ANALECTA

ARCHAEOLOGICA RESSOVIENSIA

VOLUME 18 RZESZÓW 2023

ISSN 2084-4409 | DOI: 10.15584/anarres

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VOLUME 18 RZESZÓW 2023

FUNDACJA RZESZOWSKIEGO OŚRODKA ARCHEOLOGICZNEGO

Uniwersytet Rzeszowski
Kolegium Nauk Humanistycznych
Instytut Archeologii

WYDAWNICTWO UNIWERSYTETU RZESZOWSKIEGO

Abstracts of articles from Analecta Archaeologica Ressoviensia are published
in the Central European Journal of Social Sciences and Humanities
Analecta Archaeologica Ressoviensia is regularly listed in ERIH PLUS, CEJSH and ICI

Graphic design, typesetting
DOROTA KOCZĄB

Technical editor, cover design
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ISSN 2084-4409 DOI:10.15584/anarres

2075

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tel. 17 872 13 69, tel./fax 17 872 14 26
Home page: https://wydawnictwo.ur.edu.pl

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CENTRE FUND
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First edition, A4 format, 25,50 publishing sheets, 30,75 printing sheets, order no. 114/2023
Printed and binded: The University of Rzeszów Printing House

ANALECTA
ARCHAEOLOGICA RESSOVIENSIA
Volume 18 / Rzeszów 2023
ISSN 2084-4409
DOI: 10.15584/anarres

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Volume 18 / Rzeszów 2023
ISSN 2084-4409
DOI: 10.15584/anarres

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DOI: 10.15584/anarres.2023.18.3

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Neolithic Flintworking of the Samborzec-Opatów Group in Lesser Poland in the Light of Settlement Materials from Tonie 9 Site, Kraków Commune

Abstract

Wąs M. 2023. Neolithic Flintworking of the Samborzec-Opatów Group in Lesser Poland in the Light of Settlement Materials from Tonie 9 Site, Kraków Commune. *Analecta Archaeologica Ressoviensia* 18, 41–66

The article presents flint materials obtained from settlement site of Samborzec-Opatów group from the Tonie 9 site in Lesser Poland. The flintworking of this unit is still poorly recognized. In the literature, special attention has mainly been paid to ceramic materials, especially in studies on the genesis of this group and its relations with other taxonomic units of the Neolithic in Lesser Poland (especially with the Malice culture and later groups of the Lendziel). Therefore, it is worth introducing the specificity of Samborzec-Opatów flintworking, especially since the recently arrived inventory from the Tonie 9 site is quite numerous and relatively homogeneous. Therefore, the main goal is to present materials that can be used for further studies, e.g. those of a comparative nature.

Keywords: Samborzec-Opatów group, early Neolithic, flint technology, lithic analysis, SE Poland

Received: 02.09.2023; **Revised:** 20.09.2023; **Accepted:** 29.09.2023

1. Introduction

1.1. Location of the site

The Tonie 9 site is located in the Lesser Poland Voivodeship, in the Kraków commune, in the area of the former village of Tonie, and now in the district of Kraków–Prądnik Biały. In terms of physical and geographical area, the area of the site is located in the macro-region of the Kraków-Częstochowa Upland, which is part of the Silesian-Kraków Upland. The range of the site coincides with the area of the broadly understood Kraków Fortress, i.e. the nineteenth-century Austrian fortifications of Kraków. The area of the site is located between the Red Bridge and the Pękowice Ammunition Shelter (no. 8) from the south, and Fort 44a Pękowice from the north. Currently, the site area is partly arable field and wasteland.

1.2. Excavations and their results

The flint materials presented below from the Tonie 9 site (AZP 101-56, site no. 61) were discovered during rescue excavations (Kokolus and Maciaszek 2021). These studies were carried out in connection with the construction of the S52 Northern Bypass of Kraków expressway. Exploration works were carried out in 2019 and 2021 by *Archeo-Explorers Wiesław Koszkul* from Kraków on behalf of GDDKiA branch in Kraków.

As a result of archaeological work, an area of 261 acres was examined. Their result was the discovery of a vast area of the settlement, within which 397 features (pits, post-hole pits and ditches) were distinguished. The archaeological material found there, especially the dominant pottery fragments, was identified as relics of the settlement of the Samborzec-Opatów group (hereinafter referred to as S-O). When assessing the relics from a spatial perspective, attention is drawn to the pit complexes, including two located close to each other in the north-western part of the site. In the remaining area, the features were dispersed, which is particularly visible in the southern part of the site. During the excavation, 5772 fragments of ceramics, 2843 flints, 5 stone axes or their fragments, and 2 stone battle-axes were obtained.

It should be emphasized that no remains of other Neolithic cultures have been recorded at the site.

2. Lithic materials

2.1. Introductory remarks

As a result of excavations carried out at the Tonie 9 site, a collection of 2843 flint artefacts related to the relics of the Neolithic settlement of the Samborzec-Opatów group discovered at the site was obtained.

Due to the stratigraphic context in which individual products were discovered, the entire inventory was divided into two smaller sets at the analysis stage. The first of them contains flint artefacts found in the infills of features that are relics of the S-O settlement. The second distinguished group contains specimens found during the exploration of mechanical layers outside features whose relationship with permanent relics may potentially be smaller. Although other cultural elements have not been distinguished among other categories of sources – especially in the group of ceramics, such a procedure seems justified and beneficial from the perspective of the possibility of demonstrating the relatively culturally pure characteristics of S-O flintworking.

The above division of the collection of flint artefacts also translates into the way in which the materials are presented, and consequently also into the process of analysis and inference.

2.2. Dispersion of flint materials

The dispersion of the flint material shows that it is entirely bound to the relics of a large fragment of the S-O settlement. It was scattered over almost the entire area covered by exploration.

The vast majority of materials from Tonie 9 have been discovered in the infills of features. The remaining specimens from this site, classified as finds from exploration layers outside the objects, might have originally lain in the upper parts of the features. In general, the dispersion of flint artefacts corresponds to the spatial location of individual Neolithic features or their concentrations, mainly recorded in the central and northern parts of the site.

2.3. Raw-material structure

By far the dominant raw material in the inventory of Tonie 9 is the local Jurassic Cracovian flint (Tab. 1; Fig. 1). In general, 2541 specimens were made from this raw material, which is slightly more than 89% of the inventory. In the minority there are products made of flints, which from the perspective of the studied site can be described as exotic (extra local). The most numerous non-local raw material is chocolate flint. At the Tonie 9 site, 97 products made of it were found, which constitutes almost 3.4% of the raw material structure in the discussed inventory. The group of exotic raw materials is complemented by 8 striped flint specimens, which were identified in the inventory of Tonie 9, which constitutes 0.3% of the raw material structure on this site.

On the other hand, about 6.7% are lithics whose degree of thermal transformation which they have undergone makes it impossible to indicate the type of flint raw material. They were classified as burnt specimens (193 pcs.). With a high degree of probability, these are burnt specimens from Jurassic Cracovian flint, which further increases the frequency of this raw material in the entire structure.

In addition to artefacts made of flint, 2 obsidian artefacts were found at the Tonie 9 site. For two other specimens, it was not possible to identify the raw material precisely and were therefore classified as "other".

Table 1. Tonie 9. Raw material structure of the inventory.

RAW MATERIAL	N	%
Jurassic Cracovian Flint	2541	89.4
Chocolate Flint	97	3.4
Banded Flint	8	0.3
Burnt flint	193	6.7
Obsidian	2	0.1
Others	2	0.1
SUM	**2843**	

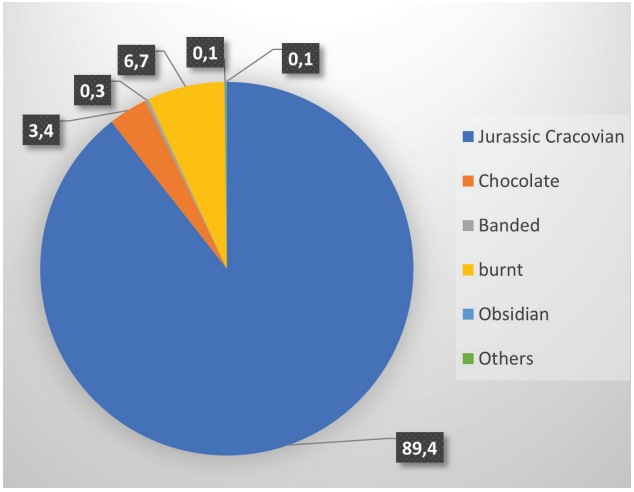

Fig. 1. Tonie 9. Raw material structure of the inventory.

2.4. Quantitative and qualitative structure

The characteristics of the flint materials from the Tonie 9 site will be presented in two parts. The first part contains the entire inventory, while the second part of the inventory is divided into two groups: 1) artefacts from features and 2) artefacts found in exploration layers outside of features. In both approaches, a convention showing the "technological" structure of the collections (as "debitage") and a separate characteristic of the tool group were used.

2.4.1. General structure of the inventory

The total amount of flint products discovered at the Tonie 9 site is 2843, of which 2515 come from features infills, and the remaining 328 specimens from exploration layers outside the objects. The general structure of the inventory consists of products classified under 12 categories of artefacts (Tab. 2; Fig. 2).

Table 2. Tonie 9. Qualitative and quantitative structure of the entire lithic inventory.

MATERIALS	n	%
Blade cores	11	0.4
Flake cores	139	4.9
Blade-flake cores	42	1.5
Blades	171	6.0
Flakes	1258	44.2
Core tablets	18	0.6
Rejuvenation flakes	15	0.5
Crested blades	16	0.6
Tools	936	32.9
Splintered pieces	10	0.4
Chunks	201	7.1
with negatives	*69*	
burnt	*96*	
natural	*36*	
Chips	26	0.9
SUM	**2843**	

The most numerous group of products in the inventory of Tonie 9 are flakes (1258 pcs.), which together with technologically related flake cores (139 pcs.) constitute almost half (about 49.1%) of the entire inventory. Much less numerous are products related to blade technology. Together, they occupy just over 8%. This group includes 171 blades (6%), 11 blade cores (0.4%), 16 crested blades (0.6%), 18 core tablets (0.6%) and 15 rejuvenation flakes (0.5%). This group can be extended by 42 blade-flake cores (1.5%). The inventory also includes a group of splintered exploitation, which consists of 10 splintered pieces, which in total accounts for 0.4% of the entire inventory. A separate part of the inventory (7.1%) are specimens defined as chunks. Most of them are burnt (96 pcs.), with negatives (69 pcs.) and natural untreated concretions and their fragments (36 pcs.). Microdebitage in the form of chips, i.e. flakes smaller than 5 mm, in the amount of 26 pieces (0.9%) was also identified.

In addition to the above-mentioned categories, a tool group was distinguished in the general structure of the inventory from the discussed site. It contains 936 tools, which constitute almost 33% of the total inventory (Tab. 3; Fig. 3). They were classified into 14 types.

Table 3. Tonie 9. Qualitative and quantitative structure of the tools group.

TOOLS	n	%
End-scrapers	63	6.7
Truncated blades	79	8.4
single	*54*	
doubled	*25*	
Perforators	3	0.3
Trapezes	2	0.2
Side-scrapers	7	0.7
Macro end-scrapers	3	0.3
Scrapers	4	0.4
Retouched blades	3	0.3
Micro-retouched blades	43	4.6
Blades with polish	12	1.3
Blades with use retouch	366	39.2
Retouched flakes	87	9.4
Flakes with use-retouch	230	24.6
Hammers/grinders	34	3.6
SUM	**936**	

Due to the degree of retouching, two subgroups of tools are distinguished. The first is typological (conventional) tools. The second group consists of utility tools, i.e. atypically retouched blades and flakes, as well as flakes and blades with traces of their use in the form of the so-called use-retouching and polishes ("sickle gloss").

In total, 164 retouched specimens were distinguished, among which two types prevail quantitatively: truncated blades (79 pcs.) and end-scrapers

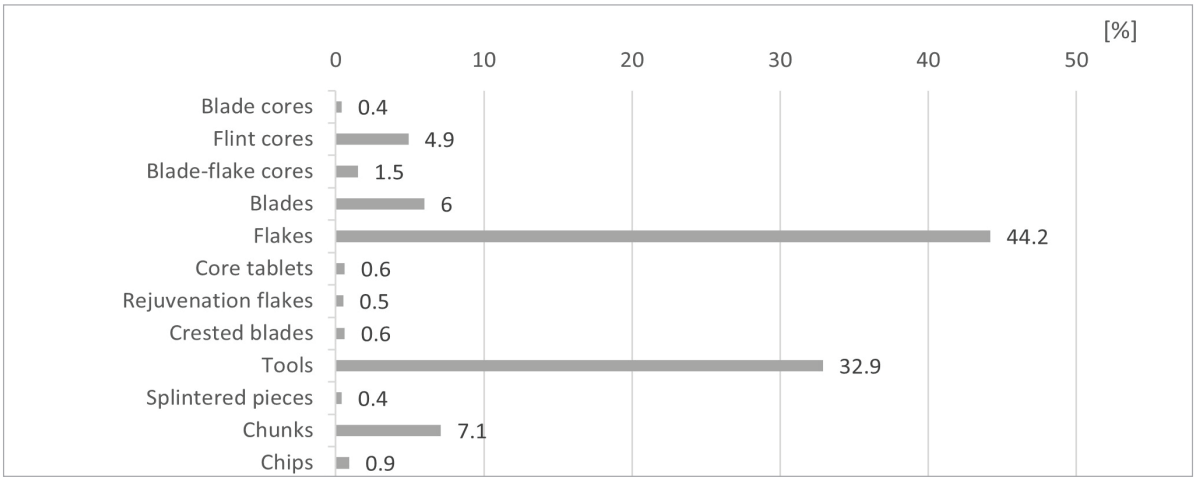

Fig. 2. Tonie 9. Frequency of product types in the entire inventory.

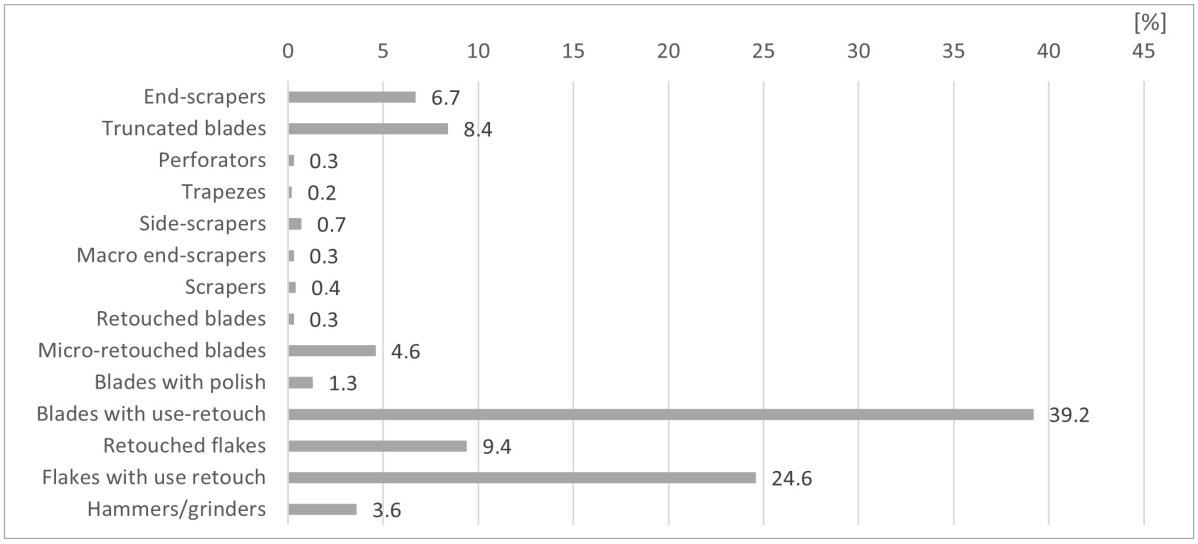

Fig. 3. Tonie 9. Frequency of tool types in the entire inventory.

(63 pcs.). Other categories of tools are represented by several ones: side-scrapers (7 pcs.), scrapers (4 pcs.), macro end-scrapers (3 pcs.), perforators (3 pcs.), retouched blades (3 pcs.) and trapezes (2 pcs.). The remaining more numerous part of the tool group are atypical specimens, of which 738 pieces were distinguished. The most numerous of them are blades with the so-called use-retouch (366 pcs.) and flakes with use-retouch (230 pcs.). The tool group also includes 34 flint hammers/grinders, which are mostly functionally transformed cores of various types.

2.4.2. Structure of collections from features and from the exploration layers outside features

Most of the flint inventory from Tonie 9 comes from the infills of 99 features. Detailed material specification is presented in table 4. In total, 2515 specimens were discovered inside them (Tab. 5; Fig. 4).

In this group, there is a far differentiation in the number of artefacts discovered in individual features. From that point of view, 4 groups can be distinguished. The most numerous of them is a group of 70 features, from which finds from 1 to 10 flints come. Features containing from 11 to 50 specimens are much less numerous – 18 such features have been distinguished. In 5 features, from 51 to 100 flint artefacts were discovered (including 2 containing over 90 pieces). A separate group consists of 6 features, from which the most numerous collections of flint artefacts originate from 113 to 363 products (ft. 47 – 113 pcs., ft. 232 – 203 pcs., ft. 274 – 300 pcs., ft. 278 – 264 pcs., ft. 279 – 363 pcs., ft. 293 – 207 pcs.) (Fig. 7: 2–6; 12: 1–10; 13: 1–4; 14: 1–8). In conclusion, the last of the distinguished groups contains 1450 flint artefacts, which is more than half of the entire inventory (51%).

Table 4. Tonie 9. Qualitative and quantitative structure of lithic from S-O features.

1	FEATURE	2	QUANTITY	3	BLADE CORES	4	FLAKE CORES	5	BLADE-FLAKE CORES	6	BLADES	7	FLAKES	8	CORE TABLETS	9	REJUVENATION FLAKES	10	CRESTED BLADES	11	END-SCRAPERS	12	TRUNCATED BLADES (SINGLE)	13	TRUNCATED BLADES (DOUBLED)	14	PERFORATORS	15	TRAPEZEZ	16	SIDE-SRAPERS	17	MACRO END-SCRAPERS	18	SCRAPERS	19	RETOUCHED BLADES	20	MICRO-RETOUCHED BLADES	21	BLADES WITH POLISH	22	BLADES WITH USE-RETOUCH	23	RETOUCHED FLAKES	24	FLAKES WITH UDE-RETOUCH	25	SPLINTERED PIECES	26	CHUNKS (WITH NEGATIVES)	27	CHUNKS (BURNT)	28	CHUNKS (NATURAL)	29	CHIPS	30	HAMMERS/GRINDERS
3		1										1																																									
7		3				1														1																																			
8		19								3		7						1		1		1																																	
9		1										1																																											
10		1								1																																												
13		1																														1																						
18		3						2				1																																										
20		32						3		3		14								1				1																													
23		7								2		2								1																							1											
24		3										1																1																										
25		1																																							1													
28		2																																																				
32		15						2				9																								1		2														
33		7								1		3								1																		2														
36		1							1																																												
41		1																																		1																	
42		11						3				3																										4		1												

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
43	6		1			2			1												1								1
45	5					4																	1						
46	5		1			2															1					1			
47	113	2	12	4	8	45		1	2	1		2							2		8	8	3	1	7	1		1	5
48	52		3	1		17					1	2							1		10	3	7			1	1		5
49	8		1			5																1			1				
50	3		1			2																							
52	63		7	1	9	19	1		1	1	1	2			1				1		7	1	2		2	3	2		2
53	2						1																1						
60	28	1	2	1		6	1		1	1	1	2					1		4		5		1		1				
61	2																				1		1						
62	30		2	1		17				1			1				1				2		2		2	1			
63	3				2	1																							
76	42			1	2	18				1		1									10		3			5			1
78	27	1	5		1	8				1									1		6		3						1
79	15		4			6															1		2		1	1			
89	4		1			1													1				1						
90	39				1	25		1		2	1								1		1		4		1	2			
91	6					4															1		1						
93	6				2						1	1									2								
94	1																						1						
109	23			1		14				1											4		2			1			
115	1					1																							
146	1																				1								
177	1					1																							
190	1					1																							
193	14		1	2	1	2				1						1			1		1		1		2	1			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
207	81	1	4	2	6	39				1		3							2	1	7	2	4	1	2	2	2		2
218	6		1			2															1		1						1
222	45		2		3	14			1	3	1				1						8	2	4	1	2		2		1
223	6					2					1								1				2						
224	1					1																							
226	3					3																							
230	4					1			1												2								
232A	1																				1								
232	203		2		18	106	5			5	1	3							4	1	28	3	8	1	6	9	1	1	1
235	3				1	2																							
239	1					1																							
240	5					4																	1						
243	2		1			1																							
246	1									1																			
248	1																				1								
254	6		1			3															2								
256	7				1	5															1								
257	5					4													1										
259	4		2																			1	1						
260	18		1			6			1	1										1			3	2		2			1
260A	32				4	13				1	1	3									4		5	1					
260B	7				1	2				1											1		2						
261	14				2	3					1				1							1	1			1	1	3	
262	6					2																	2			2			
265	1	1																											
269	1																				1								
272	97		8		11	52	1	1	1	2		1									7		4		2	7			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
274	300		6	5	15	126	1	2	3	8	2	9								3	43	20	27		12	15		1	2
276	3					3																							
278	264	2	5	7	21	118	1			9	1	3	1			1	1	1	3		34	9	26	1	3	3		13	1
279	363	2	12	6	17	195	1	5	1	3	2	4		1	1	1			5	1	49	5	27		7	9	4	3	2
289	1																										1		
291	2					1															1								
293	207		12	2	9	77	2	2	3	4	3	5			1			1	5	2	33	8	27		3	2	2	1	3
298	1													1															
300	5					1						1									1		1						1
301	3					2																	1						
304	6					5																			1				
308	1																					1							
311	3					2				1																			
312	4					1															1					2			
314	3																				3								
315	14		1			6							1								2	1	3						
318	1		1																										
319	1					1																							
320	2		2																										
321	96		2	3	4	46		1		4								1			16	4	9		2		2	2	
323	2					1						1																	
327	40		2	2		26															1	1	2	1		5			
329	7					6															1								
330	4					1						1									2								
332	2		1		1																								
335	5				1	2															1					1			
336	3					2															1								
338	1																									1			

The structure of products from features is dominated by products of flake technology. Their frequency is similar to the general structure of the entire inventory and amounts to almost 50%.

Also, the share of products related to blade exploitation is similar to the general structure presented earlier and amounts to 8.2%. Out of a total of 171 blades in the entire inventory, as many as 152 were found in the features. The other categories of the blade technology group from features are: 10 blade cores, 16 crested blades, 14 core tablets and 13 rejuvenation flakes. Thus, all the crested blades in the inventory come from features, as well as almost all blade cores (10 specimens out of 11 found in total).

A separate group are chunks – 6.2% of the total inventory. Their number, i.e. 156 pieces, accounts for over 75% of all chunks found at the site. Similar to the whole inventory are the quantitative proportions between individual varieties of chunks: burnt specimens predominate, slightly less negative ones, and there are clearly the least natural chunks.

From a comparative perspective, microdebitage stands out. Of the 26 small chips separated in the inventory, almost all (25 pieces) were separated from features in the collection.

In addition, 830 tools were separated from features in the collection, which constitutes 33% of the total collection from features and almost equals the percentage of this category of products in the general inventory structure (32.9%).

This group is quantitatively dominated by categories classified as atypical tools (Tab. 6; Fig. 5). This group contains 687 specimens, which is 78.6% of the tools from the features. The percentage of individual types is comparable in this set with the overall tool structure in the entire inventory.

Conventional tools are found in the group from features in the minority and account for just over 17% of all tools. As in the general structure, truncated blades (64 pcs.) and end-scrapers (59 pcs.) dominate, with the share of end-scrapers slightly higher (7.1%) compared to the general structure of tools, and the share of truncated blades slightly lower (7.7%). Other types of conventional tools are present in almost the same quantities as in the general structure from whole site. In particular, tools such as perforators, trapezes, macro end-scrapers and retouched blades only occurred in the features, while all of the hammers/grinders from the Tonie 9 site (34 pcs.) were found in the infills.

From the exploration layers outside the features come 328 products (Tab. 9; Fig. 6). As in the structure of the facilities, the dominant group are products related to flake technology. They account for 45.1% of this part of the inventory. It consists of 127 flakes and 21 flake cores.

Another technological group, i.e. blade component, contains only 28 products, i.e. almost 8.6%, i.e. a percentage similar to the general structure of flint inventory at this site. It consists of 19 blades, 1 blade core, 2 blade-flake cores, 4 core-tablets and 2 rejuvenation flakes.

Quantitatively, the percentage of chunks is distinguished in this inventory group. Compared to the

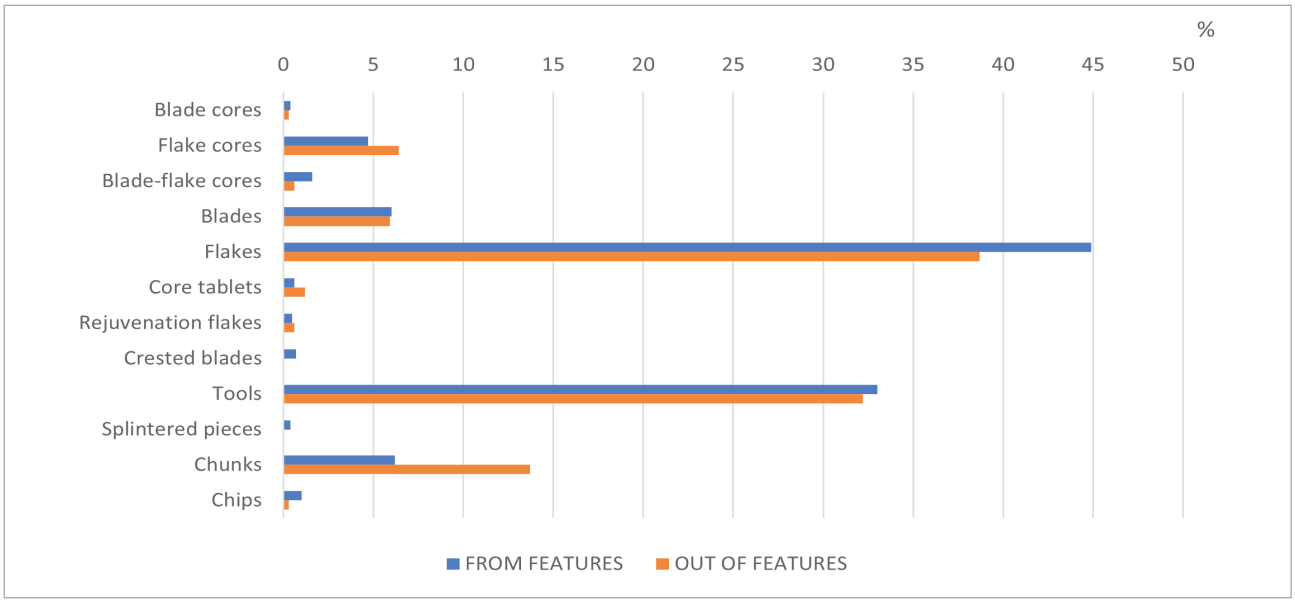

Fig. 4. Tonie 9. Frequency of product types in the lithic inventories from S-O features and exploration levels out of features.

group of materials from features, there are more than twice as many of them here and they constitute almost 14%, while in the infills of features they constituted slightly more than 6% of the collection. A different internal structure of this group is noticeable – the most numerous are natural specimens, which in the collection of features, and thus in the general structure, were the least numerous. This is perhaps due to the fact that these specimens are a natural component of the sediments that build the site soil.

Tools constitute 32.3% in the inventory (Tab. 10; Fig. 7). Out of a total of 106 tools, the majority are utility (atypical) tools, which account for about 80%. All forms of tools of this type are distinguished here, which also appeared in the collection of features. The percentage of individual tools is also similar, with a slight increase in the frequency of retouched chips (13.2%).

Conventional types of tools are four times less numerous (less than 20%) of the tool group "from the layer". Truncated blades (15 pcs.) clearly dominate quantitatively over end-scrapers (4 pcs.). In total, 9 categories of tools were distinguished here – 5 less than in the case of a collection of objects. In the exploration layer, such forms as perforators, trapezes, macro end-scrapers, retouched blades and hammers/grinders were not registered, which occurred in the collection from features.

To sum up, the flint inventory structure presented above from the Tonie 9 site, taking into account the division into a group of products from features infills and a group from exploration layers outside features, does not reflect any significant differences. Quantitative and qualitative structures contain almost the same number of similar categories of products. Only the tool structures of the two groups show slight differences. The proportions between the different types of products correspond to the overall quantitative difference between the entire groups of features and the layers outside of the features.

Table 5. Tonie 9. Qualitative and quantitative structure of the lithic inventories from S-O features and exploration levels out of features.

MATERIALS	IN FEATURES		OUT OF FEATURES	
	n	%	n	%
Blade cores	10	0.4	1	0.3
Flake cores	118	4.7	21	6.4
Blade-flake cores	40	1.6	2	0.6
Blades	152	6.0	19	5.9
Flakes	1131	44.9	127	38.7
Core tablets	14	0.6	4	1.2
Rejuvenation flakes	13	0.5	2	0.6
Crested blades	16	0.7	-	-
Tools	830	33.0	106	32.3
Splintered pieces	10	0.4	-	-
Chunks	156	6.2	45	13.7
with negatives	*58*		*11*	
burnt	*80*		*16*	
natural	*18*		*18*	
Chips	25	1.0	1	0.3
SUM	**2515**		**328**	

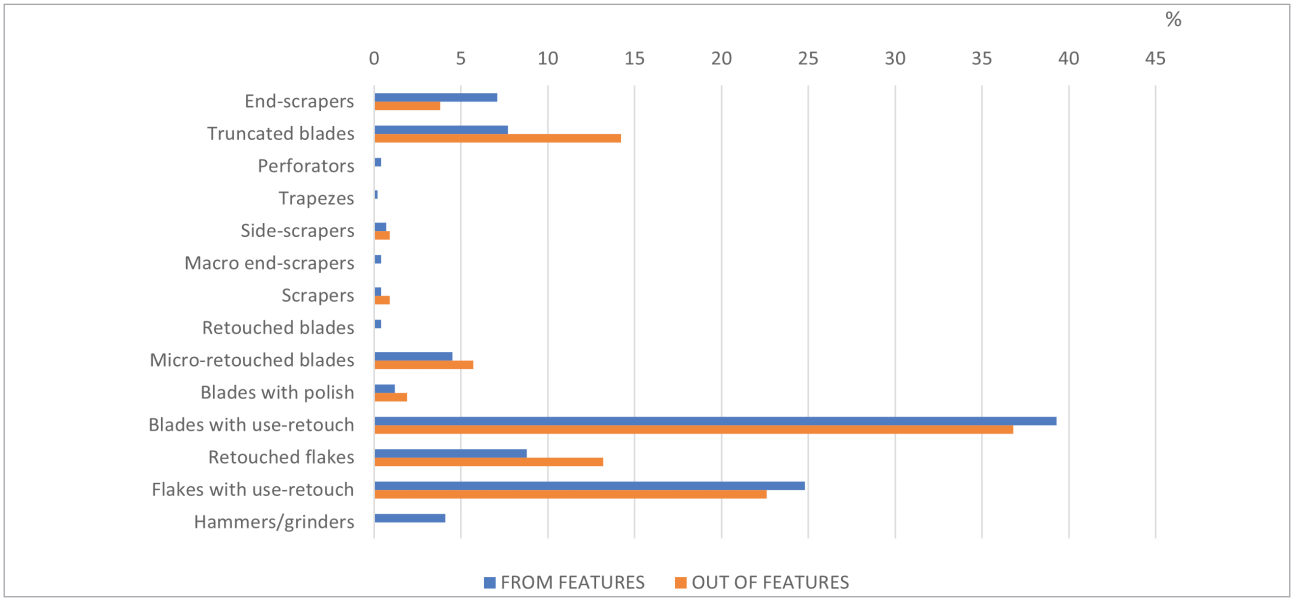

Fig. 5. Tonie 9. Frequency of tools in the lithic inventories from S-O features and exploration levels out of features.

Table 6. Tonie 9. Qualitative and quantitative structure of tool group from S-O features and exploration levels out of features.

TOOLS	IN FEATURES		OUT OF FEATURES	
	n	%	n	%
End-scrapers	59	7.1	4	3.8
Truncated blades	64	7.7	15	14.2
single	*45*		*9*	
doubled	*19*		*6*	
Perforators	3	0.4	-	-
Trapezes	2	0.2	-	-
Side-scrapers	6	0.7	1	0.9
Macro end-scrapers	3	0.4	-	-
Scrapers	3	0.4	1	0.9
Retouched blades	3	0.4	-	-
Micro-retouched blades	37	4.5	6	5.7
Blades with polish	10	1.2	2	1.9
Blades with use retouch	327	39.3	39	36.8
Retouched flakes	73	8.8	14	13.2
Flakes with use-retouch	206	24.8	24	22.6
Hammers/grinders	34	4.1	-	-
SUM	**830**		**106**	

3. General characteristics of flint materials of the Samborzec-Opatów group from the Tonie 9 site

3.1. Technological aspects

Although the structure of the flint collection found at the Tonie 9 site presented above showed quantitative differences between individual groups of artefacts found inside and outside the features, no variation in the internal inventory was noticed at the general level of flint processing technology. This observation coincides with the captured similarities in the quality of structures of sets with different contextual-stratigraphic positions. At the same time, the general qualitative and quantitative structure of the inventory does not contain forms indicating a far-reaching differentiation of flint production at these sites. Therefore, the characteristics of neolithic flintworking can be characterized generally on the basis of data contained in the entire inventory, without separating it into smaller collections, and obviously, due to the large size of the Tonie 9 collection, it is the basic source base for discussing the specifics of flint production. Unfortunately, at the stage of preparing this article, the described flint materials were unavailable to carry out a detailed characterization of the metric features of blades, flakes, and tools and to present them in the form of diagrams.

Blade debitage

In the light of the available data, it is difficult to confirm unambiguously how the blades were obtained by the neolithic S-O communities inhabiting the site. Although there are quite numerous blades here, the number of blade cores and debitage accompanying this branch of production is very modest. Excluding blades, the other categories related to this direction of flintworking (i.e. blade cores, core-tablets, rejuvenation-flakes, crested blades) account for only 2.1% of the total inventory. Perhaps in some – probably narrow – scope there was blade production, so the possibility of local blade production cannot be completely dismissed, but there are no sufficiently convincing relics for this. The individual products distinguished here are not related to the same production episodes, but are fragments of separate "*chaines operatoires*".

Blade production was carried out by exploitation of single-platform blade cores using the indirect percussion technique (cf. Inizan *et al.* 1999). Natural concretions or large and medium-sized crumbs were selected to shape them, the reduction of which was possible without extensive preparatory procedures. Some views on the form of pre-core forms are given by some blade cores. Most of them, however, are forms abandoned at an advanced stage of exploitation or specimens with clearly seen defects and errors that prevented further effective production of blades. In typological terms, these are most often single-platform subconical blade core (Fig. 7: 4; 9: 5; 11: 6; 13: 1–4). Some of them are specimens with two separate flaking surface or specimens resulting from a change of the orientation of the core during processing. Some blade cores are made of chocolate flint, which, however, does not allow for simple inferences to be made about their local exploitation due to the lack of adequate by-products.

Exhausted cores, perhaps exploited at the site, were often reused as hammers or grinders, thus supplementing the deficit of stone raw materials.

Blades

The blades from Tonie 9 have quite similar morpho-stylistic features. There were no specimens that would technologically differ from the canon of Early Neolithic blades known from other Lesser Poland sites, especially from the vicinity of Kraków (Kaczanowska 1971; Balcer 1983).

To determine the technique used for the production of blades, it is necessary to preserve the blades with their proximal parts. Blades from Tonie 9 are incomplete, but the majority (97 pcs.) are total whole

specimens (16 pcs.) and proximal parts (81 pcs.). Most of them have faceted butts without traces of abrasion and removing overhangs on the flaking edge. Similar features are legible on blade tools with preserved butts. The vast majority of blades are negative, which indicates their selection (Fig. 6: 4, 6; 9: 9; 10: 7; 11: 2; 17: 6). On relatively few blades, the cortex is present fragmentarily.

Primary and secondary crested-blades from early core exploitation indicate the output parameters of blade cores. They correlate with some of the completely preserved blades, distinguished by their length. However, the presence of crested-blades does not have to be related to local early processing of cores, but they can be forms of utility tools in the same way as blades without retouching.

Flake debitage

Although flakes are the dominant category of products in this inventory, they cannot all be considered as the result of deliberate production of flakes. Considering the flaked material in general, it can be assumed that it has a diverse technological genesis. A trace of this is the large morpho-metric diversity of the flakes. They have not only different features of the same elements, such as the formation of the proximal part, but also general proportions (ratio of width to thickness) and the nature of the surface. In the latter aspect, 90 fully cortical specimens, 491 partially cortical and 677 negative specimens were distinguished in the group of flakes. It can therefore be assumed that the flakes present here are the result of variously targeted production activities. There are specimens that were produced as deliberate flakes or flaked half-products, but there are also those that may be genetically related to the exploitation of flake cores (mainly their preparation) (e.g. Fig. 9: 5), to the shaping of pre-cores, to the transformation of large flake tools, etc.

On the other hand, the dominant cores in the group – flake cores and blade-flake cores – can be read as relics of local production of flakes with the use of the simplest methods and techniques of direct percussion.

Chunks

In the entire inventory, a group of chunks was separated, which consists of specimens that do not have the characteristics of products from other categories. Within this category, three subgroups have been distinguished. The first of these are specimens burned to the extent that it is impossible to identify their original morphology. A total of 96 such specimens were registered. The second subgroup are natural chunks and larger concretions. Of the 36 specimens, half were deposited in the exploration layers (18 pcs.) and the same number (18 pcs.) were deposited in the features.

The last subgroup are chunks with negatives, probably being amorphous fragments of crushed artefacts whose morphology cannot be determined. 69 pieces of negative chunks were separated, with 11 specimens coming from the layers out of features, and more than five times more (58 specimens) – from features.

3.2. Flint tools

Specimens classified as tools form two groups differing in the degree and standardization of transformations forming their morphology and working edges.

The first of them consists of typological tools, such as: end-scrapers, truncated blades (sickle inserts), perforators and others. The second group is utility tools. In other words, these are atypical forms of tools that cannot be classified into any of the typological tool categories. They consist of either flakes and blades with retouching modifying the edge (or edges) in an atypical way, or "raw" flakes and blades with retouching referred to as utilitarian.

In total, 738 utility tools were distinguished, which is the vast majority in the entire tool inventory and in individual sets separated for features and layers outside of them. The morphological diversity of products from this group shows that it is not possible to indicate an intermediate material (blades or flakes) with specific morpho-metric properties that was selected as appropriate for a given category of tools. The products from this group are probably *ad hoc* selected flakes and blades that ensured the implementation of specific tasks. Among them, 366 blades have been identified quantitatively, which, together with analogous "utility" flakes, accounts for almost 65% of all tools at the site (Fig. 6: 3; 7: 6; 8: 7; 10: 1, 5, 7; 14: 6; 15: 7, 8; 17: 6, 7). A slightly clearer range of secondary treatments that were created for utilitarian purposes or as a result of tool use are borne by specimens referred to as microretouched blades, although the boundary between them and the above-mentioned utility blades is quite fluid (Fig. 6: 9; 7: 1; 8: 8; 10: 6; 11: 2).

In opposition to the group of utility (atypical) tools there are much less numerous conventional (typology) tools (164 pcs.). These are standardized forms shaped by intentional retouching, whose morphology and traces of wear often correlate with one specific activity. A classic example in Early Neolithic inventories are truncated blades, also referred to as sickles or

sickle inserts, associated with cutting cereals, and also end-scrapers (e.g. Małecka-Kukawka 2001).

In the inventory from Tonie 9 site, the most numerous category of typological tools are truncated blades (79 pcs.), with twice as many single truncated blades (54 specimens) registered as double truncated blades (25 pcs.). They are made mainly of blades, but also of flakes (Fig. 6: 2, 7; 7: 2, 3; 8: 1–6; 9: 1–4, 8; 10: 3, 8–10; 11: 4, 5, 8; 12: 1–6, 8; 14: 2–5; 15: 1–4; 16: 1–12; 17: 1, 2). It seems that this group of tools is much more strongly associated with blade semi-raw material than with any other type of tool in this inventory. In addition, negative blades were clearly preferred. The truncation was most often formed in the distal part of blade, which can be seen most clearly in the case of single truncated blades. The specimens referred to as double truncated blades are probably the result of "renewing" the sickle insert by reorienting it, which involved the need to reuse the tool and re-form the second opposite truncation. Most of the truncated blades have traces of use in the form of clear polishing. Overall, from a stylistic and technological perspective, these tools are a very homogeneous

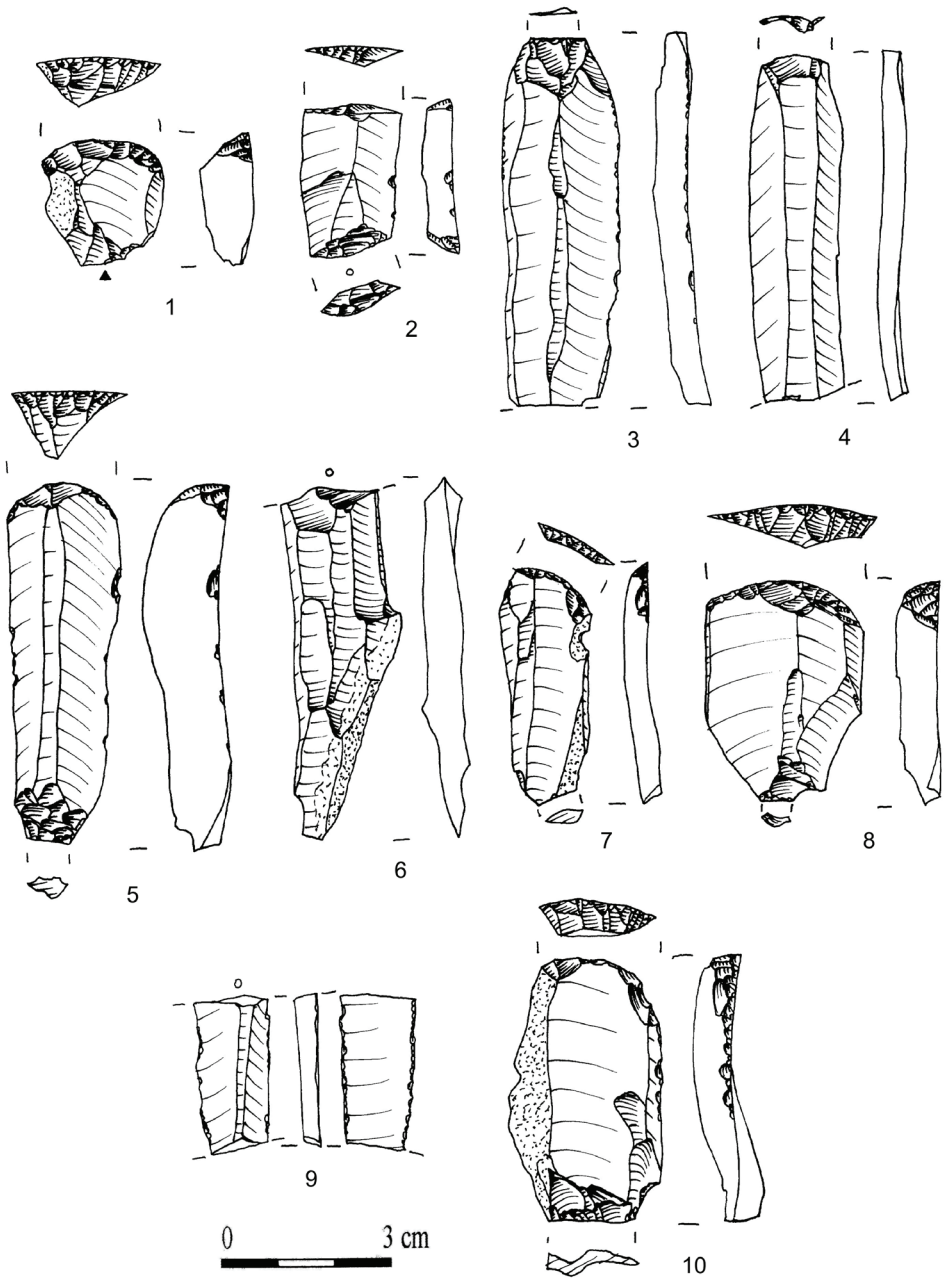

Fig. 6. Tonie 9. S-O flint materials from features: 7 (1), 8 (2–4), 20 (5–7), 23 (8), 32 (9), 33 (10). Jurassic Cracovian flint: 1–10 (drawn by M. Wąs).

group, which is probably due to their specific function requiring standardization of the form, related to the construction of harvest knives or sickles, of which they were an element.

The second most numerous typological tool in the inventory from the discussed site are end-scrapers (63 pcs.). The selected blade or flake semi-raw material transformed into end-scrapers came from various phases of exploitation, as evidenced by the fact that some of them have partially cortex surfaces while others have negative surfaces. Most of them are end-scrapers with one working edge usually located in the distal part of the blade or flake (Fig. 6: 1, 5, 8, 10; 7: 5; 8: 9, 11; 9: 1, 7; 10: 2, 4, 11; 11: 1, 3, 9, 10; 12: 7, 10; 14: 1; 15: 5, 6; 17: 3–5).

In addition to the dominant in the tool group of end-scrapers and truncated blades, the inventory of Tonie 9 includes several other types, among which perforators (Fig. 8: 12; 12: 9) and macro end-scrapers (Fig. 9: 6) stand out morphologically. Other types are represented by single specimens, such as flake scrapers (Fig. 8: 10).

The presence of two trapezes in the tool inventory of Tonie 9 should also be noted, one of which is an incomplete specimen (burnt and crushed), and the other is a form of an asymmetrical trapeze (Fig. 14: 7, 8).

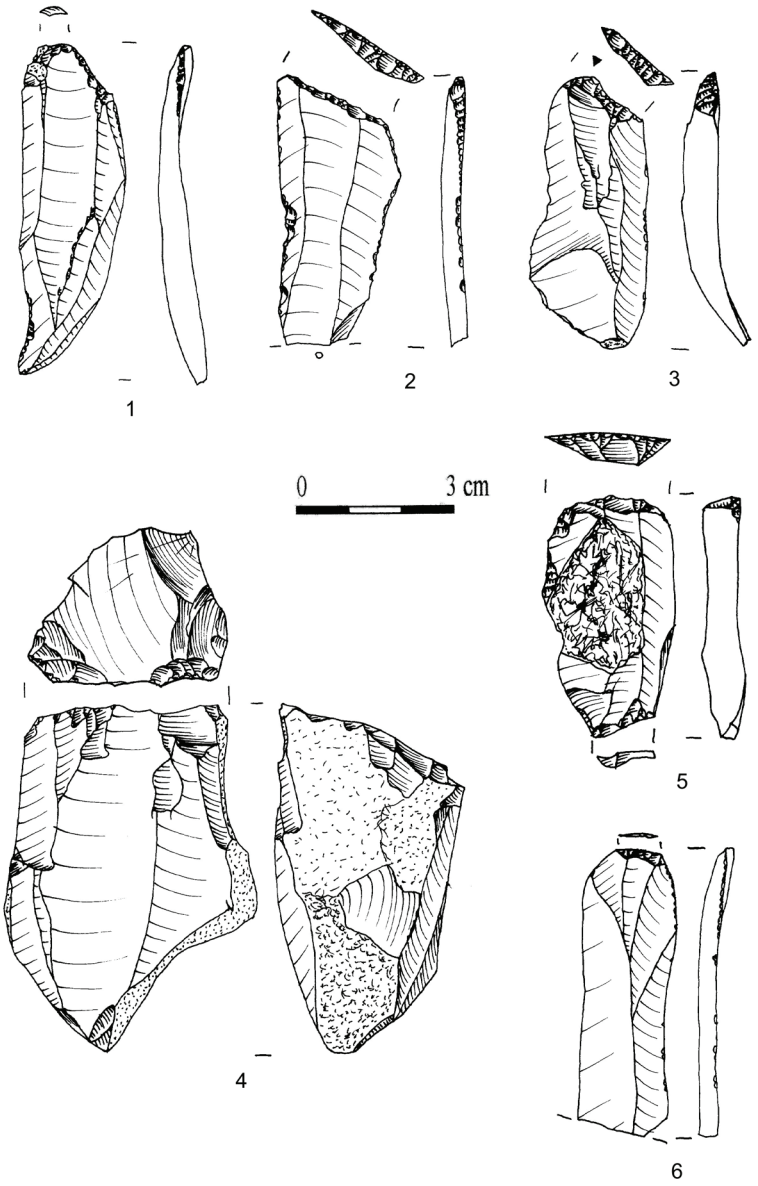

Fig. 7. Tonie 9. S-O flint materials from features: 41 (1), 47 (2–6). Jurassic Cracovian flint: 1–6 (drawn by M. Wąs).

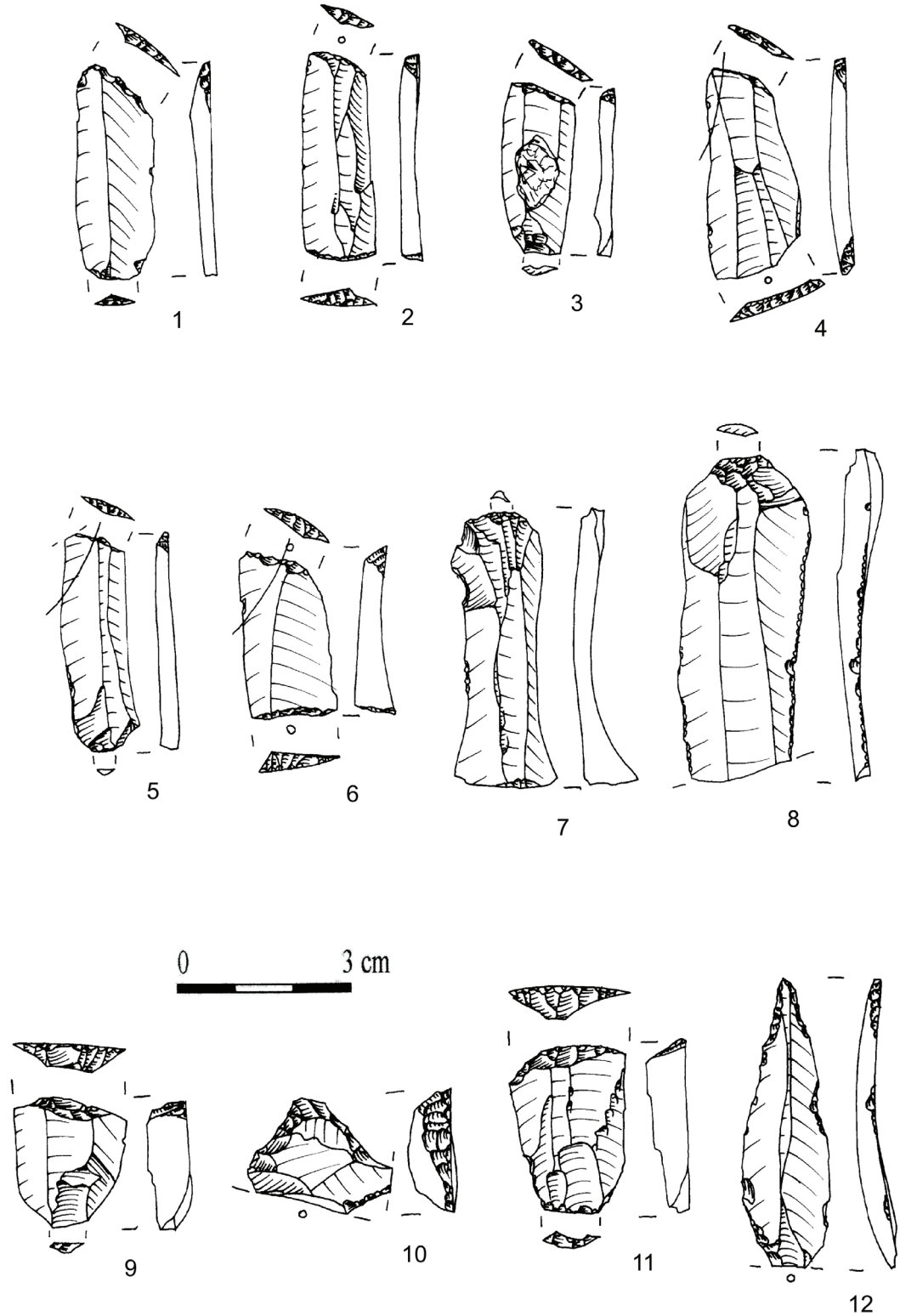

Fig. 8. Tonie 9. S-O flint materials from features: 48 (1–3), 53 (4), 60 (5–10), 62 (11–12). Jurassic Cracovian flint: 1, 2, 4–6, 9–12; c: 7, 8; chocolate flint: 3 (drawn by M. Wąs).

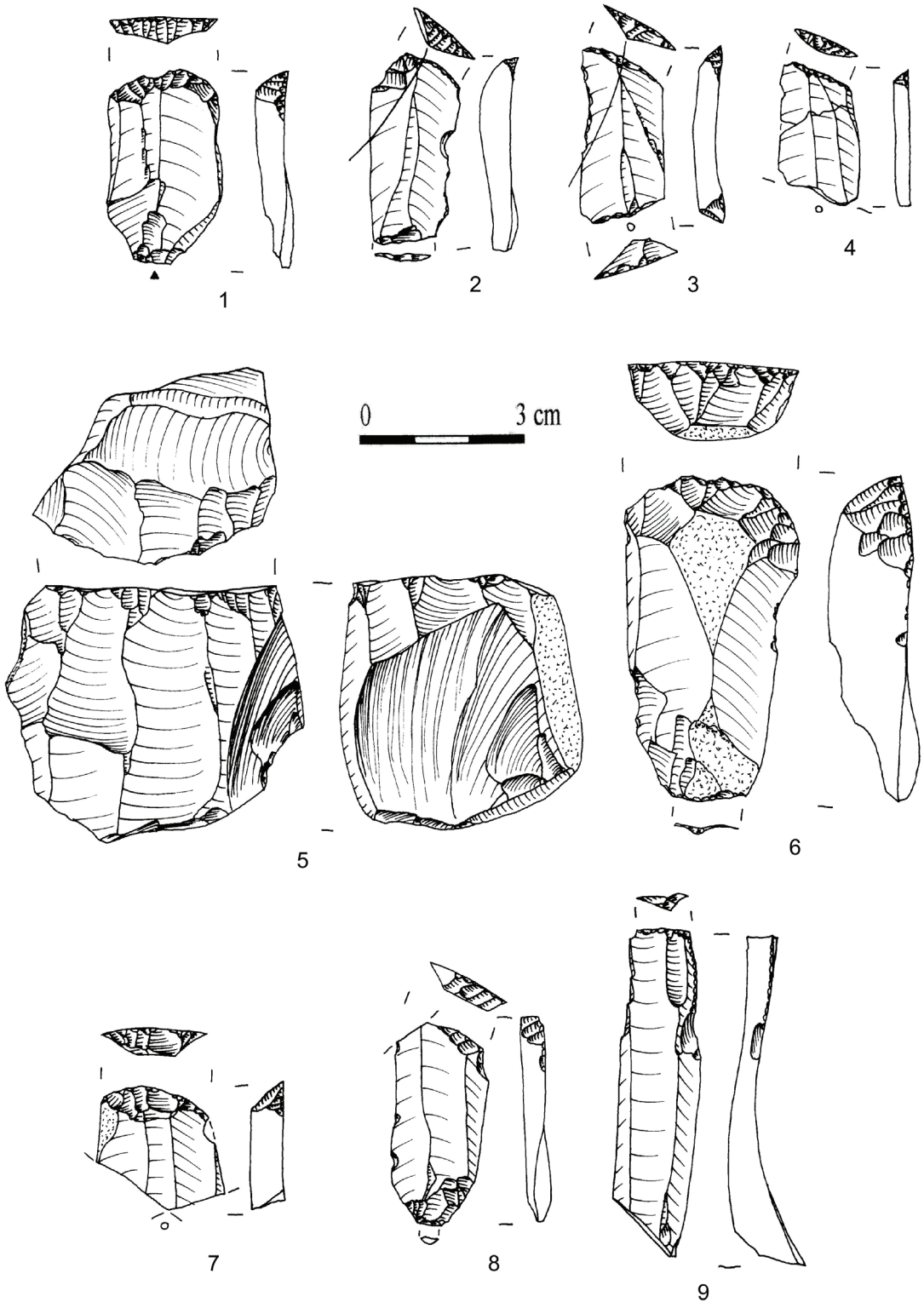

Fig. 9. Tonie 9. S-O flint materials from features: 90 (1, 2), 93 (3, 4), 193 (5, 6), 207 (7–9). Jurassic Cracovian flint: 1, 2, 5, 6, 9; chocolate flint: 7, 8; burnt flint: 3, 4 (drawn by M. Wąs).

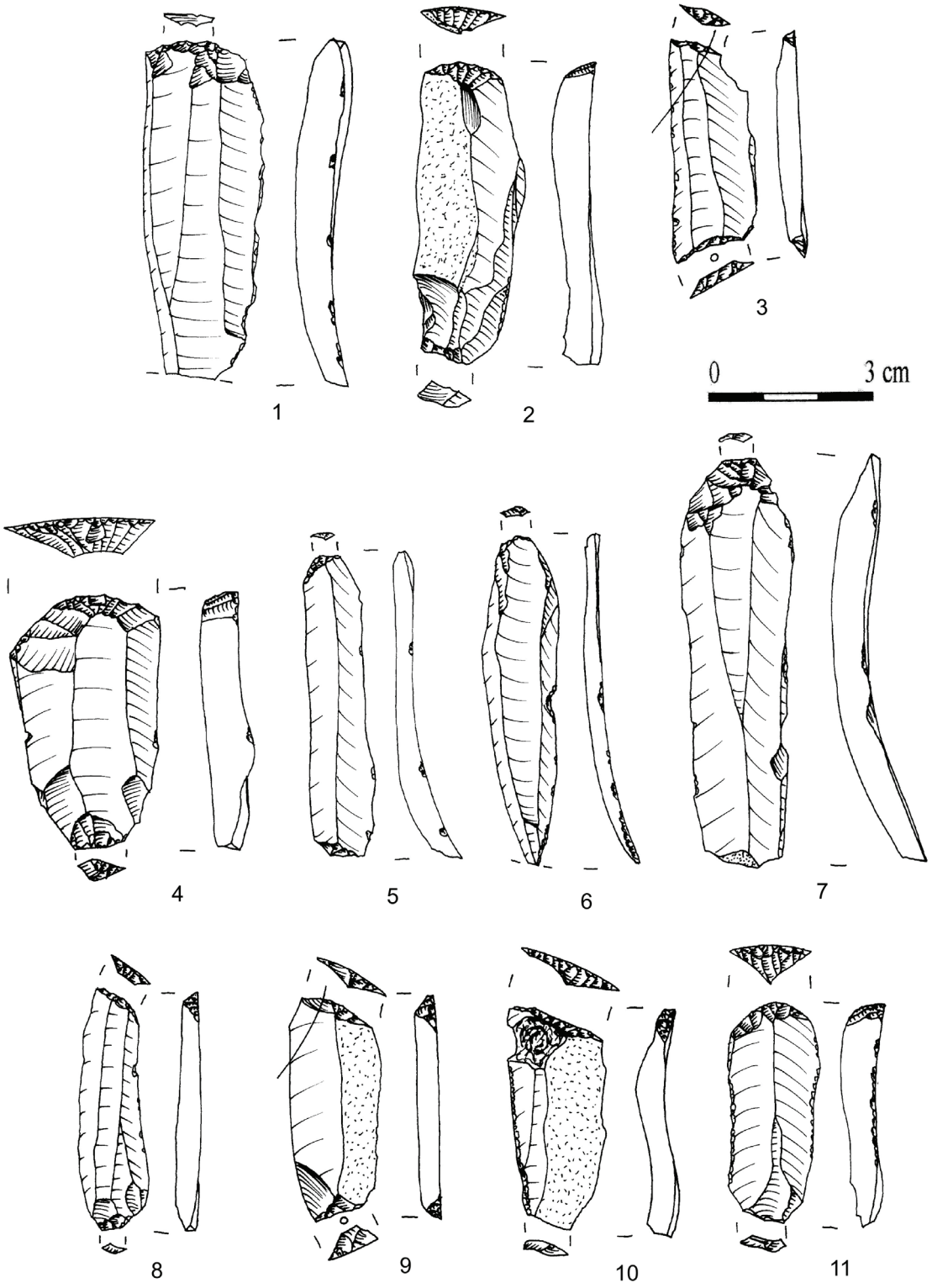

Fig. 10. Tonie 9. S-O flint materials from features: 222 (1, 2), 223 (3), 223c (4–11). Jurassic Cracovian flint: 1–4, 6–11; chocolate flint: 5 (drawn by M. Wąs).

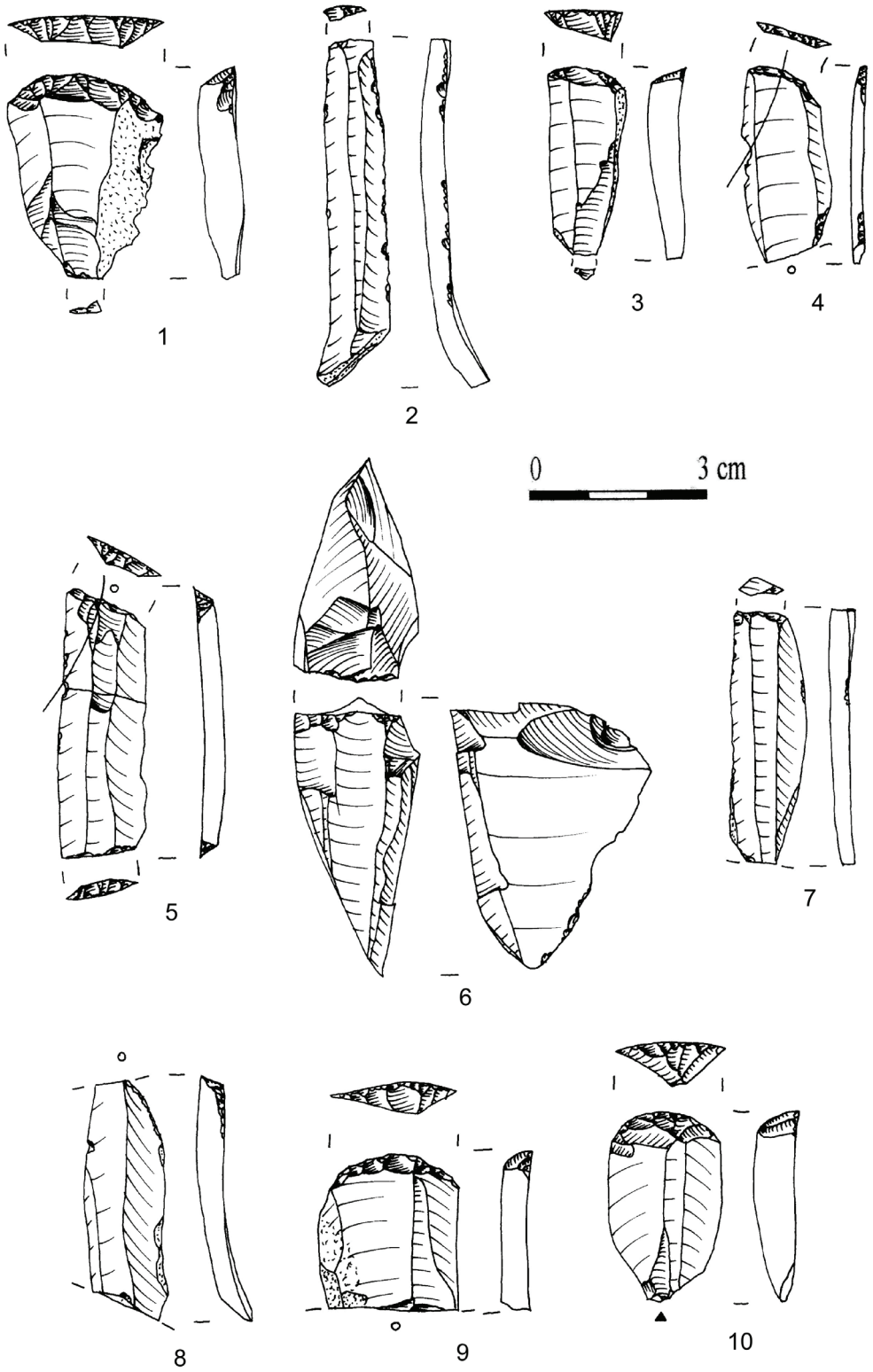

Fig. 11. Tonie 9. S-O flint materials from features: 246 (1), 257 (2), 260 (3, 4), 261 (5), 265 (6), 269 (7), 272 (8–10). Jurassic Cracovian flint: 1–5, 8, 10; chocolate flint: 6, 7, 9 (drawn by M. Wąs).

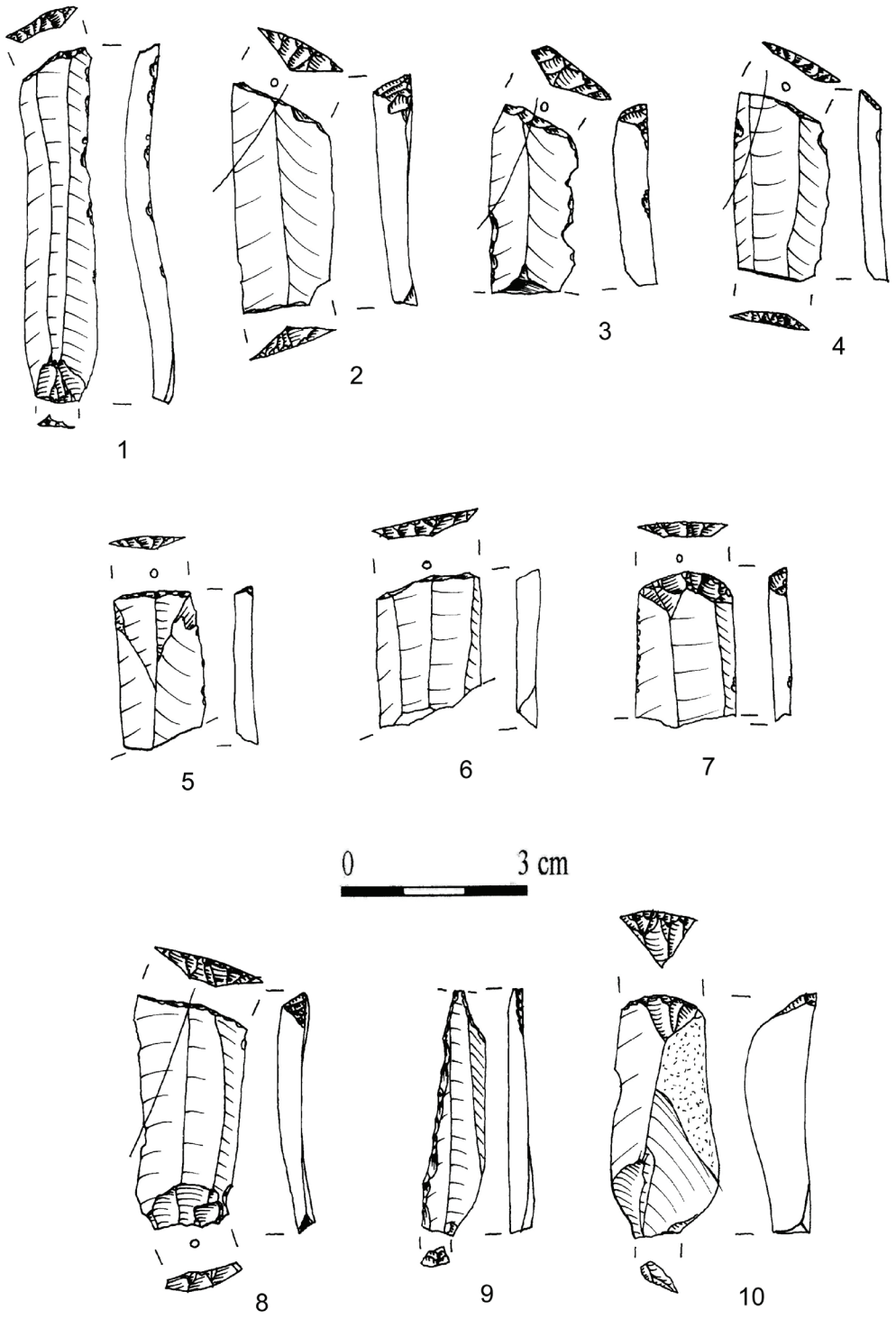

Fig. 12. Tonie 9. S-O flint materials from features: 274 (1–7), 278 (8–10). Jurassic Cracovian flint: 1–5, 8, 9; chocolate flint: 7, 10; burnt flint: 6 (drawn by M. Wąs).

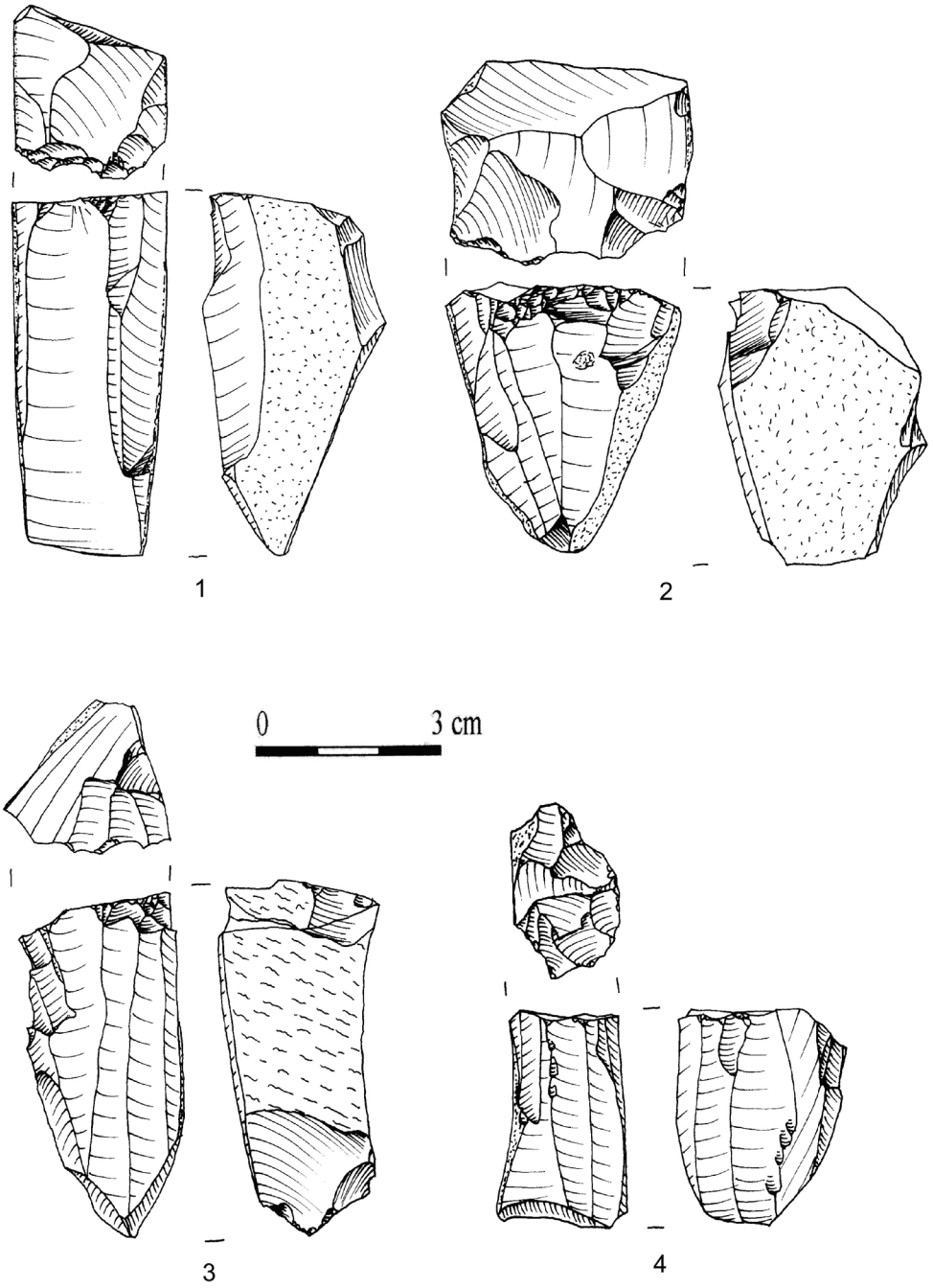

Fig. 13. Tonie 9. S-O flint materials from features: 278 (1, 2), 279 (3, 4). Jurassic Cracovian flint: 2, 4; chocolate flint: 1, 3 (drawn by M. Wąs).

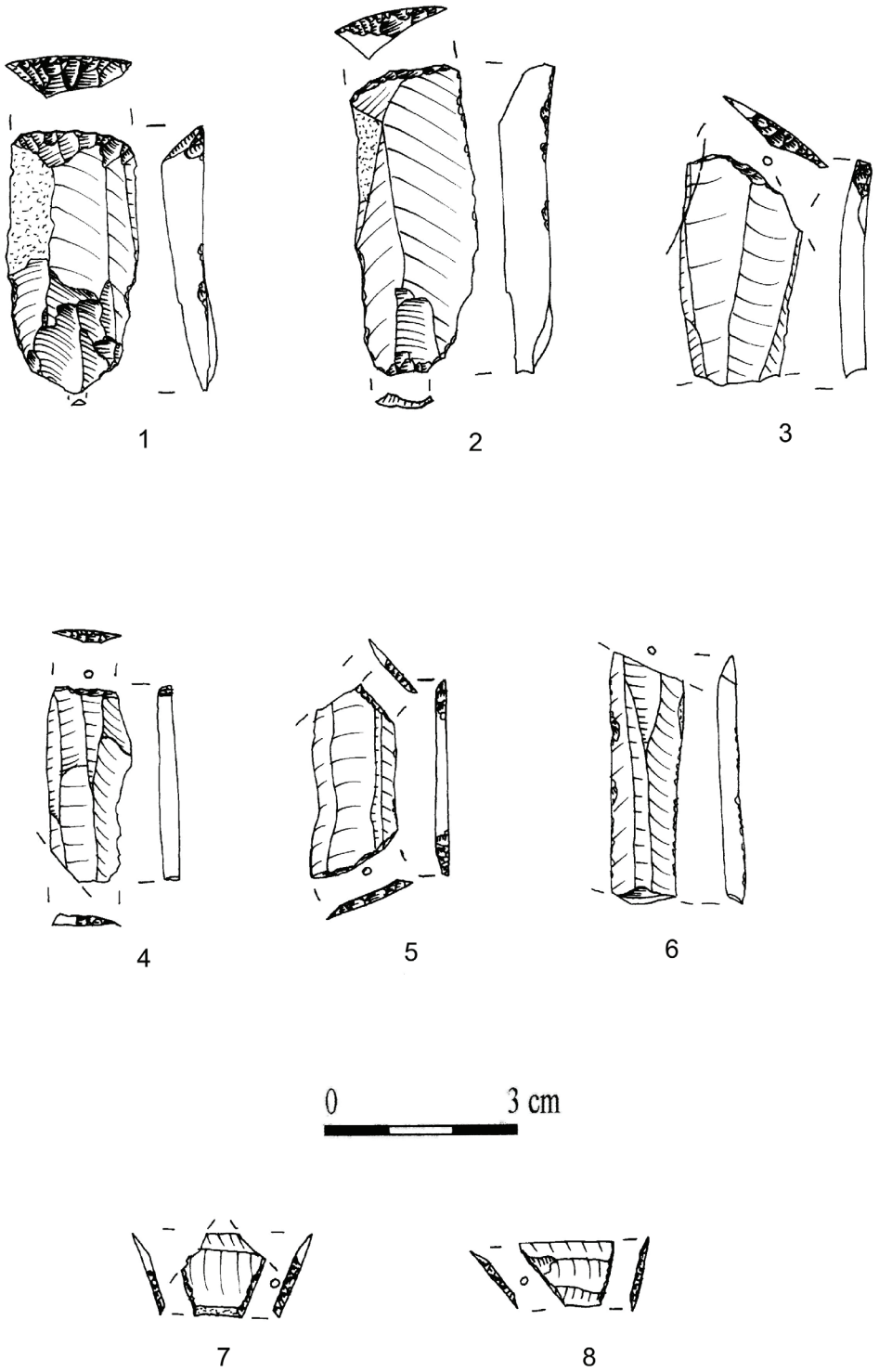

Fig. 14. Tonie 9. S-O flint materials from features: 279 (1–7), 298 (8). Jurassic Cracovian flint: 1–3, 5, 8; chocolate flint: 4, 6; burnt flint: 7 (drawn by M. Wąs).

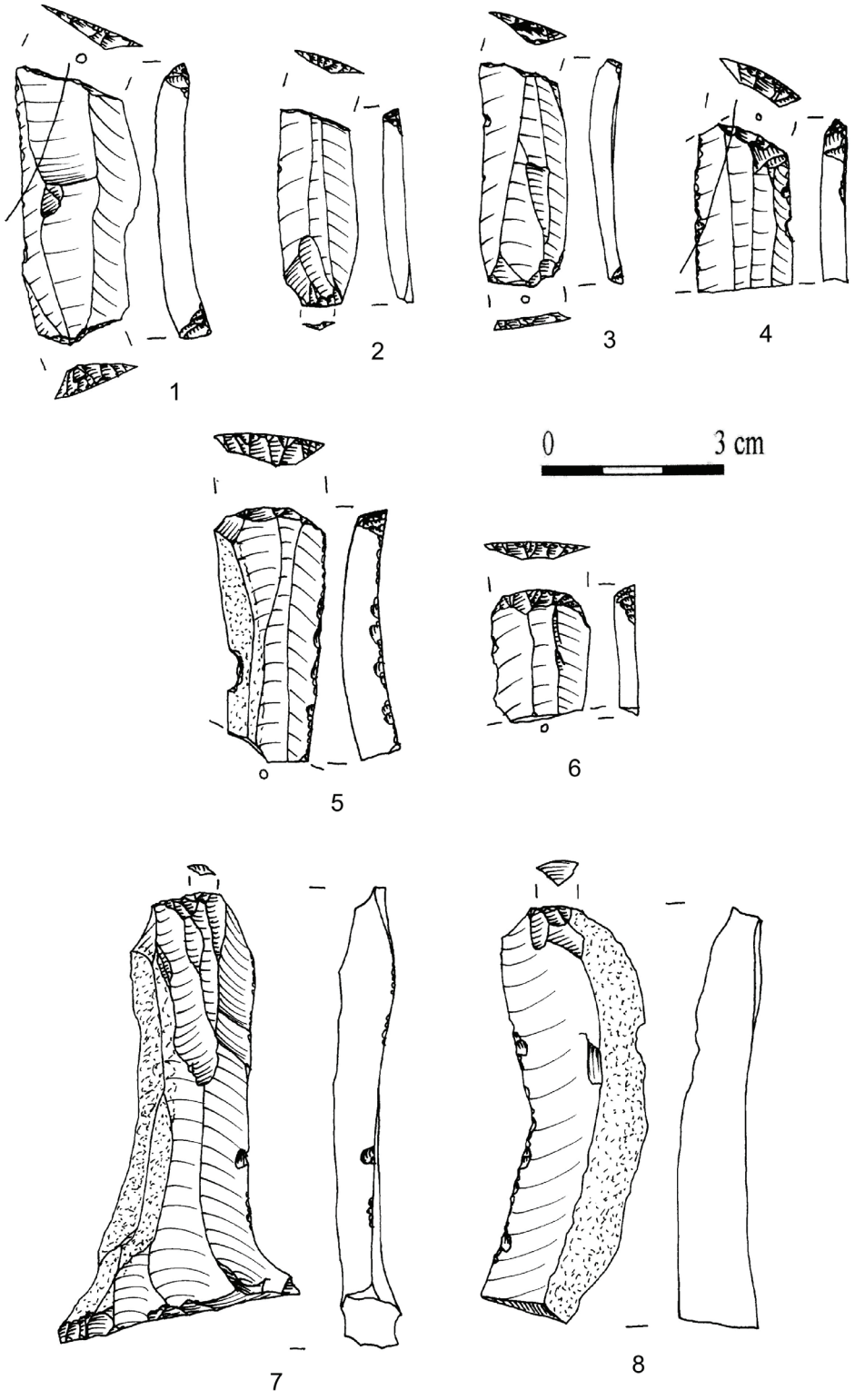

Fig. 15. Tonie 9. S-O flint materials from feature 293 (1–8). Jurassic Cracovian flint: 1, 2, 3, 6, 8; chocolate flint: 2, 5, 7 (drawn by M. Wąs).

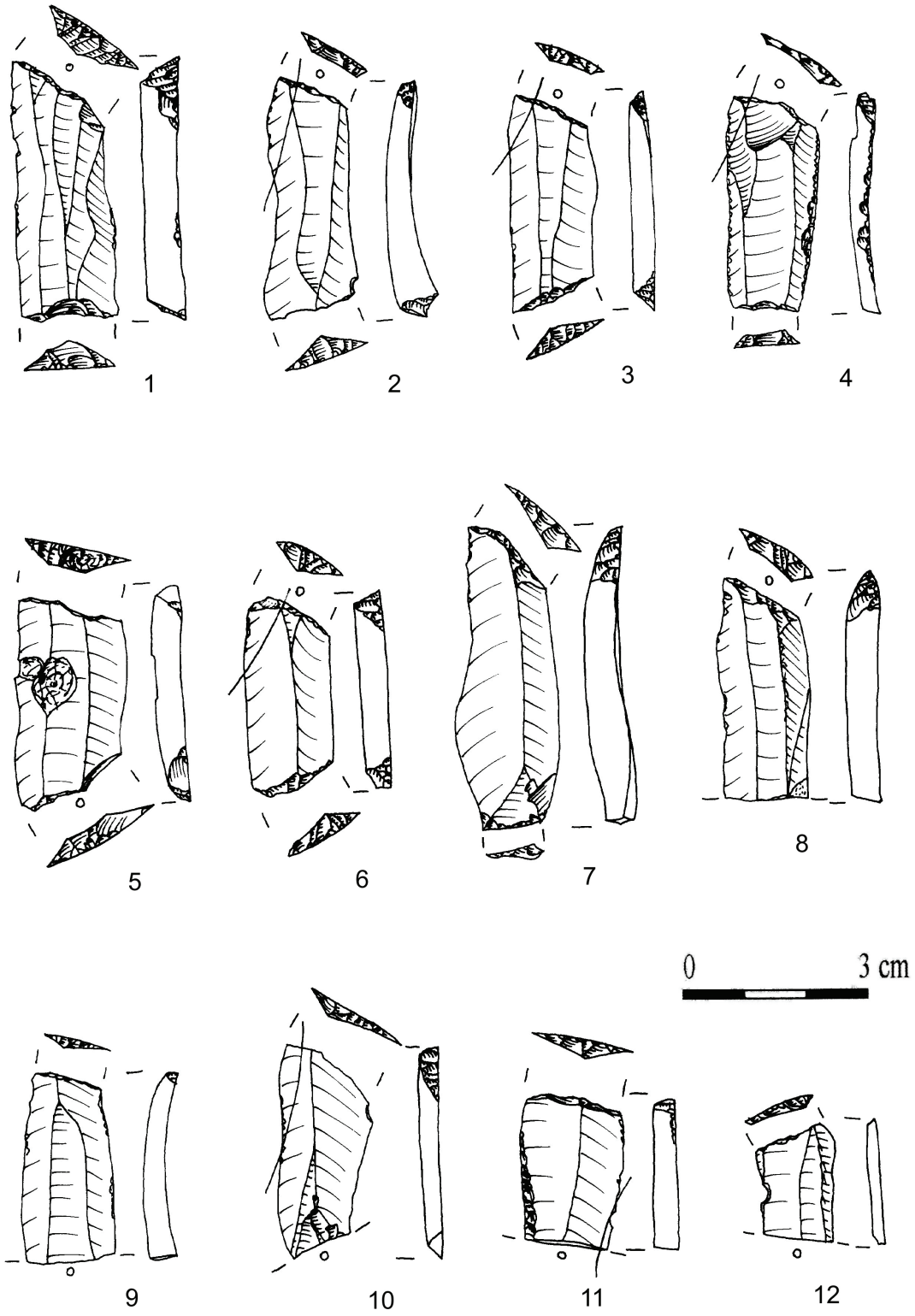

Fig. 16. Tonie 9. Flint materials from exploration levels out of S-O features. Jurassic Cracovian flint: 1–4, 6–12; burnt flint: 5 (drawn by M. Wąs).

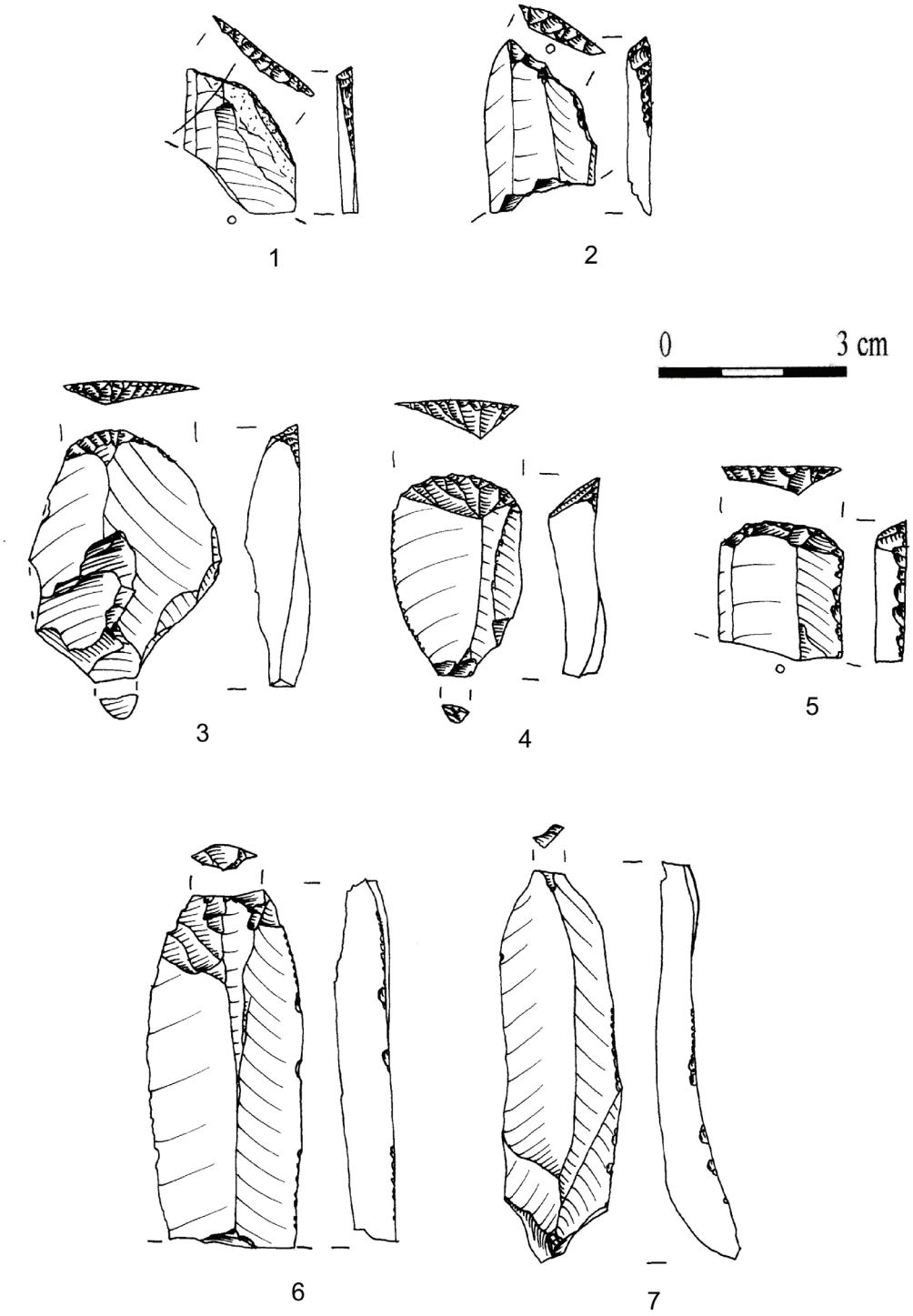

Fig. 17. Tonie 9. Flint materials from exploration levels out of S-O features. Jurassic Cracovian flint: 1–7 (drawn by M. Wąs).

4. Conclusions

Rescue excavations carried out at the Tonie 9 site provided rich flint material associated with the S-O settlement. It contains elements typical for flintworking of this unit and is characterized by a full cross-section of the technological and typological structure of Early Neolithic flint inventories (Kozłowski 1970; Balcer 1983). Also, the raw material structure, containing three components: the dominant local raw material and the trace imported and exotic raw material (like chocolate flint or obsidian), is typical for many other sites of this period in Lesser Poland. Certainly, an interesting and new element here is the presence of banded flint, which represents 8 ordinary flakes. Obsidian, on the other hand, is represented in this site in a trace. On the one hand, this contrasts with the raw material structure of other S-O inventories, and on the other hand, it sheds light on a certain difference in relation to the Malice culture inventories, in which obsidian is sometimes quite numerous (cf. Kaczanowska and Kozłowski 2006; Szeliga 2007; Wilczyński 2010; Wąs 2021).

The analysis carried out above within individual groups revealed a far-reaching standardization of flint making at the discussed site, both in terms of production and especially in terms of use.

Taking into account the qualitative structure of the flint inventory from Tonie 9, one can notice similarities to the Lesser Poland inventories referred to as "user settlements" (Lech 1981). The settlement character of the inventory is matched by the spatial context – the relationship with the relics of potential residential buildings. The structure of the tool group is characteristic of "home" inventories. Truncated blades and end-scrapers definitely dominate here. A quantitatively distinctive category of products with tool use are also blades and flakes with the so-called utility retouch, which do not show the formal standardization and metric preferences.

From a technological point of view, the entire flint inventory of Tonie 9 is a conglomerate of many production episodes. Although semi-raw material forms dominate here (with a predominance of flakes over blades), the scope and place of their production are unspecified in the structure of the settlement. With high probability, it can be pointed out that at least part of the lithic raw material (perhaps in the form of precore forms or early exploitation cores) and probably also ready-made semi-raw material (especially blades) from "mine" workshops (Dzieduszycka-Machnikowa and Lech 1976; Lech 1981) or from other settlements where production activities had places (cf. Kruk and Milisauskas 1999, 52–54).

The attempt to embed S-O flint materials from Tonie 9 against a broader comparative background encounters significant and objective limitations. First of all, attention should be paid to the highly unsatisfactory state of diagnosis of flint-making in this unit (see Kaczanowska and Kozłowski 1994; 2006). In this context, the collection of S-O flints from Tonie 9 has great cognitive value as one of the few relatively fully recognized and probably homogeneous settlement inventory. Undoubtedly, the entire S-O collection, is a more important part of the source base for S-O flint-making in Lesser Poland, which will allow for the development of appropriately targeted analytical and comparative studies aimed at identification of its characteristic features.

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