

Understanding small hunter-gatherer campsites through spatial-functional analysis. Three Mesolithic case studies from Poland*

Comprendiendo los campamentos pequeños de cazadores-recolectores mediante el análisis funcional y espacial. Tres casos de estudio del Mesolítico de Polonia

Tomasz Boron^a and Malgorzata Winiarska-Kabacińska^b

ABSTRACT

This paper presents a methodological framework for analyzing the organization of Mesolithic campsites using three eastern European archaeological case studies from Poland. Our methodology involved spatial and functional analysis through the refitting of flint items, microwear tool analyses and a spatial analysis of the distribution of items. In addition, we discuss the scientific relevance of small hunter-gatherer campsites, where a detailed spatial-functional analysis can be highly relevant to understand the everyday life and productive activities of these groups. Both our approach and conclusions may prove to be comparatively useful in larger and more complex Mesolithic sites.

RESUMEN

Este artículo presenta un enfoque metodológico para el estudio de la organización espacial de los campamentos del Mesolítico europeo recurriendo a tres casos de estudio del registro polaco. Nuestra metodología involucró el análisis espacial y funcional a través del remontaje de elementos de talla y el análisis de las huellas de uso, así como una aproximación espacial a la distribución de dichos elementos. Discutimos también la relevancia científica de estos pequeños campamentos de cazadores-recolectores, donde un detallado análisis espacio-funcional resulta fundamental para com-

prender las formas de vida y organización de la producción de estos grupos. Tanto nuestra aproximación como nuestras conclusiones pueden resultar comparativamente útiles al abordar otros yacimientos mesolíticos más grandes y complejos.

Key words: Poland; Mesolithic; functional analysis; spatial analysis; small campsites; hunter-gatherers; methodology.

Palabras clave: Polonia; Mesolítico; análisis funcional; análisis espacial; pequeños campamentos; cazadores-recolectores; metodología.

INTRODUCTION

This paper presents a methodological framework for analysing the organization of European Mesolithic campsites through the study of three eastern European archaeological case studies from Poland (Fig. 1). European Mesolithic hunter-gatherers, with their distinctive material culture and way of life, were substantially different from their previous Pleistocene groups. Their survival strategy depended on advanced hunting, gathering, and fishing methods (Kabaciński 2016: 250). Those changes are clearly visible in the stratigraphic sequence of archaeological sites located in south-east-

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^a Department of Interdisciplinary Archaeological Research, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Al. Solidarności 105, 00-140 Warszawa, Poland. E-mail: archo.boron@gmail.com <https://orcid.org/0000-0001-9831-3950>

^b Poznań Archaeological Museum; Wodna Street 27, 61-781. Poznań, Poland. E-mail: mwinkab@interia.pl <https://orcid.org/0000-0001-5927-8873>

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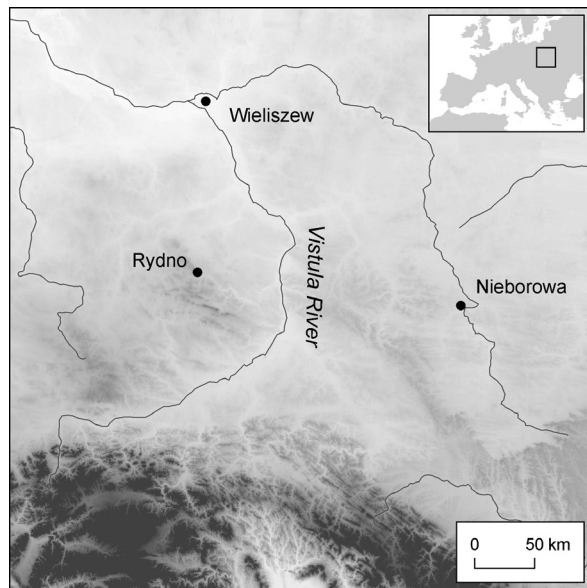


Fig. 1. Location of the three case studies. Sites of Rydno, Wieliszew, and Nieborowa (Poland). Global 30 Arc-Second Elevation (GTO-PO30), USGS EROS Archive: <https://doi.org/10.5066/F7DF6PQS>. Map courtesy of Antonio Uriarte (Laboratorio de Arqueología del Paisaje y Teledetección, Instituto de Historia, CSIC).

ern France, where the early Holocene is associated with an increase in the proportion of woodland animal remains (Langlais *et al.* 2014: 87).

The characteristic feature of flint knapping was microlitisation and geometrization of their most recognisable types of tools: triangles, rectangles, and trapezes. The development of the first Mesolithic groups in western Poland is dated to the first half of the Preboreal period (*circa* 10,900 cal BP) and is associated with the Duvensee cultural circle (known as Komornician in Poland). This is followed, already during the Boreal, by the Maglemosian, another ‘cultural circle’ that extends into the Atlantic phase. By then, in what is considered the Late Mesolithic, several so-called cultural units have been recognized in the area: Beuronian-Tardenoisian, Maglemosian, Duvensee, and Janislawician (Masojć 2016).

Although culture-history frameworks have prevailed in Mesolithic studies, there is nowadays a growing interest in spatial and functional studies of campsites and settlements (Larsson *et al.* 2003; Mc Cartan *et al.* 2009; Gaudzinski-Windheuser *et al.* 2011) as well as some relevant contributions to use-wear analysis (Marreiros *et al.* 2014; Gibaja *et al.* 2020). Some of the most spectacular results in Europe have been obtained through the comprehensive spatial-functional analysis of large campsites such as Pincevent (Bodu *et al.* 2006), Étiolles (Olive and Morgenstern 2004), Gondersdorf (Sensburg and Moseler 2008), Rydno (Fiedorczuk

2006) or Talaue des Neckars (Kind *et al.* 2012). These multiphased sites are characterised by combinations of flintknapping areas, fireplaces, pits, or dwelling structures. Known in French literature as *structures évidentes* (Leroi-Gourhan, Brézillon 1972: 247), all these features are obviously critical to our understanding of past human activity (Price *et al.* 1974: 20) and allow a multidimensional approach to behavioural, economic, and social aspects of hunter-gatherer lifestyles.

However, these ‘evident structures’ are not only present in large campsites. Many similar features have also been recorded at much smaller sites, irrespective of their geographical location (Kobusiewicz and Kabacińska 1991; Wenzel 2011; Kriiska and Sikk 2013; Warren *et al.* 2018; Reis *et al.* 2019).

In this paper, we present a comprehensive approach to the usefulness of analyzing small campsites and their contribution to our understanding of Mesolithic hunter-gatherer lifestyles. Three case studies have been selected to represent different areas in contemporary Poland. These are Rydno VI/60, Nieborowa I Trench 3, Wieliszew III, Trench XVI, and Wieliszew VI b Trench XVII c (Fig. 1). All assemblages were chosen because of the small quantities of lithic assemblages, under the assumption that understanding the spatial and functional structure of small campsites would be not just a contribution in themselves to Late Mesolithic hunter-gatherer lifestyles but comparatively useful when approaching more complex multiphased sites.

Our approach has been driven by two functionally oriented research questions. First, if activity areas are clearly recognizable within these small camps with a single clear deposition phase. Secondly, and if so, whether such sites had single or multiple activities. That is, understanding what the purpose of such sites was and how did Mesolithic communities use them.

While the number of Mesolithic assemblages that have been subject of use-were analyses is relatively significant (Winiarska-Kabacińska *et al.* 2006; Winiarska-Kabacińska 2007, 2015, 2016, 2019; Kabaciński *et al.* 2008; Pyżewicz 2011, 2012, 2013), its combination with a comprehensive spatial-functional approach is still uncommon (Osipowicz 2015, 2017; Boroń *et al.* 2018, 2019).

SELECTED CASE STUDIES

Most sites, in particular those of the so-called Janislawice culture, are located on dune riverine terraces or sandy dunes, as are Nieborowa and Wieliszew. Because of sand erosion, Mesolithic remains are occasionally mixed with chronologically younger finds. These unfavourable geomorphological conditions do not allow for the preservation of any organic material,

botanical or osteological. Flint artefacts are therefore the only source of information.

All selected sites have been documented through systematic open area excavations, reaching from 100 to a thousand square meters, depending on the density of archaeological remains, mostly flint or pottery. Other than recovery conditions, the main criteria to select these sites was based on the size of the collection and their spatial distribution: from several dozen to several hundred flints, and concentrations covering no more than 20 square meters.

Level plans every 5 to 10 cm included detailed mapping of all items. Each square meter was additionally divided into quarters and explored through thin arbitrary levels. Flint items such as tools and cores were mapped and assigned separate inventory numbers, whereas all the remaining items such as blades, flakes, or chips, were collected from each quarter meter and individually recorded on the trench plan. As a result, we have been able to put together a detailed and comprehensive map of all Mesolithic occupations, identifying stratigraphic relationships among items that allow for a functional interpretation.

Rydno VI/60

The first site is located within the large archaeological complex of Rydno, near the town of Skarżysko-Kamienna (Świętokrzyskie voivodeship), north of the Hole Cross Mountains (Fig. 1). For over fifty years and during many excavation seasons, archaeologists have investigated many of the sites (mainly Late Palaeolithic and Mesolithic) that surround the prehistoric haematite mine. Results from these long-lasting excavations are well-known in both Polish and European literature (Schild and Królik 1981; Schild 1990; Schild *et al.* 2011).

Rydno Trench VI/60 offered remains of a Late Mesolithic flint industry classified as part of the so-called Janisławice culture, mostly distributed east of the Vistula River, western Belarus and Ukraine, with a radiocarbon chronology ranging from approximately 6500 to 5500 cal BC (Kozłowski 2009: 451).

Nieborowa I, Trench 3

The site of Nieborowa is located in central-eastern Poland, close to the settlement of Sawin, in the Lublin voivodeship (Fig. 1). It is situated on the northern slope of the Wał Uhruski hills, a natural border separating the Lublin uplands from the lowlands of the Western Polesie. During the excavations conducted throughout the 1960s and 1970s, archaeologists discovered finds from

various cultures ranging from the Late Palaeolithic to the Early Iron Age (Boroń 2014).

Wieliszew III, Trench XVI and Wieliszew VI c, Trench XVII c

The village of Wieliszew, situated in the Mazovian voivodeship, on the left bank of the Narew River near to where it meets the Vistula (Fig. 1), is the location of a great number of archaeological sites (Więckowska 1985). The material discussed in this paper was recovered during the excavations conducted in the late 1950s and early 1960s and includes two inventories (Wieliszew III, Trench XVI and Wieliszew VI c, Trench XVII c). Both are associated with the same kind of flint industry, they contain a similar number of artefacts and set of tools. Use-wear analyses were performed in order to assess the functional similarity of both locations.

The assemblages from Nieborowa and Wieliszew represent relics of the diminishing Mesolithic communities (post-Janisławice) which survived into the Neolithic era and were at that time limited to territories unsuitable for agricultural purposes. A similar assemblage from Nieborowa I trench 2 offered a date of 4900-4330 cal BC (Gd – 144, 5730 ± 130 BP) (Boroń and Winiarska-Kabacińska 2016). Characteristic features of those industries are the high proportion of scrapers over end-scrapers, the use of a splintering technique, and a microlithic tradition mostly limited to trapezes. In Germany, such assemblages are considered End-Mesolithikum (Cziesla 2017: 213).

MATERIALS AND METHODS

Stone artefacts do not decompose easily so they are the largest group of artefacts found at archaeological sites and the best diagnostic material source for the spatial analyses of these campsites. For this reason, the spatial-functional studies are mainly based on the refitting of flint and the analysis of their horizontal distribution (Schild 1980: 79-80). Researchers have particularly focused on the concentration of debris result of tool production, such as burin spalls and microburins. According to a commonly accepted view, they are direct evidence for flint tool production (Welinder 1971: 81; Olive 1997: 91-92) and due to their small size, they are less susceptible to external conditions (Olausson 1986: 21) such as soil cultivation (Odell and Cowan 1987: 480-481). Traceology and the identification of microwear on flint artefacts also stimulated research on prehistoric campsites, as this method may be success-

fully used in analytical spatial studies (Keeley 1991: 257).

Refitting is a time-consuming method sporadically used since the end of the nineteenth century (Spurrell 1880) and commonly used in the 1970s. Its application has been of critical importance for the recognition of activity areas. By refitting flints, we can identify and individualise activity areas and determine spatial-temporal relations between them (Cahen *et al.* 1980: 213, 220; Tomaszewski 1986: 257-273), as demonstrated in the Belgian site of Meer II (Cahen *et al.* 1979; D. Cahen 1984: 247).

Refitting of flints was successfully used in the spatial analyses and the reconstruction of the organization of campsites in Rydno, Nieborowa, and Wieliszew. The only location of possible evident structures is trench XVI in Wieliszew III, implied by the position of flints and burnt bones, indicating the probable location of fireplaces. The presence of burnt flint is important because on many occasions it is the only clear indicator of potential fireplaces (*e.g.*, Johansen and Stapert 1997-1998: 32).

Trace-wear on stone tools and their function were determined by observing the edges and surfaces of the artefacts using a stereoscopic microscope Olympus SZX9 and metallographic microscope Olympus BX53M, with magnification between 6.3x and 500x. Results of the observations are then compared with findings made during experiments replicating the actions which may have been performed by the prehistoric groups. This method originally pioneered by Semenov (1964), was developed and improved in the following decades (Tringham *et al.* 1974; Keeley and Newcomer 1977, Keeley 1980, Anderson-Gerfaud 1981¹; Moss 1983) and is commonly used in use-wear analyses nowadays in combination with residue analyses of traces preserved on edges and surface of these tools (Marreiros *et al.* 2015).

The technological characterisation of the lithic materials was performed using so-called dynamic typology (Schild *et al.* 1975)—an analytical method that allows us to place each element of the inventory in a logical sequence of operations, from lumps of raw material to finished tools. The desired shape of the latter was usually obtained through diverse methods of retouching edges, making it possible to use retouched tools to perform specific tasks. Therefore, typologically identified tools are the basic group of analysed artefacts. However, since traceology shows that prehistoric communities often used non-retouched flint tools (*e.g.*,

blades and flakes), unretouched blades were also included in observations.

CASE STUDY 1: RYDNO VI/60

Part of the Rydno Archaeological Reserve, the site of *Pastwisko*, Trench VI (82 m²) was one of many locations (Annex Fig. 1) chosen for the excavations conducted in 1960. Most finds were semi-raw material and tools concentrated in the southern part of the trench (Fig. 2). The assemblage comprises 79 total items, all tools made from mined chocolate flint: flakes, blades, and tools, including scrapers, end-scrapers, becs, borers, burins, notches, and others (Annex Fig. 2) (Boroń *et al.* 2018). No cores were found. Five blocks consisting of two to three elements were refitted: Block 1, two scrapers and an end-scraper (Annex Fig. 2: 14); Block 2, an end-scraper and a scraper (Annex Fig. 2: 15); Block 3, a blade and a notch tool (Annex Fig. 2: 6); Block 4, two flakes and a chip (Annex Fig. 2: 1); Block 5: a crested blade and a blade (Annex Fig. 2: 2).

Except for one item (Annex Fig. 2: 6) blades are characterised by very similar parameters, all with a length smaller than 40 mm. They are much shorter than any other Mesolithic flint scatters from the Janisławice culture at the Rydno Archaeological Reserve, where blades can reach up to 64 mm in length (*e.g.*, Rydno IV/47, in Boroń 2018: 62). Their morpho-technological features suggest a pressure blade technology. They are characterised by straight edges, faceted butt, parallel scars on the top surface, and identical thickness. Since there were no cores, blade exploitation process was reconstructed based on blades themselves. The smaller size of these blades, when compared to other assemblages from Rydno, may in fact be a result of either the continuation of core exploitation (*i.e.*, smaller concretions were used) or that already-used cores were brought in, as suggested by the lack of cortex flakes among the collection. Based on the refitted block, we determined that flake exploitation was performed through single platform cores with changed orientation and natural or cortex striking platforms, and usually broad, short flaking surfaces.

Twenty-six retouched artefacts and 14 unworked blades were subject of trace analyses. The results are presented in Annex Tab. 1. Four end-scrapers, only one having traces of scraping an undetermined raw material (Annex Fig. 3: 1). Ten scrapers, two of which were broken and smaller in size. The remaining have traces of being used for scraping wood in some or all edges (Annex Fig. 3: 2-7; Fig. 4: 1). Their polish suggests their use to strip bark. The only analysed burin did not have use-wear. One of the two analysed notches was used to scrape wood (Annex Fig. 3: 8). The surfaces of

¹ Patricia Anderson-Gerfaud. *Contribution méthodologique à l'analyse des microtraces d'utilisation sur les outils préhistoriques*. Ph.D. diss., Thesis, Université de Bordeaux, Bordeaux, 1981.

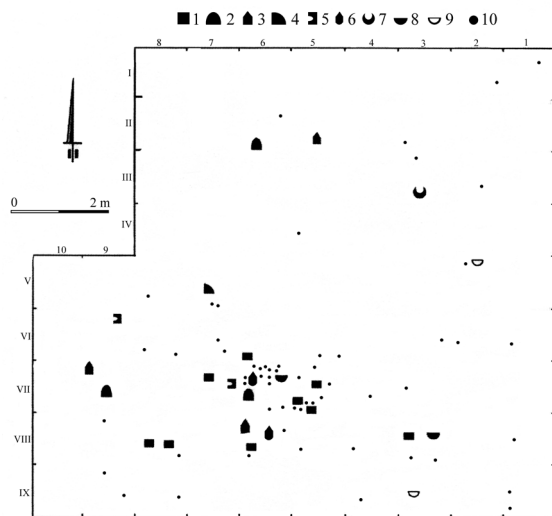


Fig 2. Spatial distribution of 82 flint finds in Trench VI/60: 1. scrapers (9); 2. endscrapers (4); 3. becs, borers (3); 4. burin (1); 5. notched tools (2); 6. combined tool (2); 7. retouched chunk (1); 8. retouched flakes (2); 9. retouched blades (2); 58 flints (blades, flakes, chunks, chips). After R. Schild *et al.* (2011: 367).

the two analysed becs had visible use-wear on the retouched edges. Their stings were additionally smoothed and were certainly an important part of the tool. In the first case (Annex Fig. 3: 9), traces suggest the tool was used to make grooves and bore holes in wood. The use of the second bec (Annex Fig. 3: 10) has not been determined as it was overheated and partially covered with a patina. The only analysed borer (Annex Fig. 3: 14; Fig. 4: 3) was used to work wood/plants. The side edge was used to scrape and the remaining surfaces for other kinds of actions. None of the combined tools revealed any evident traces of wear. Two retouched blades were analysed, one of which was used to cut soft organic raw material (Annex Fig. 3: 11). The chunk, with a retouched horizontal edge, was used to work hard raw material (wood or bone/antler) (Annex Fig. 3: 12). The two retouched flakes bore no traces of use. Out of the 14 analysed blades, only two had wear traces, one (Annex Fig. 3: 16; Fig. 4: 2) was used to split and cut plants, the other (Annex Fig. 3: 13) to scrape an undetermined raw material.

CASE STUDY 2: NIEBOROWA I, TRENCH III

Site one extends for over 1 km on a sandy embankment with a relative height of 2.5 m (Annex Fig. 5). Trench 3 (82 m²), out of the 12 that were originally opened, was dug in a surface with flint scatters (Fig. 3). The excavations yielded several hundred flint items,

mostly associated with the early Bronze Age settlement and a small collection of Mesolithic artefacts (63 pieces) was assigned to this phase due to the finds' technological characteristics and their spatial distribution. We assume that the later Bronze Age settlement did not affect the previous Mesolithic occupation, since it is unlikely that the former rearranged Mesolithic flints in two concentrations, one of which is exclusively composed of blade tools.

Mesolithic flints were mostly concentrated in the eastern part of the trench (Fig. 3). The assemblage comprises flakes, blades, scrapers, trapezes, truncated blades, a notch, retouched blades, and flakes (Annex Fig. 6: 1-6). To source the semi-raw material (erratic chalk flint), single platform blade exploitation of the core and flake exploitation technique with changed orientation was used, as illustrated by the refitted block. Some blades are both large and relatively bulky specimens, 50-60 mm long, while others are much smaller and with more regular edges. The length of these blades and the size of the refitting suggest that flint concretions brought to Nieborowa I had diameters of 8 to 10 cm.

All typological identified tools and a selection of plain blades and flakes were analysed under a microscope. Use wear traces were discovered (Annex Fig. 7; Annex Tab. 2) in 14 artefacts, mainly related to plant manipulation (Annex Fig. 7: 6-10, 13; Fig. 8: 2). Tools were used for cutting (plain blade, Annex Fig. 7: 13) or scraping plants and plant tissues (truncation, Annex Fig. 7: 6). Artefacts were used to scrape hide (scraper Annex Fig. 7: 2; Fig. 8: 1), wood (retouched flake, Annex Fig. 7: 11; Fig. 8: 3), or hard materials (Annex Fig. 7: 14). Two specimens, a notch and a retouched chunk, were used to scrape soft, inorganic raw material (Annex Fig. 7: 5, 12). One of the two analysed trapezes had visible traces of shafting, suggesting it was used as a projectile point (Annex Fig. 7: 4).

CASE STUDY 3: WIELISZEW III, TRENCH XVI AND VI b, TRENCH XVII c

Wieliszew III is located on a sandy dune south of the Narew river, between the villages of Łajski and Wieliszew (Annex Fig 9A). Trench XVI has an area of 89 m². Remains were distributed in a rather compact concentration of approximately 20-22 m² (Fig. 4A). The excavations recovered 611 flint artefacts, mostly chips and waste material, but also cores, splintered pieces, blade and flake semi-products and tools. The largest sub-group of tools were scrapers (79), followed by retouched flakes and blades as well as end-scrapers (Boroń and Kabacińska 2016). All 135 typologically-identified tools were analysed, 39 of which had

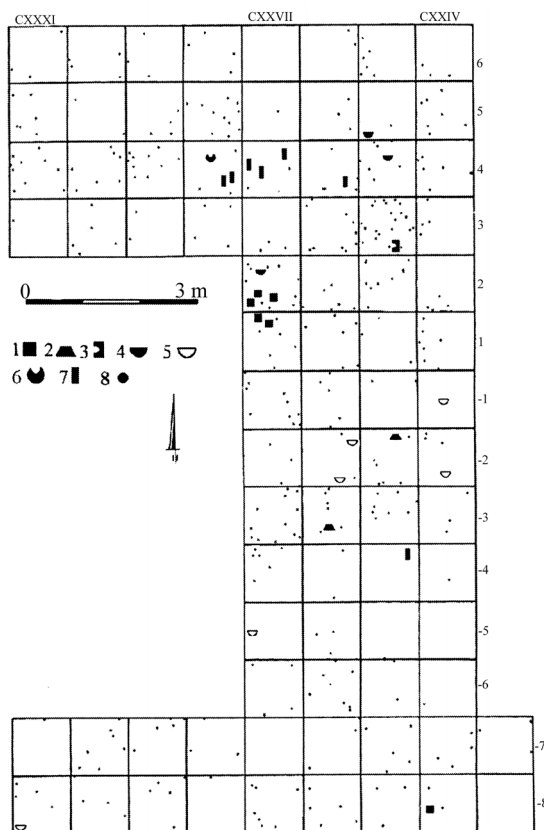


Fig. 3. Spatial distribution of flint finds at Trench 3 Nieborowa I. Only Mesolithic artefacts: tools and blades (flakes and waste material were omitted) are identified on the map. The remaining, chronologically later artefacts are marked with dots. 1. scrapers (6); 2. trapezes (2); 3. notched tools (1); 4. retouched flakes (3); 5. retouched blades (6); 6. retouched chunks (1); 7. unworked blades (7); 8. flints (flakes, chunks, chips). Prepared by T. Boroń.

use-wear traces (Annex Fig. 10; Annex Tab. 3) (Boroń and Winiarska-Kabacińska 2018: fig. 9).

Wieliszew VIb, Trench XVII c is located on a small sandy elevation (Annex Fig 9B), largely destroyed by deflation processes. Trench XVII c (131 m²) was opened in its preserved part (Fig. 5A), where 764 flint items were recovered, including chips and debris. As in Wieliszew III, Trench XVI, finds were distributed quite evenly. The unearthed flint assemblage comprised cores, splintered pieces, flakes, blades, and tools. As in Trench XVI, the main sub-category of tools was scrapers (72 specimens), although end-scrapers, trapezes, backed pieces, truncations, and other forms were also recovered. All typologically-identified tools were analysed under a microscope (132 items), 62 of which bore use-wear traces (Annex Fig. 11; Annex Tab. 4) (Boroń and Winiarska-Kabacińska 2016, figs. 27, 29). Technological results for both trenches are presented

together as they have been considered part of the same industry.

Based on archaeological sources, it was possible to identify three techniques of obtaining semi-raw material (blanks): blade-making, flaking and splintering. In the case of the flaking technique, both single-platform and changed orientation methods of core exploitation were used (Annex Fig. 12: 8-10).

Blade-making represents three varieties of core exploitation: double-platform, single-platform, and changed orientation technique. Single-platform core exploitation was most commonly used. Unfortunately, identification of the double-platform core exploitation based on the layout of the directions of scars on the flaking surface is inadequate for drawing final conclusions. However, it was probably a change of the concept in the last phase of the exploitation, hence the assumption concerning the double-platform core (Annex Fig. 12: 7).

Considering metric properties of the cores, they were divided into macro- (with a length of approximately 30 mm, Annex Fig. 12: 1-2) and microlithic (with a length up to 15 mm, Annex Fig. 12: 3-6). In addition to the common blades with ill-defined and irregular shapes (Annex Fig. 12: 11-15), there were sporadic blades and tools (Annex Fig. 12: 16-17, 23-24) which constitute the basis for an assumption that probably there was a third type of single-platform blade cores. Blades are characterised by a slender shape and regular edges, prepared butt, even thickness throughout the entire length of the specimen, and a small, clearly visible bulb. These blades were likely made using a pressure technique, with cores longer than 50 mm. It is possible that the lack of such specimens may be the result of reworking them into flakes.

The microlithisation of tools, in particular of scrapers (Annex Fig. 12: 19-21), does not seem to be a side effect of their reworking or reusing, but an intentional act. This is evidenced by the refittings, where the correction of shape with retouching is only marginal (Annex Fig. 12: 28-30).

COMPARING RESULTS OF THE FUNCTIONAL ANALYSIS

The functional analysis covered 340 artefacts from the discussed assemblages, including 131 items with use wear traces (Annex Tab. 5). Microscope observations of the materials from Rydno VI/60 have revealed that the artefacts were mainly used on wood, to cut plants and other soft organic raw materials, and to work hard materials (wood or bone/antler) (Annex Tab. 1). Although they were not used intensively, they were involved in cutting, scraping, and splitting activities.

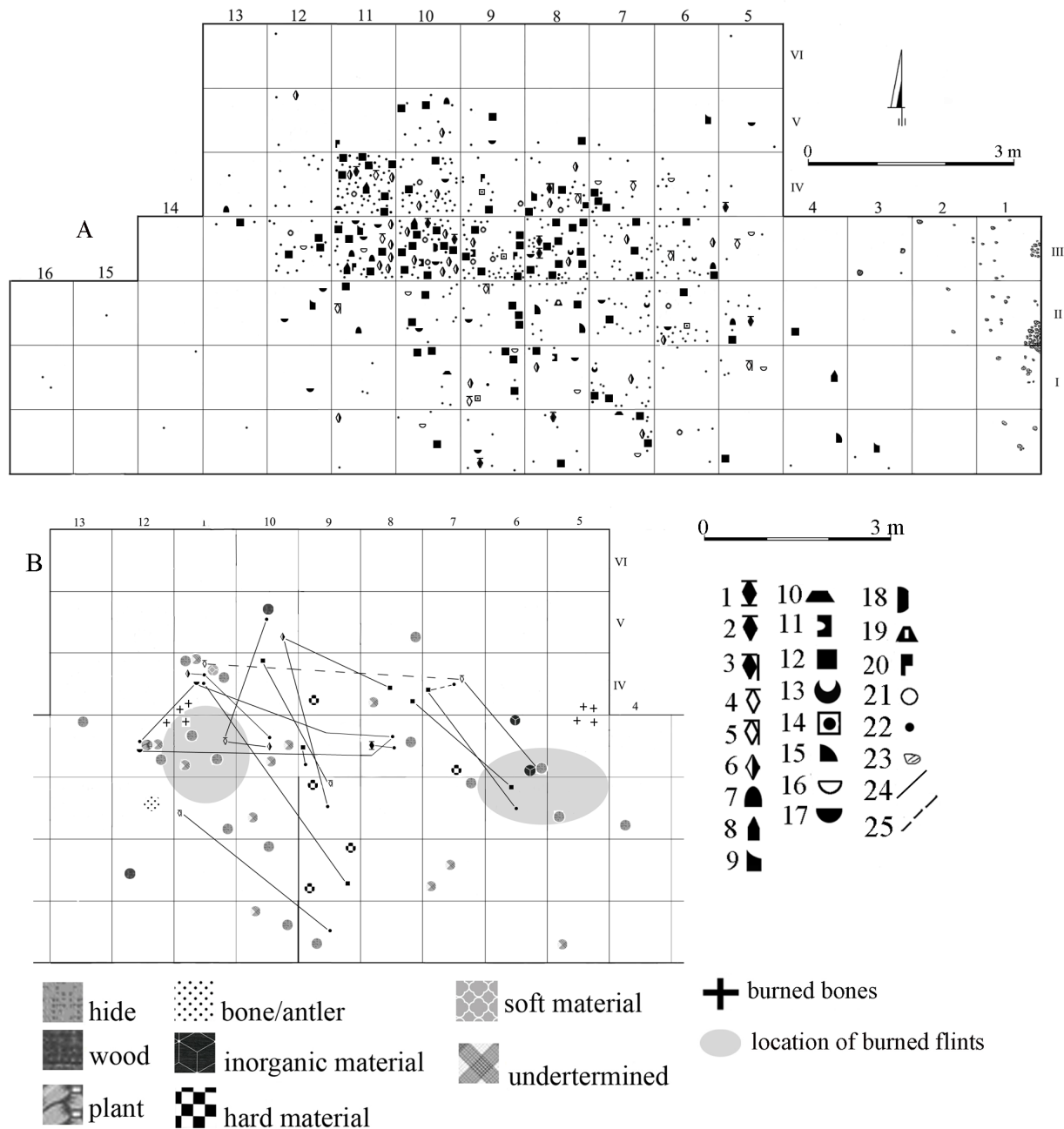


Fig. 4. Wieliszew III, Trench XVI. A. spatial distribution of flint finds; B. products with determined functions. 1. double platform blade core (1); 2. single platform blade core (7); 3. changed orientation blade core (1); 4. single platform flake core (4); 5. changed orientation flake core (6 specimens); 6. splintered pieces (28); 7. endscrapers (7); 8. becs, borers, perforators (4); 9. truncated pieces (5); 10. trapezes (3); 11. notched blades (3); 12. scrapers (79); 13. retouched chunks (4); 14. strike-a-light tools (4); 15. burins (3); 16. retouched blades (11); 17. retouched flakes (18); 18. backed blades (1); 19. tranchets (1); 20. microburins; burin spalls (4); 21. fragments of retouched tools (13); 22. flint (blades, flakes, chunks, chips); 23. stones; 24. refittings; 25. refittings of breaks. Circles show artefacts with a specified function. Prepared by T. Boroń.

At Nieborowa wear-trace analyses have revealed that almost half of the investigated flint artefacts bear traces of plant working (Annex Tab. 2), which confirms previous observations that blade tools were used for processing plants (Beugnier and Crombé 2005: 537; Guéret *et al.* 2014: 7; Mazzucco *et al.* 2016: 155).

Traces found on the edges of the remaining tools suggest that they were used to work hard raw materials (wood or bone/antler), inorganic materials (soft stone?), and wood. In some cases, the modifications caused by the post-deposition alteration activities made it impossible to interpret the observed traces (*e.g.*, those recorded at the edges of scrapers). These tools were classified as used for scraping or working undetermined raw materials and do not point to intensive use.

Tools from Wieliszew, Trench XVI, which bear traces of wear were intensively used, and the scrapers, numerous in the assemblage, were mainly used to scrape hide (Annex Tab. 3) and sometimes to scrape wood, inorganic materials, and hard materials (wood or bone/antler). End-scrapers were used to scrape hide, whereas truncations, borers, the notch, and the strike-a-light tool were used to work bone/antler, hard materials (stone?), and other undetermined materials. The remaining artefacts bearing wear traces were used to work plants, cut hides, and scrape wood and other inorganic raw materials.

Trench XVII c at Wieliszew reveals a high degree of wear in its recovered tools. They were used to work various raw materials, especially hides (Annex Tab. 4). Two of the tools were fixed in hafts, while the remaining probably used without them. Single scrapers were used to scrape bones and soft organic materials. The backed pieces, truncations, flakes, and retouched blades were used to scrape bones and wood, and the retouched blades and the borer used to cut, bore, and engrave wood.

The second major group of scraping tools from Wieliszew are the items used as projectiles, both blades (arrowheads) and other parts of weapons. They comprise trapezes, backed pieces, truncations, and undetermined microlith fragments. The observations revealed macroscopic and microscopic traces, including those of hafts, which seem to indicate that the trapezes and the backed piece were used as blades mounted to the top of shafts, whereas the truncation and two undetermined microlith fragments were most probably used as projectile's side inserts.

The sites of Rydno and Nieborowa, where tools were mainly used to work wood and plants, may have been the result of a Mesolithic community making use of the local flora. The organic raw plant materials certainly played an important part in the life of the Holocene populations. Besides consumption, treatment of diseases, and personal hygiene (especially of the oral cavity), they were used to make various objects such as

shafts of weapons, bows, shafts and hafts of flint tools, also those made from bone and antler, containers from tree bark, and baskets and ropes from plant fibres. A good example are wooden handles of axes made from antler and wooden shafts from the early Mesolithic peat site in Krzyż Wielkopolski (western Poland) (Kabaciński 2020), as well as a double-cord string made of lime tree phloem, a bark canoe or a wooden part of a leister discovered at a late Mesolithic peat site in Dąbki (northern Poland) (Kabaciński and Terberger 2015; Kabaciński 2020). The appearance of composite products (hunting weapons, fish traps, etc.) which required combining various raw materials, increased the importance of resins and binding agents and ropes (Hardy 2016; van Gijn and Little 2016; Kabaciński 2020).

Archaeobotanical studies on finds from sites with Mesolithic assemblages in Całowanie (Kubiak-Martens and Tobolski 2008) and Rotterdam-Yangtzehaven (Kubiak-Martens *et al.* 2015), the results of which can be associated with human activity, confirm that Mesolithic communities used roots, tubers, and fruit for consumption to a much greater degree than commonly believed. They were sources of starch, easily available and plentiful, while others, such as dogwood berries and water lily seeds could also provide oil and sugar. These plants were present in woodlands (dogwood berries), in marshy environments (rhizomes of common club-rush and tubers of the sedge family), and in wetlands (water chestnut and water lily seeds). Picking and processing such plants doubtless required using tools.

Analyses of microwear on flint artefacts from the Rotterdam-Yangtzehaven site (Niekus *et al.* 2015) showed that a large number of tools were used to work wood, bark, and plants with a high silica content. While tools were probably used to make wood and bark artefacts, in the case of plants, as demonstrated by experiments (Osipowicz 2019), it is hard to determine whether a tool was used to make artefacts, or simply to gather and prepare the plant for consumption. Similar observations also refer to artefacts with evidence of working in wood and processing plants recorded in the Mesolithic assemblage from Smolno Wielkie 2 (western Poland), analysed in its functional aspect (Winiarska-Kabacińska 2019). This site is located in the Wojnowo region, where archaeobotanical studies were carried out as a part of a project concerning sites from the Younger Dryas and Early Holocene period (Kubiak-Martens 2019). Despite the lack of conclusive evidence linking the results of that study to human activity, macroremains of reed and sedges confirm an intentional use of plants.

In the context of this discussion, tools from Rydno used for scraping wood and bark, shaving, cutting, and splitting plants, and tools from Nieborowa used for scraping wood, shaving, and cutting plants and their fi-

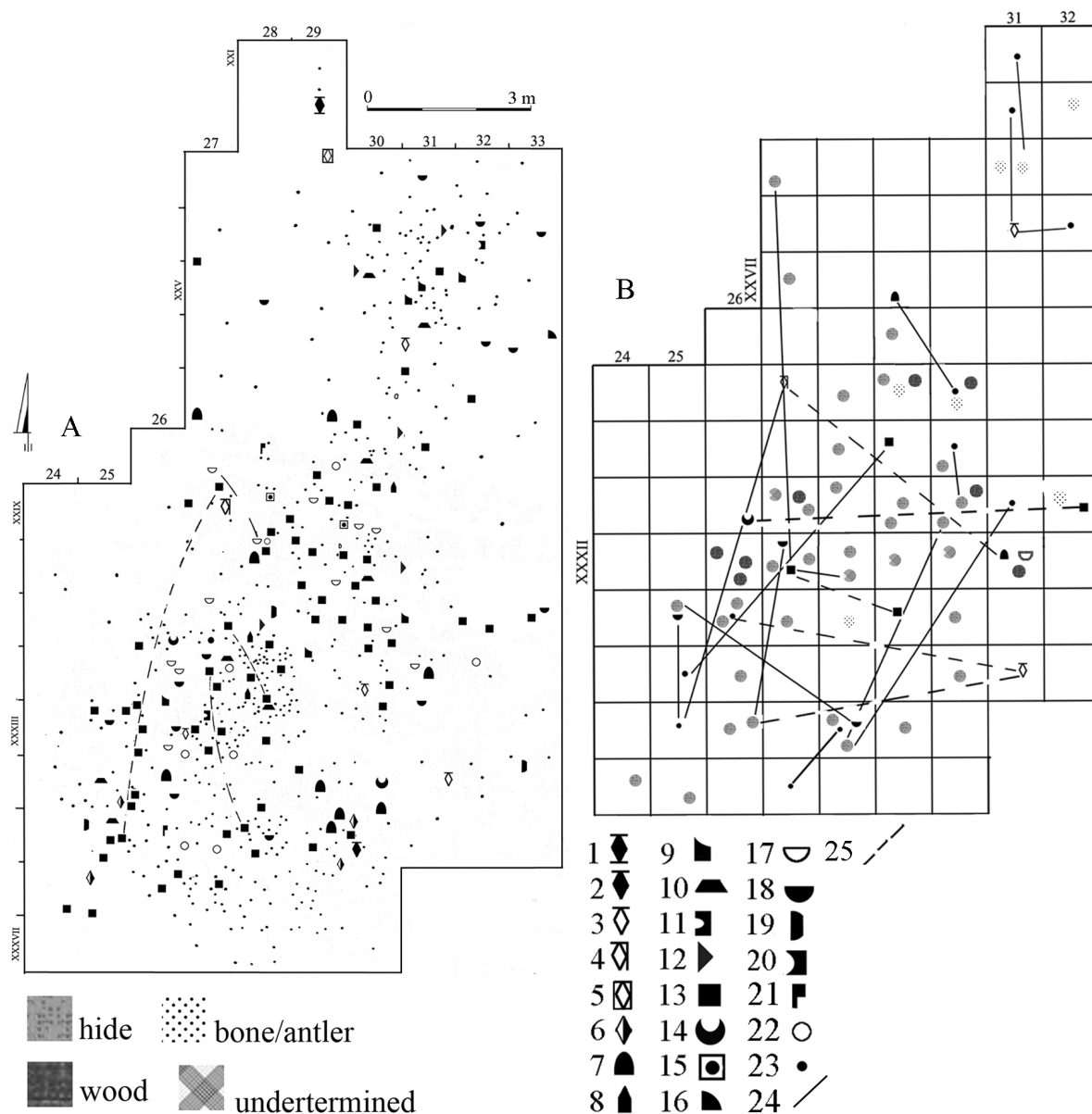


Fig. 5. Wieliszew VI c, Trench XVII c. A. spatial distribution of flint finds; B. products with determined functions: 1. double platform blade core (1); 2. single platform blade core (1); 3. single platform flake core (4); 4. changed orientation flake core (1); 5. semi-circular core (1); 6. splintered pieces (4); 7. end-scrapers (9); 8. bees, borers (3); 9. truncated pieces (6); 10. trapezes(8); 11. notched blades (1); 12. fragments of unspecified microliths (5); 13. scrapers (72); 14. retouched chunks (2); 15. strike-alight tool (2); 16. burins (1); 17. retouched blades (12); 18. retouched flakes (14); 19. backed blades (3); 20. grooving tools (1); 21. microburins; burin spalls (2); 22. fragments of retouched tools (8); 23. flint (blades, flakes, chunks, chips); 24. refittings; 25. refittings of breaks. Circles show artefacts with a specified function. Prepared by T. Boroń.

bres could be used for both producing necessary artefacts and gathering and preparing plants for consumption.

The importance of exploitation and working of organic raw materials of plant origins in the Holocene communities has been confirmed by the ethnographers but

also by some rare archaeological finds. The latest analyses of microwear traces on artefacts from other Late Mesolithic assemblages from Poland brought more evidence that these tools were used to work wood and plants (Pyżewicz 2013: 169-207; Osipowicz 2017, 2018).

However, the assemblages discovered in Wieliszew are different, primarily hundreds of artefacts with numerous tools (especially scrapers) used mainly to scrape hide. In some cases, traces of hafts were recorded. Scraping hide, as evidenced by the results of the spatial analysis (Boroń and Winiarska-Kabacińska 2018: figs. 14, 15), was performed intensively in this campsite.

Processing raw materials originating from animals was undoubtedly important as well. Numerous tools from the Wieliszew assemblages were used for dressing hides – a long-lasting, multi-stage process requiring specialised tools made not only of stone but also bone or antler. Traces recorded on working edges of tools indicate that they were used in preliminary and later stages of the hide dressing process. Ochre was often used to soften the hide, to improve its quality, and as a dye. It was found on several artefacts from Wieliszew but related to secondary processing. It is,

however, possible that ochre was also used during hide dressing. The studies of the Late Mesolithic assemblages from Poland (Pyżewicz 2013; Osipowicz 2017; Winiarska-Kabacińska 2019) also revealed the presence of tools used for processing hides.

A SPATIAL APPROACH TO ACTIVITY AREAS

Rydzno VI/60

Flakes and flake tools were found in a fairly compact concentration. Flakes from this site are thin and flat, with a thin longitudinal profile. They are also much smaller than other items used for the production of flake tools (Annex Fig. 2: 1). Furthermore, there is no evidence for cortex, while unworked blades and the few blade tools were found scattered over a large area covering the space around this concentration (Fig. 6A).

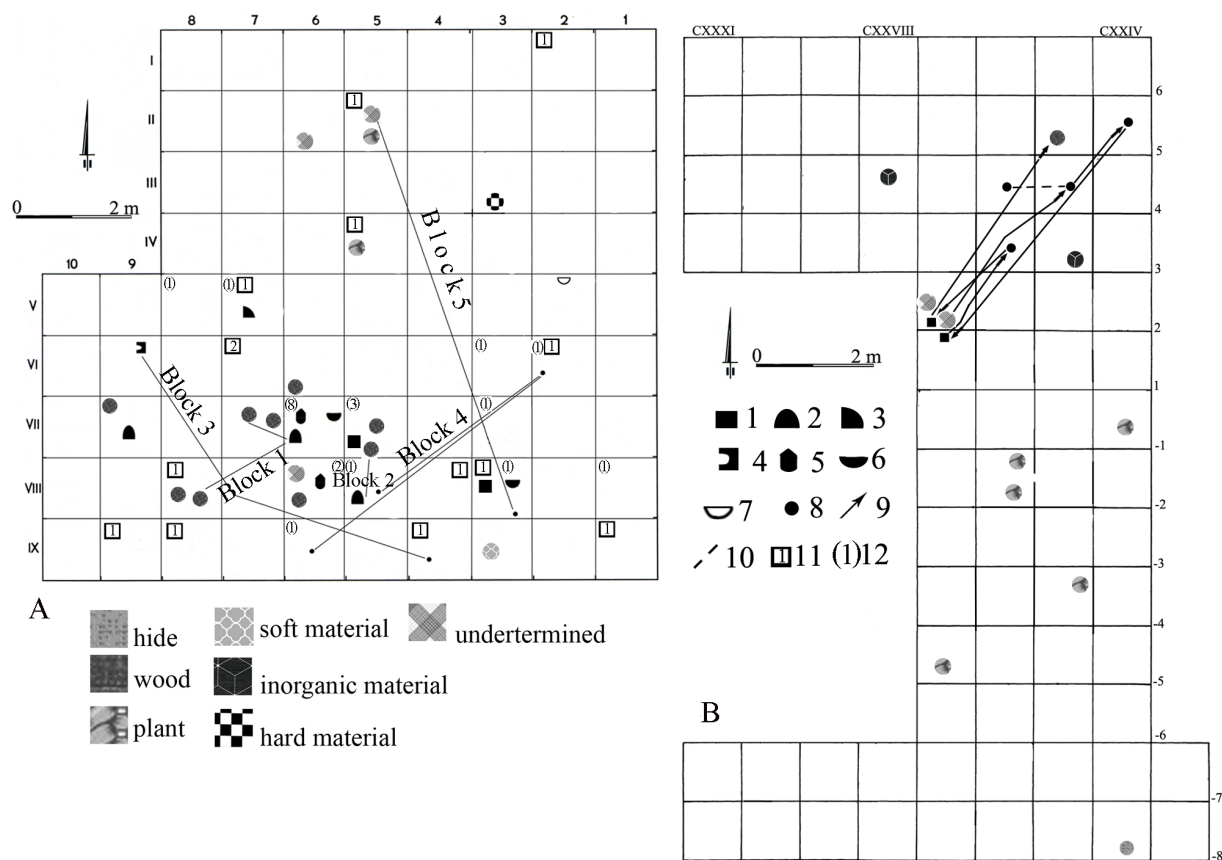


Fig. 6. A. tools with determined functions from Rydzno VI/60; B. from Nieborowa I, Trench 3: 1. scrapers; 2. end-scrapers; 3. burin; 4. notched tools; 5. combined tools; 6. retouched flakes; 7. retouched blades; 8. flints (blade, flakes, chips); 9. refittings lines; 10. refitting of breaks; 11. number of blades per square meter; 12. number of flakes per square meter. Circles show artefacts with a specified function. Prepared by T. Boroń.

Refittings, and in particular refitted flakes and blades, suggest that despite the lack of flake and blade cores in the assemblage, such cores were indeed exploited. In the case of flake cores, it seems that the exploitation took place on the spot of the actual concentration (probably the centre of the campsite). In fact, the network of connections between the refitted artefacts additionally stresses the spatial coherence and homogeneity of finds. Semi-raw material was then used for tool production.

The large dispersion of semi-raw blade material does not suggest a specific place of exploitation. However, taking into consideration the above-mentioned connotations concerning the morphological features of flakes, it seems that they may constitute waste material from the rejuvenation of blade cores. If so, their processing was concentrated in the main area of the campsite, and products in the form of blades were carried to different sectors, as illustrated by the refitting of a crested blade (block 5; Fig. 6A).

Work associated with processing wood with the use of flake tools accumulated in the central part of the camp, while other activities were located on the edges of the campsite.

Nieborowa I, Trench 3

Based on the spatial distribution, two separate concentrations of Mesolithic artefacts occupying similar areas (8-9 m²) were distinguished (Fig. 6B). The northern concentration comprises unworked blades, flakes, and tools made out of them, including five scrapers discovered near the edge of the trench.

One block was refitted from three scrapers, a retouched flake, and three flakes (Annex Fig. 6: 1). Refitted artefacts were found in two distant places and the refitting lines are two-directional, connecting alternately the two groups (Fig. 6B). Such a scatter of flints from the core indicates the place where it was worked and the places where tools were used. Scrapers were made from selected flakes and later moved to another part of the camp, for it is improbable that the concentration of the scrapers was formed because they were tossed in the same direction when they were no longer used.

The second concentration of Mesolithic finds is located 2-3 m south. In contrast to the first, it contains only blade tools – trapezes, retouched blades, and an unworked blade with use-wear traces (Fig. 3; Fig. 6B).

The spatial division into two tool concentrations is paralleled by the different actions performed in them. The analysis of the micro-traces of wear on the tools from the northern concentration revealed traces of working of inorganic materials (a notch, a retouched

chunk), wood (a retouched flake), and undetermined materials (scrapers)². Traces of wear found on the artefacts from the southern concentration indicate intensive working of plant material (blade, retouched blades).

The presence of blades in the northern concentration may indicate that they were produced there, whereas their use consisted in intentional selection and transporting of respective specimens to the southern concentration.

Wieliszew III, Trench XVI

Refitted flints were found in two distinctive areas, east and west. There are no shared refittings. This division is reflected by the distribution of the artefacts (Fig. 4B). Trace analysis has revealed that the majority of the tools were used to work hides. These tools were found in the central part of both areas. Artefacts with traces of working hard materials were also discovered there.

At the perimeter of the western zone, single finds with diagnosed traces of work in wood, bone/antler, plant material, and inorganic materials were uncovered. In both zones also small burnt animal bones were found next to burnt flints. They were recorded at the eastern and western edge of the concentration and may be remains of hearths. The location of such hearths at the perimeter of the camp suggests that all household activity was polarised (Séara *et al.* 2002: 252, fig. 225; Souffi *et al.* 2018: 550, fig. 15) as their location at the centre of a camp would draw flint processing and household activities around them (Schmider and de Croisset 1990: 435; Carr 1991: 244; Olive 1997: 89; Séara 2000: 217, 2013: 181-182; Wenzel 2009: 116; Wenzel and Jagu 2010: 79).

Wieliszew VI c, Trench XVII c

In Trench XVII c, it is possible to distinguish three concentrations with typologically different sets of tools (Boroń and Winiarska-Kabacińska 2018: tab. 2). The first is located in its northern part, the second in the centre, and the third in the southern part (Annex Tab. 6).

Artefacts are concentrated in the southern and central areas. Even if the overall number of refittings is rather small, there are no refitting lines between them and the northern concentration (Fig. 5B). As in Trench

² Not all the tools are included in the plan, as the retouched flake was picked from the surface layer, whereas the truncation was next to the edge of the trench near a concentration of blade tools.

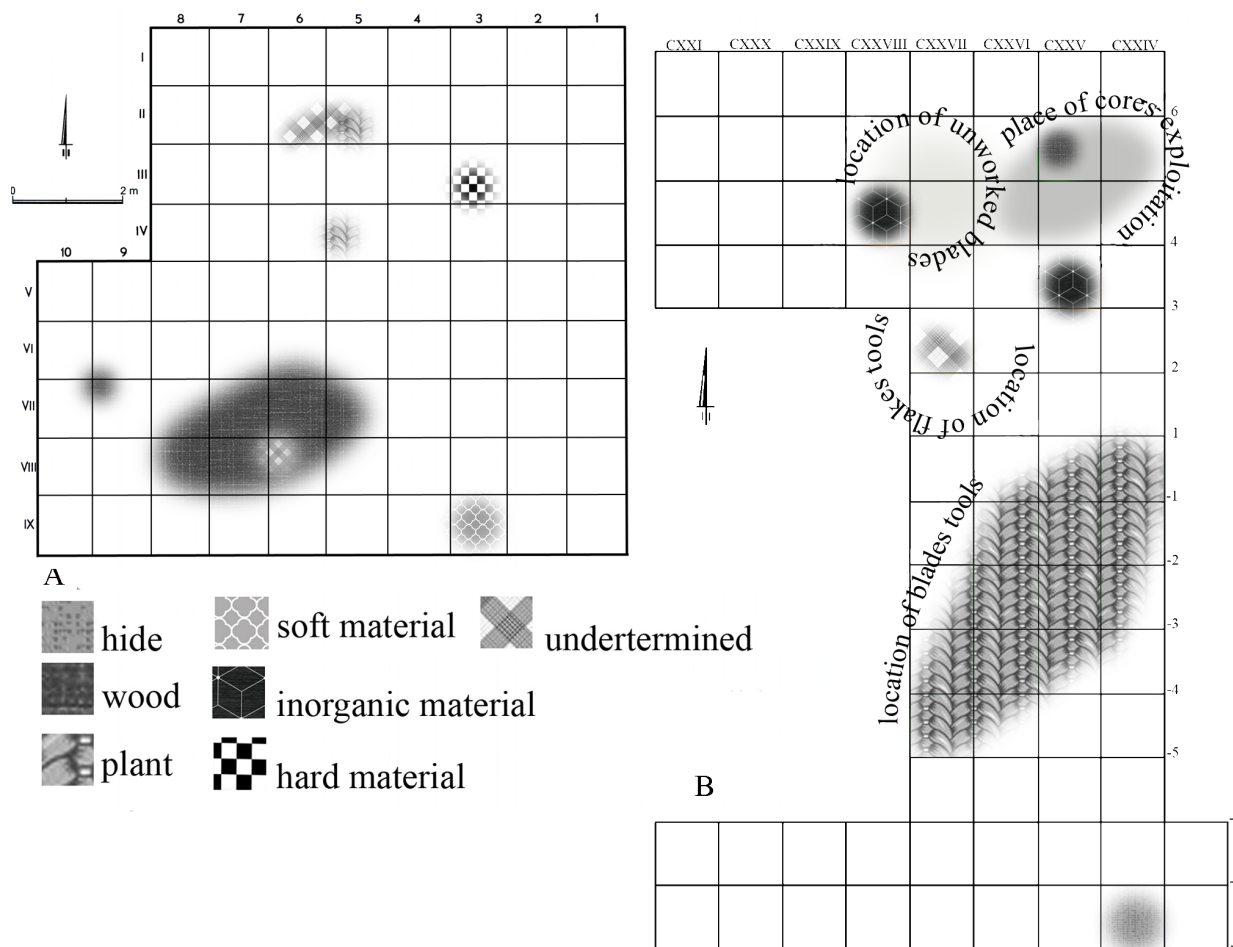


Fig. 7. Graphic modelling of activity zones based on the functional and spatial analysis. A. Rydno VI/60; B. Nieborowa I, Trench 3. Prepared by A. Sołodko.

XVI, the scarcity of refittings is due to the fact that the material was intensively processed and, consequently, flints items are small.

Two spatial units can be distinguished if we take into account the distribution of these refitting lines. The first one comprises the southern and central concentration. The majority of the distinguished forms were used to process hides and only a few were used to work wood and bone. In the northern concentration, the presence of a core and refitted flakes indicates that semi-products were made there. Tools suggest that bone material was worked there³.

³ The site plan of trench XVII c (Fig. 5) 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.

FINAL REMARKS

The spatial-functional analysis of the selected sites from Poland – Rydno, Nieborowa, and Wieliszew – reveal substantial differences in the spatial organisation and functions of Mesolithic camps. The analysis of the micro traces of wear found on different forms of tools and unretouched semi-products from the Late Mesolithic assemblages, combined with additional research procedures such as refitting and analysing the spatial distribution of the artefacts, has allowed a rather precise reconstruction of the spatial-functional organisation of the camps. This has opened the possibility to address how Mesolithic communities functioned in these small camps, and also make some reliable suggestions.

In Rydno VI/60, trace analysis of flint tools revealed that the main household activity was working wood. Artefacts bearing traces of woodworking were concentrated in the central part of the camp. Other activities, such as working hard materials, cutting plants and soft materials, were performed at or near the perimeter (Fig. 7A).

Two separate areas of activity, northern and southern, were recorded in Nieborowa. In the former, mainly flake tools were found and there was a special place for working cores. The microwear traces of work were found on a few tools. They indicate that these were used to work inorganic materials, while in two cases materials were undetermined. In the southern area, plants were intensively worked with the use of blade tools (Fig. 7B).

The fact that the presence of blade and flake tools in separate locations may be associated with performing different economic activities is evidenced not only by the analysis of microwear on flints from Nieborowa and Rydno. Similar results were obtained when the functions of two distant concentrations at the Belgian site of Meer II were analysed: hides were worked in one and bones and antler in the other (Cahen *et al.* 1979: 671).

A similar situation was documented at the Mesolithic site of Vænget Nord (Denmark), where antler was worked next to the hearth located in the central

part of the camp while hides were worked in its periphery (Jensen and Petersen 1985: 49-50). These two areas differed also in the kind of tools that were recovered: scrapers in the central area, end-scrapers and blades in its periphery. This spatial layout matches some ethno-archaeological observations (Yellen 1977: 92).

The presumably intentional removal of flint material at the camps in Rydno and Nieborowa is far more often evidenced in Palaeolithic sites. Cleaning the camp by removing flint material (or moving it to one place and forming so-called secondary refuse heaps) is known for many sites (Bodu *et al.* 1990: 144-146; Taborin 1994: 136-137; Olive 1997; Boroń 2006: 19; 2013: 54; Fiedorczuk 2006: 153; Wenzel 2011: 154). Such behaviours have been also recorded for much later sites (Hull 1987: 777; Boroń 2017: 141).

The spatial analysis distinguishes two zones of activity at Wieliszew Trench XVI—east and west, with probable hearths at their edges. It is difficult to state with certainty if this was one large camp with two simultaneous settlement structures or two separate ones. In both zones, the central areas were used to perform activities connected with processing hides and working hard materials. Wood, bone, and plant materials were worked at the western edge of the camp. These actions were probably temporary and of short duration. The parallel distribution of household activities in both

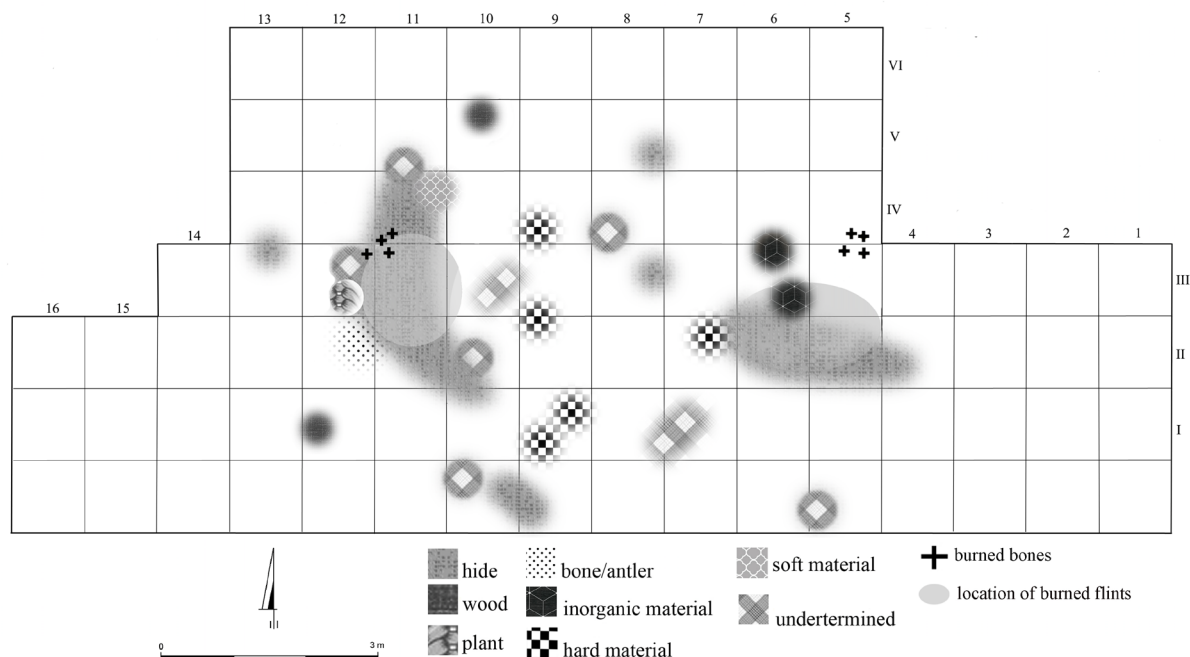


Fig. 8. Graphic modelling of activity zones based on the functional and spatial analysis. Wieliszew III, Trench XVI.N Prepared by A. Sołodko.

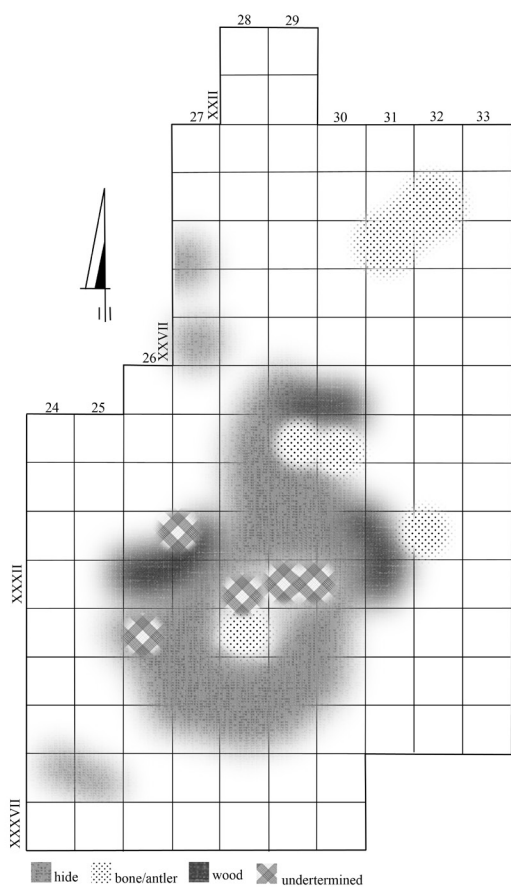


Fig. 9. Graphic modelling of activity zones based on the functional and spatial analysis: Wieliszew VI c, Trench XVII c. Prepared by A. Sołodko.

zones and their functional synchronisation are also indices of the bipolarity of the site (Fig. 8).

This spatial arrangement is slightly different in Trench XVII c, where the southern and central concentrations comprise the main camp whereas the northern one was of secondary importance. Almost the whole area of the main camp was used for hide processing, while other activities such as wood and bone processing were performed in its perimeter. The tools found in the northern concentration bore only traces of wood working (Fig. 9).

The even distribution of flint material in both trenches at Wieliszew suggests there was no central place where cores were worked (Newcomer and de Sieveking 1980; Stevenson 1991: 274). Of course, at all of the analysed sites, besides the predominant raw material, others were also worked: their variety was

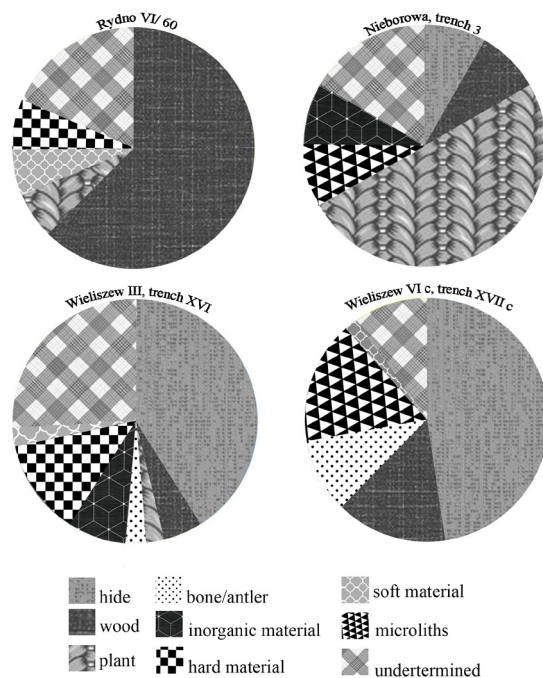


Fig. 10. Activities performed in respective assemblages. Prepared by M. Winiarska-Kabacińska.

much greater in Wieliszew and much more limited in Rydno and Nieborowa (Fig. 10).

Considerable disproportion between respective activities was also recorded at the site of Pod Křídlem in the northern Czech Republic, where material remains were interpreted as a result of short-term occupations by Mesolithic groups. The main wear traces on tools were those related to plant manipulation (Hardy and Svoboda 2009: 169). In contrast, at the Caochanan Rudha site in Scotland, where an oval-shaped habitation structure was discovered with a small number of flint remains, two clearly differentiated areas were recorded, one related to plant processing and the other to the transformation of animal raw materials (Warren *et al.* 2018: 941).

Clearly, the diversity of documented activities and raw materials seems to be related to the nature of the camp and the duration of its use. At those sites considered as strictly hunting camps, flint materials reveal micro-wear traces typically associated with hunting weapons and processing of animal carcasses (Lemorini 1992: 54; 1997: 50; Philibert 1995: 91, 2002: 43; Pignat and Plisson 2000: 77; Petru 2004: 202, fig. 4). At the more domestic or long-lasting sites, documented activities tend to be more diversified and balanced

(Lemorini 1992: 55; Crombé and Beugnier 2013: 180; Guéret 2017: 366; Conneller *et al.* 2018: 493-534).

How do our case studies fit into this general scheme? Rydno and Nieborowa were occupied for a short period, the main activity being the processing one kind of raw material, either wood or plants. It seems that these camps were occupied to achieve short-term goals connected with the production of specific objects made out of organic materials.

In Wieliszew the group remained for a longer period of time. The production of miniature end-scrapers and scrapers and the absence of refits among them remains unexplained. The small dimensions of scrapers suggest they were highly specialised objects, perhaps precision tools used to transform more fragile materials, such as delicate animal hides or furs. The location may be thus associated with the hunting of small fur animals, usually hunted in late autumn when their furs are of the best quality. The reason for settling in that specific location may have then been the favourable environmental conditions for organising such hunts.

To conclude, the interpretation of European late prehistoric hunter-gatherer settlement patterns should take into account the wide functionally variability of campsites. Thus, approaching small and short-term sites through spatial and functional analyses seems key to the understand of the logistical mobility and landscape use of these societies. Conclusions drawn from these smaller logistical sites will be equally useful when understanding more complex spatial arrangements in long-term residential areas with overlapping activities.

ANNEX: SUPPLEMENTARY FILE

A supplementary file is available in the online version of this paper with the following figures and tables:

- Annex Fig. 1. Rydno, Świętokrzyskie voivodeship. Location of trenches in the Pastwiska area near the village of Grzybowa Góra. After R. Schild *et al.* (2011: 62).
- Annex Fig. 2. Rydno VI/60: blades, scrapers, end-scrapers, becs, combined tool, burin, borer, re-touched blades and notched tool. Drawing by E. Gumińska.
- Annex Fig. 3. Rydno VI/60. Flint artefacts demonstrating use-wear evidence. Photo by M. Winiarska-Kabacińska.
- Annex Fig. 4. Rydno VI/60. Flint tools with specific use-wear traces. Microscope photography by M. Winiarska-Kabacińska.

- Annex Fig. 5. Location of Trench 3 at the site of Nieborowa I (Lubelskie voivodeship). Prepared by T. Boroń.
- Annex Fig. 6. Nieborowa I, Trench 3: refitting, re-touched blades, trapezes and notched tool. Drawing by E. Gumińska; photo by M. Osiadacz.
- Annex Fig. 7. Nieborowa I, Trench 3. Flint artefacts with use-wear evidence. Prepared by M. Winiarska-Kabacińska.
- Annex Fig. 8. Nieborowa I, Trench 3; Lubelskie voivodeship. Flint tools with specific use-wear traces. Microscope photography by M. Winiarska-Kabacińska.
- Annex Fig. 9. Wieliszew, Mazovian voivodeship.
- Annex Fig. 10. Wieliszew III, Trench XVI. Flint tools with traces of use.
- Annex Fig. 11. Wieliszew VI c, Trench XVII c. Flint tools with traces of use.
- Annex Fig. 12. Wieliszew, Trenches XVI and XVII c.
- Annex Tab. 1. Rydno VI/60: Flint artefacts demonstrating use-wear evidence.
- Annex Tab. 2. Nieborowa I, Trench 3: Flint artefacts demonstrating use-wear evidence.
- Annex Tab. 3. Wieliszew III, Trench XVI: Flint tools with traces of wear.
- Annex Tab. 4. Wieliszew VIc, Trench XVII c: Flint tools with traces of wear.
- Annex Tab. 5. Rydno VI/60, Nieborowa I, Trench 3 and Wieliszew III, Trench XVI and Wieliszew VI c, Trench XVII c. Total numbers of analysed, unused and used artefacts, showing the raw materials (r. m.) and work performed at the respective sites.
- Annex Tab. 6. Set of tools in particular focus Wieliszew III, Trench XVII c.

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