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On the Classification of By-Products of the Reduction for Blades – Some Aspects of Technology in Swiderian Assemblages

Foreword

In my earlier study on the methods of blade production I focused largely on the Swiderian method and the question of predetermined debitage; results of this research were published (Dziewanowski 2006: 138–166). In this paper, trying to take the cognitive perspective, I established the presence of intentional removal of very small blades and bladelets in the Swiderian method; I also determined that this debitage was in a close relationship to technical procedures and with an evident intention of obtaining blades having narrow proximal and pointed distal sections. For the purpose of this study I tried to reconstruct experimentally many different Late Palaeolithic and Early Mesolithic concepts of blades production from different kinds of Polish flint. I tested a huge range of techniques and conducted research over relations between techniques, concepts, methods, as well as relations between by-products and preferential products. Although I was aware even at that early stage that these forms originated from dissimilar contexts, I defined them all as a group of correction blades/bladelets and linked them to the procedure of correcting the parameters of the flaking surface. The next obvious step in the study of by-products of technical procedures is to make a morphological, metric and functional classification with a view to demonstrate the intentionality of these procedures (to assess whether various forms result from preferential, accidental or incorrect action) and the degree of awareness of the phenomenon on the part of the knapper. Next, we must give individual groups adequate names forming sequences of notions describing the procedures and their products[1] (Ginter 1974: 28–31; Krukowski, Nowakowski 1976: 9; Schild 1992: 95–102; 2000: 35–36).

Determining the aim and context of origin of products of core reduction is a condition necessary for moving on to further stages of investigation of methods of blade production. Output from these studies should help in advancing our understanding of Late Palaeolithic and Early Mesolithic technologies with regard to the nature of the concept, techniques used and technical procedures. The issue of correction bladelets should be referred to technological traditions which involved on the edge percussion (mainly, the technique of direct stone hammer percussion) combined with trimming and polishing of the platform edge. In this context Swiderian (Dziewanowski 2006: 154; Dmochowski 2005: figs. 9, 10) and Early Mesolithic technologies should be investigated in particular (Dmochowski, Dziewanowski 2008: 14). Using so construed technological entities it is necessary to fill in the details in the *chaîne opératoire* of 'soft edge technologies' (first of all, the 'Swiderian technological tradition'). This way of research is strictly connected with the tradition of "Dynamic Technological Analysis" (Schild 1980: 57–66), in purpose of "reading of the individual histories of artefacts recorded in their attributes" (Schild 1980: 58).

In the 1990s theoretical aspects of archaeological research started to be more and more important for archaeology, and Polish archaeologists became more convinced of taking advantage from theoretical studies (see: Rączkowski 2002: 11–15, 220–231).

In the end of the 20th c. in Polish archaeology of the Stone Age many authors were increasingly taking advantage of contribution in theoretical, especially cognitive approach (Fiedorczuk 1992: 22–24; 1995: 60; 1999: 81–82; Libera, Wąs, Zakościelna 2008: 362–373; Migal, Wąs 2006: 179, 182; Tomaszewski 1986: 239–277; 1988: 7–66; 1999: 169–175; Przeździecki 2006: 127–137; Wąs 2005: 18–26). It shows that archaeologists started to point more precisely the question how it was made and who the knapper was. Assessing the level of understanding of blade production technologies in this context, it is possible to note an unsatisfactory adjustment of research procedures

[1] See issues related to the classification of forms defined by Krukowski as "surki" and, in particular, "stanżyki" (Krukowski, Nowakowski 1976: 19–20, 101, pl. IX:6–9).

and terminology to the development of theoretical lines of thought aimed at resolving specific social and cognitive issues.

Studies of predetermined debitage vs. the development of the cognitive perspective and its applications

The Polish Stone Age scholarship tradition of flint technology studies is strictly connected with the person of S. Krukowski (cf. Kozłowski 2007: 10). The most important in the context of Polish tradition of technological studies is his work *Skam 71. Zbiór rozpraw prahistorycznych* (Krukowski, Nowakowski 1976: 7–23, 24–66), with its own language created on the basis of Slavic languages. Krukowski's idea of research of flint technologies is put by using hundreds of words. Even in an attached dictionary appear colourful and idiosyncratic definitions in his own language. Today it is a huge problem for Polish archaeologists of the Stone Age because we cannot translate his work, but only understand his ideas and use in our archeological practice. However, a lot of his terms are in usage today.

During the latter half of the 20th c. archaeologists developed a *chaîne opératoire* (the corresponding Polish term is 'dynamic classification') for most of the flintworking traditions of the Late Palaeolithic and Mesolithic in Poland (Krukowski, Nowakowski 1976: 85–110; Schild, Marczak, Królik 1975: 12–32; Schild 1980: 60–66; Sobkowiak-Tabaka 2011: 13–24; Szymczak 1992: 3–14; Wąs 2005: 13–15, 19), setting apart and naming a series of distinctive products of core reduction (crested blades, platform rejuvenation flakes, core tablets, plunged blades/flakes, etc.). In the course of many years of research archaeologists succeeded in reassembling numerous products of core reduction and cleared up many specific issues, nevertheless more research is needed to clarify issues of internal technological differentiation of methods of blade production in the Late Palaeolithic and Mesolithic of the Polish Lowland zone. In this context, it is especially important to develop a detailed *chaîne opératoire* for the process of core reduction, that is, specifically, the production of blades.

This awareness started to intensify from the final decade of the 20th c., in response to the filtering of post-processual ideas into Polish archaeology (Rączkowski 2002: 11–15, 220–231). Parallel to the development of this line of thought a programme of technological studies was initiated which made use of new notions such as: concept, method, technique, technical procedures, as were new research methods based on refitting of products of reduction targeted on resolving specific issues (Tomaszewski 1986: 253–257). More sophisticated application of this research method in Poland was made by J. Fiedorczuk (1992: 13–15, 47–55; 1995: 61). An attempt to define criteria of selection based on analyses of morphology, with use made of input from actualistic research[2] connected with experimental flint-knapping was made by W. Migal (2006: 139).

One of more fertile theoretical lines of study that has gained in importance is cognitive archaeology, which has been evolving in many directions of research (Fiedorczuk 2006; Schiffer, Skibo 1987; Stout 2002; Tomaszewski 1988). On the one hand this particular line of thought calls for in-depth investigation of products of reduction; on the other, pursuing in-depth technological studies should refer to results of research of cognitive perspective.

In recent years with increased intensity archaeologists have been addressing issues related to learning and systems of transfer of knowledge (Stout 2002: 693–722). To date, on the level of understanding the evidence, attempts were made to distinguish between forms produced by skilled and unskilled knappers – 'master' and 'pupil' (Bamforth, Finlay 2008; Fischer 1990: 41–46; Högberg 1999: 83, 85, 94–103; Przeździecki 2006: 127–132; Stout 2002: 705–711). In the same time J. Apel (2001: 336) was much more interested in postprocessual-social perspective. My particular interest is in issues related to how individuals learned to organise the space of the flint nodule with regard to the question of technical and technological innovations, also those not used due to psychomotoric and culture habits (reflecting the general level of development of technology).

In these times the very original and highly advanced Swiderian technology with huge amount of blades and target points with sharp endings was shown by archaeologists (Cyrek 1996: pls. X:3, XI:9–11, XXII, XXIII:3; Kobusiewicz 1975: fig. 6; Chmielewska 1978: pl. XLI: 1,2,6; Libera 1995: pls. XXIX:1, XLI:3,6, XLII:9;

[2] Also the theoretical aspect of actualistic research was undertaken (Marciniak 1996: 12–24).

Schild 1975: pl. XCVII; Szymczak 1992: pls. XX:5, XXI:3). This technological phenomenon was easy to find (Dziewanowski 2006: figs. 1, 9:A,B; Migal 2006: figs. 6, 7; Sobkowiak-Tabaka 2011: figs. 140, 141, 146, 147; Szymczak 1992: pl. XXX), but it was much more difficult to prove the relation between pattern of cores and blades, as well as to conclude on the scientific ground that there was a precise 'mental template' of the blade (Dziewanowski 2006: fig. 9:C; Fiedorczuk 1995: 61–66; Migal 2006: 140; Szymczak 1992: 113).

Introduction to dynamic classification of technical procedures and their products

Classification of correction bladelets makes it necessary first to characterise other similar by-products of core reduction, by determining the range of contexts and the metric range of occurrence of this type of debitage. Contextual classification of products of reduction should cover a full range of technological phenomena attending the production of blades, independent of the chronological status and culture attribution of the assemblage (Ginter 1974: 28; Schild 1969: 3–15; 1980: 58–60; Schild, Marczak, Królik 1975: 12–21). In the context of planned cognitive research it should make easier the undertaking of an in-depth study of different concepts and their realisation, and in consequence, the passing to the level of quantitative studies of the same units of the technological classification.

Problems of methodology

Technological considerations can be perceived multi-dimensionally. The study of technical procedures and their products may be made on two different levels – i.e. focusing on the present context within actualistic approach, in which case, the level is theoretical and concerned with studying the nature of the evidence (perspectives of artefacts research). The second level is the prehistoric context – in which case, the matter is conceptual. The most difficult is to find the code of prehistoric material culture and translate it into the context of recent culture. The archaeologist must find the way to create one's own vision of ideas of the prehistoric knapper and understand the essence of prehistoric material culture. In this case we start to study semiological aspects of material culture at all.

The theoretical and the conceptual aspects require the most complex terminology. In this area identifying and defining technological entities is not a problem.

Considerably more difficult is a correlation of the output from the technological considerations with the analysis of artefacts, where the object of observation and object of research are first of all single units: cores, blades, flakes, chips, etc. Unfortunately, at this stage of cabinet analysis we have insight only into the narrow range of the context of use of procedures and formations of blades, so the interpretation is weighted with a considerable probability of error. It may be more of a problem to validate the existence of procedures, already identified on the theoretical level, and attribute the products of reduction to specific groups. In case of dynamic methods of blade production a solution of the problems in classification could come from perceptive conceptual and experimental studies combined with theoretical studies. In practice, only by obtaining a series of refittings of debitage it becomes possible to make a detailed classification of the products of core exploitation. A more serious challenge may be demonstrating the application of a specific manner of shaping the convexity of the flaking surface by detaching a series of blades/bladelets, each time alternated with abrasion of the striking platform edge. The presence of such procedures was determined, thanks to time-consuming refitting of very small Swiderian products from Site Dręstwo 37 (Dziewanowski 2006).

Description of the products and their context of origin (cf. Classification list)

Conceptually unspecified

Quite a few products of core reduction are rather difficult to classify. Forms originating from incorrect blows have been defined as accidental (Migal, Wąs 2006: fig. 3). In this group I include base flakes (the result of splitting of the product with the plane remnant platform perpendicular to the morphological axis) and side flakes (resulting from the flaking off a chip or bladelet on one side of the product). Detachments of the described type are easy to identify in assemblages characterised by intensive use of procedures such as trimming and abrasion. Another type of detachment resulting from incorrect estimation of the angle and force of the blow used during blade removal are top flakes. They are hard to distinguish from correction debitage. Their only distinctive feature may be concentrations of waves of percussion seen on their ventral surface. Unlike in case of detachment of bottom and side flakes, which only rarely results in the deterioration of parameters of the flaking surface, top flakes have a negative effect on the dynamics of the series and usually made it necessary to remove correction bladelets.

In the group of blades we also find many quite large forms which for various reasons do not satisfy the criteria of selection, although quite frequently they are used as tools (Fiedorczuk 1995: fig. 1:d). These are mostly products resulting from incorrect configuration of parameters of the core – i.e., the presence of convexities and angles.

A separate classification group are hinged flakes and blades and their derivatives – so called step fractures, of various sizes.

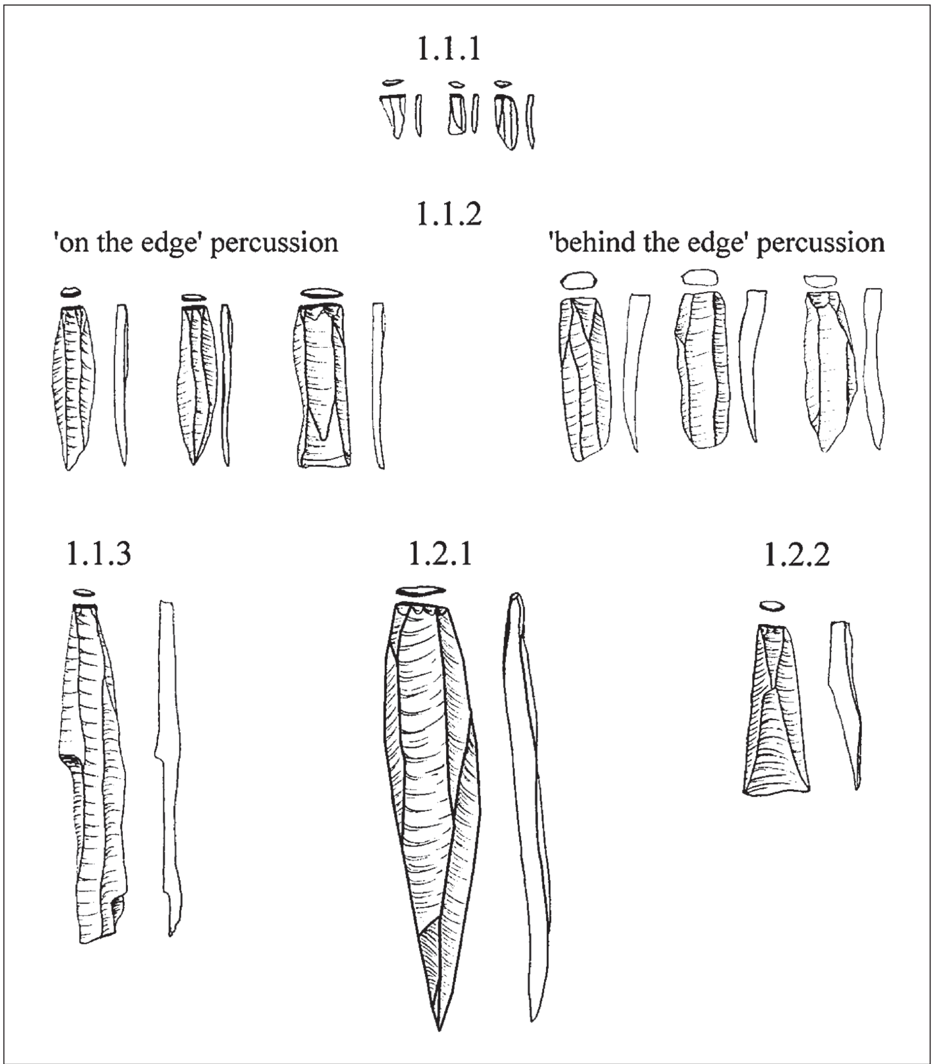


Fig. 1. Products of the advanced stage of core reduction (Drawing M. Dziewanowski)

Ryc. 1. Produkty debitażu z zaawansowanego etapu rdzeniowania wiórowego.

Predetermining debitage[3] – also a group of correction debitage (Figs. 1, 2)

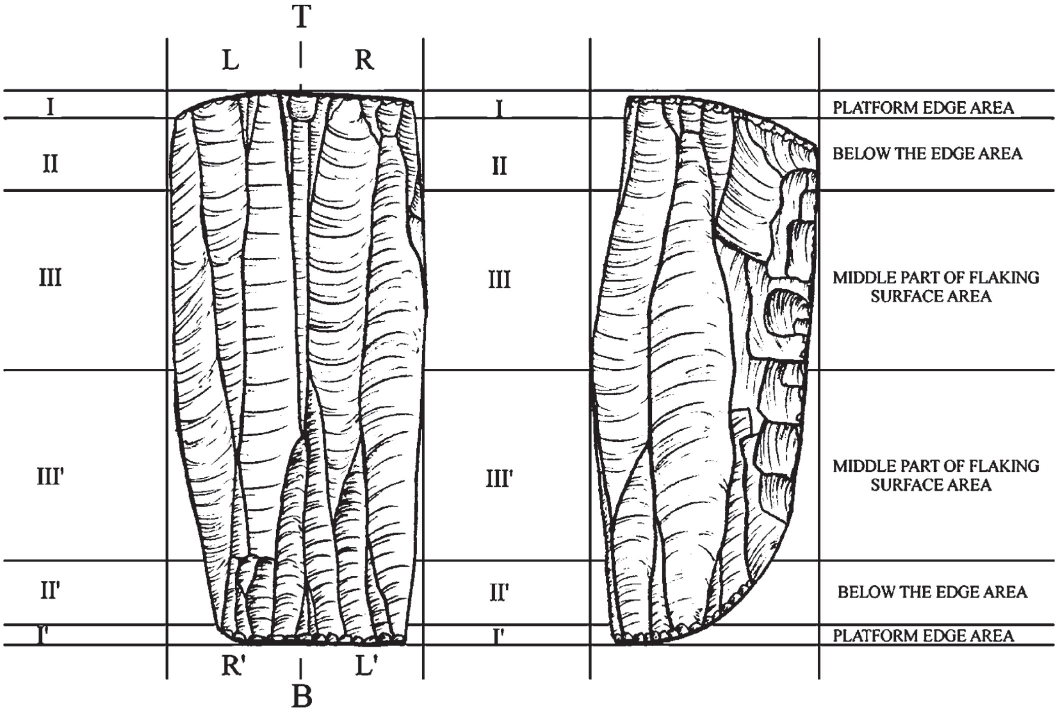
Most often in this group we encounter small-sized forms which are by-products of the process of trimming and abrasion. In the present study this procedure is understood as applying strong pressure to the edge of the striking platform, possibly with a soft blow meant to make it more even, resulting in the detachment of chips and microchips.

I called 'correction bladelets' a distinctive group of microblades, bladelets, flakes, chips, detached by soft blows placed to an abraded and trimmed striking platform edge (Dziewanowski 2006: figs. 1:a, 8).[4] If, as a result of repeated rejuvenation, the striking platform had developed ridges, then the bladelet may have a broad remnant platform with numerous scars.[5] A definite majority of products have a flat single platform, what shows preparation of the core platform by one blow at the beginning of production. Traits associated with double-platform cores are seen

[3] Predetermining debitage understood as an effect of deliberate intention. These products can function on one or more technological levels.

[4] *There is evidence of care taken to obtain blanks of proper form expressed by* [...] *a relatively frequent adjustment of the core platform edges. This involved the removal by very fine detachments of irregularities which developed during removal of successive series of blanks* (Ginter 1974: 28; transl. by the author).

[5] In other Late Paleolithic technologies this phenomenon is not so clear and preparation style of the core platform for long production is not so conservative.



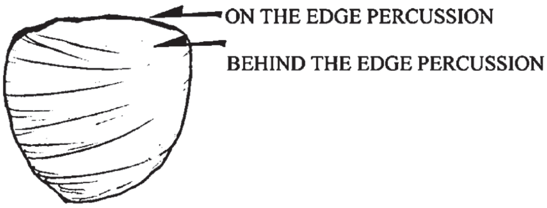


Fig. 2. Spatial context of origin of debitage forms (Drawing M. Dziewanowski).

Ryc. 2. Lokalizacja przestrzenna produktów rdzeniowania wiórowego.

only occasionally in case of detachment of a longer blade. In such case the procedure of correcting was used mainly to increase the convexity of the flaking surface (Sulgostowska 1989: pl. LXI:4).

Another form are blades taken off to remove hinges and horizontal convexities, i.e. to create a vertical ridge. This group called 'correction bladelets 1b' includes larger forms which have tips frequently exceeding ½ of the height of the flaking surface (Dziewanowski 2006: figs. 10:C, 7:A). Not infrequently they are hard to distinguish from products of intentionally unspecified blows targeted on obtaining tanged points.

Predetermined debitage[6]

This is a rather small group of blades and other products of core reduction which I describe as 'correction bladelets 1c' (Dziewanowski 2006: fig. 9:A,B). The group includes small-sized forms with traits indicating detachment from double-platform cores, resulting from the removal of scars of distal section of tanged blades.[7] They may

[6] Predetermined debitage understood as a conscious effect of precise intention of core reduction, specified rhythm, closely connected by a cause-and-effect sequence with the 'mental template' of the target tanged blade. Products of this type became an end in themselves as they were expected to increase the likelihood of obtaining a series of blanks having the desired parameters.

[7] I had hardly submitted my previous paper (Dziewanowski 2006) when I came across a clear cut example of the idea of correcting widely noted in early Neolithic lithic assemblages from Turkey dated to 8500–7500 BP. There, the counterpart of 'correction bladelets 1c' are the so-called 'upsilon blades.' These forms were consistently used as tools (Conolly 2003: fig. 5:7,22; Wilke, Quintero 1994: 43–60). Other examples of this type of product, presumably not intentional, may be found in the study of a late Ahrensburgian site of Oldehaske in the Netherlands (Johansen, Stapert 2000: figs. 13:6, 17:1).

have quite varied proportions and metric parameters (Fiedorczuk 1995: fig. 2:d,e; Sulgostowska 1989: pl. XXII:5). If they appear during reduction of larger core forms they themselves may satisfy the selection criteria and be used for tools, or by reason of their large size, may be utilised without additional retouch (Sulgostowska 1978: fig.7:e; 1989: pl. XXIV:11). In most cases the process of removing a correction blade had other purposes: it helped to correct the external angle and shaped the configuration of parallel ridges.

In many cases the removal of a tanged blade resulted in the development of a hump at the opposite platform. This hump was subsequently removed by a series of blows placed to the platform edge, each time preceded by trimming and abrasion. Much less rarely used was a blow placed accurately on the surface of the striking platform,[8] only initially assisted by abrading the platform edge. In such cases, the correct classification of products of reduction needs to be supported by findings from refitting. Although the context of origin of the discussed series of debitage is similar to that of 'correction bladelets 1c,' most products should be classified as group 1a.

Evidently, the principal representative of predetermined debitage is the target blade (mainly tanged points), having a definite range of proportions and dimensions, as well as – presumably – also the desired configuration of convexities of its outline, profile, etc. (Dziewanowski 2006: fig. 9:A,B; Fiedorczuk 1995: fig. 1:e,c; Migal 2006: 141–143).

The conceptual context

Many years of study of the technological aspect of Polish assemblages helped to identify several methods differing on the level of the general intention of obtaining blades (Migal 2002: 255–264; 2006: 137–140; Dmochowski 2002; Wąs 2005). As examples of a different strategy it is possible to indicate:

1. Strategy of three blows – idea of the target blade in the Lyngby technology (Migal 2006: 138–139).
2. Strategy of continuous removal of blades/bladelets (Mesolithic pressure flaking technology, pressure flaking technology for production of macrolithic blades in the Funnel Beaker Culture, a large group of technologies using indirect percussion).
3. Internally highly complex 'Swiderian technology' with a conservative option of obtaining blades having strictly defined parameters.
   3.1. Option associated with a large quantity of predetermining debitage.
   3.2. Option targeted on obtaining the largest number of blades satisfying a specific function without further treatment.

These differences are quite often in a cause-and-effect relationship with one type of technique or a set of such techniques. These in turn may have a similar effect on the range and diversity of technical procedures employed, such as core platform rejuvenation, faceting, trimming, abrasion/polishing, and chipping. On them in turn depends the clarity of the realisation and ease in distinguishing individual types of products. The named categories of forms may be divided further into subgroups by the nature of treatment of the area near the platform edge.

Conclusion

In this article I only outlined the selected aspects of the study of methods of blade production made from a cognitive perspective and filled in the details on the concept of correction debitage. The postulate of a technical approach seems particularly important now, when different theoretical trends are developing intensively and in a constant flux, evolving within diverse research disciplines and when, at the same time, there is a growing need to transfer research issues which have surfaced within these trends to the field of experimental flintknapping. Results of recently carried out 'in-depth reading' technological analyses have demonstrated that the cognitive trend may be particularly rich in insight. The development of understanding of flintknapping technology within the cognitive trend is dependent on intensification of research on technical procedures and their products, and as such, enriching the vocabulary of names of products of these procedures, without which it will be difficult to move freely across the research problems. Continuation of inquiry in the indicated direction will no doubt lead to the increase in number of units of technological classification of traditions, styles and technological trends of the Late Palaeolithic and the Early Mesolithic. In consequence, our present set of notions of dynamic

[8] A large number of specimens of blade forms with traits indicating detachment from a double platform core are illustrated in the study of the flint knapping workshop at Winduga (Cyrek 1976: pls. III:5,6, IX:1,4,6). The majority of interesting forms were classified to Group IV according to R. Schild (1969: 3–15).

classification concepts on the 'macro' level (method, concept, technique, technical procedures) will also have to grow.

In the context of the study of culture processes on the Polish Lowland territory it is worth pointing to the radical change in the meaning and function of correction bladelets at the transition from the Palaeolithic (Galiński 1999: 26–30; 2000: fig. 1:7–15; 2007; Galiński, Jankowska 2006: 107–127) to the Mesolithic (Dziewanowski, Dmochowski 2006: figs. 2, 3; Galiński, Jankowska 2006: figs. 34:1,2,3, 49:6). Also worth noting is the concurrent change in the attribution of these products to groups defining intentionality of action, i.e., predetermining/predetermined debitage. With time, also the range of meaning of these groups of superordinate classification is changed, in connection with the change in the relationship between technological levels.

At the end we must ask a question if it is possible that in assemblages from the Polish so-called Swiderian Culture appear traces of a very precise concept of production of blades with pointed tips, connected with a concept of 'correction blades of Type 1c.' This issue needs to be continued on more collections with method of refitting.

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Classification list

I. Products of the advanced stage of core reduction (**Fig.1**).
- 1.1. Predetermining debitage products.
  - 1.1.1. Trimming and abrasion products.
  - 1.1.2. 'Correction blades/bladelets 1a.'
  - 1.1.3. 'Correction blades/bladelets 1b.'
- 1.2. Predetermined debitage products.
  - 1.2.1. Blanks (tanged point blades, burin blades, etc.).
  - 1.2.2. 'Correction blades/bladelets 1c.'
- 1.3. Occasional blades.
  - 1.3.1. Top flakes.
  - 1.3.2. Base flakes.
  - 1.3.3. Side flakes.

II. Spatial context of lithic actions and their products (**Fig. 2**).
- 1. Correcting the configuration of convexities of the flaking surface in the platform edge area.
  - 1.1. Accentuating the point of percussion and adjusting the platform edge – trimming (trimming and abrasion products)
  - 1.2. Forming a spur at the platform edge and/or constricting the ridge (Dziewanowski 2006: fig. 8 – 'correction bladelets 1a').
  - 1.3. Pushing back the point of convergence of force (Dziewanowski 2006: fig. 10:C2 – typically, by striking off thin flake-blades and flakes – 'correction bladelets 1a').
  - 1.4. Removing scars of apexes of blades – see 'correction bladelets 1b' (Dziewanowski 2006: fig. 9:A,C).
- 2. Correction of the configuration of the convexity of the flaking surface in the medial section of future blades and around the middle of the flaking surface.
  - 2.1. Increasing the convexity of the flaking surface.
    - 2.1.1. On the L/R axis ('correction 1b,' blanks – target blades).
      - a) increasing convexity of the flaking surface by clearing the margins (Dziewanowski 2006: figs. 7:C, E2a,2b).
    - 2.1.2. On the T/B axis (trimming and abrasion debitage, 'correction debitage 1a, 1b, 1c').
      - a) removing hinges and other irregularities (Dziewanowski 2006: fig. 10:C).
      - b) creating vertical convexities (ridges between scars left by removals).
      - c) broadening the flaking surface.

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Klasyfikacja produktów eksploatacji wiórowej – wybrane aspekty badań nad technologią w zespołach świderskich

Prezentowany artykuł zawiera podsumowanie studiów nad późnopaleolitycznymi zespołami kultury świderskiej, charakteryzującymi się dominacją koncepcji rdzenia wiórowego dwupiętowego wspólnoodłupniowego i wiórów o soczewkowatym zarysie. Autor podjął próbę zrozumienia wskazanej technologii w ramach nurtu kognitywnego studiów technologicznych. Przemyślenia autora były realizowane zgodnie z polską tradycją badań nad procesem produkcyjnym, w ramach sformułowanej przez R. Schilda idei „dynamicznej klasyfikacji technologicznej".

Wnioski z koncepcyjnych studiów nad świderską ideą kształtowania rdzenia autor weryfikował poprzez doświadczalną realizację „koncepcji świderskiej" z wykorzystaniem różnych technik, gestów, procedur technicznych i surowców krzemiennych. W rezultacie wieloaspektowych rozważań uzyskano obraz interakcji między działaniami wytwórcy, służącymi produkcji wiórów, oraz zmianami układu kątów i wypukłości obrabianej bryły. Przeprowadzone studia umożliwiły sformułowanie listy kategorii wyrobów powstających w trakcie formowania odłupni, sprzyjających pozyskaniu prostych wiórów o punktowych piętkach i ostrych wierzchołkach. Podstawowy element konstrukcyjny proponowanej klasyfikacji stanowi podział produktów rdzeniowania na debitaż predeterminujący i predeterminowany. Pierwsza grupa wyrobów służyła kształtowaniu wypukłości odłupni i tworzeniu kątów pomiędzy odłupnią i piętą. Należące do tej grupy „wióry korekcyjne 1a" zmieniały wskazane parametry jedynie w partii przypięciskowej odłupni, zaś „wióry korekcyjne 1b" mogły przechodzić przez środkową część odłupni, zdejmując struktury zawiasowe. Druga grupa wyrobów jest reprezentowana przez półsurowiec wiórowy, pełniący bez retuszu funkcję narzędzi lub w pierwszym rzędzie przeznaczony do modyfikacji narzędziowej. Specyficzny wariant „wiórów korekcyjnych 1c" zaliczono do grupy debitażu predeterminowanego z uwagi na bezpośredni związek tych okazów z ideą produkcji wiórów liściakowych.

Przeprowadzone studia wyjaśniły obecność w późnopaleolitycznych pracowniach dużych ilości wiórów oraz wskazały nowe kierunki studiów nad późnopaleolityczną technologią produkcji wiórów. W świetle wyników badań produkcję wiórową należy postrzegać nie tylko w kategoriach działalności utylitarnej, związanej z produkcją narzędzi, ale również kształtowania wiedzy technologicznej i wyobraźni przestrzennej ich wytwórców.