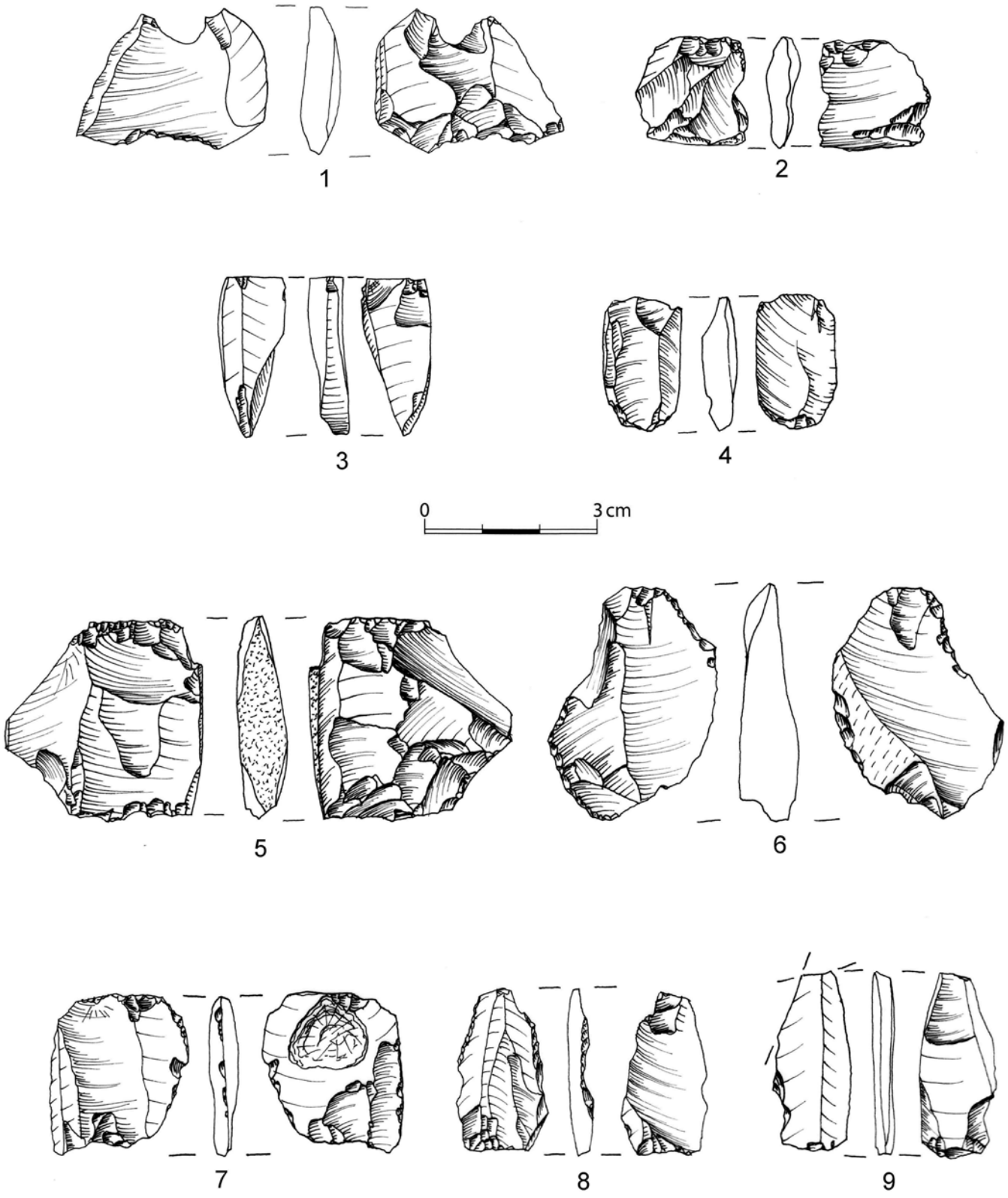


Fig. 34. Przybranówek 43. House 3 (1-4); house 4 (5-9). Splintered pieces (1-5, 9); retouched splintered pieces (6-8).

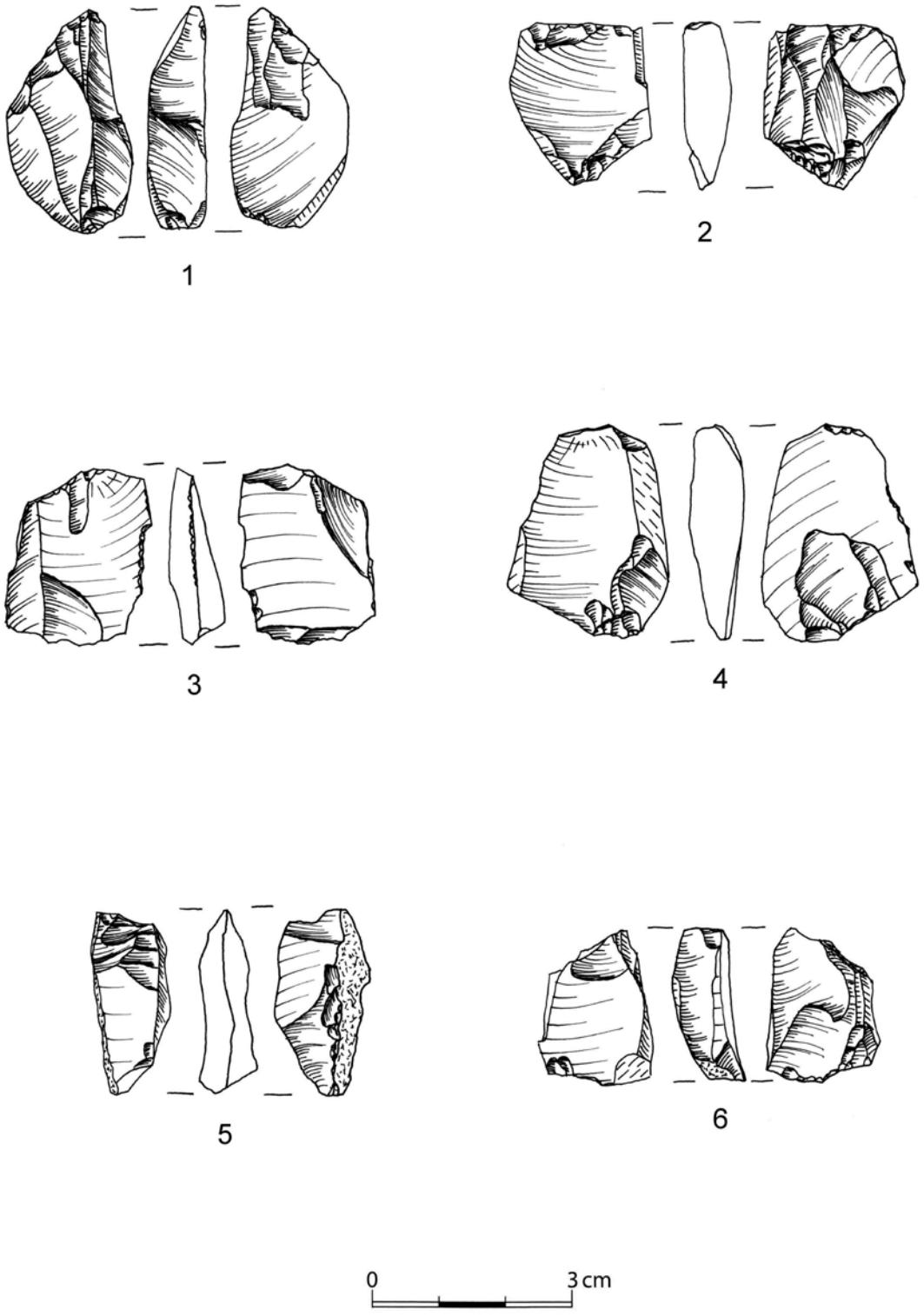


Fig. 35. Przybranówek 43. House 5 (1-6). Splintered pieces (1-2, 4-6); retouched splintered piece (3).

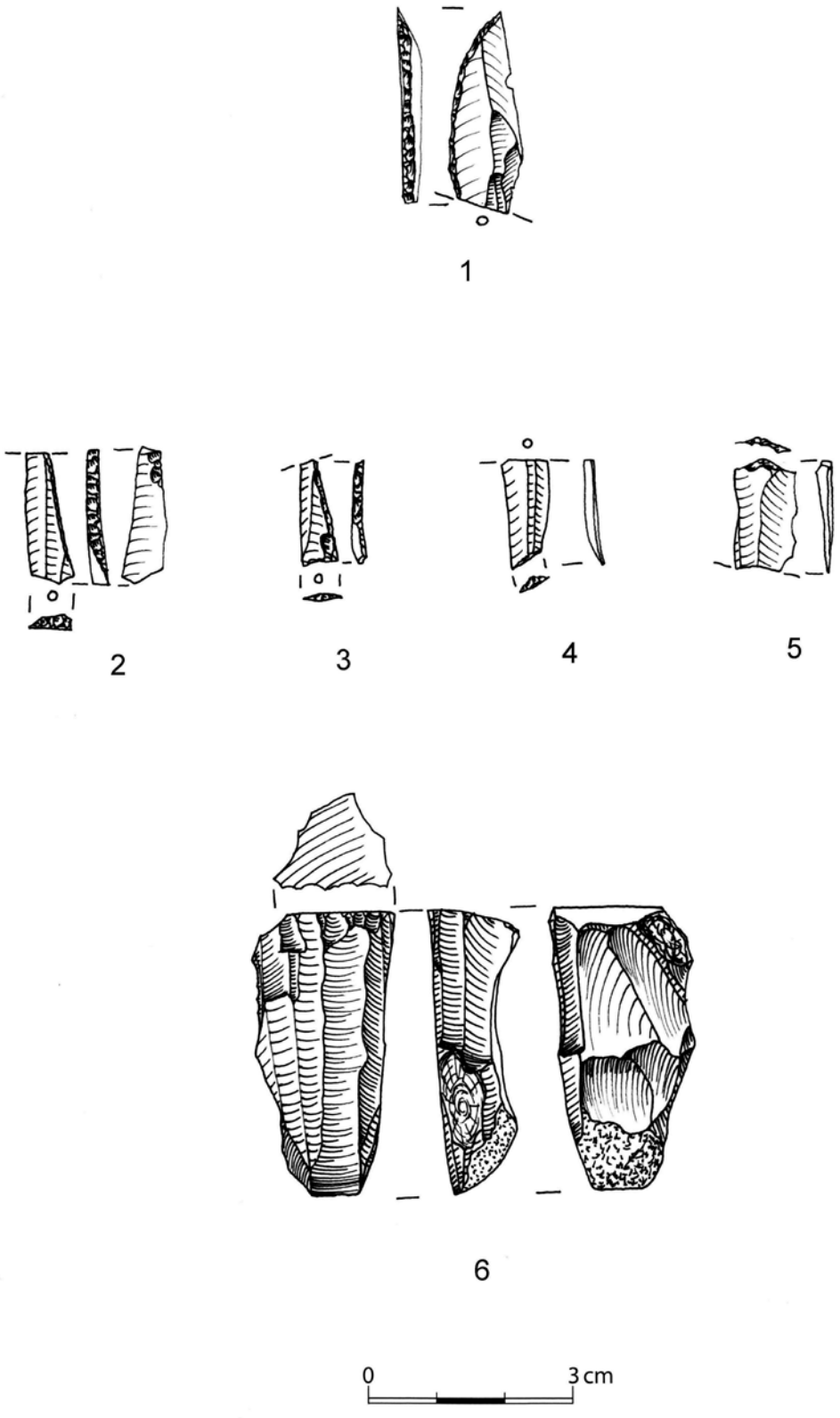


Fig. 36. Wilkostowo 23/24. Arch-backed piece (1); microliths (2-4); bladelet (5); blade core (6).

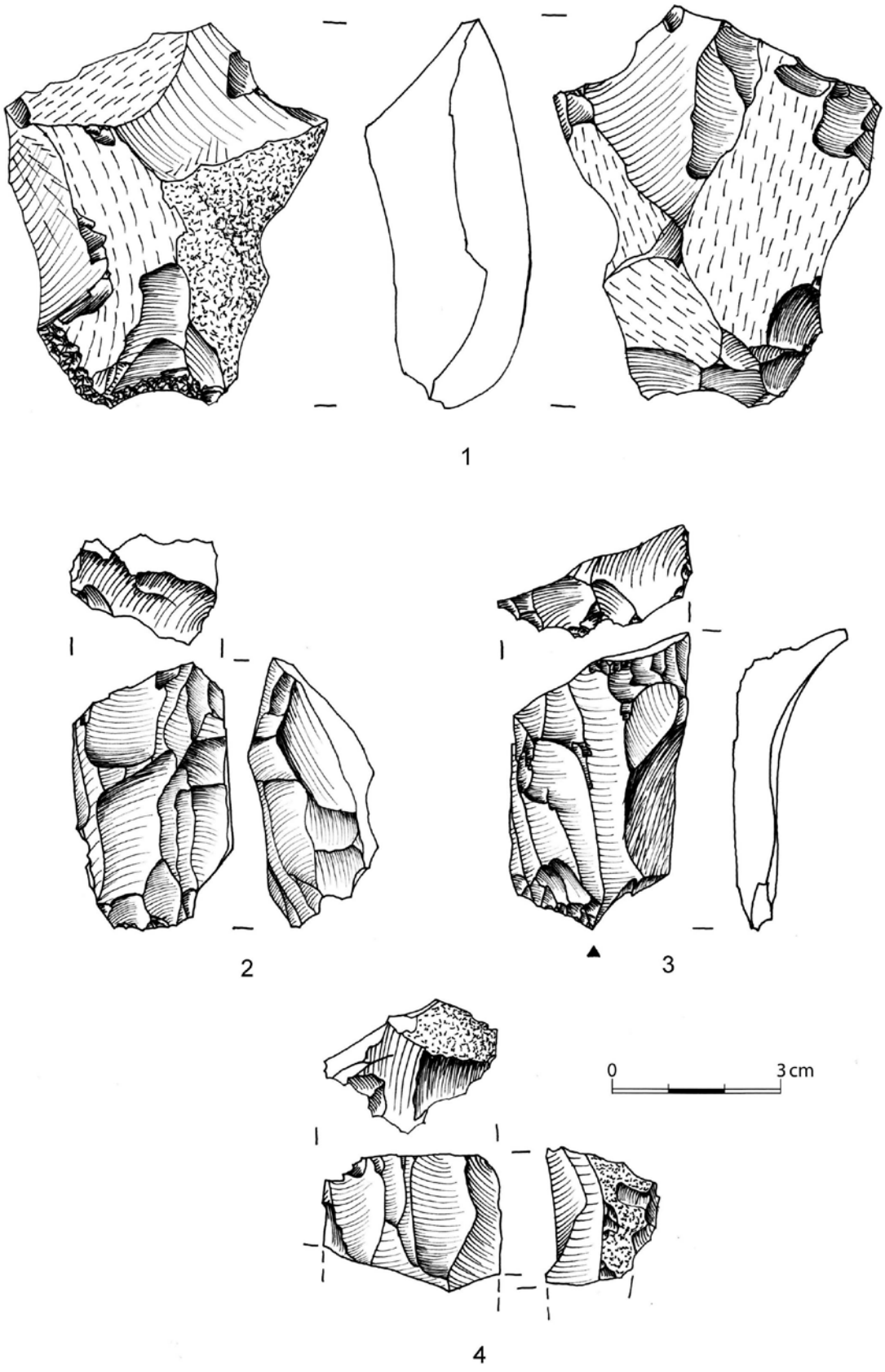


Fig. 37. Wilkostowo 23/24. Flake core (1); blade-flake core (2); overpassed blade (3); blade core (4).

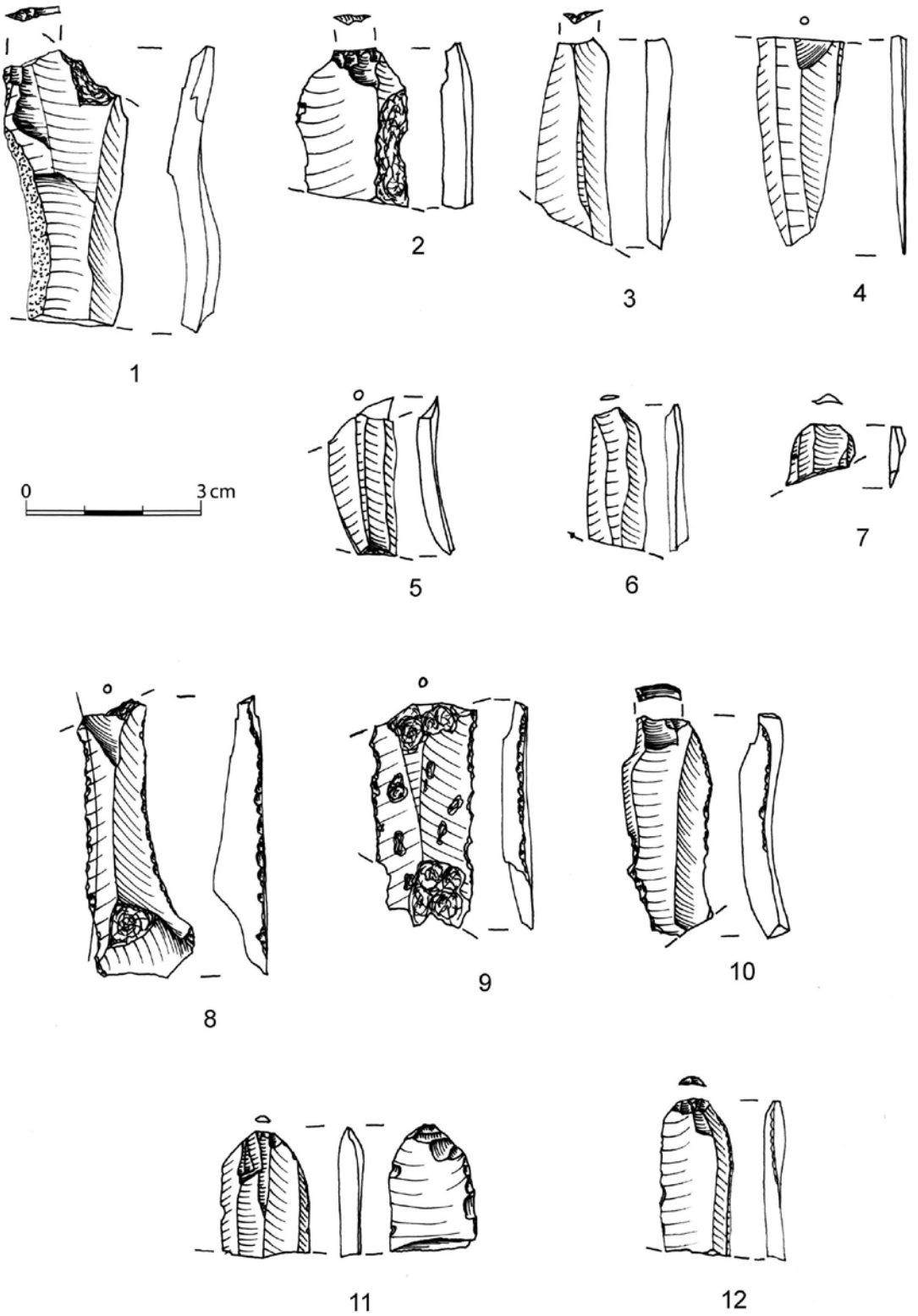


Fig. 38. Wilkostowo 23/24. Blades (1-7); micro-retouched blades (8-10, 12); retouched blade (11).

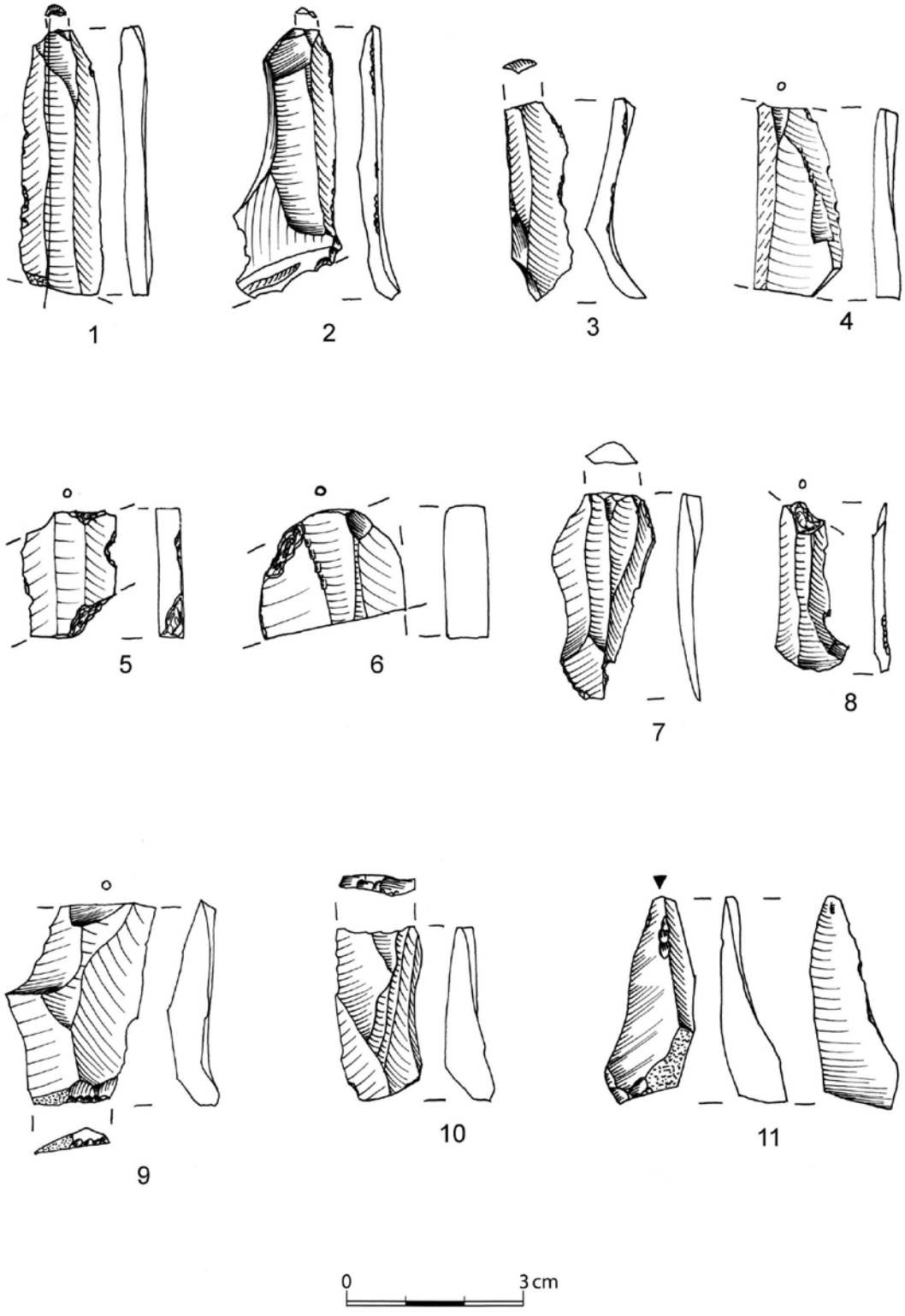


Fig. 39. Wilkostowo 23/24. Blade with polish (1); blades with use retouch (2-8); flakes with use retouch (9-11).

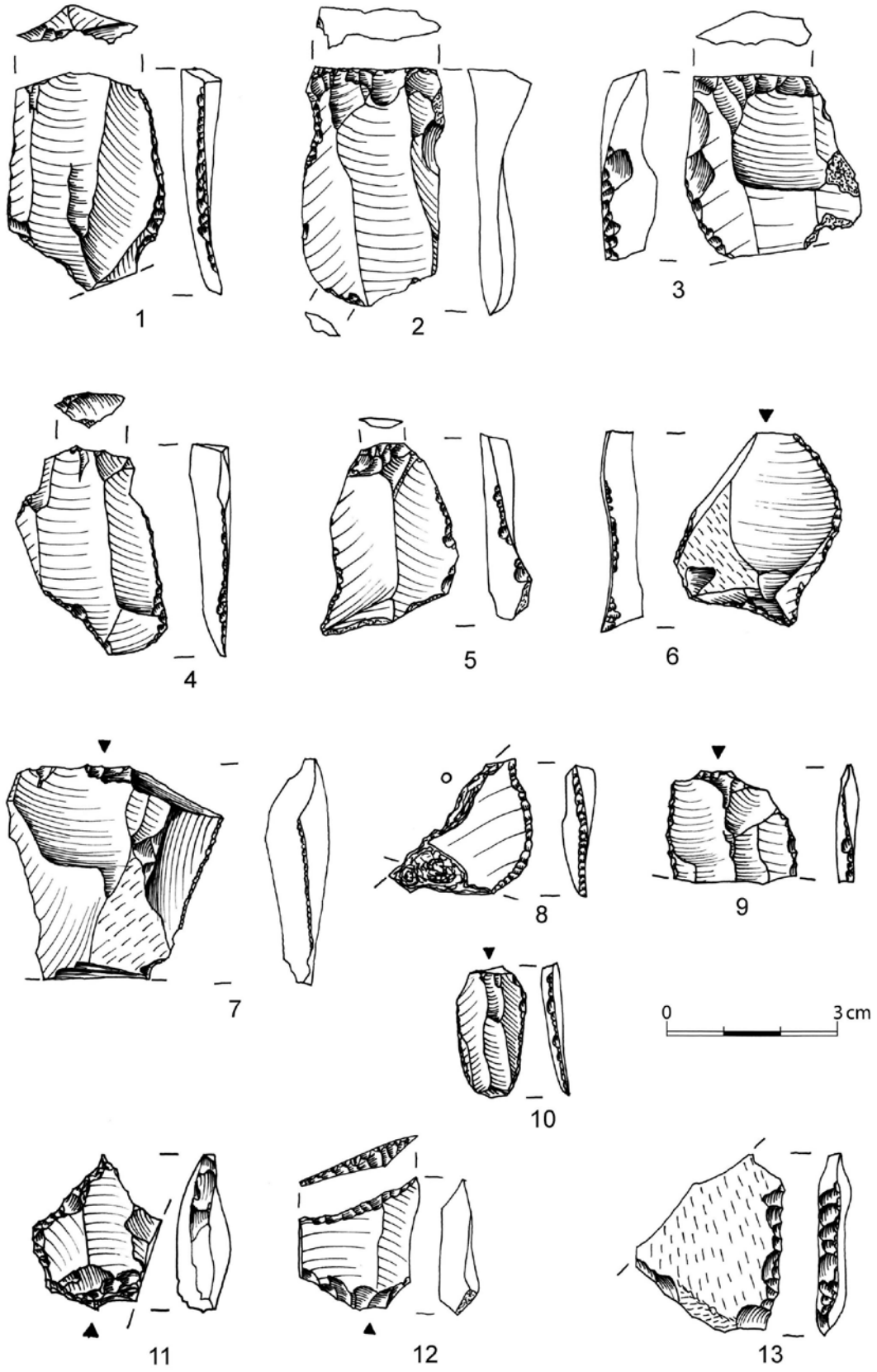


Fig. 40. Wilkostowo 23/24. Retouched flakes (1-6, 8-9, 11-12); micro-retouched flakes (7, 10); retouched chunk (13).

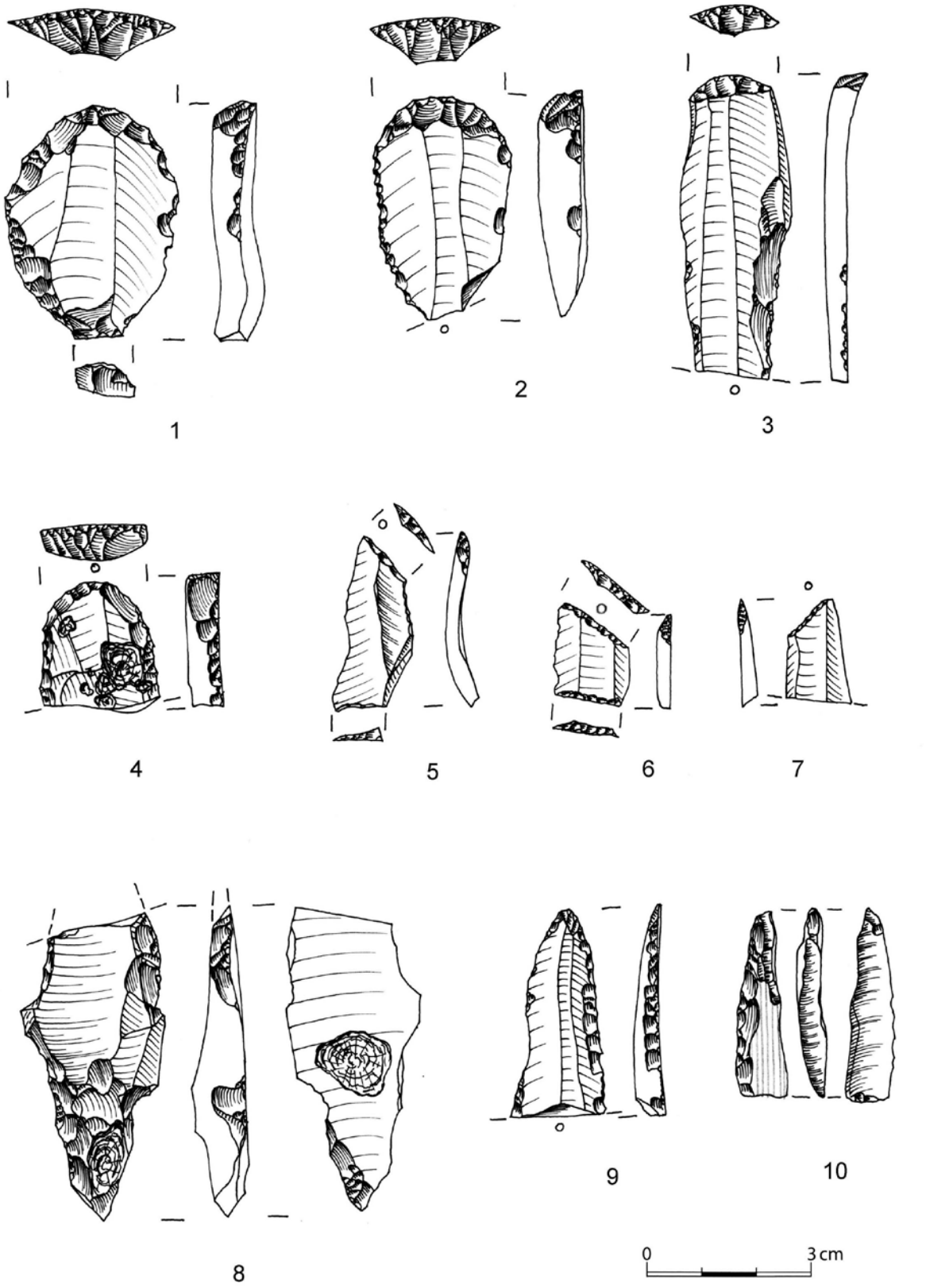


Fig. 41. Wilkostowo 23/24. End-scrapers (1-4); truncated blades (5, 7); trapeze (6); borers (8, 10); perforator (9).

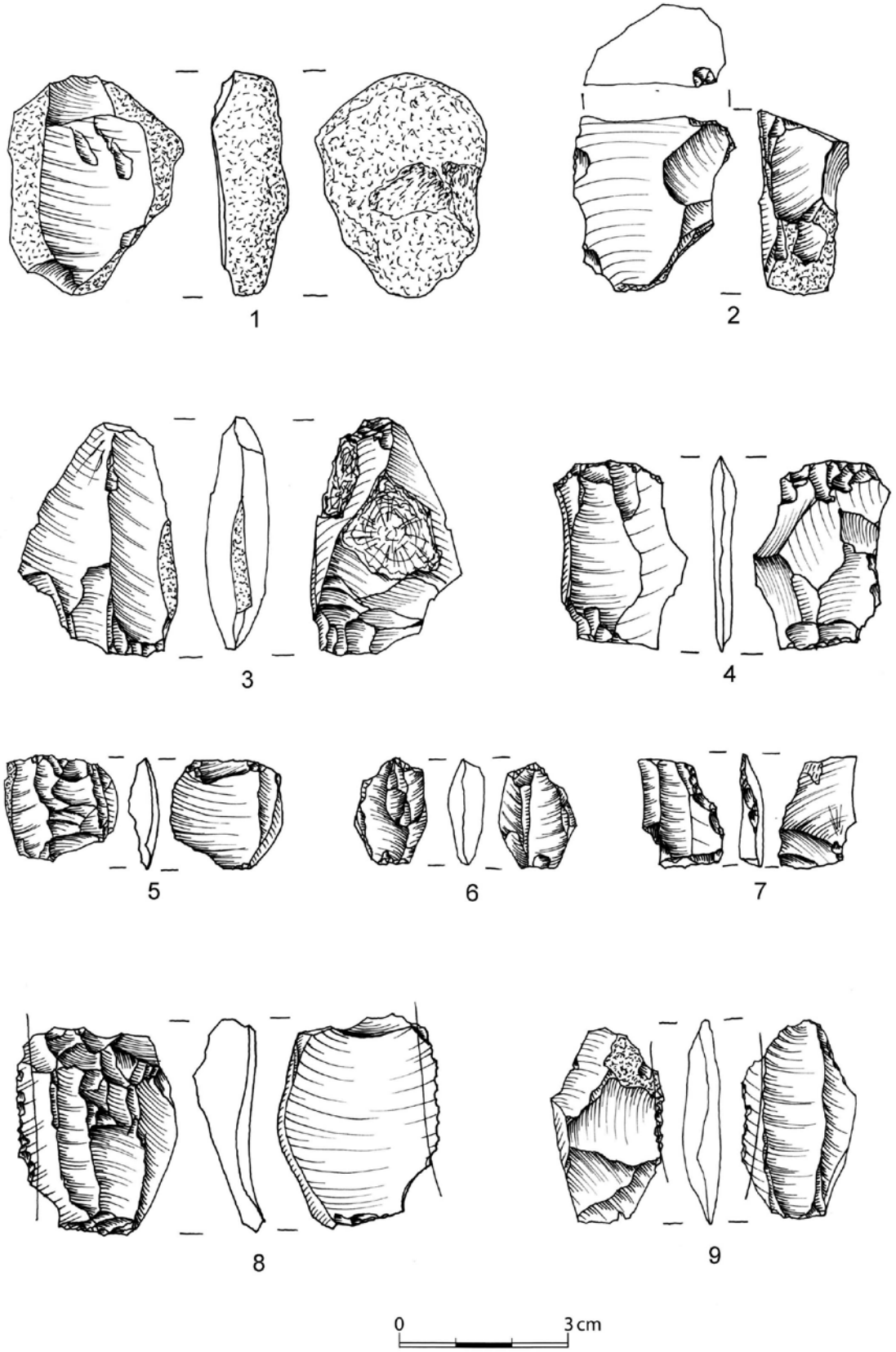


Fig. 42. Wilkostowo 23/24. Splintered pieces (1-6); retouched splintered pieces (7-9).

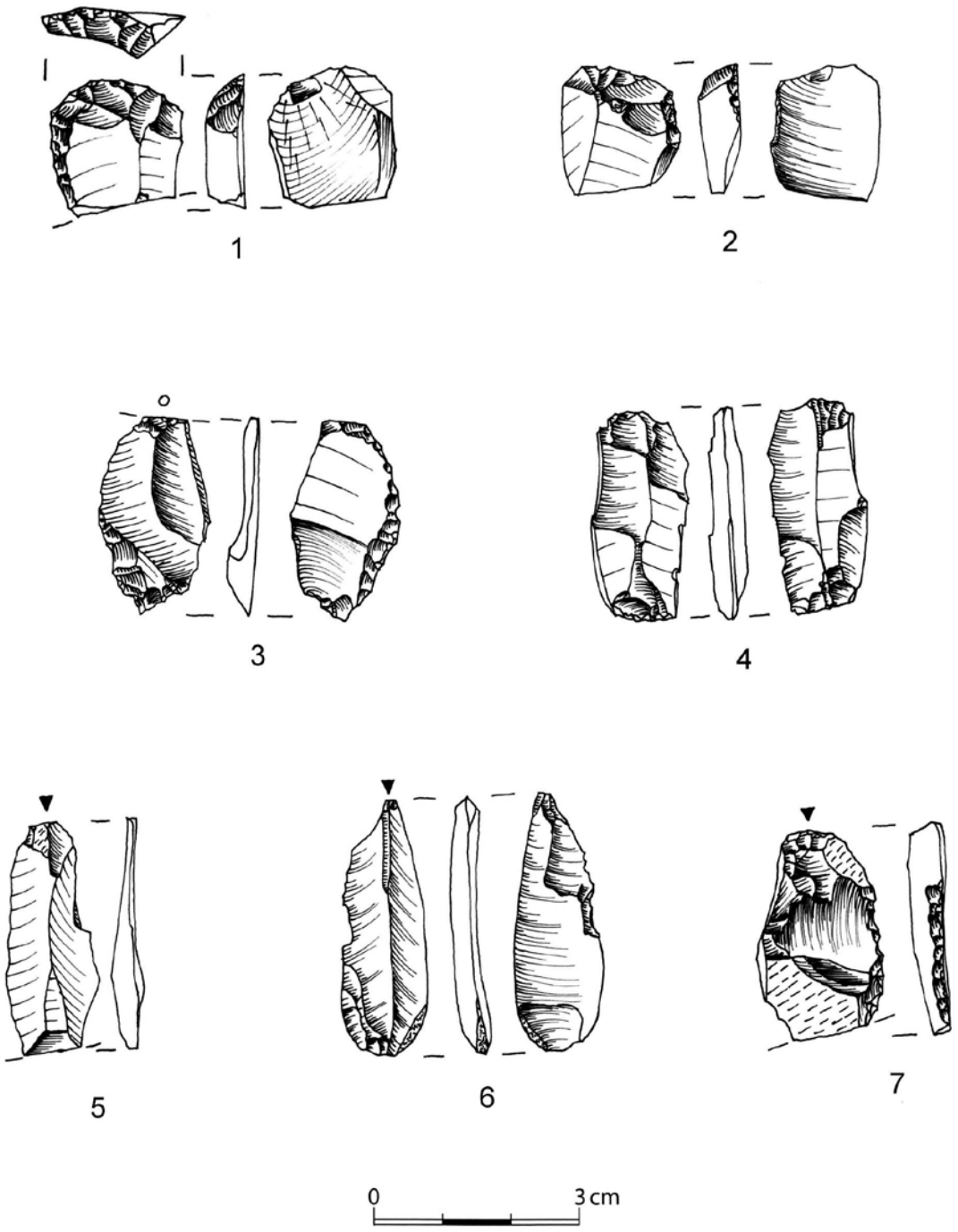


Fig. 43. Wilkostowo 23/24. Artefacts transformed by using the splintering technique (1-7).

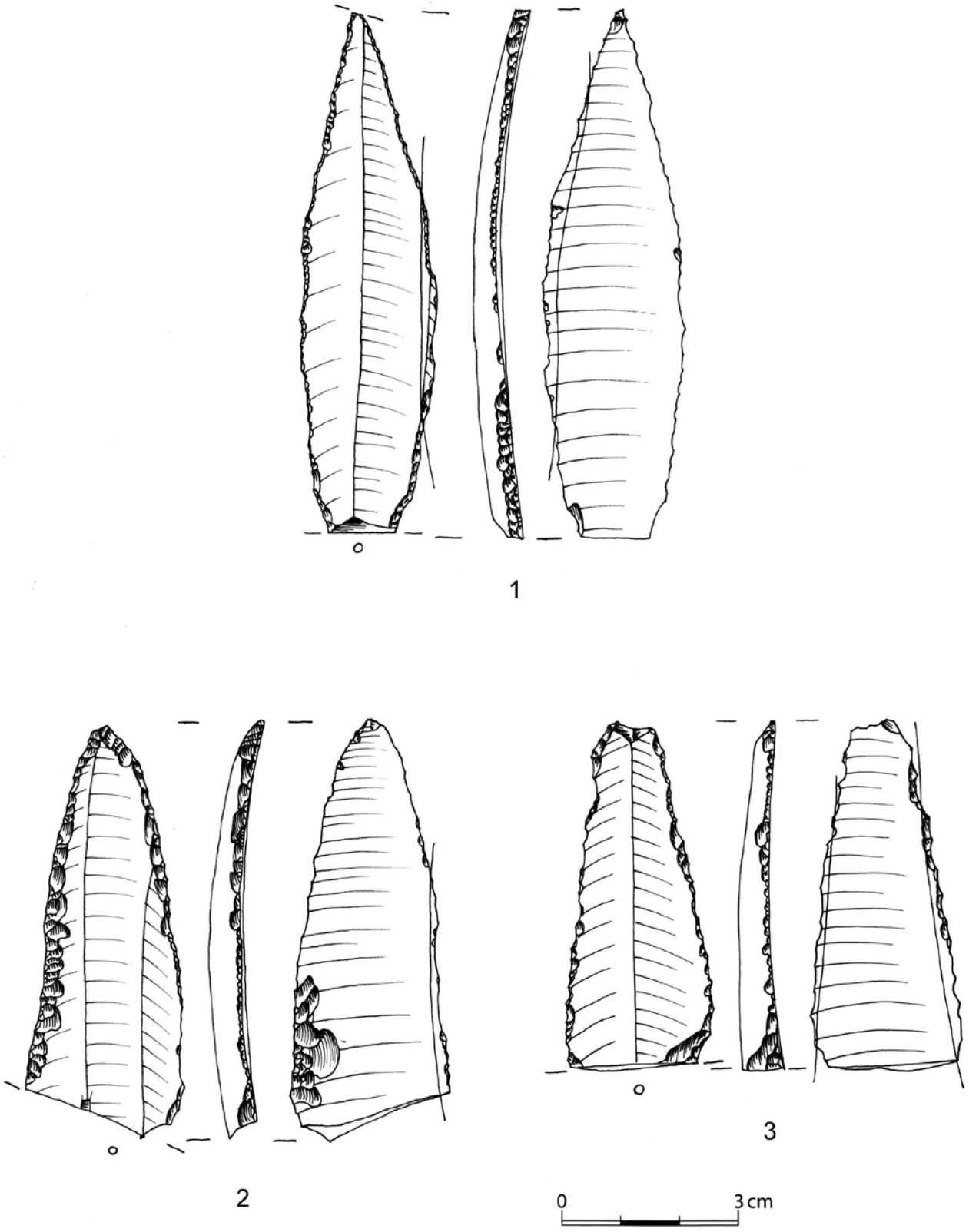


Fig. 44. Wilkostowo 23/24. Macro-blades with continuous retouch (1-3).

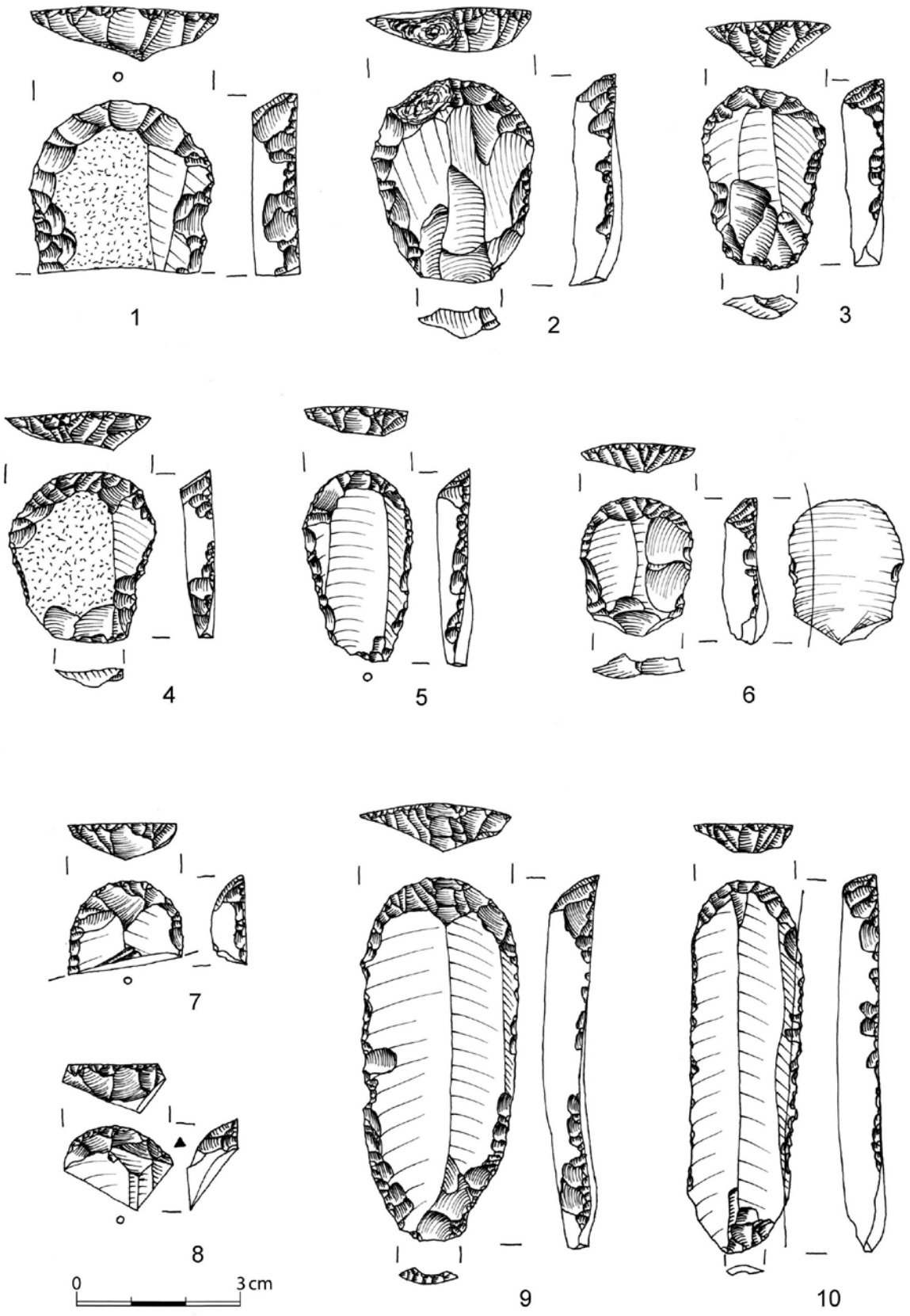


Fig. 45. Wilkostowo 23/24. End-scrapers (1-10).

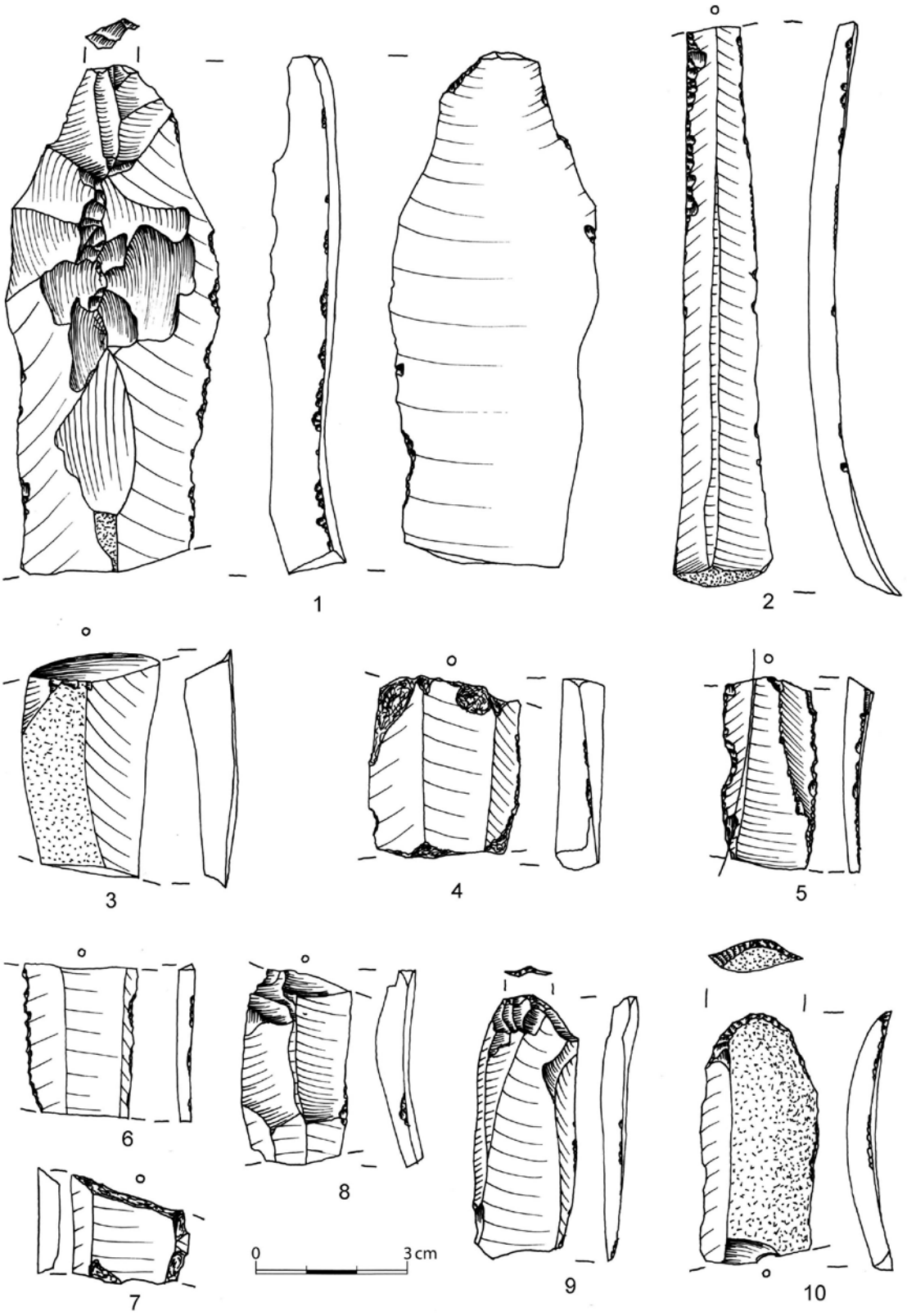


Fig. 46. Wilkostowo 23/24. Blades with use retouch (1, 4, 8-9); retouched blades (2, 10); blade with continuous retouch (5); micro-retouched blade (6); blades (3, 7).

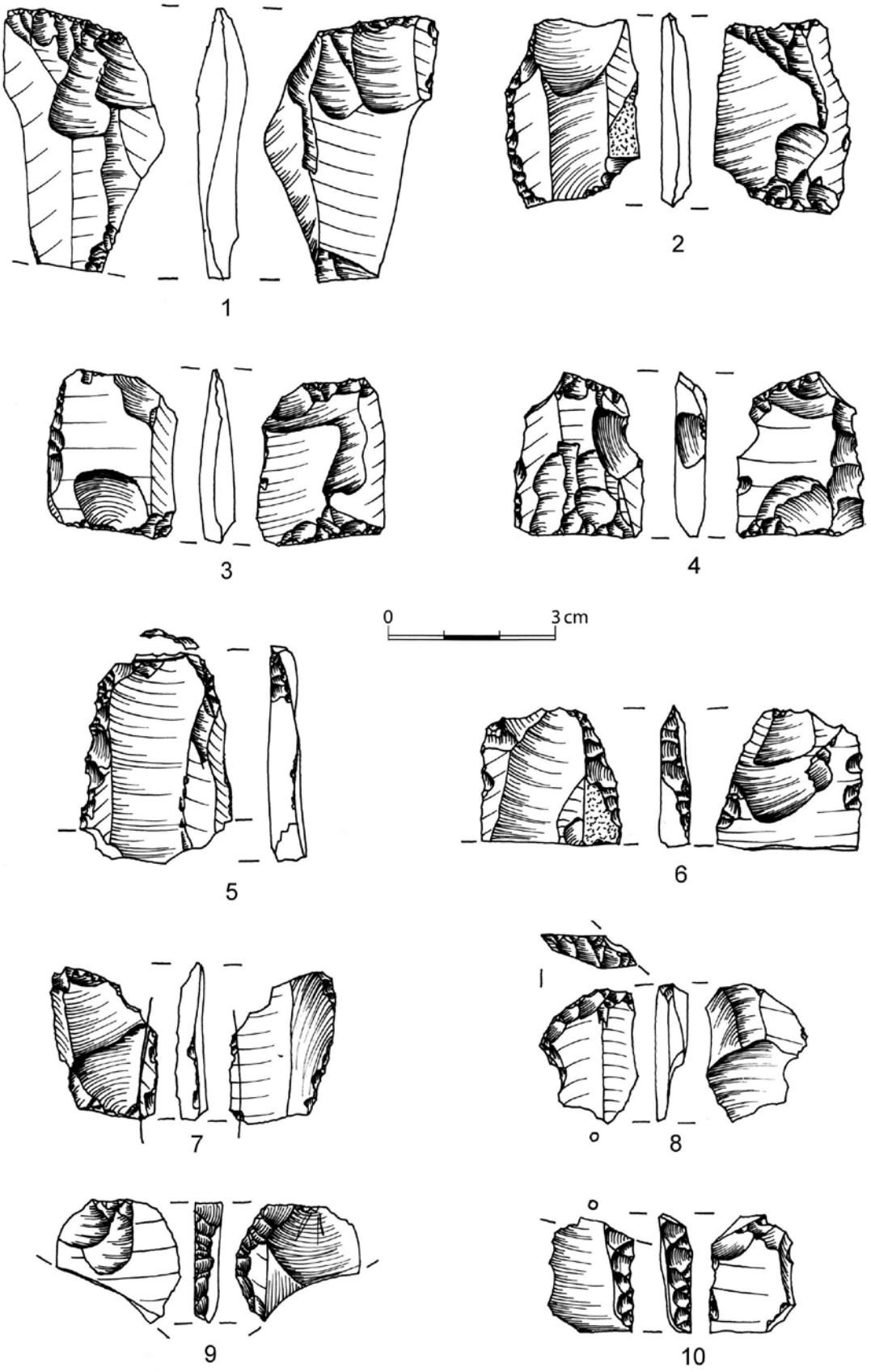


Fig. 47. Wilkostowo 23/24. Blade tools transformed by using the splintering technique (1-10).

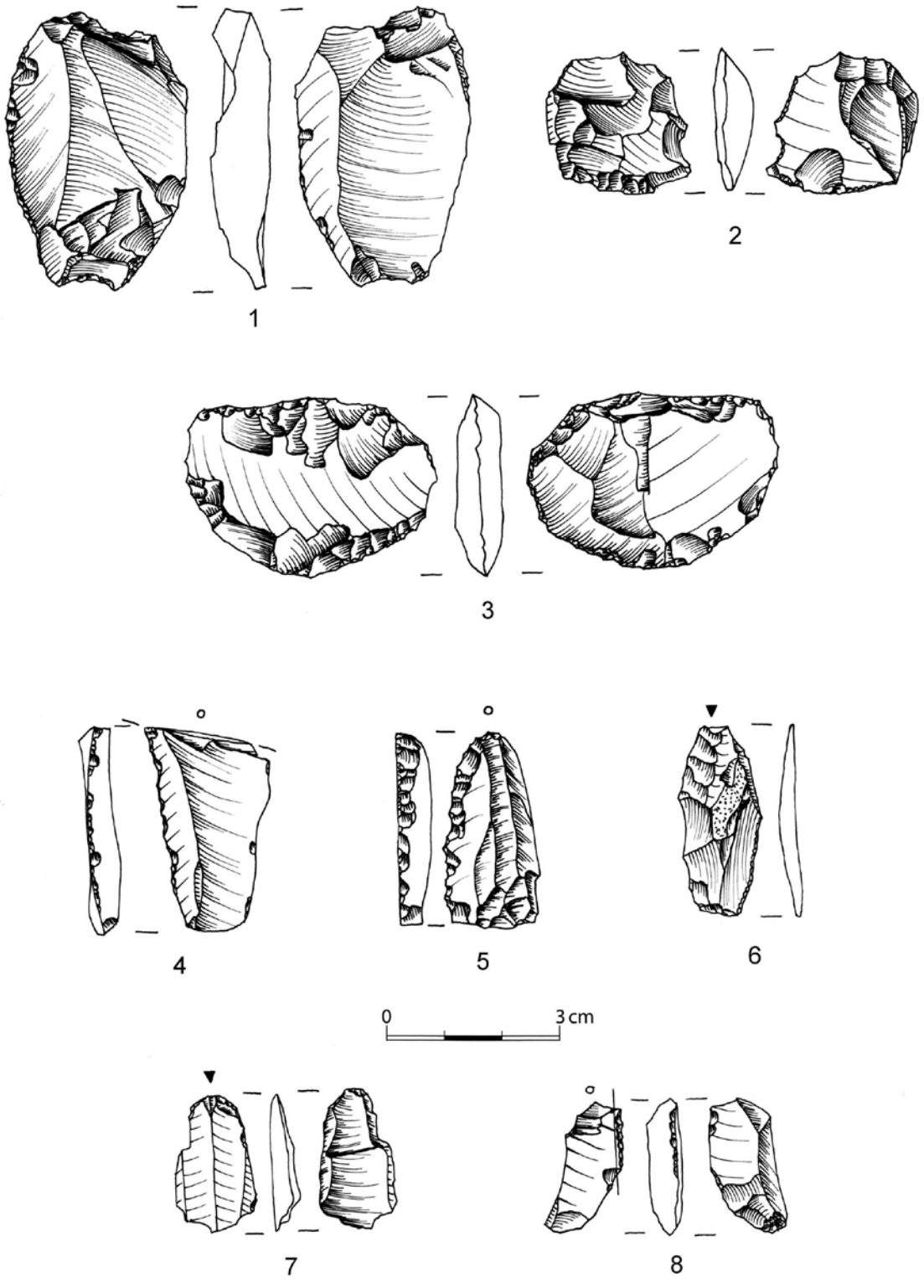


Fig. 48. Wilkostowo 23/24. Retouched splintered pieces (1-3); tools transformed by using the splintering technique (4-6, 8); blade transformed by using the splintering technique (7).

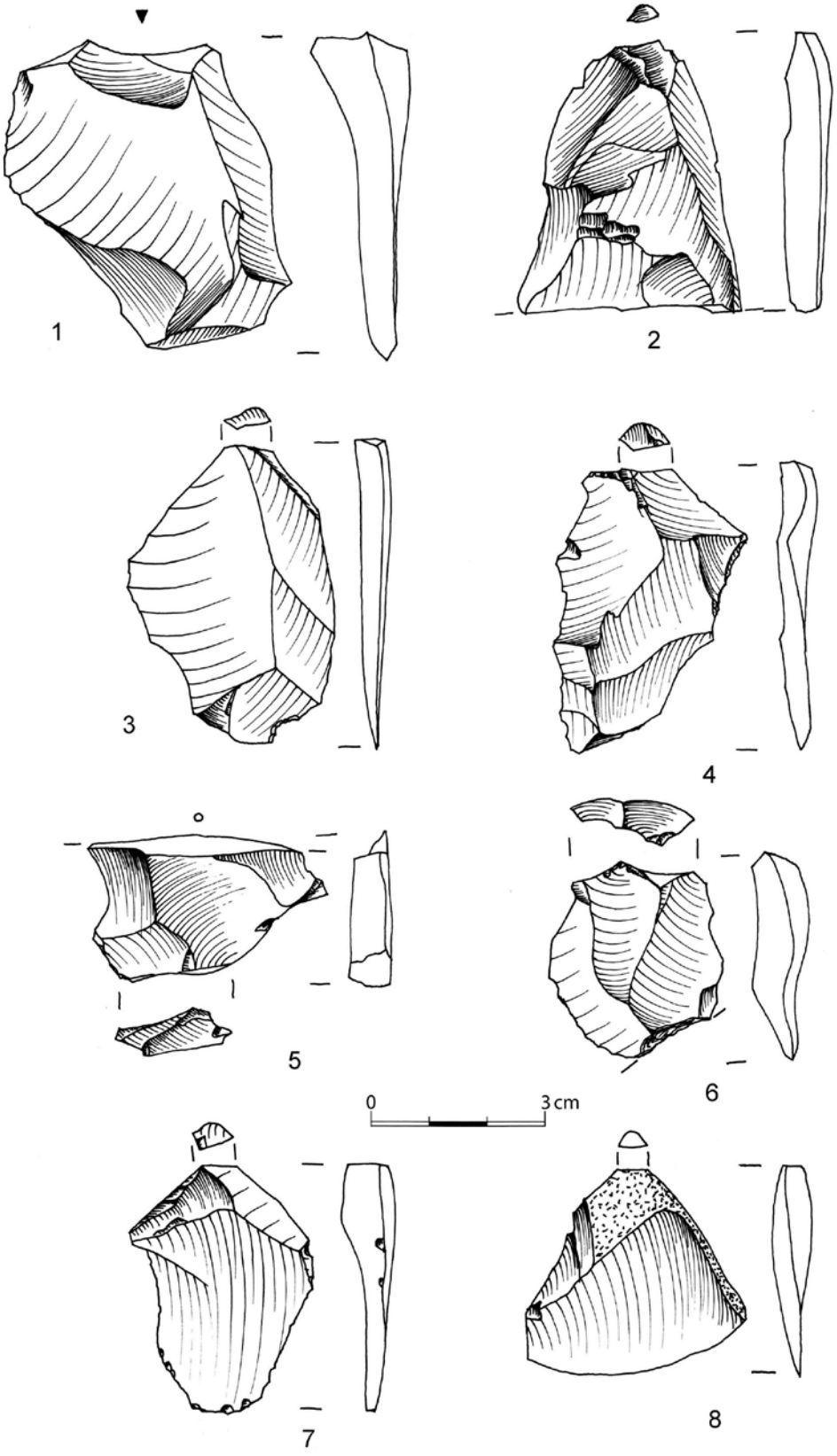


Fig. 49. Wilkostowo 23/24. Flakes (1-6, 8); flake with use retouch (7).

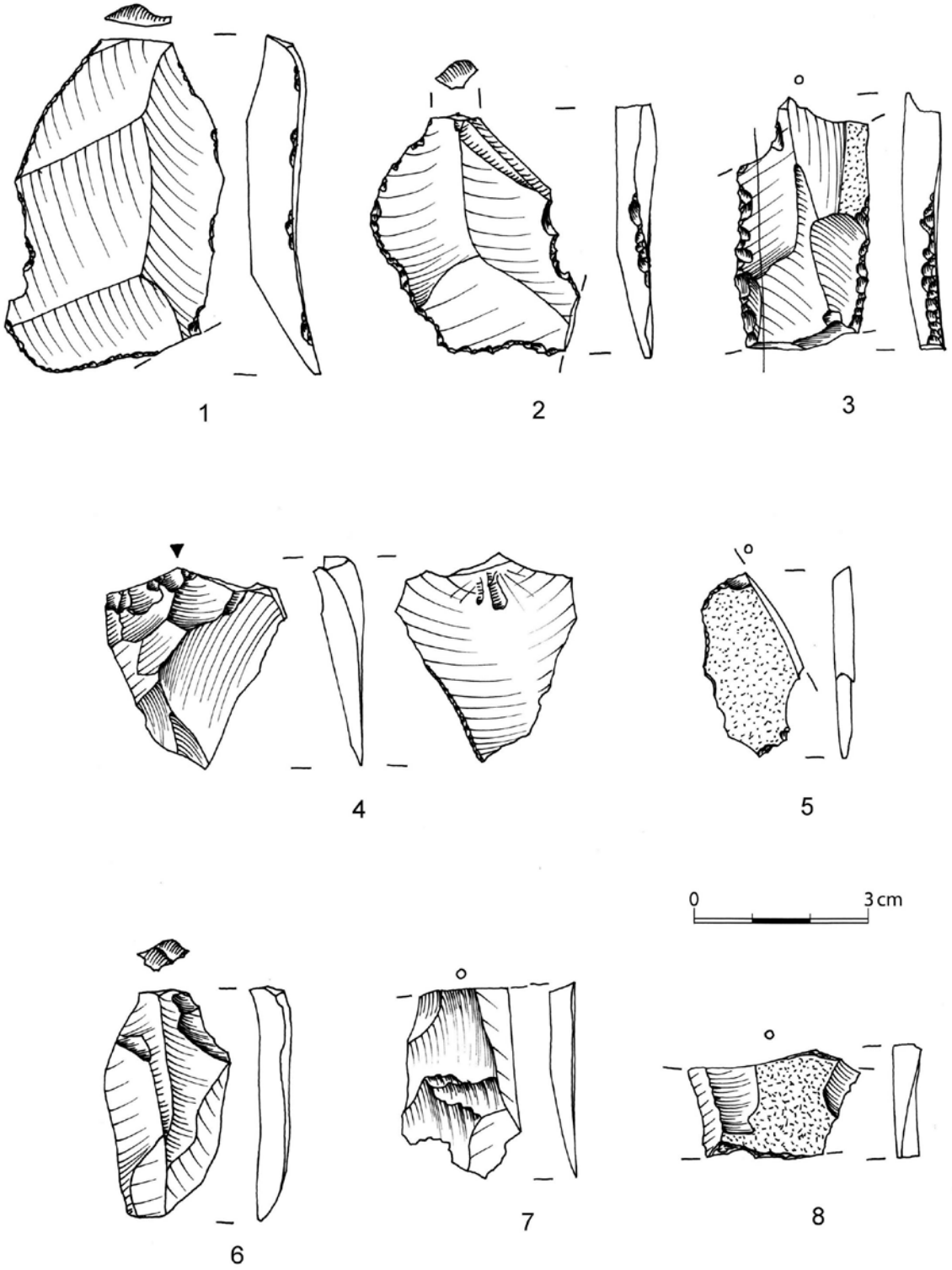


Fig. 50. Wilkostowo 23/24. Micro-retouched flakes (1-2, 4-5); retouched flake (3); flakes (6-8).

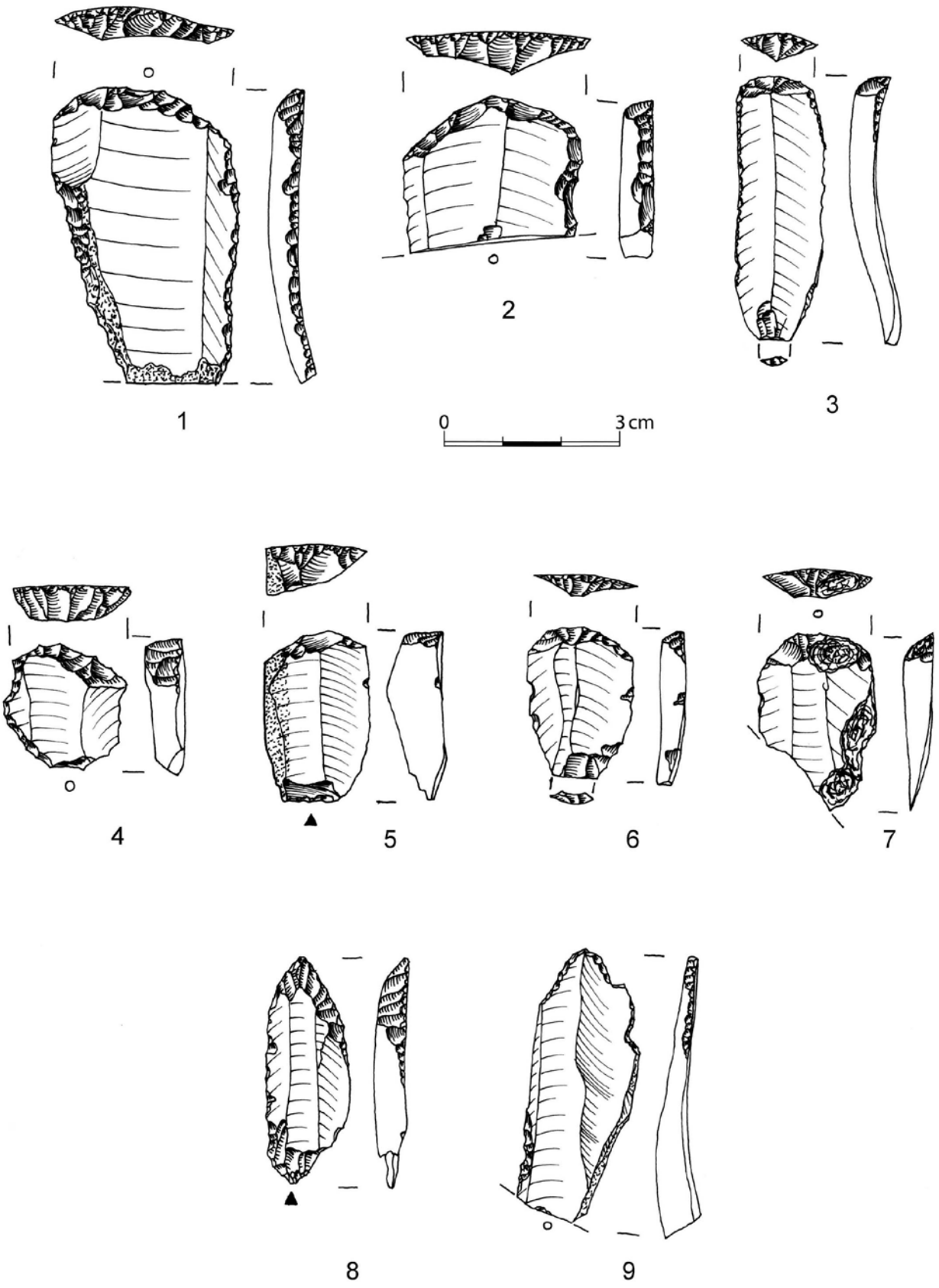


Fig. 51. Wilkostowo 23/24. End-scrapers (1-7); perforators (8-9).

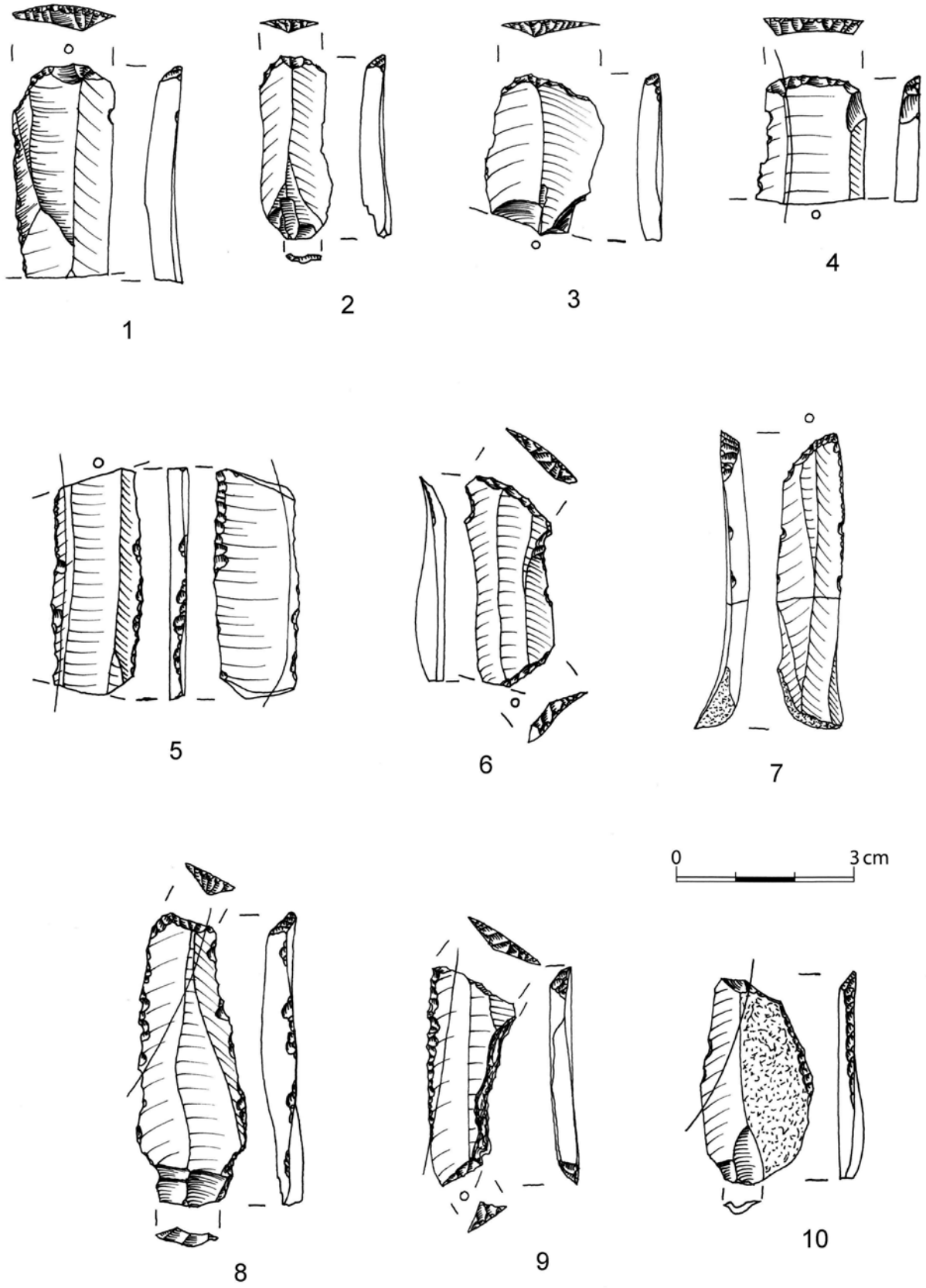


Fig. 52. Wilkostowo 23/24. Truncated blades (1-4, 6-10); blade with polish (5).

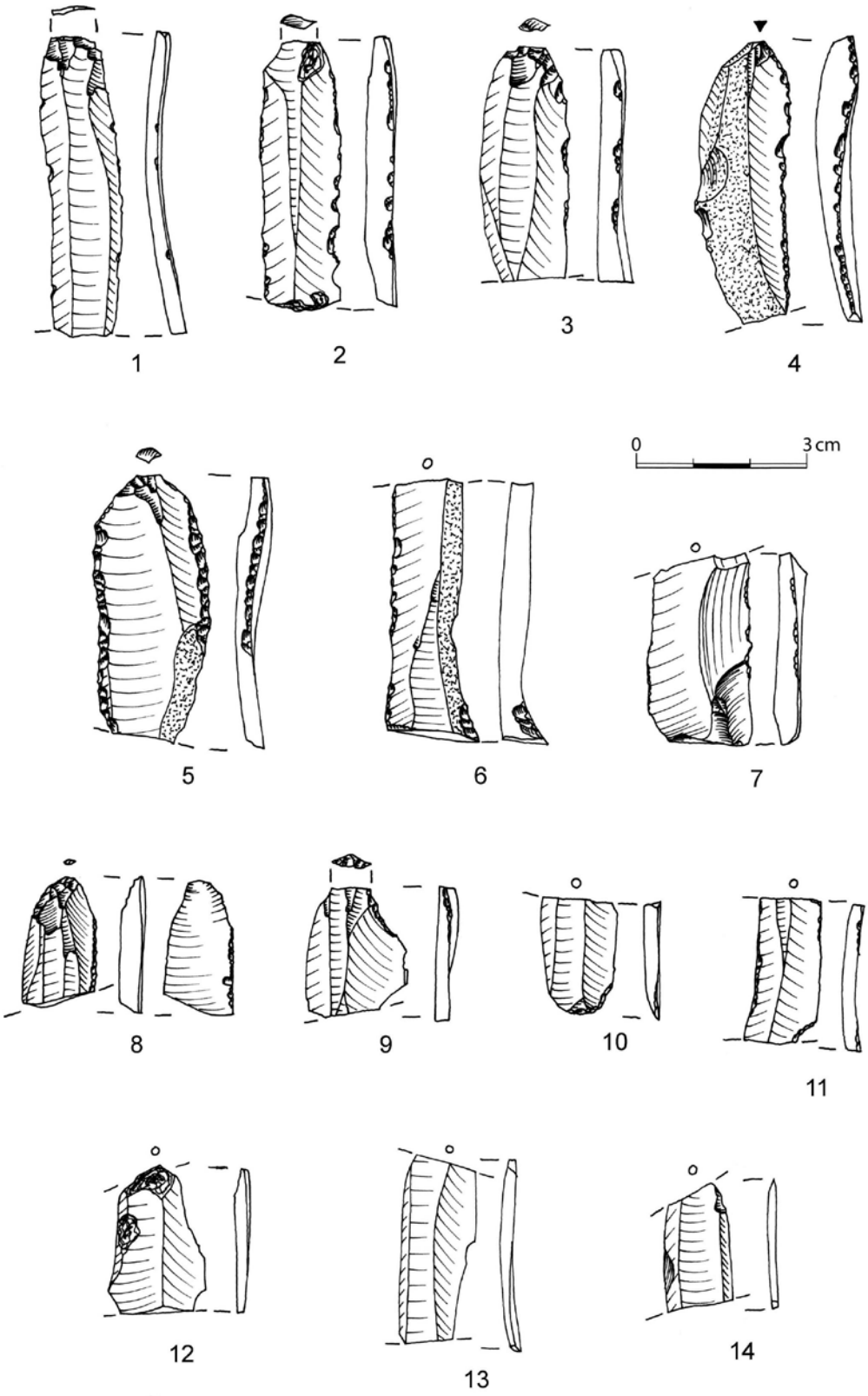


Fig. 53. Wilkostowo 23/24. Retouched blades (4-5); micro-retouched blades (8-11); blades with use retouch (1-3, 6-7); blades (12-14).

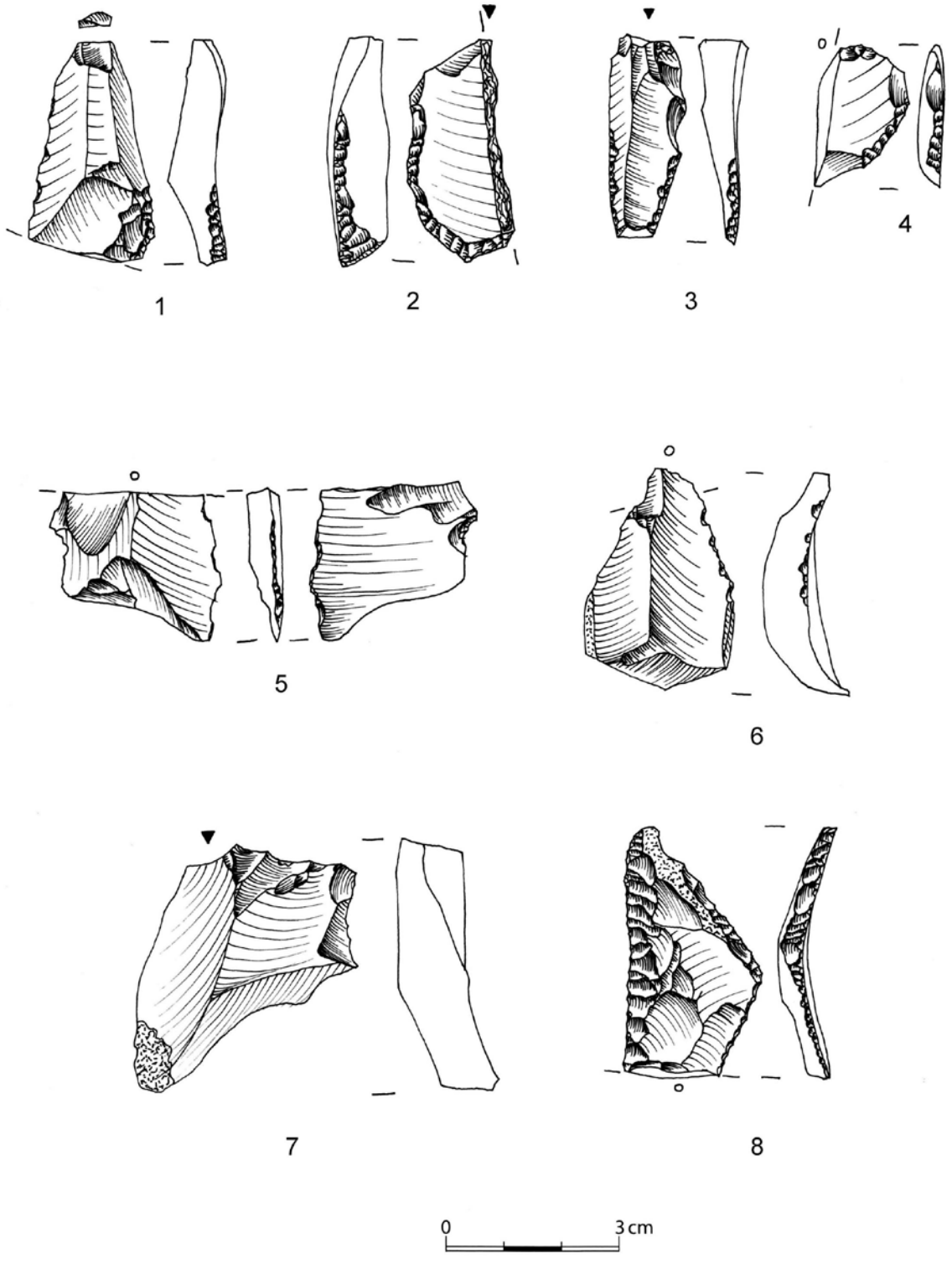


Fig. 54. Wilkostowo 23/24. Retouched flakes (1-4, 8); flakes with use retouch (5-6); flake (7).

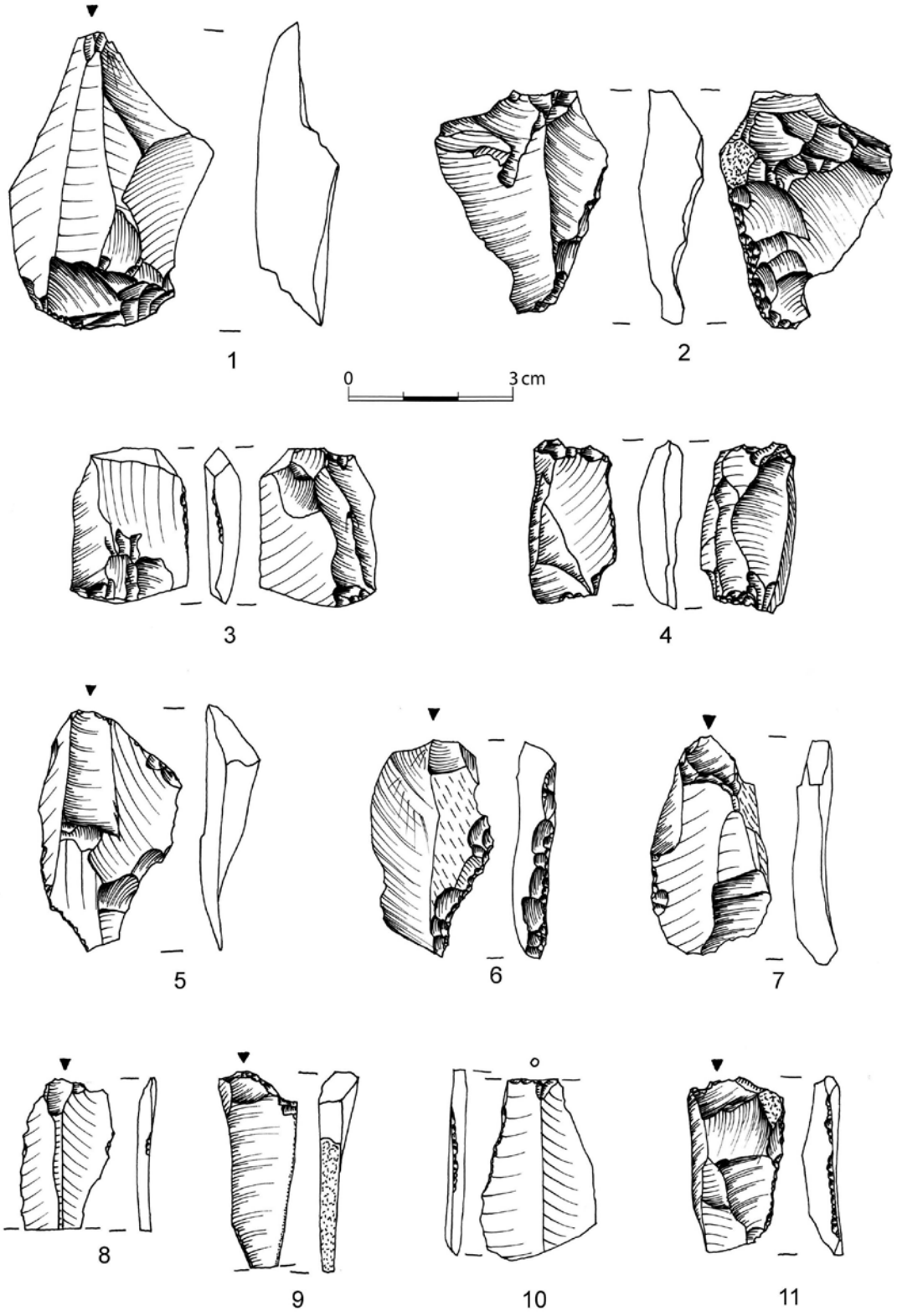


Fig. 55. Wilkostowo 23/24. Splintered piece flake (1); retouched splintered pieces (2-4); splintered piece flakes with use retouch (5, 7); retouched piece flake (6); blade with use retouch (8); micro-retouched splintered piece flakes (9-11).

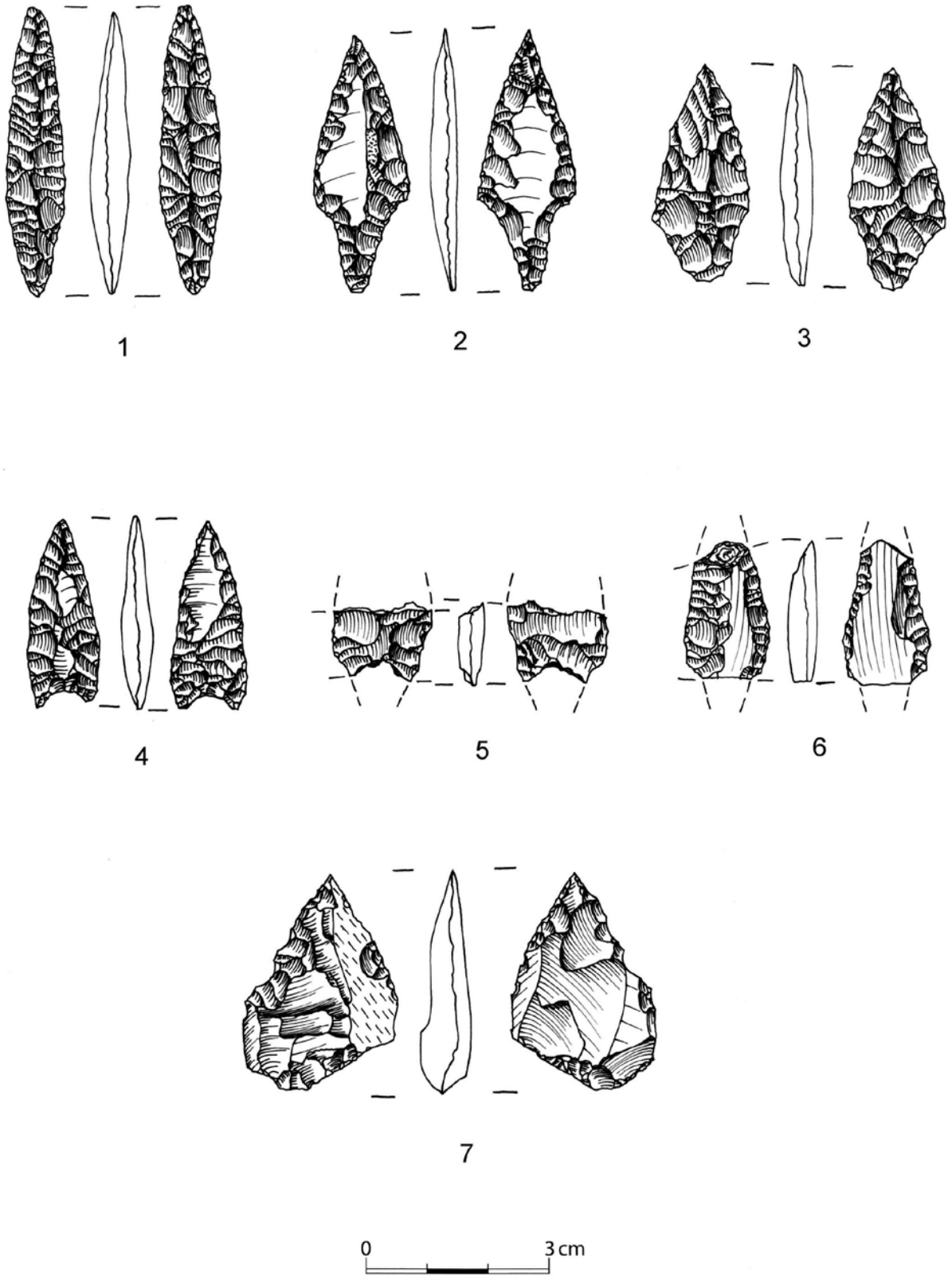


Fig. 56. Wilkostowo 23/24. Projectile points (1-6); semi-finished projectile point (7).

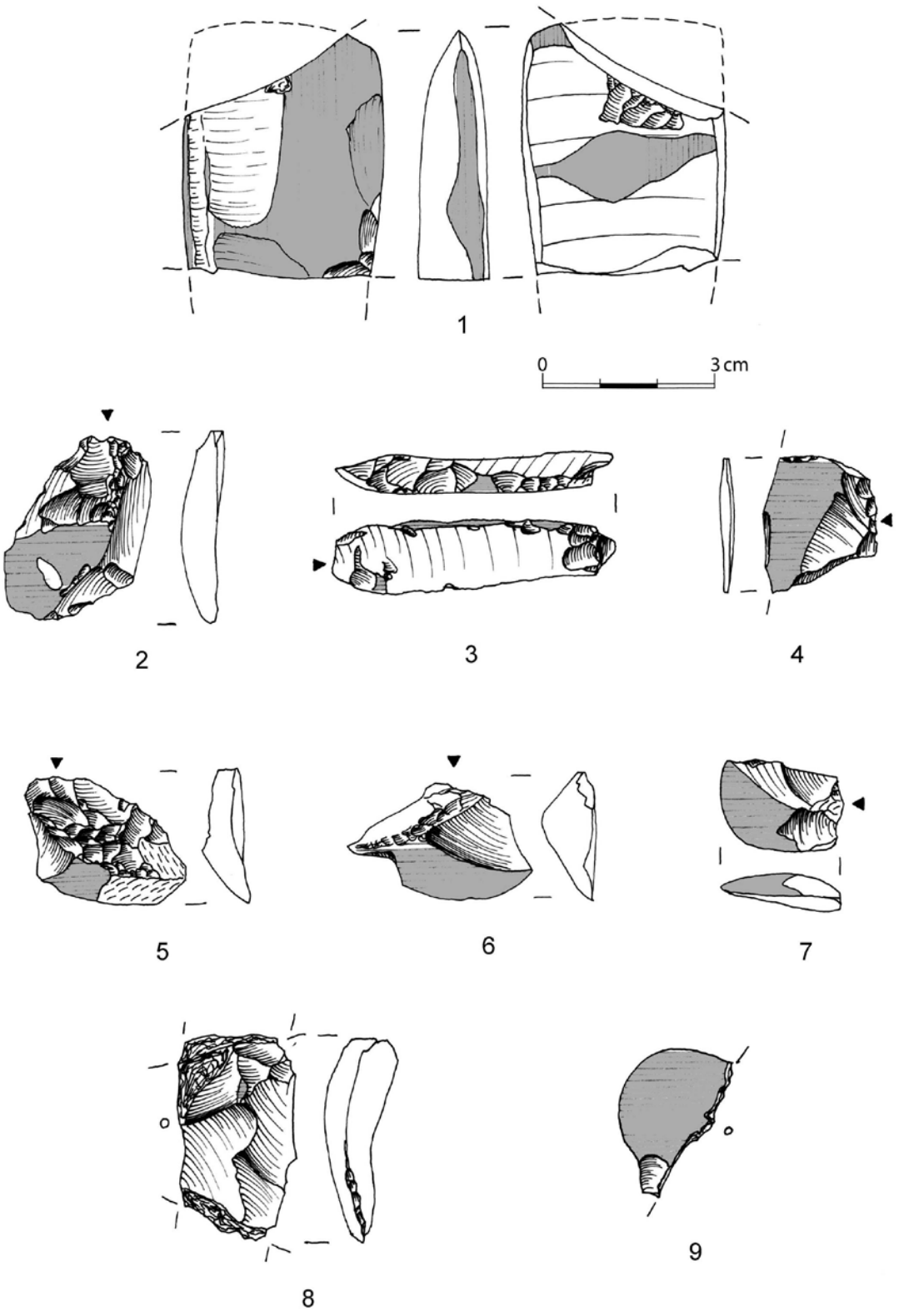


Fig. 57. Wilkostowo 23/24. Axe (1); flakes from axes (2-9).

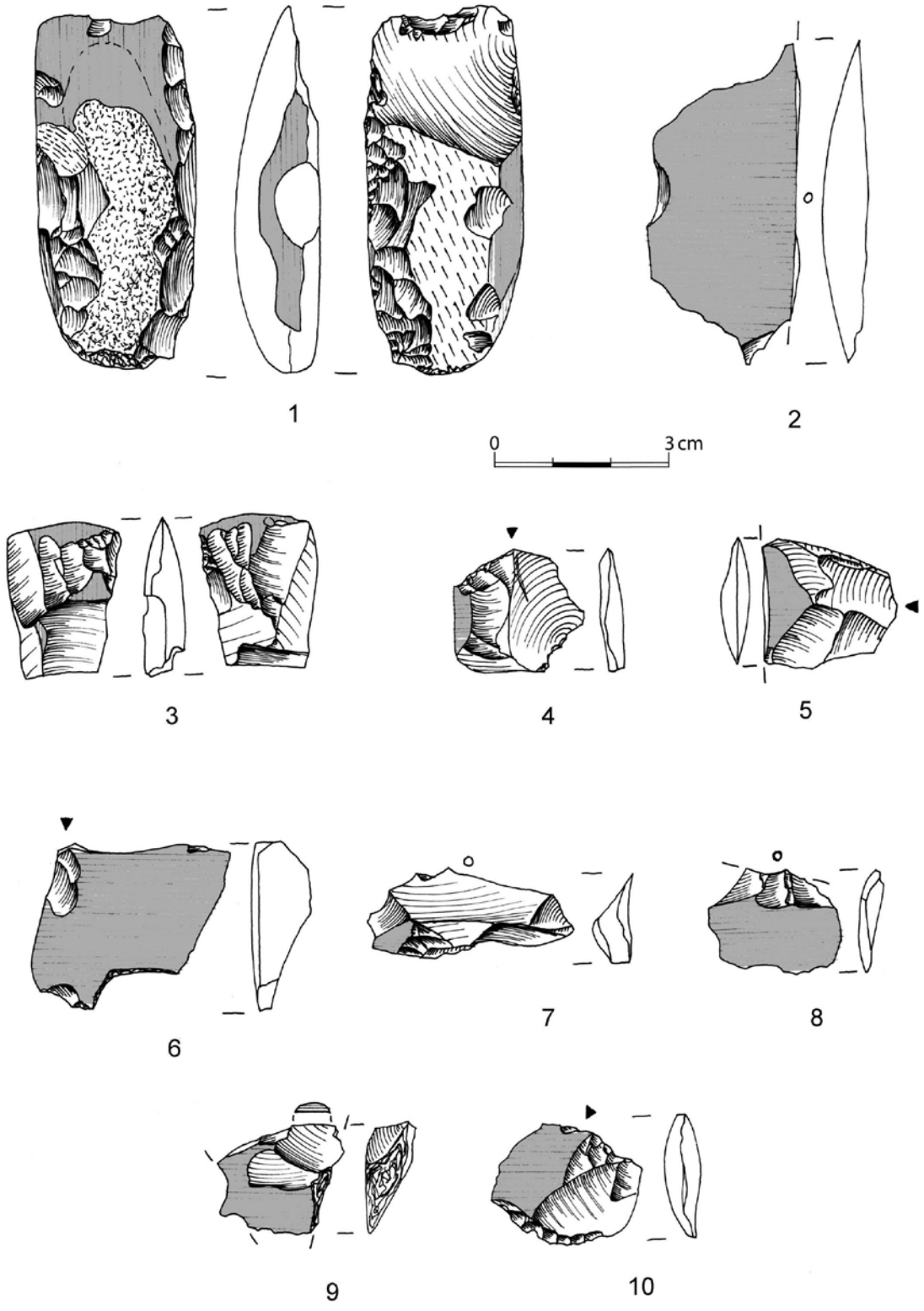


Fig. 58. Wilkostowo 23/24. Axe (1); flakes from axes (2-10).

REFERENCES

Anderson S.H.
1983 The introduction of trapezes in the South Scandinavian Mesolithic. A brief survey. *Archaeologia Interregionalis* 2, 257-262.

Andrefsky W.
2001 *Lithics. Macroscopic approaches to analysis*. Cambridge.

Balcer B.
1983 *Wytwórczość narzędzi krzemiennych w neolicie ziem polskich*. Wrocław.

Cofta-Broniewska A., Kośko A.
2004 *Kujawy w pradziejach i starożytności*. Inowrocław-Poznań.

Conolly J.
1996 The knapped stone. In: I. Hodder (ed.), *On the Surface: Çatalhöyük 1993-95*. Cambridge-London, 173-198.
1999 *The* Çatalhöyük *Flint and Obsidian Industry. Technology and Typology in Context* (= *British Archaeological Reports. International Series* 787). Oxford.

Czerniak L.
1988 Czynniki zewnętrzne w rozwoju kulturowym społeczeństw Kujaw w okresie wczesnego i środkowego neolitu. In: A. Cofta-Broniewska (ed.), *Kontakty pradziejowych społeczeństw Kujaw z innymi ludami Europy* (= *Studia i Materiały do Dziejów Kujaw* 2). Inowrocław, 55-78.
1990 First settlement of the oldest phase of the Linear Band Pottery Culture on the Polish Lowland: Grabie 4, Włocławek voivodeship. *Archaeologia Interregionalis* 11, 49-62.

1994 *Wczesny i środkowy okres neolitu na Kujawach 5400-3650 p.n.e*. Poznań.

Czerniak L., Kośko A.

1993 *Z badań nad genezą rozwoju i systematyką kultury pucharów lejkowatych na Kujawach*. Poznań.

Domańska L.

1983 Wybrane zagadnienia krzemieniarstwa strefy nadmorskiej w epoce kamienia. In: T. Malinowski (ed.), *Problemy epoki kamienia na Pomorzu*. Słupsk, 217-228.

1995 *Geneza krzemieniarstwa kultury pucharów lejkowatych na Kujawach (The Origin of the Flint Industry of the Funnel Beaker Culture in Kuyavia)*. Łódź.

2000 Krzemienne groty kultury pucharów lejkowatych z Poczałkowa, stanowisko 38, gmina Aleksandrów Kujawski. In: *Archaeologia et Historia. Księga jubileuszowa dedykowana Pani Profesor Romanie Barnycz-Gupieńcowej*. Łódź, 113-118.

2003 Hunter-gatherers and farmers: neighbours in north-eastern Kuyavia, Poland. *Documenta Praehistorica* XXX, 93-98.

2003a Przybranówek 43 – The early Neolithic settlement site from Northern Poland. In: LEE Yung-jo (ed.), *Palaeolithic Men's Lives and their sites*, 895-908.

2004 The origin of the Funnel-Necked Beaker Culture flint industry on the North European Plain. In: E.A. Walker, F. Wenban-Smith, F. Healy (eds.), *Lithics in Action. Papers from the conference Lithic Studies in the Year 2000* (= *Lithic Studies Society Occasional Paper* 8), 206-214.

2006 Materiały krzemienne. In: A. Kośko, M. Szmyt, *Opatowice – Wzgórze Prokopiaka* I (= *Studia i Materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* I). Poznań, 223-235.

2010 Mesolithic Hunting Rituals – a Case from Northern Poland. In: LEE Yung-jo, WOO Yong-yoon (eds.), *Suyanggae and Her Neighbours: the 15 International Symposium*, 241-249.

2013 *Krzemieniarstwo horyzontu klasycznowióreckiego kultury pucharów lejkowatych na Kujawach* (= *Spatium Archaeologicum* 7). Łódź.

2015 Flint materials. In: S. Rzepecki, *Wilkostowo 23/24. A Neolithic Settlement in Kuyavia, Poland, c. 3500 BC* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 15). Kraków-Bonn, 287-322.

2015a Wytwórczość z krzemienia. In: A. Kośko, M. Szmyt, *Opatowice – Wzgórze Prokopiaka* V (= *Studia i Materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* V). Poznań, 395-430.

Domańska L., Forysiak J., Rzepecki S., Twardy J.
2013 The TRB culture settlement in the middle Tążyna Valley: a case study. In: S. Kadrow, P. Włodarczak (eds.), *Environment and subsitance – forty years after Janusz Kruk's "Settlement studies..."* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 11). Rzeszów-Bonn, 105-116.

Domańska L., Rzepecki S.
2001 Osiedla kultury pucharów lejkowatych ze stanowiska Przybranówek 43, gm. Aleksandrów Kujawski w świetle badań przeprowadzonych w latach 1994-1997. *Łódzkie Sprawozdania Archeologiczne* VII, 13-62.
2009 Chlewiska 132 Site: The Linear Band Pottery Culture Settlement from the Sandy Areas of the Kuyavia Region. In: J.M. Burdukiewicz, K. Cyrek, P. Dyczek, K. Szymczak (eds.), *Understanding the Past. Papers offered to Stefan K. Kozłowski*. Warsaw, 107-113.

Domańska L., Wąs M.
2007 Dąbrowa Biskupia, site 71. New data for evidence of the Mesolithic specialized camps. In: M. Masojć, T. Płonka, B. Ginter, S.K. Kozłowski (eds.), *Contributions to the Central European Stone Age. Papers dedicated to the late Professor Zbigniew Bagniewski*. Wrocław, 141-152.
2009 Dąbrowa Biskupia 71: a specialized camp from the Maglemose culture. In: S.B. McCartan, R. Schulting, G. Warren, P. Woodman (eds.), *Mesolithic Horizons* I. Oxford and Oakville, 261-268.

Inizan M.I., Roche H., Tixier J.
1992 *Technology of Knapped Stone*. Meudon.

Kabaciński J.
2009 Quarrying the antler adzes – a new Mesolithic site of the Boreal period at Krzyż Wielkopolski, western Poland. *Quartär* 56, 119-130.
2010 *Przemiany wytwórczości krzemieniarskiej społeczności kultur wstęgowych strefy wielkodolinnej Niżu Polskiego*. Poznań.

Kabaciński J., David E., Makowiecki D., Schild R., Sobkowiak-Tabaka I., Winiarska-Kabacińska M.
2008 Stanowisko mezolityczne z okresu borealnego w Krzyżu Wielkopolskim. *Archeologia Polski* LIII(2), 243-287.

Kabaciński J., Sobkowiak-Tabaka I. (eds.)
2004 *Komorniki. Chata ludności kultury pucharów lejkowatych*. Poznań.

Kobusiewicz M.
1999 *Ludy łowiecko-zbierackie północno-zachodniej Polski*. Poznań.

Kondracki J.
1981 *Geografia fizyczna Polski*. Warszawa.
1994 *Geografia Polski. Mezoregiony fizycznogeograficzne*. Warszawa.

Kośko A.
1981*Udział południowo-wschodnioeuropejskich wzorców kulturowych w rozwoju niżowych społeczeństw kultury pucharów lejkowatych. Grupa mątewska* (= *Seria Archeologiczna* 19). Poznań.
1988 Rozwój kulturowy społeczeństw Kujaw w okresach późnego neolitu oraz interstadium epok neolitu i brązu w aspekcie recepcji egzogennych wzorców kulturowych. In: A. Cofta-Broniewska (ed.), *Kontakty pradziejowych społeczeństw Kujaw z innymi ludami Europy* (= *Studia i materiały do dziejów Kujaw* 2). Inowrocław, 145-183.
2000 Osadnictwo społeczności kultury pucharów lejkowatych (grupy: wschodnia i radziejowska). In: A. Kośko (ed.), *Osadnictwo kultur późnoneolitycznych oraz interstadium epok neolitu i brązu: 3900-1400/1300 przed Chr.* (= *Archeologiczne badania ratownicze wzdłuż trasy gazociągu tranzytowego* III. *Kujawy* 4). Poznań, 19-133.
2006 Ceramika kultury pucharów lejkowatych. In: A. Kośko, M. Szmyt, *Opatowice – Wzgórze Prokopiaka* I (= *Studia i materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* I). Poznań, 139-194.

Kośko A., Przybył A.
2004 Kultura pucharów lejkowatych. In: J. Bednarczyk, A. Kośko (eds.), *Od długiego domu najstarszych rolników do dworu staropolskiego. Wyniki badań archeologicznych na trasach gazociągów Mogilno – Włocławek i Mogilno – Wydartowo*. Poznań, 235-314.

Kośko A., Szmyt M.
2006 *Opatowice – Wzgórze Prokopiaka* I (= *Studia i materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* I). Poznań.
2007 *Opatowice – Wzgórze Prokopiaka* II (= *Studia i materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* II). Poznań.
2007a *Opatowice – Wzgórze Prokopiaka* III (= *Studia i materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* III). Poznań.
2015 *Opatowice – Wzgórze Prokopiaka* V (= *Studia i materiały do badań nad późnym neolitem Wysoczyzny Kujawskiej* V). Poznań.

Kruk J., Milisauskas S.
1999 *Rozkwit i upadek społeczeństw rolniczych neolitu. The Rise and Fall of Neolithic Societies*. Kraków.

Lech J.
1997 Materiały krzemienne z osad społeczności wczesnorolniczych w Strachowie, woj. Wrocław. In: A. Kulczycka-Leciejewiczowa, *Strachów. Osiedla neolitycznych rolników na Śląsku*. Wrocław, 229-266.

Niesiołowska-Śreniowska E.
1980 Materiały krzemienne z fazy AB kultury pucharów lejkowatych z grobowca 8 w Sarnowie, w woj. Włocławskim. *Prace i materiały Muzeum Archeologicznego i Etnograficznego w Łodzi* (= *Seria Archeologiczna* 27), 85-139.
1983 Osada z fazy AB kultury pucharów lejkowatych na stanowisku 1A w Sarnowie, województwo włocławskie, w świetle materiałów krzemiennych i niektóre problemy z nią związane. *Prace i materiały Muzeum Archeologicznego i Etnograficznego w Łodzi* (= *Seria Archeologiczna* 30), 202-245.

Papiernik P., Rybicka M.
2002 *Annopol. Osada kultury pucharów lejkowatych na Pojezierzu Gostynińskim*. Łódź.

Pyzel J.
2010 *Historia osadnictwa społeczności kultury ceramiki wstęgowej rytej na Kujawach (History of the Settlement of People of the Linear Band Pottery culture in Kuyavia). Gdańskie Studia Archeologiczne* (= *Seria Monografie* 1). Gdańsk.

Rzepecki S.
2004 *Społeczności środkowneolitycznej kultury pucharów lejkowatych na Kujawach.* Poznań.
2011 *The roots of megalithism in the TRB culture*. Łódź.
2013 Beside the mainstream. Some reflections on the LBK in Kuyavia. *Sprawozdania Archeologiczne* 65, 79-130.
2015 *Wilkostowo 23/24. A Neolithic Settlement in Kuyavia, Poland, c. 3500 BC* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 15). Kraków-Bonn.

Schild R.
1980 Introduction to Dynamic Technological Analysis of Chipped Stone Assemblages. In: R. Schild (ed.), *Unconventional Archaeology. New Approaches and Goals in Polish Archaeology*. Wrocław, 57-85.

Szmyt M.
2013 *Late Neolithic Landscapes on the Polish Lowland: people, culture and economy in Kujawy – 4th and 3rd millenia BC* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 12). Poznań-Bonn.

Appendix 1

Małgorzata Winiarska-Kabacińska

Microwear analysis of two flint assemblages from the Tążyna river valley

Two flint assemblages were subjected to microwear analysis: Mesolithic products from the site Dąbrowa Biskupia 71 (L. Domańska, M. Wąs 2006; 2007) and flint materials of the Funnel Beaker culture from the site Wilkostowo 23/24 (S. Rzepecki 2015). The assemblage from Dąbrowa Biskupia is a modified version of the paper published in 2007 while the first analysis of Wilkostowo was printed in Polish and English in 2014 and 2015 respectively (M. Winiarska-Kabacińska 2007; 2014; 2015).

The flint materials were analysed using a dissecting microscope at the magnification of several tens and a metallographic microscope at the magnification of 100, 200 and 500x, which enabled the recording for all traces such as damage, abrasions and polishes which were then interpreted by the method developed by L.H. Keeley (1980).

1. Dąbrowa Biskupia 71

1.1. Materials

The analysis focused on most specimens from the assemblage. The artefacts showed different degrees of preservation. Many pieces were covered, to a varying degree, by patina.

The analysis was made for 189 microliths, 2 retouched flakes, 1 retouched blade, 150 blades, 50 flakes and 2 rejuvenation flakes. 76 specimens (66 microliths, 1 retouched flake, 9 blades) revealed transformations allowing for a conclusion that the analyzed products were in use. The transformations were visible in the form polishes and the following types of

edge damage: very delicate retouch, retouch or breaking off. The polishes were present both on the retouched and unretouched edges.

All microliths had a similar function – they were components of composite tools. One specimen is distinguishable in this group (Fig. 1: 11). In its distal end, linear microscopic traces of polishes (Fig. 3b) known as MILT (microscopic linear impact traces) were noted. Such traces are typically observed in the distal ends and edges of the specimens used as components of arrows. Also, an impact scar was visible – which probably occurred as a result of hitting the specimen against a given target (A. Fischer, P.V. Hansen, P. Rasmussen 1984; A. Fischer 1989). The traces noted on the lateral edges of the analyzed microlith were derived from the mounting in which they were embedded. The other microliths possessing some traces of use represent complete specimens as well as proximal and distal parts (Fig. 1: 6-8, 10, 12-36).

Among the used blades, two complete specimens were identified (Fig. 1: 2) and the rest were smaller (Fig. 1: 1, 3) or bigger fragments (Fig. 1: 4). Transformations were localised on both the retouched and unretouched edges. In the latter case, the nature of traces indicate contact with some soft material (Fig. 2b). The traces are not intense, but they show some differentiation, presumably caused by contact with various kinds of raw material such as meat and bone. The location of those traces is of non-homogeneous nature, which can be probably explained by the different location of individual specimens in the mounting of the point or on the arrow shaft. The traces of polishes are accompanied by some minor damage to the edges (Fig. 3; 4b). In turn, the retouched edges reveal transformations varying in terms of the nature and distribution – which were probably derived from embedding the edges of those specimens on the mounting.

Also, some observations were conducted on the specimens which are elements of refits. In the case of the refit consisting of three microliths, all the components had transformations indicating their use on their unretouched edges (Fig. 1: 6-8). Similar traces were registered on the edges of the other two microliths forming a refit. Also, a proximal fragment of a broken and reconstructed microlith of the Nowy Młyn type was undoubtedly used.

The edge of the flake with regular retouch revealed a presence of traces indicating its use for scraping wood (Fig. 1: 5; 2a). A big microlith had probably a different function from other specimens, being a component of refitting with blade (Fig. 1: 9). A distinct trace of polish was observed in its distal end (Fig. 4), presumably caused by contact with leather. This is accompanied by very delicate retouch covering the apical part, which indicate drilling or boring through the said raw material.

1.2. Discussion

The traces of use recorded on the microliths are not intense. Also, the applied mountings did not leave noticeable damages on the edges. This issue was the subject of numerous considerations (V. Rots 2003; 2010) and is explained by using some extra strengthening of the mounted specimens, e.g. in the shape of bonding organic adhesives (B.L. Hardy, J.A. Swoboda 2009). Their use resulted in permanent mounting of the artefacts, not causing transformations on the flint that are visible under magnification. Various degrees of preservation of the analyzed artefacts, as mentioned at the beginning, and especially the presence of patina, hampered the observations, probably also lowering the number of the specimens used. On the other hand, however, the macroscopic examinations, especially in the case of blades, bring to a conclusion that a part of the analyzed material was not used. This corresponds with the observations of the authors of the research (L. Domańska, M. Wąs 2007), who conclude on the basis of the technological analysis of the materials and refits that the site was the production place of blanks which were then processed into insets (especially the Nowy Młyn type) as well as triangles (L. Domańska, M. Wąs 2006).

Apart from two specimens – a retouched flake, which was used for scraping wood and a triangle used for drilling skins, all the other products showed some traces indicating that they were part of the hunting equipment. Differentiation of the distribution and nature of the traces (in some places the traces resulting from contact with the bone, meat or fat are visible, which can be interpreted as a result of contact with the animal carcass) indicates various possibilities of mounting the analyzed artefacts, both as blades embedded on the apical parts of arrows and as inserts – reinforcing elements.

Analyzing the microliths and blades from Dąbrowa Biskupia, it seems that they were selected in a targeted manner, and so they were embedded in the frame to optimally fulfill its utilitarian role. It also appears that the diverse nature of the traces of use can be associated with the extensive use of composite tools. Some of these tools could also be used as knives.

2. Wilkostowo 23/24

2.1. Materials

The Funnel Beaker culture site discovered in the middle section of the Tążyna river basin yielded 1,031 flint specimens (L. Domańska 2015). The microwear analysis focused on 330 artefacts, including all the tools (181)

and a choice of blades, flakes, splintered piece flakes, splintered pieces and flakes resulting from the production of axes. 104 specimens in the analyzed material possess some traces of use (Fig. 5-11).

Splintered pieces (11 pcs. – Fig. 5: 1-2, 4-9, 11-12) were generally used to scrape wood, leather and hard raw materials, for cutting plants and wood, drilling (Fig. 12: 1); two specimens possess some traces of cutting cereals. Apparently, the splintered pieces had various functions and their edges were used to perform specific jobs, but it should be noted, however, that these were not the edges from which the splintered piece flakes were removed. It is worth noting that some splintered pieces were created as a result of reusing some parts of larger tools (possibly large harvesting tools), and in such cases – the distinct signs of use should be associated with their primary function as tools (Fig. 5: 4-5, 7). Considering the three artefacts identified as used retouched splintered pieces, one was utilized for cutting cereal (Fig. 5: 10), another for sawing bones/antlers (Fig. 5: 3), and in the last case, both the type of activity and the raw material remained unspecified (Fig. 5: 14).

End-scrapers (17 pcs. – Fig. 6: 1-17) were predominantly used for scraping skins (Fig. 12: 2), adding that, with one exception, all the tools were mounted on holders. The nature of the recorded traces indicates that these tools were utilized to perform dry leather tanning. Furthermore, the end-scrapers were used for cutting plants (Fig. 6: 4, 6, 9, 13) and cereals (Fig. 6: 2, 12) – in this case the lateral edge functioned as a working edge for undefined activities. Four specimens were probably originally used for scraping skin (some traces are visible on the front of the end-scrapers) and then, they were mounted on holders and utilized for cutting crops (Fig. 6: 14-17).

Projectile points (5 pcs. – Fig. 7: 1-4) do not have the characteristic marks caused by their utilization as arrows used to shoot a target (the specific breaking off of the apex part and – not always accompanying these cases – linear microscopic traces of polishes MILT). However, four of these specimens revealed some presence of transformations derived from the mounting in which they were embedded (Fig. 12-13). One projectile point – broken and overheated – does not possess any distinct signs of use, while the surface of another one reveals some gloss, which indicates that the specimen was remade from a tool previously used to cut cereals.

Truncated blades (7 pcs. – Fig. 7: 5-11) were used for cutting cereals (Fig. 13: 3; 14: 1) and scraping bones. One tool was used for various activities connected with the treatment of plants, whereas the other was used for works with an unspecified character.

Traces of use were found on two perforators (2 pcs. – Fig. 7: 12-13). In one case, the tool was used to perform multiple operations for the treatment of bone/antler (Fig. 7: 12) and namely: drilling, scraping and cutting; in the other case, the tool was used for works with an unspeci-

fied character (Fig. 7: 13). All the edges were in use; only the first out of the described specimens had traces of use in the extended tip of the tool. Borer (Fig. 7: 14) was used for drilling some hard materials (Fig. 14: 2).

Macro-blades with continuous retouch (4 pcs. – Fig. 8: 1-4) were extensively used for cutting plants and cereals . In one case, the specimen served as an insert in a harvesting tool (Fig. 8: 1), and three others – of large sizes – probably served as knives.

Micro-retouched blades (3 pcs. – Fig. 8: 8-10) were utilized for cutting plants (Fig. 8: 10) and some unspecified material as well as for works with unspecified character (Fig. 8: 8-9). Retouched blades (4 pcs. – Fig. 8: 5, 11-12; 9: 4) were utilized for scraping bones, cutting plants (Fig. 8: 5) and skins (Fig. 8: 12) and various activities connected with processing antler (Fig. 8: 11; 9: 4). Blades with use retouch (11pcs. – Fig. 8: 6-7, 13-14; 9: 1-2, 5-7, 9-10) were used for cutting skins (Fig. 8: 13), plants, cereals (Fig. 8: 7), wood (Fig. 9: 2, 6-7), bones, antlers (Fig. 9: 1, 9) and some unspecified material. Three specimens were, in addition to cutting, utilized for scraping plants, wood and bones. Blades with polish (2 pcs. – Fig. 9: 3, 8) were employed for cutting cereal and as mounted inserts.

Flakes constitute a big group of artefacts with transformations of utilitarian nature. Retouched splintered piece flakes (3 pcs. – Fig. 9: 11, 13) were used for cutting, reaming and scrapping some unspecified material. Splintered piece flakes with use retouch (2 pcs.) were utilized for cutting plants (Fig. 9: 14) and bones (Fig. 10: 5; 15: 1), whereas common splintered piece flakes (6 pcs.) were used for scraping (Fig. 9: 12) and reaming some unspecified material (Fig. 10: 3), cutting inorganic material (Fig. 10: 4), cutting cereals (Fig. 11: 2-3) and, in one case, the activities remain unspecified (Fig. 10: 2). Micro-retouched flakes (3 pcs.) were used for scraping bones/antlers (Fig. 11: 5), scraping and cutting bones (Fig. 11: 6) and for works with an unspecified character (Fig. 11: 1). Retouched flakes (8 pcs.) were employed for scrapping hard (Fig. 10: 10) and unspecified material (Fig. 10: 9, 12), cutting wood (Fig. 10: 11) and cereals (Fig. 10: 13) and for scrapping and cutting while processing bones and antlers (Fig. 10: 7-8; 11: 4). Flakes with use retouch (3 pcs.) were used for processing inorganic material (Fig. 10: 6, 15), cutting bones/antlers (Fig. 10: 14) and drilling wood (Fig. 10: 15). Common flakes (3 pcs.) were used for scraping inorganic material (Fig. 11: 11), processing plants (Fig. 11: 12) and for works with an unspecified character (Fig. 11: 13).

Flakes with traces of use were significantly less numerous (4 pcs.) and they were utilized for cutting plants (Fig. 11: 7, 9) and wood (Fig. 11: 8) and also for sawing wood (Fig. 11: 10).

Chunk with negative scar (Fig. 11: 14; 15: 3-4) was used for polishing inorganic material. Polished axe preparation flakes (7 pcs.) possess some traces of smoothing or polishing which were created in the course of the production of axes and they do not reveal any traces of their further use.

Two axes were probably used for the works connected with processing wood.

2.2. Discussion

The flint material, which was subjected to the microwear analysis revealed some traces of intensive use, and the recognized functions – ascribed to the specified tools – allow for the characterization of the activities performed at the study site.

One of the more commonly performed activities was leather tanning, mainly using some specialized tools – end-scrapers – in most cases embedded on mountings, which additionally allowed for more efficient work. Some further work connected with the treatment of skins is certified by the presence of blades which were used in the cutting process.

The most numerous finds in the study assemblage were used for cutting, and occasionally the scraping of plants and wood. The first group includes the tools used for cutting cereals. The character of the registered traces of use leads to the conclusion that the analyzed artefacts also include the tools intended for cutting products of reed (Fig. 8: 2; 9: 14). The results of the microwear analysis therefore confirm the importance of processing plants at the site, which among other things, constitute the raw material for manufacturing some everyday objects. It should be emphasized that the tools were both selected randomly for performing specific jobs (e.g. blades and flakes) and also prepared deliberately, for which they were mounted using some professional tools. The characteristic location of the traces made in the course of their use, as well as those produced by the mounting, suggest the existence of two types of composite tools: the sickles with the flint inserts embedded either slightly diagonally or straight and the knives made with individually mounted large blades.

The identified functions of the tools did not significantly differ from the functions ascribed to the artefacts derived from other Funnel Beaker culture assemblages, researched in the microwear context (M. Winiarska-Kabacińska 2004; 2010).

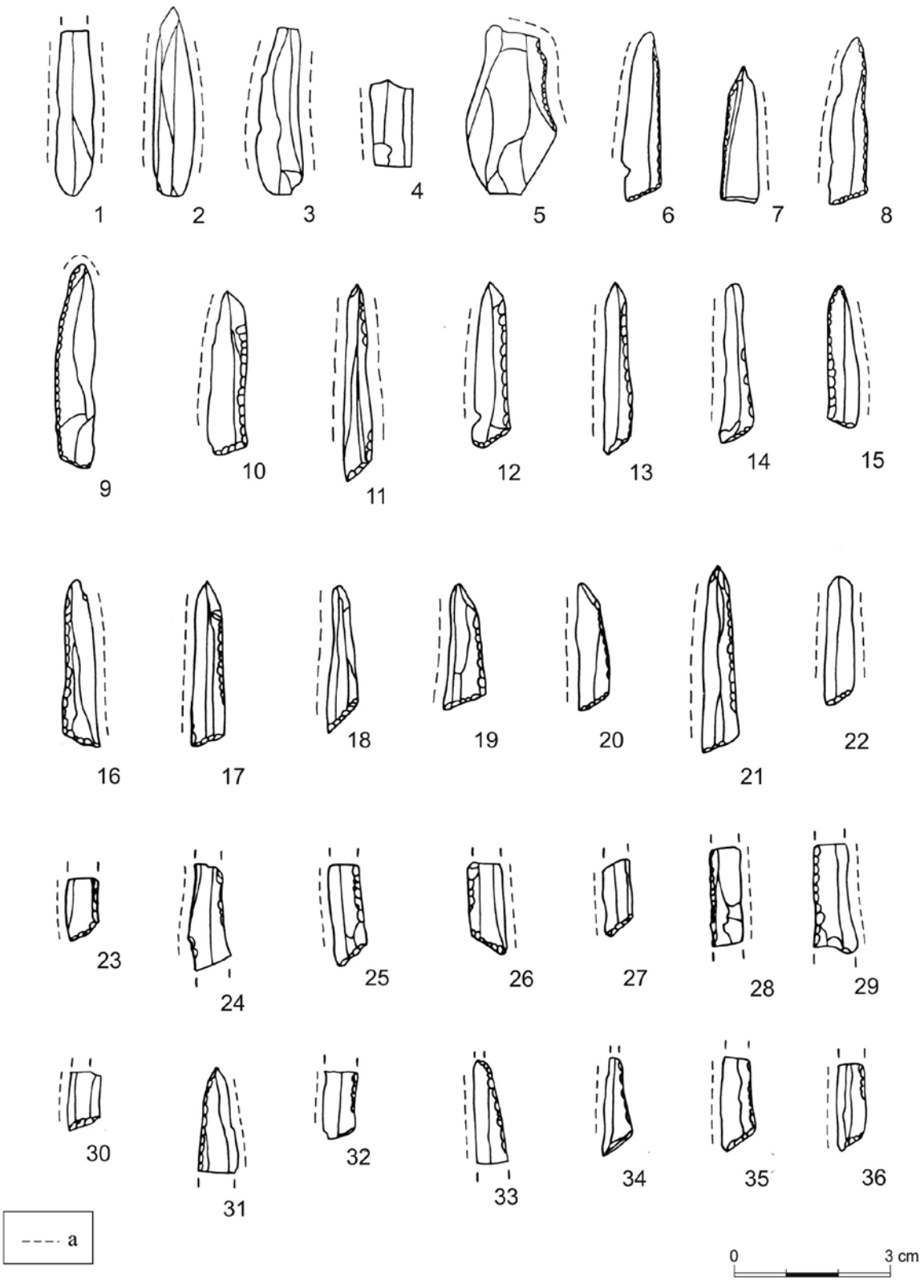


Fig. 1. Dąbrowa Biskupia 71. Selected specimens with traces of use: blades (1-4); retouched flake (5); microliths (6-36). Key: a – distribution of traces of use.

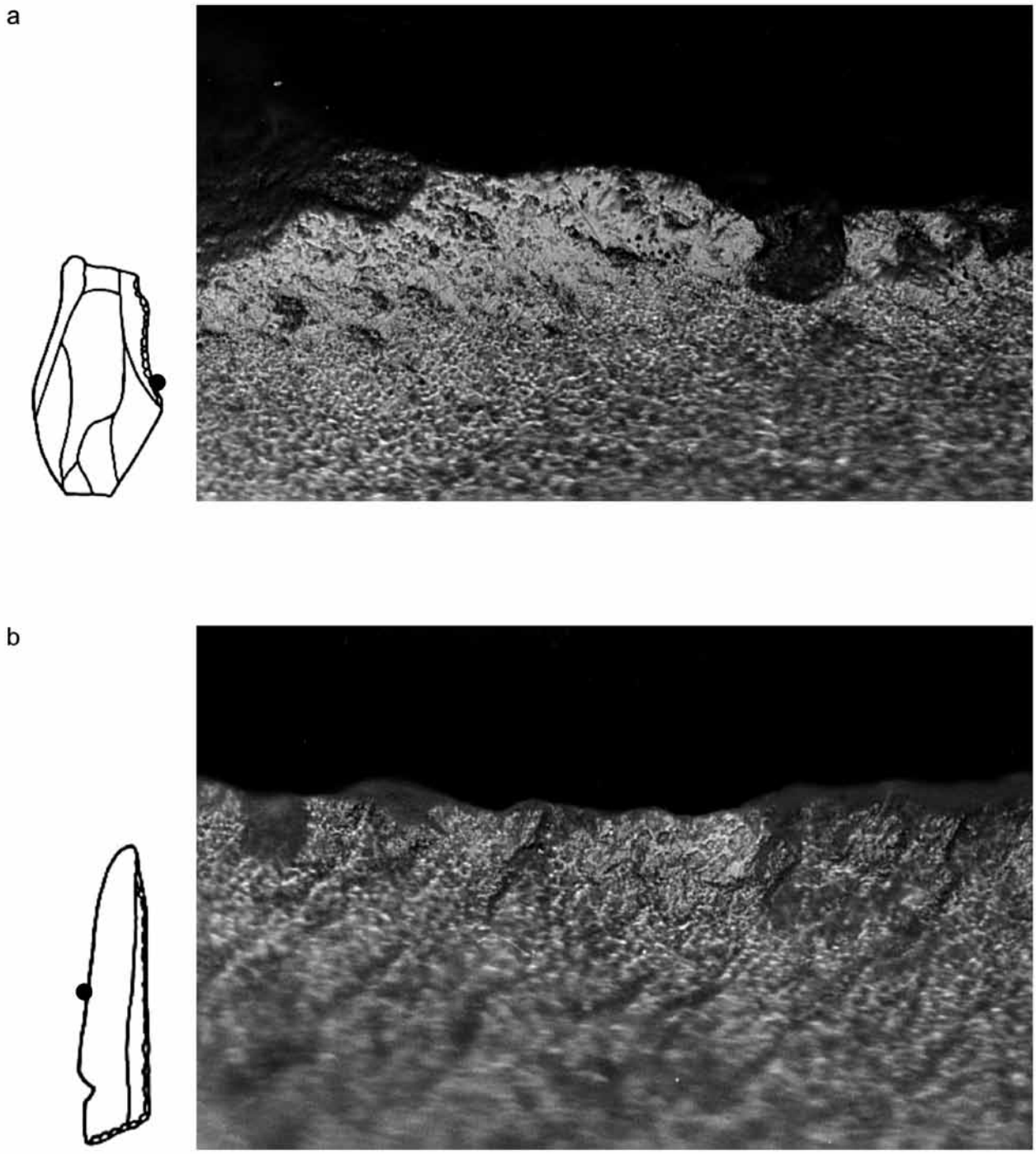


Fig. 2. Dąbrowa Biskupia 71. Microscope photographs: retouched flake (a); microlith (b); magnification 200x.

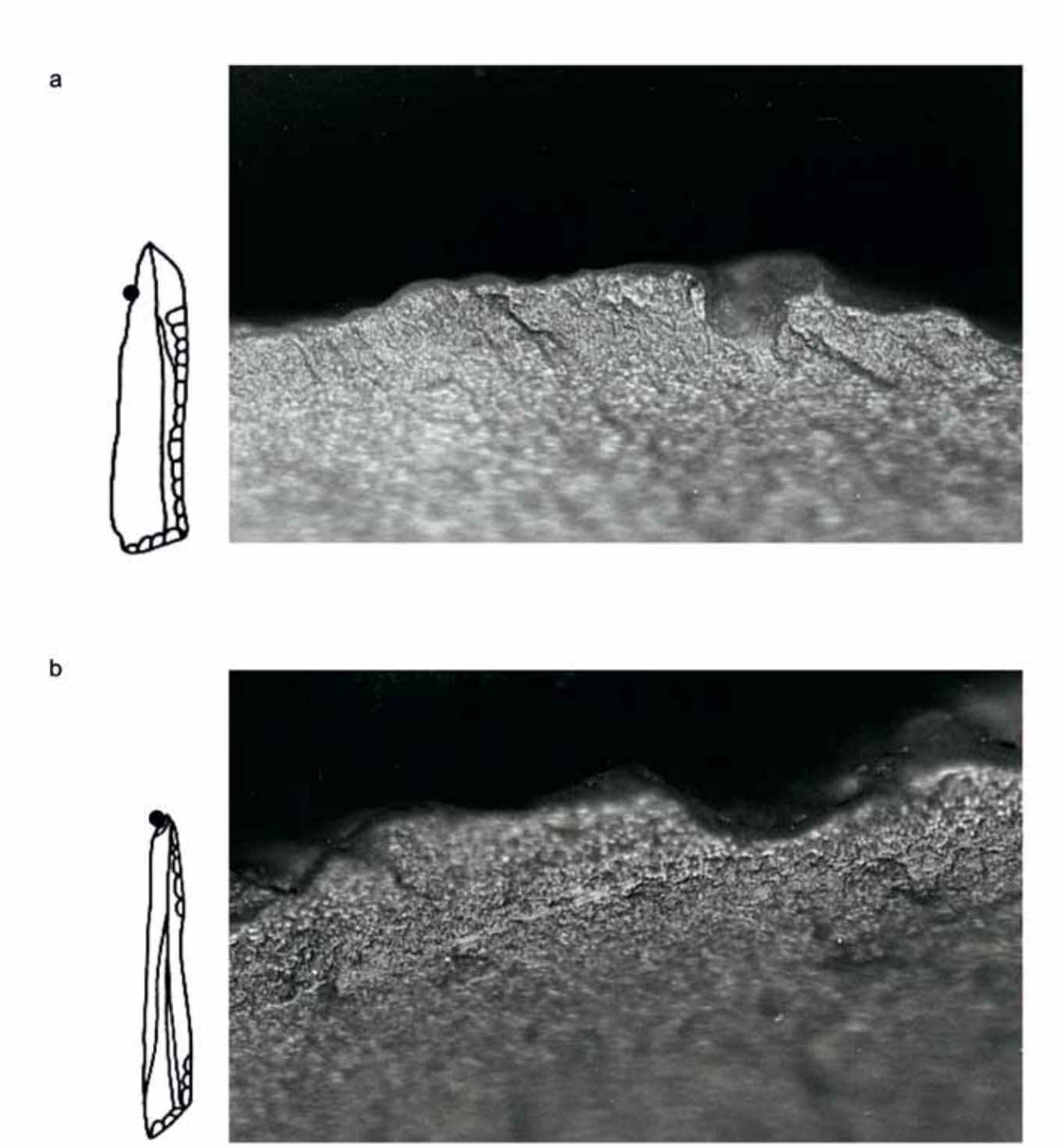


Fig. 3. Dąbrowa Biskupia 71. Microscope photographs of microliths (a-b); magnification 200x.

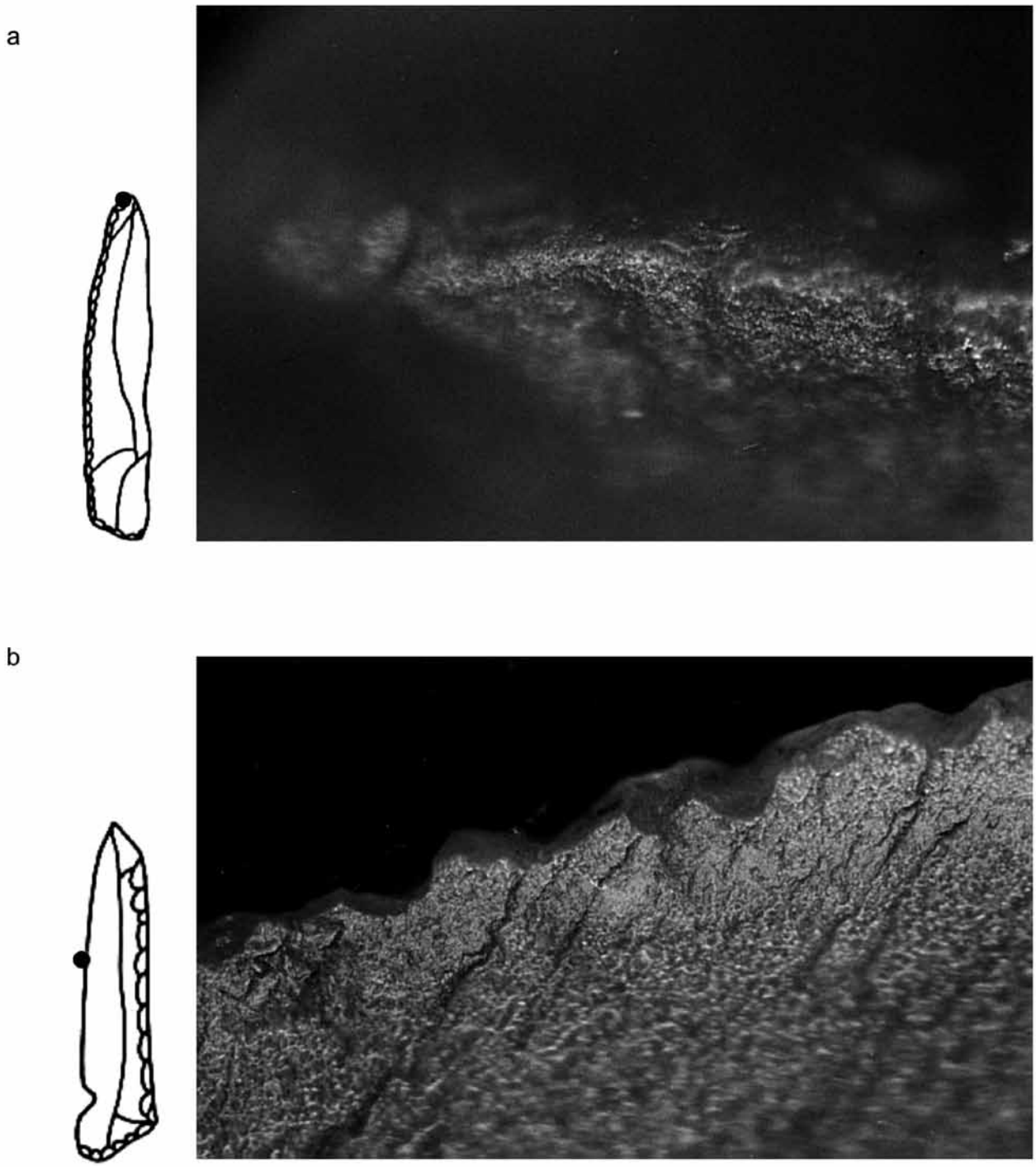


Fig. 4. Dąbrowa Biskupia 71. Microscope photographs of microliths (a-b); magnification 200x.

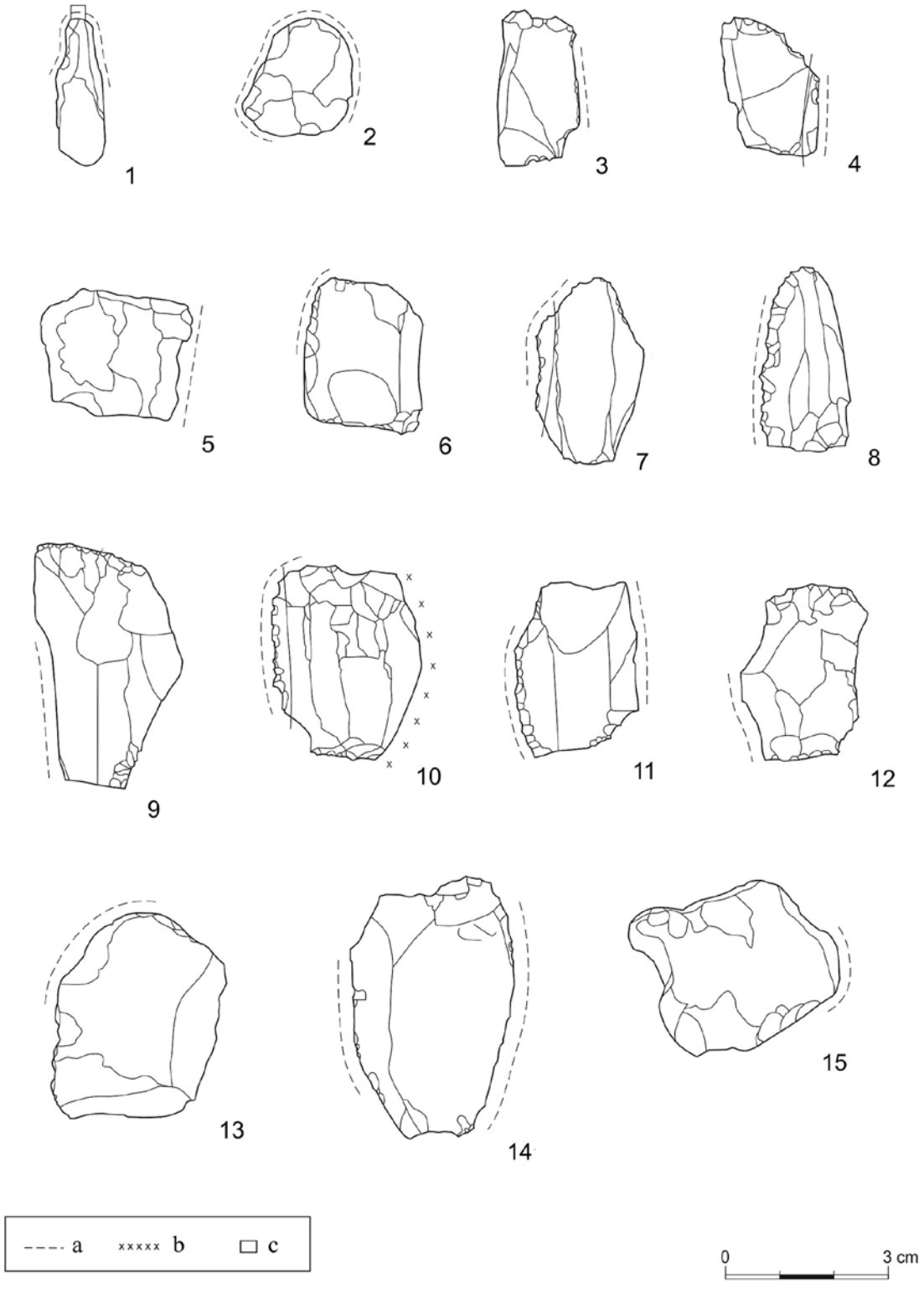


Fig. 5. Wilkostowo 23/24. Specimens with traces of use: splintered pieces (1-2, 4-9, 11-12); retouched splintered pieces (3, 10, 14).
Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

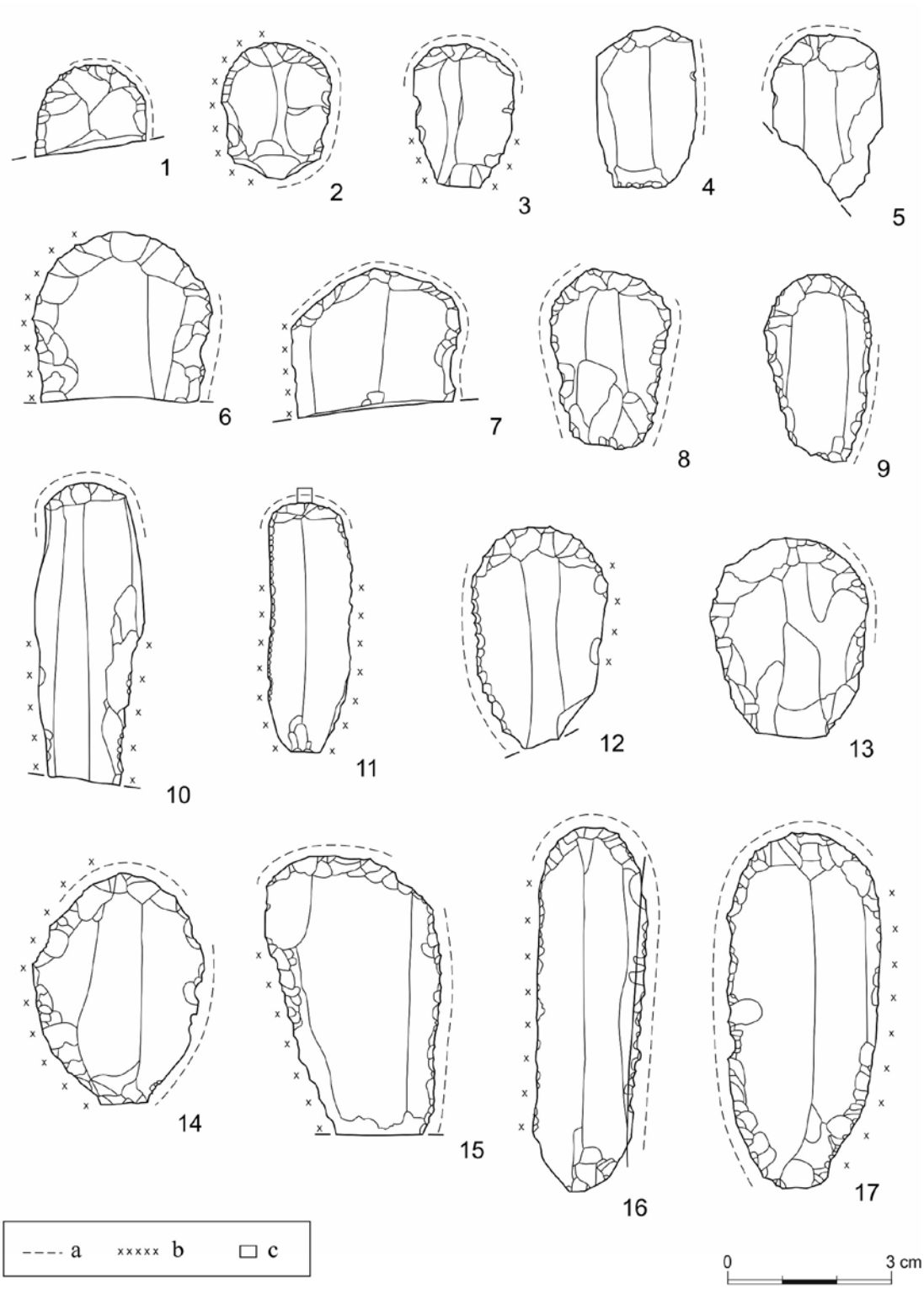


Fig. 6. Wilkostowo 23/24. Specimens with traces of use: end-scrapers (1-17).
Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

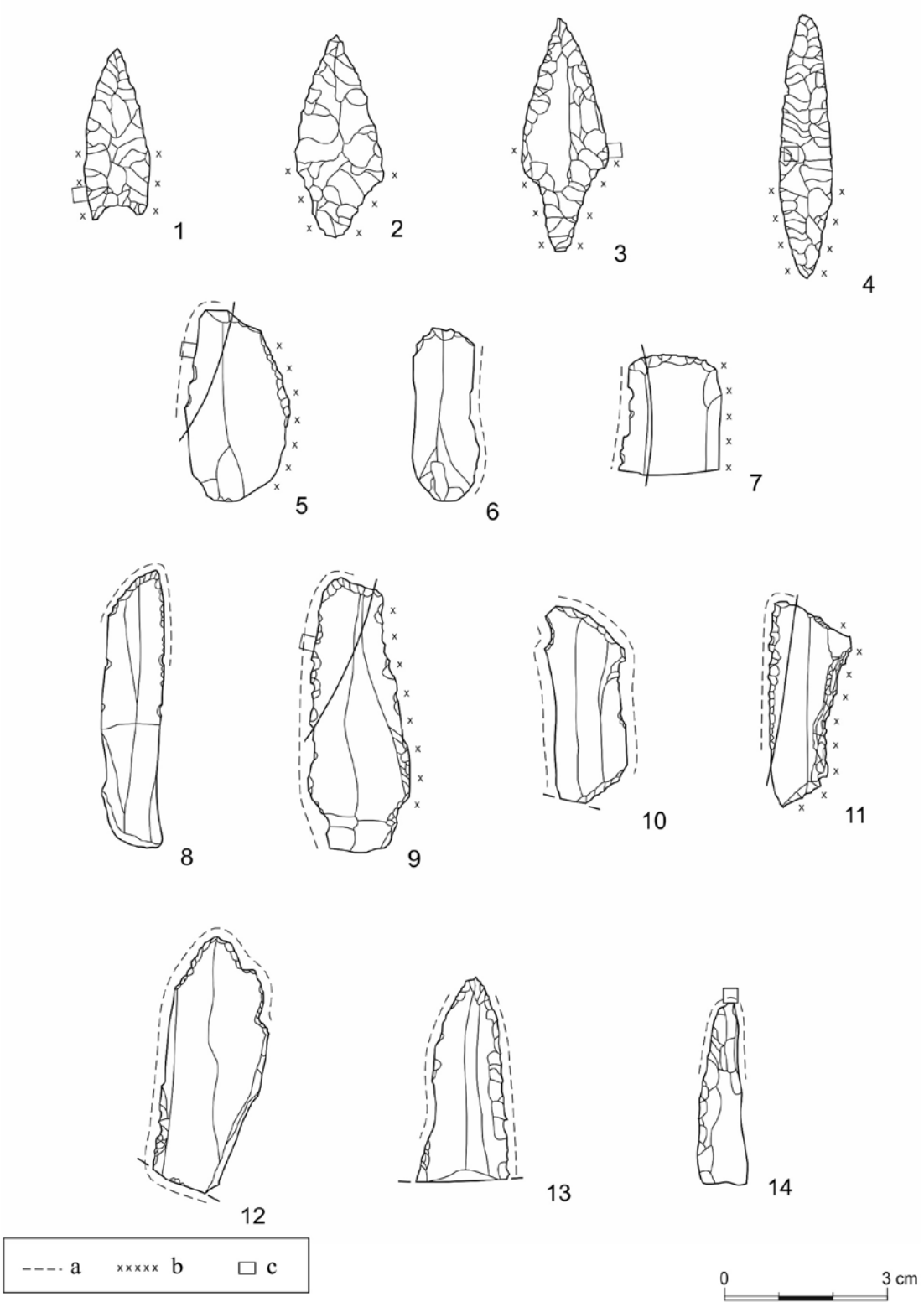


Fig. 7. Wilkostowo 23/24. Specimens with traces of use: projectile points (1-4);
truncated blades (5-11); perforators (12-13); borer (14).
Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

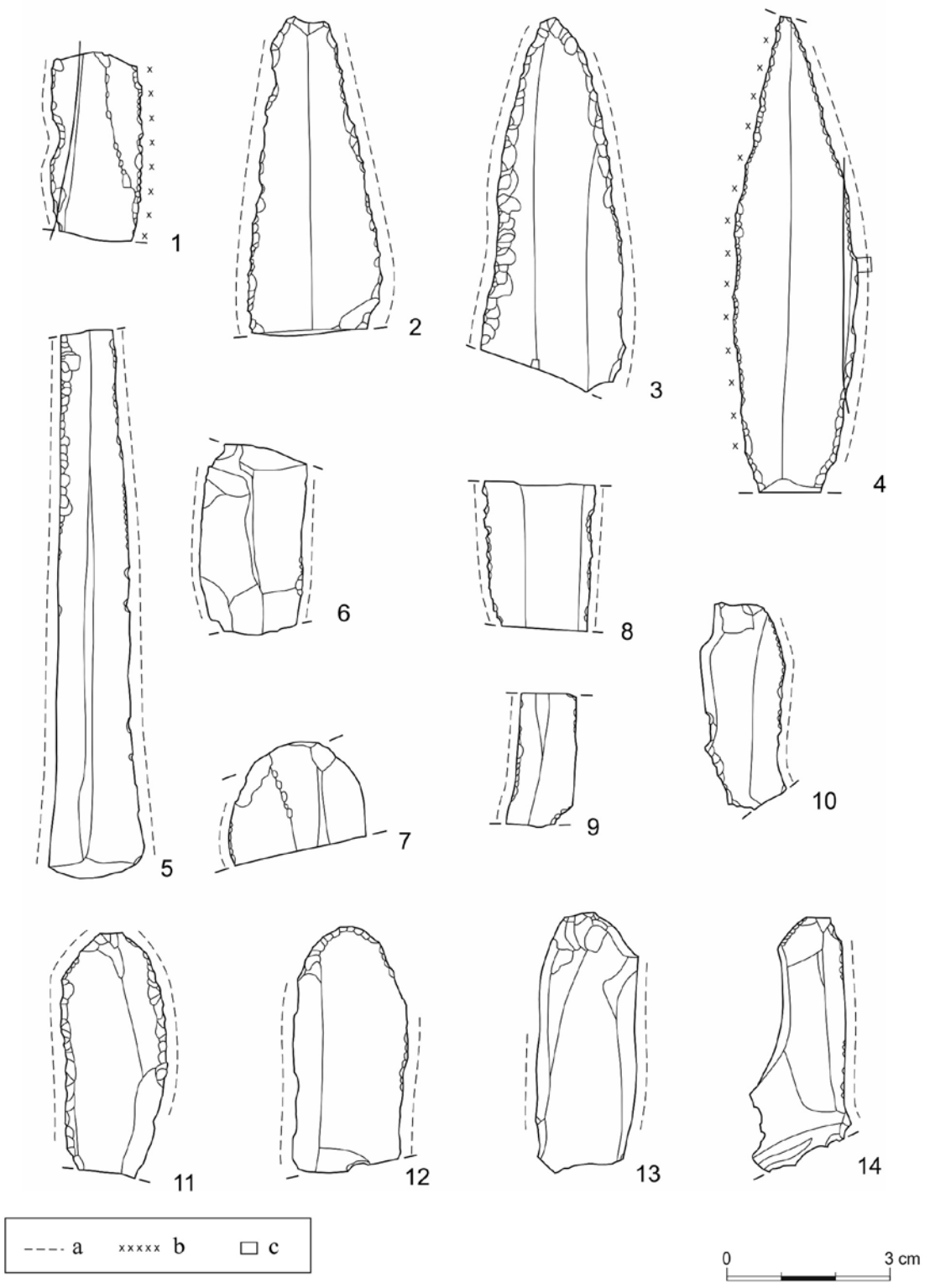


Fig. 8. Wilkostowo 23/24. Specimens with traces of use: macro-blades with continuous retouch (1-4); retouched blades (5, 11-12); blades with use retouch (6-7, 13-14); micro-retouched blades (8-10).
Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

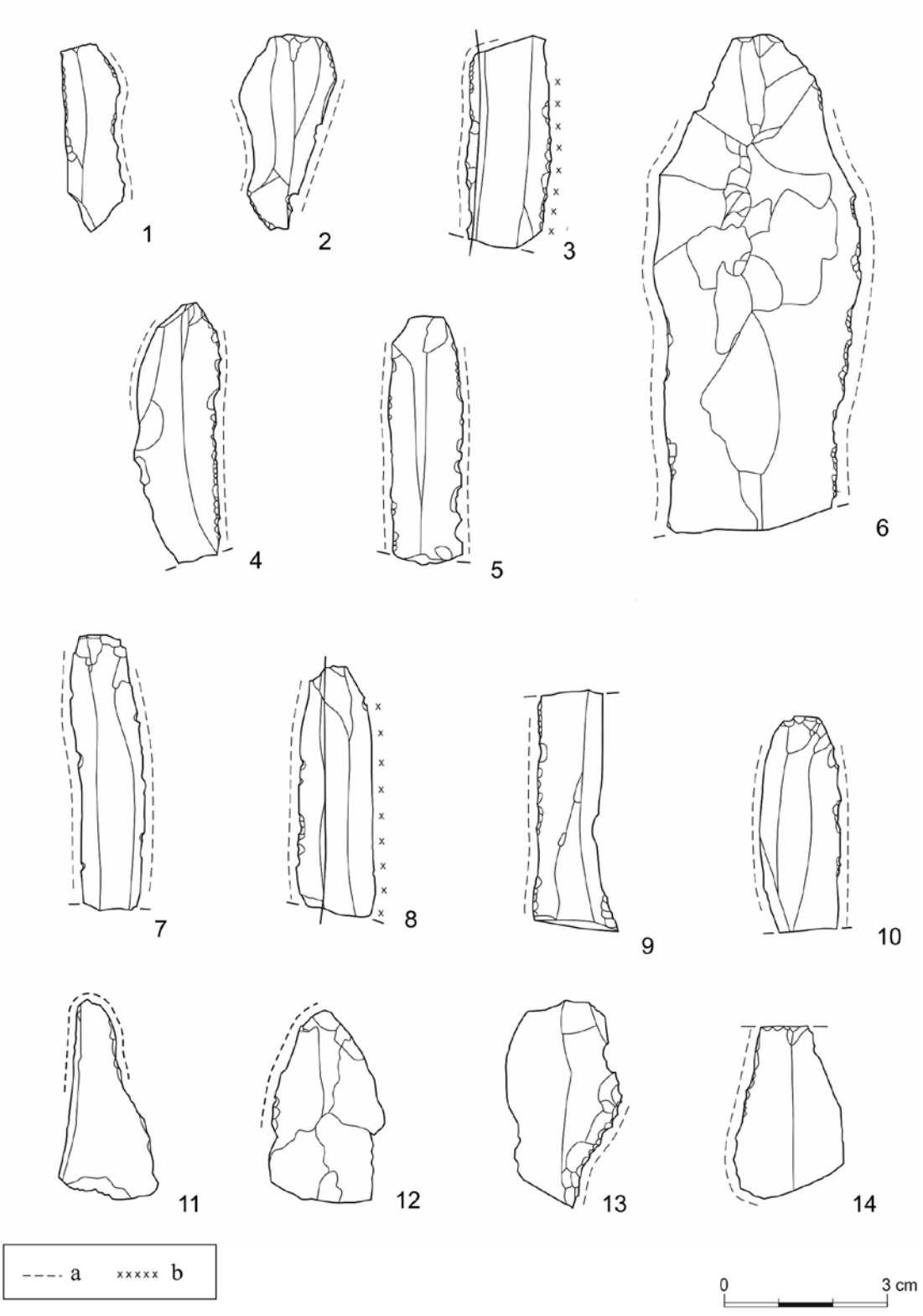


Fig. 9. Wilkostowo 23/24. Specimens with traces of use: blades with use retouch (1-2, 5-7, 9-10); retouched blade (4); blades with polish (3, 8); retouched splintered pieces (11, 13); splintered piece flake (12); splintered piece flake with use retouch (14).
Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

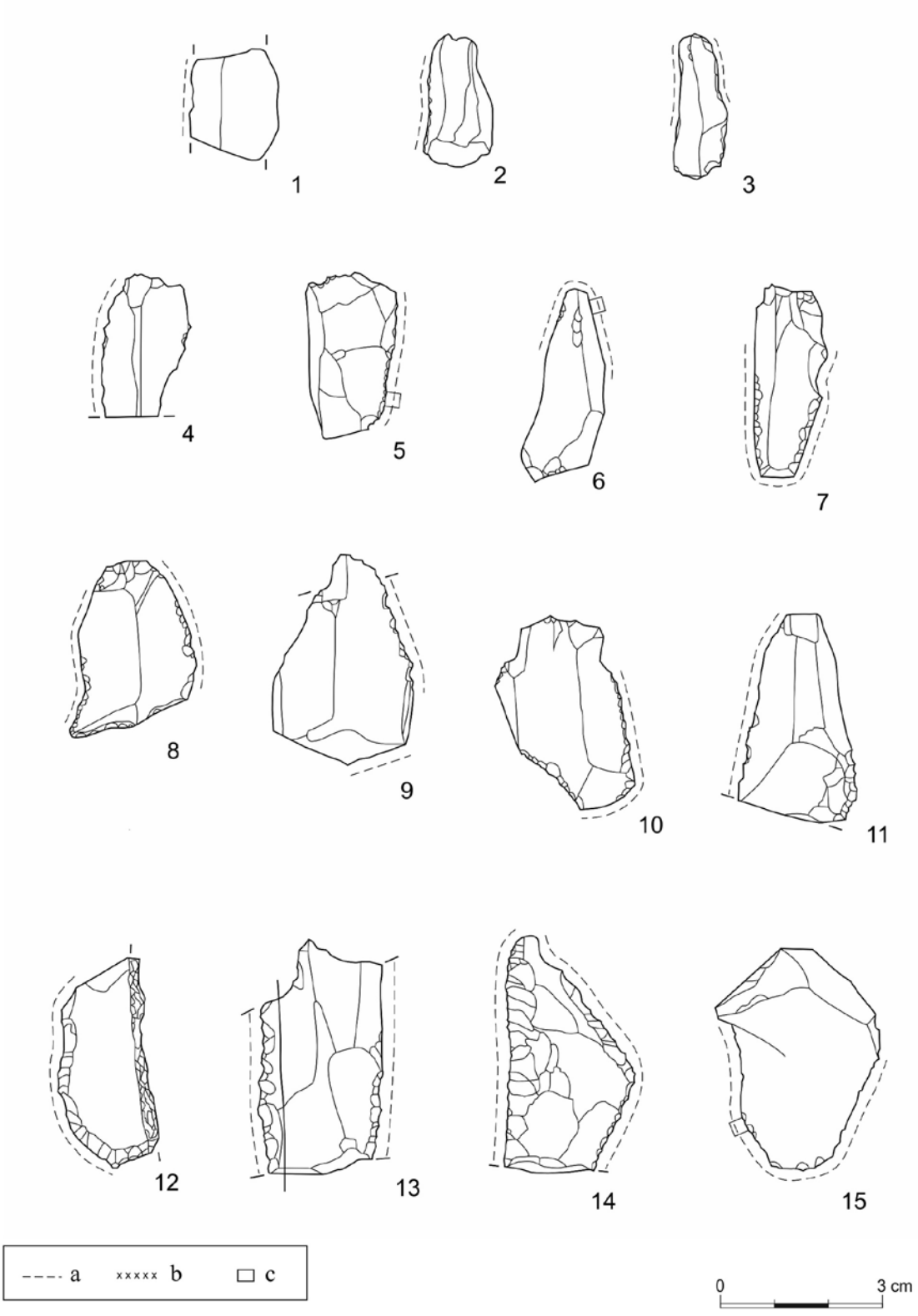


Fig. 10. Wilkostowo 23/24. Specimens with traces of use: splintered piece flake (1); splintered piece flakes (2-4); splintered piece flake with use retouch (5); flakes with use retouch (6, 14-15); retouched flakes (7-13).
Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

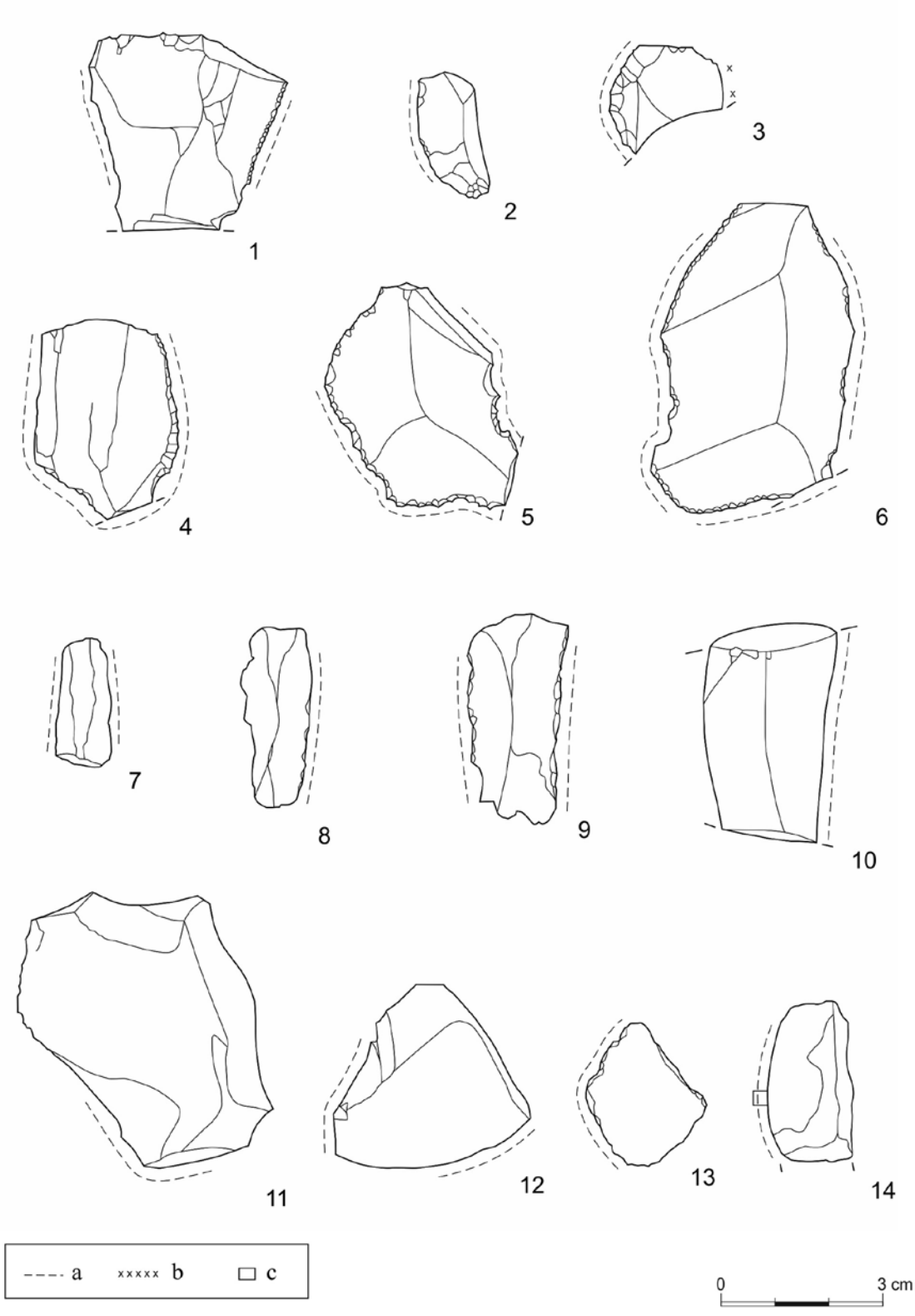


Fig. 11. Wilkostowo 23/24. Specimens with traces of use: micro-retouched flakes (1, 5-6); splintered flakes (2-3); retouched flake (4); blades (7-10); flakes (11-13); chunk with negative scar (14). Key: a – distribution of traces of use; b – distribution of traces of mounting; c – the photographed area.

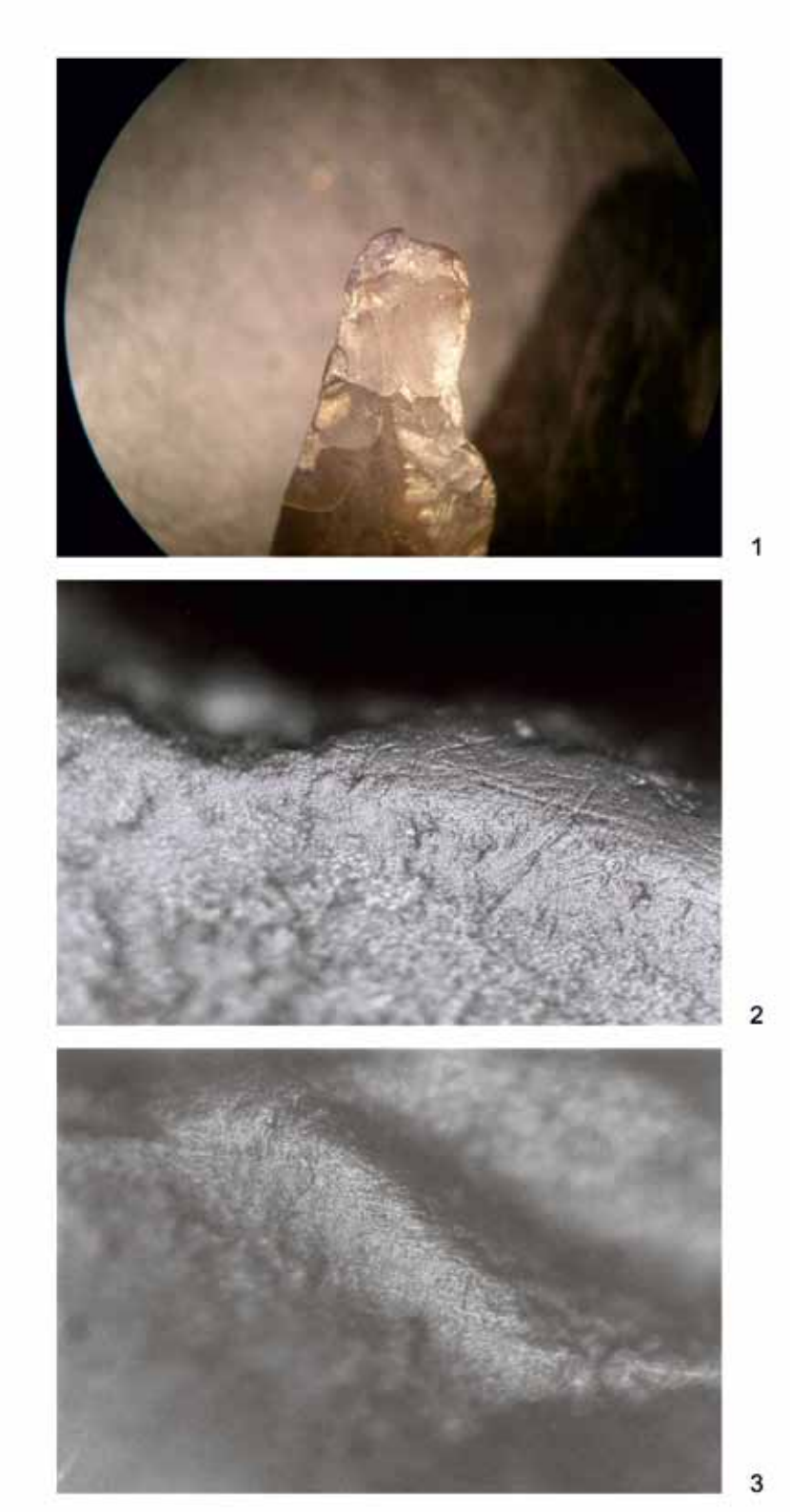


Fig. 12. Wilkostowo 23/24. Key: 1 – macroscopic photography, splintered piece used for boring hard materials, Fig. 5: 1, magnification 200x; 2 – microscopic photography, end-scraper, traces of scraping skins, Fig. 6: 11, magnification 200x; 3 – microscopic photography, projectile point, traces of mounting, Fig. 7: 1, magnification 200x.

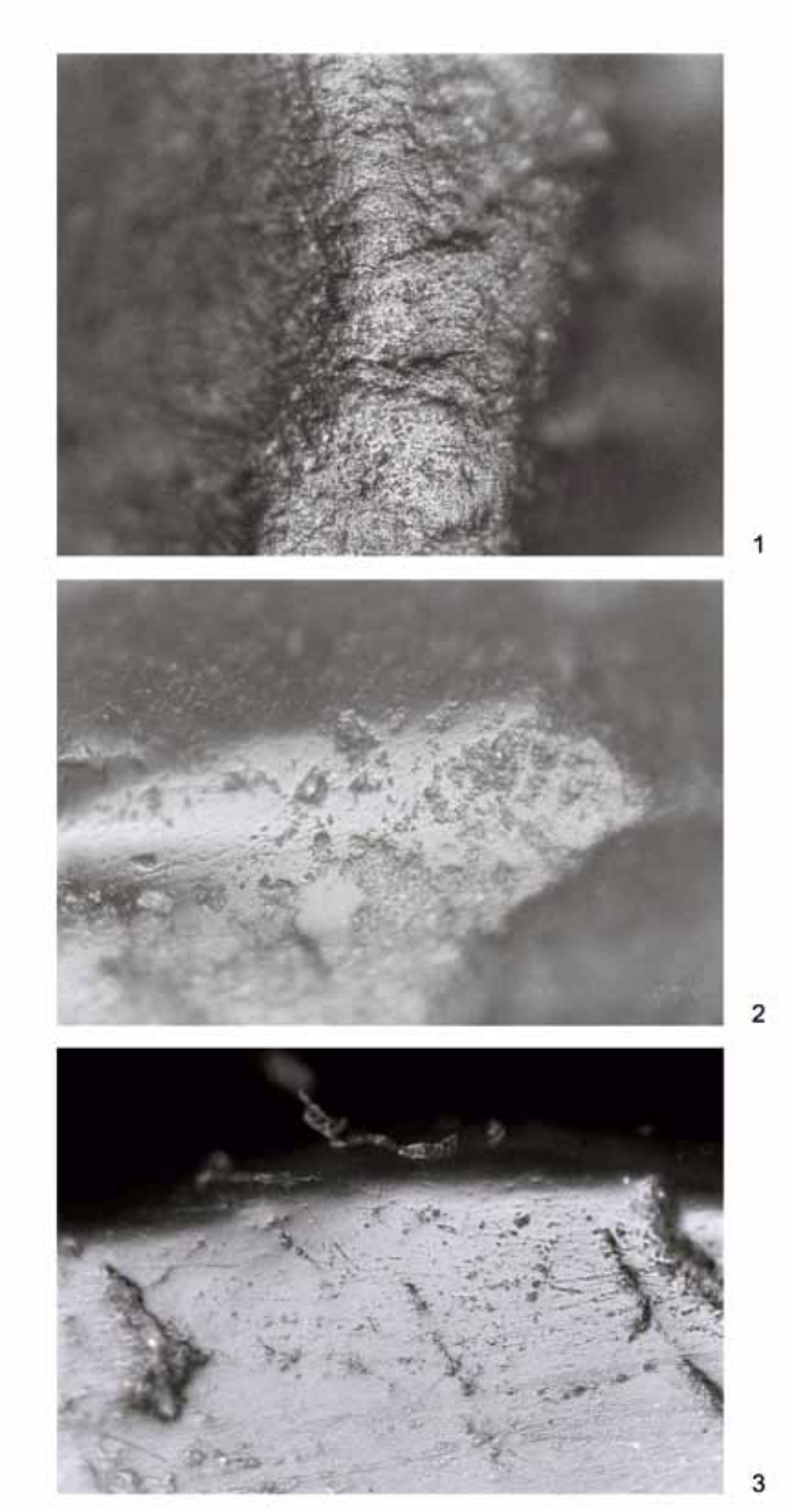


Fig. 13. Wilkostowo 23/24. Key: 1 – microscopic photography, projectile point, traces of mounting, Fig. 7: 3, magnification 200x; 2 – microscopic photography, projectile point, traces of cutting cereals on the surface of the projectile point, Fig. 7: 4, magnification 200x;
3 – microscopic photography, truncated blade, traces of cutting cereals,
Fig. 7: 5, magnification 200x.

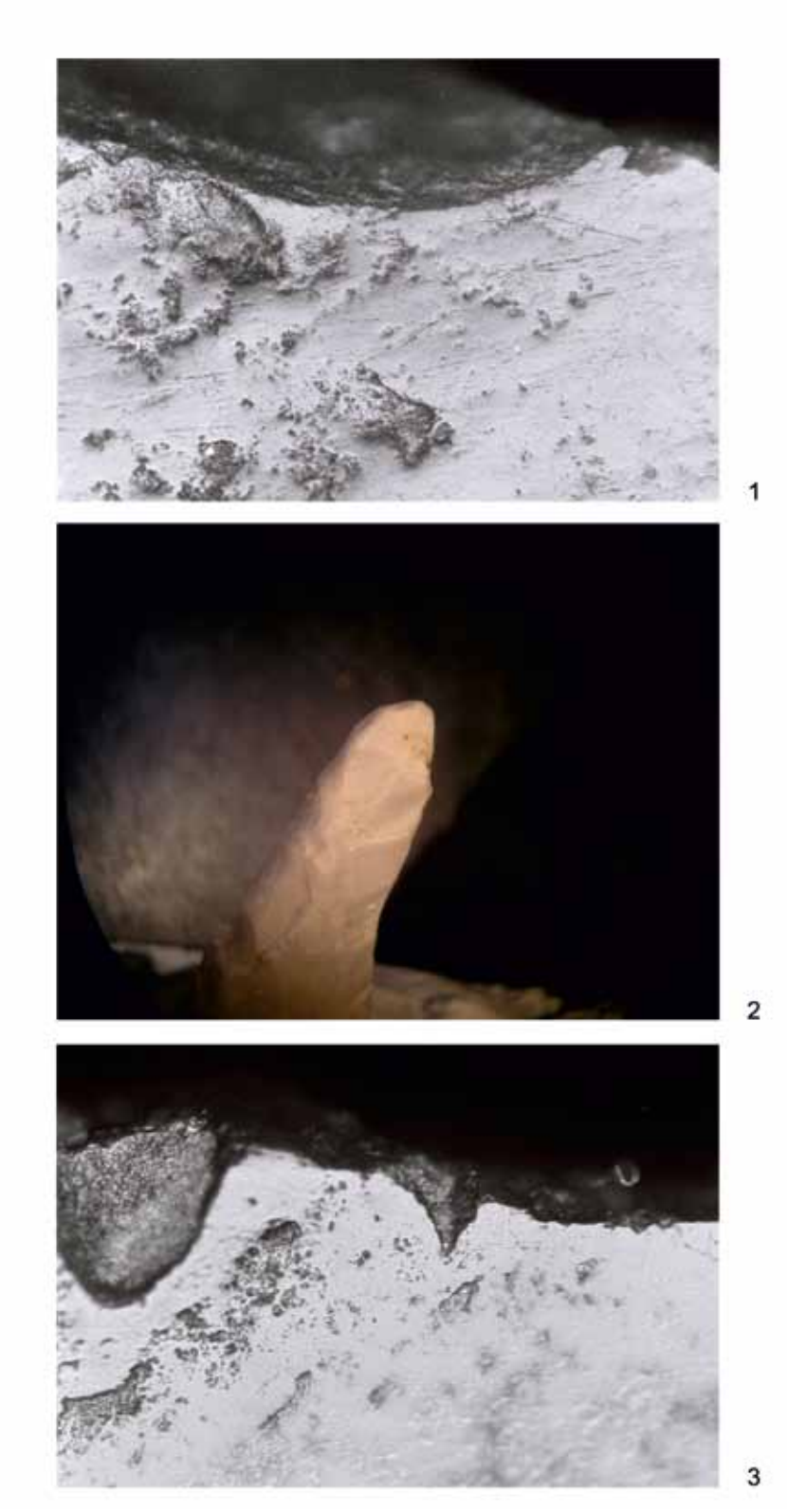


Fig. 14. Wilkostowo 23/24. Key: 1 – microscopic photography, truncated blade, traces of cutting cereals, Fig. 7: 9, magnification 200x; 2 – macroscopic photography, borer, Fig. 7: 14, magnification 200x; 3 – microscopic photography, macro-blade with continuous retouch, traces of cutting cereals, Fig. 8: 4, magnification 200x.

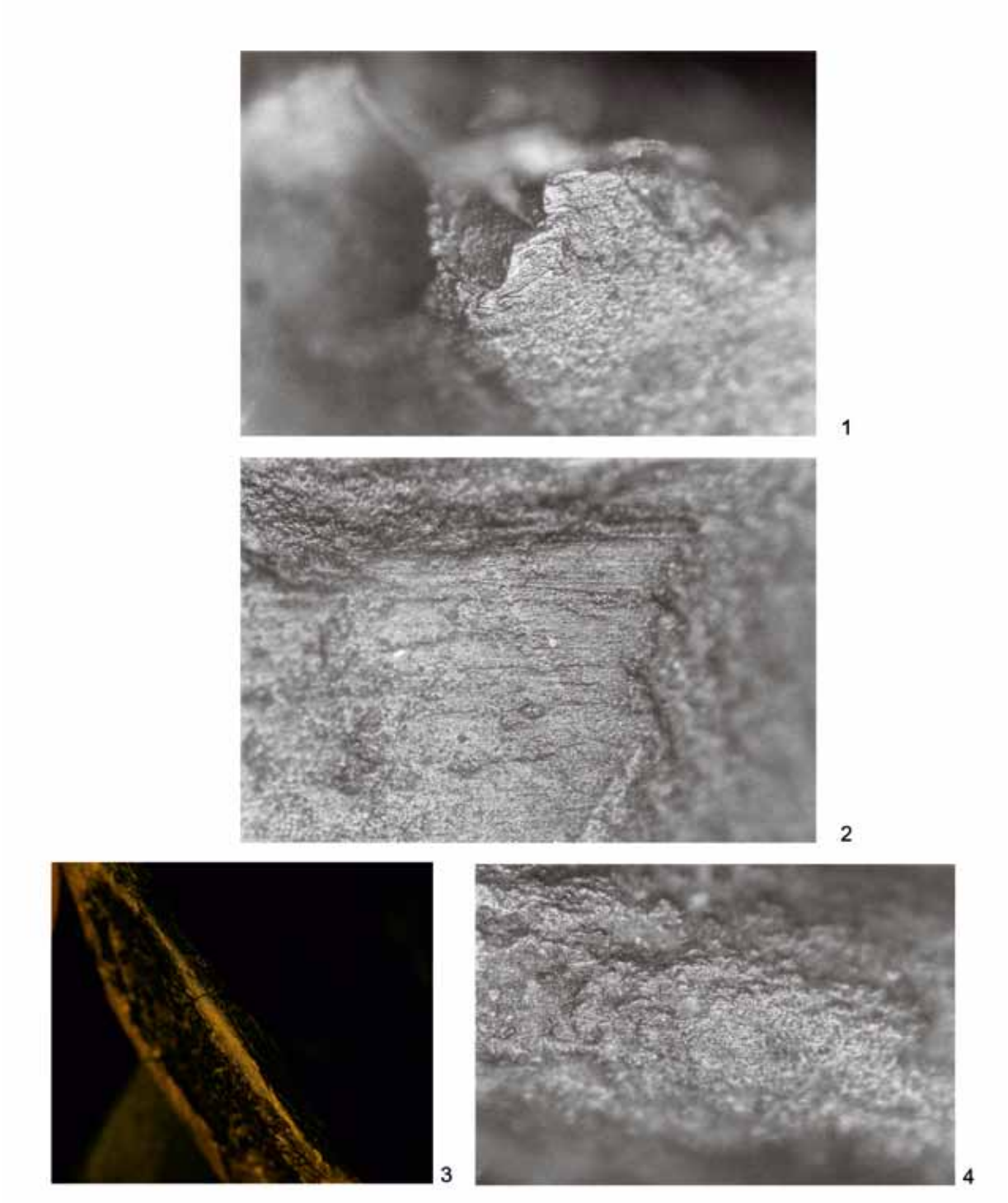


Fig. 15. Wilkostowo 23/24. Key: 1 – microscopic photography, splintered flake with use retouch, traces of cutting bones, Fig. 10: 5, magnification 200x; 2 – microscopic photography, flake with use retouch, traces of processing inorganic material, Fig. 10: 6, magnification 200x;
3 – macroscopic photography, chunk with negative scar, traces of polishing of inorganic material, Fig. 11: 14, magnification 200x;
4 – microscopic photography, chunk with negative scar, traces of polishing of inorganic material, Fig. 11: 14, magnification 200x.

REFERENCES

Domańska L.
2015 Flint materials. In: S. Rzepecki, *Wilkostowo 23/24. A Neolithic Settlement in Kuyavia, Poland, c. 3500 BC* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 15). Kraków--Bonn, 287-322.

Domańska L., Wąs M.
2006 Mezolityczne obozowisko łowieckie ze stanowiska Dąbrowa Biskupia 71, woj. kujawsko-pomorskie. In: K. Szymczak, M. Przeździecki (eds.), *In Memoriam Valdemari Chmielewski. Księga poświęcona pamięci profesora Waldemara Chmielewskiego*. Warszawa, 179-190.
2007 Dąbrowa Biskupia, site 71. New data for evidence of the Mesolithic specialized camps. In: M. Masojć, T. Płonka, B. Ginter , S.K. Kozłowski (eds.), *Contributions to the Central European Stone Age. Papers dedicated to the late Professor Zbigniew Bagniewski*. Wrocław, 143-154.

Fischer A.
1989 Hunting with flint-tipped arrows: results and experiences from practical experiments. In: C. Bonsall (ed.), *The Mesolithic in Europe*. Edinburgh, 29-39.

Fischer A., Hansen P. V., Rasmussen P.
1984 Macro and microwear traces on lithic projectile points. Experimental results and prehistoric samples. *Journal of Danish Archaeology* 3, 19-46.

Hardy B.L., Svoboda J.A.
2009 Mesolithic stone tool function and site types in Northern Bohemia, Czech Republic. In: M. Haslam, G. Robertson, A. Crowther, S. Nu-

gent, L. Kirkwood (eds.), *Archaeological science under a microscope. Studies in Residue and ancient DNA Analysis in Honour of Thomas H. Loy* (= *Terra Australis* 30). Canberra, 159-174.

Keeley L.H.
1980 *Experimental determination of stone tool uses: A microwear analyses*. Chicago and London.

Rots V.
2003 Towards an understanding of hafting: the macro and microscopic evidence. *Antiquity* 77, 805-815.
2010 *Prehension and hafting traces on flint tools. A methodology*. Leuven.

Rzepecki S.
2015 *Wilkostowo 23/24. A Neolithic Settlement in Kuyavia, Poland, c. 3500 BC* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 15). Kraków-Bonn.

Winiarska-Kabacińska M.
2004 Analiza funkcjonalna inwentarza krzemiennego. In: J. Kabaciński, I. Sobkowiak-Tabaka (eds.), *Komorniki. Chata ludności kultury pucharów lejkowatych*. Poznań, 42-45.
2007 Dąbrowa Biskupia 71: Mesolithic hunter's camp? In: M. Masojć, T. Płonka, B. Ginter, S. K. Kozłowski (eds.), *Contributions to the Central European Stone Age. Papers dedicated to the late Professor Zbigniew Bagniewski*. Wrocław, 155-162.
2010 Analiza funkcjonalna materiałów krzemiennych ze stanowisk kultury pucharów lejkowatych i kultury amfor kulistych z terenu kotliny Toruńsko-Bydgoskiej. *Fontes Archaeologici Posnaniensis* 46, 193-219.
2015 Results of microwear analysis of flint artefacts. In: S. Rzepecki, *Wilkostowo 23/24. A Neolithic Settlement in Kuyavia, Poland, c. 3500 BC* (= *Studien zur Archäologie in Ostmitteleuropa/Studia nad Pradziejami Europy Środkowej* 15). Kraków-Bonn, 323-336.

Appendix 2

Katarzyna Pyżewicz

Microwear analyses of the selected flint artefacts

In order to determine the functions of Neolithic flint specimens, typological tools and intentionally unretouched debitage products characterised by modified edges being potential traces of use as well as single cores were subjected to detailed microscopic analyses. The products were obtained from six Neolithic sites connected with the Linear Band Pottery culture (Grabie 4, Przybranowo 3, Podgaj 32, Chlewiska 132) and the Funnel Beaker culture (Poczałkowo 38 and Przybranówek 43) occupation. As a result of the conducted analyses, an attempt was made to show similarities and differences between the inventories regarding the use of particular types of artefacts made of different variants of flint.

Method

In the course of microscopic analyses of tools exploitation traces, standard instruments were used. The analyses were conducted by the Nikon LV150 metallographic microscope, suitable to work in reflected light, enabling magnification range from 50x to 500x. In order to clean the flint surfaces, detergent with hot water and acetone were used. The artefacts were examined at the magnification of 50, 100, or 200x enabling a detailed identification of the specific traces – micro-flake scars, scratches, and polishes (cf. i.a. L.H. Keeley 1980). An interpretation of the obtained microscopic picture of the Neolithic products surfaces was made on the grounds of the results of the experimental research carried out in the previous years by the author of the study, and with reference to literature. A detailed description of the observed changes of flint surfaces that occurred as a result of the following factors of individual artefacts is

presented further below: post-depositional (cf. i.a. H. Plisson, M. Mauger 1988; A.L. Van Gijn 1990, 51-53; J. Kamińska, K. Szymczak 1994; I. Levi Sala 1993; 1996; D. Burroni, R. Donahue, E. Pollard 2002; J. Kamińska-Szymczak 2008), technological (J.J. Ibánez, J.E. Gonzáles, M.A. Lagüera, C. Gutièrrez 1990; J.M. Vergès, O. Andreu 2011) and usage (cf. i.a. L.H. Keeley 1980; E. Moss 1983; P.C. Vaughan 1985; P. Anderson-Gerfaud 1988; H. Juel Jensen 1988; 1994; G.F. Korobkowa 1999; J. Małecka-Kukawka 2001; V. Rots 2003; 2008; 2010; K. Pyżewicz 2013).

1. Flint materials from the sites of the Linear Band Pottery culture

Chlewiska 132, Dąbrowa Biskupia commune

Detailed microscopic analyses included 35 flint artefacts. Part of them underwent the devastating impacts of the post-depositional factors – their surfaces were covered with shiny patina, which inconsiderably impeded an interpretation of the microscopic picture. Additionally, single products were overheated and thus it was impossible to identify any potential traces of use.

A few products were used as harvesting insets – these were fragments of blades and truncated blades. These tools were characterized by intensive sheen, considerably overlapping the inner surfaces and use-related micro-flake scars. Moreover, the linear traces running diagonally or perpendicularly to the cutting edge were observed. The extent of polished surfaces suggests that usually only top parts, triangular in the outline, protruded beyond the haft (in such cases, the linear traces were running diagonally to the cutting edge) and sometimes, additionally, the micro-traces spread further along the other edge parts (in such cases they were accompanied by parallel scratch marks).

In the group of harvesting insets, there was one specimen made of Świeciechów flint (Fig. 1: 8; 2: 1). Most probably, this product was repositioned in the haft during its use, which is suggested by the location of some microscopic traces on two opposite sides of the product. On the remaining, unpolished during the use surface, some abrasions of the ridges – which probably occurred as a result of keeping the specimen in a haft made of hard, organic raw material, were registered. Also, truncated blade (Fig. 1: 1; 2: 2-3), blade with polish (Fig. 1: 10; 2: 4) and flake with use retouch (Fig. 1: 7; 2: 5-6) of chocolate flint as well as two specimens of Baltic flint: a borer (Fig. 3: 1-2) and a truncated blade (Fig. 1: 2; 3: 3) were used to cut the crops.

The proximal end of a blade with use retouch made of Baltic flint should be connected with another type of plant treatment (Fig. 1: 6).

Most probably, this specimen was broken during its use. It is characterized by delicate use-related retouch and sheen occurring along the lateral edge. The linear traces preserved within the sheen indicate performing movements diagonal to the cutting edge (e.g. splitting the plant fibres). The poorly visible traces of use connected with plant treatment were registered along the lateral edge of another truncated blade made of chocolate flint (Fig. 1: 3).

Some of the identified tools were used for soft tissue treatment. One of them –retouched blade – was characterized by traces connected with skin processing (Fig. 1: 9; 3: 4), both scraping and cutting. It is indicated by the transverse and longitudinal location of use-related scratch marks towards the cutting edge. Also, another specimen – a micro-retouched flake shows some traces of skin processing (Fig. 1: 5; 3: 5). These traces intensively occur mainly along the preserved part of one of the lateral edges. What is more, the observed traces of linear character indicated that the specimen was used as a knife. Both described artefacts were made of Baltic flint.

A blade with use retouch made of chocolate flint was used for animal carcass treatment (Fig. 1: 11; 3: 6). This tool shows traces of soft tissue cutting. Moreover, sheen on the protruding parts, being probably an effect of contact with bones/antler, was observed. Some use-related changes are located along one, longer lateral edge.

Grabie 4, Aleksandrów Kujawski commune

38 specimens were submitted to microscopic analyses from among flint materials obtained at the site Grabie 4. Most of them were characterised by evident post-depositional deformations impeding microwear analyses. Only single artefacts were covered with more intensive patina or were submitted to thermal factors operation, which fundamentally influenced the possibility of their interpretation in terms of the use.

As a result of the undertaken research, an inset for crop cutting was identified. For this purpose, a relatively small truncated blade of Baltic flint (Fig. 4: 2; 5: 2) was used. Its surface of use has a triangular outline, whereas the remaining part of this product is characterized by abrasions and small sheen that occurred probably during keeping the specimen in a haft. Another specimen of Baltic flint, defined as a double truncated blade, was used for plant treatment. Microscopic traces on this tool are limited to the edge part, which may suggest not too intensive use of it (Fig. 4: 5; 5: 1). On the remaining surface, smoothing and delicate sheen on protruding parts, mainly ridges – probably connected with the use of a haft made of hard organic material, were observed.

Blade with use retouch made of Jurassic flint (Fig. 4: 13; 5: 3) and another specimen made of Baltic flint (Fig. 4: 12) were used for works

connected with plant or wood processing. Sheen on these specimens was observed in the mesial part of one of the longer sides. Linear traces are arranged perpendicularly to lateral edges, which suggests that these products were used for activities connected with scratching/planning or splitting the raw material.

In the group of artefacts obtained from the site of Grabie 4, tools for processing animal carcass were most numerous.

One of the truncated blades of Baltic flint revealed some traces of contact with skin (Fig. 4: 9). The location of the use-related sheen and the morphology of the product itself suggest that this specimen served as a cutting tool. Similar function was probably performed by three other artefacts – a truncated blade (Fig. 4: 1; 5: 4), and the mesial part of a blade with use retouch (Fig. 4: 10), both made of Jurassic flint, as well as retouched blade made of Baltic flint (Fig. 4: 14). Along their cutting edges, a tiny use-related crumbling and sheen are visible – developed during cutting skin or meat. Moreover, tiny spots of sheen were observed; they probably resulted from the contact of the tool with antlers/bones.

To scrape skin, typological end-scrapers made of Jurassic flint (Fig. 4: 4, 6) and truncated blade (Fig. 4: 8) were used. What was registered on the surfaces of the end-scraper fronts of the specimens was not too intensive, use-related sheen that occurred mainly on the protruding parts of the retouch scars.

One of the specimens from the discussed inventory may be considered an element of throwing weapons. Such a function can be assigned to the doubled truncated blade. On the edges of this specimen, an impacts were observed from which linear traces situated at a slight slant to the edge come away (Fig. 4: 3; 5: 5). These deformations suggest that the study tool might have been used as an projectile point, and was set the unretouched edge upwards.

On two retouched flakes (Fig. 4: 7, 11) sheen was observed – it resulted from contact with organic raw material. The sheen is not characteristic and therefore it cannot be precisely determined which actions were performed with their use. One of the mentioned flakes (a specimen of Baltic flint) is characterised by the traces of contact with an undetermined organic material, as well as some traces of antler/bones processing. Traces of this type occur on protruding parts of intentionally retouched edges.

Podgaj 32, Aleksandrów Kujawski commune

Nine flint artefacts were submitted to microscopic analyses. Their surfaces were characterized by relatively intensive post-depositional deformations in the form of shiny patina. Traces of usage were only registered on three specimens.

On a small retouched flake, sheen along its whole circumference was registered (Fig. 6: 2). It was a result of organic raw material processing. The effects of post-depositional factors precluded a further clarification as for the character activity it was used for.

A single platform core, after exploitation, was transformed into a tool which was used for striking fire (Fig. 6: 3-6). Intensive traces of use are localised on the edge between the platform and the flaking surface. This edge was strongly smoothed, moreover, clear sheen is visible. Within this sheen, numerous groups of linear traces indicating repeatedly taken actions of striking were observed. This specimen was most probably set in or kept in a sheath made of soft organic raw material. It is indicated by a number of abrasions and sheen on the edges of the earlier removed blades.

On the last product – an inset fragment, no microscopic traces of use were identified. Nevertheless, macroscopic fracture of the specimen – an impact with hinged end – suggests the use of the specimen as a projectile point of throwing weapon (Fig. 6: 1).

Przybranowo 3, Aleksandrów Kujawski commune

116 products were subjected to an analysis, among them blades and flakes prevailed. Only a few of them were covered with microscopic functional traces. The examined specimens were not significantly post-depositionally modified, only part of them were characterized by more intensive glossy patina (e.g. part of the end-scrapers) or deformations caused by burning or overheating.

Two truncated blades (Fig. 7: 3, 5; 8: 1-2, 4) and the mesial part of a blade (Fig. 8: 3; 9: 1) were used as harvesting insets. The described specimens were produced from chocolate flint. Intensive sheen covers a part of the surface forming a triangular outline in all the presented cases. Moreover, linear traces located longitudinally along the cutting edge were registered. Other, unpolished parts of tools were probably set in an organic socket.

One of the micro-retouched blades of chocolate flint (Fig. 7: 8) was used to process harder organic raw material – probably wood or antler/bones. On a fragment of the lower edge of this specimen retouch, scars and use-related sheen are visible.

Another truncated blade of chocolate flint most probably performed a double function. On one edge, just beneath the truncation, slight traces of cutting plants preserved (Fig. 7: 2; 9: 3), whereas on the retouched surface, delicate polishes that probably occurred during skin processing are visible. This tool was most probably originally used as an inset, and then, after re-retouching the specimen was used to scraping skin.

Five blades with use retouch of chocolate flint characterized by traces of the contact with skin can be connected with animal carcass treat-

ment (Fig. 7: 10-11, 13). These specimens most probably served as knives for cutting soft tissue (skin/flesh).

Another blade with use retouch of analogous morphology was of similar use (Fig. 7: 9). Along its lateral edges, tiny use-related retouch and sheen resulting from soft tissue treatment were observed. On the tool, also single spots of sheen localised on protruding parts of edges were registered. They are effects of the specimen's contact with bones/antler. These features correspond to tools used for butchering activities.

Sheen resulted from the contact with skin was observed on the edges of a fragment of a blade with use retouch made of Baltic flint (Fig. 7: 1; 9: 2). In this case the preserved linear traces, transverse to the cutting edge, suggest that this blade was used to perform some scraping activities. Also, end-scraper (Fig. 7: 1) and retouched flake (Fig. 7: 6) were used as functional scrapers. Traces that indicate such a function were registered on the part covered with intentional retouch. Most probably, also a truncated blade of chocolate flint was used for both above mentioned purposes. Sheen and use-related micro-flake scars are visible along both lateral edges of this specimen, as well as on retouched truncation (Fig. 7: 4; 9: 4).

Whereas, at the proximal end of a massive blade covered with cortex, specific traces of work were observed (Fig. 7: 12). Both cortical edges of this specimen were blunted, most probably as a result of rubbing against hard raw material (mineral). Unfortunately, due to specificity of the raw material (lime cortex) a detailed identification of the performed action is impossible.

On two other fragments of blades of chocolate flint, uncharacteristic traces of use extending along the longer edges of the mentioned specimens, were registered. The function of these tools is unclear.

Discussion

Summarising the results of the analyses from individual sites, it should be acknowledged that a large part of specimens from the site of Grabie 4 is not characterized by any traces of use, only few products present functional micro-traces, usually not in a developed form, which might suggest their not intensive use. As a result of the research, the most numerous group is represented by tools used for animal carcass treatment (skin scraping and butchering activities), moreover, single harvesting insets, blades used during herbaceous plants/wood processing and a projectile point were distinguished.

On the other hand, in the inventory from the site of Chlewiska 132, a number of harvesting insets, single tools connected with other type of herbaceous plants treatment, as well as a few products for leather scraping and cutting animal carcass were registered.

The smallest number of tools was registered among the materials from Podgaj 32 – a core transformed to strike-a-light, an arrowhead and an undetermined flake tool. Other specimens did not show preserved traces of use.

Among the tools from the site of Przybranowo 3, most numerous were the ones which were used in activities connected with animal carcass treatment, including those serving as knives or scrapers. Only single products served as harvesting insets.

2. Flint materials from the sites of the Funnel Beaker culture

Początkowo 38, Aleksandrów Kujawski commune

63 specimens obtained from the site of Początkowo 38 were subjected to detailed use-wear analyses. Only on a few products traces of use were identified. It is probably caused by, among other things, an activity of post-depositional factors. A number of artefacts were covered with intensive patina, furthermore – part of the micro-flake scars should be considered an effect of the natural factors activity. Both types of deformation destroyed the potential traces of use.

Among the analyzed products, splintered pieces were relatively numerous. On these specimens, despite a lack of destruction by post-depositional factors, no traces of use were registered.

A retouched macro-blade with continuous retouch of Volhynian flint can be connected with plant treatment. Along one of the retouched edges, traces of use are visible – not large edge sheen (Fig. 10: 6; 11: 1). Whereas, the other side is covered with clear sheen resulting from the contact with a haft made of soft raw material – skin (Fig. 11: 3). The intensity of setting traces in reference to delicate signs of use suggests that the cutting edge might have been transformed during the successive stages of its use.

Another specimen, a fragment of retouched flake of Baltic flint, was also used for plant processing but in a bit different way. A use-related crumbling, the linear traces situated transversely towards the cutting edge and the edge sheen are located on the convex, mesial part of one of the artefact sides (Fig. 10: 7; 11: 2). The location and morphology of the micro-traces indicate that wood scraping/planing activities were most probably performed with the use of this flake.

Three projectile points show preserved traces of use. The first of them has a top fractured in a specific way (impact with hinged end), which testifies the fact that the product was set off and hit the target. Slightly above the mesial part of the specimen, the border of the haft is

visible. Moreover, clear abrasions and sheen on the ridges and lateral edges of the specimen were recorded (Fig. 10: 2; 11: 4). This part of the point probably was set in the shaft. Another projectile point (Fig. 10: 1) is not characterized by any macroscopic fractures, whereas its surface is characteristic of abrasions and sheen on the protruding parts (ridges and lateral edges). The location and morphology of the sheen suggest keeping the specimen, probably, in a container made of soft organic raw material (e.g. in a pouch or quiver). The third projectile point (Fig. 10: 3) was broken at its distal end (an impact with step ending is visible) as well as at the tang (transversal fracture from which the impact scars come away). Both types of fractures are characteristic of the forms used as elements of throwing weapons. On one of the surfaces of the described projectile point, some linear traces are noticeable. However, it should be emphasized that this product was deformed under the influence of temperature, therefore an interpretation of microscopic traces was considerably hindered.

Problems in functional interpretation were also caused by two other specimens, that is a retouched blade (Fig. 10: 5) and a typological end--scraper (Fig. 10: 4). Both specimens were made of Baltic flint. Along their retouched edges there are traces indicating their use for skin processing. However, due to the fact that the specimens were covered with shiny patina, a detailed analysis of these traces is hindered.

Przybranówek 43, Aleksandrów Kujawski commune

In the course of microwear analyses of the flint materials coming from the site of Przybranówek 43, the artefacts obtained from huts: 1 (45 items), 2 (21 items), 3 (21 items), 4 (11 items), and 5 (20 items) were analyzed. In most cases, these products did not show considerable post-depositional traces, only in the cases of huts 3 and 5, the surfaces covered with more intensive shiny patina (significantly hindering the analyses) were relatively more often registered. Single specimens were also overheated or burnt.

House 1

The most numerous group of artefacts is constituted by harvesting insets. These are mostly truncated blades of chocolate flint, differentiated in morphological and metrical terms. Usually, the polished parts of the described tools form a triangular outline and are located at the distal end, considerably overlapping the internal parts (Fig. 12: 4, 6, 8, 10; 14: 1-5). Only in one case, the sheen spreads along the whole lateral edge (Fig. 12: 5; 14: 6). In the case of two specimens, sheen of plant provenance occurred at the proximal end parts (Fig. 12: 7; 13: 11; 15: 1-2). The preserved linear traces are parallel to the cutting edges.

One more specimen should be associated with plant processing – a typological end-scraper made of chocolate flint. In the mesial part of the lateral edge – sheen, which is an effect of herbaceous plants processing or intensive wood processing, was identified (Fig. 12: 1; 15: 3). Linear traces occurring within the sheen suggest that scratching/planing or splitting the raw material movements were made with the use of this tool.

To cut soft tissue, a blade with use retouch made of chocolate flint was used. Along its both edges, sheen resulted from the contact with skin spread (Fig. 13: 13; 15: 4). Similar traces were observed on the preserved fragment of retouched blade of chocolate flint (Fig. 13: 7). Along both intentionally retouched edges, sheen similar to this which occurs as a result of the contact with skin is visible. Within the analyzed group of products, one more specimen used for soft tissue processing was identified. This product, a typological end-scraper of chocolate flint (Fig. 12: 2), is characterised by traces of skin processing located both on the surface of the end-scraper front and along one of the lateral edges.

Another artefact – micro-retouched blade of chocolate flint (Fig. 13: 8) broken in its mesial part, is characterised by difficult to determine sheen resembling animal carcass or plant processing. Preserved linear traces indicate making movements transverse to the cutting edge.

What should be considered an element of throwing weapon among the analyzed products is a truncated blade with double truncation made of chocolate flint. This specimen has a fractured longer, unretouched edge. The scar of this fracture considerably overlaps the positive surface. What is more, linear traces, visible on both surfaces, come from the fracture edge, transversely or obliquely to it. The presented signs indicate that the inset hit an undetermined target.

Moreover, micro-retouched blade with broken distal part, made of chocolate flint, characterised by unspecified micro-traces of use preserved in the bottom part of the tool was identified (Fig. 13: 9).

House 2

Among the analyzed products, four forms serving as harvesting insets were distinguished. Three of them are typological truncated blades (Fig. 12: 9, 11-12; 16: 1-2). One completely preserved specimen was made of chocolate flint. Two other were damaged and burnt, but the traces are intensive enough to be, in a bit deformed shape, still noticeable (Fig. 16: 2). The fourth specimen, characterised by harvesting sheen (Fig. 13: 15; 16: 3), is a blade with use retouch made of Baltic flint with irregular cutting edge. All the described tools present triangular outline of the polished surface – situated above the haft. The preserved linear traces are located parallel to the cutting surfaces.

Only on the surface of one blade (with regular shape, made of Baltic flint) traces connected with animal carcass treatment preserved (Fig. 13: 14). Morphology of the sheen and character of the tool indicate that this product was used for cutting soft tissue.

House 3

Likewise in case of the above described feature, among the analyzed products – mainly tools for herbaceous plants processing were distinguished. Three truncated blades of chocolate flint were used as harvesting insets. These specimens present some similarities in the location of the use-related sheen as well as the location of the linear traces (parallel to the cutting edge) in comparison with the products of the same type obtained from other huts (at the distal end, a triangular outline; Fig. 13: 1-3; 16: 4; 17: 1-2).

Another find – a massive typological perforator made of Jurassic flint is quite problematic to estimate. Along the retouched lateral edges, there are microscopic traces, morphology of which sometimes resembles signs of contact with skin, antler/bones or of plant processing (Fig. 13: 6; 18: 1).

Whereas, two micro-retouched blades (one complete and a proximal fragment) of chocolate flint probably served for animal carcass treatment. Along their edges, slight curvatures of protruding parts and sheen resulting from contact with skin were registered (Fig. 13: 12; 17: 3).

House 4

From among the presented group of specimens, three products characterised by traces of its use were distinguished. In contrast to the other objects, in this case – no harvesting insets were recorded. Instead, two typological end-scrapers (blade and flake ones), both made of chocolate flint that were used for skin treatment were identified. On the surfaces of both end-scraper fronts there is sheen of curvature scars (Fig. 12: 3, 15; 18: 2-3). Morphology and location of the traces indicate the use of the described artefacts as scraping tools. The third product – a retouched flake has unidentified traces of organic raw material processing along the whole perimeter.

House 5

In the last of the presented features, a similar set of tools as in huts 2 and 3 was identified. Three harvesting insets were distinguished. Two of them are typological truncated blades of chocolate and Baltic flints (Fig. 13: 4-5; 17: 4; 18: 4). Both specimens, likewise most of the above mentioned,

are characterized by intensive harvesting sheen covering a vast surface, triangular in the outline and situated at the distal end of the specimens. Traces of plant treatment in the case of the third inset (Fig. 12: 14; 18: 5) are distributed in a different manner – on the mesial part of the blade with use retouch made of chocolate flint. Sheen spreads along both lateral edges, slightly overlapping the inner parts. Location of the described traces suggests that the tool might have been repositioned in the haft during its use.

One of the micro-retouched blades of regular outline was used as a tool for cutting skin. Intensive traces of use (Fig. 12: 13; 18: 6) in the form of sheen resulting from contact with skin and the curvature of protruding parts, as well as some linear traces situated parallel to the cutting edge indicate soft tissue cutting.

The last product – a micro-retouched blade of chocolate flint with broken distal part (Fig. 13: 10) is characterized by an intensive use-related micro-flake scars and uncharacteristic sheen along the lateral edge. Unfortunately, the use of this tool could not be determined.

Discussion

Summarising the conducted research on the materials from Poczałkowo 38, it should be noted that most of the analyzed materials are specimens from the group of splintered exploitation. No splintered pieces were characterized by traces of use despite the fact that a large part of artefacts of this type were not covered with intensive post-depositional deformations. Therefore, it should be concluded that the examined splintered specimens were not intended as functional tools.

Whereas, in the group of specimens with traces of use there are projectile points, a retouched blade for cereal cutting and a blade for wood processing, as well as single tools for cutting and scraping skin.

The site of Przybranówek 43 yielded, first of all, harvesting insets and single specimens used for activities connected with scraping, polishing or cleaving plants, rarely tools for animal carcass treatment were registered. An exception is the group of artefacts from hut 4 where no tool serving for plant treatment was distinguished.

Conclusions

The presented results of the microscopic analyses referring to the way the flint products were used indicate that among the groups of the Linear Pottery and the Funnel Beaker cultures they were used both in the activities connected with plant and animal carcass treatment. The presented relation between the selection of individual types of products for

the manner of use, and the range of activities refer to the general knowledge on the use of flint tools by the mentioned groups inhabiting Great Poland and Kuyavia (cf. J. Małecka-Kukawka 1999; 2001, 34 and further; R. Grygiel 2004, 579-613; M. Winiarska-Kabacińska 2004; G. Osipowicz 2010, 160 and further; G. Osipowicz, H. Pomianowska, D. Makowiecki 2014, 96-101; K. Pyżewicz 2015). It should be noted that truncated blades were most often used as harvesting insets (probably, the formation of the truncations was connected with fitting the specimen to the haft), and more rarely – untransformed blade specimens were used as insets. The study tools were usually placed in the haft obliquely to their axis of symmetry. For other types of plant treatment – cleaving, scraping or polishing – blade specimens were usually used, most often intentionally unretouched ones. Functional tools of this type can be connected with the forms in the type of end-scraper or retouched blade. Traces of use registered on the given tools are predominantly located in mesial parts of one of longer edges.

Whereas, untransformed blades were used for animal carcass treatment, depending on the type of activity, sometimes they were additionally retouched and then they were usually used for cutting, while for skin scraping – products with intentionally blunted edges, mainly typological end-scrapers were used.

The above described preferences are noticeable among the societies of the Linear Pottery and the Funnel Beaker cultures. It should be added that within the materials of both units, also single elements of throwing weapons were identified. These are not big insets or, as in the case of specimens from Poczałkowo 38, flint bifacial projectile points. What is worth emphasising is one more specimen – a strike-a-fire made from core. Artefacts performing such a function are rarely registered in flint inventories connected with Neolithic groups inhabiting the area of Poland (K. Pyżewicz, P. Rozbiegalski 2012).

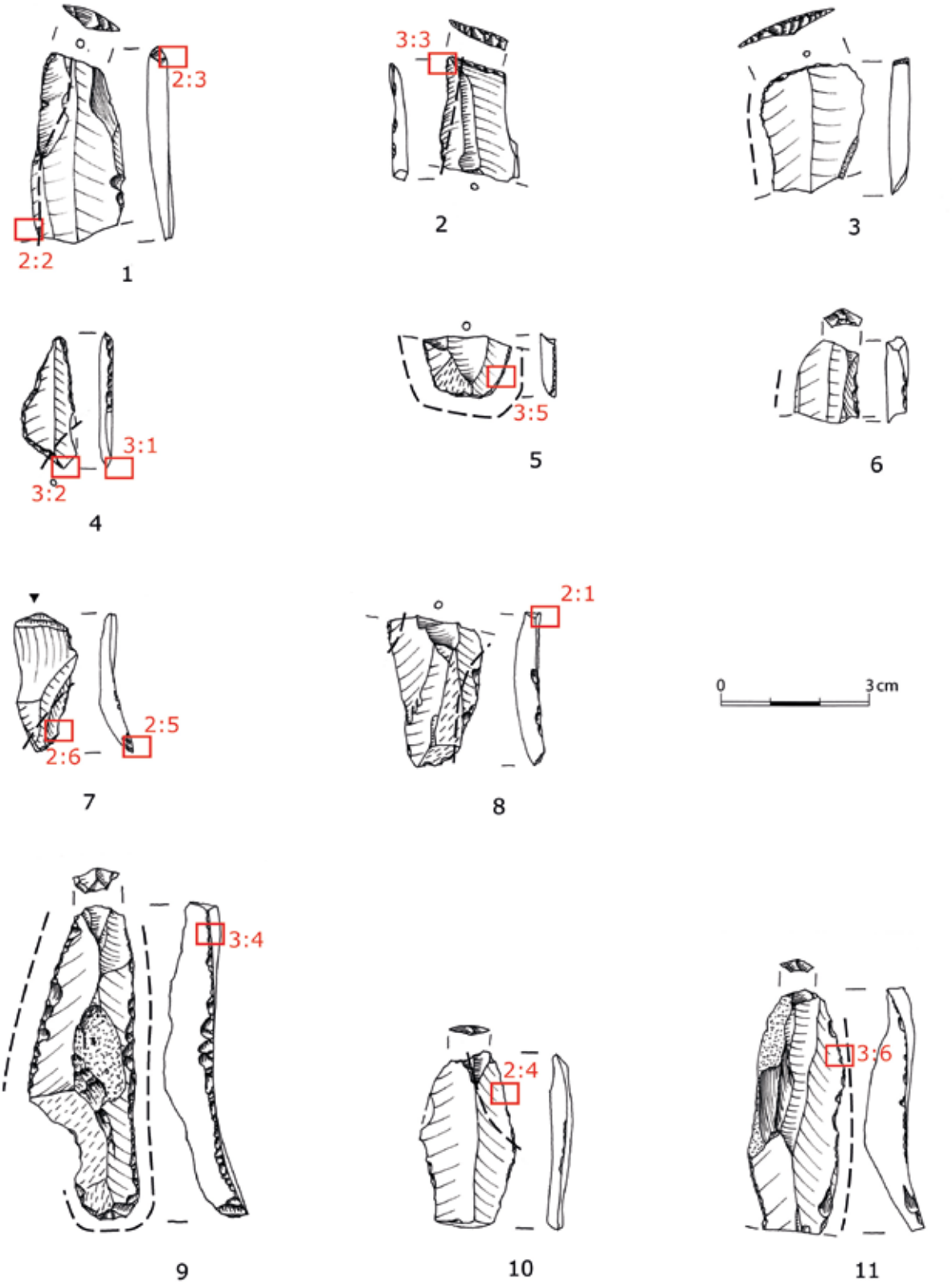


Fig. 1. Chlewiska 132. Flint tools covered with functional traces (1-11).

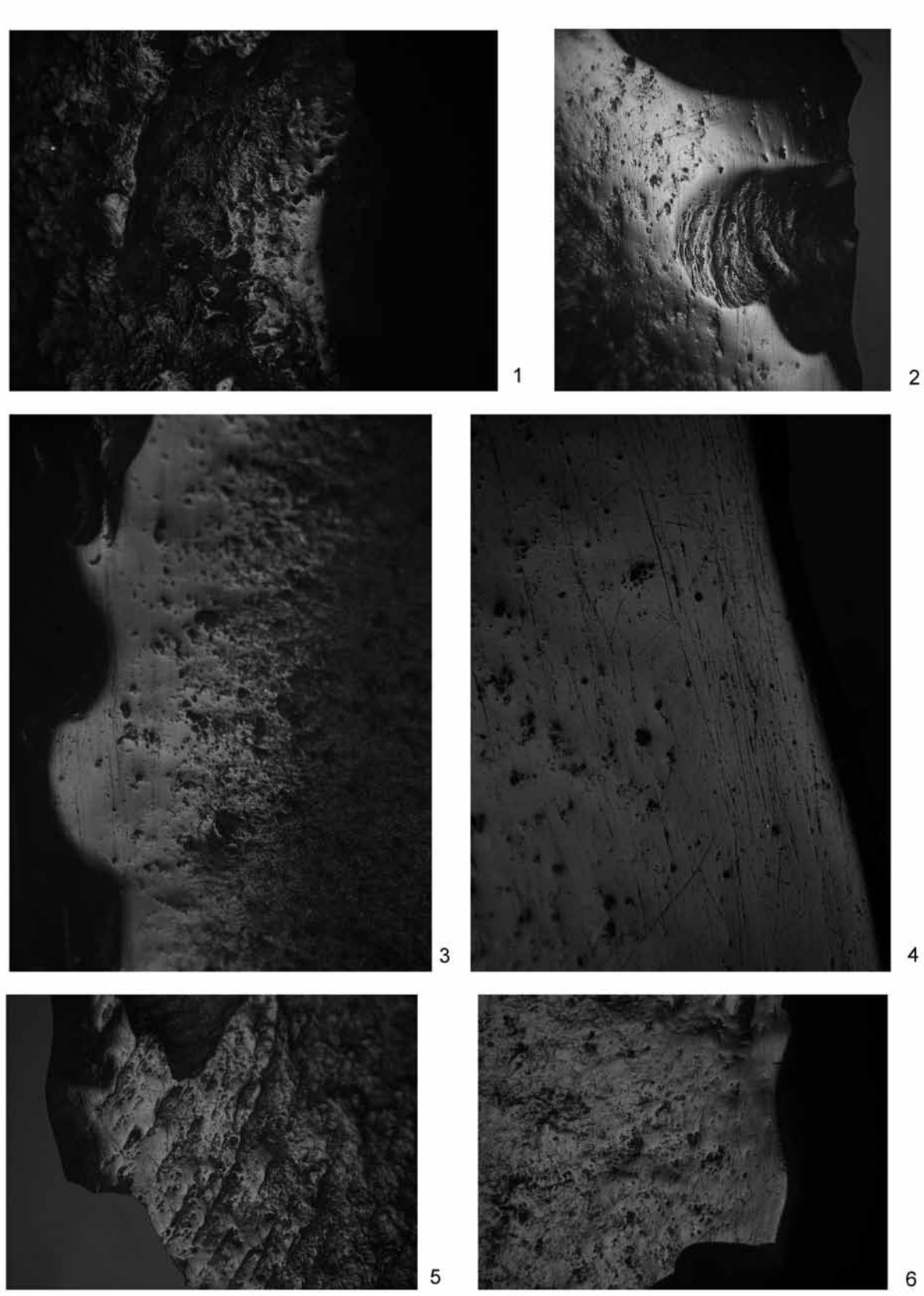


Fig. 2. Chlewiska 132.
Microwear traces. 1-4 – traces associated with the processing of siliceous plants (orig. mag. 50×).

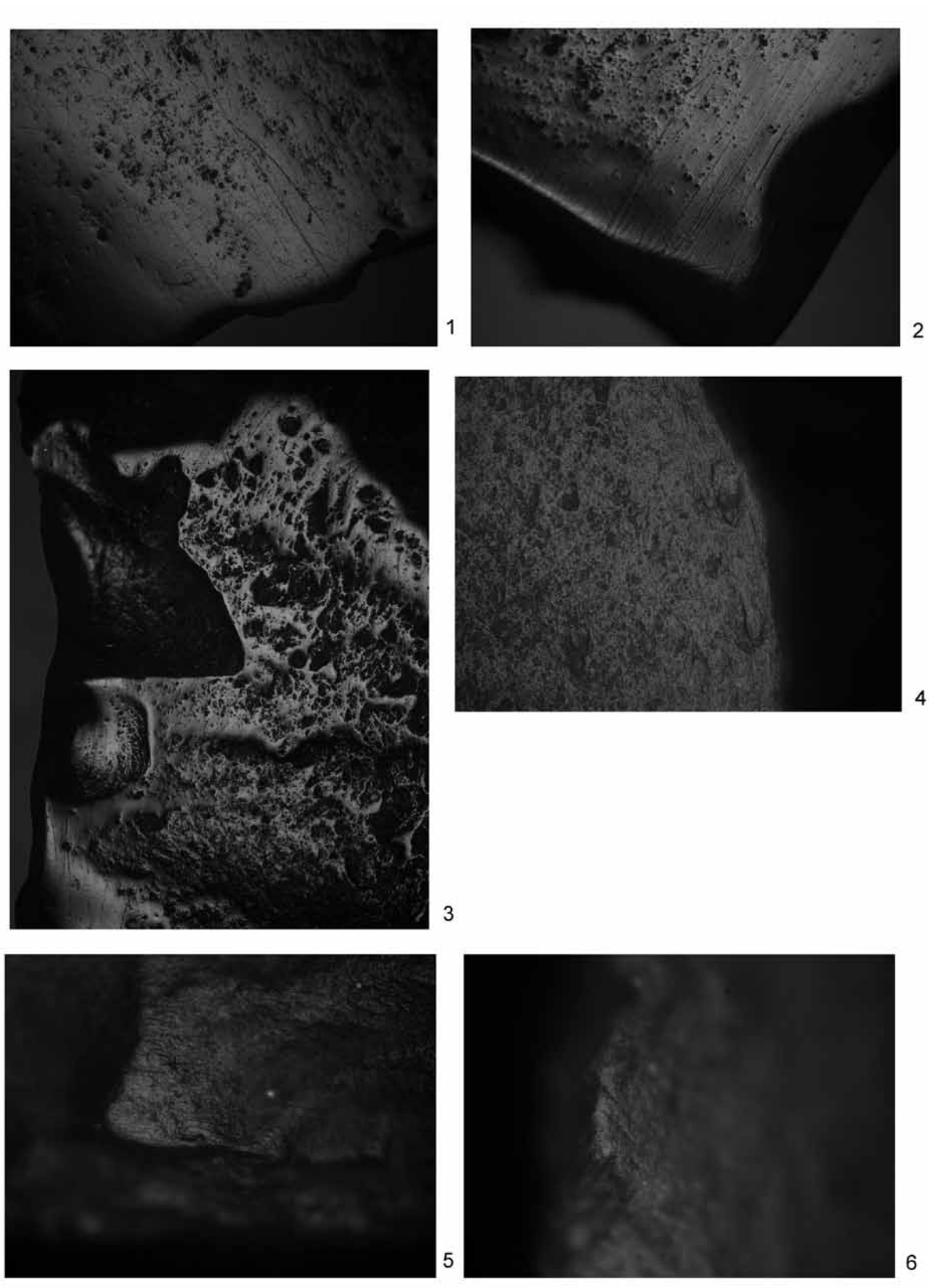


Fig. 3. Chlewiska 132. Microwear traces. 1-3 – traces associated with the processing of siliceous plants; 4-5 – traces associated with the skin processing; 6 – traces associated with the butchering activities (1-3 – orig. mag. 50×; 4-5 – orig. mag. 200×; 6 – orig. mag. 100×).

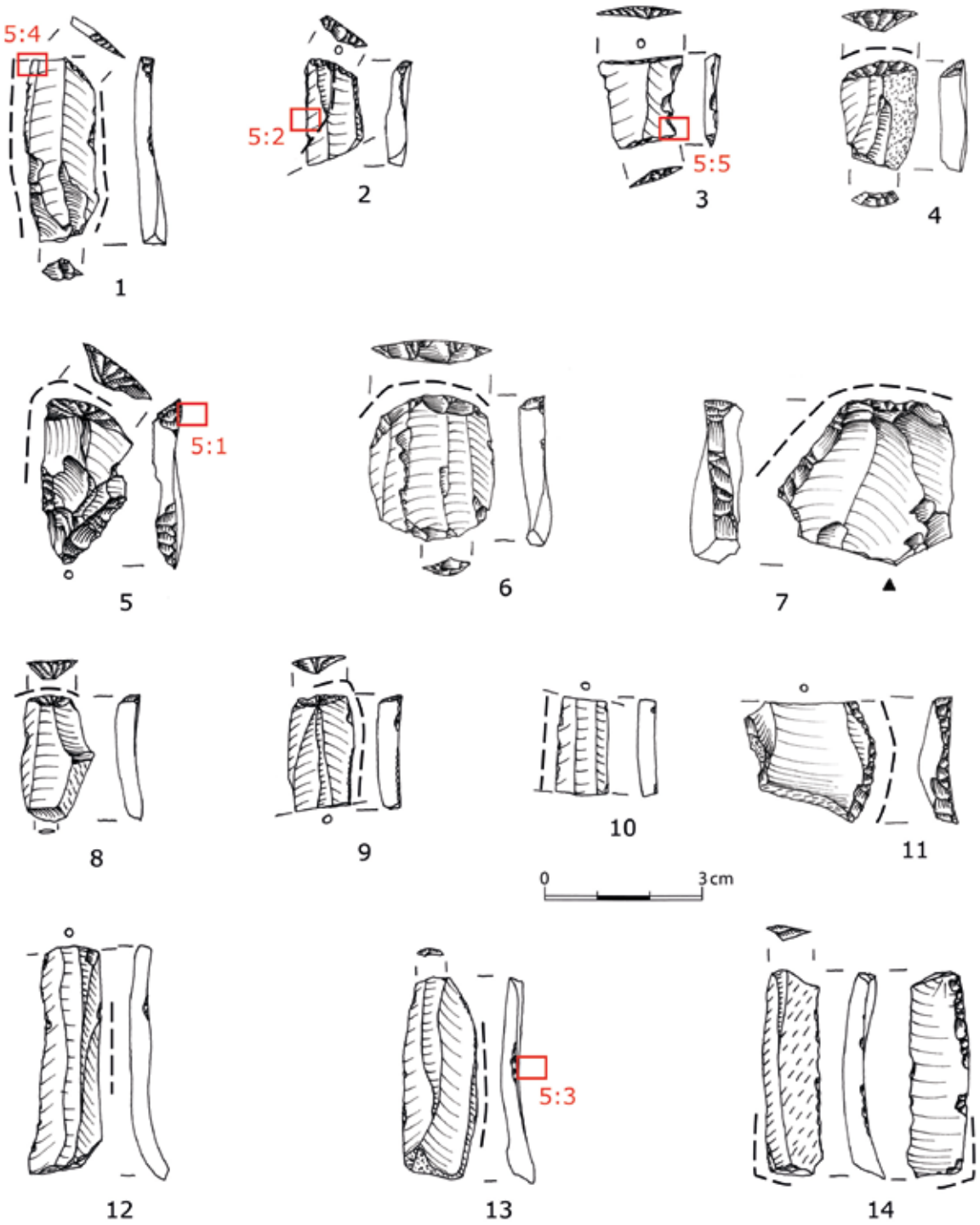


Fig. 4. Grabie 4. Flint tools covered with functional traces (1-14).

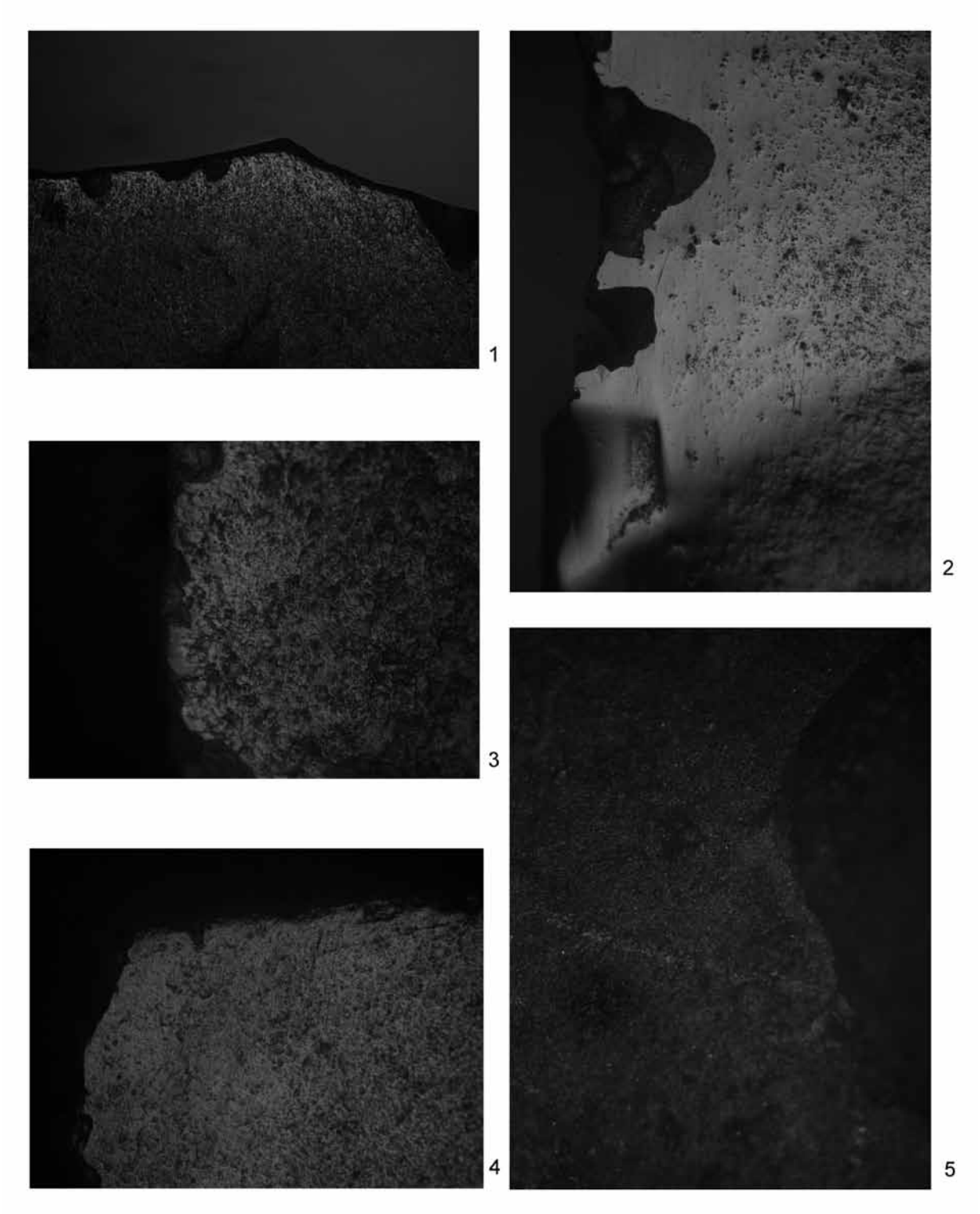


Fig. 5. Grabie 4. Microwear traces. 1-2 – traces associated with the processing of siliceous plants; 3 – traces associated with the plant or wood processing; 4 – traces associated with the skin processing; traces of use of the artefact as projectile point (1-2, 5 – orig. mag. 50×; 3-4 – orig. mag. 100×).

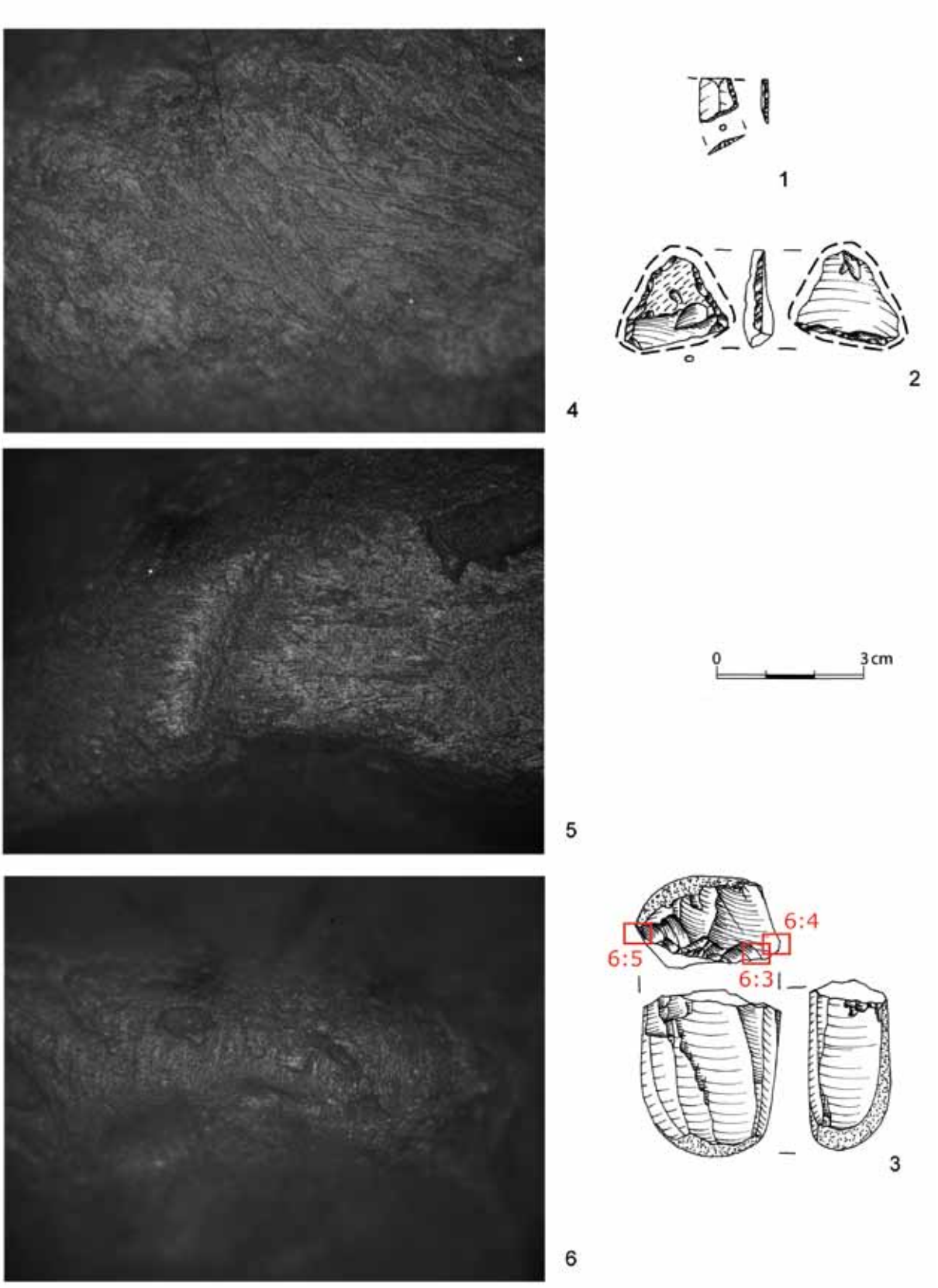


Fig. 6. Podgaj 32. Flint tools covered with functional traces (1-3).
Microwear traces. Traces of use of the artefact for striking a fire (4 – orig. mag. 100×; 5-6 – orig. mag. 50×).

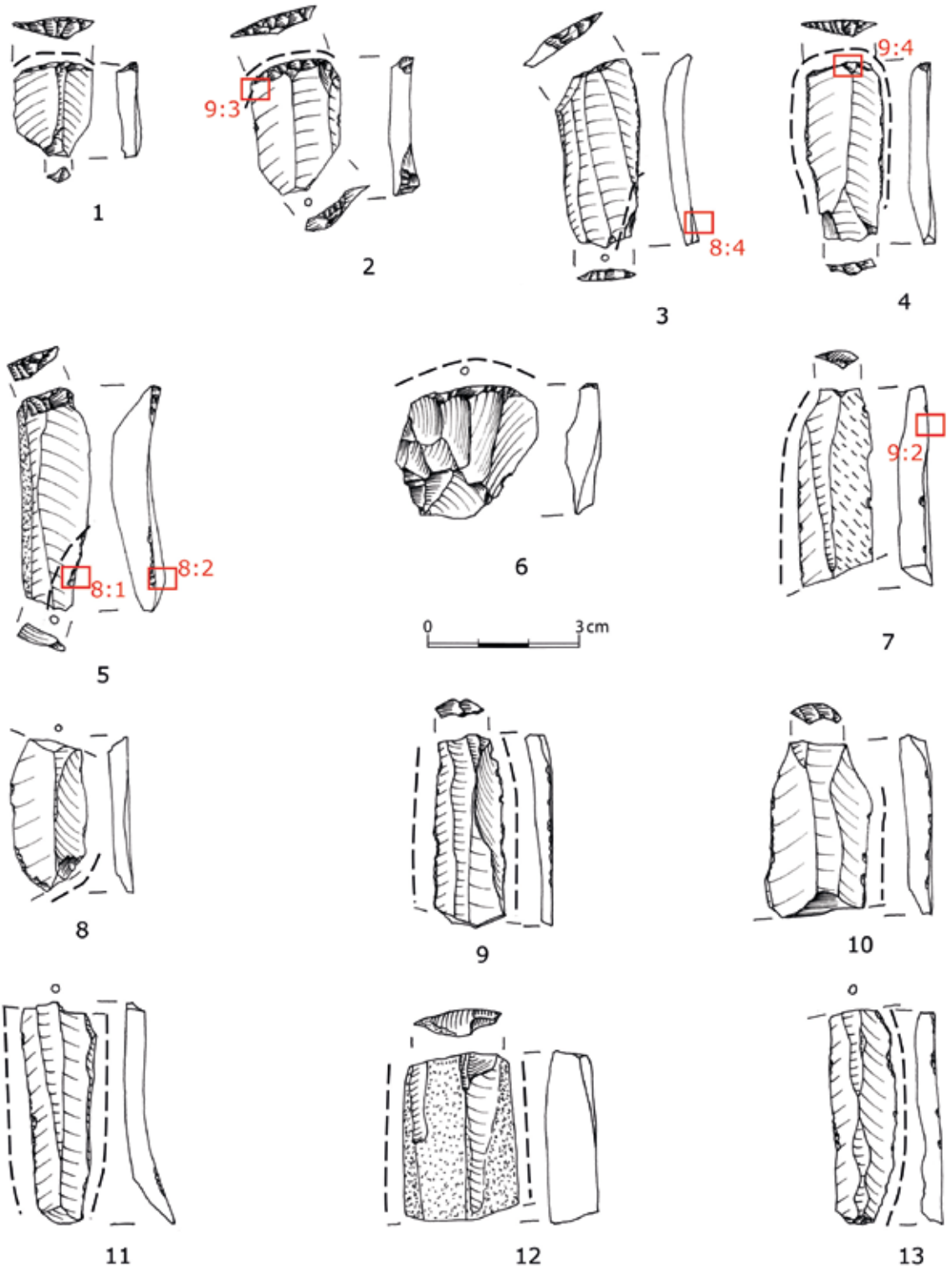


Fig. 7. Przybranowo 3. Flint tools covered with functional traces (1-13).

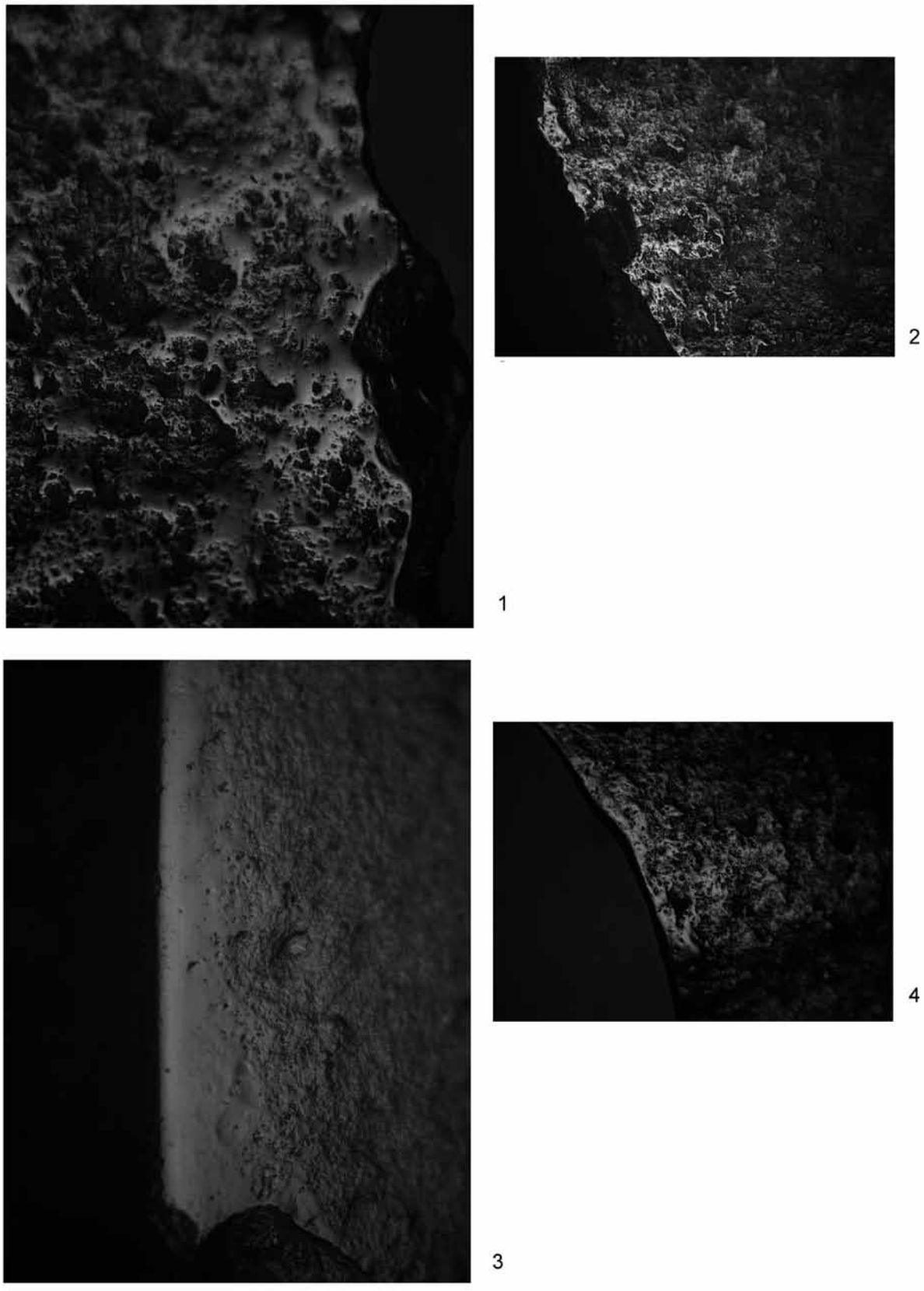


Fig. 8. Przybranowo 3. Microwear traces. 1-2 – traces associated with the processing of siliceous plants (1-2, 4 – orig. mag. 50×; 3 – orig. mag. 100×).

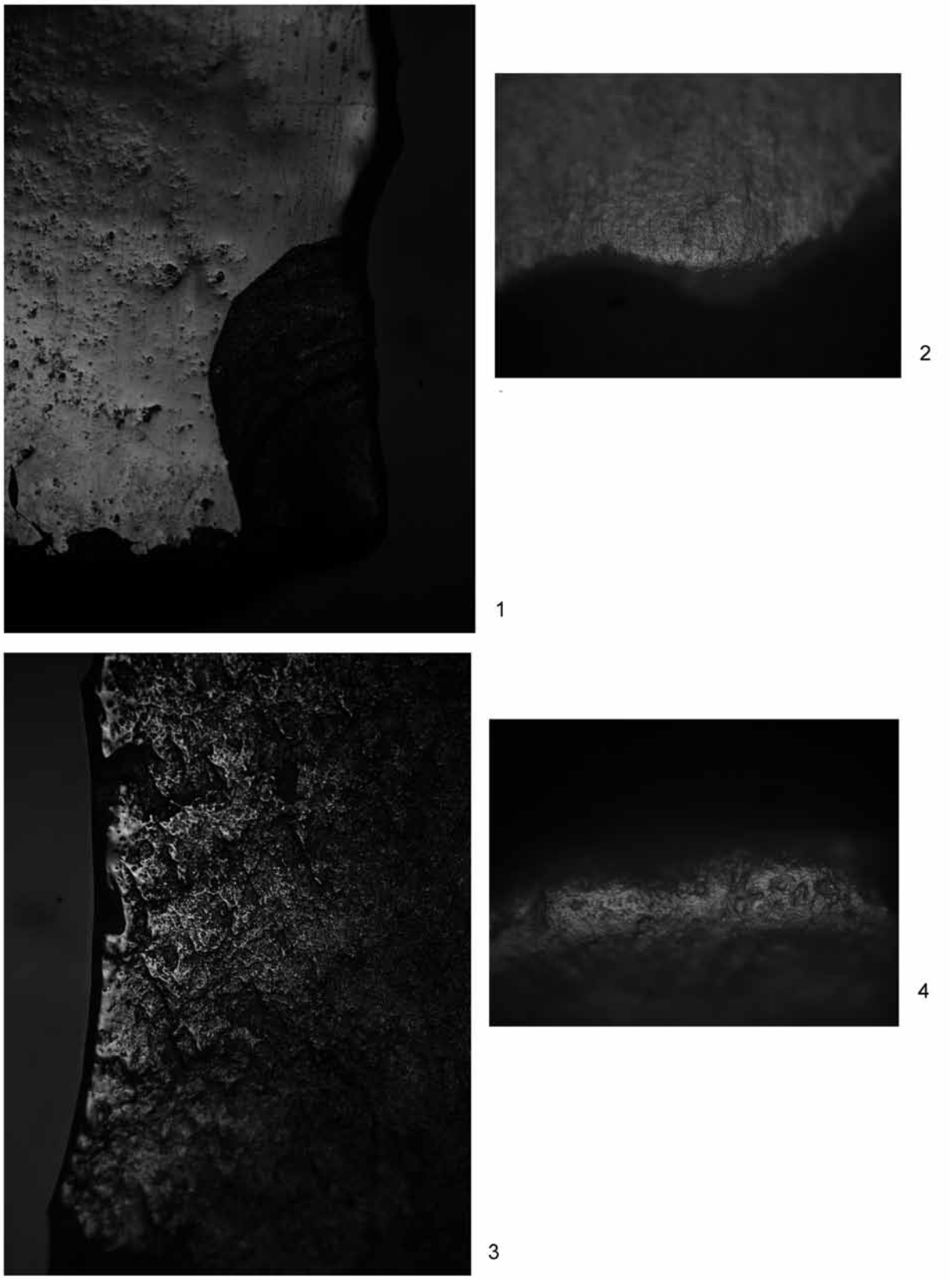


Fig. 9. Przybranowo 3. Microwear traces. 1, 3 – traces associated with the processing of siliceous plants; 2, 4 – traces associated with the skin processing (1-3 – orig. mag. 50×; 2 – orig. mag. 100×; 4 – orig. mag. 200×).

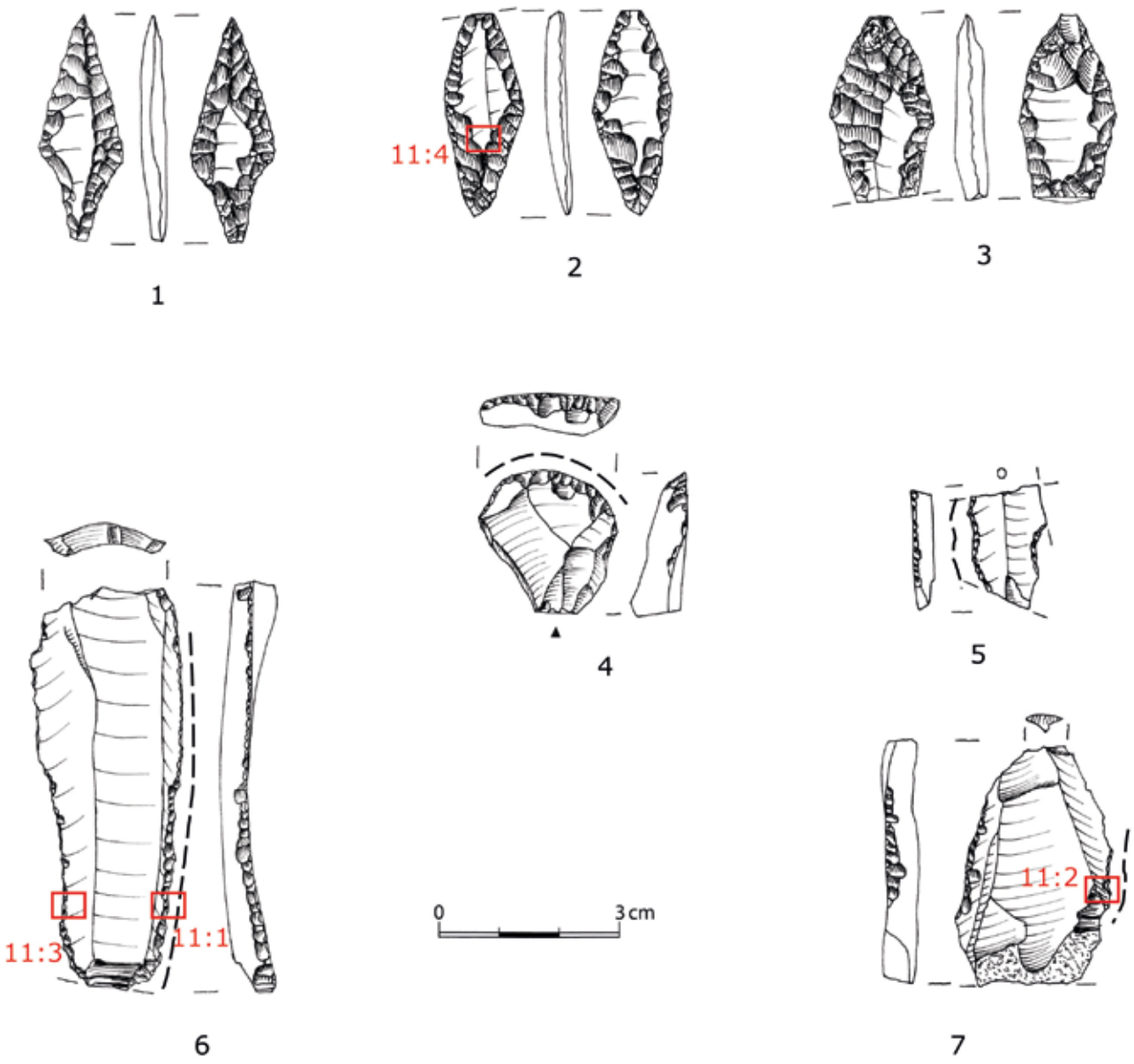


Fig. 10. Poczałkowo 38. Flint tools covered with functional traces (1-7).

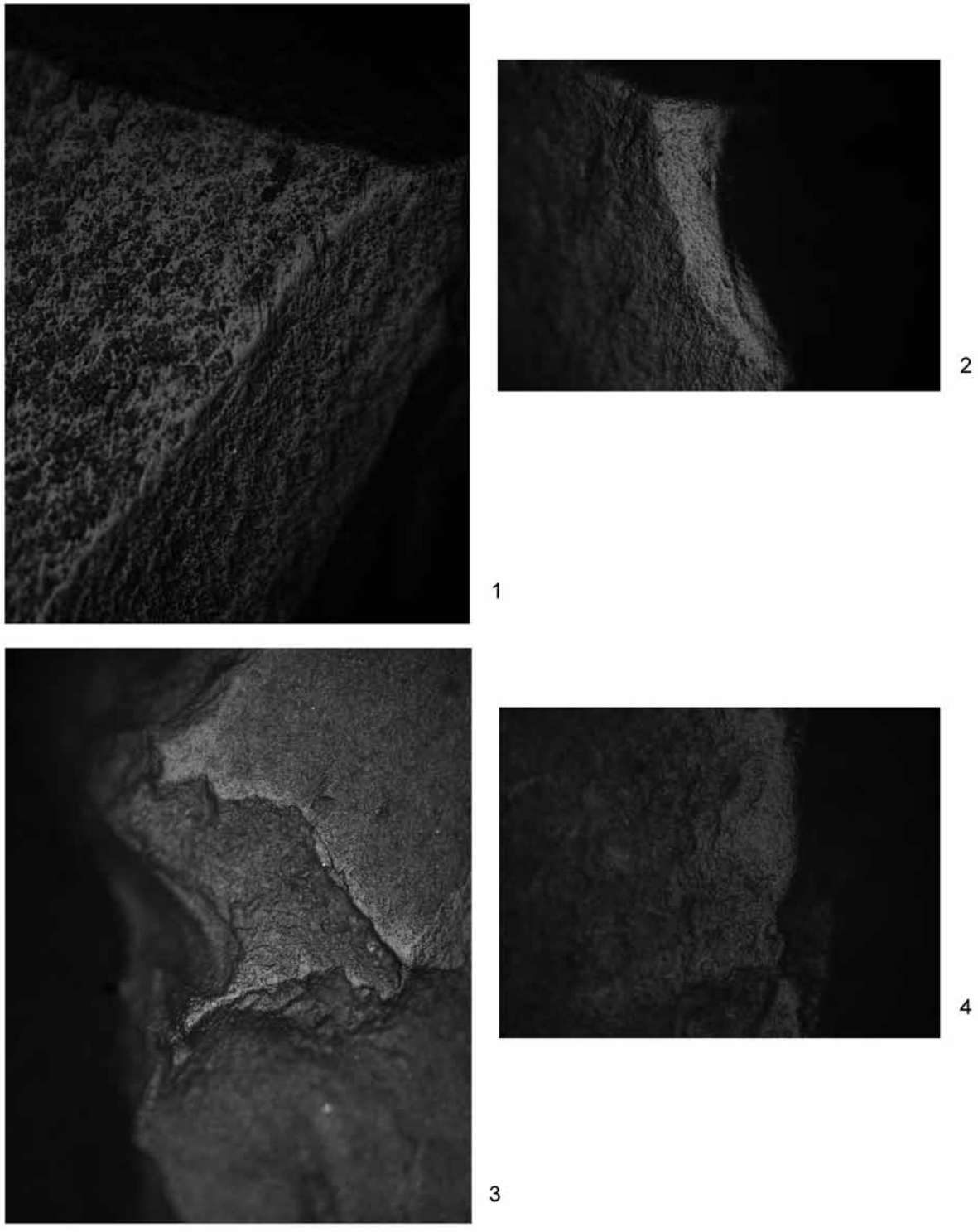


Fig. 11. Poczałkowo 38. Microwear traces. 1 – traces associated with the processing of siliceous plants; 2 – traces associated with the plant/wood processing; 3-4 – hafting traces (1-4 – orig. mag. 100×).

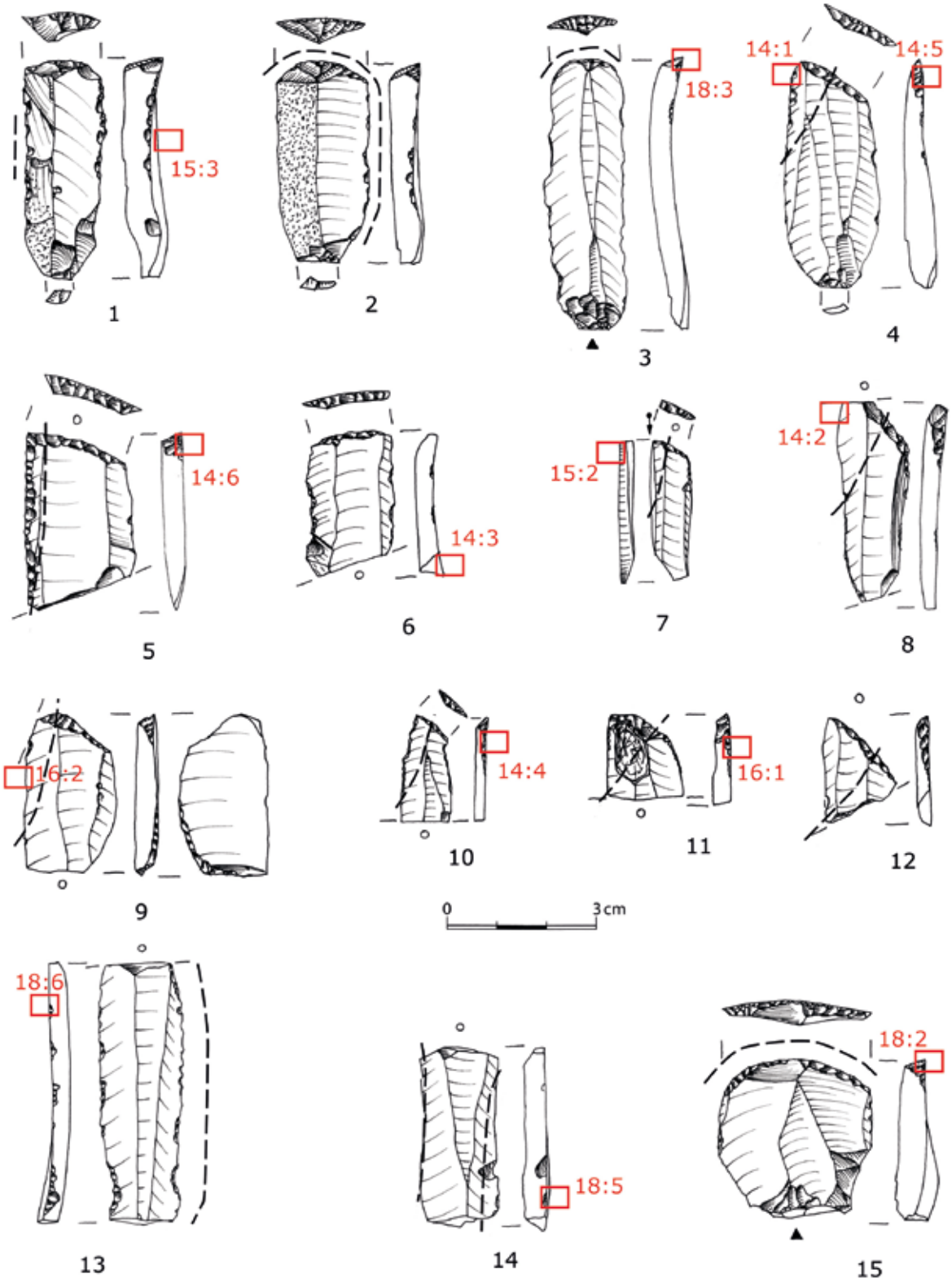


Fig. 12. Przybranówek 43. Flint tools covered with functional traces (1-15).

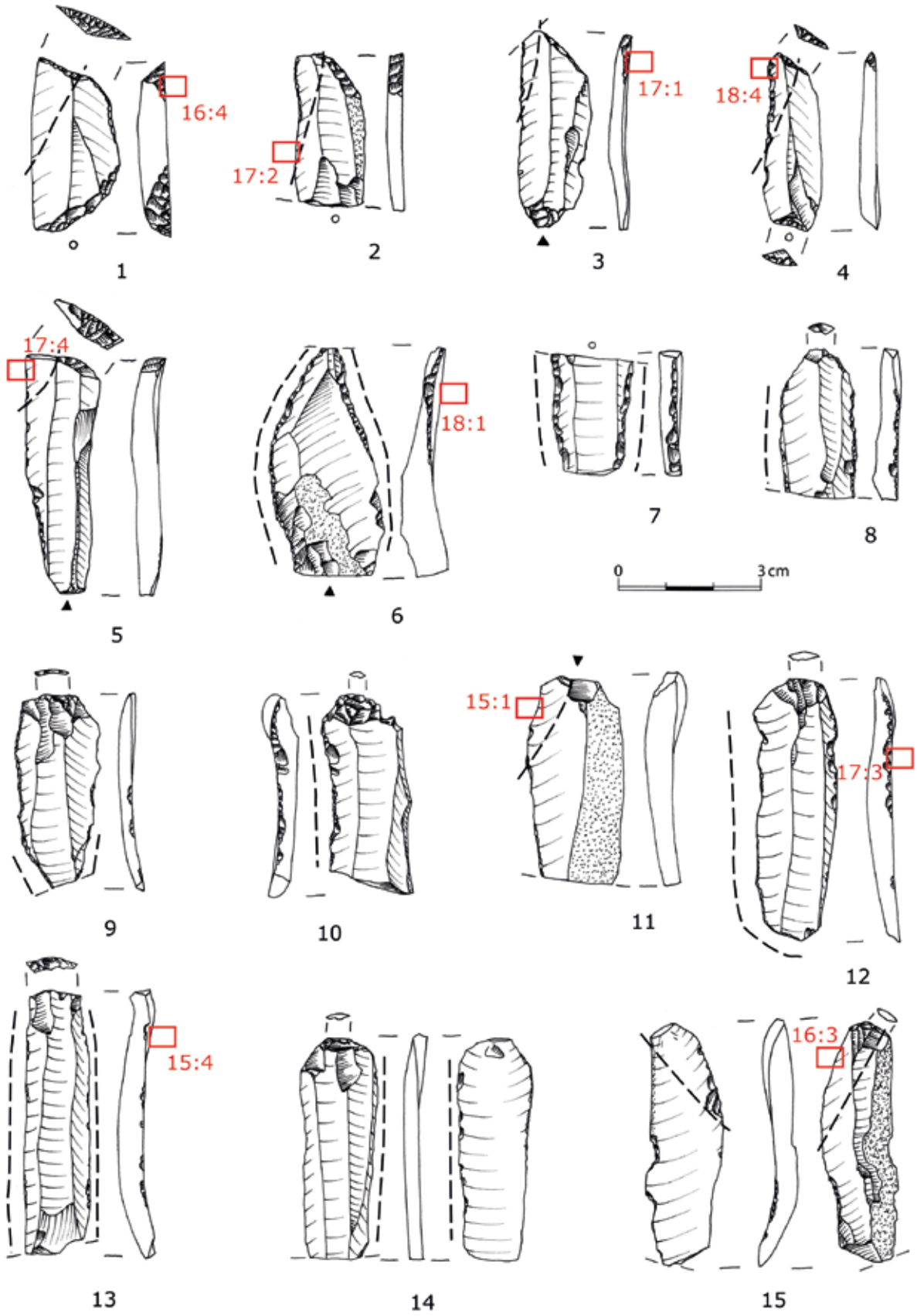


Fig. 13. Przybranówek 43. Flint tools covered with functional traces (1-15).

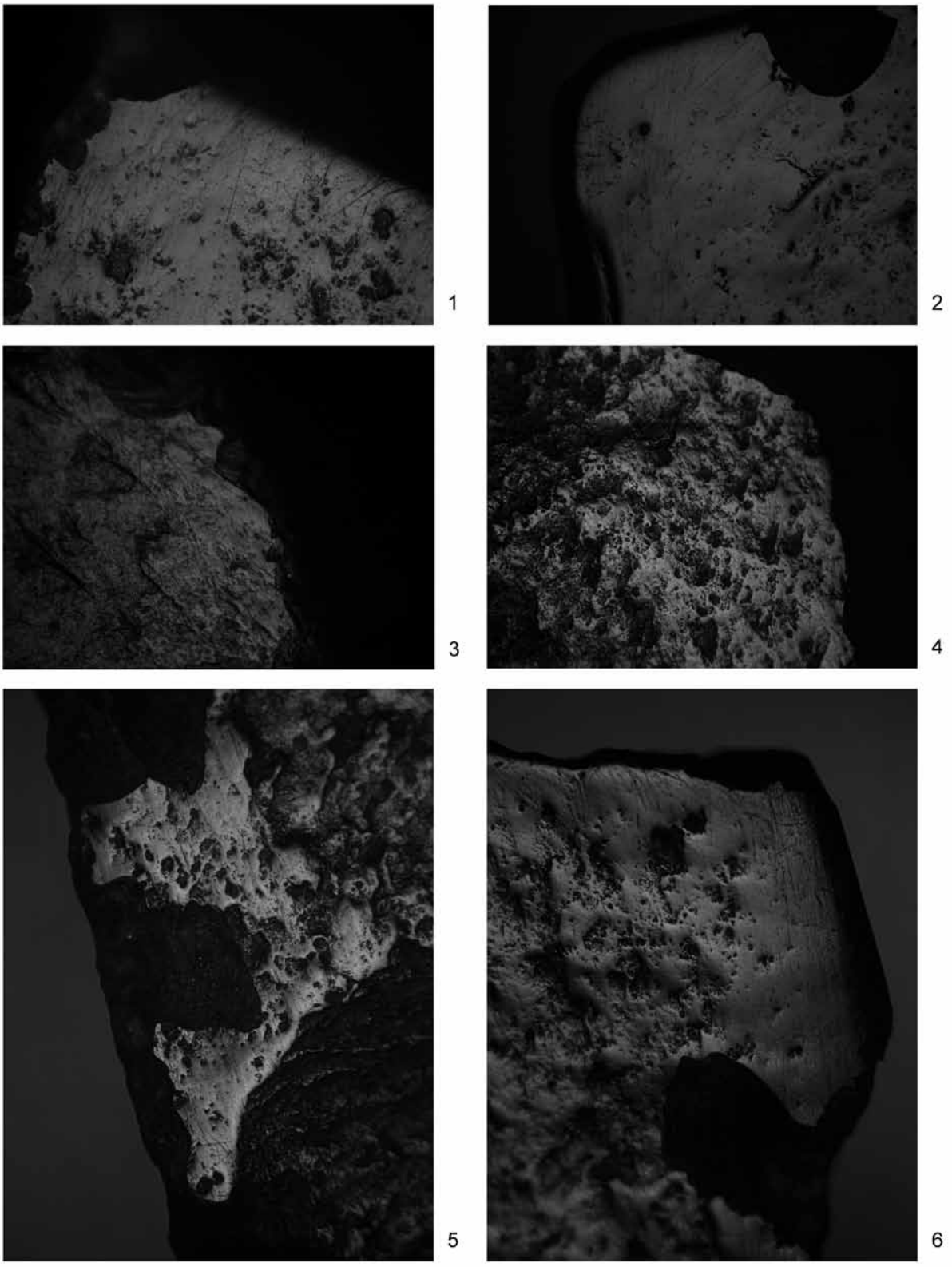


Fig. 14. Przybranówek 43. Microwear traces. 1 – traces associated with the processing of siliceous plants (2, 4-6 – orig. mag. 50×; 1, 3 – orig. mag. 100×).

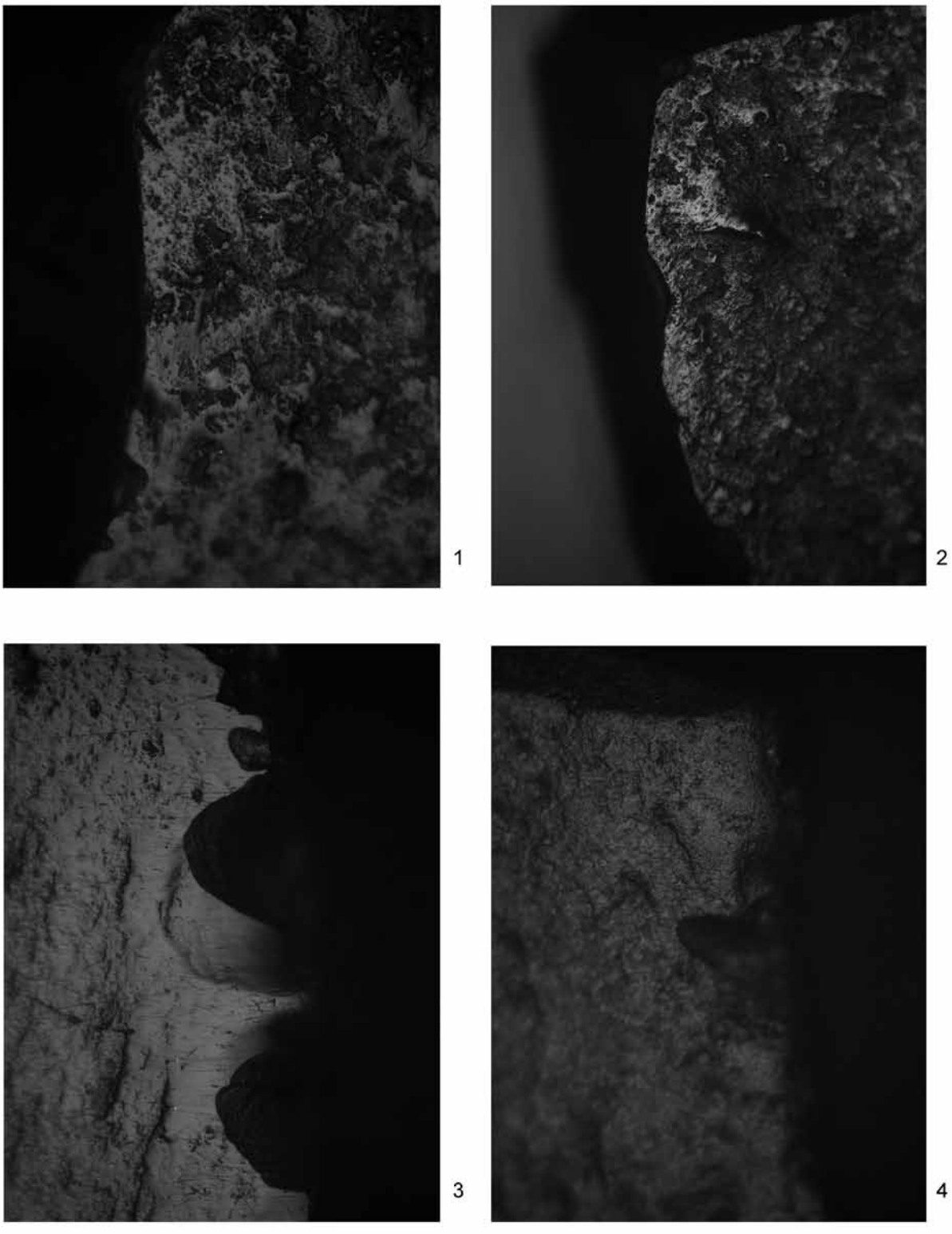


Fig. 15. Przybranówek 43. Microwear traces. 1-3 – traces associated with the processing of siliceous plants; 4 –traces associated with the skin processing (1, 3-4 – orig. mag. 100×; 2 – orig. mag. 50×).

Fig. 16. Przybranówek 43. Microwear traces. 1-4 – traces associated with the processing of siliceous plants (1-4 – orig. mag. 50×).

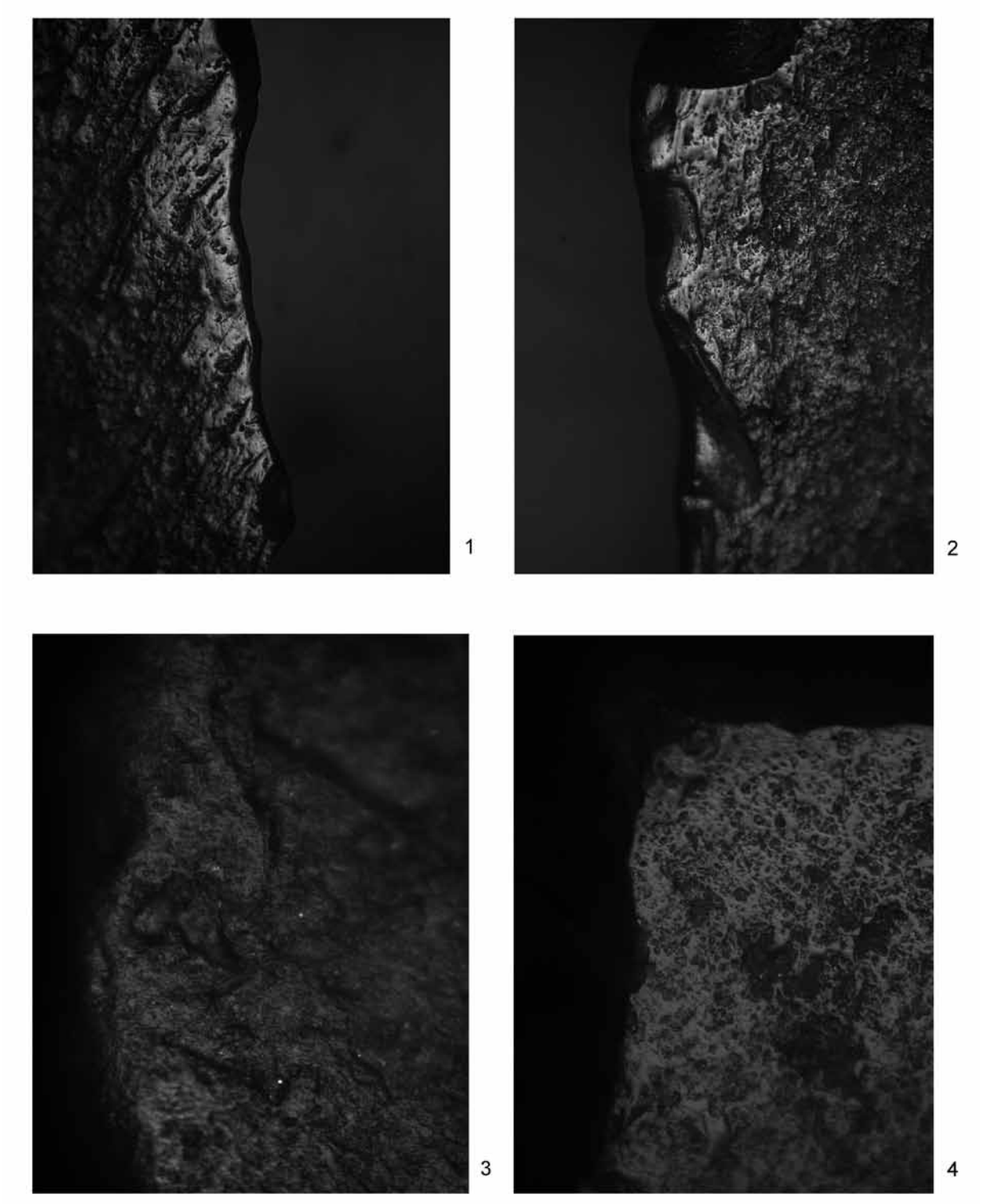


Fig. 17. Przybranówek 43. Microwear traces. 1-2, 4 – traces associated with the processing of siliceous plants; 3 – traces associated with the butchering activities
(1-2 – orig. mag. 50×; 3 – orig. mag. 200×; 4 – orig. mag. 100×).

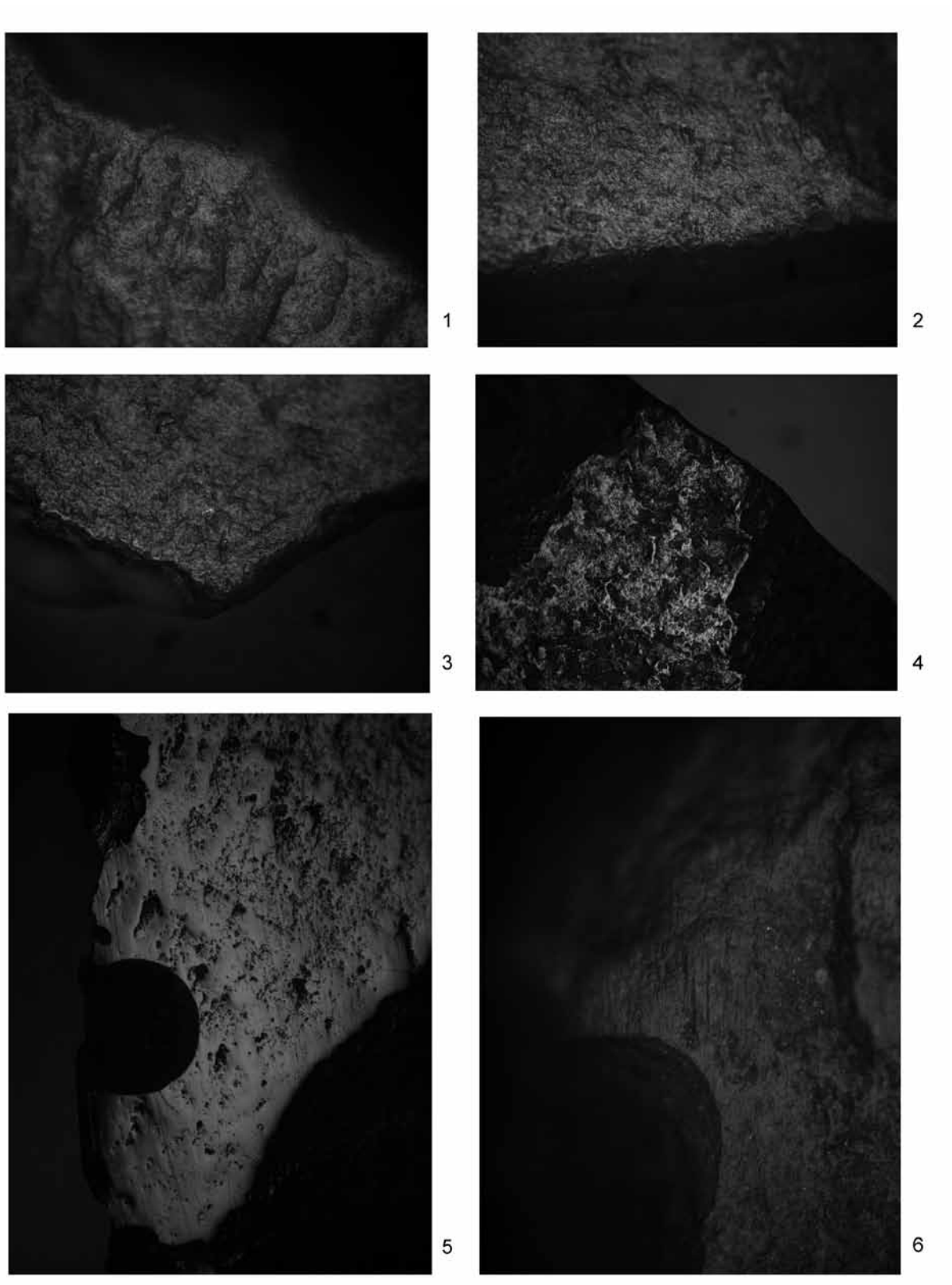


Fig. 18. Przybranówek 43. Microwear traces. 1 – traces associated with the skin, antler/bones or plant processing?; 2-3, 6 – traces associated with the skin processing; 4-5 – traces associated with the processing of siliceous plants (1-3 – orig. mag. 100×; 4-5 – orig. mag. 50×; 6 – orig. mag. 200×).

REFERENCES

Anderson-Gerfaud P.
1988 Using prehistoric stone tools to harvest cultivated wild cereals: preliminary observations of traces and impact. In: S. Beyries (ed.), *Industries Lithiques: Ttracéologie et Technologie* (= *British Archaeological Reports. International Series* 411). Oxford, 175-198.

Burroni D., Donahue R.E., Pollard A.M.
2002 The Surface Alteration Features of Flint Artefacts as a Record of Environmental Processes. *Journal of Archaeological Science* 29, 1277-1287.

Grygiel R.
2004 *Neolit i początki epoki brązu w rejonie Brześcia Kujawskiego i Osłonek* I. *Wczesny neolit. Kultura ceramiki wstęgowej rytej*. Łódź.

Ibáñez J.J., Gonzáles J.E., Lagüera M.A., Gutièrrez C.
1990 Knapping traces: their characteristics according to the hammerstone and the technique used. In: *Le silex de sa genèse á l' outil. Actes du Ve colloque international sur le silex, 1987* (= *Cahiers du Quaternaire* 17), 547-553.

Juel Jensen H.
1988 Functional Analysis of Prehistoric Flint Tools by High-Power Microscopy: A Review of West European Research. *Journal of World Prehistory* 2(2), 53-87.
1994 *Flint tools and plant working. Hidden traces of stone age technology. A use wear study of some Danish Mesolithic and TRB implements*. Aarhus.

Kamińska J., Szymczak K.
1994 Patyna powierzchni zabytków krzemiennych jako wyznacznik chronologiczny. *Światowit* 39, 215-223.

Kamińska-Szymczak J.
2008 Wyniki badań wybłyszczenia powierzchni zabytków krzemiennych ze stanowiska Kraków Kosocice. In: J. Chochorowski (ed.), *Młodsza epoka kamienia. Wybrane znaleziska*. Kraków, 225-258.

Keeley L.H.
1980 *Experimental Determination of Stone Tool Uses. A Microwear Analysis*. Chicago.

Korobkowa G.F.
1999 *Narzędzia w pradziejach. Podstawy badania funkcji metodą traseologiczną*. Toruń.

Levi-Sala I.
1993 Use-Wear Traces: Process of Development and Post-depositional alterations. In: P.C. Anderson, S. Beyries, M. Otte, H. Plisson (eds.), *Traces et fonction, les gestes retrouvés. Actes du colloque international de Liège, 8-9-10 décembre 1990 (ERAUL 50)*. Liège, 401-416.
1996 A *Study of Microscopic Polish on Flint Implements* (= *British Archaeological Reports. International Series* 629). Oxford.

Małecka-Kukawka J.
1999 Sierpy, sierpaki, sierpce... – analiza funkcjonalna wczesnorolniczych wkładek narzędzi żniwnych z ziemi chełmińskiej. In: S. Kukawka (ed.), *Szkice prahistoryczne. Źródła – metody – interpretacje*. Toruń, 139-157.
2001 *Między formą a funkcją. Traseologia neolitycznych zabytków krzemiennych z ziemi chełmińskiej*. Toruń.

Moss E.
1983 *The Functional Analysis of Flint Implements. Pincevent and Pont d'Ambon: Two Cases from the French Final Paleolithic* (= *British Archaeological Reports. International Series* 177). Oxford.

Osipowicz G.
2010 *Narzędzia krzemienne w epoce kamienia na ziemi chełmińskiej. Studium traseologiczne*. Toruń.

Osipowicz G., Pomianowska H., Makowiecki D.
2014 Wytwory krzemienne, kamienne, z kości, poroża i zębów zwierzęcych. In: G. Osipowicz (ed.), *Kowal 14. Miejsce sepulkralno-obrzędowe ludności kultury amfor kulistych*. Toruń, 91-117.

Plisson H., Mauger M.
1988 Chemical and mechanical alteration of microwear polishes: An experimental approach. *Helinium* 28, 3-16.

Pyżewicz K.
2013 *Inwentarze krzemienne społeczności mezolitycznych w zachodniej części Niżu Polskiego. Analiza funkcjonalna*. Zielona Góra.
2015 Analiza traseologiczna artefaktów krzemiennych. In: A. Marciniak, I. Sobkowiak-Tabaka, M. Bartkowiak, M. Lisowski (eds.), *Kopydłowo, stanowisko 6. Osady neolityczne z pogranicza Kujaw i Wielkopolski*. Poznań-Pękowice, 193-205.

Pyżewicz K., Rozbiegalski P.
2012 Sposoby rozpalania ognia w młodszej epoce kamienia na terenie ziem polskich w kontekście badań eksperymentalno-traseologicznych. *Światowit* 9(50), 259-272.

Rots V.
2003 Towards an understanding of hafting: the macro- and microscopic evidence. *Antiquity* 77, 805-815.
2008 Hafting and raw materials from animals. Guide to the identification of hafting traces on stone tools. *Anthropozoologica* 43, 43-66.
2010 *Prehension and Hafting Traces on a Flint Tools. A Methodology*. Leuven.

Van Gijn A.L.
1990 The Wear and Tear of Flint. Principles of Functional Analysis to Dutch Neolithic Assemblages. *Analecta Praehistorica Leidensia* 22.

Vaughan P.C.
1985 *Use-Wear Analysis of Flaked Stone Tools*. Tucson.

Vergès J.M., Andreu O.
2011 Technical microwear and residues in identifying bipolar knapping on an anvil: experimental data. *Journal of Archaeological Science* 38, 1016-1025.

Winiarska-Kabacińska M.
2004 Analiza funkcjonalna zabytków krzemiennych. In: J. Kabaciński, I. Sobkowiak-Tabaka (eds.), *Komorniki. Chata ludności kultury pucharów lejkowatych*. Poznań, 76-87.