RESEARCH ARTICLE – VÝZKUMNÝ ČLÁNEK

Formation of Mesolithic hunting campsites: Case studies of the Rydno and Wieliszew sites (Poland)

Formování mezolitických loveckých tábořišť: Případové studie lokalit Rydno a Wieliszew (Polsko)

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The organisation of hunter-gatherer campsites and whether repetitive behaviour patterns are reflected in the cultural and functional context of archaeological sites remains an important issue in Mesolithic archaeology. We analysed the material from the Rydno and Wieliszew sites in Poland, using the refitting of flint artefacts, the identification of use-wear on tools, and their spatial analysis to deliver the reconstruction of socio-technical processes that affected the formation of flint assemblages. The results indicate that despite the similar function of the campsites at Rydno and Wieliszew, they differed in the use of natural resources. These results are discussed in a broad European context and compared with findings obtained elsewhere. The article highlights new opportunities for reinterpreting many previously studied Mesolithic sites, some of which are already recognised as archival collections. Such lithic collections have the potential for developing new theories and comparing them with findings derived from materials obtained using modern excavation methods. The research results show that studies based on thorough and detailed analysis contribute to a deeper understanding of the processes involved in the formation of Mesolithic sites through the identification and description of settlement structures, which also allows us to determine the spatial and even temporal relationships between them.

Poland – Mesolithic campsites – site formation – archaeological record – behavioural activity

Uspořádání tábořišť lovců a sběračů a otázka, zda se opakující se vzorce chování odrážejí v kulturním a funkčním kontextu archeologických nalezišť, zůstávají důležitými tématy mezolitické archeologie. Analyzovali jsme materiál z lokalit Rydno a Wieliszew v Polsku, přičemž jsme využili skládanky pazourkových artefaktů, identifikaci stop opotřebení na nástrojích a jejich prostorovou analýzu, abychom rekonstruovali sociálně-technické procesy, které ovlivnily vznik pazourkových souborů. Výsledky naznačují, že navzdory podobné funkci tábořišť v Rydnu a Wieliszewu se tyto lokality lišily ve způsobu využívání přírodních zdrojů. Tyto výsledky jsou diskutovány v širším evropském kontextu a porovnávány se zjištěními z jiných lokalit. Článek zdůrazňuje nové možnosti reinterpretace mnoha dříve zkoumaných mezolitických lokalit, z nichž některé jsou již považovány za archivní soubory. Takové soubory kamenné industrie mají potenciál pro vytváření nových teorií a jejich srovnání s poznatky vycházejícími z materiálů získaných moderními exkavačními metodami. Výsledky výzkumu ukazují, že studie založené na důkladné a detailní analýze přispívají k hlubšímu porozumění procesům formování mezolitických lokalit prostřednictvím identifikace a popisu sídelních struktur, což nám zároveň umožňuje určit prostorové a dokonce i časové vztahy mezi nimi.

Polsko – mezolitická tábořiště – formování lokalit – archeologický záznam – behaviorální aktivita

Introduction

Mesolithic communities of the Early Holocene differed significantly in their material culture and way of life from populations living in the Late Pleistocene. Their existence

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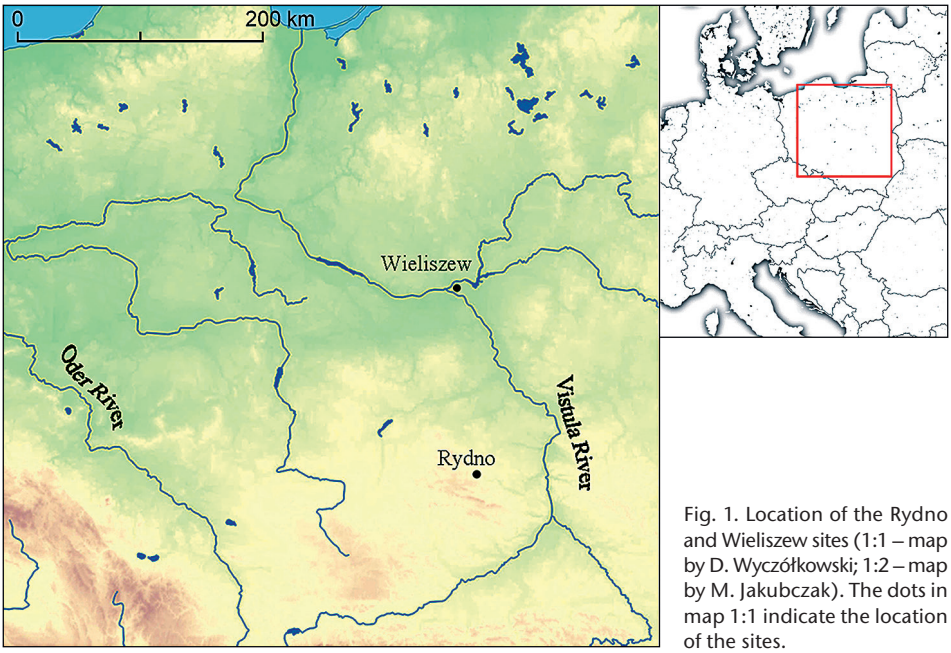

Fig. 1. Location of the Rydno and Wieliszew sites (1:1 – map by D. Wyczółkowski; 1:2 – map by M. Jakubczak). The dots in map 1:1 indicate the location of the sites.

and survival strategy depended on advanced methods of hunting, gathering, and fishing (*Kabaciński 2016*, 250). A characteristic feature of their lithic inventories was the microlithisation and geometrisation of the main tool types, such as triangles, rectangles, and trapezes, which required implementing a new concept of organisation for the processing of flint raw material (*Sørensen – Sternke 2004*, 105–106; *Fisher 2006*, 237).

These changes were dictated by adaptation to the conditions of the new ecosystem, which was characterised by a change in vegetation cover and the emergence of dense forest communities (*Klerk 2004*, 37) and, consequently, the emergence of forest fauna. This adaptation to the different environmental requirements is clearly visible in the stratigraphic sequence of archaeological sites, where, with the onset of the Holocene, the proportion of skeletal remains of forest animals increases in the northern parts of Central Europe (*Kobusiewicz – Kabaciński 1993*, 118; *Benecke 2004*, 45–46). According to *Galiński* (*2019*, 84), it is possible to distinguish five elementary complexes in the northern areas of Central Europe: Sauveterrian, Beuronian-Tardenosian, Duvensian, Maglemosian, and Janislavician. Their typology is based particularly on lithic and bone tools, as each complex possessed its own distinctive toolkit. There is also a change in the structure of social groups and their organisation, their way of life, and their working conditions, which is reflected in the structure of sites, whose context is extremely important in assessing human-environment relationships.

Flint artefacts are a concrete form of human categorisation understood as productive processes (*Miller 1982*, 17). They are the most numerous artefacts found at hunter-gatherer sites, especially when – as in the case of most sites in Poland – these are located on sandy dunes or on other geomorphological strata unfavourable for the preservation of organic materials. In these environments, lithic scatters thus constitute the primary archaeological

sources for research on the Mesolithic communities. It is thus crucial to understand formation processes that constitute the archaeological record of these sites and how past human agencies can be reconstructed within them (*Pecora 2001*, 188). This can be achieved on the basis of refittings and the detailed interpretation of the flint scatters.

The key issue addressed in this article is how Mesolithic hunter-gatherers organised their camp sites, and whether there are repetitive 'behaviour patterns' that are reflected in the cultural and functional context of the formation of archaeological sites. In order to learn more about the aspects of the life of Mesolithic groups and at the same time about the mechanisms that generated them, we may not only rely on the successive discoveries of new sites but should also attempt to reinterpret contexts of the already discovered sites, including archival excavations. We addressed this issue using the Rydno and Wieliszew sites as case studies. Both settlement sites represent distinct structures of artefact deposition, allowing us to study the formation of Mesolithic sites using the example of two qualitatively different flint scatters. Undoubtedly, these differences are not only the result of divergent processes creating the archaeological record but also of the distinct contexts in which the two sites were located. For this reason, the selected sites are perfectly suited to the aims, objectives, and issues discussed in this study.

Location and description of the sites

The case-study inventories were selected based on methodological and archaeological aspects. In methodological terms, appropriate procedural steps were taken to ensure the validity and reliability of the analysis of the material sources, whilst from the archaeological point of view, we should emphasise their homogeneity and the absence of any significant disturbance of the spatial distribution of flints, which can be caused by post-depositional human activity or ground erosion. Nevertheless, the selected sites represent two separate cultural-chronological horizons, allowing for broader comparisons in terms of cultural and chronological variability.

Rydno IV/47

The first site is located in the area of the large 'Rydno' settlement complex near Skarżysko-Kamienna (Świętokrzyskie Voivodeship) (*Fig. 1*). Over several decades of research, archaeologists discovered numerous Late Palaeolithic and Mesolithic sites in that area related mainly to a prehistoric haematite mine (*Schild et al. 2011*). The discovered sites have so far been the subject of many studies presented in numerous articles (e.g., *Ginter 1965*; *Schild – Królik 1981*; *Fiedorczuk 1992*). Detailed information on the study history, geomorphology, and taxonomy is provided by *Schild et al.* (*2011*).

Trench IV/47, which is the focus of this study, is situated in the area called Pastwisko, one of the several large areas of archaeological excavations carried out at the Rydno settlement complex (*Fig. 3*: a). In this case, an area of 130 m² was excavated (*Fig. 3*: b). During the excavation, 576 flints (including chips and waste) were recovered.

The assemblages of artefacts from Rydno IV/47 are associated with the flint industry of the Janisławice culture. Its existence in the territory of Poland dates from the mid-7th millennium to almost the end of the 6th millennium BC (*Kozłowski 2009*, 451). At Rydno,

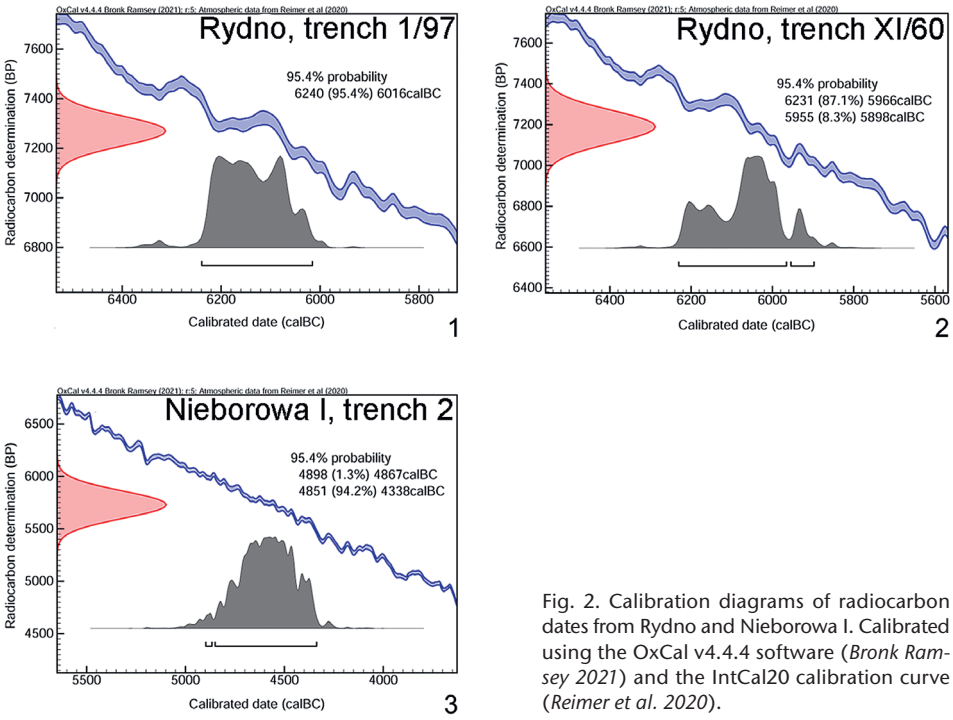

Fig. 2. Calibration diagrams of radiocarbon dates from Rydno and Nieborowa I. Calibrated using the OxCal v4.4.4 software (*Bronk Ramsey 2021*) and the IntCal20 calibration curve (*Reimer et al. 2020*).

this chronology has been confirmed by radiocarbon dating of charcoal samples taken from campfires from other trenches, i.e. XI/60 and I/97, where Janisławice culture lithics were located next to the hearths (*Fig. 2*: 1–2; *Tab. 1*).

The grouping of a number of Mesolithic sites of the Janisławice culture in a small area of the Rydno complex makes the scientific value of the materials excavated there exceptional and unique. The flint scatters are characterised by a highly diverse number of finds – from several dozen to several thousand artefacts. Also, the structure of the flint inventory is most often different. Assemblages containing mainly flake tools (*Schild et al. 2011*, 366; *Boroń et al. 2018*) were identified along with assemblages containing a fairly wide spectrum of tools (*Ginter 1965*, 7–10). Such typologically and technologically diverse collections of artefacts constitute an important contribution to the discussion on the nature and specificity of Mesolithic camps of the Janisławice culture in Poland.

Site	Context	Sample	Lab code	C^{14} age BP	BC cal (95.4% probability)	References
Rydno	trench XI/60	charcoal	Gd-1765	7190±80	6231–5898	*Schild et al. 2011*
Rydno	trench I/97	charcoal	Poz-18065	7270±60	6240–6016	*Schild et al. 2011*
Nieborowa	trench 2	charcoal	Gd-144	5730±130	4898–4338	*Boroń 2014*, 26

Tab. 1. Overview of radiocarbon dates mentioned in the text. Calibrated using the OxCal v4.4.4 software (*Bronk Ramsey 2021*) and the IntCal20 calibration curve (*Reimer et al. 2020*).

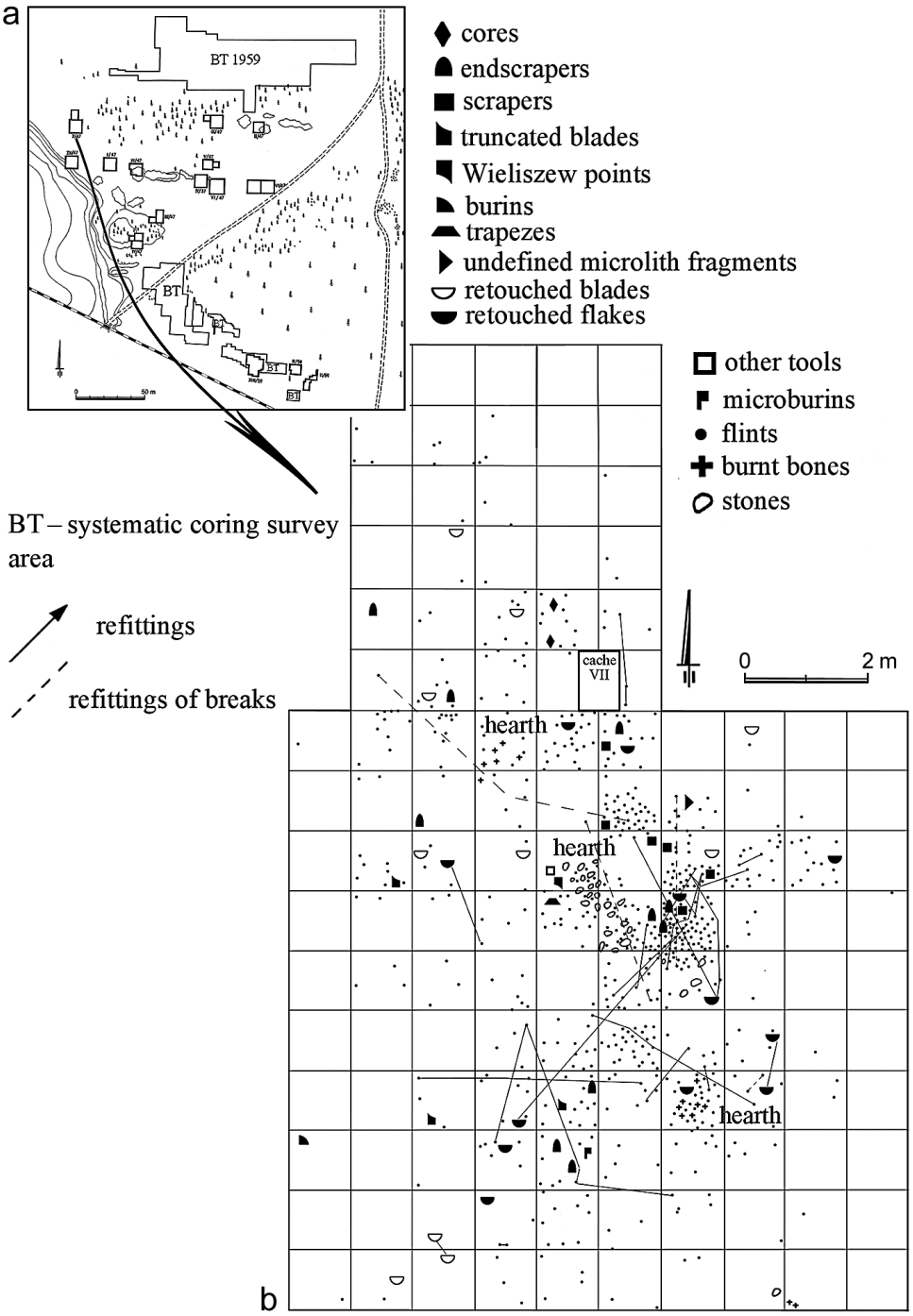

Fig. 3. Rydno site. a – location of trenches in the Pastwisko area; b – Planigraphy of the distribution of flint finds in trench IV/47.

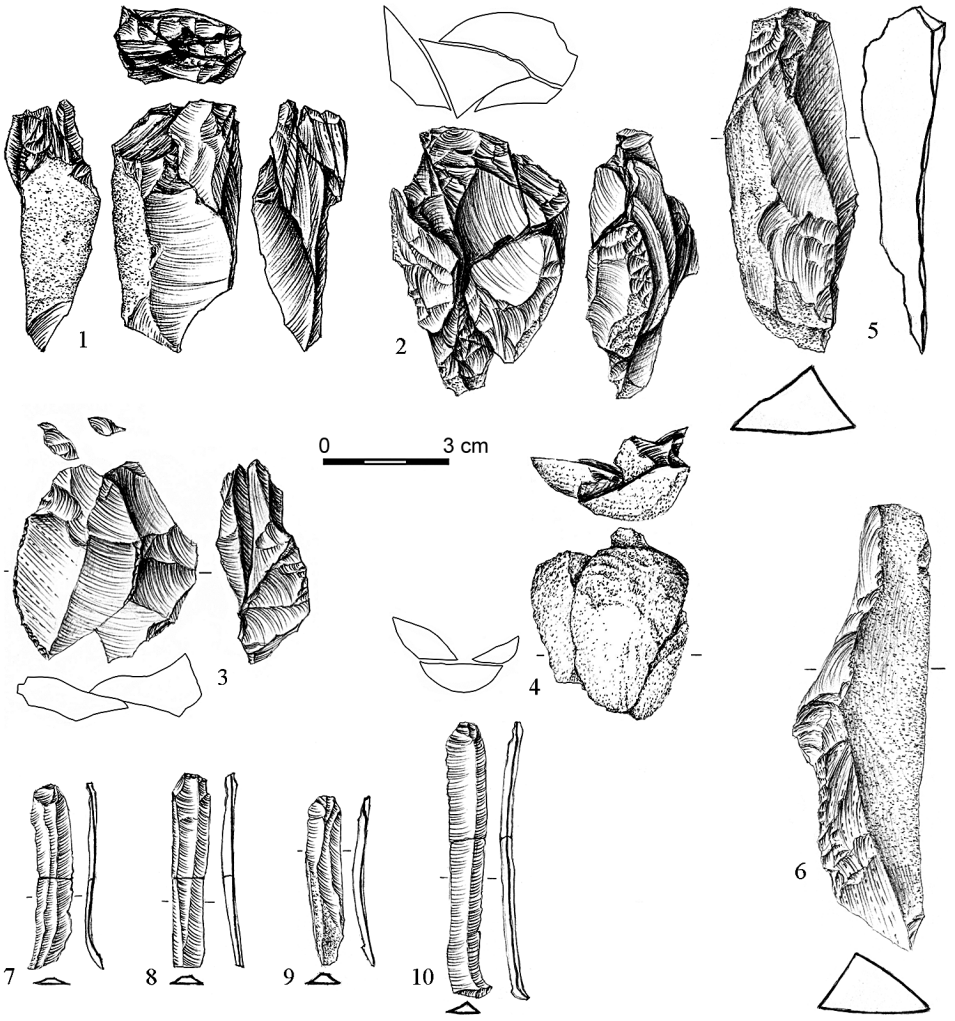

Fig. 4. Chipped stone artefacts from Rydno, trench IV/47. 1–4 – refittings (1–3 – from central concentration, 4 – from south concentration); 5–6 – crested blades; 7–10 – blades (drawing by E. Gumińska).

Wieliszew, trench XVII c

The site of Wieliszew is located in the Mazovian Voivodeship in Central Poland. It is situated on the left bank of the Narew River, next to its confluence with the Vistula River (*Fig. 1*). The material presented in this paper comes from excavations carried out in the late 1950s and early 1960s. To date, it has been the subject of several separate publications (*Więckowska 1965*; *1969*, 94).

Trench XVII c with an area of 124 m² (*Fig. 5*: b) was opened on a small sandy hill (dune) defined as the Wieliszew site, where two other trenches – XVII a and XVII b – were also selected for exploration. This proves that the sandy hill was intensively settled by Mesolithic communities. Although there was concern that the site had been destroyed due to

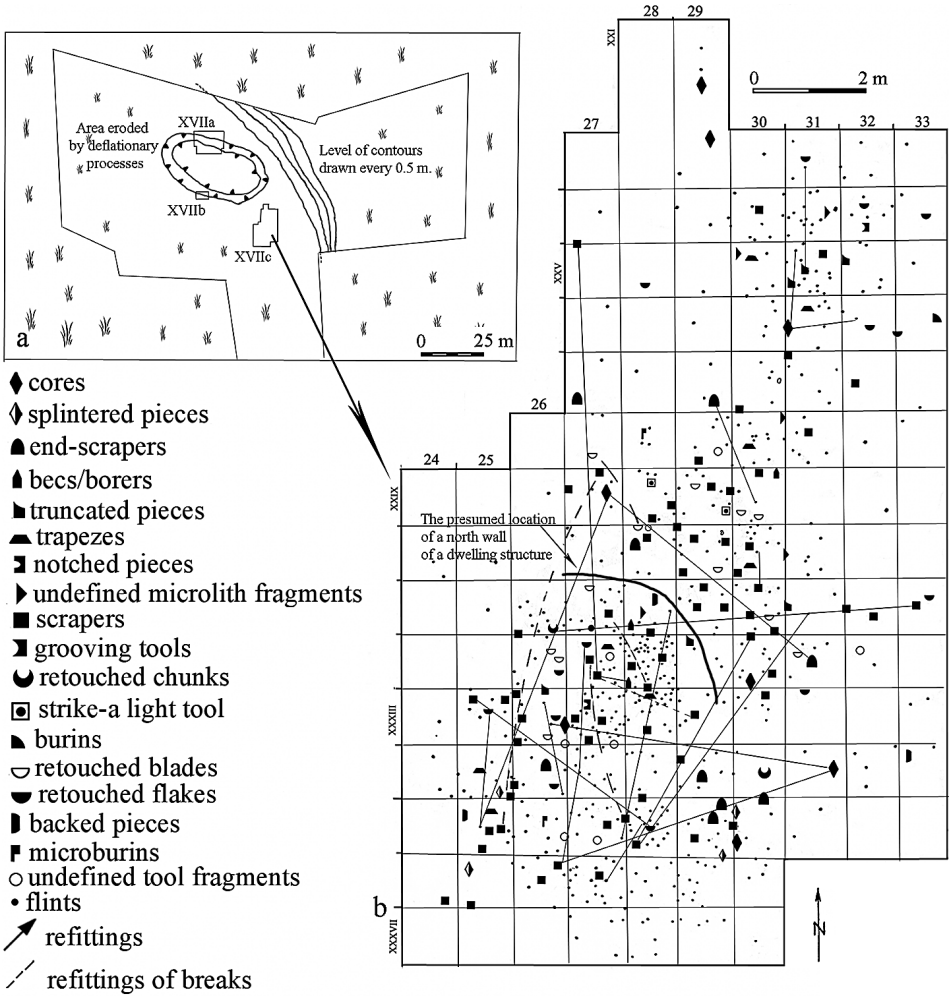

Fig. 5. Wieliszew site: a – location of trenches XVII a, XVII b, XVII c; b – planigraphy of the distribution of flint finds (according to *Więckowska 1965*, 3).

erosion, as is often recorded on exposed dunes, the trench section shows that the natural stratigraphy had been preserved (*Fig. 5*: a). A total of 736 flints were recovered from the trench, 483 of which were chips and small waste fragments. The artefacts were located at a depth of 40 to 60 cm.

In contrast to the Rydno site, the inventory from Wieliszew XVII c is associated with Mesolithic communities of the Late Atlantic period. Such a chronology can be inferred by analogy with the inventory from the Nieborowa I site located in central-eastern Poland, where a radiocarbon date from a charcoal sample obtained from a campfire within the concentration of flints sets the activities in 4898–4338 cal BC (see details in *Fig. 2*: 3; *Tab. 1*). The said inventory from Nieborowa I (*Boroń 2014*, 231–237) is typologically and technologically very similar to the collection of artefacts from Wieliszew. The termi-

nology describing these inventories in the Polish archaeological literature is quite abundant and varied, depending on the individual researcher's approach and interpretation. They are referred to as 'Kokry industry', 'post-Janisławice inventories', or 'assemblages with dominant trapezes' (*Libera 2003*, 26). Later in this article, I use the term 'post-Janisławice culture.'

The chronological range of the post-Janisławice assemblages covers the beginning of the 5th millennium BC, while the decline of these groups is associated with the arrival of the Neolithic Funnel Beaker culture or even the chronologically later Globular Amphora culture communities (*Kozłowski – Nowak 2019*). This took place at different times depending on the region of Poland.

The characteristic features of the post-Janisławice industry, which formed the basis for their separation, are the miniaturisation of tools. Depending on the region of Poland, the assemblages are characterised by the significant predominance of scrapers over endscrapers (mostly flake forms), the presence of the splintering technique, and the small size of a set of microliths limited mainly to trapezes (*Więckowska 1985*, 102).

Methods

The complexity of the issues and research demands required the use of several analytical methods, including a) in-depth spatial-functional studies based on the analysis of the dispersion of archaeological sources to capture the logic of their distribution; b) the refitting of flint artefacts; and c) studies of use-wear transformations on the surfaces of flints. Combinations of these research procedures were developed within the analysis of the Meer II site in the Netherlands (*Cahen et al. 1979*; *Cahen – Keeley 1980*).

Spatial analysis of finds was – and still is – considered one of the objective methodological procedures in explaining the archaeological record at given archaeological sites (*Binford 1977*, 9). The horizontal distribution plan of archaeological finds is used in many methods of planigraphic analysis and is one of the fundamental aspects of spatial studies (*Schild 1980*, 79–80). Therefore, in the absence of features, studying their distribution is sometimes the only option for the spatial or settlement interpretation of a given site (*Fiedorczuk 2006a*, 11). In the case of the Rydno IV/47, where the planigraphy of finds indicated three possible concentrations of lithics, we decided to present the distribution of the flint material using a map depicting the frequency of points in each square metre made with the use of the Surfer software. At the same time, at the Wieliszew site, the map of finds was very clear and legible, showing a dense concentration with distinct boundaries.

The application of the technique of refitting flint artefacts was especially important. This simple research procedure, which in fact had already been used sporadically since the late 19th century (*e.g. Spurrel 1880*), has become a useful method and is now even an indispensable research activity, comprising a wide range of studies interpreting site formation processes (*Kroll – Isaac 1984*, 22; *Morrow 1996*, 355). The scientific aspects arising from the application of the flint refitting method were presented by *Cahen et al.* (*1980*). However, it is important to skilfully use the data we obtain from the refitting in conjunction with the structure and nature of the site (*McCall 2010*, 27–28). Several factors influenced the final outcome of the flint refitting. As in the case of Wieliszew, the work was hindered by small and minute finds, which constituted almost the entire flint inventory.

At Rydno, however, the work was made even more difficult by the selective and discriminating processing of cores and, in general, the relatively limited amount of flint material.

The research perspectives offered by the analysis of microwear on flint surfaces have provided scholars studying the Stone Age with an additional opportunity to interpret flint inventories, including archival ones, as in the case of the sites discussed here. It was introduced by Semenov and Keeley (*Semenov 1964*; *Tringham et al. 1974*; *Keeley – Newcomer 1977*; *Keeley 1980*) and further developed in line with research and technological and methodological advances (cf. *Marreiros et al 2015*). The method enables a more complete and accurate reconstruction of the economic activities of prehistoric communities (*Keeley 1974*, 323).

An Olympus SZX9 stereoscopic microscope and an Olympus BX53M metallographic microscope were used to record microwear on the flint specimens and determine the function they performed, which provided us with the ability to observe images at magnifications of several to several hundred times (from 6.3x to 500x). In order to make the results of the use-wear analysis reliable and provide possibilities for comparative studies, the assemblages selected for analysis included all tool categories as well as unworked blades. All traces of work discovered on flint surfaces were compared with a reference collection, which includes artefacts used in experiments involving the processing of organic and inorganic materials.

Results

Spatial analysis

Rydno

The lithic finds formed a rather dispersed horizontal distribution with a marked concentration of flints in the central part of the trench. The tools have a similar spatial distribution to other lithic finds (blades, flakes, and chips). However, taking into account individual types, microliths were found only in the central part of the excavation trench, and most of the retouched flakes were obtained from its southern part (*Tab. 2*). On the other hand, endscrapers were distributed fairly evenly. They were found in the southern, central, and northern parts of the trench.

Cache VII, containing cores and pre-cores, was discovered in the northern part of the trench (*Schild et al. 2011*, 89, 91). It represents a distinct, separate archaeological structure with spatially closed boundaries. This makes it difficult to determine the relationship with the other flint material from the site, and for this reason, it has been omitted from this analysis.

In the case of Mesolithic inventories, one of the most important categories of artefacts is blades. During archaeological excavations, nearly 100 of them were recovered (*Fig. 4*: 7–10), which is a relatively large number compared to the number of flakes (96). Their length varies greatly: from 22 to 64 mm (excluding crested blades, whose maximum length is 103 mm, *Fig. 4*: 5–6). The arithmetic mean length of the blades is 36 mm, which is basically consistent with the results obtained for selected, homogeneous inventories of the Janisławice culture (*Szymczak 1982*, 134). The two-blade cores left at the site are 60 mm long.

Cores and tools	Rydno IV/47			Total	Wieliszew XVII c		Total
	North camp	Central camp	South camp		North camp	South camp	
cores	2			2	3	9	12
end-scrapers	3	4	3	10		9	9
scrapers	1	5		6	4	68	72
burin			1	1	1		1
truncated pieces		1	2	3	3	3	6
Wieliszew point		1		1			
trapeze		1		1	2	6	8
backed pieces						3	3
borers						1	1
becs						2	2
notched pieces						1	1
undefined microlith fragments		1		1	2	3	5
retouched blades	3	4	3	10		12	12
retouched flakes	2	4	6	12	5	9	14
microburin			1	1		2	2
others		1		1	1	12	13

Tab. 2. Presence of artefact forms in individual camps at the Rydno and Wieliszew site.

Three campfires were identified. One, located in the central part, was probably surrounded by stones. The other two, in the northern and southern parts of the trench, were recorded at the site of occasional flint occurrence and were identified based on the presence of small, burned bones and flints (*Fig. 3*: b). This is important, as there are sometimes no other clear clues to indicate the location of a campfire. Similar methodological considerations occurred in the case of two sites from the Netherlands: Gramsbergen I (*Johansen – Stapert 1997/1998*, 32) and Zwolle (*Niekus et al. 2019*, 53).

Wieliszew

Based on the planigraphy of the artefacts, it is possible to distinguish one large concentration in the southern part of the excavated trench and another, a smaller one, in its northern part. In both concentrations, the spatial distribution of the tools is the same as that of the other lithics, i.e. they cover a similar area.

There are, however, some differences between the concentrations in terms of the occurrence of tools. In the northern concentration, there are no endscrapers, retouched blades, backed pieces, becs, which are present in the southern concentration (*Tab. 2*). The largest group of tools is scrapers, which significantly outnumber other tools. The next group consists of endscrapers, truncated blades, blades, and retouched flakes, whose numbers are very similar. The presence of microliths (trapezes, backed pieces, microlith fragments) is also clearly marked in the inventory.

Based on the analysis of archaeological sources, three techniques of core exploitation were distinguished: blade-making, flaking and splintering (*Fig. 6*: 4–6). Among the two-flake cores, one is a single platform core and the other is a double platform core, although the double platform core exploitation is probably the result of a change of the platform in

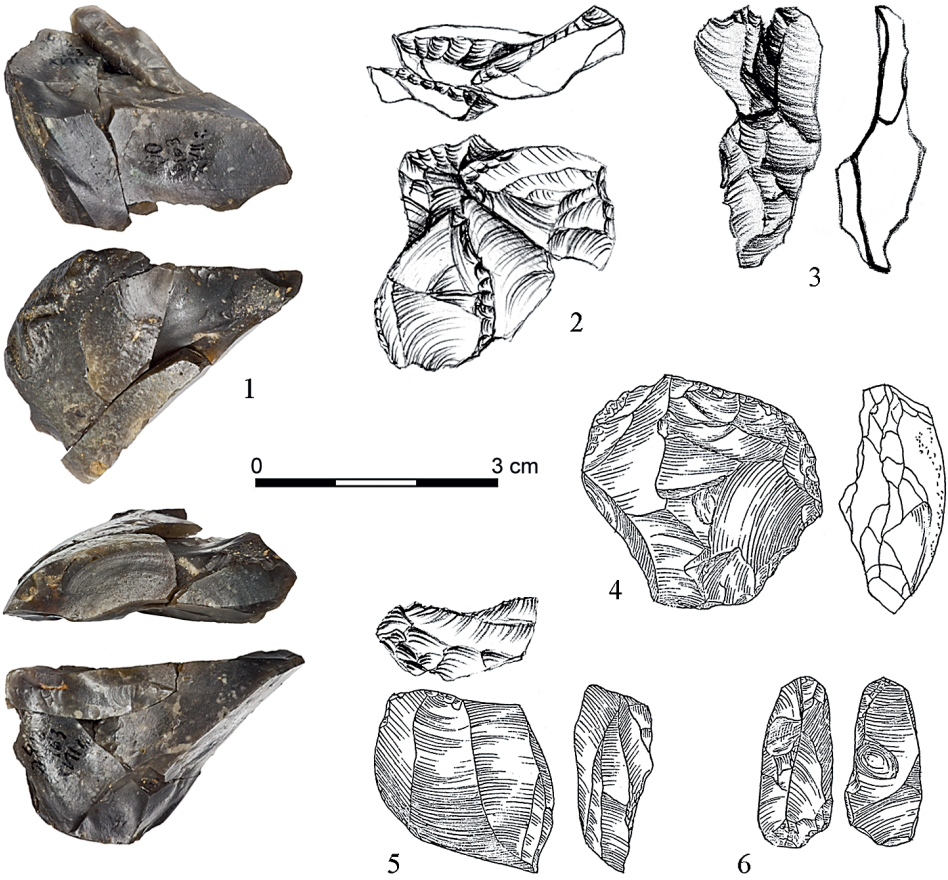

Fig. 6. Chipped stone artefacts from Wieliszew, trench XVIIc. 1–3 – refittings (1 and 2 from south concentration, 3 from north concentration); 4–5 – cores; 6 – splintered piece (drawing and photo by E. Gumińska and I. Niewiadowska).

the final phase. The remains of the flaking technique are single platform cores (4 pieces), with changed orientation (1), and semi-discoidal (1). The predominance of flake cores is reflected in the ratio of blades to flakes: 41 blades were recorded (including fragments), while there were 78 flakes and chips.

Unfortunately, no traces of dwelling structures have been found in Wieliszew, as is the case at the majority of sandy sites in Poland. Apart from the unfavourable preservation conditions, identification might also be hampered, as they may have been light and shallow structures (*Vasilevich – Smolyak 1964*, 638–639; *Rogers 1967*, 18–20; *Grøn 2003*, 688), which does not mean that dwelling structures did not exist. The refitting lines in the south cluster are arranged in a quadrangular pattern, which may represent the 'barrier effect' (*Cahen et al. 1980*; *Tomaszewski 1986*; *Ciepielewska 2022*, 51) marking the walls of a dwelling structure. Presumably, it would have had dimensions of 4 x 4 metres. The north wall of the feature is also perhaps outlined by the adjacent small concentration of artefacts (*Fig. 5*: b).

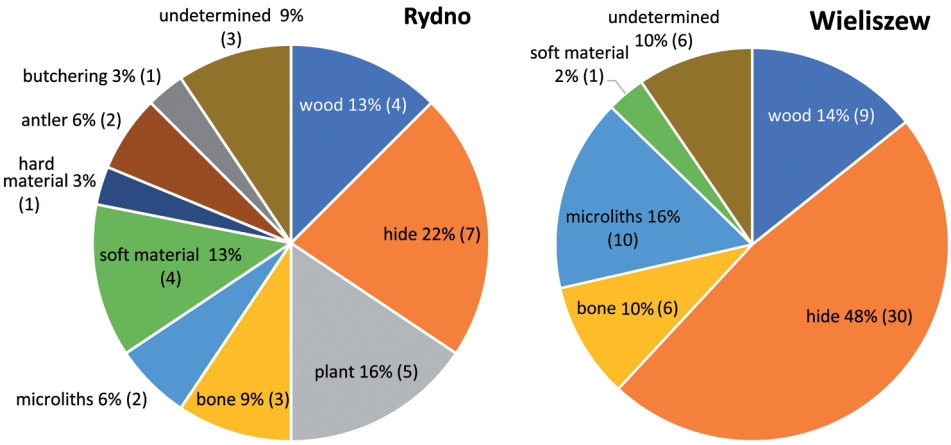

Fig. 7. Frequency of tools with traces of use-wear processing different raw materials at Rydno, trench IV/47 and Wieliszew, trench XVIIc (the number of artefacts is given in brackets).

Use-wear analysis

During the analysis, various traces were recorded on the edges and surfaces of the artefacts, such as damage, abrasion, rounding and polish associated with their use.

Rydno

Use-wear analysis was applied to the following tools: endscrapers, truncated blades, a burin, microliths, blades and retouched flakes, and a scraper (total 48 pieces). Unworked blades (32 pieces) were also analysed. The analysis took into account all excavated tools, while in the case of unworked blades, specimens were selected from each part of the excavation trench, i.e. its southern, central, and northern parts.

The activities performed at the site were mainly related to the processing of animal carcasses and the working of wood and plants (*Tab. 3*; *Fig. 7*; *Fig. 8*). It seems that the tools utilised in carrying out these tasks were generally not intensively used, and the nature of the transformations recorded on the endscraper fronts indicates the scraping of fresh hides. Also, tools with edge-marks resulting from bone working could be linked to butchering animal carcasses. Two of the analysed microliths were components of a projectile weapon. One was a trapeze with minor damage visible on one of the lateral edges, and the other was a Wieliszew point, which also had traces of use on the lateral edge.

Wieliszew

In total, 132 tools were subject to microscopic observations, of which 62 specimens had transformations associated with their use (*Tab. 3*; *Fig. 7*). Two main groups of tools can be identified: the first is related to the processing of hides, and the second is interpreted as elements of weapons.

With regard to the first activity, the tools show a high degree of wear. Apart from two endscrapers set in hafts, the tools were probably used without hafts (*Boroń – Winiarska-Kabacińska 2018*, table 2). Processing hides is a lengthy, multistage process that requires

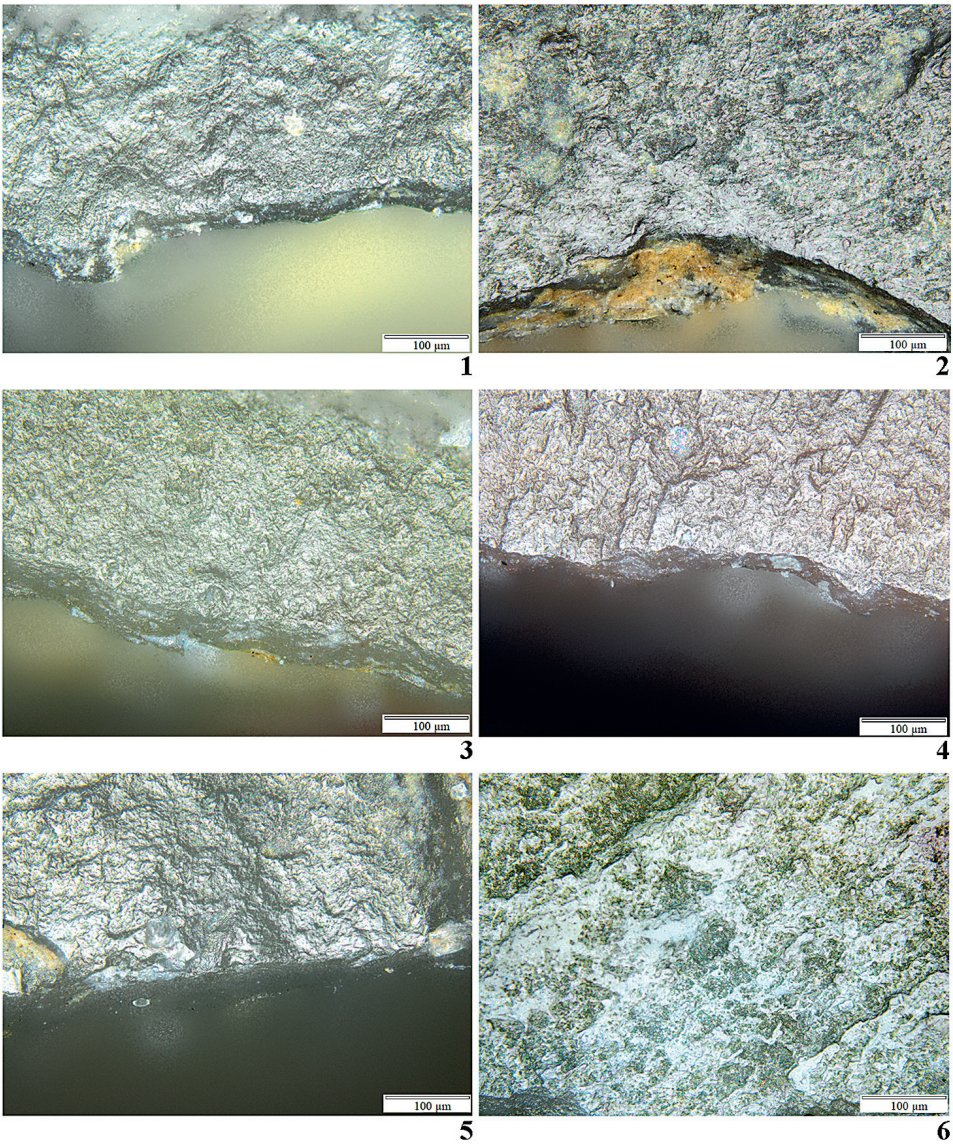

Fig. 8. Use-wear traces on the artefacts from Rydno, trench IV/47. 1 – endscraper, scraping hides; 2 – crested blade, scraping bones (northern concentration); 3 – endscraper, scraping hides; 4 – retouched flake, scraping bones (central concentration); 5 – burin, carving bones; 6 – retouched blade, cutting plants (southern concentration) (photo by M. Winiarska-Kabacińska).

the use of specialised tools made not only from stone raw materials but also bone or wood (among others, *Hayden 1990*; *Weedman 2006*; *Beyries 2008*). In part, this time-consuming process is also reflected in the diagnosed traces, indicating the use of tools at various stages of the hide dressing process. Ochre was often used to soften hides (*Beyries – Inizan 1982*, 321), and its presence was recorded on several artefacts in the assemblage from Wieliszew

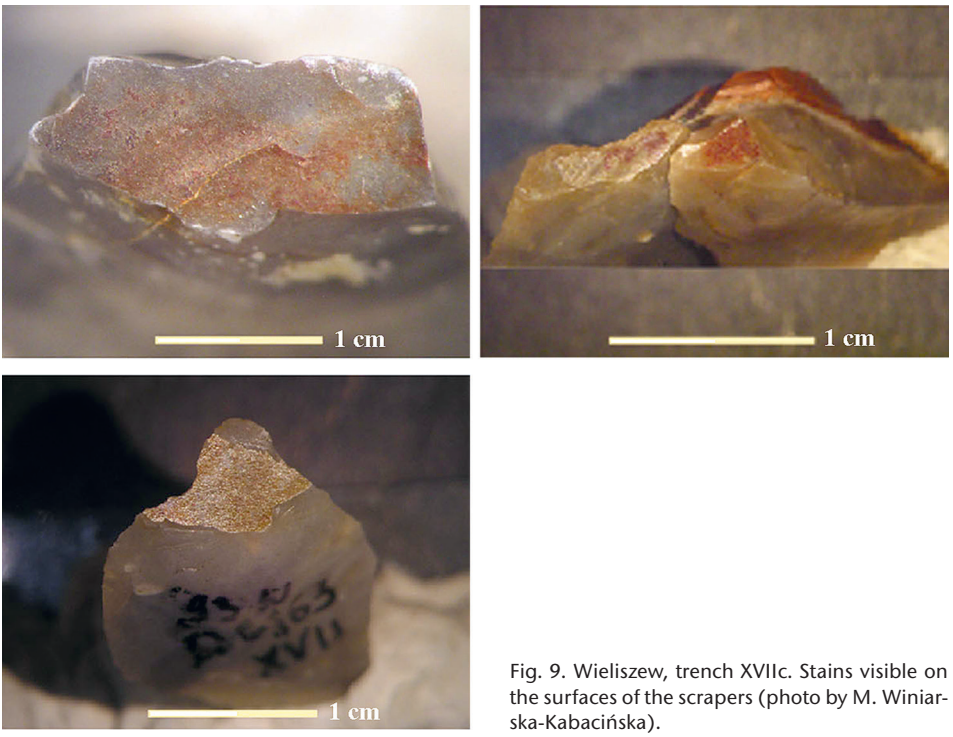

Fig. 9. Wieliszew, trench XVIIc. Stains visible on the surfaces of the scrapers (photo by M. Winiarska-Kabacińska).

(*Fig. 9*), although this may also be a secondary indication of contact between flints and ochre.

The second group, clearly identified in the Wieliszew inventory, are specimens functioning as weapon elements. The observations made and the macroscopic and microscopic traces found, including traces from the haft, would indicate that five trapezes and two backed pieces were arrowheads, while two microlith fragments and a truncated blade served as inserts for composite tools (*Fig. 10*). This interpretation of the use of microliths as an element of weapons is supported by the characteristic and distinctive traces, repeatedly described in the literature and also recognised through experiments (*Fischer et al. 1984*; *Crombé et al. 2001*; *Rots 2008*; *2010*; *Cristiani et al. 2009*).

Identification of the socio-technical and functional processes of artefact deposition

Rydno

The model projection made with the use of the SURFER software took into account all of the flint material. According to the results obtained, three clusters were identified: northern, central, and southern, and the archaeological sources were divided accordingly (*Fig. 11*).

The northern concentration covers an area of about 12–13 m². This concentration has quite clearly defined spatial boundaries; tools and cores were found on its periphery, and only three flakes were refitted. It was possible to identify two spots with the presence of

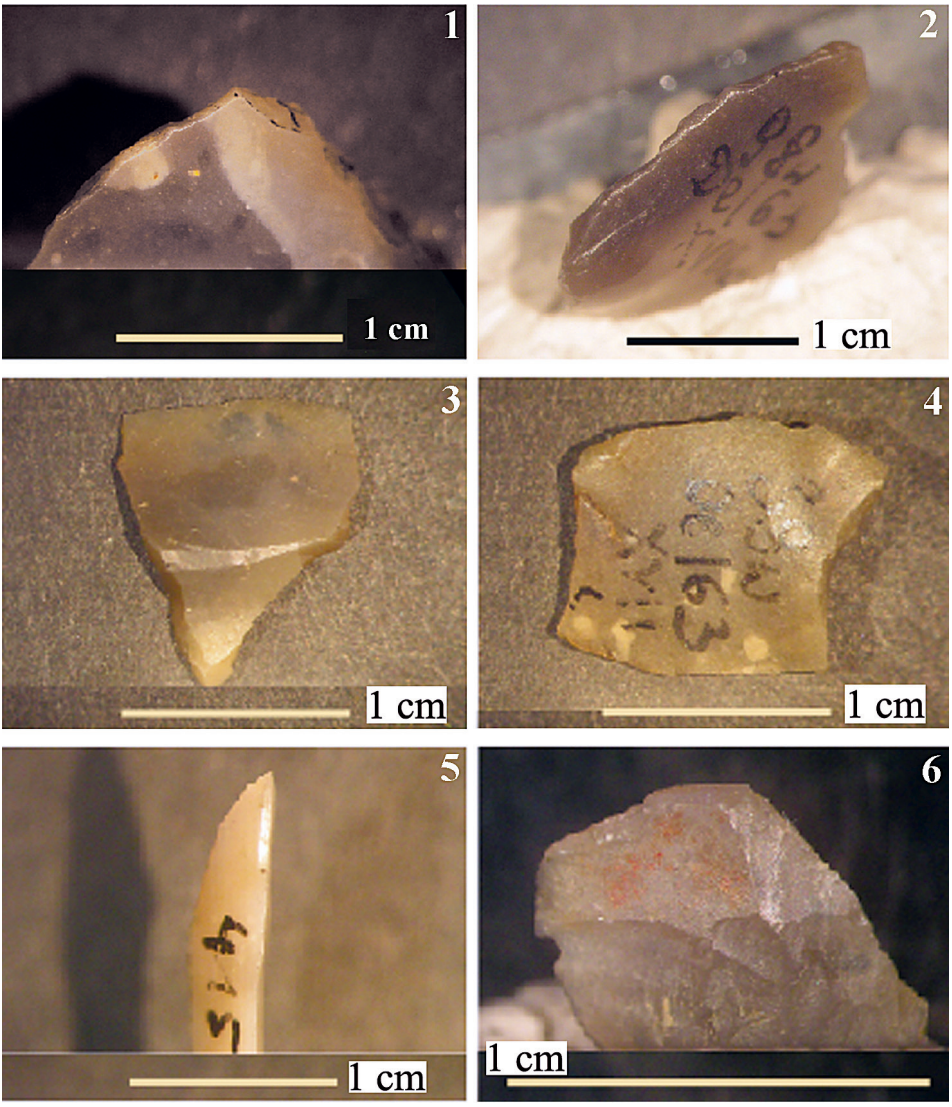

Fig. 10. Wieliszew, trench XVIIc. 1–2 – rounding on scraper's edge; 3 – broken trapeze; 4 – trapeze with an impact scar; 5 – backed piece with an impact scar; 6 – stains visible on blade dorsal face (photo by M. Winiarska-Kabacińska).

flints with diagnosed microwear. The first one contains finds associated with the processing of plant material (wood, plants), while the second has finds associated with the processing of bone and hides (butchering) (*Fig. 12*).

Central concentration, which covers about 13–14 m², is characterised by the greatest number of finds. The variety of tool types recorded here is much greater than in the northern and southern concentrations. Several blocks were refitted – most often consisting of two elements (*Fig. 4*: 3); only blocks 1 and 2 contained more artefacts. Block 1 is a refitting

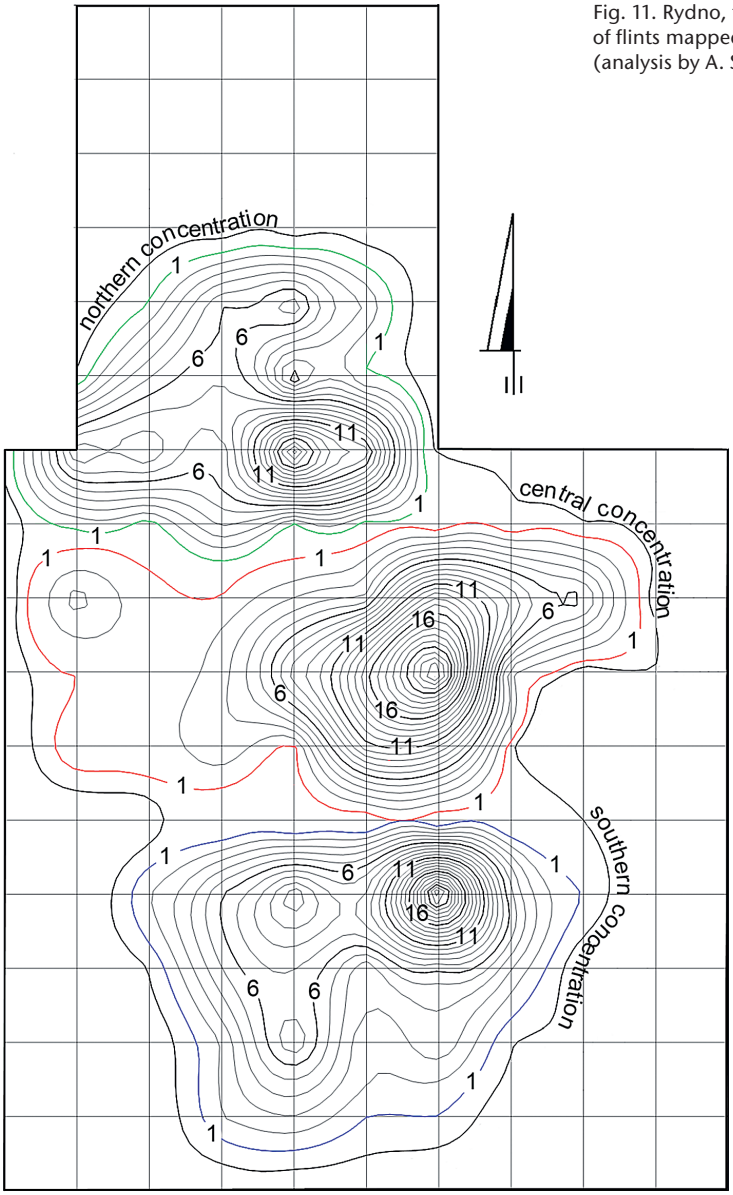

Fig. 11. Rydno, trench IV/47. Frequency of flints mapped with SURFER software (analysis by A. Sołodko).

of four platform rejuvenation flakes (*Fig. 4*: 1), while block 2 constitutes a crested blade and flakes from the preparation of the flagging surface, including an endscraper (*Fig. 4*: 2). Within this concentration, a zone with the highest density of lithics was identified, in which all the refittings are also grouped. This may suggest that this was the area of a presumed workshop, especially since nearly all platform rejuvenation flakes were also recorded there. Two distinct zones of activity were recorded around the campfire: one associated with the repair of hunting weapons and the other with the butchering of game. Other identified

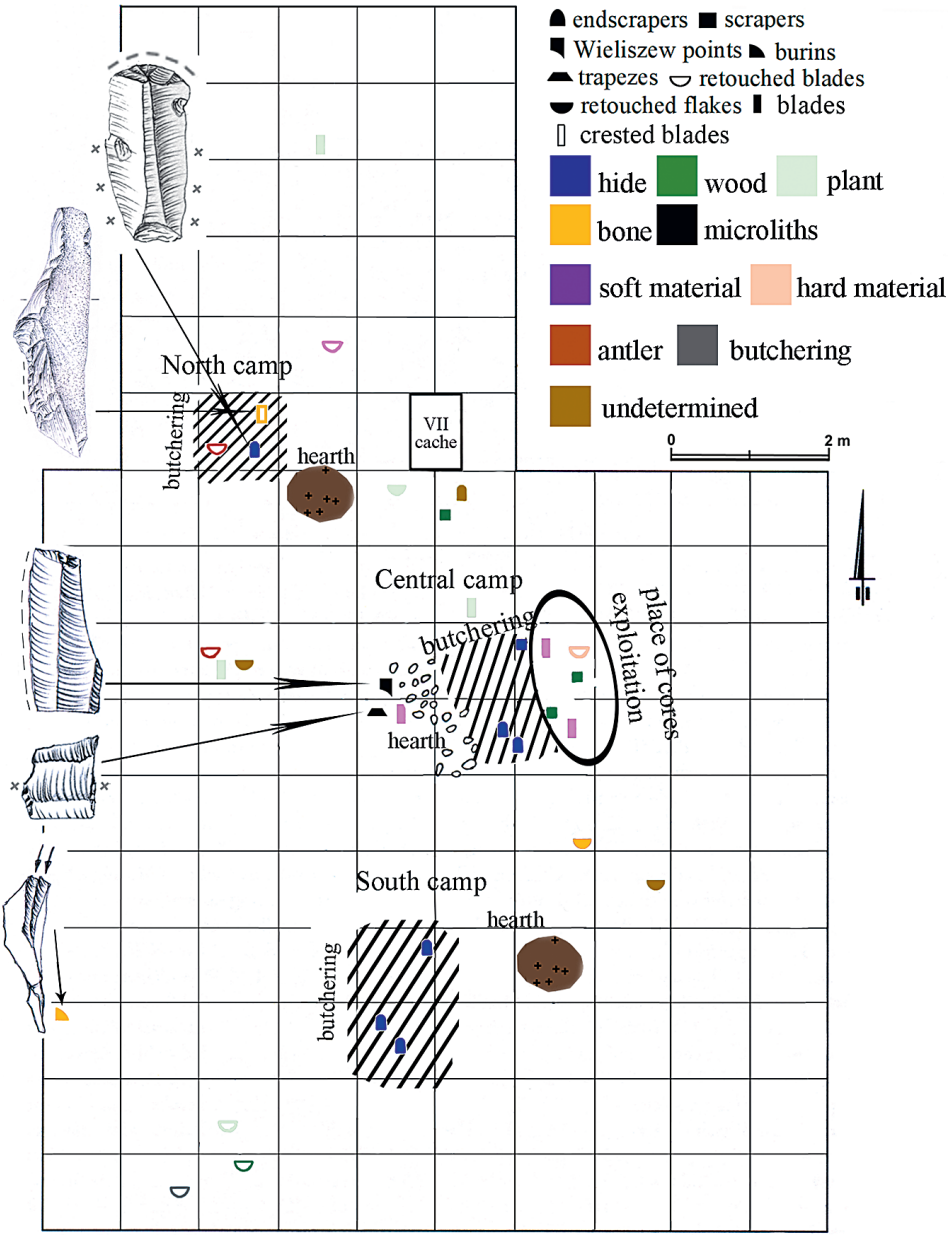

Fig. 12. Rydno, trench IV/47. Model of the last phase of the formation of the flint assemblage, taking into consideration the layout of the activity zones. The model presents the separation of three distinct camps and their spatial relationships. The individual areas of activity were determined on the basis of the dispersion of functionally identified flint material. Chipped stone tools: dashed line – the course of use-wear traces; crossing – haft (map by A. Sołodko).

Function	Rydno IV/47			Wieliszew XVIIc	
	North camp	Central camp	South camp	South camp	North camp
Hide					
scraping	1-endscraper	2-endscrapers; 1-scraper	3-endscrapers	25-scrapers; 4-endscrapers; 1-backed piece	
Wood					
grooving				1-retouched blade	
cutting				1-retouched blade	
scraping	1-scraper	2-scrapers		1-retouched flake; 1-retouched blade	1-retouched flake
perforating				1-borer	
working			1-retouched blade	3-retouched blades	
Plant					
scraping	1-retouched flake				
working	1-unworked blade				
cutting		2-retouched blades	1-retouched blade		
Bone					
scraping	1-unworked blade	1-retouched flake		1-retouched blade	1-truncated piece
working				3-scrapers	1-scraper
engraving			1-burin		
Microliths					
		2 arrowheads (1-trapeze; 1-Wieliszew point)		2-projectile's side inserts; 6-arrowheads	1-projectile's side insert 1-arrowhead
Soft raw materials					
scraping				scraper	
working	1-retouched blade	3-retouched blades			
Hard raw materials					
cutting		1-retouched blade			
Undetermined raw materials					
grooving				1-bec	
scraping				2-scrapers; 1-truncated piece; 1-retouched blade	
working	1-endscraper	1-retouched flake	1-retouched flake		
unspecified activity				1-bec	
butchering			1-retouched blade		
Antler					
cutting	1-retouched blade	1-retouched blade			

Tab. 3. Raw materials and work performed at the respective sites. The table presents the distribution of activities according to the concentrations identified at individual camps, as this highlights the similarities and differences between them.

activity zones included the area of core processing and the site of processing wood, soft and hard raw material, and plants. The location of the abandoned microliths next to the campfire in the central campsite supports the hypothesis, and it is documented by several discoveries suggesting that the potential repair of hunting weapons took place mostly in this area (*Caspar – De Bie 1996*, 451; *Fiłatova 2004*, 45; *Wenzel 2011*, 154). On the other side of the campfire, where the presumed 'butchering' activity zone was identified, no flint artefacts were recorded, which seems quite significant considering the activity of quartering game and processing hides. Flints with sharp and piercing edges lying on the ground could have made walking difficult. The absence of even chips suggests that the spot may have been intentionally cleared of flint remains.

The southern concentration covers the largest area, about 18–19 m². As in the northern concentration, the finds are loosely scattered. From this area comes the refitting of the crested blade and three flakes – block 3 (*Fig. 4*: 4), in addition to other two-element refittings. The refitting of a crested blade with flakes may indicate that core exploitation also took place here, although perhaps of an *ad hoc* nature. A zone used for dressing hides and processing plant material was identified in that concentration. The presence of plant processing tasks diagnosed based on the use-wear analysis of flints from all three concentrations described here is not unusual in terms of the set of activities performed in a hunting camp. However, it was not a main activity (*Lemorini 1992*, 55; *Petru 2004*, 202; *Langlais et al. 2018*, 525).

Wieliszew

The most intensive activity carried out on the site was dressing hides. The largest assemblage of tools related to this activity was found in the southern concentration. Outside this area, the number of artefacts with identified traces of such work decreased significantly (*Fig. 13*).[1] Woodworking (broadly understood as the processing of wood comprising a variety of activities – *Tab. 3*) was located in three distinct places on the periphery of the hide dressing zone. These correspond to the locations of retouched blades. Finds associated with bone processing were also placed in different zones. Likewise, the spots containing worn components of hunting weapons constitute spatially distinct areas. They are most often found next to the areas associated with processing wood. In the northern concentration, based on the use-wear analysis, bone and wood processing were identified (*Fig. 13*).

Due to the small size of the flints, refitting did not yield results comparable to Rydno. The dominating type is two-element blocks, such as the refitting of a truncated blade with an overpassed blade from a single platform core (*Fig. 6*: 3). Others include a flake core with a matching flake, a retouched flake and an endscraper (*Fig. 6*: 1), and two scrapers and a bec (*Fig. 6*: 2). In the northern part of the trench, the presence of adjustments of a core and flakes, as well as the refitting of a truncated blade with a flake, suggests that this was also the site of obtaining blades and flakes. The functionally diagnosed tools attest to the processing of bone material. Two damaged microliths were also recorded there.

[1] The site plan of the trench does not include the location of the scraper with recorded traces of working in a soft material. This was associated with the lack of an inventory number.

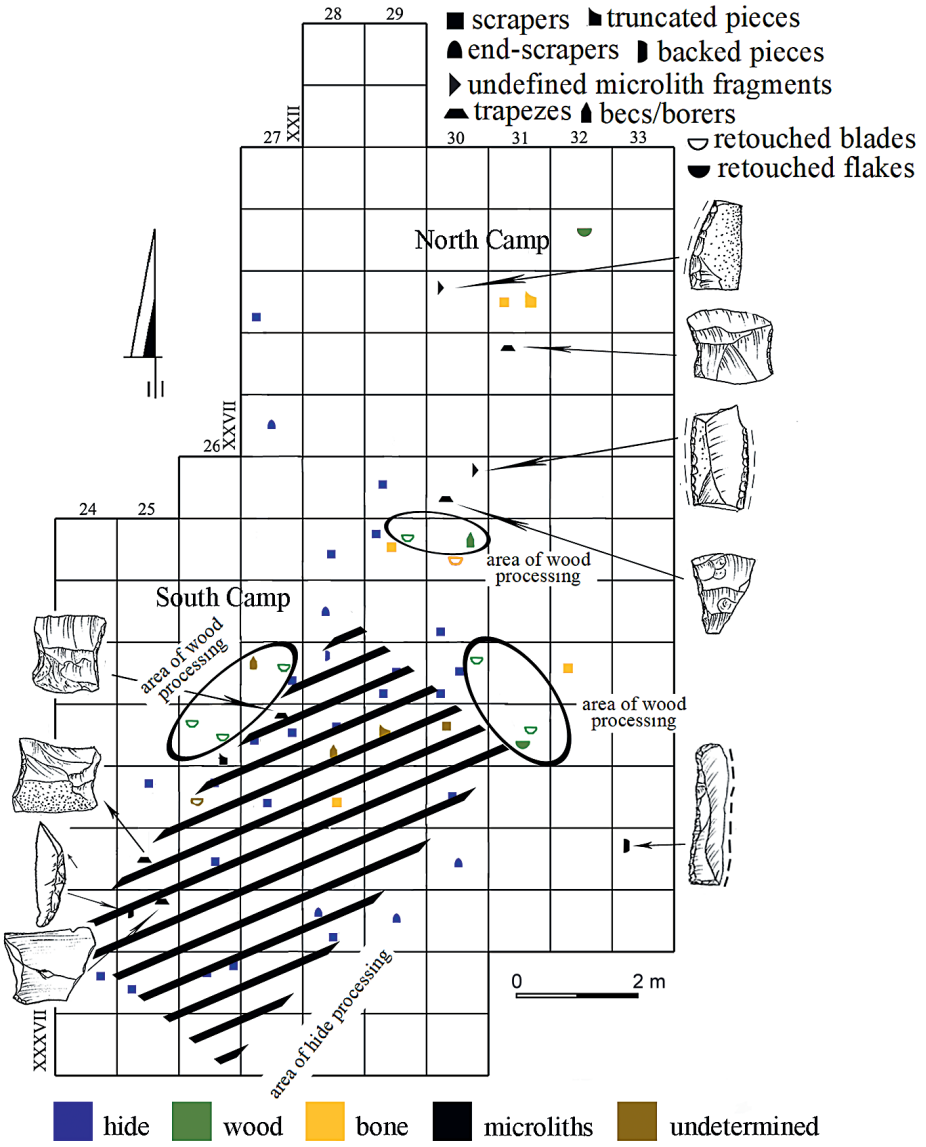

Fig. 13. Wieliszew, trench XVII c. Reconstruction of the model of the last phase of the formation of the flint assemblage, taking into consideration spatial relationships between the southern and northern clusters. The individual areas of activity were determined on the basis of the dispersion of functionally identified flint material. Chipped stone tools: dashed line – the course of use-wear traces (map by A. Sołodko).

The lack of refittings between the southern and northern clusters may indicate that these are flint assemblages from different periods. The few refittings show that the miniaturisation of scrapers, but also of other tools, was not the result of their transformation but is related instead to the size of the flakes, and the retouching only corrected minor irregularities on the edges.

Discussion

Settlement and behavioural interpretation of Rydno

Three zones of find accumulations were identified at the Rydno site. All activity remains are grouped on the same side of the campfires, which is an astonishing correlation with the Verrebrock 'Dok' site (*Crombé et al. 2003*, 211). However, the question remains whether these three zones are related to each other or are separate spatio-temporal settlement episodes. Considering the first option, if Rydno was simultaneously inhabited by a single common group of hunter-gatherers, each zone should have been characterised by different activities. This is the case at the Vaenget Nord site in Denmark (*Price – Petersen 1987*, 117), the site at 62 rue Henry-Farman à Paris, locus 5 (*Souffi et al. 2013*, 24), and the Siebenlinden site in Germany, where the model of a Mesolithic living unit included several varying activity zones (*Kind 2009*, 145). Similar assumptions also apply to several sites near Havelte in the Netherlands, based on differences in the type of wood in hearths and pits (*Price et al. 1974*, 57), and the site Doel-'Deurganckdok J/L', C3 in Belgium (*Noens 2013*, 229). At the Meer IV site in Belgium, two Mesolithic concentrations several metres in diameter were discovered. In each of them, zones with separate flint-working activities were identified. These are interpreted as a single occupation (*Nijs 1990*, 505).

At Rydno, each of the three zones has a similar functional character, fairly similar flint inventory, and traces of campfires, which basically rules out the aforementioned model of spatial organisation. If the northern and southern campfires at Rydno were to be treated as 'foyer satellites', they should have a different function from the central hearth (*Julien 1984*; *Moseler 2011*, 123). At the Pen Hoat Salaün site in France, three zones with a parallel arrangement of flint deposition were distinguished within a single large concentration, which – according to the authors – may suggest cyclical returns of the Mesolithic community (*Nicolas et al. 2012*, 491). The final argument in favour of the lack of interdependence between the zones at the Rydno site is the absence of refittings between them. According to researchers, refitting lines determine the coherence between individual clusters (*de Bie 2007*, 42; *Souffi et al. 2018*, 556). However, the lack of flint circulation between individual concentrations proves the lack of synchronicity between them (*Bodu et al. 1990*, 159). In addition to the identified use-wear evidence, some transformations associated with mounting tools in hafts were also recorded. Mounting tools in hafts, shafts or handles undoubtedly increased efficiency and productivity (*Keeley 1982*, 799).

In summary, Rydno either represents three independent but simultaneous episodes, which reflect the simultaneous presence of three human groups, or these three episodes are cyclical returns of one group. The first possibility seems unlikely.

The handling and processing of plant-based raw materials may be related to the manufacturing of items necessary for daily use, such as bark containers, baskets, ropes, and mats (*Martínez-Sevilla et al. 2023*, 8), food production (*Jacomet – Vandorpe 2022*, 7; *Bishop et al. 2023*, 75) and the use of plant dyes in dressing hides. The short-term settlement at the Rydno site suggests that the optimum explanation for processing plants may have been consumption. The camps were associated with short-term hunting activities, so it is difficult to imagine that the inhabitants were also engaged in the production of objects from organic raw materials. It seems reasonable to assume that the processing of plants was related to food production.

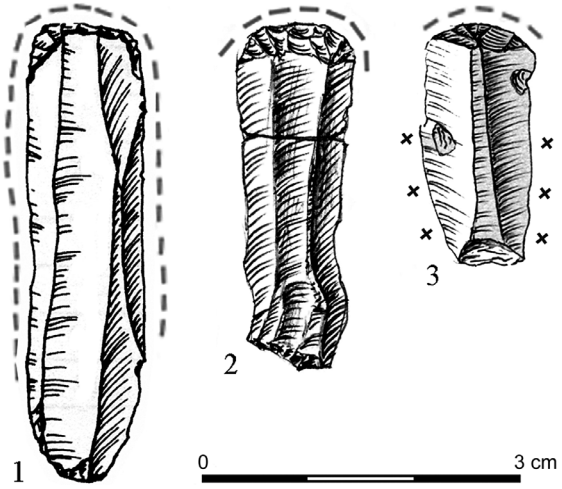

Fig. 14. Rydno, trench IV/47. Endscrapers. Dashed line – the course of use-wear traces; crossing – haft. (drawing by E. Gumińska).

In the case of reconstructing the supply of flint tools to hunting sites, the first option to consider is their production on site, which was the case here (*Fig. 4*: 1–4). However, the second option may also be their transport (*Nelson 1991*, 83). An example illustrating such a possibility is a large, massive blade, 104 mm long and 14 mm thick, with traces of butchering game, recovered from the northern campsite at Rydno (*Fig. 4*: 6).

Moreover, some tools may have been used in another location than where they were discarded (*Keeley 1987*, 95). Prehistoric communities moving from place to place also carried the necessary equipment constituting their personal belongings (*Kuhn 1994*, 427), and most often this group of artefacts is in some sense different from the inventory produced in a given place, e.g. it is distinguished by the raw material or morphological features (*Fiedorczuk 2006b*). The suggestion that the massive blade was brought in is based largely on the interpretation of the assemblage of artefacts in this cluster. The parameters indicate that it was removed during the early phase of core exploitation, while the other blades are 30–40 mm shorter, with regular straight edges and small thickness – up to 2.5 mm. This apparent gap in the length of the blades shows a lack of continuity in the production of blades or the extraction of a very specific length group. The remaining blades were most likely removed from other cores – smaller and already preliminarily exploited.

Regarding the endscrapers (*Fig. 14*), eight were produced from blades and three from flakes. Seven specimens had traces of use. Among the blade specimens, only three were complete forms, while five were fragments preserved in the form of a broken working part. The shortest complete specimen is the one with diagnosed marks of hafting (*Fig. 14*: 3), which could indicate long-term use, well beyond the time of the hunters' stay at the Rydno site. In contrast, when people abandoned the campsites, they may have taken cores and blades with them.

Settlement and behavioural interpretation of Wieliszew

Based on the planigraphy of the finds and the arrangement of the activity, it was concluded that there were two spatial units (campsites). At the southern campsite, a central

feature in the form of a dwelling structure is presumed. Similar indications of dwellings were identified at the Aggemose site located in Denmark (*Grøn 1995*, 8) and the Rönneholm 6 site located in northern Sweden (*Larsson – Sjöström 2011a*, 239). The dwelling of Wieliszew is characterised by the artefact concentration related primarily to dressing hides. The location of these activities indicates that much of the work took place inside the building and directly around it. However, it seems that the northern cluster constitutes an area where people processed bone raw material and fixed their hunting weapons (*Fig. 13*). This is evidenced by the trapeze that served as an arrowhead and a fragment of microlith that formed a part of a composite weapon (insert). These finds suggest that this cluster can be interpreted as an indicator of a short-term stay of hunters, perhaps at the same time of year. The similar method of core exploitation and the use of the same type of flint (Cretaceous) and the miniaturisation of tools indicate that it may have been the same group of people.

During the excavations at the Wieliszew site, worn and damaged armament components such as trapezes and other microliths were discovered next to zones associated with woodworking, indicating separate sites for repairing hunting weapons (*Fig. 13*). Given that woodworking took place near the hafting-and-retooling area, it can be assumed that this activity may have been related to the preparation of arrow shafts. Similar conclusions drawn on identical grounds were presented for the Mesolithic inventory from the Laghetti del Crestoso site (*Lemorini 1997*, 57).

Temporal and functional patterns

Each of the campsites at Rydno represents a distinct settlement event and this thesis is confirmed by the typologically similar flint inventory in each of these camps, with preserved quantitative proportions between the different classes of tools, the performance of the same activities using a specific group of artefacts, and, above all, the recorded activity of chopping meat and dressing hides (butchering), which were carried out close to the hearths, with the occasional presence of other identified activities.

Flint inventories with a small number of artefacts are also found at other sites associated with hunting, such as Jardinga in the Netherlands (*Prummel et al. 2002*, 417) and Vignes in France (*Lelouvier et al. 2012*, 110). Multiple instances of hunter-gatherers returning to the same site are not uncommon. For example, successive stays by groups have been recorded at the Verrebroek site in Belgium (*Crombé et al. 2001*, 256), the Bergumermeer S-64B site in the Netherlands (*Niekus et al. 2018*, 959), the Rönneholms Mosse sites in Sweden (*Larsson – Sjöström 2011b*, 462), and the Paliwodzizna 29 site in Poland (*Osipowicz et al. 2023*, 19). Systematic re-occupations have also been recorded at the Mesolithic site of Strandvägen in Sweden (*Molin et al. 2018*; *Gummesson et al. 2019*).

The successful returns of the bearers of the Janisławice culture to Rydno may be due to favourable environmental conditions, which can also be explained by the idea of resource monitoring (*Kelly 1983*, 287), which is consistent with the ‘optimal foraging theory’ (*Bayliss-Smith 2004*, 183). In total, nine flint assemblages and many individual elements distinctive of the Janisławice culture, such as the Wieliszew point, have been identified at Rydno. Ethnographic data (*Houtsma et al. 1996*, 98) show that where there is ample food, there is a significantly greater accumulation of sites. In addition, there are many other possible reasons for the presence of the Janisławice culture community at Rydno, in particular the extraction of hematite. Rydno was a place where hematite was extracted by prehistoric

communities for many thousands of years, so it seems obvious that this possibility should not be ruled out.

In contrast, the site in Wieliszew is presumably a hunting campsite of late autumn provenance, because the highly specialised tools were mainly used for processing delicate hides, which would be acquired in late autumn, when the animals would already have their winter fur (*Boroń – Winiarska-Kabacińska 2018*). Thus, these camps would have been associated with the seasonal migration of the Mesolithic community. A similar interpretation was presented for the Pod Zubem campsite (*Hardy 1999*; *Hardy – Svoboda 2009*, 168), where excavated faunal remains also point to this explanation (*Horáček 2003*).

The campsites at Rydno and Wieliszew, although their character is determined by hunting activity clearly indicated in the flint material through use-wear analysis, vary in the implementation of this process, expressed in different behavioural and social aspects. The former illustrates the *ad hoc* need to provide food and can be described as a satellite hunting camp (*Jochim 1976*, 142), while the latter is an example of the gathering of skins of small fur-bearing animals during the late autumn season. It seems that a certain indication of the temporary nature of the campsites is the rather spatially limited activity zones. In the case of campsites with a significantly longer settlement episode, there is a gradual expansion of the utilised sectors, which is associated with a greater dispersion of flints (*Carr 1984*, 127). On the other hand, the longer the period of settlement, the shorter the time of use of individual tools (*Bamforth – Becker 2000*, 283). Thus, the anticipation that the shorter the time of settlement, the more intensively the tools would be used is consistent with the above assumptions, as confirmed by the analysed flint inventory from Wieliszew and Rydno. The implication of the longer period of settlement at Wieliszew in relation to Rydno is the greater diversity of tool types recorded at the former site. As *Schiffer* (*1975*) notes, there is a correlation between longer settlement and the diversity of tool forms.

Conclusion

In the literature, the flint scatter at Rydno is referred to as a '*middle-sized flint processing workshop*' (*Schild et al. 2011*, 351). Of course, when considering the area of a flint processing workshop, due to the distribution of lithic artefacts, this designation is legitimate. The use of research methods such as refitting of flint artefacts, planigraphic analysis, and use-wear analysis has allowed us to redefine its context and significance. The concentration does not represent a single settlement episode, but three different ones, all interpreted as hunting camps.

This methodological package made it possible to highlight differences between the camps at Rydno and Wieliszew. Despite the functional similarities within the lithic assemblages, their spatial organisation and the method of depositing flint artefacts pointed to distinct variants of hunting camps.

A detailed analysis of the processes involved in the formation of sites shows that a medium-sized concentration, such as that at the Rydno site, need not always be the result of a single continuous settlement episode, but rather the consequence of successive returns by hunter-gatherers to the same location, thereby demonstrating the repetitiveness of their behavioural patterns. Perhaps many similar Mesolithic sites are also the result of rhythmic, short-term settlement episodes. Functional verification of the campsite at

Wieliszew, pointing to hunting aspects associated with the pursuit of small fur-bearing mammals, not only implies a new significance for the campsite but also defines the seasonality of its occupation.

We contextualised our case studies within a broader European and sometimes global background, looking for convincing and expressive analogies for the described camps and the processes that shaped them. We aimed for comparisons in many areas, such as flint resource management, spatial organisation of campsites, and the comparison of the spatial arrangement of artefacts, which are both the result of diverse depositional processes manifested, e.g. in the accumulation of particular groups of finds, as well as the result of various aspects of human behaviour such as discarding, transferring, and the selective use of tools and their re-use. The relationship between the size of the camps and the duration of settlement was also assessed in our studies.

The article indicates new possibilities for the reinterpretation of many previously explored Mesolithic flint concentrations. The research results show that studying archival collections also contributes to a deeper understanding of the processes of Mesolithic site formation through the identification and description of settlement structures, which also allows us to determine the spatial and even temporal relationships between them. The revision of previous findings introduces new research perspectives for many other Mesolithic sites studied in the 1960s and 1970s, which can contribute to the discussion on the methodological aspect of revising views and the state of research. The scientific potential of archival flint collections – and the analysed clusters that can be regarded as such – is undeniable. The theories built on this basis are authentic and in line with contemporary expectations based on materials acquired through modern excavation methods developed over many years of fieldwork experience.

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