ANTHROPOLOGIE • LVIII/2–3 • pp. 321–337 • 2020

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NOT ONLY SIMPLE WORKSHOP: NEW RESEARCH OF MAGDALENIAN HORIZON AT SITE SOWIN 7, SW POLAND

ABSTRACT: It is commonly accepted that the life style of hunters and gatherers of the Late Palaeolithic was perfectly adapted to the environmental and climate conditions. One of the crucial aspects of the adaptation was an effective strategy of exploitation of the varied natural resources. It assumed different forms and intensity depending on inter-regional and local factors.

The aim of this study was to answer the question which type of activity can be associated with the materials from the site Sowin 7, SW Poland, representing the late phase of Magdalenian culture, and if the site is chronologically homogeneous. Earlier research suggested that it was a remnant of a short-lived workshop of blade blank production, while our studies make it possible to adopt a more precise view. The view is based on the results of integrated techno-typological studies, refitting study, as well as spatial and use-wear analysis.

At present it can be said that the Magdalenian finds from Sowin 7 form a more complex spatio-functional and chronological structure. Besides the zone of blade blank production, the site held a zone where tools were prepared and repaired using organic materials. It can be also said that the northern and southern parts of the site may have originated at different times. The isolated refits, which link the two parts, indicate recycling rather than coordinated activity of one group. Similar tasks were performed during the two episodes.

KEY WORDS: Magdalenian – Activity – Tool function – Space – Time – Embedded procurement

1. INTRODUCTION

The spatial aspect of the behaviour of hunters and gatherers is among the least studied problems in the studies on the occupation of open-air Magdalenian sites north of the Sudetes and Carpathians. This mainly results from the lack of properly preserved sites. After the warming GI-1e (interstadial GI-1e), most sites

Received 4 August 2020; accepted 7 August 2020.

DOI: https://doi.org.10.26720/anthro.20.08.07.1

were subject to complicated processes, such as solifluction, deflation or frost contraction, and somewhat later their remains were disturbed by settling or agricultural exploitation of the area (Przeździecki *et al*. 2012, Schild 2014, Wiśniewski 2015). Till now, the discussion on the activity and space was limited to sites which, except Dzierżysław 35 (Ginter *et al*. 2005), yielded modest assemblages which formed small structures (Bobak *et al*. 2017, Przeździecki *et al*. 2011).

Here we attempt to present preliminary results of analyses of Magdalenian materials from the open-air site Sowin 7, SW Poland. We address the question of the function of the inventory in space, and consider its chronological homogeneity and possible connections of the Sowin remains with a definite mobility strategy.

In the first stage of excavations at the site the inventory was identified as a blade blank production workshop (Furmanek *et al*. 2001). Further field work as well as completion of the basic examination of the inventory, refit study and spatial studies convinced us that the first interpretation of the occupancy dynamics of the site was only partly correct.

Due to the new data we found that the site's formation may have had a more complex character and actually the site was composed of different zones corresponding to different activities, rather than a small production structure of workshop type. Preliminary assessment of the range of activities in individual clusters and outside them indicates on the one hand repairing or/and manufacturing of hunting weapons, on the other routine production of blade blanks and cores for export. The study of refits of lithic finds indicates an absence of strong associations between the clusters. All this suggests that we are dealing with traces of a few overlapping visits rather than a single episode.

Our present results are based on spatial and technological studies, supported by refitting analyses and microscope examination of the material obtained in 2001, 2003, 2012–2013, 2015–2017.

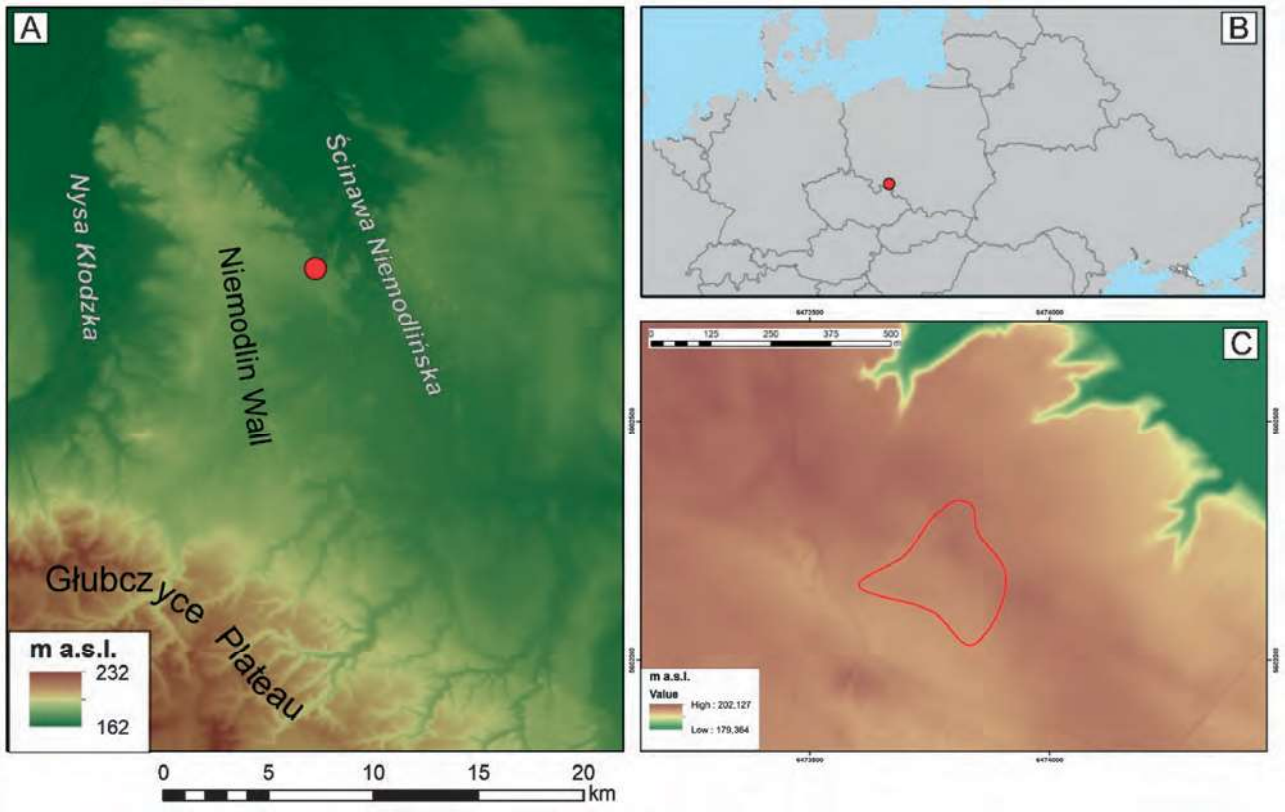

FIGURE 1. Location of site 7 in Sowin, SW Poland: A. Digital model of terrain of the neighbourhood of the site Sowin 7; B. General map of central Europe; C. Range of distribution of lithic artefacts on the surface of site Sowin 7. Prepared by A. Wiśniewski.

2. MATERIAL AND METHODS

2.1.1. Location of the site

The site from which the data originate is located north of the village Sowin. It is situated on the Niemodlin Plain, in its specific part called Niemodlin Wall which in the east and west is delimited by the valleys of rivers Ścinawa Niemodlińska and Nysa Kłodzka (*Figure 1*). The Niemodlin Wall is a kind of bridge connecting the Głubczyce Plateau in the south with the Odra Valley in the north. Site 7 is located at the south-eastern edge of the valley of Ścinawa Niemodlińska. The site is situated within an elevation which extends along the valley's edge. The elevation is built of aeolian sands, with thin loess deposits in places. Below, there are glacial sediments, associated with glacial activity in MIS 6 (P. Moska, pers. com. 2017).

2.1.2. History of research of the site

The area where site 7 is located has been subject to amateur exploration since the 1920s. H. Kurtz found artefacts near sites 7 and 9, and classified them as Late Palaeolithic (Ginter 1974, Kozłowski 1964, Kurtz 1930, von Richthofen 1930).

Verification of this interpretation started 70 years after the discovery. Four sites were selected. New collections from sites 7 and 10–11 were classified as late Palaeolithic (?), while 8 and 9 were generally assigned to stone age. The richest site no. 7 was selected for excavations, preceded by field prospection during which we distinguished three clusters of artefacts (Furmanek 2001 *et al.*, see *Figure 2*). In 2000, a probing trench was made of 4 m^2 (Furmanek *et al.* 2001), which yielded a relatively rich material (1,068 lithic finds). In the first seasons 2001–2002, a trench was made in the southern part of site 7, with the total area of 40 m^2, and the artefacts were located at mechanical layers 5–10 cm thick (Furmanek, *pers. com.*). It turned out that the site was multicultural: the top (soil and aeolian sands) held Magdalenian artefacts, while Epigravettian artefacts were found ca. 70 cm below the top of recent soil. Remains of clusters were found in the Magdalenian level. Regretfully in that period the material was not sieved. In 2003 another trench, of 24 m^2, was made about a dozen metres north of trench 1/2001, in the place of occurrence of another cluster of artefacts, which yielded a rich inventory, also assigned to the Magdalenian.

In 2009 site 7 was re-examined, with a series of probing trenches, and in 2012 exploration was continued between the trenches of 2003 and 2001; a trench of 20 m^2 was made, of which 16 m^2 were explored. Remains of yet another cluster were uncovered. More trenches were made in the seasons of 2013, 2015–2017 within site 7; in the north and south it bordered on the 2001 trench. The material was much scattered, but the 2015 trench held fragments of a cluster.

It is noteworthy that a surface prospection was done in 2015–2016 north of Sowin. The position of each find exceeding 2 cm was GPS-recorded which made it possible to specify the precise range of distribution of the material on the surface of site 7.

2.1.3. Spatial distribution of Magdalenian finds in site 7 and dating

Site 7 encloses ca. 4.6 ha in area (*Figure 1*). The surface distribution is thus much wider than the area delimited by the trenches of 2000–2003 (ca. 0.03 ha). The 2009 prospecting revealed no clusters of artefacts outside the neighbourhood of the trenches of 2001–2002 and 2003. This may mean that this extensive area is an effect of specific activity which did not result in formation of clusters of material which would be now visible on the surface. A possible effect of agricultural machinery on the scattering of single artefacts should also be considered (Navazo, Diez 2008). It can not be excluded that the large extent of the site is an effect of an admixture of artefacts which represent other cultural units. It should be remembered that Epigravettian artefacts were found below the Magdalenian horizon in site 7, and site 9 yielded artefacts associated with backed piece cultures of the Allerød (Wiśniewski *et al. in press*).

The stratigraphy of Magdalenian artefacts is similar to that of most open-air Magdalenian sites in Poland (Połtowicz-Bobak 2012, T. Wiśniewski *et al.* 2012). The finds from Sowin come from two horizons: 1. arable soil; 2. aeolian sands. Surprisingly, the finds from the arable horizon also formed diverse patterns. In both the 2003 trench and in the later explored trenches (2012–2015) the distribution range of clusters of artefacts matched that of the finds in the underlying sands. In the aeolian sands clusters of artefacts were interspersed with zones of scattered occurrence of artefacts.

The aeolian sands were OSL-dated for a period probably not earlier than Gl-1e, but considering the deviation of the second sample, the end of GS-2.1: 13830 ± 860 and 14710 ± 900 years can not be excluded (Wiśniewski *et al.* 2017). Thus the inventory represents

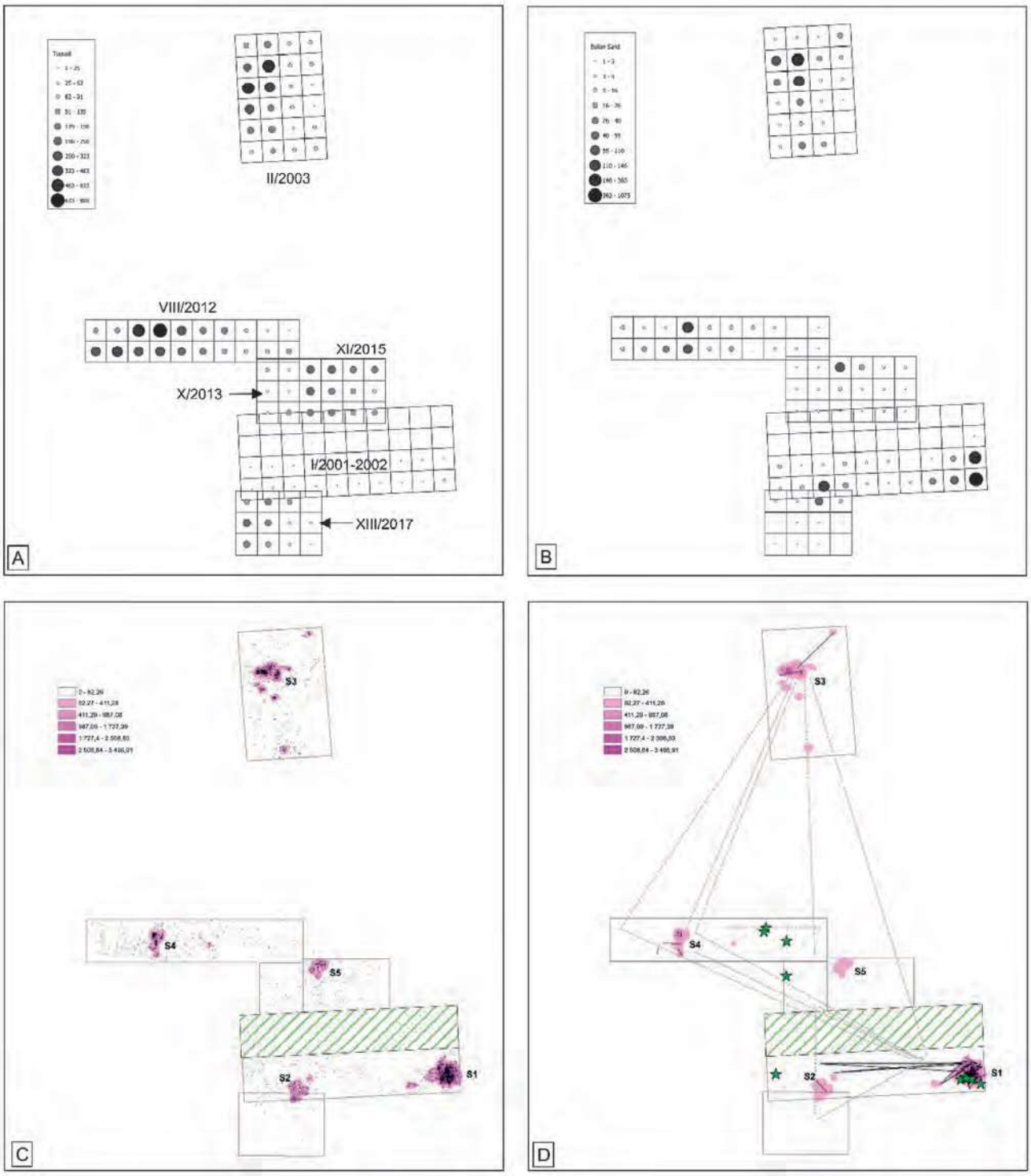

FIGURE 2. Distribution of Magdalenian lithic artefacts at site Sowin 7. A, Frequency of artefacts in the arable layer (1) in trenches I/2001-XIII/2017; B, Frequency of artefacts in the layer of aeolian sands (2); C, Artefact Kernel density in layer 2; D, Density of artefacts and refits (continuous black lines – refits of artefacts from layer 2, dotted grey lines – schematic directions of refits between artefacts without precise location from layer 1 and 2, green stars – location of tools with use-wear traces. Drawing by M.Chłoń and A. Wiśniewski.

the later phase of the Magdalenian complex. The set of artefacts from the TL-dated site Hłomcza is similarly dated (Łanczont *et al.* 2002).

2.2. Methods

The data from the excavations were analysed in terms of techno-typological diversity of the inventory, spatial distribution of the artefacts and the presence of traces of use. We followed the analysis of Late Palaeolithic or Mesolithic sites which yielded a large number of inter-locus refits, thus making it possible to trace the dynamics of the camp's occupancy (De Bie 2007, Fiedorczuk 2006, Skar, Coulson 1986, Takakura 2018). During typological analysis of the inventory we applied traditional classification of both products and core waste, as well as categories of retouched tools (see *Table 1*).

The spatial analysis included attempts at identification of clusters using Kernel Density Estimates with ArcMap (v. 10) software, and considering precisely located artefacts (*Figure 2C-2D*). Scale of colours was applied to visualise the differences in the number of finds; bandwidth of 0.26 m was used (Average Nearest Neighbor Ratio = 0.259 m; see also *Table 2*). To compare the distribution of finds from the aeolian sands with the distribution of Magdalenian artefacts in the arable soil we applied the model of frequency of finds per square metre (*Figure 2A-2B*). The frequency analysis included area which was explored in the same way. We had to exclude the trench of 2001–2002, where the deposits were not sieved.

In the technological and spatial analyses we included also the data from refitting studies (*Figures 3-6*). The refitting was done in two stages. The first was done in 2008 and included finds of 2000–2001 (A. Wiśniewski *et al.* 2012). The second stage, in 2017–2019, included additionally materials of 2003 and 2012–2017. The refitting followed the traditional protocol of refitting of production sequence and breaks, as well as single refits of modification type (Cziesla 1990, Schurmans 2007). The state of preservation of the finds presented no problem due to the absence of intensive patina on the flint surface. Overall, we obtained 599 pieces from the Magdalenian level; they formed 226 refit groups. The largest blocks included up to 10 pieces. Production sequences (ca. 65% – 241) were the most numerous and followed by broken artefacts (32.7% – 122). Only 4 pieces represented tool modifications. The remaining group included refits of natural fragmentation (6).

Microscopic analyses were aimed at recognition of use-wear traces (*Figure 7*). Use-wear analysis was carried out with the brightfield reflected light technique using the Nikon ECLIPSE LV100 metallographic microscope (×50–500). The Olympus SZX9 stereomicroscope (up to ×114) was used to analyse a general preservation state of the flint tools. Photomicrographs were taken with magnification ×100 and ×200. Prior to the microscopic observations, the artefacts were cleaned in the Polsonic 0.5 ultrasonic tank.

We analysed 117 retouched tools grouped into eleven types (*Table 3*). About a dozen tools of 2003 were excluded from the analysis. Retouched flakes (30) and blades (17), as well as fragments of undetermined tools (20) were the most numerous in the assemblage, followed by backed pieces (19), drilling tools (9 perforators, 1 bec, 1 borer), truncations (8), burins (6), endscrapers (5) and sidescrapers (1). Traces of use were identified on 17.1% of the group of tools, which forms a large proportion, considering further 15.4% with possible traces of use. No traces were recorded on 67.5% of the tools, mainly retouched flakes, blades and tools of undetermined type.

Two aims of the microscopic study were to evaluate the limitation of the use-wear analysis caused by bad preservation condition and to identify the activities performed by hunters and gatherers at or near the site and reflected by the traces of use.

The whole technological, functional and spatial information made it possible to present a preliminary general model of the range of activity (for whole inventory) and a detailed model (for clusters and relations between them).

3.1. Raw material and techno-typological structure

The assemblage of Magdalenian artefacts is mainly based on flint material from the local deposits of glacial origin which are situated near the site (A. Wiśniewski *et al.* 2012). Matt, transparent and Bryozoa-containing flint can be distinguished (Dmochowski 2006). Based on the refits it was ascertained that the size of lumps exceeded 20 cm. The inventory includes hammers, anvils and functionally undetermined tools made of other rocks obtained from glacial deposits. The presence of pieces of fossil wood, much fragmented, is noteworthy. Such pieces can be found in the glacial deposits in the vicinity of the site.

The assemblage includes also non-local components: lumps of hematite. Based on XRD examination some of them were classified as raw materials (Přichystal *pers. com.*, 2018) which may originate from northern Moravia: the region of Šternberk-Horní Benešov Belt and Vrbno Group (Přichystal 2013). The distance of

TABLE 1. A general structure of the assemblage.

Category	Arable soil (1)		Aeolian sands (2)		Non-localized		Total	
	n	%	n	%	n	%	n	%
Raw materials	16	0.13	6	0.08	-	-	22	0.1
Debris	139	1.09	44	0.62	11	0.73	194	0.91
Pre cores	8	0.06	9	0.13	3	0.2	20	0.09
Cores	31	0.24	28	0.39	22	1.47	81	0.38
Core rejuvenation	273	2.15	215	3.02	70	4.67	558	2.61
Blades	1,127	8.87	679	9.52	215	14.34	2,021	9.47
Flakes	2,939	23.12	1,911	26.8	661	44.1	5511	25.82
Chips	8,067	63.46	4,162	58.37	491	32.76	12,720	59.61
Retouched tools	88	0.69	46	0.65	18	1.2	152	0.71
Tool wastes	22	0.17	29	0.45	6	0.4	57	0.27
Anvil	-	-	-	-	1	0.07	1	0.005
Hammerstones	1	0.01	1	0.01	1	0.07	3	0.01
Total	12,711	100	7,130	100	1,499	100	21,340	100

TABLE 2. Structure of clusters (S1–S5).

Features	S1		S2		S3		S4		S5	
	n	%	n	%	n	%	n	%	n	%
Area - KDE-0,26 (sqm)	1.72		0.76		1.13		0.75		0.57	
Number of artefacts	1,464	100	111	100	468	100	190	100	95	100
Raw material	-	-	-	-	2	0,43	-	-	1	1.05
Flakes	659	45.01	18	16.22	219	46.79	99	52.11	36	37.89
Blades	217	14.82	3	2.7	55	29.47	56	29.47	25	26.32
Cores	5	0.34	-	-	1	0.21	2	1.05	-	-
Pre-cores	1	0.07	-	-	-	-	-	-	-	-

transport would then be more than 90 km. Besides, two flakes of radiolarite may originate from the Biele Karpaty (ca. 170 km). Some lumps were used on site, as indicated by a refit of ochre fragments and remains of pigment in flint artefacts. Traces of pigment and its use come from the southern part of the site, only traces of its use are known from the northern part.

The set of lithic artefacts associated with the Magdalenian includes more than 21 thousand units (*Table 1*). As in many open-air sites of late Magdalenian

in Central Europe, wastes associated with manufacture of blade blanks prevail (89.6%) in the set (Pasda 2016, Schild 2014, Wiśniewski 2015). Cores and refit groups indicate that the raw material was imported in the form of nodules or larger chunks. It is not excluded that the chunks were preliminarily tested outside the camp. Manufacture of blade blanks was based on reduction of one-platform cores, less often double-platform cores. The cores were subject to a very precise stage of preparing and were often repaired during reduction. There is also a proportion of flake cores which could be the product of activity of individuals with less technical experience. Both blades and blade cores were in demand, many of which in all probability left the camp.

Tools form a small proportion (0.71%). Most of them are made of blades (ca. 57%). Apart from marginal retouched flakes or blades, none of the groups seems to predominate. Only backed tools form a slight majority (ca. 23%) suggesting activity associated with production or repair of hunting weapons. In the studied zone of the site burins and scrapers are poorly represented. Considering the division into formal and expedient tools, the latter predominate. Only single refits with tools were found, suggesting that the set of tools may have been mostly imported.

3.2. Spatial distribution

3.2.1. Vertical distribution

Besides the arable horizon, the finds were buried in the top of the aeolian sands, sometimes secondarily displaced to their lower parts due to cryoturbation and bioturbation. Such a situation was observed in trenches

FIGURE 3. Group of refits Sow7-u1 from cluster S1 illustrating the preparing and blade core reduction. Photo by G. Michalec.

VIII/12 and XI/15. The vertical dispersion is best illustrated by the material from the largest trench VIII/12. The vertical range of most finds was ca. 28 cm, with the maximum depth of 0.9 m. The maximum distance between refit pieces in the trench was ca. 20 cm. The scale of vertical displacement was thus rather small. Obviously, the top of the sands should not be regarded as living floor.

3.2.2. Horizontal distribution: frequency of finds and density estimate

The uneven distribution of material in site 7 was recorded already during the first field survey of the surface. During the excavations, except 2000–2002, the frequency of finds in the arable horizon was recorded (layer 1; *Figure 2A*). The relatively small damage to the site may be due to the fact that only light cultivation equipment was used.

The horizontal distribution in the top layer of the sands (layer 2) is based on estimates of Kernel density, which made it possible to identify clusters and zones of scattered occurrence of lithic artefacts. The clusters were from 3–4 m to 7–8 m apart. We distinguished 5 clusters (S1–S5; *Figures 2C–2D*). Based on materials located in the horizon of aeolian sands (layer 2), it can be said that they were of diverse shape, surface area and numbers of finds (see *Table 2*). Clusters 2 and 3 had a regularly oval shape, the remaining ones were less regular. The surface area of the clusters and the number of finds were positively correlated. The largest were clusters S1 (1,464 specimens) and S3 (468 specimens) of 1.72 and 1.13 m^2, respectively. The smallest, S5, contained 123 finds within an area of 0.57 m^2. Clusters 4 and 5 were remains of structures which were distorted by cryogenic processes and bioturbation. The remaining parts were also disturbed by modern cultivation procedures, as shown by the example of refit of artefacts obtained from the aeolian sands (layer 2) and arable soil (layer 1). Besides, it was possible to distinguish seven other concentrations. The clusters do not exceed 0.6 m in diameter and contain a small number of artefacts (see *Figure 2C*). Their origin is so far difficult to explain.

3.2.3. Typological and technological composition of clusters

Analysis of techno-typological composition of the clusters shows that all of them, except S2, are associated with deposition of waste materials concerning blade core reduction (*Table 2*). The proportion of blades is close to 14.8% or much larger and single cores were also recorded. However the larger group of wastes is formed by flakes from preparation and repair stages; their proportion is at least 39.84% (S5). The composition of S2 and S5 is different, with predominance of proper flakes, including small forms, while no cores were recorded. It is likely that these clusters reflect only some of the procedures. The proportion of retouched tools in only two clusters (S1 and S4) is somewhat larger. It appears however that the tools were discarded with the waste rather than in the place where they were used. Overall, it can be said that all the clusters are remains of dumps which were formed during production of varied dynamics: clusters 1, 3 and 4 contain a full range of wastes, while clusters 2 and 5 hold only fragments of production chains. In

TABLE 3. Sowin, SW Poland. Results of the use-wear analyses.

Tool type	Traces of use	Possible traces of use	No traces	Total
Endscrapers	1	-	4	5
Truncated pieces	1	3	4	8
Backed pieces	1	3	14	18
Perforators	5	3	1	9
Becs	-	-	1	1
Borers	1	-	-	1
Burins	4	1	1	6
Retouched blades	4	1	12	17
Retouched flakes	-	3	27	30
Sidescrapers	-	-	1	1
Undetermined tools	2	3	14	19
Total	19 (16.5%)	17 (14.8%)	79 (68.7%)	115 (100%)

spite of this they show a great functional consistency in performing the tasks which were associated with byproduct for the tools to be exported and those to be used on site. It can not be excluded that also cores for export were made.

3.2.4. Refits and space

Based on dorsal-ventral refitting results, as well as breaks and modifications, we attempted to trace intra- and inter-locus relations. In this last case we wanted to answer the question of chronological homogeneity of the clusters. We assumed that when there are no or only single refits, the clusters may result from non-simultaneous activity. Single links can be treated as a result of recycling (Beyries, Cattin 2015, Brenet *et al.* 2018, Takakura 2018).

The analysis of refits in terms of their distribution indicates that precisely located artefacts from the aeolian sands formed 113 links of short distance (mean 0.53 m), with the maximum distance of 6.54 m. The distribution of refits to a large extent matches that of the clusters (*Figure 2D*). Characteristically, among the precisely located refits only single refits were found between the clusters from the southern part of the study plot.

Links between the clusters occurred only in the context of blocks which were partly or wholly formed of artefacts of the arable horizon and had no precise location. Till now 14 such groups were found. The longest distances were up to about a dozen metres (distance between the 2000 trench (imprecisely located probing trench) and II/2003). Some refit pieces represent breaks (18 pieces), some are parts of production sequences (25 pieces; *Figures 5-6*). The latter category represents small sequences, and when they are more numerous, the pieces displaced for a long distance reflect mid parts of production sequences (Sow7-u59, Sow7-u148, Sow7-u165), suggesting that they may have been naturally shifted or were picked up within recycling.

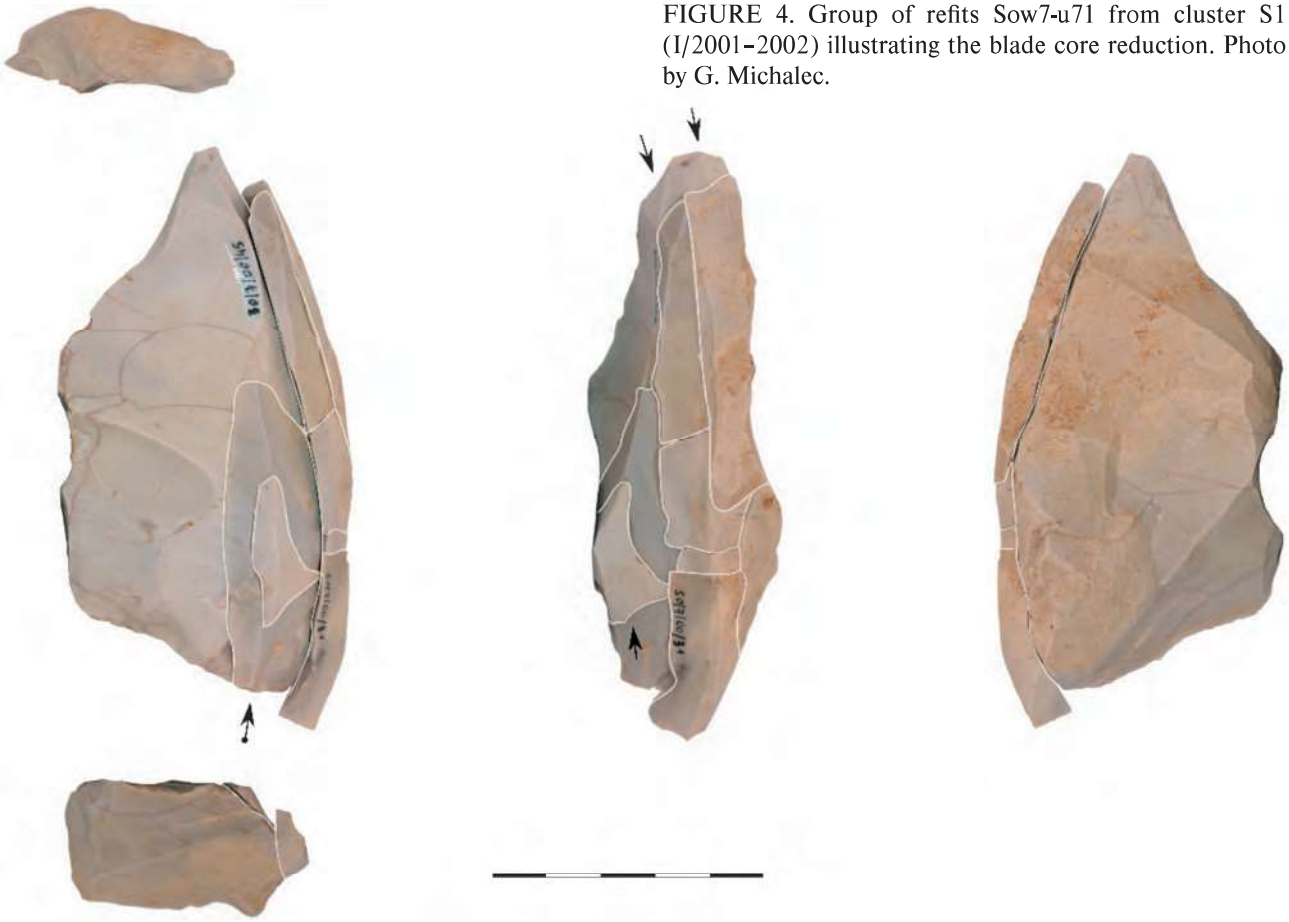

FIGURE 4. Group of refits Sow7-u71 from cluster S1 (I/2001–2002) illustrating the blade core reduction. Photo by G. Michalec.

3.2.5. Traces of use and spatial distribution

All the lithic inventory included in the Magdalenian taxonomic group have been deposited in the surface organic layer and aeolian sands. The processes arisen from shallow deposition depth caused considerable alteration of lithic artefacts, common in case of Magdalenian assemblages (Pyżewicz 2015a, 2015b). Microscopic observation was limited to some portions of the edges. The changes refer mainly to the bright spots densely distributed on one or both faces of tools from all the excavation seasons (*Figure 7: 1*). Numerous pieces are covered by randomly distributes flat or concave patches or lines of bright friction polish (*Figure 7: 2*) that mimicked hafting polish (Levi-Sala 1996, Rots 2002). Soil sheen that could be a result of frost contraction is also common (Michel *et al.* 2019). Some of the tools exhibit abraded or ground edges, a few are slightly patinated. Accidental scars that form pseudoretouch along the edges also occur.

Nineteen lithic artefacts exhibited traces of use such as edge scarring, edge rounding, polish and abrasive linear traces. Traces of with mineral retouch were also documented on several pieces (*Figure 7: 3*). Despite the considerable number of backed pieces, no clear impact traces related to hunting activity were recorded on any of the retouched tools, what would make a difference to the short-term occupation in Wierzawice (Bobak *et al.* 2017). The lithic artefacts were used mainly for crafting, since most of them (17) bear traces of working hard or semi-hard materials, including bones, teeth and stone, as well as other abrasive materials (*Table 4*). The tools were used for boring, sawing and scraping (*Figure 7: 4–7*). Similarly, predominance of working organic hard material, particularly with perforators, is reported by K. Pyżewicz in Podgrodzie 16 and Ćmielów 95 (Pyżewicz 2015a) and Klementowice (Pyżewicz 2015b). Three other tools exhibit traces of piercing or cutting soft materials, such as hide (*Figure 7: 8*). The traces are not very pronounced in most of the cases, indicating a rather short use of tools.

Artefacts with traces of use-wear occurred both within the clusters and outside them (*Figure 2D*). In terms of clusters they were found in cluster S1, which yielded 4 probably used artefacts. At the boundary of this cluster one tool was found bearing traces of scraping of a hard material. We think that the artefacts found here got there as waste and their position has little to do with the place of performing the task.

Further artefacts were found outside the clusters. An artefact which can be interpreted as a used as projectile insert was found west of cluster S2; it may indicate a place of exchange of parts of weapons. It should be noted that many other tools were found within the area of cluster S2 and outside it, to the west and east. They included household implements which may suggest that the region of cluster S2 attracted diverse activities, as opposed to S1.

More artefacts with preserved traces were found between clusters S4 and S5. It is noteworthy that they include forms which suggest scraping, boring and sawing of hard material. One of the finds is not certain in terms of preserved traces. We are probably dealing with a place of weapon preparation/repair. In the discussed area tools with no traces of use occurred mainly in cluster S5. It should be regarded as a remnant of a dump.

TABLE 4. Sowin, SW Poland. Tools with traces of use.

Tool type	Soft material		Hard, semi-hard, abrasive materials				Total
	cutting	perforating	sawing	boring	incising	scraping	
Endscrapers	-	-	-	-	-	1	1
Truncated pieces	-	-	-	1	-	-	1
Backed pieces	-	-	-	-	-	1	1
Perforators	-	1	-	4	-	-	5
Becs	-	-	-	-	-	-	-
Borers	-	-	-	1	-	-	1
Burins	-	-	-	2	1	1	4
Retouched blades	-	1	1	-	-	2	4
Retouched flakes	-	-	-	-	-	-	-
Sidescrapers	-	-	-	-	-	-	-
Undetermined tools	1	-	-	1	-	-	2
Total	1	2	1	9	1	5	19

The above observations make it possible to distinguish a zone of localisation of remains of typical blade workshops which became places of deposition of used/discarded tools. This role can be assigned to clusters S1, S3 and S4. Another zone is represented by scattered finds or clusters of very varied material where, besides single core reduction procedures, there occurred traces of tool preparation and repair. The zone is represented by the area between clusters 4 and 5 and by cluster 2 with its neighbourhood.

4. DISCUSSION

4.1. Zones and spatio-functional pattern

Tree questions should be addressed here. The first is the assessment of activity in Sowin 7 in relation to other open-air Magdalenian sites in Central Europe. Our studies, which included preliminary techno-typological and spatial analyses integrated with other spatial data, show that the studied part of the site includes two zones. One holds remains of manufacturing of blanks. These places became de facto dumps. The second zone, which did not require such a great number of flint tools during work, mainly attracted attention of individuals which dealt with manufacturing or repair of objects (*Figure 8*). Microwear analyses indicate work with hard material, perhaps also organic, such as bone or antlers. In terms of surface area the zone was obviously much more extensive than the zone of post-production dumps. No traces of fire, in the form of charcoal, or burnt artefacts were found in this zone to date. One of the artefacts found near cluster S2 bears traces which suggest the function of strike-a-light.

Such a pattern of remains is known from numerous open-air sites of the discussed chronological-cultural horizon. Workshops associated with blank manufacturing and use of relatively small sets of tools are known first of all from the site Podgrodzie 16 and a late

FIGURE 5. Group of refits Sow7-u148 comprised of specimens from cluster S3 (II/2003) and trench 2000 (red arrow) located in the area of trench I/2001–2002. Photo by G. Michalec.

FIGURE 6: Group of refits Sow7-u165.comprised of specimens from three trenches: 2000, 2003 and 2012. Photo by G. Michalec.

Magdalenian site Wierzawice (Przeździecki *et al.* 2011, Bobak *et al.* 2017), which additionally contained a hearth. Like Sowin, it yielded traces of the use of ochre. The structure of activities in Ćmielów, Klementowice and Wilczyce was probably much more complex (Przeździecki *et al.* 2011, 2012, Schild 2014, Wiśniewski 2015). Especially the last two sites provided many features of a residential camp. However, it is difficult to discuss them since the arrangement of remains was distorted by slope processes and frost contraction. Many other sites could be cited here, which contained if not identical, then at least similar structural elements. All of them point to the existence of spatio-functional pattern used by hunters during expeditions (Audouze 2010). The existing differences in the structure of remains are dictated by access to lithic material resources, material quality, as well as range and period of the tasks performed.

4.2. Problem of chronological homogeneity

The second question pertains to the time of origin of the finds. Do they come from one or a few visits? The question is justified by the large number of finds from Sowin 7 (more than 21 thousand). Large inventories are most often interpreted as the effect of a longer stay or of overlap of traces of many episodes. In the case of a longer seasonal stay associated with the existence of a camp, we could expect a greater formal diversity of tools and reduction wastes, and the presence of structures of fixed or semi-fixed type (Zubrow *et al.* 2010), e.g. remains of hearths, wind screens, artefacts of non-utilitarian activity etc. Though the site yielded traces of use of e.g. red pigment, it can be always regarded as an indicator of a stable territorial unit (Vencl *et al.* 1995). It should be mentioned that in Wierzawice, a short-term site, ochre is also well represented (Bobak *et al.* 2017; see also remarks T. Wiśniewski 2015).

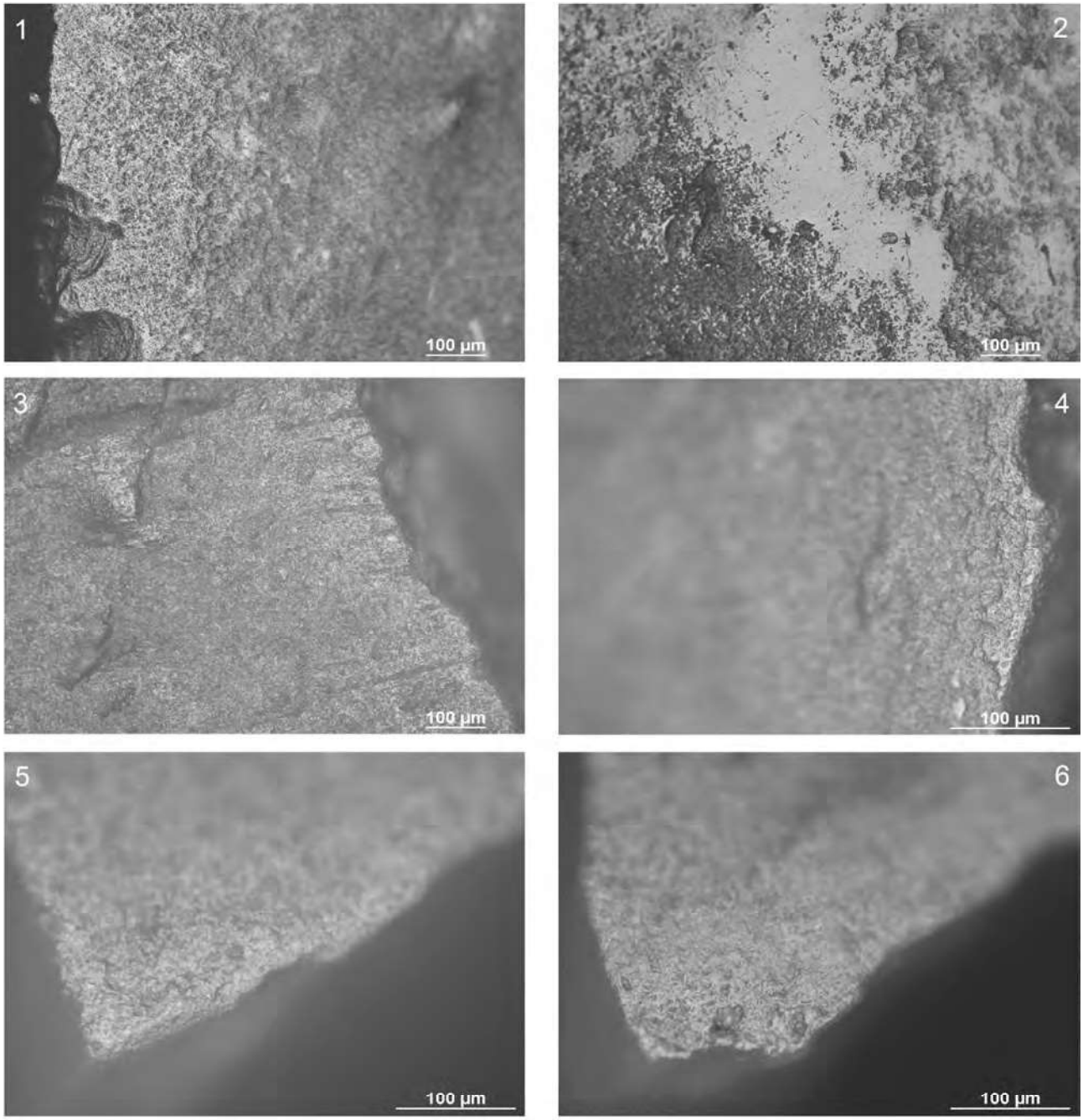

FIGURE 7: 1, Bright spots on the edge of endscraper used for scraping abrasive material; 2, Friction gloss on backed piece; 3, Traces of retouching on truncated piece; 4, Traces of sawing hard organic material on retouched blade; 5, Traces of drilling hard material on borer; 6, Traces of piercing soft material on retouched blade. Photo by B. Kufel-Diakowska.

The other situation, namely overlap of remains of many visits, can vary in magnitude. It can be a mixture of remains of different activities, related to different times of stay, or a mixture of remains of a narrow range of tasks of one or many culturally unrelated groups (Sano 2012, Takakura 2018). In our opinion in Sowin we should consider accumulation of traces of several visits to the same place. In the analysed case we are

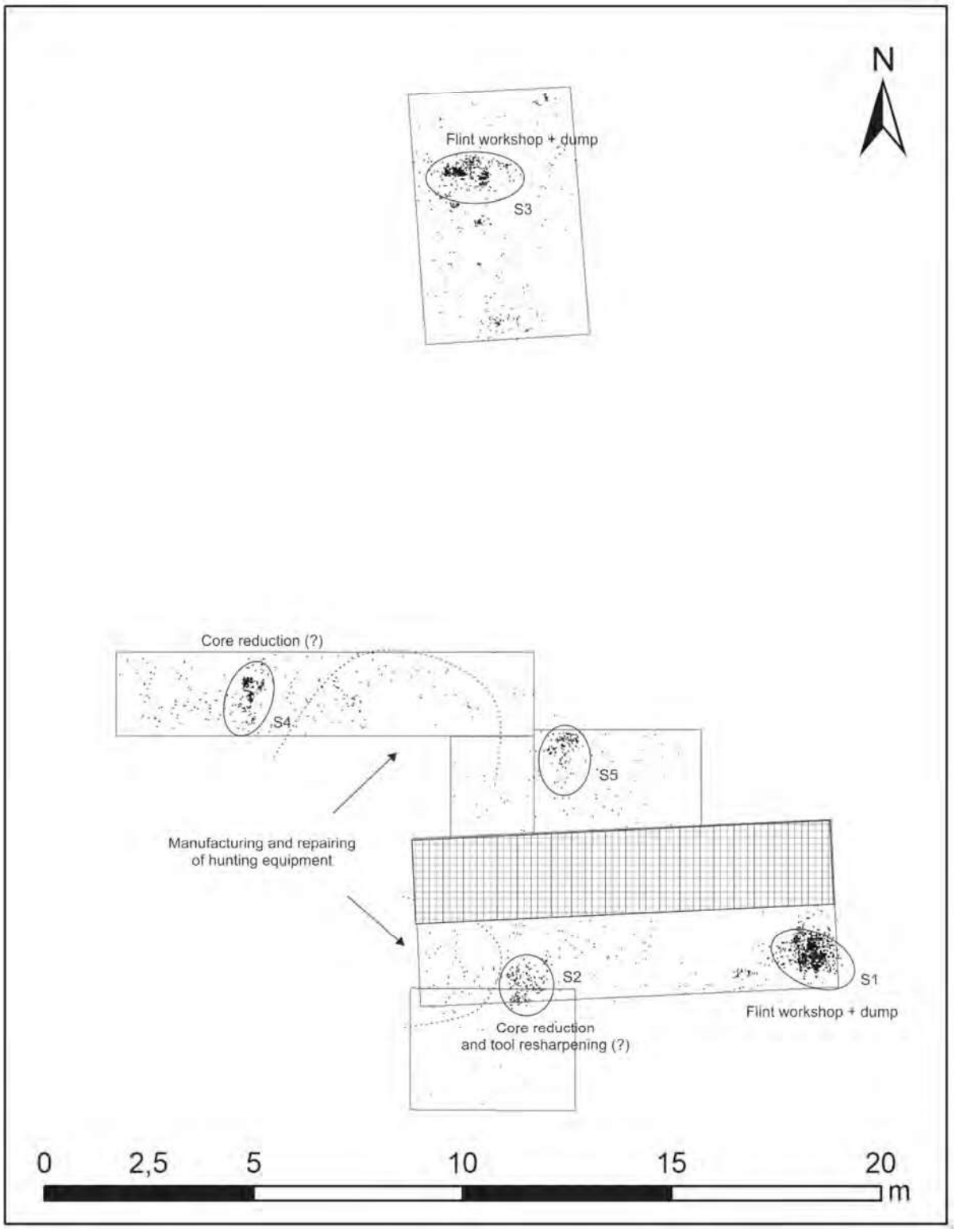

FIGURE 8: Hypothetical zones of human activity at site Sowin 7. The non-studied part of the trench is marked with crosshatched area.

dealing with repeated, similar activities within a short period of time. We assume that in Sowin the northern cluster and the southern part with its two zones may have originated independently. Single groups of refit pieces which link the two fragments of the site indicate recycling rather than co-ordinated activities associated with transfer/transport of a set of objects (Audouze 2010, Debout *et al.* 2012, Leesch *et al.* 2012, Street *et al.* 2012, Terberger 1997). In the case of some finds from the arable horizon we can not exclude involvement of agricultural processes in short-distance transport of single artefacts.

4.3. Technology and mobility

The third question pertains to the reasons for performing a narrow range of fairly repeatable tasks. It appears that the monospecific range of activities represented in Sowin 7 reflects the specificity of resources and the specific economic attitude of the hunters. The environs of Sowin 7 hold extensive depressions, watercourses, and closed basins which in the Bølling certainly provided a good gathering point for game animals such as horses or reindeer (see e.g. lists of Pasda and Pfeifer 2019). In this respect Sowin 7 corresponds to the location of numerous other Magdalenian sites near medium and large river valleys in Central Europe (Maier 2015). The area where the site is situated is a kind of deflation surface which uncovers erratic flint of very good quality (A. Wiśniewski *et al.* 2012). Its quality and availability provided unlimited possibility of manufacturing of both expedient and formal tools. In such circumstances, it is difficult to suspect that the hunters used a strategy different from the embedded type (Binford 1979), which minimizes the cost of repair or production of hunting equipment, and improves the chances of faster supply of e.g. adequate food (Thacker 2006). It seems less likely at present that the remains are an effect of special-purpose procurement (Duke, Steele 2010, Gould, Saggers 1985). Considering the fact that in Sowin 7 we are dealing with not one, but at least two visits, and the information on the discovery of more traces of the Magdalenian complex (surface prospecting of 2016) near site 7, it can be conjectured that the selection of the site as the place of performing the tasks was routine, i.e. may have been based on earlier obtained information on the environment, landscape, and resources of the Niemodlin Wall.

It is commonly accepted that such kind of assemblage as the Magdalenian from Sowin 7, with no signs of "stabilisation", may indicate the existence of a camp with a logistic system. In contrast, diverse inventories may suggest the development of refugial mobility (Binford 1983). The former situation is probably associated with more frequent migrations. In the past, using various approaches, the model was applied to the Central European Magdalenian and Epigravettian (Kretschmer 2015, Maier 2015, Weniger 1989 and others). It is noteworthy that with access to optimum resources which minimize the cost of obtaining mineral material and e.g., food supply, the technological organisation can remain unchanged. The phenomenon was pointed out on several occasions in the past, emphasising a greater value of local reconstructions compared to global models (Thacker 2006). We think that a similar situation may have occurred in the environs of Sowin, which presents great problems with applying the known model.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the organizers of the conference Magdalenian: chronology – territory – settlement – structures. The work has been financially supported by the National Science Centre (no project UMO-2014/13/B/HS3/04906). The studies would have been impossible without the friendly attitude of the Sobek family from Sowin – the owners of the land on which site 7 is situated. We thank Dr. Mirosław Furmanek for making available the 2001-2003 material and documentation.

REFERENCES

AUDOUZE F., 2010: *Domesticity and spatial organization at Verberie*. In: E. B. W. ZUBROW, F. AUDOUZE, J. G. ENLOE (Eds.): *The Magdalenian Household: Unraveling Domesticity*. Pp. 145–175. Institute for European and Mediterranean Archaeology Distinguished Monograph Series. State University of New York Press, Albany New York.

BEYRIES S., CATTIN M. I., 2015: Resharpening and recycling: Different conceptions of the Magdalenian tools. *Quaternary International* 361: 260–268. https://doi.org/10.1016/j.quaint.2014.07.042

BINFORD L. R., 1983: *In pursuit of the past*. Thames and Hudson, Decoding the archaeological record. London.

BINFORD L. R., 1979: Organization and formation processes: looking at curated technologies. *Journal of Anthropological Research* 35: 255–273.

BOBAK D., ŁANCZOT M., MROCZEK P., POŁTOWICZ-BOBAK M., NOWAK A., KUFEL-DIAKOWSKA B., KUSIAK J., STANDZIKOWSKI K., 2017: Magdalenian

settlement on the edge of the loess island: A case study from the northern foreland of the Carpathians (SE Poland). *Quaternary International* 438: 158–173. https://doi.org/https://doi.org/10.1016/j.quaint.2017.04.034

BRENET M., GUÉGAN S., CLAUD É., MESA M., PASQUET V., 2018: The Late Solutrean open-air site of Landry (Aquitaine, France). A preliminary spatio-temporal analysis. *Quaternary International* 498: 30–50. https://doi.org/10.1016/j.quaint.2017.06.038

CZIESLA E., 1990: On refitting of stone artefacts. In: E. Cziesla (Ed.): *The Big Puzzle: International Symposium on Refitting Stone Artefacts*. Pp. 9–44. Holos, Bonn.

DE BIE M., 2007: Benefiting from refitting in intra-site analyses: lessons from Rekem (Belgium). In: U. Schurmans, M. De Bie (Eds.): *Fitting Rocks: Lithic Refitting Examined*. Pp. 31–44. BAR International Series 1596. Archaeopress, Oxford.

DEBOUT G., OLIVE M., BIGNON O., BODU P., CHEHMANA L., VALENTIN B., 2012: The Magdalenian in the Paris Basin: New results. *Quaternary International* 272–273: 176–190. https://doi.org/10.1016/j.quaint.2012.05.016

DMOCHOWSKI P., 2006: A new classification of erratic flint from western Poland. In: A. Wiśniewski, T. Płonka, J. M. Burdukiewicz (Eds.): *The Stone: Technique and technology*. Pp. 217–226. Uniwersytet Wrocławski, Instytut Archeologii, SKAM Stowarzyszenie Krzemieniarskie, Wrocław.

DUKE C., STEELE J., 2010: Geology and lithic procurement in Upper Palaeolithic Europe: a weights-of-evidence based GIS model of lithic resource potential. *Journal of Archaeological Science* 37: 813–824. https://doi.org/10.1016/j.jas.2009.11.011

FIEDORCZUK J., 2006: *Final Paleolithic Camp Organisation as Seen from the Perspective of Lithic Artifacts Refitting*. Polish Academy of Sciences, Warszawa.

FURMANEK M., MOLENDA G., RAPIŃSKI A., 2001: Wstępne wyniki badań na stanowisku schyłkowopaleolitycznym w Sowinie, pow. Niemodlin w roku 2000. *Śląskie Sprawozdania Archeologiczne* 43: 485–490.

GINTER B., 1974: *Spätpaläolithikum in Oberschlesien und im Flußgebiet der oberen Warta*. Prace Archeologiczne 17. Uniwersytet Jagielloński, Kraków.

GINTER B., POŁTOWICZ M., PAWLIKOWSKI M., SKIBA S., TRĄBSKA J., WACNIK A., WINIARSKA-KABACIŃSKA M., WOJTAL P., 2005: Dzierżysław (Dirschel) 35 e ein neuer Fundplatz des Magdalénien in Oberschlesien. *Archäologisches Korrespondenblatt* 35: 431–446.

GOULD R. A., SAGGERS S., 1985: Lithic procurement in Central Australia: a closer look at Binford's idea of embeddedness in archaeology. *American Antiquity* 50: 117–136.

KOZŁOWSKI J. K., 1964: *Paleolit na Górnym Śląsku*. Zakład Narodowy im. Ossolińskich, Wrocław Warszawa.

KRETSCHMER I., 2015: *Demographische Untersuchungen zu Bevölkerungsdichten, mobilität und landnutzungsmustern im späten Jungpaläolithikum*. Kölner Studien zur Prähistorischen Archäologie. Verlag Marie Leidorf GmbH Rahden/Westf., Köln.

KURTZ H., 1930: Die Funde der alteren und mittleren Steinzeit aus dem Falkenberger Kreise. *Heimatkalender Kreises Falkenberg* 1930: 57–71.

ŁANCZOT M., MADEYSKA T., MUZYCZUK A., VALDE-NOWAK P., 2002: Hłomcza – stanowisko kultury magdaleńskiej w Karpatach polskich. In: J. Gancarski (Ed.): *Starsza i Środkowa Epoka Kamienia w Karpatach Polskich*. Pp. 147–187. Muzeum Podkarpackie w Krośnie, Krosno.

LEESCH D., MÜLLER W., NIELSEM E., BULLINGER J., 2012: The Magdalenian in Switzerland: Re-colonization of a newly accessible landscape. *Quaternary International* 272–273: 191–208. https://doi.org/10.1016/j.quaint.2012.04.010

LEVI-SALA I., 1996: *A Study of Microscopic Polish on Flint Implements*. BAR International Series 629. Archeopress, Oxford.

MAIER A., 2015: *The Central European Magdalenian: regional diversity and internal variability*. Vertebrate Paleobiology and Paleoanthropology Series. Springer, Dordrecht Heidelberg New York London.

MICHEL M., CNUTS D., ROTS V., 2019: Freezing in-sight: the effect of frost cycles on use-wear and residues on flint tools. *Archaeological and Anthropological Science* 11: 5423–5443. https://doi.org/10.1007/s12520-019-00881-w

NAVAZO M., DIEZ C., 2008: Redistribution of archaeological assemblages in plowzones. *Geoarchaeology* 23: 323–333. https://doi.org/10.1002/gea.20201

PASDA C., 2016: Altendorf – eine Fundstelle des Magdalénien im mittleren Saaletal. *Alt-Thüringen* 45: 7–34.

PASDA C., PFEIFER S., 2019: Tier und Mensch, Klima und Landschaft im Weichselspätglazial und Frühholozän Mitteldeutschlands. *Archäologisches Korrespondenblatt* 49: 465–478.

POŁTOWICZ-BOBAK M., 2012: Observations on the late Magdalenian in Poland. *Quaternary International* 272–273: 297–307. https://doi.org/10.1016/j.quaint.2012.05.029

PŘICHYSTAL A., 2013: *Lithic raw materials in Prehistoric times of eastern central Europe*. Masaryk University, Brno.

PRZEŹDZIECKI M., MIGAL W., KRAJCARZ M., PYŻEWICZ K., 2012: Obozowisko kultury magdaleńskiej na stanowisku 95 "Mały Gawroniec" w Ćmielowie, pow. ostrowiecki, woj. świętokrzyskie. *Światowit Fascykuł B Archeologia Pradziejowa I Średniowieczna 7B*: 225–234.

PRZEŹDZIECKI M., MIGAL W., PYŻEWICZ K., 2011: Badania nad osadnictwem paleolitycznym północnego obrzeżenia Wyżyny Sandomierskiej. *Światowit Fascykuł B Archeologia Pradziejowa i Średniowieczna 8/B*: 27–34.

PYŻEWICZ K., 2015a: Biographies of Magdalenian lithic tools from Poland. An in-depth look at two cases from the Kielecka Upland. *Anthropologie (Brno)* 53: 519–529.

PYŻEWICZ K., 2015b: The use-wear analysis of the artefacts found at the Magdalenian site. In: T. Wiśniewski (Ed.): *Klementowice. A Magdalenian Site in Eastern Poland*. Pp. 184–214. Uniwersytet Marii Curie-Skłodowskiej w Lublinie, Lublin.

RICHTOFEN VON B., 1930: *Altsteinzeitliche Funde aus der Provinz Oberschlesien*. Eiszeit und Urgeschichte, Aus Oberschlesiens Urzeit. Provinzialdenkmalpflege f. kulturgeschichtl., Wien.

ROTS V., 2002: Bright Spots and the Question of Hafting. *Anthropologica et Praehistorica* 113: 61–71.

SANO K., 2012: Functional variability in the Magdalenian of north-western Europe: A lithic microwear analysis of the

Gönnersdorf K-II assemblage. *Quaternary International* 272–273: 264–274. https://doi.org/10.1016/j.quaint.2012.02.057

SCHILD R., (Ed.) 2014: *A Late Magdalenian Winter Hunting Camp in Southern Poland*. Polish Academy of Sciences, Warszawa.

SCHURMANS U., 2007: Refitting in the old and new worlds. In: U. Schurmans, M. De Bie (Eds.): *Fitting Rocks: Lithic Refitting Examined*. Pp. 7–23. BAR International Series 1596.Archaeopress, Oxford.

SKAR B., COULSON S., 1986: Evidence of behaviour from refitting a case study. *Norwegian Archaeological Review* 19: 90–102. https://doi.org/10.1080/00293652.1986.9965434

STREET M., JÖRIS O., TURNER E., 2012: Magdalenian settlement in the German Rhineland – An update. *Quaternary International* 272–273: 231–250. https://doi.org/10.1016/j.quaint.2012.03.024

TAKAKURA J., 2018: Lithic refitting and its implication for the integrity and duration of site occupation: The case of the Late Upper Paleolithic site of Kiusu-5 in Hokkaido, Northern Japan. *Quaternary International* 474: 156–167. https://doi.org/10.1016/j.quaint.2018.03.013

TERBERGER T., 1997: *Die Siedlungsbefunde des Magdalénien-Fundplatzes Gönnersdorf. Konzentrationen III und IV*. Der Magdalénien-Fundplatz Gönnersdorf 6. Franz Steiner Verlag, Stuttgard.

THACKER P., 2006: Local raw material exploitation and prehistoric hunter-gatherer mobility. In: F. Sellet, D. Greaves, P. L. YU (Eds.): *Archaeology and Ethnoarchaeology of Mobility*. Pp 240–261. University Press of Florida, Gainesville.

VENCL S., FEJFAR O., KOVANDA J., NEUSTUPNÝ E., 1995: *Hostim: Magdalenian in Bohemia*. Památky archeologické 4. Institute of Archaeology, Prague.

WENIGER G. C., 1989: The Magdalenian in Western Central Europe: settlement pattern and regionality. *Journal of World Prehistory* 3: 323–372.

WIŚNIEWSKI A., FURMANEK M., BOROWSKI M., KĄDZIOŁKA K., RAPIŃSKI A., WINNICKA K., 2012: Lithic raw material and Late Palaeolithic strategies of mobility: a case study from Sowin 7, SW Poland. *Anthropologie (Brno)* 50: 391–409.

WIŚNIEWSKI A., KUFEL-DIAKOWSKA B., KOZYRA C., CHŁOŃ M., RÓŻOK Z., PŘICHYSTAL A., (in press.): Epigravettian in the area north of Sudetes: a case study from the site Sowin 7, SW Poland. In: G. Lengyel, J. Wilczyński (Eds.): *The Upper Palaeolithic Research in Central and Eastern Europe*. Proceedings Of The XVIIIth UISPP World Congress (4–9 June 2018, Paris, France) Session XVII-4. Pp. 15–35. Archaeopress, Oxford.

WIŚNIEWSKI A., POŁTOWICZ-BOBAK M., BOBAK D., JARY Z., MOSKA P., 2017: The Epigravettian and the Magdalenian in Poland: New chronological data and an old problem. *Geochronometria* 44: 16–29. https://doi.org/10.1515/geochr-2015-0052

WŚNIEWSKI T., 2015: *Klementowice. A Magdalenian site in eastern Poland*. Instytut Archeologii Uniwersytetu Marii Curie-Skłodowskiej w Lublinie, Lublin.

WIŚNIEWSKI T., MROCZEK P., RODZIK J., ZAGÓRSKI P., WILCZYŃSKI J., FIŠÁKOVÁ M. N., 2012: On the periphery of the Magdalenian World: An open-air site in Klementowice (Lublin Upland, Eastern Poland). *Quaternary International* 272–273: 308–321. https://doi.org/10.1016/j.quaint.2012.06.032

ZUBROW E. B. W., AUDOUZE F., ENLOE J. G., 2010: Introduction to domesticity of spatial organization. In: E. B. W. Zubrow, F. Audouze, J. G. Enloe (Eds.): *The Magdalenian Household: Unraveling Domesticity*. Pp. 105–108. Institute for European and Mediterranean Archaeology Distinguished Monograph Series. State University of New York Press, Albany, New York.

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