

Exploitation and Processing of Cretaceous Erratic Flint on the Polish Lowland. A Case Study of Sites in the Vicinity of Gorzów Wielkopolski

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Abstract: For many years, the Polish Lowland was considered as an area lacking good quality flint material, as well as specific associated with its exploitation and initial processing. However, flint does appear here, in primary deposits which include *in situ* Upper Cretaceous formations, as well as glacial rafts deposited in younger Quaternary formations. One of the locations particularly rich in erratic flint material is without a doubt the region of Gorzów Wielkopolski. At least 7 sites associated with exploitation and initial processing have been identified in the vicinity of the city. They differ in terms of their function (mine-type flint workshops and flint processing workshops), as well as chronology (Late Palaeolithic, Mesolithic and Neolithic, mainly Funnel Beaker Culture). Despite research spanning over 40 years, the degree of identification of these types of sites in the Gorzów Wielkopolski area is still insufficient.

Keywords: Polish Lowland, Gorzów Plain, mine-type sites, workshops, erratic flint exploitation

Introduction

Issues associated with the exploitation of flint materials by prehistoric communities inhabiting the territory of Poland have been the subject of research of archaeologists for nearly 100 years. The discovery of natural deposits of banded and chocolate flint and the prehistoric mines associated with its exploitation stimulated Stefan Krukowski to distinguish the 'mining' and 'residential subfacies' within the Late Palaeolithic Swiderian culture and the distinction between residential sites from those associated with the exploitation of the material and its processing (Krukowski 1920, 1922, 1939/48: 101–102). Later detailed studies regarding the distribution and exploitation of deposits, processing and distribution of the material, as well as finished flint products created the possibility of distinguishing between 'near-home', 'near-mine' and 'in-mine' workshops (Ginter 1974; Ginter and Kozłowski 1975). Bogdan Balcer applied a slightly different functional separation in reference to Neolithic sites by distinguishing between 'flint mines', 'production settlements' and finally 'user settlements' (Balcer 1983: 30–31). Jacek Lech placed emphasis above all on issues associated directly with the exploitation of materials. Evidence of the exploitation of deposits or occurrence of the material is the fact that it was discovered on the premises of mines with their characteristic landscape (e.g. mining area) or flint workshops which processed flint. The workshops have a high volume of industrial flint scrap from initial processing phases, damaged

unfinished forms and natural material fragments (Lech 1981a, 1981b, 1983).

Siliceous resources of the Polish Lowland

Research on the functional variation of sites where flint or stone inventory appeared developed in the 1960s and 1970s, especially in areas where the initial deposits of the material had been discovered where it was possible to conduct relatively complete reconstruction of all the phases of the exploitation and production cycle (see for example Krukowski 1939/48; Ginter 1974; Schild 1975; Balcer 1975, 1983; Lech 1981a). In this backdrop, the Polish Lowland was for a long time considered as an area which was not only lacking good quality material, but also specific places associated with its exploitation and initial processing which is best reflected by the opinion stated by Stefan Krukowski: 'The Polish Lowland is a region of inferior value for stone cultures, due to poor flint and the lack of other materials which could have replaced it. For some it constitutes the edge of propagation or the final shelter and a degenerating place of slightly longer survival; for others – the soil of an impaired existence and an area passed along the way towards more alluring domains under the profound influence of direct factors, such as the migration of other peoples' (Krukowski 1922).

The Polish Lowland does however have its own flint material resources. Flint does appear here, in primary deposits which include *in situ* Upper Cretaceous

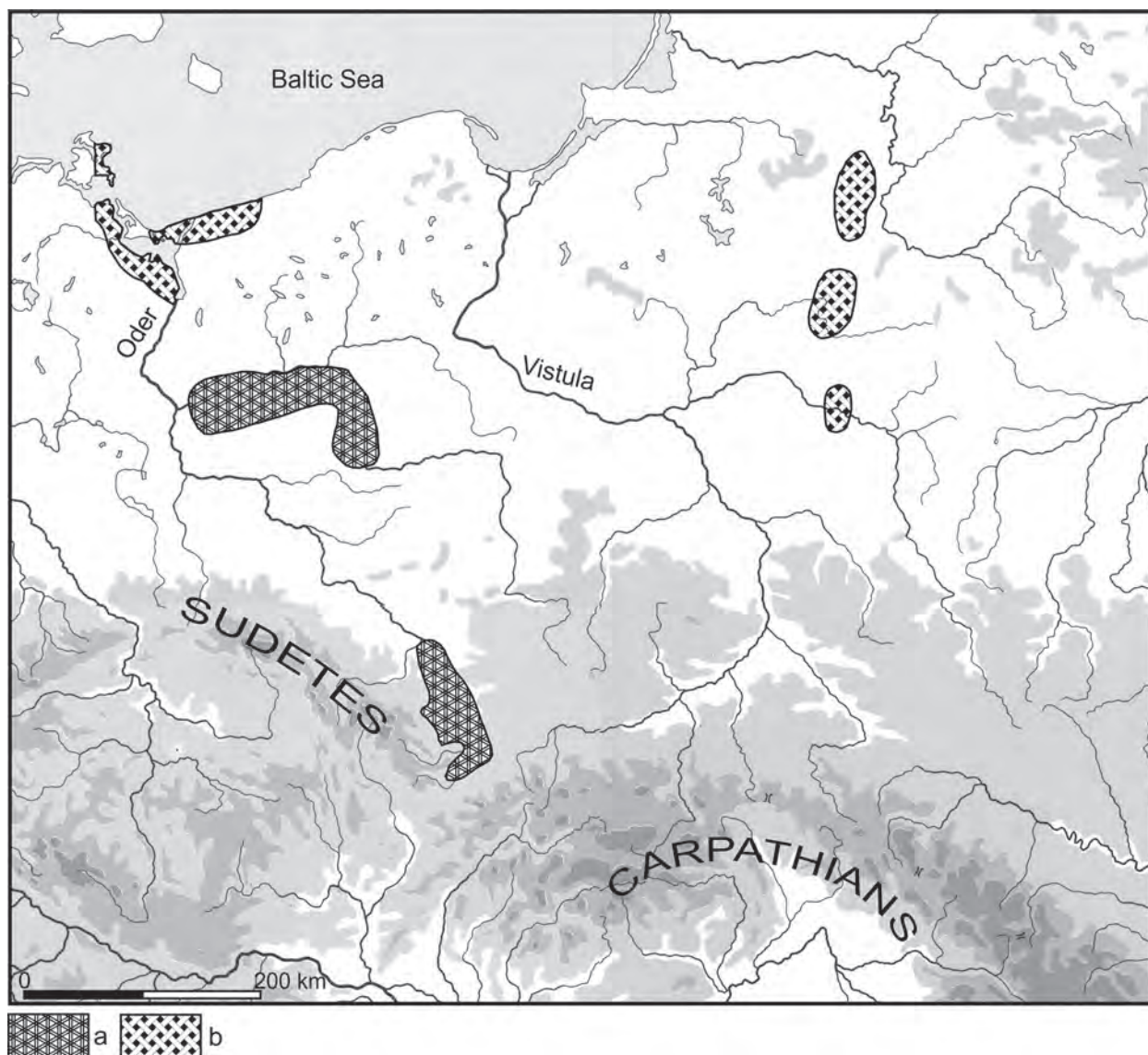


Fig. 1. Outcrops of flints on Polish Lowland. a – rich occurrences of erratic flint; b – concentrations of glacial rafts with Cretaceous flint; acc. to Sulgostowska 2005; Fig. 10; Bobrowski 2009a. Drawn: A. Tabaka.

formations, as well as glacial rafts deposited in younger Quaternary formations (Fig. 1). Secondary deposits of the material appear as larger or smaller accumulation of erratic flint of a Quaternary origin. Flint originating from the first type of deposit are generally better than erratic flint in terms of their technical characteristics.

Erratic flint appears throughout the entire area of the Polish Lowland which is the effect of the advance and regression of an ice sheet lobe during the Odra glaciation and Vistula glaciation periods. The distribution of the resources of the material which can be exploited is however not uniform. Above average enhancement of Quaternary formations into erratic flint of different fractions can especially be seen in those areas where initial material deposits appear. The largest known and compact accumulation of erratic flint materials appears

above all in the western and southwestern part of the Polish Lowlands – in the basin of the Oder River and in the eastern part of the Lowland, east of the Vistula valley in the Podlasie valley.¹

In certain areas of the Polish Lowland, archaeologists who had been interested in local sources of the material for prehistoric communities noted exceptionally enriched Quaternary formations in flint materials.

¹ There are also areas within the Polish Lowland where flint material appears very dispersed without creating larger accumulation, as well as areas where it does not appear at all. These are above all old glacial central Poland lowlands located south of the maximum range of the last glaciation, in southern Greater Poland, in most areas of the Silesian Lowland and in the basin of the middle Vistula River (central Poland and Mazovia). In the young moraine zone of the Polish Lowland, areas which were completely deprived of flint materials included Kuyavian and the Masurian Lake district.

Such particular areas were determined near the western Pomerania seashore on the Wkra, Gryfice and Białogard Plains (Czarnecki 1970; Galiński 1999; Krzyszowski 1991), in the southern Pomerania Lake District, in the Brda Valley, as well as in the Drawsko and Dobiegniewo Lake Districts (Bagniewski 1987, 1993, 1999), Toruń-Eberswalde ice marginal valley near Gorzów Wielkopolski (Lech 1974), Międzychód (Płonka 1996, 1997, 1999; Bobrowski and Sobkowiak-Tabaka 2012), Bydgoszcz (Woźny 1995), in the Poznań Lake District and on the breakthrough section of the Warta River valley near Poznań (Bartkowski 1961; Kobusiewicz 1961, 1967, 1999; Bobrowski and Krzyszowski 2005), in the Warsaw-Berlin ice marginal valley on the breakthrough section of the Oder River near Krosno Odrzańskie (Burdukiewicz 1988a, 1988b, 1989; Krzyszowski 1988; Brodzikowski 1989), and also on the Niemodlin Plain and the Głubczyce Plateau which are a part of the Silesian Lowland (Kozłowski 1964; Ginter 1972; Balcer 1977, 1983). Similar accumulation of the erratic material has also been discovered in the eastern part of the Polish Lowland in the area of north-eastern Poland, in zones where glacial rafts with Cretaceous flint mentioned earlier appear. These areas include the vicinity of Lipsk on the River Biebrza (Szymczak 1992) and the Zrąb Łukowski (Nowak 1977).

One of the locations on the scale of the Polish Lowlands particularly rich in erratic flint material is without a doubt the region of Gorzów Wielkopolski, Lubusz Voivodeship. The information entered scientific circles thanks to Professor Jacek Lech, as an effect of the research he conducted in the area of Chwałęcice, near Gorzów Wielkopolski, today a district of the city (Lech 1974, 1980, 1981a). Afterwards, the area aroused the interest of many archaeologists (Szczurek 1981; Balcer 1983; Bobrowski 2009a, 2009b). Intense rescue excavation conducted in the area of Gorzów Wielkopolski over the last few years and the discovery of places of intense processing of the material fully confirm the claims set forth on the existence of a flint region in the area.

Gorzów Wielkopolski region

Gorzów Wielkopolski lies at a point where two mesoregions meet, i.e. the Gorzów Plain being a part of the southern Pomerania Lake District and the Gorzów Basin which is a part of the Toruń-Eberswalde ice marginal valley. The Gorzów Plain had been within the reach of the Vistulian Pomeranian phase. The region is mostly covered with outwash from the final glaciation phase. Moraine hills (ground moraine) originating from the period of recession of the Poznań phase and the Krajeńska subphase of the last glaciation appear from out of the sand in places. In the vicinity of Gorzów Wielkopolski at the meeting point with the Gorzów

Basin, their height exceeding 100 m above sea level (Kondracki 2000: 79). The Gorzów Basin is the largest mesoregion of the Toruń-Eberswalde ice marginal valley and lays on the route of the outflow to the west of fluvioglacial waters in the Krajeńska subphase and the Pomeranian phase (Kondracki 2000: 127).

Baltic erratic flint in Gorzów Wielkopolski region

In the formations of the ground moraine which build the Gorzów Plain, specific locations of erratic accumulation have been noted, including above average quantities of particularly good quality flint. The mechanism which led to the formation of exceptionally rich flint deposits in the area of Gorzów Wielkopolski was likely associated with the activity of the ice sheet lobe during the recession of the Poznań phase of the final glaciation. The material transported by the ice sheet lobe had been deposited in the form of deposits. These are above all deposits created as a result of direct deposition from the ice (glacial accumulation). Glacial deposits contain erratic allochthonous material collected by the ice sheet lobe along the route of its movement. This usually entails fragments of solid rock (stones, pebbles), but it could have also been larger packets in the form of glaciotectionic xenoliths. The most important glacial deposits are however glacial clays. The moraine highlands, or ground moraine are in this group of deposits which had been created inside the ice sheet lobe in the subglacial zone. It had also occurred that the waters of the receding ice sheet lobe washed out the moraine and with it, finer material. We are then dealing with a so-called 'outwash moraine'. If as a result of such outwash, an accumulation of larger stones is created, we are dealing with 'moraine cobble' (Książkiewicz 1957; Klimaszewski 2002). We are most likely seeing such a case in the deposits near Gorzów Wielkopolski where the ground moraine had been washed out by fluvioglacial waters flowing from the north to the Toruń-Eberswalde ice marginal valley during the Krajeńska subphase and the Pomeranian phase. As a result of fluvioglacial water activity, the ground moraine in the Gorzów region was covered with a surface layer of outwash plain, whereby the region in the distal zone of outwash cones where the material is finest.

The erosion activity of rivers most likely had a large effect in the uncovering of deposits in the ground moraine and even their dislocation, as the river banks and the river bed would be cut away and washed out. In this case, we could of the erosion activity of the Warta River and its branches, Kłodawka and Srebrna. Notable accumulation of the material was uncovered in the alluvia of both branches of the Warta which cut through the moraine highlands north of Gorzów Wielkopolski and in the erosional dissections on the

edge of the Gorzów Plain where it meets with the Toruń-Eberswalde ice marginal valley. The varied types of erosional dissections, landslides and gullies provided the opportunity for exploitation of the material.

The Baltic Cretaceous flint noted in the region appears in numerous varieties, differing in colour, degree of gloss, matte effect or transparency. Above all, you encounter flint in a variety of gray tones, from light a whitish gray through gray or dark gray, to nearly black, usually glossy with high transparency, a gray matte flint with the addition of fine white carbonate compounds. Occurring rarely is flint with a trace of white or blue patina or reddish marsh patina. Slightly mixed into the material is the Cretaceous erratic flint of the pebble type (Pomeranian) and gray-coloured cherts which are heavily matte and slightly rough. Flint appears most often in the form of small lumps with a diameter of around 10–15cm of which most is coated in a white cortex, and some is heavily rounded. Larger lumps of the material exceeding a diameter of 20–30cm were also a common find. Flint also appeared as chunks caused by the cracking of larger lumps.

Characterization of the sites

As was already mentioned, the exploitation of flint and rock materials in prehistoric times is strictly associated with a specific kind/type of archaeological site. These are above all locations where the material was directly exploited and any workshops associated to a greater or lesser degree – places of initial processing, advanced production of blanks or finished tools. Regardless of the period in which these sites operated, they all feature not only specific locations close to the material deposits, but also specific typological structure of the flint inventory registered there, resulting from the characteristics of production. At these sites, pieces associated with the preparation of core, preliminary processing of core and early phases of core exploitation (flakes and cortical blades, preparation flakes) and a variety of waste from core preparation, as well as technical forms associated with core repair prevail above all. The presence of unprocessed lumps of material, precores, initial and heavily exploited cores is characteristic. The share of finished tools is relatively low, whereby atypical forms prevail, most often trivial retouched forms, notch tools, not uncommonly made from massive waste debitage. So-called mine-type tools are a regular component of the inventories (Ginter 1974; Ginter and Kozłowski 1975; Lech 1981a, 1981b, 1983).

At least 7 sites associated with exploitation and initial processing have been identified in the vicinity of Gorzów Wielkopolski (Fig. 2 and 3). Most of them (Kłodawa, site 3; Kłodawa, site 89; Gorzów Wielkopolski-Chwałęcice site 9 and 11) are located in the north part

of the city and further north of it within the Gorzów Plain (Fig. 2: a–d). The Gorzów Wielkopolski site, no. 10 is located in the southeast part of the city where the moraine highland meets the ice marginal valley (Fig. 2: g). Another two (Gorzów Wielkopolski-Wieprzyce, site 120 and 121) are located in the western part of the city on a wet, irrigated flood plain of the Warta River at the foot of the Gorzów Plain (Fig. 2: e–f). The source materials from research at these sites have been compiled to a varying degree and most have not been published to date, with the exception of site no. 3 in Kłodawa.

Kłodawa, site 3, Gorzów Wielkopolski district

The site is located in the fork of the Kłodawka and Srebrna Rivers which dissect the moraine highland (Fig. 3). As a result of excavation work in 2001, around 2700 fragments of pottery, nearly 3000 flint artefacts, 45 animal bones, 4 metal and 15 stone artefacts had been obtained. Their analysis revealed the presence of settlements on the site beginning from the Late Palaeolithic until the Bronze Age, whereby the flint artefacts had been associated with the older Stone Age.

All the flint products had been made from Baltic erratic flint, among which pieces having relatively high transparency, gloss and relatively good cleavage prevailed. They represent all the stages of the flint production process, whereas the largest group consists of product originating from the first phases of exploitation and included checking the quality of lumps and the formation of precores and cores. The few precores registered on the site includes forms having a one-sided or two-sided crest, with a pre-platform formed using a single removal flake or a few platform rejuvenation flakes and natural sides and back; with opposing platforms having acute core exploitation angles and prepared sides. The quite numerous (52 pieces) group of cores is typologically varied and includes single platform and double platform pieces and with changed orientation. The core platforms display signs of edge regularization and edge sharpening. The back and sides of the cores often remained raw and coated with cortex. A large part of the blanks, among which flakes definitely prevail over blades, is covered with cortex. Pieces associated with forming or repair of the core also make up a relatively large group. Worth mentioning here are crested blades, primary blades (podtępce), as well as platform rejuvenation and rejuvenation flakes (Rakoca and Rozbiegalski 2015).

There are very few tool forms in the presented collection. Most often occurring are burin forms and scraper made of flake blanks; also present were notched tools and retouched flakes. Two so-called mine-type tools had also been noted, i.e. a scraper and a dihedral

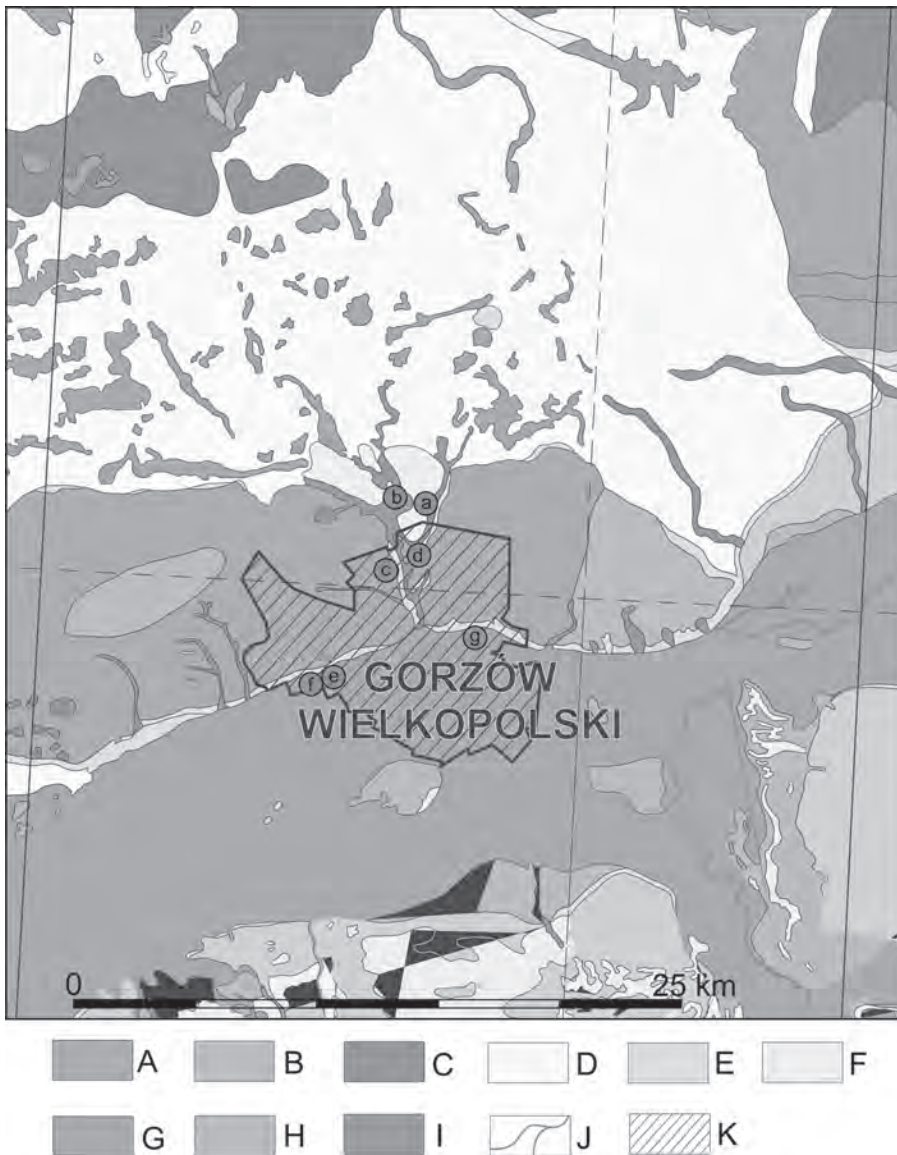


Fig. 2. Location of mine-type workshops on a digital geomorphological map of Wielkopolska Lowland (elaborated in 2007, Institute of Paleogeography and Geoecology, based on B. Krygowski's geomorphological map 1953, 1961 [http://igig.amu.edu.pl/_data/assets/pdf_file/0011/164189/Krygowski_mapa.pdf]; a – Kłodawa, site 3; b – Kłodawa, site 89; c – Gorzów Wielkopolski-Chwałęcice, site 9; d – Gorzów Wielkopolski-Chwałęcice, site 11; e – Gorzów Wielkopolski-Wieprzyce, site 120; f – Gorzów Wielkopolski-Wieprzyce, site 121; g – Gorzów Wielkopolski-Chwałęcice, site 10; A. Moraine undulating upland; B. Hilly moraine upland; C. Moraine hills; D. Outwash plains; E. Terrace levels, terrace edges, risers, valley slopes; F. Dune hills; G. Floodplain, low terrace, basin bottoms; H. Medial dune terrace; I. Small valleys and gullies dissecting the upland; J. Drainage system; K. Selected towns.
Computer drawing: A. Tabaka.

burin made of solid flakes, the surfaces of which were covered with cortex (Rakoca and Rozbiegalski 2015: Fig. 18).

Kłodawa, site 89, Gorzów Wielkopolski district

The site located on the right bank of the Kłodawka River (Fig. 3) had been researched in 2002 and 2003 by Tadeusz Szczurek and Stanisław Sinkowski from the Jan Dekert Lubuskie Museum in Gorzów Wielkopolski. A large quantity of debitage of a production nature had been registered, associated with the preparation and processing of cores, as well as the production of macrolithic tools, as evidenced by the axe semi-products found among the flint artefacts. The site is probably the remains of a workshop from the Neolithic period or the beginning of the Bronze Age (Bobrowski 2009b).

Gorzów Wielkopolski-Chwałęcice, site 11, Gorzów Wielkopolski district

The site is located on a high right bank of the Kłodawka River (Fig. 3). Jacek Lech led test excavations here in 1973 (Fig. 4). The test excavation unit of a surface of 20m² created in the upper part of the Kłodawka terrace slope revealed the remains of a pit and post and a large quantity of artefact materials, above all flint, was registered. A number of cores, blades, flakes and other production waste were distinguished, as well as lumps of material (including large pieces coated with cortex), and also a few tools. The site was deemed as a flint mine and processing workshop. Based on the analysis of a few ceramic pieces, settlement on the site had been associated with the Globular Amphora Culture and the cultures of the early Bronze Age (Lech 1974, 1980, 1981a).



Fig. 3. Location of mine-type workshops on a topographic map 1:50 000 (N-33-115-C). a - Kłodawa, site 3; b - Kłodawa, site 89; c - Gorzów Wielkopolski-Chwałęcice, site 9; d - Gorzów Wielkopolski-Chwałęcice, site 11; e - Gorzów Wielkopolski -Wierprzycze, site 120; f - Gorzów Wielkopolski-Wierprzycze, site 121; g - Gorzów Wielkopolski-Chwałęcice, site 10.
Computer drawing: A. Tabaka.



Fig. 4. Location of mine-type workshop in Gorzów Wielkopolski-Chwałęcice, site 11. Site during excavations carried out by Professor Jacek Lech in 1973. Archive of the Archaeology Department of the Jan Dekert Lubuskie Museum in Gorzów Wielkopolski.

Gorzów Wielkopolski-Chwałęcice, site 9, Gorzów Wielkopolski district

The site is located on the left bank of the Kłodawka River, on a small hill surrounded by wet meadows (Fig. 3). It was discovered as a result of surface studies associated with the Polish Archaeological Record program. Rescue excavations on the site were led in 2003–2004 on behalf of the Jan Dekert Lubuskie Museum by Stanisław Sinkowski.² A total of 2498 flint artefacts had been registered over the area of the site, which included 58 cores, 124 tools and 2316 debitage pieces. A significant part of the debitage was made up of forms associated with initial core processing. Prevailing among all the flakes were cortical and preparation flake pieces. Crested blades associated with the preparation of cores and technical pieces associated with the repair of cores made up a large group as well. Among the cores, mostly blade cores prevailed, which were usually single platform or with changed orientation. A lump of material, precore and two initial cores had also been registered (including a piece discarded due to internal cracking). Among all the tools, the share of insets (13 pieces, including 6 triangles, a trapeze, a Komornica truncated bladelet) and typical endscrapers and scrapers was small. In the latter group, flake forms prevailed which gave the impression of having been made *ad hoc*. The share of notched and denticulate

tools was large however, including pieces made from preparation flakes. Among these, one notched tool resembles mine-type tools in form. Prevailing tool forms included flakes and no fewer blades and retouched bladelets (in total around 54.2% of all tools). Based on technological and typological analysis it was determined that the vast majority of flint material (tools, cores, as well as debitage) should be associated with Late Mesolithic settlement (Bobrowski 2009b).

Gorzów Wielkopolski, site 10, Gorzów Wielkopolski district

The site is located in the northeast part of the city at the edge of the Gorzów Plain and the Toruń-Eberswalde ice marginal valley (Fig. 3). Szczurek led excavation work here in 1975–1975. An area of over 10 ares had been researched and 24 features (pits and hearths), as well as extensive ceramic and flint material had been registered in the process. Production waste definitely prevailed in the flint inventory. Over 250 flakes were found in certain pits. Flake pieces with changed orientation prevailed among the few cores. The near lack of any blank blade was peculiar. From a formal perspective, the group of tools was rather modest. Endscrapers on a flake of differing shapes and sizes appeared, as did irregular blades with traces of retouching on the edges. In addition, the inventory included 10 laurel leaf bifacial projectiles, 3 flint axes, as well as 3 characteristic flakes with traces of surface polishing (damaged axe fragments). The site was deemed as a production settlement of a Funnel Beaker

² Given the special location and topography of the terrain, the was deemed as an alleged stronghold from phase C of the Early Middle Ages. During research, traces of Stone Age settlement, phases D-E of the Early Middle Ages and Late Middle Ages were registered.



Fig. 5. 1. Gorzów Wielkopolski-Wieprzyce, site 120, Cretaceous Baltic flint. a – Nodule; b – Artefacts. Photo: I. Sobkowiak-Tabaka.

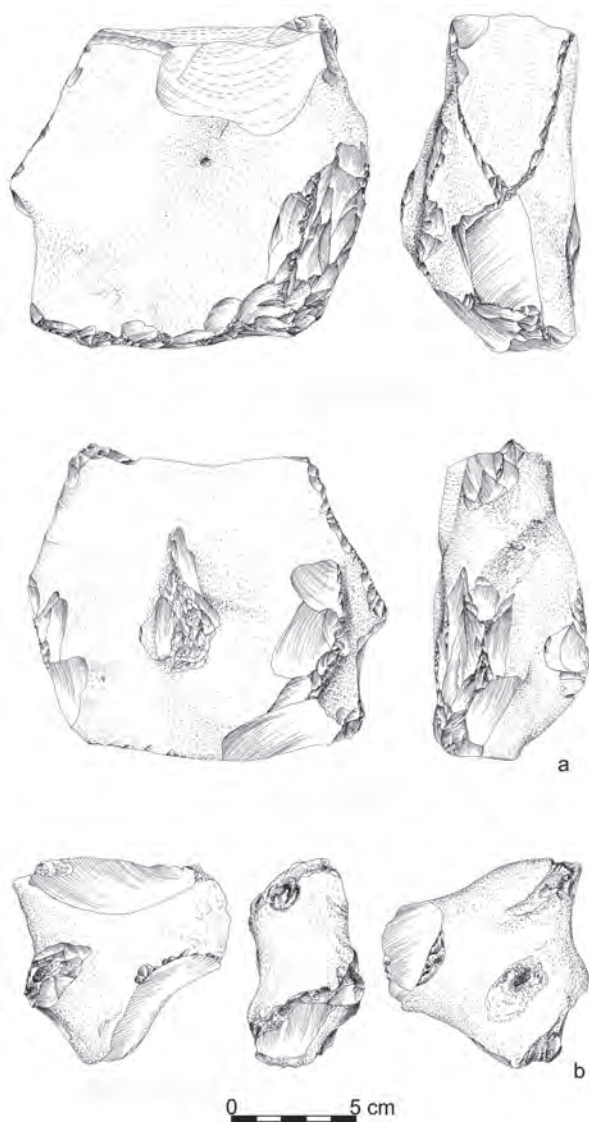


Fig. 6. Gorzów Wielkopolski-Wieprzyce, site 120. Precocores. Drawn: J. Mugaj.

Culture community associated with flint processing, dated around the Luboń phase (Szczurek 1981; Balcer 1983).

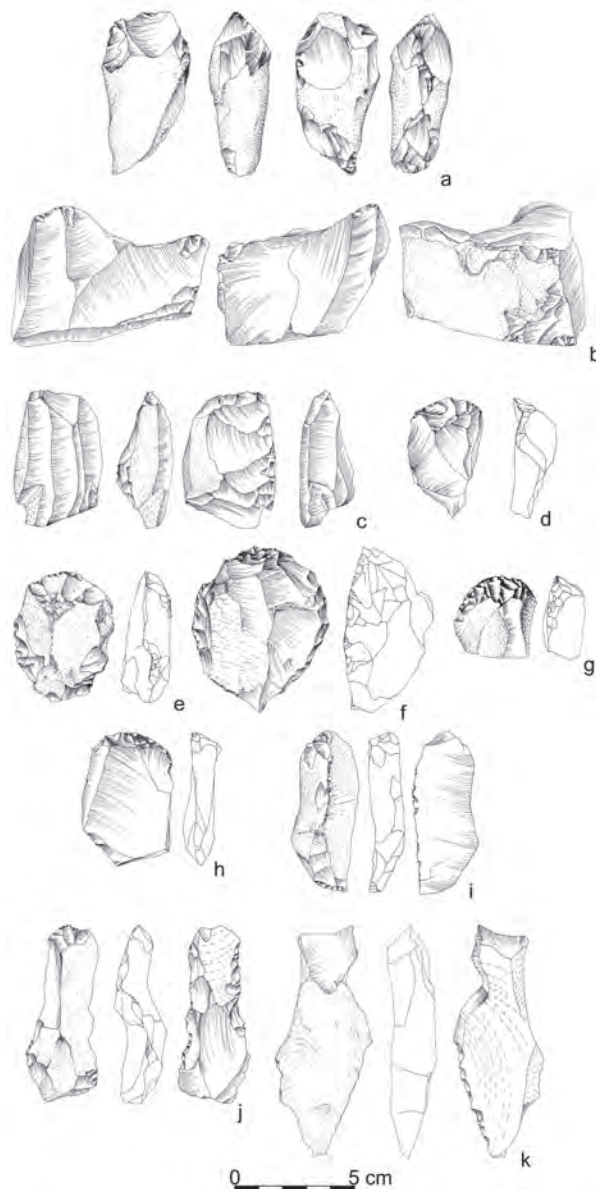
Gorzów-Wieprzyce, site 120 and 121, Gorzów Wielkopolski district

Sites marked as nos. 120 and 121 in Gorzów-Wieprzyce are located above the flood plain terrace of the lower Warta Valley, around 100m away from each other (Fig. 3). The sites were discovered in 1983 as a part of the Polish Archaeological Record program. In the 2004–2005 timeframe, archaeological excavations were conducted on the sites on account of the construction of the western bypass of Gorzów Wielkopolski. The remains of multicultural settlement extending from the Middle Stone Age to modern times were discovered

on both sites. Most intense were the traces associated with the settlements of Funnel Beaker (site 120 and 121) and Globular Amphora (site 121) Culture communities. Aside from the numerous vessel fragments typical for sediment-type sites (around 2700 fragments on site 120 and around 6000 on site 121), flint artefacts in large volume appeared on both sites as well (Pytlak *et al.* 2004a, 2004b; Fijałkowski *et al.* 2005a, 2005b). The nature of the flint products suggests that we are dealing with workshops specializing in the processing of Baltic Cretaceous erratic flint, obtained most likely from the nearby moraine plateau gaps (only 500m away to the north). The analyzed collection of flint contains above all waste forms associated with material selection, quality checks of lumps and cores from the preparation phase, their initial processing and early core exploitation phases (Fig. 5). Flake debitage definitely prevails and



Fig. 7. Gorzów Wielkopolski -Wieprzyce, site 120. a-d – Cores; e. Blade; f – Endscraper; g-h – Denticulate tools; i – Mine-type tool. Drawn: J. Mugaj.



8. Gorzów Wielkopolski -Wieprzyce, site 121. a – Precore; b-c – Cores; d-e, g-h – Endscrapers; f – Mine-type tool; i – Retouched blade; j-k – Denticulate tools. Drawn: J. Mugaj.

includes cortical and preparation flake pieces often in large sizes and a variety of technical forms associated with the preparation of platforms and flaking surfaces. Lumps of the material are also numerous and in great size (Fig. 5) covered in a thick cortex, precores (Fig. 6: a-b; 8: a) and initial cores (Fig. 7: a). Cores include blade pieces, as well as flake core (most often single platform), whereas the share of finished blades corresponding to negatives on the cores is relatively low (Fig. 7: b-d; 8: b-c). Irregular forms appear most often (Fig. 7: e). The share of tools is minimal in both teams. They are prevalently trivial forms of retouched flakes or blades (Fig. 8: i), or denticulate and notched tools (Fig. 7:

g-h; 8: j-k). Of other forms, endscrapers appear most often and include massive pieces made from cortical or preparation flakes (Fig. 7: f; 8: d-e, g-h). Mine-type tools also appear (Fig. 7: i; 8: f).

Conclusions

The region of Gorzów Wielkopolski is most probably one of the areas with key significance for the research of prehistoric flint production on the Polish Lowland. It without a doubt owes its meaning to geological build, formed for the most part by glacial events and associated accumulation processes. Thanks to the presence of

(secondary) deposits of erratic Baltic Cretaceous flint, above all in easily accessible moraine formations, the region was attractive for Stone Age communities for whom flint material treatment was the basic method of producing various kinds of tools.

The sites presented above document the complex treatment and exploitation of flint material over various periods of the Stone Age, beginning with the Late Paleolithic through the Mesolithic, to the turn of the Neolithic and the early Bronze Age. These were mine-type flint workshops or flint processing workshop which is suggested by their location, as well as special technological structure (including the lack of first-rate flake specimens or homely-type tools).

Although nearly 40 years have passed since Professor Jacek Lech led the first research of mine-type workshops in the region in the 1970s and we are familiar with sites associated with deriving and processing flint material, our level of knowledge of these types of sites in the Gorzów Wielkopolski area is still insufficient. What we have in mind here is the number of sites, the structure of inventory registered there, as well as dating by use of absolute methods. Even if the state of research on issues presented in the article is unsatisfactory, we can with all certainty say that we are dealing with an area with exceptional cognitive potential.

Acknowledgements

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References

- Bagniewski, Z. 1987. *Mezolityczne społeczności myśliwsko-rybackie południowej części Pojezierza Kaszubskiego*. Wrocław, Wydawnictwo Uniwersytetu Wrocławskiego. Acta Universitatis Wratislaviensis No 901. Studia Archeologiczne 17.
- Bagniewski, Z. 1993. Mezolit Pojezierza Ińskiego. *Śląskie Sprawozdania Archeologiczne* 34: 117–141.
- Bagniewski, Z. 1999. *Mezolityczna enklawa osadnicza na Polanie Łęczyńskiej (Pojezierze Dobiegniewskie)*. Wrocław, Wydawnictwo Uniwersytetu Wrocławskiego.
- Balcer, B. 1975. *Krzemień świeciechowski w kulturze pucharów lejkowatych. Eksploatacja, obróbka i rozprzestrzenienie*. Wrocław–Warszawa–Kraków–Gdańsk, Zakład Narodowy im. Ossolińskich.
- Balcer, B. 1977. Z badań nad krzemieniarstwem neolitycznym w dorzeczu górnej Odry. *Przegląd Archeologiczny* 25: 5–51.
- Balcer, B. 1983. *Wytwórczość narzędzi krzemiennych w neolicie ziem Polski*. Wrocław–Warszawa–Kraków–Gdańsk–Łódź, Zakład Narodowy im. Ossolińskich.
- Bartkowski, T. 1961. Wiek teras w przełomowej dolinie Warty pod Poznaniem a stanowisko archeologiczne w Poznaniu-Starołęce. *Fontes Archaeologici Posnanienses* 12: 24–37.
- Bobrowski, P. 2009a. The exploitation of local sources of flint on the Polish Plain during the Final Palaeolithic. In M. Street, N. Barton and T. Terberger (eds), *Humans, Environment and Chronology of the Late Glacial of North European Plain. Proceedings of Workshop 14 (Commission XXXII) of the 15-th. U.I.S.P.P Congress, Lisbon, September 2006*: 141–153. Mainz, Römisch Germanisches Zentralmuseum.
- Bobrowski, P. 2009b. *Eksploatacja zasobów surowców krzemiennych Niżu Polskiego przez społeczności pradziejowe*. Unpublished PhD thesis, Institute of Archaeology and Ethnology Polish Academy of Sciences, Poznań.
- Bobrowski, P. and Krzyszowski, A. 2005. Inwentarze krzemienne z badań powierzchniowych i sondażowych na terenie kopalni kruszywa w Mściszewie, gm. Murowana Goślina. *Fontes Archaeologici Posnanienses* 41: 19–36.
- Bobrowski, P. and Sobkowiak-Tabaka, I. 2012. Eksploatacja surowców krzemiennych w rejonie Pojezierza Międzychodzkiego na przykładzie stanowiska 4 w Chrzypsku Wielkim, gm. loco. *Fontes Archaeologici Posnanienses* 48: 5–40.
- Brodzikowski, K. 1989. Budowa geologiczna systemu terasowego rzeki Odry w rejonie stanowiska archeologicznego Strumiennie 1 w okolicach Krosna Odrzańskiego (sprawozdanie z badań terenowych w sezonie 1986). *Śląskie Sprawozdania Archeologiczne* 29: 16–25.
- Burdukiewicz, J.M. 1988a. Stanowisko paleolityczne w Strumiennie, gm. Krosno Odrzańskie. *Śląskie Sprawozdania Archeologiczne* 27: 5–10.
- Burdukiewicz, J.M. 1988b. Stanowisko paleolityczne w Strumiennie gm. Krosno Odrzańskie (wyniki badań w sezonie 1987). *Śląskie Sprawozdania Archeologiczne* 30: 7–14.
- Burdukiewicz, J.M. 1989. Wyniki badań stanowiska paleolitycznego w Strumiennie gm. Krosno Odrzańskie (sezon 1986). *Śląskie Sprawozdania Archeologiczne* 29: 5–13.
- Czarnecki, M. 1970. Z problematyki badań nad paleolitem i mezolitem Pomorza Zachodniego. *Materiały Zachodniopomorskie* 16: 31–72.
- Fijałkowski, K., Pytlak, M., Sinkowski, S. and Szczurek, T. 2005a. *Sprawozdanie z ratowniczych badań wykopaliskowych w Gorzowie Wlkp. na stan. 120, AZP 45-11/9. Obwodnica Zachodnia, etap III, sierpień 2005*. Unpublished report. Gorzów Wielkopolski.
- Fijałkowski, K., Pytlak, M., Sinkowski, S. and Szczurek, T. 2005b. *Sprawozdanie z ratowniczych badań wykopaliskowych w Gorzowie Wlkp. na stan. 121, AZP*

- 45-11/10. *Obwodnica Zachodnia, etap III, sierpień 2005*. Unpublished report. Gorzów Wielkopolski.
- Galiński, T. 1999 (2000). Stanowisko późnopaleolityczne w Kocierzy. *Materiały Zachodniopomorskie* 45: 7-65.
- Ginter, B. 1972. Dwa stanowiska mezolityczne z miejscowości Dzierżno, pow. Gliwice. Ze studiów nad epoką kamienia na Górnym Śląsku. *Rocznik Muzeum Górnośląskiego. Archeologia* 10: 7-76.
- Ginter, B. 1974. Wydobywanie, przetwórstwo i dystrybucja surowców i wyrobów krzemienych w schyłkowym paleolicie, północnej części Europy Środkowej. *Przegląd Archeologiczny* 22: 5-122.
- Ginter, B. and Kozłowski, J.K. 1975. *Technika obróbki i typologia wyrobów kamiennych paleolitu i mezolitu*. Warszawa, Państwowe Wydawnictwo Naukowe.
- Klimaszewski, M. 2002. *Geomorfologia*. Warszawa, Państwowe Wydawnictwo Naukowe.
- Kobusiewicz, M. 1961. Stanowisko z końca paleolitu i początku mezolitu z Poznania Starołęki. *Fontes Archaeologici Posnanienses* 12: 1-23.
- Kobusiewicz, M. 1967. Źródła surowców krzemienych w paleolicie schyłkowym i mezolicie na terenie środkowo-zachodniej Niziny Wielkopolskiej. In R. Jamka (ed.), *III Sympozjum Paleolityczne Kraków 30. XI-2 XII 1967, Referaty*: 57-65. Kraków, Uniwersytet Jagielloński, Muzeum Archeologiczne w Krakowie.
- Kobusiewicz, M. 1999. *Ludy łowiecko-zbierackie północno-zachodniej Polski*. Poznań, Poznańskie Towarzystwo Przyjaciół Nauk.
- Kondracki, J. 2000. *Geografia regionalna Polski*. Warszawa, Państwowe Wydawnictwo Naukowe.
- Kozłowski, J.K. 1964. *Paleolit na Górnym Śląsku*. Wrocław-Warszawa-Kraków, Zakład Narodowy im. Ossolińskich.
- Krygowski, B. 1953. *Mapa geomorfologiczna Niziny Wielkopolsko-Kujawskiej 1:300 000*. Unpublished manuscript. Poznań, Institute of Paleogeography and Geoecology, Adam Mickiewicz University.
- Krygowski, B. 1961. Rzeźba i geologia. In F. Barciński, B. Krygowski and S. Zajchowska (eds), *Województwo zielonogórskie. Monografia geograficzno-gospodarcza*: 3-30. Poznań, Instytut Zachodni.
- Krukowski, S. 1920. Pierwociny krzemieniarskie górnictwa transportu i handlu w holocenie Polski, cz. I. *Wiadomości Archeologiczne* 5: 185-206.
- Krukowski, S. 1922. Pierwociny krzemieniarskie górnictwa transportu i handlu w holocenie Polski, cz. I. *Wiadomości Archeologiczne* 7: 37-54.
- Krukowski, S. 1939-1948. Paleolit. In S. Krukowski, J. Kostrzewski and R. Jakimowicz (eds), *Prehistoria ziem polskich* 4: 1-117. Kraków, Zakład Narodowy im. Ossolińskich.
- Krzyszowski, D. 1988. Budowa geologiczna osadów czwartorzędowych w rejonie stanowiska archeologicznego 'Strumiennie 1b', gmina Krosno Odrzańskie. *Śląskie Sprawozdania Archeologiczne* 30: 15-26.
- Krzyszowski, A. 1991. Studia nad krzemieniarstwem społeczności kultury ceramiki sznurowej w dorzeczu dolnej i środkowej Parsęty. Wyniki badań archeologicznych na stanowisku 7 w Nawinie, gm. Białogard, woj. Koszalin. *Folia Prehistorica Posnaniensia* 4: 83-118.
- Książkiewicz, M. 1957. *Geologia dynamiczna*. Warszawa, Wydawnictwo Geologiczne.
- Lech, J. 1974. Gorzów Wlkp. - Chwałęcice. *Informator Archeologiczny (za 1973 rok)*: 20-21.
- Lech, J. 1980. Gorzów Wielkopolski - Chwałęcice, woj. Gorzów Wielkopolski, In G. Weisgerber, R. Slotta and J. Weiner (eds), *5000 Jahre Feuersteinbergbau. Die Suche nach dem Stahl der Steinzeit*: 624. Bochum, Deutsches Bergbau-Museum. Veröffentlichungen aus dem Deutschen Bergbau-Museum 77.
- Lech, J. 1981a. Flint Mining among the early farming communities of Central Europe. *Przegląd Archeologiczny* 28: 5-55.
- Lech, J. 1981b. *Górnictwo krzemienia społeczności wczesnorolniczych na Wyżynie Krakowskiej. Koniec VI tysiąclecia - 1 połowa IV tysiąclecia p.n.e*. Wrocław-Warszawa-Kraków-Gdańsk-Łódź, Zakład Narodowy im. Ossolińskich.
- Lech, J. 1983. Górnictwo surowców krzemienych w kulturze społeczności wczesnorolniczych na terenie Polski. In J.K. Kozłowski and S.K. Kozłowski (eds), *Człowiek i środowisko w pradziejach*: 114-126. Warszawa, Państwowe Wydawnictwo Naukowe.
- Nowak, J. 1977. Specyficzna budowa geologiczna form polodowcowych zależnych od podłoża (okolice Łosic na Podlasiu). *Studia Geologica Polonica* 52: 347-357.
- Płonka, T. 1996. *Sprawozdanie z ratowniczych badań archeologicznych przeprowadzonych na stanowisku nr 15 w Radgoszczy gm. Międzychód, woj. gorzowskie*. Unpublished report. Wrocław.
- Płonka, T. 1997. Pracownie krzemieniarskie w Radgoszczy, stan. 15, woj. gorzowskie. Badania w 1995 roku. *Śląskie Sprawozdania Archeologiczne* 39: 47-64.
- Płonka, T. 1999. Drugi sezon badań wykopaliskowych w Radgoszczy, stan. 15, gm. Międzychód. *Śląskie Sprawozdania Archeologiczne* 41: 53-63.
- Pytlak, M., Szczurek, T. and Sinkowski, S. 2004a. *Wstępne wyniki ratowniczych badań wykopaliskowych na stanowisku nr 120 w Gorzowie Wlkp., AZP 45-11/9*. Unpublished report. Gorzów Wielkopolski.
- Pytlak, M., Szczurek, T. and Sinkowski, S. 2004b. *Wstępne wyniki ratowniczych badań wykopaliskowych na stanowisku nr 121 w Gorzowie Wlkp., AZP 45-11/10*. Unpublished report. Gorzów Wielkopolski.
- Rakoca, A. and Rozbiegalski, P. 2015. Charakterystyka nakopalnianej pracowni krzemieniarskiej z okresu schyłkowego paleolitu na podstawie materiałów krzemienych ze stanowiska Kłodawa 3, pow. gorzowski, woj. lubuskie. *Folia Praehistorica Posnaniensia* 20: 397-427.

- Schild, R. 1975. Późny paleolit. In W. Chmielewski and W. Hensel (eds) *Prahistoria ziem polskich, t. 1. Paleolit i mezolit*: 159–338. Wrocław–Warszawa–Kraków–Gdańsk, Zakład Narodowy im. Ossolińskich.
- Szczurek, T. 1981. Osada młodszej kultury pucharów lejkowatych w Gorzowie (stanowisko10). In T. Wiślański (ed.), *Kultura pucharów lejkowatych w Polsce (Studia i materiały)*: 161–169. Poznań, Polish Academy of Sciences.
- Szymczak, K. 1992. Północno-wschodnia prowincja surowcowa kultury świderskiej. Łódź, Wydawnictwo Uniwersytetu Łódzkiego. *Acta Univeritatis Lodziensis. Folia Archaeologica* 15.
- Woźny, J. 1995. Pracownia krzemieniarska kultury pucharów lejkowatych w Bydgoszczy–Pałczu, Stanowisko 123 – wyniki badań sondażowych, Państwowa Służba Ochrony Zabytków w Bydgoszczy. *Komunikaty Archeologiczne* 7: 75–87.