Manufacturing rectangular-sectioned axes in a Corded Ware culture in the light of refittings at Wilczyce 10, district Sandomierz (Poland)

Výroba seker s obdélníkovým průřezem v kultuře se šňůrovou keramikou ve světle skládanek z Wilczyc 10, okr. Sandoměř (Polsko)

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Site Wilczyce is situated on Sandomierz Upland in the south of Poland. It was discovered in 1994 during a systematic archaeological survey within the project Archaeological Picture of Poland. The flint material constituting the source database for the analysis of the production of rectangular-sectioned axes was excavated during the exploration of feature No. 11. The collection of flint artifacts consists of 271 items. In course of laboratory works refitted were 13 blocks, each counting from 2 to 26 elements.

Poland – Late Neolithic – Corded Ware culture – rectangular-sectioned axes

Lokalita Wilczyce leží na Sandoměřské vrchovině na jihu Polska. Byla objevena v roce 1994 během systematického průzkumu v rámci projektu „Archeologiczne Zdjęcie Polski". Pazourkový materiál, který představuje zdrojovou databázi pro studium výroby seker s obdélníkovým průřezem, byl získán výzkumem struktury č. 11. Soubor zahrnuje 271 pazourkových artefaktů. V průběhu laboratorního zpracání bylo složeno 11 bloků, které sestávaly ze 2 až 26 elementů.

Polsko – mladý neolit – kultura se šňůrovou keramikou – sekery s obdélníkovým průřezem

Introduction

The Wilczyce site located on the Sandomierz Upland was discovered in 1994 during a systematic archaeological survey (the survey was a part of a large national project entitled *Archaeological Picture of Poland*) by H. Kowalewska-Marszałek from the Institute of Archaeology and Ethnology of the Polish Academy of Sciences (*fig. 1: 1*; *Kowalewska-Marszałek – Włodarczak 2002*, 21).

The site is situated on the top of a loess hill in the Opatówka Valley. Excavation research led by Dr. Jan Fiedorczuk began in 1998 and was continued after his death by Prof. Romuald Schild. The excavations lasted until 2010 and a few years after their completion a monograph of the site was published (*Schild 2014*). The unique and spectacular discovery related to the Magdalenian culture settlement, published in many foreign journals as well (*Fiedorczuk et al. 2007*; *Irish et al. 2008*; *Boroń 2010*; *Boroń – Królik – Kowalski 2011*), inspired the local government of the Wilczyce community to exclude this area from agricultural activities. This allowed to continue the excavations and concentrate on the Neolithic settlement (*Boroń 2013*, 131–135).

Flint artifacts, being the source material of this paper, were found during the exploration of feature No. 11 – the so called "combustion feature" ("piecowisko"). This was an elongated

pit – 250 cm long, 150 cm wide and 50 cm deep (*fig. 1: 2*). Its bottom consisted of oxidized primary loess, orange in color (*fig. 1: 3*). Revealed pottery fragments indicate the presence of Corded Ware culture. Such features occur most often near grave constructions, as can be observed in the case of Wilczyce 10, where two burials of the Corded Ware culture were discovered: one niche grave (feature No. 15), one flat grave (feature No. 28) and three "combustion features" – features Nos. 1, 11 and 16.

Materials and methods

Problems related to manufacturing and use of bifacial and rectangular-sectioned axes were often discussed – in Polish as well as in foreign literature (*Balcer – Kowalski 1978*; *Arnold 1981*; *Olausson 1983*; *Kopacz – Pelisiak 1988*; *Borkowski et al. 1991*; *Borkowski – Migal 1996*; S*ałaciński – Migal 1997*; *Mitura 2007*; *Augereau 2012*; *Pelegrin 2012*). In general, there are five stages in the production of axes – the choice of a suitable nodule (Phase 1), shaping it (Phase 2–4) and in the end – polishing the surface (Phase 5; *Hansen – Madsen 1983*; *Beuker 1986*). According to other archaeologists the process may be limited to three stages: 1) preparation of raw material nodule; 2) shaping the four sides and giving the implement its final shape; 3) fine processing – the cutting edge and head being given their final shape (*Migal – Sałaciński 1996*, 124; *Haßmann 2000*, 154).

The attempt to reconstruct the production technology of rectangular-sectioned axes on the site Wilczyce 10 is based on the technological and morphological analysis of flakes and refitted blocks. An important point of reference are the results obtained by experimental production of these flint forms.

The flint collection from feature 11 consists of 271 items. The prevailing part of them, about 224, have no traces of cortex. Unidirectional dorsal scars are visible on 210 flakes, while scars in two or more directions can be found on 61 of them. All the finds were made of raw material from Świeciechów.

Seven types of butts were distinguished: cortical, natural, plain, dihedral, faceted, linear and punctiform. Most numerous are flakes with plain butts (*table 1*). On the diagram showing the length/wide ratio, the prevailing set of points appears within the range of 15 to 25 mm – length and width. Beyond this range the number of points considerably decreases (*fig. 2*). The variations of size are the smallest in the group of flakes with faceted and punctiform butts. Similar relatedness was also noted between the thickness of flakes and the butt types. The lowest point dispersion on the diagram was noted among flakes with faceted butts (*fig. 3*).[1]

Type of butt	Number of specimens
cortical	29
natural	43
plain	129
dihedral	20
faceted	32
linear and punctiform	18

Table 1. Classification of butts.
Tab. 1. Klasifikace patek.

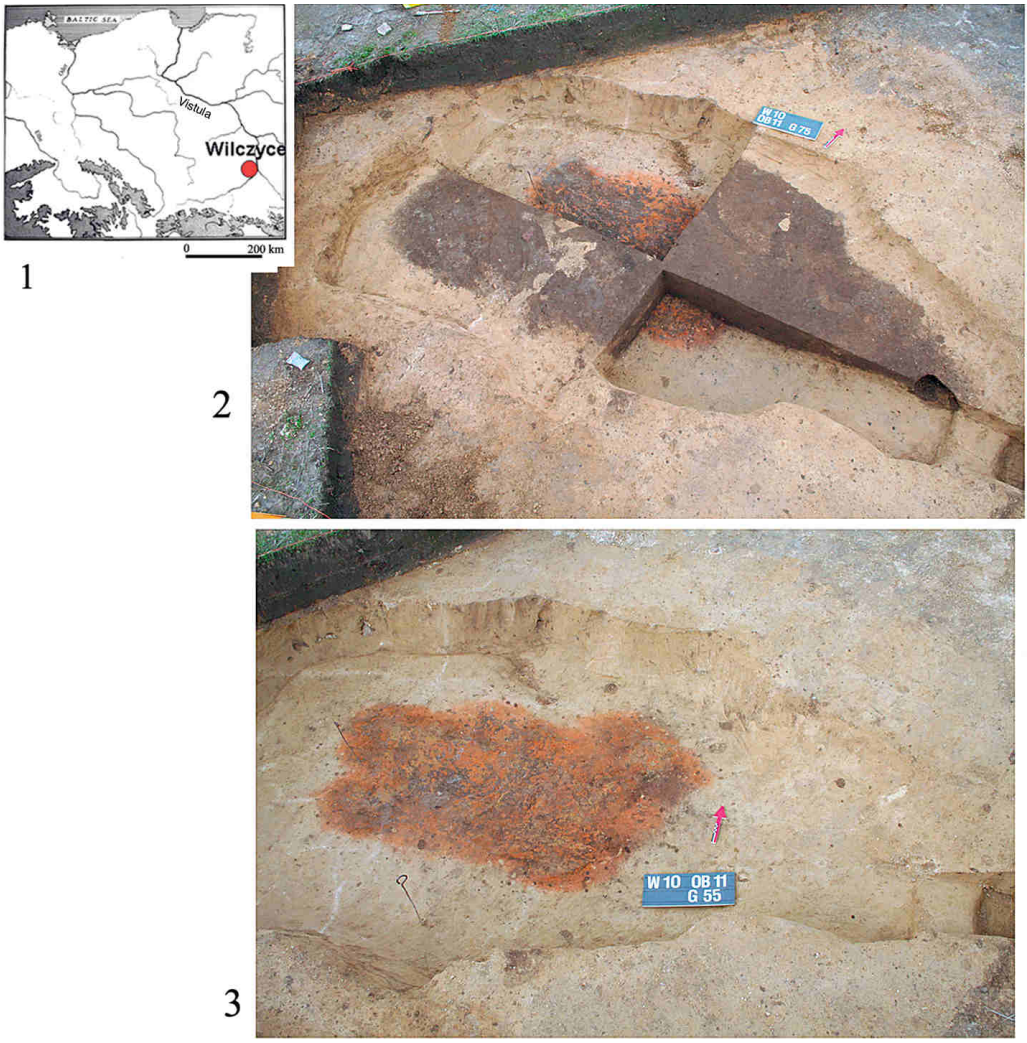

Fig. 1. 1 – geographical situation of Wilczyce; 2 – the feature 11; 3 – floor of the feature 11.
Obr. 1. 1 – geografická situace Wilczyc; 2 – objekt 11; 3 – dno objektu 11.

During the laboratory work, 13 blocks consisting of from 2 to 26 items were refitted:

Block No. 1. Consists of 26 flakes. Refitting the flakes resulted in reconstruction of two sides of an axe – the broad and the narrow side (*fig. 4*) – at the right angle.

Block No. 2. Three joined flakes formed a piece measuring 38 × 47 mm. The butts of flakes are natural and plain, with a shape resembling lens, while the bulbs – convex and large (*fig. 5: 3*).

[1] The difference between the flakes with faceted butts and all other types of butts would be more visible if the thickness was measured in the place of greatest bulb convexity – which was demonstrated on the example of flakes from block No. 1.

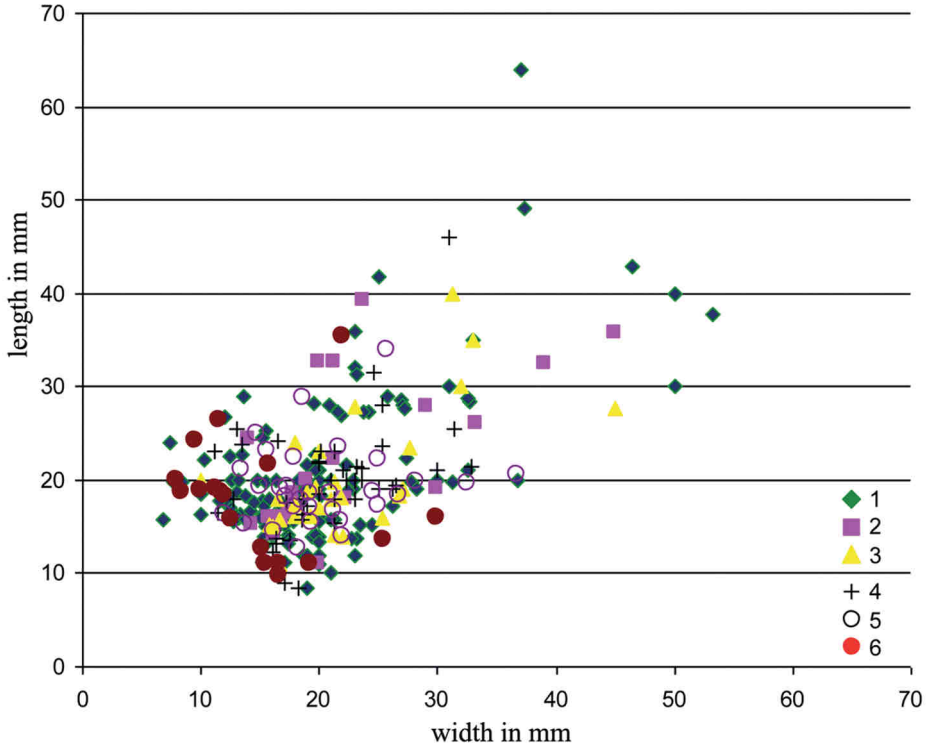

Fig. 2. Wilczyce, site 10, feature 11. Length-to-width ratio of flakes. 1 – flakes about plain butts; 2 – flakes about dihedral butts; 3 – flakes about cortical butts; 4 – flakes about natural butts; 5 – flakes about faceted butts; 6 – flakes about linear and punctiform butts.
Obr. 2. Wilczyce, lokalita 10, objekt 11. Poměr délka – šířka úštěpů. 1 – úštěpy s rovnou patkou; 2 – úštěpy s lomenou patkou; 3 – úštěpy s korovou patkou; 4 – úštěpy s přírodní patkou; 5 – úštěpy s fasetovanou patkou; 6 – úštěpy s lineární a bodovou patkou.

Block No. 3. Two reffited flakes with natural surfaces, two-direction scars, cortical butts and rather extensive bulbs gave a piece measuring 26 × 53 mm (*fig. 5: 5*).

Block No. 4. Consists of two thin and flat refitted flakes with two-direction scars and faceted, dihedral butts. The obtained refitting is 40 mm long and 39 mm wide (*fig. 6: 3*).

Block No. 5. Refitting of three single-direction flakes with faceted and plain butts formed a piece 20 mm long and 46 mm wide (*fig. 6: 2*).

Block No. 6. A two-element-refitting of flakes with characteristic dihedral butts, extensive bulbs and two-direction scars on the obverse face. 36 mm long, 49 mm wide (*fig. 5: 7*).

Blocks No. 7 and 8. These are morphologically and technologically very similar two pairs of flakes. Their common feature is thinness and flat, slender longitudinal profile. They have dihedral and plain butts (*fig. 6: 5, 6*).

Block No. 9. A refitting of five flakes with two-direction scars. The obtained piece has a flat, wide surface measuring 37 × 46 mm. The flakes have lens shaped cortical butts; their bulbs are small. The distal part of the biggest flake bears scars from processing the adjacent face (*fig. 6: 7*).

Block No. 10. It is a refitting of four elements – flakes with single-direction scars. Its measurements are: 38 cm width and 20 mm length. The flakes have cortical butts; the bulbs sometimes extend beyond the half of the item's length. Their distal sections are slightly bent (*fig. 7: 2*).

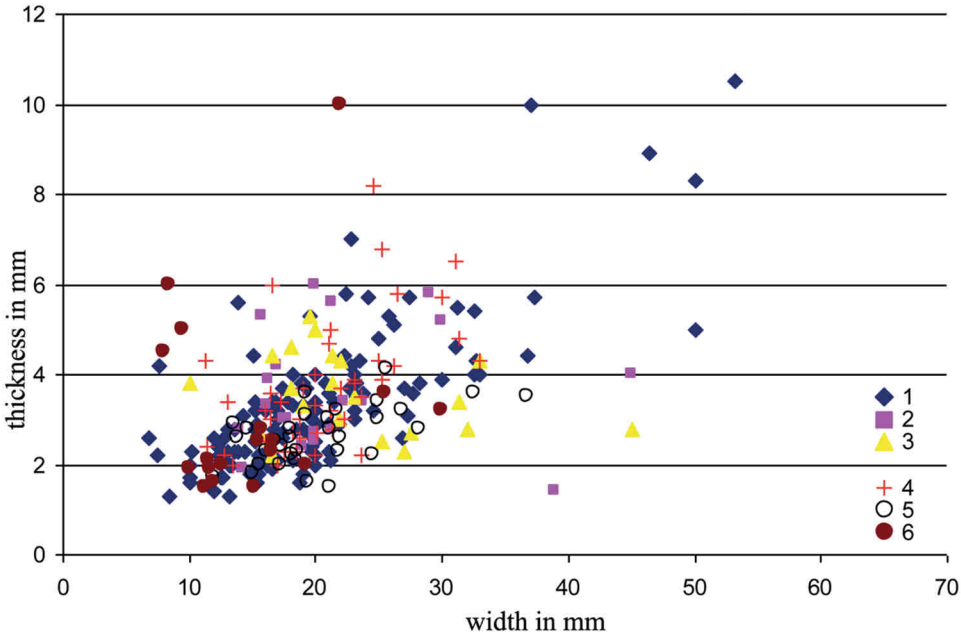

Fig. 3. Wilczyce, site 10, feature 11. Thickness-to-width ratio of flakes. 1 – flakes with plain butts; 2 – flakes with dihedral butts; 3 – flakes with cortical butts; 4 – flakes with natural butts; 5 – flakes with faceted butts; 6 – flakes with linear and punctiform butts.
Obr. 3. Wilczyce, lokalita 10, objekt 11. Poměr tloušťka : šířka úštěpů. 1 – úštěpy s rovnou patkou; 2 – úštěpy s lomenou patkou; 3 – úštěpy s korovou patkou; 4 – úštěpy s přírodní patkou; 5 – úštěpy s fasetovanou patkou; 6 – úštěpy s lineární a bodovou patkou.

Block No. 11. Consists of three flakes with bent distal parts. Their butts are natural, scars unidirectional and the bulbs are convex and extensive. Measurement: 22 mm long, 33 mm wide (*fig. 7: 3*).

Block No. 12. A refitting of two unidirectional dorsal scars flakes, with natural, lens shaped butts and rather large and extensive bulbs. Measurements: 24 mm long, 32 mm wide (*fig. 7: 5*).

Block No. 13. Consists of two flat and thin flakes with plain butts. The distal end has visible scars resulting from the preparation of the broad face. Measurements of the refitting: length 20 mm, width 30 mm (*fig. 7: 4*).

Manufacturing of rectangular-sectioned axes in the light of refittings

The second and third phase of axe manufacturing is best illustrated by block No. 1 (*fig. 4*; *7: 12*). The analysis of the reduction sequences proved that the initial stage of forming the axe's shape proceeded successively, i.e. firstly, one of the front and side faces were prepared simultaneously and subsequently – the two remaining ones. Preparation of the narrow side was carried out by means of a series of unidirectional removals, sometimes completed by a removal from the opposed face. The broad side was formed by removals coming from both lateral edges. Flakes obtained in this way often show significant thickness, large bulbs, which sometimes cover over the half of their length (measured according to guidelines

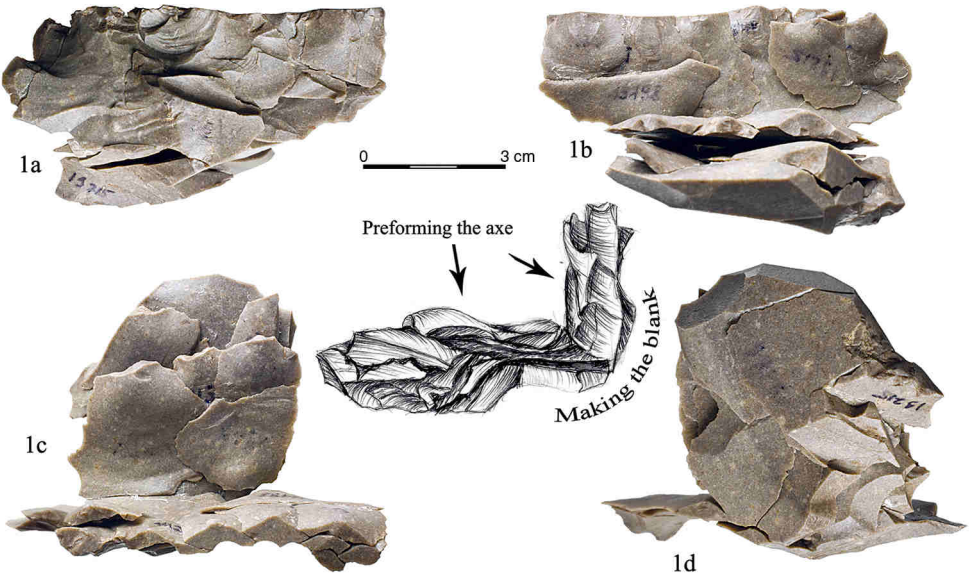

Fig. 4. Wilczyce, site 10, feature 11. Block No. 1 (drawing: E. Gumińska; photo: M. Osiadacz).
Obr. 4. Wilczyce, lokalita 10, objekt 11. Blok č. 1.

of *A. Högberg 2006*, 389), and wide butts – which are mostly natural, plain and dihedral. The angle between the butt and the scar-surface of the flake differs, depending on the surface of the axe. 10 flakes, each of the broad and narrow side, were refitted from this stage of processing.

Characteristic flake features indicate utilization of a hard hammerstone. Similar conclusions were drawn by experimental manufacturing of a flint axe (*Hansen – Madsen 1983*, 45; *Migal – Sałaciński 1996*, 125).

The third phase of producing an axe was similar in technique to the previous phases, however – it was far more precise. The change of technique resulted in smaller flakes with thinner and flat intersection, more delicate bulbs and mostly prepared butts, as is demonstrated by the dispersion of points in the diagram on *fig. 8*.

An essential feature distinguishing flakes at this stage of axe reduction is also the 90° angle between the butt and the flake's obverse face. The broad face, reconstructed on the basis of four refitted flakes, was formed with regular strikes from both lateral edges. Its width measures from 29 to 35 mm. The narrow side is about 25 mm thick. Two refitted flakes do not have the typical curved distal end.

It was observed that the block dimensions were considerably less reduced. In the third phase of forming an axe, the angle between both surfaces was around 90°.

Waste material of different morphology is certainly related to the change of flint working techniques. The final form was obtained by using an antler punch (*Hansen – Madsen 1983*, 45–46; *Migal – Sałaciński 1996*, 125).

Axe surfaces were ultimately formed in the last knapping phase. The straightness of edges was corrected and the axe-butt along with the point were shaped by removing small

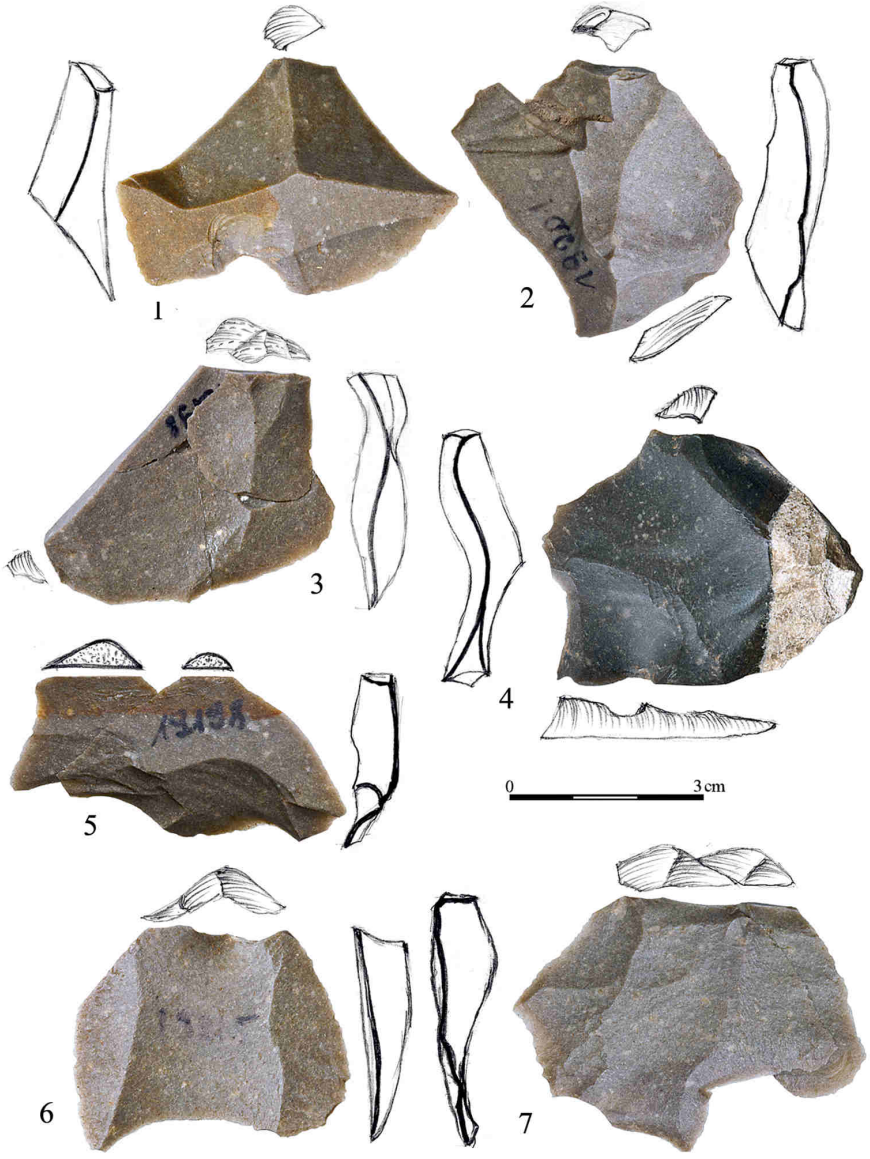

Fig. 5. Wilczyce, site 10, feature 11. Flakes: 1–5 – making the blank; 6–7 – preforming the axe (drawing: E. Gumińska; photo: M. Osiadacz).
Obr. 5. Wilczyce, lokalita 10, objekt 11. Úštěpy: 1–5 – příprava polotovaru; 6–7 – tvarování sekery.

flakes. There are a few instances of the presence of overpassed flakes, what is absent in case of experimental axes production (*Migal – Sałaciński 1996*, 127).

Scars over the axe surface are flat, in two directions, sometimes with a clearly selected point of punch application.

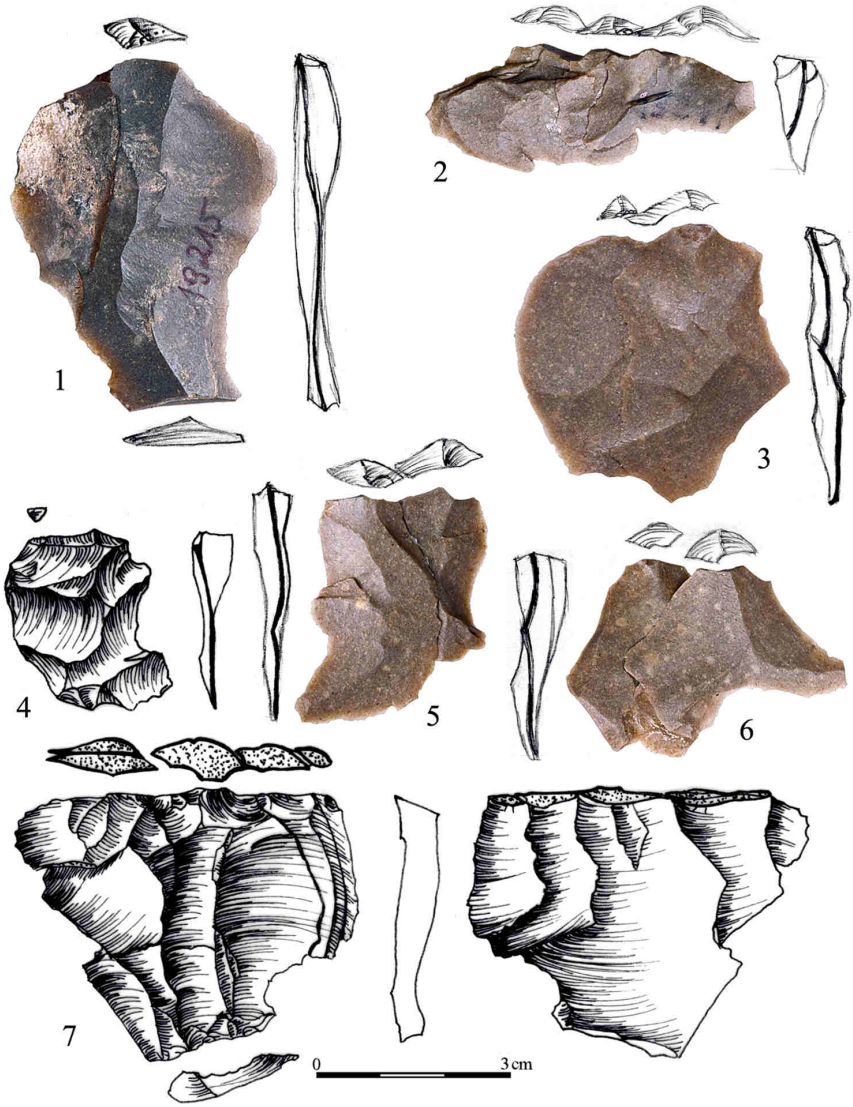

Fig. 6. Wilczyce, site 10, feature 11. Flakes: 1–2 – preforming the axe; 3–7 – final shaping of the axe (drawing: E. Gumińska, A. Pałasz; photo: M. Osiadacz).
Obr. 6. Wilczyce, lokalita 10, struktura 11. Úštěpy: 1–2 – tvarování sekery; 3–7 – dokončování sekery.

In case of the item shown on *fig. 9: 2*, one of the broad side was knapped before forming the narrow faces. If the form of a nodule determined and sometimes simplified the way of producing an axe (*fig. 9*), then perhaps not all production phases can be specified.

It seems that this type of knapping was used on site Wilczyce 10. As the evidence can serve the natural butts of flakes detached from the side surface and its relatively straight edge.

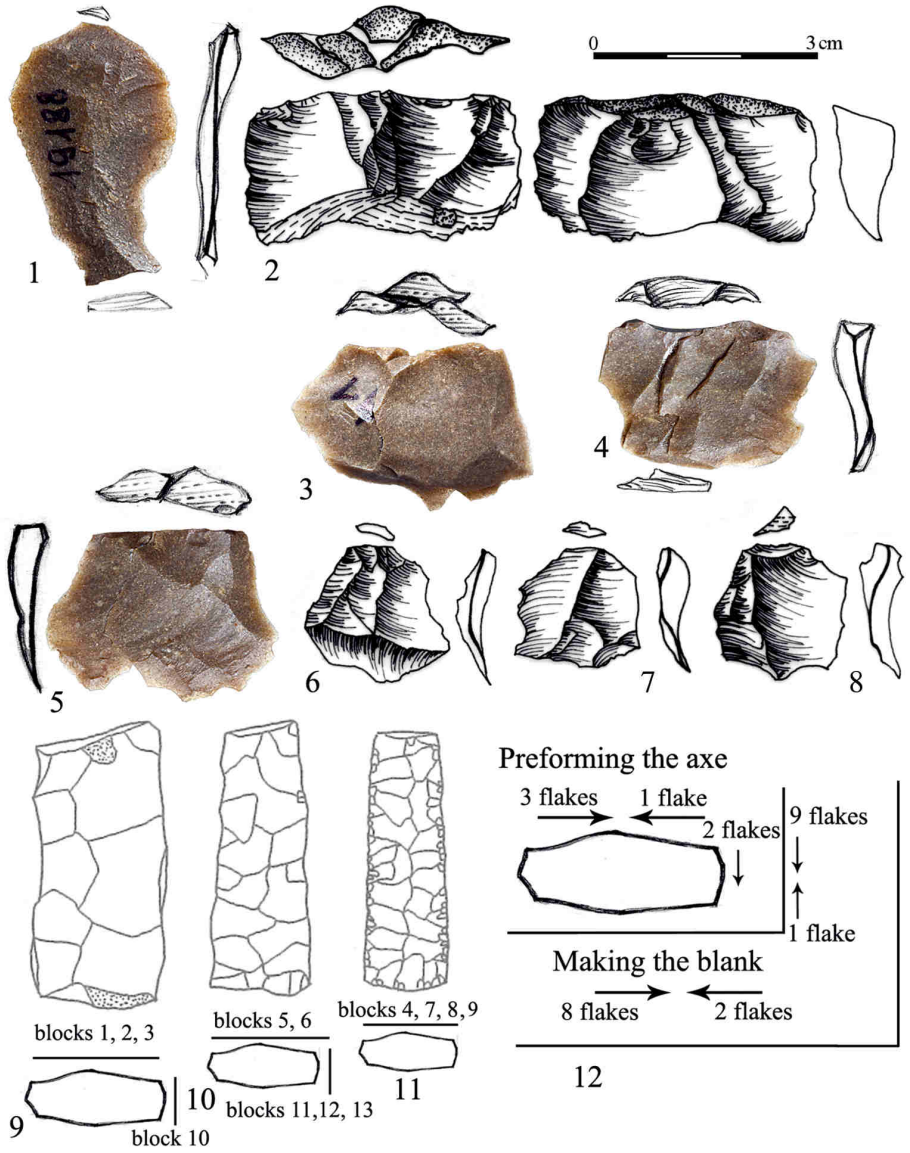

Fig. 7. Wilczyce, site 10, feature 11. Flakes: 1 – final shaping of the axe; 2–8 – flakes from forming the narrow side; 9–11 – stages in the manufacture of flint axes; according to *Hansen – Madsen 1983*, 45; 12 – block No. 1 (drawing: E. Gumińska, A. Pałasz; photo: M. Osiadacz).
Obr. 7. Wilczyce, lokalita 10, objekt 11. Úštěpy: 1 – dokončování sekery; 2–8 – úštěpy z tvarování úzké strany; 9–11 – stádia výroby pazourkových seker; podle *Hansen – Madsen 1983*, 45; 12 – blok č. 1.

It is very difficult to discern technical differences while comparing the size and the scar quality from the last phase of axe production to the flakes of block No. 1 from the third phase.

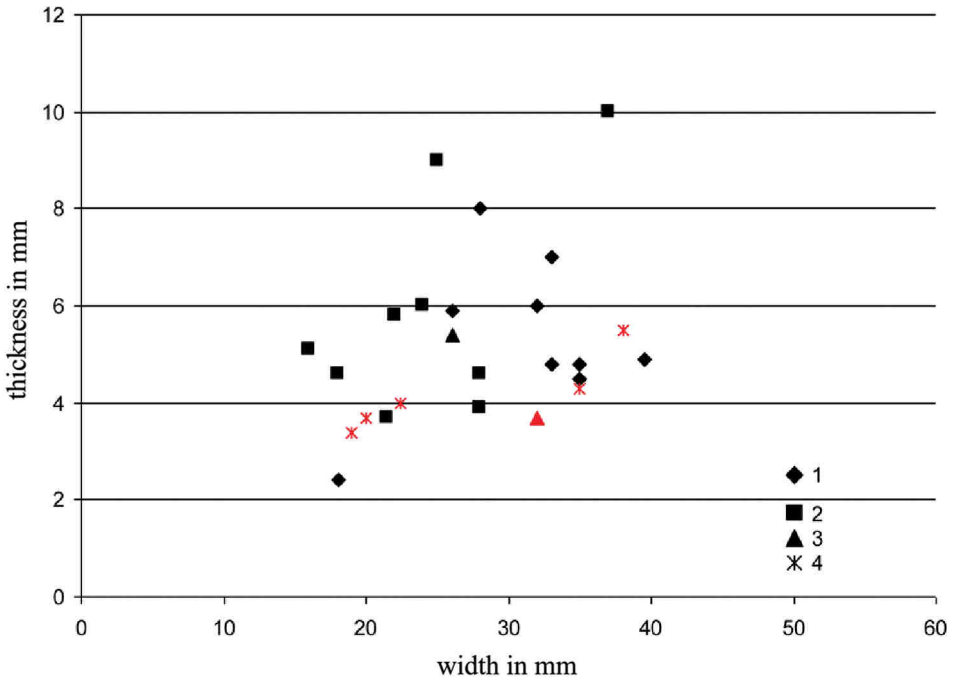

Fig. 8. Wilczyce, site 10, feature 11. Thickness-to-width ratio of flakes from block No. 1. 1 – flakes with plain butts; 2 – flakes with natural butts; 3 – flakes with dihedral butts; 4 – flakes with facetted butts. Red colour: flakes from preforming the axe.
Obr. 8. Wilczyce, lokalita 10, objekt 11. 1 – úštěpy s rovnou patkou; 2 – úštěpy s přírodní patkou; 3 – úštěpy s lomenou patkou; 4 – úštěpy s fasetovanou patkou. Červeně: úštěpy z první fáze tvarování sekery.

Results

Although the analysis is based on a relatively limited flint material, it is still possible to distinguish all the phases of axe production.

Making the blank. This category involves blocks Nos. 1, 2 and 3, as well as flakes (*fig. 4*; *5: 1–5*; *7: 9*). Main technological and morphological attributes observed in this group of flakes are: natural, plain and dihedral butts, big massive bulbs, significant thickness (over 5 mm) and the occurrence of natural or cortical face.

The flakes from block No. 10 result from forming the narrow side. They have cortical butts, while the distal ends have natural surface (*fig. 7: 2*).

Preforming the axe. Guidelines obtained from the analysis of block No. 1 allowed to select flakes and blocks with particular technological attributes (*fig. 5: 6–7*; *6: 1–2*; *7: 10*). The basis for their classification was: regularity of the butt outline, shallow flake scars, a rather flat longitudinal profile of flakes, right angle between the butt and the obverse face of flake.

Blocks Nos. 11, 12 and 13 were included in the waste material produced while working the narrow side. Their length shows that they cannot result from the last phase of axe processing (*fig. 7: 3–5*).

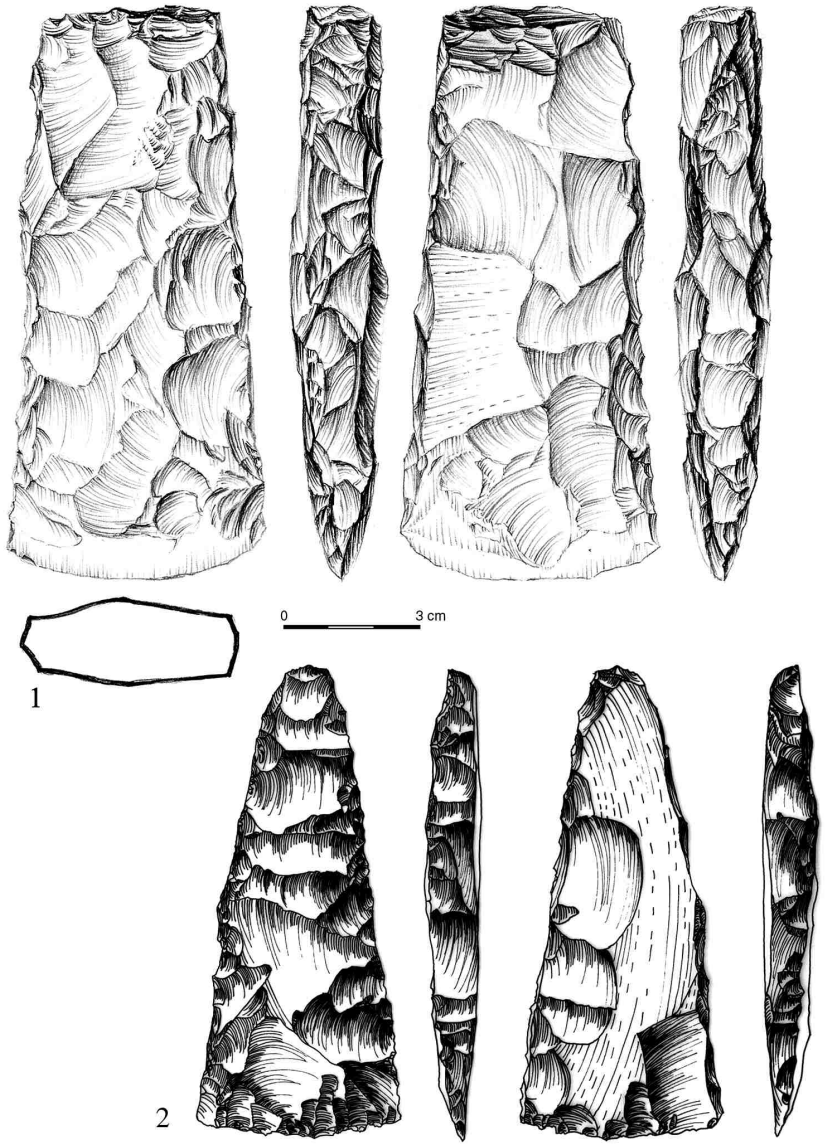

Fig. 9. Wilczyce, site 10, the Corded Ware culture: 1 – flint axe: feature 15; 2 – flint axe: surface find (drawing: A. Pałasz, E. Gumińska).
Obr. 9. Wilczyce, lokalita 10, kultura se šňůrovou keramikou: 1 – pazourková sekera: struktura 15; 2 – pazourková sekera: povrchový nález.

Final shaping of the axe. Unfortunately, there are no finds that would illustrate the last phase of axe-shaping in case of block No. 1. Nevertheless, it is possible to specify certain examples among flint material: blocks Nos. 4, 7, 8 and 9 (*fig. 6: 3, 5–7*) and flakes (*fig. 6: 4*; *7: 1*).

Flakes removed from the narrow side are curved at the distal end. The distal end shows scars resulting from forming the adjacent face (*fig. 7: 6–8*).

However, it is difficult to fit the method of producing axes from the Wilczyce site into the model obtained in the process of experimental manufacturing of such items.

Final remarks

In the Kraków-Sandomierz group of Corded Ware culture, including also Site Wilczyce 10, over 67 % of axes found in graves were produced from Świeciechów flint (*Włodarczak 2006*; *Budziszewski – Włodarczak 2011*, 60).

As it can be exemplified on the axes from Wilczyce (*fig. 9*), the nodules for their production were sometimes obtained from the geological exposures and pits. Therefore, it is possible to find the remains on the surface in form of natural chaps.

The analysis of refits and flakes has shown that the axe production included all the production phases. This is not always the case. The studies of *P. Mitura* (*2007*, 316) and *A. Högberg* (*2009*, 40–41) proved that the axes after their initial reduction were transported to another locality.

During the experimental production of rectangular-sectioned axes, in the "full core formation" detached about 300 flakes. Block No. 1 has 26 of them. One may reasonably assume that this is around 10 %.

However, considering the fact that possibly only three surfaces were shaped (and the fourth only corrected), the number of detached flakes could be substantially lower than 300. Therefore, the amount of semi-raw material left would indicate the production of only 1–2 axes. This is a premise pointing to a local character of this manufacturing.

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Výroba seker s obdélníkovým průřezem v kultuře se šňůrovou keramikou ve světle skládanek z Wilczyc 10, okr. Sandoměř (Polsko)

Lokalita Wilczyce v Sandoměřské vrchovině byla objevena v roce 1994 v rámci povrchových průzkumů H. Kowalewské-Marszałek. Kamenný materiál byl získán při výzkumu objektu 11, tzv. pecovité struktury – protáhlé jámy o délce 250 cm, šířce 150 cm a hloubce 50 cm (*obr. 1*).

Pokus o rekonstrukci technologického procesu výroby seker s obdélníkovým průřezem se opírá o technologicko-morfologickou analýzu úštěpů, složených bloků i experimenální výrobu. Soubor kamenných artefaktů ze struktury 11 čítá 271 ks, které jsou vyrobeny ze silicitu typu Świeciechów.

Na grafu poměrů délek a šířek je zřetelný shluk bodů v oblasi od 15 do 25 mm délky a šířky (*obr. 2*). Nejmenší rozdíly velikosti jsou ve skupině úštěpů s patkami fasetovanými a bodovými. Podobná závislost byla pozorována také mezi tloušťkami a typy patek. Nejmenší rozptyl bodů je zřejmý u úštěpů s patkami fasetovanými (*obr. 3*). Během laboratorních prací bylo rekonstruováno 13 bloků čítajících od dvou do 26 kusů.

Ačkoliv analýza je založena na poměrně malém množství materiálu, lze na jeho základě rozlišit všechna stadia výroby sekery:

Výroba polotovaru. Do této kategorie patří bloky č. 1, 6 i 11 a také úštěpy (*obr. 4*; *5: 1–5*; *7: 9*). Hlavní technologické atributy u této skupiny úštěpů jsou: přirozená, rovná nebo lomená patka, velké masivní bulby, výrazná tloušťka (přes 5 mm) a přítomnost přirozeného nebo korového povrchu. Úštěpy z bloku č. 10 pocházejí z formování úzké strany (*obr. 7: 2*).

Tvarování sekery. Poznatky získané analýzou bloku č. 1 umožnily vyčlenit úštěpy a bloky s konkrétními technologickými atributy (*obr. 5: 6–7*; *6: 1–2*; *7: 10*). Mezi odpad z výroby úzké strany patří bloky č. 11, 12 a 13 (*obr. 7: 3–5*).

Dokončení sekery. Žádný artefakt z této fáze nebyl přiložen k bloku č. 1. Nicméně s vysokou pravděpodobností lze této fázi přiřadit bloky č. 4, 7, 8, 9 (*obr. 6: 3, 5–7*) a úštěpy (*obr. 6: 4*; *7: 1*). Úštěpy odbíjené z úzké strany jsou zakřivené na distálním konci, kde jsou patrny negativy odštípnutí z přilehlé plochy (*obr. 7: 6–8*).

Překlad *Petr Škrdla*

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