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CORE-SHAPED FORMS: ENDSCRAPERS, BURINS, CORES? ANALYSIS OF AURIGNACIAN ARTEFACTS FROM THE KRAKÓW, SPADZISTA SITE

ABSTRACT

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Core-shaped forms are one of the most distinctive kinds of artefacts identified in Aurignacian assemblages. Classification of such pieces frequently causes difficulties, and the boundaries between certain types seem to be fluid and intuitive. The question whether to categorise those artefacts as tools or as cores is another unresolved issue. This leads to conflicting interpretations of morphologically and technologically identical lithics. The present paper investigates these topics, using the assemblage of core-shaped forms from the group of sites in Spadzista Street in Kraków as an example. The authors propose a standardised examination method, without dividing the artefacts into typological categories, tools or cores. Such an approach, combined with microwear analysis of the materials, confirms the hypothesis that the forms may have been used both as tools and as cores, and that their use was not always the same, but depended on the specific needs of their users/makers.

Key words: Aurignacian, core-shaped forms, endscrapers, burins, cores, microwear analysis
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INTRODUCTION

The diversity of core-shaped forms has been the subject of many works on typological classification (e.g. Pradel 1952; Perrot and Sonneville-Bordes 1953; Perrot and Sonneville-Bordes 1956; Pradel 1962; Demars 1990; Stefański 2013). Researchers dealing with the problem have pointed out items similar in shape to cores (mainly carinated cores) as well as characteristic bladelet negatives shaping those tools. A strong similarity between burins and endscrapers has also been emphasised.

Some researchers believe that the core-shaped forms should be considered as cores (Krukowski 1939; Le Brun-Ricalens 1993; Lucas, 1997; Chiotti 2000; Hays and Lucas 2000; Chiotti 2003; Broglio *et al.* 2005; O'farrell, 2005; Le Brun-Ricalens, Bracco *et al.* 2006; Normand *et al.* 2008; Chiotti and Cretin 2011). One argument for this opinion is the co-existence, and often the refitting, both of carinated endscrapers and of carinated burins with retouched bladelets, some of which also bear microscopic use-wear traces. Other researchers think, however, that the use of waste forms resulting from the formation and repairing of tools is not tantamount to recognising those artefacts as cores (Dinnis 2008; Kaczanowska *et al.* 2010). At the same time, they pay attention to the characteristic morphology of the products and the way their working edges, very often shaped with fine retouching, were prepared. Moreover, micro-traces identified on the artefacts point to their use for work and to the functional character of the carinated endscrapers and carinated burins (Lenoir 1971; Dinnis *et al.* 2009). The core-shaped forms, therefore, could have been used as tools, not unlike bladelets obtained in the process of their formation (Inizan *et al.* 1999, 84).

THE PROBLEM OF CLASSIFYING THE CORE-SHAPED FORMS

When analysing flint artefacts, it is important to divide the items into morphological, typological and technological groups. Such an approach is unproblematic when we deal with distinctive forms relatively easy to assign to particular typological groups of lithics. However, when the forms are atypical, rare, or when they can be assigned to more than one category of artefacts, unambiguous classification may be difficult, which has a major impact on further inferences.

This problem is common particularly when the analysed material includes core-shaped forms which may be considered as tools or as cores. When they are treated as tools, assigning them to a specific typological group can be questionable as well.

One of the features that differentiate carinated burins from carinated endscrapers is the location and direction of retouching. In the case of endscrapers, retouching was directed from the ventral to the dorsal faces (Demars, Laurent 1989, 29, 44–45; Ginter and

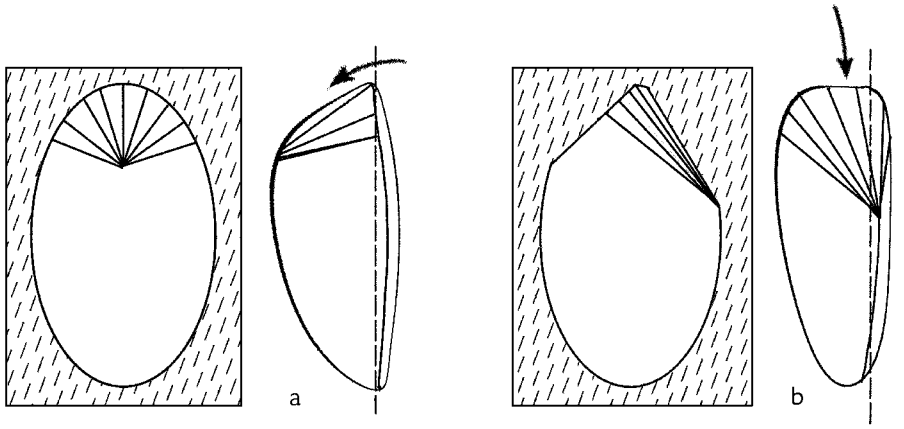

Fig. 1. Difference between carinated end-scrapers and burins made from debitage: a — production of endscrapers; b — production of burins (drawn by A. Nowak)

Kozłowski 1990, 89), whereas in the case of burins, blows were parallel to the blank edge, i.e. the edge between the positive and the negative surfaces (Fig. 1; Demars and Laurent 1989, 30, 52–53; Ginter and Kozłowski 1990, 90). With the core-shaped forms made from previously produced blanks, i.e. blades or flakes, many carinated forms can be assigned to the groups of burins or endscrapers relatively easily. Doubts arise, however, when the artefacts are shaped from chunks and non-industrial fragments. Since they do not have the positive surface, it is impossible to determine whether the forming retouch was directed from the upper to the lower faces or whether it run parallel to the edge between the two sides.

Apart from the location and direction of the retouch, discussions on the diversity of the artefacts also focus on the width of the worked edge (Sonneville-Bordes *et al.* 1960, 30) and the curvature radius of the blow (Pradel 1962, 688). These traits provide the basis for further divisions into types that define the forms in between busked burins and carinated burins or carinated burins and carinated endscrapers. The core-shaped forms often show a continuity of one general form, and the assignment of individual items to particular groups is intuitive (Stefański 2013, 113).

Sometimes, one set of artefacts is interpreted differently by different researchers. The analyses of the items from Góra Puławska are an example of such divergent interpretations. Stefan Krukowski, who explored the site, treated all core-shaped forms uncovered there as carinated cores for bladelets, and he proposed to interpret carinated endscrapers from other Aurignacian sites in the same way. He believed that those artefacts had primarily been used for the production of bladelets and longitudinal flakes, and that their use as endscrapers had been secondary and minor (Krukowski 1939, 67–68). However, Elżbieta Sachse-Kozłowska, who re-examined the artefacts from Góra Puławska, considered all the

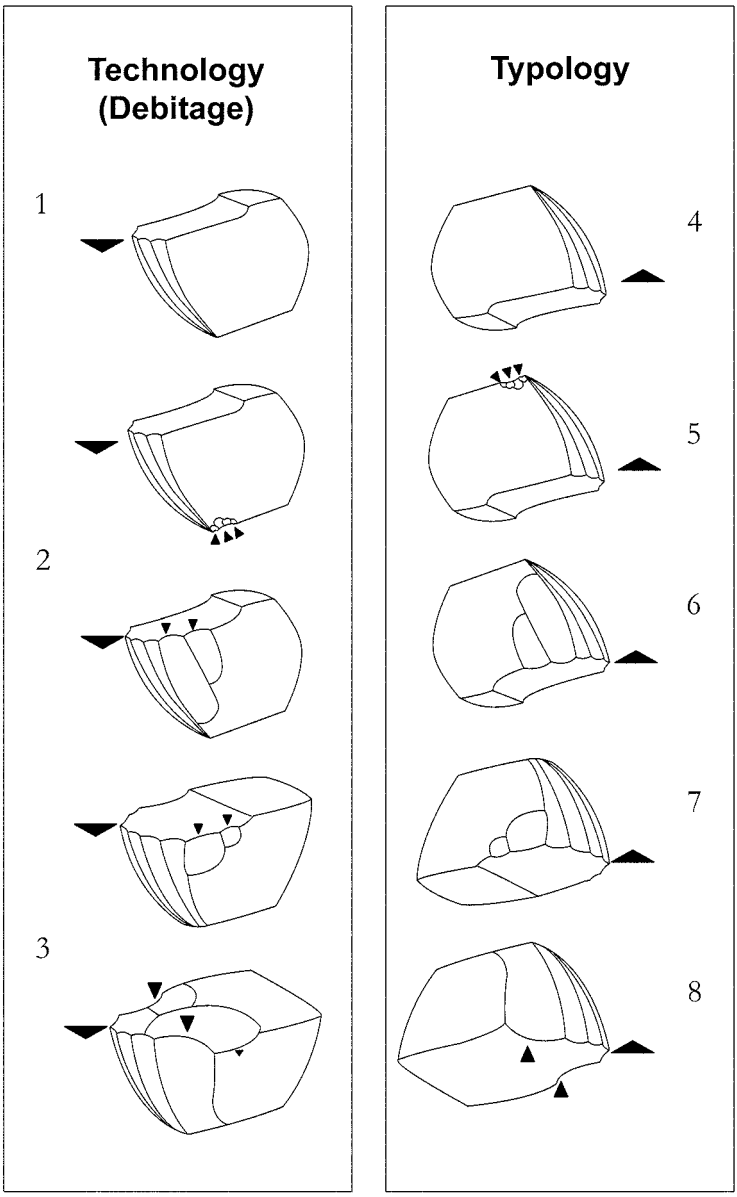

Fig. 2. Different orientations of "carinated products", depending on whether the artefacts are identified as cores or as tools. Differences between the technological and the typological approaches (Le Brun-Ricalens 2005, fig. 16). Technological approach: 1 — bladelet core; 2 — artefact made on flake or blade; 3 — artefact made on a flake or blade with or without a rejuvenated striking platform; typological approach: 4 — carinated burin, dihedral angle burin, transverse burin; 5 — busked burin; 6 — flat burin, Vachon type burin; 7 — carinated endscraper; 8 — massive shouldered endscraper

core-shaped forms as carinated endscrapers (Sachse-Kozłowska 1976, 104, Sachse-Kozłowska 1978, 20). She noted the predominance of those tools, a significant share of Dufour type bladelets and the lack of carinated burins in the assemblage (Sachse-Kozłowska 1978, 21). For her, this quantitative distribution of the types of tools was the basis for separating the Góra Puławska Aurignacian type, with references to the Krems-Dufour culture (Sachse-Kozłowska 1978, 30).

In his work on the Aurignacian assemblages in Moravia, Martin Oliva has analysed particular types of tools, viewing all core-shaped forms, which make a considerable part of his material, as tools. He assumed that the distinction between carinated burins and carinated endscrapers is unquestionable (Oliva 1987). On the basis of this analysis, Oliva divided the Aurignacian artefacts from Moravia into groups, determined their relative chronology and defined the functions of some sites.

A model example of divergent interpretations of core-shaped forms has been provided by Foni Le Brun-Ricalens (2005, fig. 16). He believes that one artefact at various stages of its reduction may be regarded as a carinated burin, a flat burin, then a carinated endscraper and a nosed endscraper. At the same time, it may be treated as a core with a narrow flaking surface, with a moulded apex, a rounded flaking surface, and ultimately as a core with a rejuvenated striking platform and a narrow extended flaking surface (Fig. 2).

It is worth noticing that the division of core-shaped forms into groups depends largely on the person who examines them. Identification of that type of lithics as tools or as cores has a direct influence on the analysis. The assignment of the items to particular categories (chosen by the researcher before beginning the analysis) affects directly the method of describing and drawing them. Thus, it imparts *a priori* typological and technological meanings to the items, which affects their interpretation.

AURIGNACIAN MATERIAL FROM THE KRAKÓW, SPADZISTA SITE

The site on Spadzista Street in Kraków is one of the most important Upper Palaeolithic loess sites in Poland, known mostly for its assemblage assigned to the Gravettian Kostienki type (Kozłowski 1969; Kozłowski *et al.* 1975; Drobniewicz *et al.* 1976; Sachse-Kozłowska 1978; Kozłowski 1980; Madeyska 1981; Kozłowski 1996; Escutenaire *et al.* 2004; Stefański 2007). Its Layer 7, consisting of light brown layered loess affected by solifluction processes and frost wedges, situated below cultural levels with backed forms, contained material linked with the Aurignacian culture. The artefacts discovered there did not form clusters and were heavily cracked by frost (Sachse-Kozłowska 1973, Kozłowski *et al.* 1975, Sobczyk 1996). Their fragments could rarely be refitted together; matching items came mainly from the same or neighbouring meters, but there were no refittings which would represent flint knapping.

The inventory discovered in layer 7 during exploration of sector C on Spadzista Street in Kraków has been analysed by Sachse-Kozłowska in her work on Aurignacian assemblages from the area of Poland (Sachse-Kozłowska, 1978). Sachse-Kozłowska identified 42 tools in the material: twelve endscrapers, seventeen burins, four retouched blades, three sidescrapers and three retouched bladelets. Three tools were classified as "other items". The domination of burins (40–55%) over endscrapers (approx. 29%) and the smaller number of retouched blades (9–13%) are characteristic of the Zwierzyniec type that corresponds to the developed phase of the Aurignacian culture (Sachse-Kozłowska 1978, 24). According to Sachse-Kozłowska, the presence of retouched bladelets in the inventory indicates that the chronology of the site might have been slightly younger (Sachse-Kozłowska 1978, 27).

The Aurignacian inventory discovered in layer 7 during exploration of sector D at the site on Spadzista Street has been examined by Krzysztof Sobczyk (1996). In that sector, too, burins (33%) dominated over endscrapers (14%), flakes (24%) and retouched blades (14%). Other tools appeared singly. The material has been interpreted as the remains of a short time hunting camp (Sobczyk 1996).

The material from sector B-B1 has been studied by Damian Stefański (Stefański 2007, 2013), who has carried out morphological and use-wear analysis of burins recovered from the site, including core-shaped items from the Aurignacian layer. Stefański notes that it is difficult to identify the difference between busked burins and carinated burins, and that the latter forms are clearly similar to carinated endscrapers. He also points out that some of the artefacts can be assigned to other categories of burins, and that in some cases the formation of side notches resulted in producing nosed or shoulder forms (Stefański 2013, 113). Stefański also believes that the burin technique bears a closer resemblance to the process of core utilisation than to classical marginal retouching. Therefore, he suggests that burins be described with a number of terms related directly to the terminology used in description of cores (2013, 114).

The authors of this paper have studied the Aurignacian lithics uncovered during the excavations at Spadzista Street B1 and B2. They have also re-analysed artefacts from sector D and C1, i.e. 809 items in total.

The artefacts were made from local (Kraków area) Jurassic flint. Most of them (669 items) are damaged to a greater or lesser extent. 331 lithics are covered with patina, 41 items show signs of burning. A very large proportion of the material consists of debris (216 items), which, like 18 "unidentified fragments", has not been taken into account when calculating the rates below. From among the other finds, flakes (374 items, 65%) are the most numerous; blades (98 items; 17%) and fragments of blades or flakes (69 items; 12%) are definitely less common. Moreover, the assemblage includes twenty bladelets (3%), seven cores (1%), five nodules of raw material and one splintered piece.

CORE-SHAPED FORMS FROM THE KRAKÓW, SPADZISTA SITE

Core-shaped forms make the most interesting artefacts from Spadzista Street. Nineteen items are discussed below, including possible ways of describing and dividing them into tools or cores.

Due to their traits, the analysed artefacts may be assigned to the groups of carinated or nosed endscrapers and carinated, flat or busked burins. Most of them can also be regarded as cores. Only nine pieces were made from previously obtained blanks (flakes or blades). One product may be considered a burin on a broken blade (Fig. 3: 6), but the number of negatives and their size do not preclude that it was used for the production of blades; in that case, it should be assigned to cores. Three items can be viewed both as endscrapers and as carinated cores (Fig. 6: 1, 2, 6). Another three artefacts may be ranked among carinated dihedral busked burins (Fig. 4: 2, 4; Fig. 6: 3; two of them have been classified thus by Sachse-Kozłowska 1978, 170) or among cores with a prepared striking platform and a narrow flaking surface. A number of lithics have traits typical of small carinated cores with a flaking surface rounded on one or both sides and a prepared or a rejuvenated striking platform (Fig. 3: 8, 9; Fig. 4: 1, 3; Fig. 5: 2–4). It is also possible to include them into the group of carinated endscrapers (one item, shown in Fig. 5:3, has been classified in that way by Sobczyk 1996, 89) or elongated nosed endscrapers, as suggested by the shape of the endscraper front. They can also be viewed as carinated dihedral burins; the prepared rejuvenated striking platform may have been a burin blow that served as the basis for striking subsequent burin spalls. Two artefacts were damaged during the operation, and their further treatment was abandoned (Fig. 5: 1; Fig. 6: 4), but their forms clearly refer to the above items. Another two finds can be identified, respectively, as a prismatic core (Fig. 6: 5) and a pyramidal core (Fig. 3: 7), or as residual carinated endscrapers with traces of repair to the base (striking platform).

Very similar forms were made both from chunky flakes and non-industrial fragments. Consequently, the choice of blanks cannot really be treated as the basis for dividing the items into tools or cores. Virtually all of the described artefacts were retouched very finely along the edge of their flaking surface (endscraper front), which may mean that they were used as tools. At the same time, the forms made from non-industrial fragments have no positive side, which makes it difficult to divide them into burins or endscrapers (Fig. 3: 7, 8, 9; Fig. 4: 1; Fig. 5: 2, 3).

The core-shaped forms described above can be researched in two ways. The researcher may assume before the observation that all the artefacts are tools or cores and describe them in accordance with the accepted standard (cf. the analyses by Krukowski, Sachse-Kozłowska and Oliva, mentioned above). However, such an approach excludes the possibility that at least some of the items defined as cores were really tools or vice versa, that

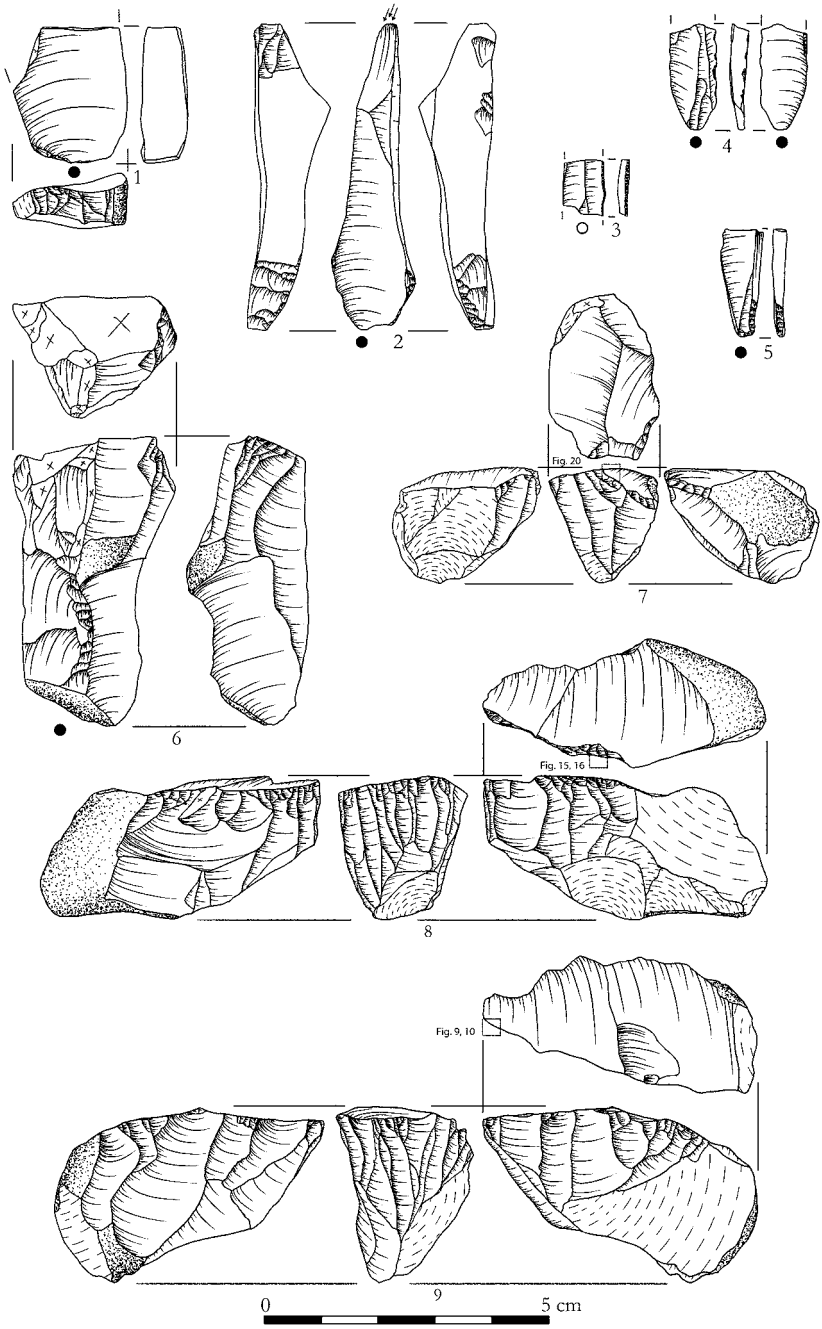

Fig. 3. Kraków, Spadzista Street: core-shaped forms from sectors B2 (6, 8, 9) and D (7); rejuvenated core flakes (1, 2) and retouched bladelets (3–5) from sector C (drawing by A. Nowak)

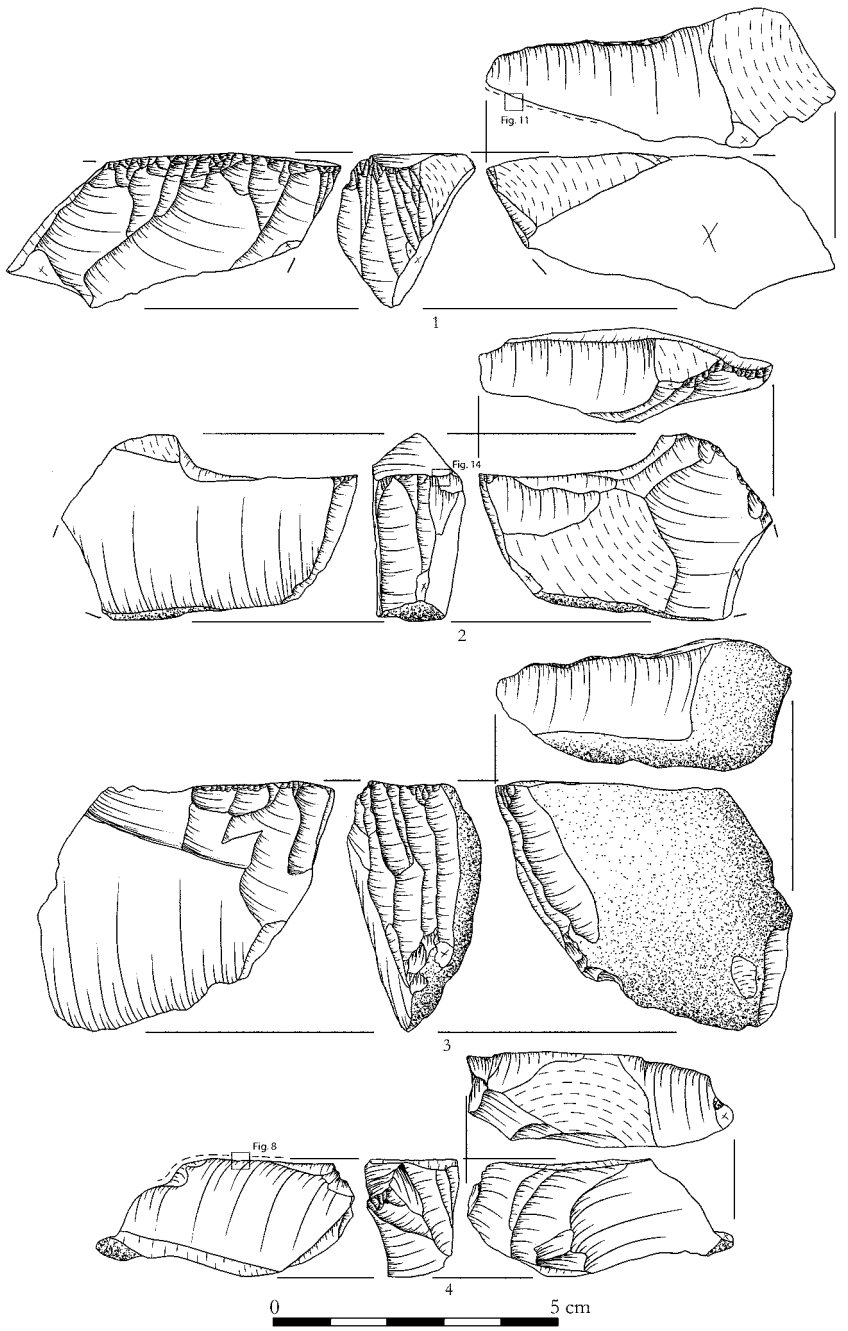

Fig. 4. Kraków, Spadzista Street: core-shaped forms from sectors B2 (1, 3) and C (2, 3) (drawing by A. Nowak)

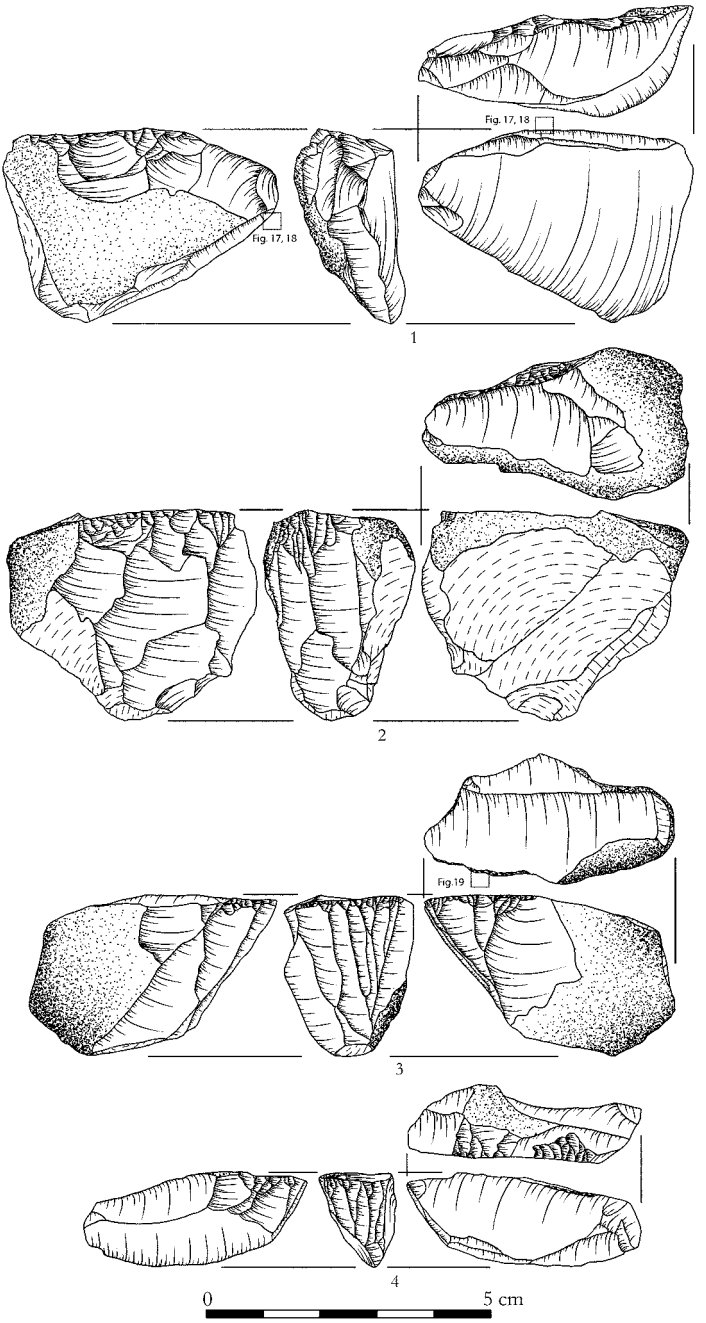

Fig. 5. Kraków, Spadzista Street: core-shaped forms from sectors B2 (1), C (2, 4) and D (3) (drawing by A. Nowak)

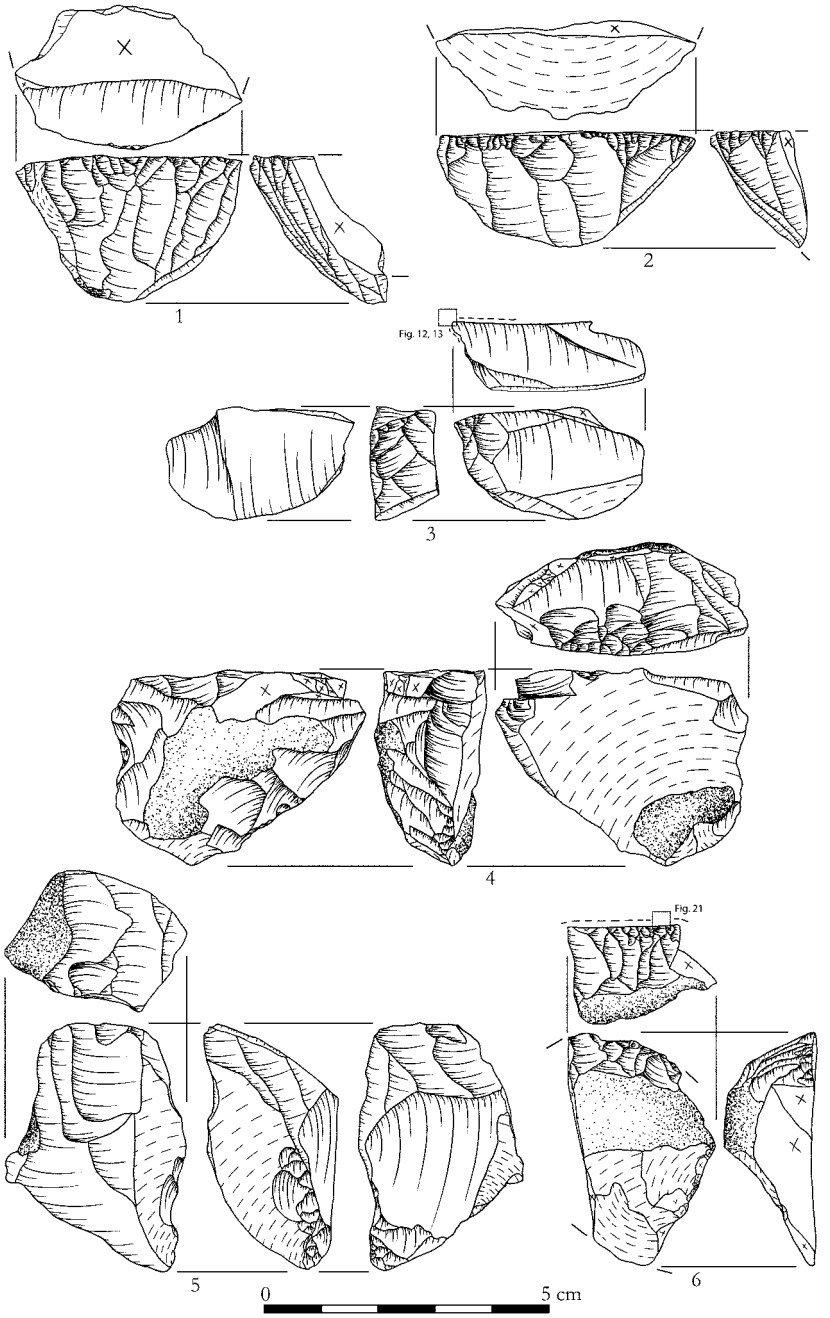

Fig. 6. Kraków, Spadzista Street: core-shaped forms from sector C (1–6) (drawing by A. Nowak)

some of the tools never in fact served as tools and were only used to get fine bladelets or flake blanks. Alternatively, the researcher may refrain from assuming at the start that all core-shaped forms are tools or cores, and may decide how to classify a given item during its analysis, describing the artefact according to the standard adopted for cores or for tools. In consequence, some items, though clearly similar morphologically and technologically, are analysed in entirely different ways.

Both of these approaches make the researcher assign the artefacts to specific groups of lithics before the whole assemblage is examined. This is accurate when the research involves the types of tools that can hardly be interpreted as cores and when their assignment to specific typological groups is trouble-free. With core-shaped forms, however, it seems necessary to look for a new method of analysis which would postpone the classification of particular items until the end of the process of describing the assemblage.

A STANDARDISED WAY TO DESCRIBE AND DRAW CORE-SHAPED FORMS: AN ALTERNATIVE METHOD OF ANALYSIS

An alternative method of analysing core-shaped forms should be based on a unified procedure of description and drawing without dividing the artefacts into cores or tools. As a result, the lithics are not considered *a priori* in terms of their function. Such an approach, however, does not eliminate subsequent division of the analysed material.

The description of core-shaped forms should include information about the production and reduction of the artefacts, their morphology or the choice of blanks. It seems that while studying those items, it is possible to use the terminology applied commonly in core analyses. Moreover, the drawing method accepted in the documentation of cores may prove accurate enough for core-shaped forms, too. At this point, it should be clarified that, in this paper, the term "retouch" referring to tools has been replaced with the term "reduction". Burin spalls obtained in the formation of carinated burins as well as waste produced during the reduction of nosed and carinated endscrapers are here called bladelets. The flaking surface is the surface where bladelets were flaked off; its description covers the negatives, shape and any traces of preparation. The striking platform in those artefacts is the surface whose edge was struck or pressed in order to reduce the form; its description covers the way it was made, its profile and the angle it forms with the flaking surface. Terms defining the way the platform was formed have replaced here the terminology related to particular varieties of burins: truncation burin — prepared striking platform; dihedral burin — rejuvenated striking platform; single blow burin, burin made on a broken blade — natural striking platform. Moreover, the detailed description of the core-shaped forms includes both sides, the back and the top of each artefact.

In the drawings, core-shaped forms are oriented like cores, with their flaking surface at the front; other projections show the items from one or both sides, from above (their striking platform) and, if necessary, from below (their apex). It should be noted that the terminology and the drawing method used for the documentation is not equivalent to arbitrarily identifying those artefacts as cores.

Following the assumptions presented above, the core-shaped items have been analysed in a consistent way. The vast majority of them (15 items) may be described as sharing many morphological and technological traits (Fig. 3: 7, 8, 9; Fig. 4: 1–4; Fig. 5: 1–4; Fig. 6: 3, 4). To produce those lithics, relatively stocky blanks or chunks and non-industrial fragments were chosen. The process of knapping began with striking one or more elongated flakes or blades which formed the striking platform for further reduction. In the case of forms made of flakes, the directions of knapping run from the butt, with the longitudinal edge of the flake used as a natural crest. Sometimes the striking platform was rejuvenated during the reduction, as shown by the items with an intensely prepared butt that overlapped the faces of the flake or blade in some cases (Fig. 3: 1, 2). Most artefacts have straight (12 items) or curved (2 items) prepared or rejuvenated striking platforms. The angles of the striking platforms range from approx. 65° (9 items) to 80° (6 items).

Proper reduction focuses on a narrow area of the flaking surface, sometimes bearing traces of forming the crest (Fig. 5: 1; Fig. 6: 4). Some blades also show traces of shaping the edges from which they were separated. In most cases, the flaking surface overlaps one or both sides, where the negatives are much

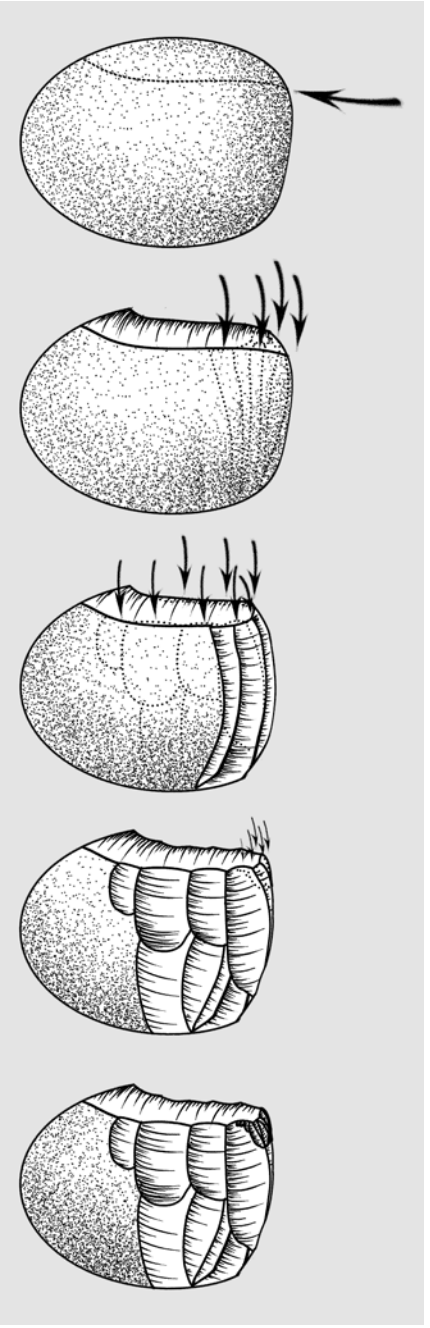

Fig. 7. Reduction scheme of core-shaped forms (drawing by A. Nowak)

larger and more massive. This process is not visible on regular narrow forms (Fig. 4: 2, 4; Fig. 6:3). Another distinctive trait is a markedly protruding apex which forms an atypical "nose", sometimes emphasised with one or two shallow notches (Fig. 3: 8, 9; Fig. 4: 1, 3; Fig. 5: 2–4). In most cases, the edges of the flaking surfaces, their protruding parts in particular, are trimmed (10 items).

The process of producing core-shaped forms (Fig. 7) seems to have been related to the techniques described in the publication about bladelets in the early Aurignacian (Le Brun-Ricalens 2005, fig. 15). The items were probably produced with those techniques combined into one, which would explain the blurred distinction between endscrapers and core-shaped burins (Le Brun-Ricalens 2005, fig. 16). The technological sequence and the morphology of those items are similar to forms called *burins des Vachons*, Vachons type burins, made from flakes or blades, with traces of intense shaping before reduction, and with less pronounced "noses" (Pesesse and Michel 2006, fig. 5).

Three core-shaped forms, only partially preserved (Fig. 6: 1, 2, 6), probably belong to a different group of artefacts. Their striking platforms are made from flat natural surfaces or the positives of flakes, while their flaking surfaces are arched and much wider. The surviving fragments bear no traces of earlier preparation.

USE-WEAR ANALYSIS

Microwear analysis has covered the selected nineteen flint artefacts, core-shaped forms of the Aurignac type. Among those, twelve items are partially covered with patina, which has limited the range of the analysis in several cases, making it impossible to obtain a complete microscopic view of all the relevant surfaces (cf. the list of the analysed items below).

The main aim of the study has been to determine whether the core-shaped forms bear traces of use noticeable in the micro-scale. Moreover, the researchers have checked the micro-reliefs of the items for so-called technological traces which might provide information about specific techniques employed at various stages of flint reduction.

Microscopic observation has been carried out with optical equipment in the possession of the Institute of Archaeology, University of Rzeszów: a stereo microscope Olympus SZX16 (magnification 10,5–172,5 x), a polarizing microscope Olympus BX51-P (magnification 40–1000 x) and a photographic set compatible with both microscopes and computer hardware. Photographic documentation has been made with the CELL programme combining areas with different depths of field and thus helping to take sharp photomicrographs at any stage of the examination procedure. Moreover, the software may be used to precisely measure distances at the microtopography of the artefacts.

The use-wear (traceological) analysis has been based on the methods of high-power (Keeley 1980; Voughan 1985) and low-power analysis (Tringham *et al.* 1974; Odell and Odell-Vereecken 1980), the latter being used only complementarily. While identifying the

functions of the artefacts, therefore, the authors have not been guided by the nature of damages noticed on the edges, but by other distinctive transformations of the flint texture, described below.

The flint material has been analysed in two phases. First, macroscopically discernible functional damages to the edges of the items were assessed by the examination of scratches, fractures, roundings and potential functional retouches. Next, microscopic study was carried out with gradually increased magnification and changes in the intensity of light. The aim was to identify significant use-wear traces: micropolish or striations. Depending on the stage of the analysis, the artefacts were mounted on a movable or a fixed platform. Before inserting them under the lens of the microscope, each was cleaned in ethyl alcohol solution.

Microtraces identified on core-shaped forms

B2_E7_83 (Fig. 5: 1; 17; 18)

• no patina;

• scratches centred in several points perpendicularly to the edge of the striking platform — the edge of the striking platform shaped with a hammer stone during flaking.

C_2284 (Fig. 6: 3; 12; 13)

• partial patina with no adverse effect on the analysis;

• strong bright micropolish indicative of the processing of plant material, most probably fresh wood. The micropolish is blotchy, situated around the apexes of protruding rough places. It is the most noticeable at the highest apex on the edge of the striking platform; farther on, it loses in intensity.

C_2583 (Fig. 6: 6; 21)

• patina centred in small areas, with no adverse effect on the analysis;

• rounding and smoothing at the edge, indicative of using the item as a scraper in hide-working. This small trace is situated at the highest point of the edge of the striking platform. The rest of it was removed during reduction of the item.

C_2451 (Fig. 4: 2; 14)

• no patina;

• a circular trace of a blow with a hammer stone — reduction or repair of the flint nodule.

B2_A6_999 (Fig. 3: 9; 9; 10)

• partial patina making it difficult to analyse the item;

• a circular trace of a blow with a hammer stone, perhaps indicative of an attempt to make, or repair, the striking platform;

• bright, blotchy, shiny micropolish clearly visible on the edge of the item; deep grooves, their interior filled partly with polish, run parallel to the strongly smoothed edge. The grooves may point to knapping with a hard stone, but the polish seems to be a trace of sawing of antler / bone that involved an abrasive agent (intended or not).

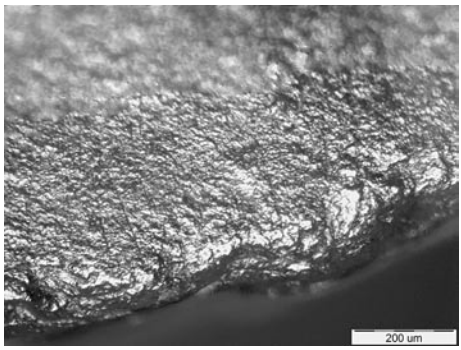

Fig. 8. C_2930, magn. 120 x (Fig. 4: 4)
(photo by D. Wolski)

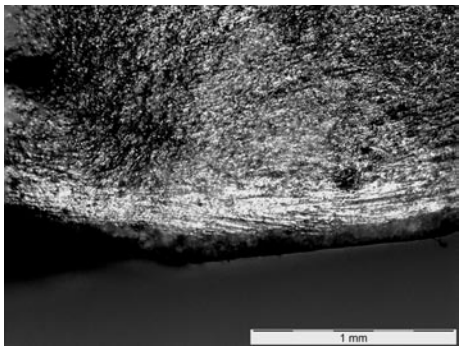

Fig. 9. B2_A6_999, magn. 60 x (Fig. 3: 9)
(photo by D. Wolski)

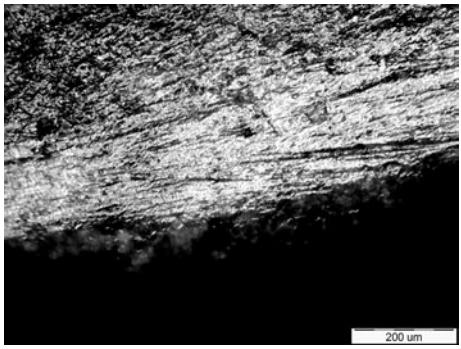

Fig. 10. B2_A6_999, magn. 150 x (Fig. 3: 9)
(photo by D. Wolski)

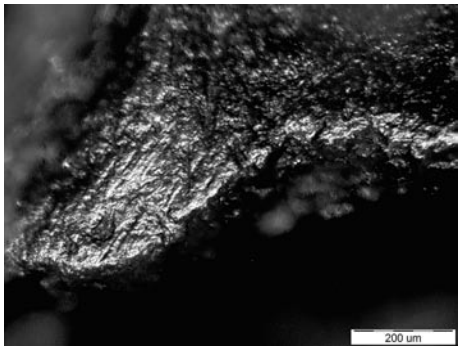

Fig. 11. B2_E0_186, magn. 150 x (Fig. 4: 1)
(photo by D. Wolski)

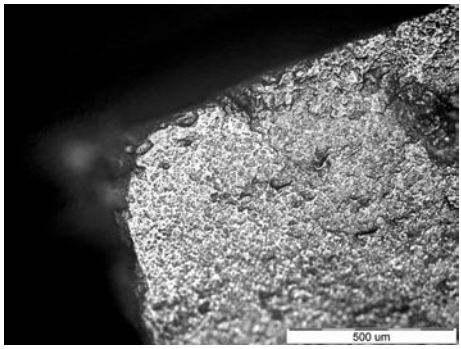

Fig. 12. C_2284, magn. 100 x (Fig. 6: 3)
(photo by D. Wolski)

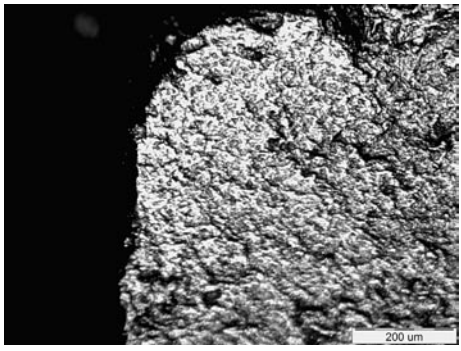

Fig. 13. C_2284, magn. 150 x (Fig. 6: 3)
(photo by D. Wolski)

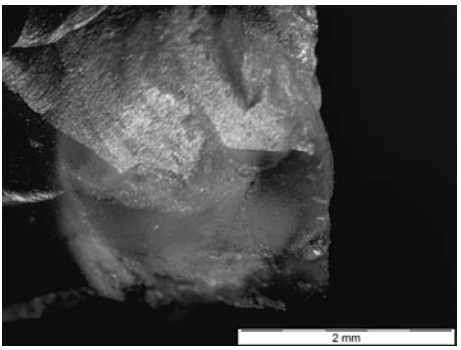

Fig. 14. C_2451, magn. 24 x (Fig. 4: 2)
(photo by D. Wolski)

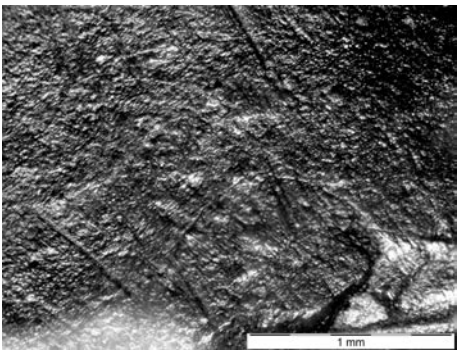

Fig. 15. B1_A6_1, magn. 60 x (Fig. 3: 8)
(photo by D. Wolski)

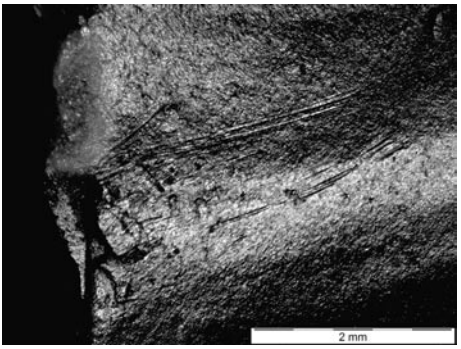

Fig. 16. B1_A6_1, magn. 30 x (Fig. 3: 8)
(photo by D. Wolski)

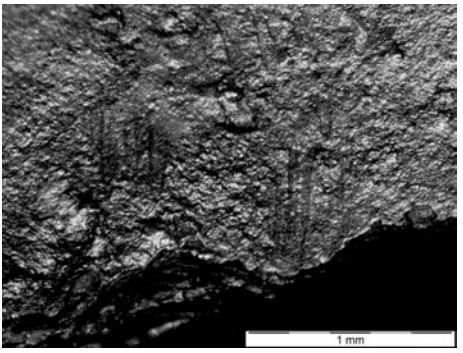

Fig. 17. B2_E7_83, magn. 60 x (Fig. 5: 1)
(photo by D. Wolski)

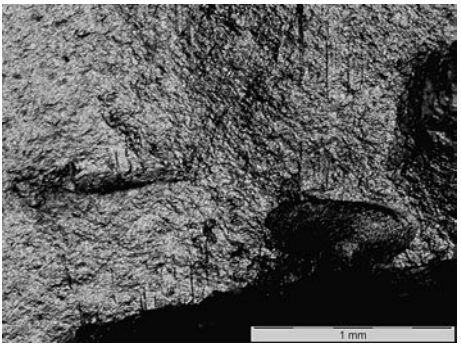

Fig. 18. B2_E7_83, magn. 60 x (Fig. 5: 1)
(photo by D. Wolski)

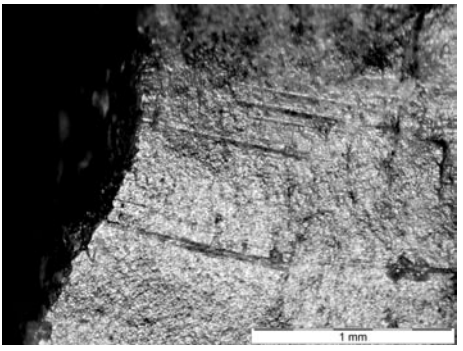

Fig. 19. D_240_13, magn. 60 x (Fig. 5: 3)
(photo by D. Wolski)

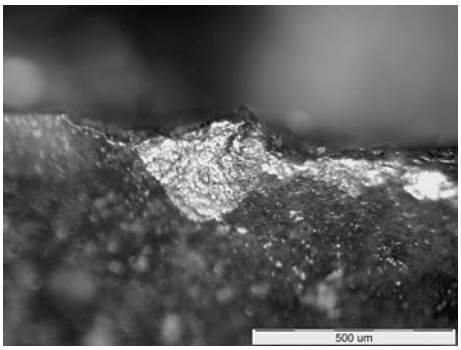

Fig. 20. D_199_19, magn. 120 x (Fig. 3: 7)
(photo by D. Wolski)

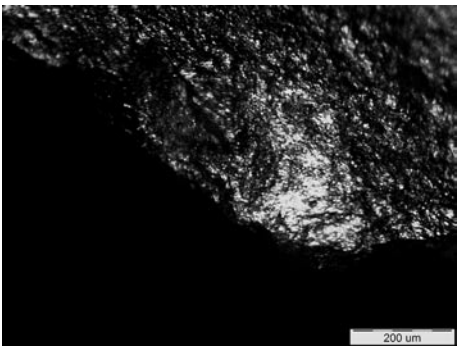

Fig. 21. C_2583, magn. 150 x (Fig. 6: 6)
(photo by D. Wolski)

Because the micropolish is located within a small patch of patina, its original form may have been distorted.

B2_E0_186 (Fig. 4: 1; 11)

• no patina;

• matt polish with perpendicular grooves. The micropolish is accompanied by the rounding of the edges. This trace is discernible along a longer part of the edge of the flaking surface. The item was used for scraping dry hide.

B2_A6_1 (Fig. 3: 8; 15; 16)

• no patina;

• grooves perpendicular to the edge; their considerable length (approx. 2 mm) seems to have resulted not only from shaping the edge of the striking platform, but also from reduction with a hammer stone, whose blow has also left a circular trace on the item.

D_240_13 (Fig. 5: 3; 19)

• slight patination making it difficult to analyse the item;

• groves/scars perpendicular to the edge, indicative of platform edge trimming with a hammer stone.

D_199_19 (Fig. 3:7; 20)

• partial patina;

• a semicircular trace of a blow with a hammer stone, indicative of reduction or repair of the flint nodule.

C_2390 (Fig. 4: 4; 8)

• no patina;

• rounding of the edges and bright greasy micropolish, indicative of using the artefact to work fresh hide. The trace is discernible along the working edge. Both within and outside that polished area, grooves run perpendicularly to the working edge.

ANALYSIS AND INTERPRETATION

Owing to their morphology, the Aurignacian core-shaped forms may be considered as cores, endscrapers or burins. This makes it necessary to analyse microtraces in a way proper to each of those typological categories.

Microtraces of use

Microtraces of use have been recorded on five artefacts. In three cases, they indicate using the items to scrape hide (Fig. 1; 11; 21). Interpretation of the other two is not entirely clear. Certain traits within their surface microrelief can only suggest that the artefacts were used to process specific materials: fresh wood (Fig. 12; 13) and stone or antler (Fig. 9; 10). The items could also have been used for more than one kind of work. The edges of all the forms with traces of use are distinctly jagged due to reduction.

Hideworking

One artefact has visibly rounded edges, matt micropolish and grooves perpendicular to the edge (Fig. 11). These traits suggest that the item was used to scrape dry hide. Two other items bear traces indicative of work with fresh hide (Fig. 1; 21): bright greasy micropolish and rounded working edges, the latter with scratches pointing to the presence of an abrasive agent during the work (Fig. 8; 11). The scratches may have resulted from processing hide on a mineral layer or from other activities linked to the conservation of animal carcasses (Hatt 1969, 11–20; Beyries and Rots 2008, 21–28).

Processing of other materials

One artefact shows microtraces resulting from work with plant material, most probably fresh wood (Fig. 12; 13). Distinct bright blotchy micropolish has been recorded around the apexes of its protruding rough places. An almost right angle of the working edge and the polish which gradually loses in intensity suggest that the item was used as a scraper. Another artefact bears traces of stone processing: deep abrasive scratches parallel to the edge (Fig. 9; 10), indicative of a parallel direction of working. However, the shiny blotchy micropolish may mean that the item had contact with antler or bone rather than stone (Korobkowa 1999, 108). Moreover, the trace is situated within a small patch of patina, which may have distorted its original form.

Analogies

The results presented above may be compared to other use-wear analyses of Aurignacian artefacts. So far, there have been several publications on the use of core-shaped forms (Lenoir 1971 Schulte im Walde, 1987; Hays and Lucas 2000; Chiotti, 2005; Arrighi *et al.* 2006; Hardy *et al.* 2008; Dinnis *et al.* 2009) and bladelets obtained from them (Lenoir 1971; Normand *et al.* 2008). The studies differ in their methodological assumptions, the ways microscopic analysis has been carried out and, consequently, in their results. Almost all, however, have proven the functional use of the core-shaped forms.

The purely utilitarian purpose of the items has been confirmed due to the identification of microtraces on finds from the Les Vachons site in France. The study has shown that core-shaped forms served as hafted projectile points of throwing weapons (Dinnis *et al.* 2009). The authors used several methods of microscopic analysis of flint artefacts. Apart from the most popular methodological solutions based on low-power and high-power magnifications, they employed the X-ray (EDX) method helping to identify microremains. Other analyses of use-wear traces, carried out on items from the Caruso and San Cassiano sites in Italy, have shown that core-shaped forms were used as burins (Arrighi *et al.* 2006). Analyses of Aurignacian artefacts from Breitenbach have identified characteristic rounding on the edges of core-shaped forms, a trait that may have been related to hideworking (Schulte im Walde 1987).

Quite remarkable data have resulted from the study of microscopic material from cave sites in Germany (Hohle Fels, Geißenklösterle and Vogelherd). Exceptionally well-preserved items: blades, retouched blades, burins, scrapers, flakes and backed blades, provided ample remains of hair, feathers, bone / antler, wood, plant tissues, phytoliths and grains of starch and resin (Hardy *et al.* 2008, Table 3, 4). In many cases, the researchers recorded several different kinds of residues on the same item, which may mean that the same tool was used for various types of work.

Technological microtraces

The studies mentioned above have not included analysis of technological traces. At the site on Spadzista Street, eight traces of that type (Fig. 14–20) have been recorded altogether. They are related primarily to repairing the edge of the flaking surface during knapping (Moss 1983, 102–104). The edge was shaped through light striking/rubbing with a mineral hammer stone, which made it possible to further reduce the flint nodule (Ginter and Kozłowski 1990, 58), but which also caused characteristic microtraces, i.e. small grooves, often centred in several points, running transversely to the edge of the striking platform (see Pyżewicz 2013, 30–31). Other technological traces may be associated with reduction itself or with repair of the flint module. A blow to the surface of an item may result in circular or semicircular microtraces, called Hertzian cones in the literature (Cotterel and Kamminga 1987, 685–687), and deformations of that kind have been noted at the edges of the examined core-shaped forms. The scratches and percussion marks indicate clearly the use of a hammer stone, both in the course of flaking and of shaping the edge of the striking platform. The use of an organic hammer has not been confirmed microscopically, but this may have resulted from the disappearance of distinctive microtraces. Traces of percussions with a soft hammer tend to survive rather poorly (Voughan 1985, 41; Pyżewicz 2013, 31).

To sum up, the microscopic analysis of nineteen core-shaped forms recovered from the Aurignacian site on Spadzista Street in Kraków has shown the presence of both use-wear traces and technological traces, the latter related to correcting the edge of the striking

platform and to flint reduction with a mineral hammer. The research has also documented microrelief changes caused by processing of raw material, which can be divided into microtraces of plant origin (scraped fresh wood) or of animal origin (scraped fresh or dry hide; probably processed antler/bone). The analysis leads to the proposition that the items were used not only for the production of blades. The core-shaped forms certainly served as tools, which has been proven by the characteristic microtraces identified microscopically on the items from Spadzista Street and by other use-wear analyses of similar material. It should be emphasised that the utilitarian nature of the artefacts has almost always been confirmed by functional analyses, irrespective of the sub-method applied (low-power, high-power, X-ray) and certain differences in the final results.

CONCLUSIONS

The material from the Kraków Spadzista site is an example of an inventory containing core-shaped forms. The specific character of those items and the difficulty of dividing them into categories of artefacts suggest that the standard procedure of analysis which distinguishes between tools and cores should be abandoned. A broader perspective on that group of lithics helps to notice traits indicating similarities and differences between the items. This approach has worked very well in the analysis of the core-shaped forms from Spadzista Street. Artefacts which, when analysed by the standard method, would be identified as atypical and "enriching" the assemblages of various tools or cores, turn out to have common traits, both morphological and technological ones.

The analysis has identified a particularly interesting technology of knapping of core-shaped forms that combined the methods of production of carinated endscrapers and burins. The choice of the type of blank: a flake or a flattened flint nodule, was presumably of minor importance. What counted was the possibility to prepare a flat longitudinal striking platform. In some cases, a narrow flaking surface was formed with a crest. That method seems to have been optional, and when the form of the blank was appropriate, reduction began immediately after forming the striking platform. During the reduction, the maker checked the width of the flaking surface by separating much wider blanks, often in the form of flakes, at the sides of the item, thus obtaining a very narrow surface, sometimes marked off with one or two shallow notches. The maker also paid attention to the edge of the flaking surface, which was usually well regulated. The angle between that surface and the striking platform was checked, too. While striking off bladelets and regulating the edge, the maker certainly used a hammer stone, as shown by the use-wear analysis; for knapping, soft hammers may have been used as well.

The analysed material contains few bladelets and small flakes which might be linked with reduction of the core-shaped forms. That is why it has been impossible to try to recreate the sequence of preparation and exploitation of the artefacts on the basis of refitting.

Blanks made during the reduction of the core-shaped forms may certainly have been used to produce tools. Three out of twenty bladelets recovered at the site were retouched (Fig. 3: 2–5). The use of blanks obtained during reducing the core-shaped forms is often considered as an argument for classifying the items as cores. It is worth stressing, however, that several characteristics of those artefacts: the shape of the flaking surface and the profile of the striking platform, the same angle between those two surfaces in all the items and the fine regulation of the edge of the striking platform, made it possible, when combined, to use the items as tools to work with different materials. This has been confirmed by the use-wear analysis which has shown that some of the core-shaped forms bear traces of contact with dry or fresh hide, wood and antlers.

Some researchers studying the core-shaped forms have pointed out that those artefacts may have been reused as tools (Krukowski 1939; Schulte im Walde, 1987; Inizan *et al.* 1999). However, it seems that the lithics were employed equally for production of bladelets and for work with diverse raw materials, and one function did not have to exclude the other. On the contrary, repairing the functional part led to the production of bladelets and flakes, while the production of blanks renewed and formed the working edge, maintaining its angle without changes. This interpretation has been confirmed by the microtraces of use, partly obliterated due to the further reduction of the nodule. This is why the use of the artefacts as tools was not their last stage, since it alternated with periods when small blanks were produced, and earlier microtraces may have been removed completely together with butts of the knapped blank.

It may be concluded, therefore, that the core-shaped forms combined the functions of tools and cores. They were suitable for work with different raw materials and, simultaneously, for production of small blanks. The way of using those artefacts depended on the actual needs of their makers / user and could be changed at any time.

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