

The raw material aspects of flint production at the end of the Eneolithic in western Lesser Poland

Surovinové aspekty silicitové produkce na konci eneolitu v západním Malopolsku

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KEYWORDS

Corded Ware culture – Lesser Poland – lithic industry – raw material – Świeciechów flint

ABSTRACT

Rich inventories of flint artifacts originate from the graves of the Corded Ware culture in western Lesser Poland. Additionally, materials from settlements have also been found in this area. The significant increase in available data in recent years has provided us with a deeper understanding of the raw material conditions of the flint industry during the Final Eneolithic Period. The grave inventories reveal the special significance of Świeciechów flint in the production of axes, while chocolate flint is primarily used for creating blade and flake tools. The use of K-type flint for axe production is specific to the western Lesser Poland region. The evident selection of raw materials is not merely utilitarian but is also influenced by the ideological system prevalent in Final Eneolithic communities.

1. Introduction

Occupying the southern part of the Lesser Poland Upland, the western Lesser Poland loess upland has yielded the largest cluster of funerary sites of the Corded Ware culture (CWC) in south-eastern Poland (Fig. 1). This cluster has usually been discussed jointly with the finds from the Sandomierz Upland as the ‘Kraków-Sandomierz group of CWC’ (Machnik 1966; Włodarczak 2006). Early Bronze Age finds, primarily graves and settlement sites from the early phase of the Mierzanowice culture, are also abundant in the region (generally: Kadrow, Machnik 1997). Final Eneolithic and Early Bronze Age funeral materials from western Lesser Poland stand out for their characteristic sets of flint objects (the term flint is used in a very broad sense, actually it means siliceous rock). In particular, the inventories of the Kraków-Sandomierz group (later phase of the CWC) are prominent here, comprising rich and functionally diverse sets of flint implements, with axes, arrowheads, various types of knife forms, and fire strikers as the basic tool types (Tab. 1). One noteworthy aspect in analyses of Final Eneolithic flintwork is the raw material preferences regarding the objects deposited in the grave. Interestingly, the choice of raw material depends on the tool category, with different preferences observed for core tools and tools made from flakes or blades. The effort put into furnishing the deceased with appropriately selected raw materials is most evident in the richest inventories associated with particularly distinguished burials of adult men.

Type of artefacts	The number of graves	Percentage representation of artefacts in the total number of graves (%)
Axes	145	50.0
Arrowheads	43	14.8
Blade tools	96	33.1
Flake tools	54	18.6
Flakes & blades	109	37.6

Tab. 1. Frequency of major categories of flint artefacts in CWC graves from western Lesser Poland (total number of graves: 290).

Tab. 1. Frekvence výskytu hlavních kategorií silicitových artefaktů v hrobech kultury se šňůrovou keramikou ze západního Malopolska (celkový počet hrobů: 290).

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The number of CWC burials known from western Lesser Poland has increased significantly in recent years owing to research carried out as part of major roadbuilding projects (database summary: Jarosz et al. 2022). As a result, cemeteries were discovered in previously poorly recognised micro-regions, which allowed for refining previous findings on the raw material preferences of Final Eneolithic communities (primarily: Balcer 1983;

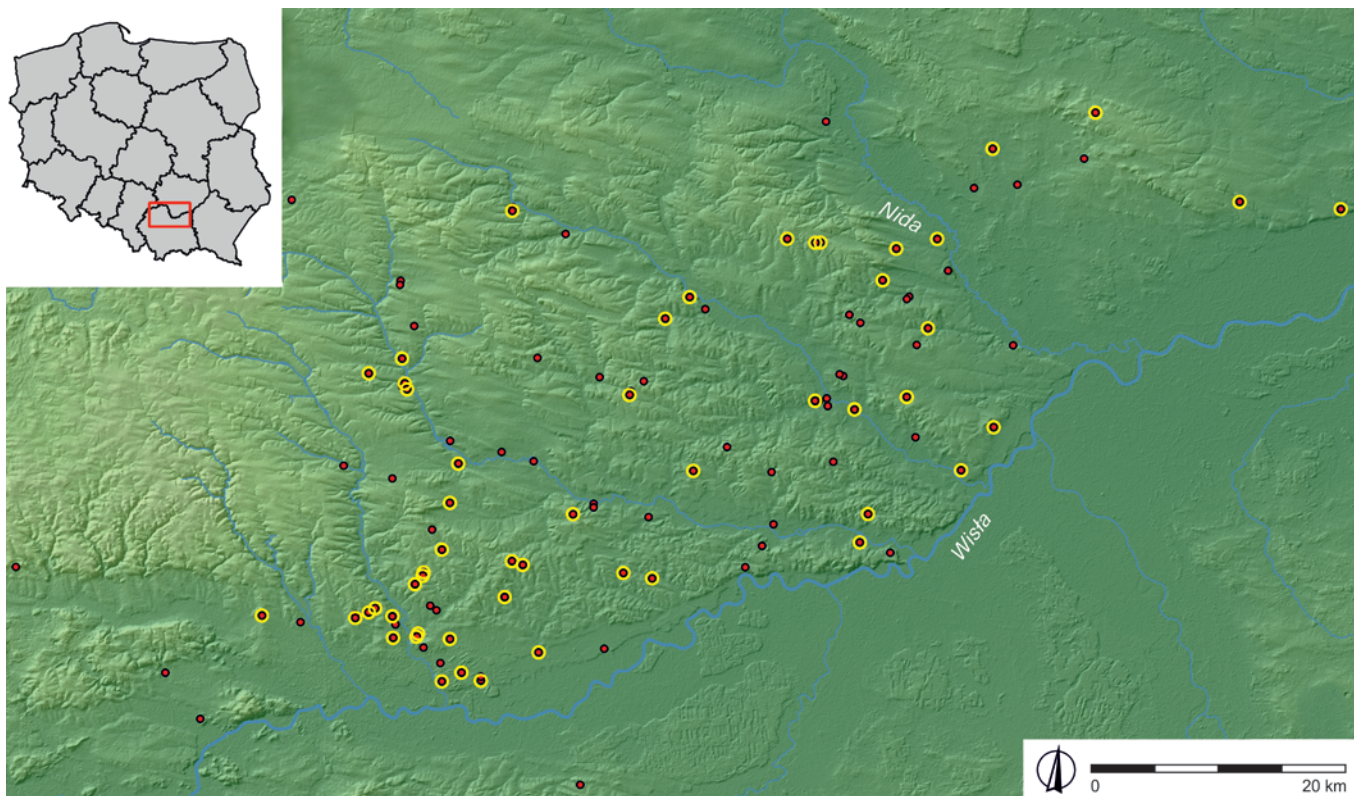


Fig. 1. Grave sites of Corded Ware culture from western Lesser Poland. Yellow circles mark the sites where axes made of Świeciechów flint were discovered. Graphic by A. Sznajdrowska-Pondel, P. Włodarczak.

Obr. 1. Hroby kultury se šňůrovou keramikou ze západního Malopolska. Žlutými kroužky jsou označeny lokality, kde byly nalezeny sekery ze świeciechowského silicitu. Grafika A. Sznajdrowska-Pondel, P. Włodarczak.

Włodarczak 2006; 2008). In addition, the large-scale rescue excavations of the last 20 years have resulted in the discovery of CWC settlement sites, previously unknown from western Lesser Poland altogether (summary: Włodarczak 2013). This has made it possible to verify views about the selective choice of raw materials and thus the special character of flint artefacts from grave inventories. However, the state of knowledge on Final Eneolithic flint mining sites remains poor. Only one mining-related feature from this period has so far been identified: shaft 1 from the chocolate flint mine in Polany Kolonia II (Schild et al. 1977).

Previous research into the use of flint raw materials in the Final Eneolithic of Lesser Poland has almost always been based on macroscopic examination of artefacts by archaeologists specialising in lithic industries. Such simple methods were usually successful, given the raw material diversity in the region. Indeed, in their majority, the flints of Lesser Poland can be quite easily divided into basic types, and this general division is sufficient to broadly characterise Final Eneolithic flint industries in terms of raw material patterns. What is much more difficult, and often impossible, is distinguishing varieties that would allow the provenance of the studied products to be precisely determined (e.g. for Jurassic flint from the Kraków region, Lower Turonian flints from the Świętokrzyskie region, or chocolate flint). The proposals in this respect put forward by archaeologists tend to be regarded with scepticism by specialists in the geological sciences (e.g. Kochman et al. 2020; Matyszkiewicz, Kochman 2020). The overview presented here does not go beyond general divisions of raw materials, which are generally not controversial. Reservations are raised only regarding the possibility of distinguishing the G-type flint from Jurassic Kraków flints. However, the former is quite characteristic and is associated with outcrops located in the Jurassic zone north of Kraków.

The other contentious issue remains the detailed division of the Lower Turonian raw materials from the eastern margin of the Świętokrzyskie Mountains, among which only the Świeciechów variety is unanimously distinguished. The other varieties distinguished here (Ożarów, Gościeradów, or generally Turonian) follow the division presented in an earlier study of Lesser Poland axes (Budziszewski, Włodarczak 2011). Admittedly, the controversy over their identifiability is not entirely unfounded. Still, the uncertainty surrounding the accuracy of their identification does not significantly affect the prehistoric interpretations presented below. This is because the outcrops of all these raw materials are located in the same zone to the north-east of the western Lesser Poland loess upland discussed here.

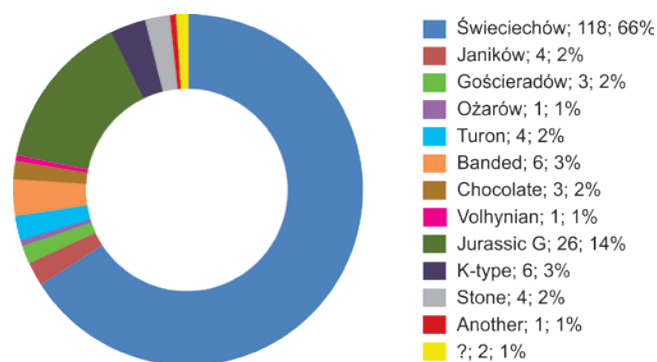
Raw material aspects of flint artefacts from graves long remained of low interest in prehistoric studies of Lesser Poland. As recently as the 1960s, a CWC monograph by Jan Machnik contained major interpretative errors, including an indication of the primary role of Jurassic flint in the production of blade tools and arrowheads (Machnik 1966, 52). A breakthrough finally came in the 1970s, when studies of mining sites in the Świętokrzyskie region were published (e.g. Balcer 1971; 1975; Schild et al. 1977). Thanks to these, subsequent works discussing the CWC flint-working correctly presented the general raw material characteristics (e.g. Kempisty 1978; Balcer 1983). A monograph on the Lesser Poland CWC published 40 years later (Włodarczak 2006) had a much richer source base to draw on than that available to Machnik. This enabled extending the raw material analysis to cover western Lesser Poland as well (Włodarczak 2006, 20–32). The increase in data was much greater in that area than in the Sandomierz Upland, and the source base has continued to grow over the last 15 years as well: at present (as of 2022), 290 CWC grave assemblages are known from the western Lesser

Poland loess upland, compared to the 165 assemblages used for analysis in the 2006 monograph. Discoveries from large-scale development-driven projects, most notably finds from excavations prior to the construction of the Kraków-Kielce section of the S7 road, have contributed to the marked enrichment of the dataset.

In the 21st century, new significant research opportunities have opened up with the excavation of Late Neolithic settlements and flint workshops in western Lesser Poland (first summary: Włodarczak 2013). Although still modest and often of uncertain homogeneity, the sources obtained from those sites allow a new perspective on CWC flint-working. This is because they make it possible to verify the raw material, functional, and technological findings established on the basis of funeral materials. Analyses of the latter often involved questions about the selective choice of flint artefacts, linked to the ritual context of their deposition.

2. Core tools and Świeciechów flint

Core tools, often referred to as ‘axes’ (this general name is applied to a diverse group of ‘wedge-shaped core tools’, i.e. tools like adzes and chisels as well), constitute the most important category of flint artefacts in the western Lesser Poland CWC graves (Tab. 1). The special role of Świeciechów flint is evident here, from which the clear majority of such tools were made (Graph 1). A considerable distance separates the discussed areas from the deposits of this raw material located on the right bank of the Vistula (depending on the site: from approx. 80 to approx. 170 km). At the same time, western Lesser Poland has easy access to deposits of Jurassic flints from the vicinity of Kraków. Outcrops of Jurassic flint of the G-type – intensively quarried used for axe production in the Middle and Late Eneolithic (e.g. Pelisiak 2008) – are also situated closer than the deposits from the eastern Świętokrzyskie region. This demonstrates beyond any doubt that Świeciechów flint was particularly valued (for non-utilitarian reasons) by CWC communities. Interestingly, its role was important only in the manufacture of core tools, which is in contrast to the picture of the Globular Amphora Culture (GAC) communities of Lesser Poland, where Świeciechów flint was used on a large scale for the production of regular blades, while axes were primarily made from banded Krzemionki flint. Świeciechów flint played a significant role in the manufacture of blades in the Middle Eneolithic as well (Funnel Beaker culture). In the Sandomierz Upland, there is only one CWC niche grave in which a series of Świeciechów flint blades was discovered: feature 15 from site 10 in Wilczyce (Boroń 2019). The grave is dated to the older phase of the Kraków-Sandomierz group, and its inventory refers to the GAC Late Eneolithic lithic tradition (Włodarczak 2019, 182–183).



Graph 1. Raw material spectrum of the silicite axes from Corded Ware culture graves in western Lesser Poland. Author P. Włodarczak.

Graph 1. Surovinové spektrum silicitových seker z hrobů kultury se šňůrovou keramikou v západním Malopolsku. Autor P. Włodarczak.

The communities from western Lesser Poland were not the only ones to import Świeciechów flint. It was also transported eastwards to the Lublin Upland, as well as to the south-east, towards the Rzeszów Foothills. To the north, in the areas of Mazovia and Kuyavia, it is less clear due to the very small number of grave finds there. However, the importance of this raw material is evidenced by finds of artefacts made from it far to the south, in Moravia (Přichystal, Šebela 2004). The southernmost site is a stray, and therefore uncertain, find of a Świeciechów flint axe from Schiltingeram (near Krems) in Lower Austria (Ruttkay 1999).

Lesser Poland axes have not yet been comprehensively analysed in terms of typology and technology. Taxonomic proposals rely on basic morphometric features (e.g. Machnik 1966; Balcer 1983; Włodarczak 2006; Libera 2016). The most detailed division so far (Budziszewski, Włodarczak 2011) attempts to take into account the functional differentiation of this group of tools (based on data on Eneolithic tool handles) and cultural diversity (for example, identifying axes with GAC or Baden features in Final Eneolithic graves). In addition to the dominant Final Eneolithic forms, specimens with Late Eneolithic characteristics were also present in CWC graves. These were usually axes made of Jurassic G-type flint (similar to Baden culture tools) or banded flint (typically resembling GAC forms). These finds prove that deposits of these two important Late Eneolithic raw materials continued to be exploited in the Final Eneolithic. They also indicate the survival of older technological traditions in the later phase of the Final Eneolithic (after c. 2600 BC). This situation has prompted some scholars to claim a lack of taxonomic distinctions between the GAC and CWC axes (Libera 2009). In general, however, it is possible to identify the characteristic features of the axes from the later phase of the CWC (Fig. 2), while accounting for a certain technological diversity resulting from the coexistence of different lithic traditions and the nature of long-distance cultural relations in the Final Eneolithic. The large collection of axes from CWC graves (almost 300 pieces) is clearly dominated by forms made using characteristic Final Eneolithic technology.

Axes made from Jurassic G-type flint come mainly from the western part of the region discussed here, in areas relatively close to outcrops of this raw material. Moreover, until the turn



Fig. 2. Typical Final Eneolithic axes made of Świeciechów flint (Niedźwiedz, grave 97). Photo by E. Włodarczak.

Obr. 2. Typické pozdně eneolitické sekery ze świeciechowského silicitu (Niedźwiedz, hrob 97). Foto E. Włodarczak.

of the 4th and 3rd millennia BC, Jurassic G-type flint was intensively used in this area by FBC-Baden communities (e.g. at the Bronocice settlement: see Kruk et al. 2023).

3. The role of chocolate flint

In the Kraków-Sandomierz group of the CWC, chocolate flint was the most important raw material in the production of blade and flake tools (Fig. 3). The main implements made from it were solid knife inserts (either blade or flake) and arrowheads. In the Sandomierz Upland, such tools were made almost exclusively from chocolate flint. In western Lesser Poland, on the other hand, varieties of Jurassic flint were also significantly used for this purpose. In the southern zone, local Jurassic ('Kraków') raw materials were used, while in the western zone (especially on the middle Nidzica and the middle Szreniawa Rivers) tools made from Jurassic G-type flint are present. Still, the special role of chocolate flint is evident in many assemblages from these areas, as shown by the addition of tools from this raw material even to inventories in which Jurassic flint objects predominate. In such cases, tools made of regular chocolate flint blades are present. This shows a desire to provide the deceased with a basic form of knife with an insert made from the raw material of the utmost value. Occasionally, fire strikers – another basic item in male grave inventories – are also made from chocolate flint. Summing up, chocolate flint was the raw material of first choice for the production of knives and arrowheads in the area of western Lesser Poland, and efforts to ensure its presence in grave furnishings of deceased males are evident.

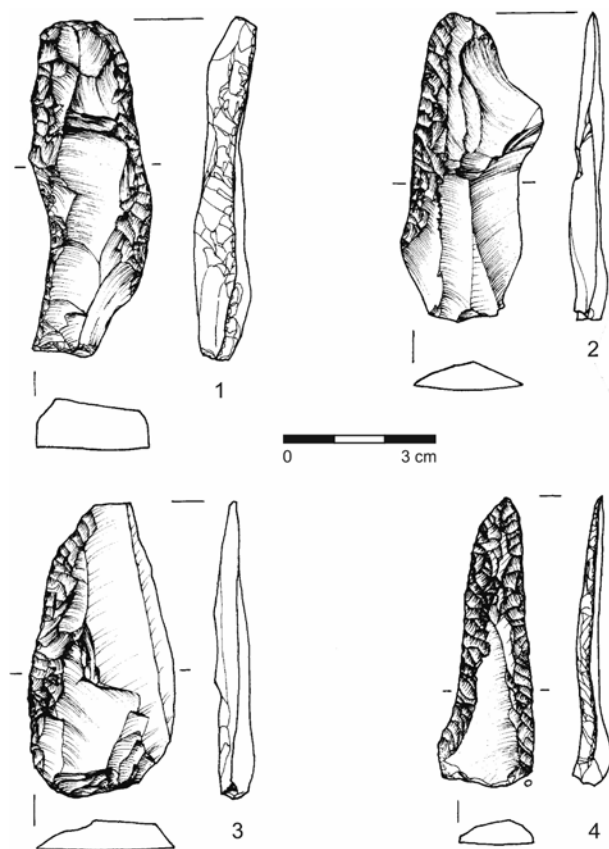


Fig. 3. Examples of typical blade and flake tools from Corded Ware culture grave (Zielona, site 3, grave 3). Material: 1 – jurassic G-type flint, 2–4 – chocolate flint. Drawing by E. Osipowa.

Obr. 3. Příklady typických čepelových a úštěpových nástrojů nalezených v jednom z hrobů kultury se šňůrovou keramikou (Zielona, lokalita 3, hrob 3). Surovina: 1 – jurský silicit typu G, 2–4 – čokoládový silicit. Kresba E. Osipowa.

Only three axes made from chocolate flint have been discovered in the western Lesser Poland graves (grave 2 from Gabułów, grave 4 from Kolosy and grave 5/2 from Książnice Wielkie). Interestingly, no axes made of this flint are known from CWC cemeteries in the Sandomierz Upland, the zone adjacent to its outcrops. This points to, on the one hand, the only marginal role of core tools made of chocolate flint in grave inventories, while on the other it proves that axes were sometimes made from this raw material – as previously indicated by materials from mining sites, above all from Polany Kolonia II (Schild et al. 1977). It can thus be assumed that on the occasion of the extraction of flint for blade and flake production, materials for axe production were also obtained. The true proportions in this respect are probably distorted by the scarcity of materials from CWC settlements.

4. Lithic industry in CWC settlements near Kraków

Excavations preceding major road-building projects in the Vistula Valley zone near Kraków uncovered several CWC settlements and associated workshops producing tetrahedral axes. The most important of these are site 20 in Kokotów (Czerniak et al. 2015) and site 33 in Kraków-Bieżanów (Jarosz et al. 2010). In both sites, the presence of ceramic and flint materials of the older phase of the CWC was recorded, including artefacts attesting the manufacture of core tools from K-type flint (Fig. 4). This raw material was identified at other settlement sites as well. When juxtaposed with flint workshops and stray finds of axes discovered in western Lesser Poland many years ago (especially in the vicinity of Ojców and Zakrzów), these finds demonstrate the significant role of local K-type flint in the manufacture of Final Eneolithic core tools (Włodarczak 2022). Previously, on the basis of data from cemeteries, this raw material was not attributed a major role, as axes made from it were only known from five graves from the Kraków area. Single flake tools made from K-type flint eluded identification and were included among artefacts made from Kraków Jurassic flints.

Thus, the raw material structure of the inventories from CWC settlement sites in western Lesser Poland differs from that emerging from funerary inventories. In settlements, a greater role is played by local raw materials, primarily Jurassic Kraków flint and K-type flint (Kaczanowska, Kozłowski 1976, 207–208), the latter also referred to as 'Wielka Wieś flint' (Přichystal 2009, 95). The location of these sites at the intersection of different geological zones means that artefacts made from Carpathian flysch rocks, such as sandstones, siltstones or various types of siliceous marls, also appear on them.

Another general conclusion emerging from analyses of flint materials from settlements is their technological and typological



Fig. 4. Artefact made of bedded chert labelled as K-type flint – the raw material typical only for sites of Corded Ware culture from western Lesser Poland (Kraków-Bieżanów, site 33). Photo by E. Włodarczak.

Obr. 4. Artefakt vyrobený z vrstevnatého rohovce typu K – suroviny typické pouze pro lokalitu kultury se šňůrovou keramikou ze západní části Malopolska (Kraków-Bieżanów, lokalita 33). Foto E. Włodarczak.

similarity with finds from graves. There is no evidence to suggest that the tools deposited in graves had special functions, although they admittedly were often refreshed or rejuvenated before being deposited (Osipowicz 2022, 226). The question of the special nature of grave inventories has been raised in the past: it has been pointed out that artefacts discovered in such contexts cannot show the full technological and typological spectrum of CWC flintwork (Gancarski, Valde-Nowak 2011, 286–287).

As indicated above, the settlements recorded so far come from the southern periphery of the western Lesser Poland cluster of CWC sites, which borders the Carpathian zone. Hence, the raw material patterns recorded there may be region-specific and not reflective of the patterns typical of areas deeper in the western Lesser Poland loess upland (from where settlement assemblages remain so far unknown).

5. Raw material valuation

Compared to earlier periods, the selective choice of stone raw materials, including flint for the production of major tool types, intensifies in the 3rd millennium BC (Włodarczak 2017). Selected types of flint were then transported over long distances from their deposits, in the form of blanks or finished tools. They were used to produce the most important tool types: axes, knife inserts (including dagger forms), and arrowheads. The long-distance distribution of axes made of banded flint by communities of the GAC has taken centre stage in studies of the Eneolithic of Lesser Poland. This continues to eclipse the equally intensive use of Świeciechów flint for the production of core tools by communities of the Final Eneolithic CWC. Although the technologically superior and aesthetically sublime GAC products understandably attract attention, the economic system of the Final Eneolithic communities was more strongly oriented towards long-distance imports of raw material. The raw material aspect played a major role here, determining the prestige value of artefacts. This is reflected in the funerary rites, with the deceased being furnished with tools made from flint raw materials of the highest value. Compared with grave inventories, settlement sites show a tendency towards the economically justified use of flints from the nearest available deposits.

Much like with flint products, the value of other objects, for example stone battle axes, was also affected by the raw material. In various regions of Europe, including Lesser Poland, tools made from metamorphic rocks, green or greenish in colour, primarily serpentinite, were of particular value. As a result, battle axes made from Lower Silesian rocks, including the characteristic forms of the Ślęża type (German: Zobtener Äxte), found their way into the area of Lesser Poland. Their presence has been recorded mainly in graves, while the forms known from settlement sites represent a variety of raw materials, including even different types of sandstone. This proves that battle axes made of particularly valuable raw materials were chosen for deposition into graves. What becomes important in funerary ritual is the highly valued raw material from which the artefact is made, rather than its specific form or type. This situation is probably attributable to the establishment in the Final Eneolithic of a network of long-distance exchange (in the 3rd millennium BC) in which whole groups of relatively egalitarian CWC communities participated. This resulted in relatively high frequencies of objects of high prestige value in cemeteries from this time.

6. Conclusions

The comments above were intended to juxtapose earlier findings on raw material patterns with the results of the most recent studies of the CWC lithic tradition in western Lesser Poland.

In recent years the database has expanded considerably and, in addition, sources from previously poorly recognised settlement contexts have been documented. As a result, earlier interpretations have received better source confirmation, and in several aspects new findings have been made.

The data obtained indicate that, with similar general trends, the raw material patterns differ somewhat among the individual micro-regions of western Lesser Poland. The reason for the differences is the focus on the exploitation of locally available deposits, such as K-type flint in the Kraków area or Jurassic G-type flint in the Miechów Upland. To a limited extent, these locally favoured raw materials replace the flints preferred throughout the Lesser Poland upland.

The raw material preferences of the western Lesser Poland CWC communities cannot be fully explained by the economic aspect, the availability of deposits, or the technological parameters of the flint. The choice of raw material was also influenced by the supra-regional, cultural predilection for flints of a certain appearance, and possibly colour as well. This resulted in the increased exploitation and subsequent long-distance distribution of products made from selected types of flint, such as axes made from Świeciechów flint.

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Resumé

Článek se zabývá početným souborem silicitových artefaktů pocházejících z hrobů kultury se šňůrovou keramikou v západním Malopolsku a v menší míře i nálezy ze sídlištního prostředí. Výrazný nárůst dostupných dat v posledních letech nám umožnil hlouběji porozumět surovinovým aspektům silicitové produkce v období pozdního eneolitu. V současné době je známo 290 hrobů ze západního Malopolska. Jejich inventář často obsahuje bohaté a funkčně rozmanité soubory silicitových nástrojů, včetně seker, hrotů šípů, různých typů nožů a křesadel. Pozoruhodným aspektem při analýze silicitů z pozdního eneolitu jsou preference výběru použitých surovin u předmětů uložených v hrobech. Úsilí vynaložené na vybavení zesnulých vhodně zvolenými surovinami je nejzřetelnější v nejbohatších inventářích spojených se zvláště významnými hroby dospělých mužů. Inventáře hrobů prozrazují vazbu świeciechowského silicitu při výrobě seker, zatímco čokoládový silicite se používal především k výrobě čepelových a úštěpových nástrojů. Použití vrstevnatého rohovec typu K pro výrobu seker je pak specifické pro oblast západního Malopolska. Evidentní výběr surovin není pouze utilitární, ale je ovlivněn také ideologickým smýšlením převládajícím v pozdně eneolitických komunitách.

Oproti dřívějším obdobím zesiluje ve 3. tisíciletí př. n. l. selektivní výběr kamenných surovin, včetně silicitů pro výrobu

hlavních typů nástrojů. Vybrané druhy silicitů se pak přepravovaly ze zdrojových oblastí na velké vzdálenosti, a to jak ve formě polotovarů, tak hotových nástrojů. Dálková distribuce seker z páskovaného rohovce nositeli kultury kulovitých amfor se stalo středobodem studia malopolského eneolitu. V jejím stínu zůstává stejně intenzivní využívání świciechowského silicitu využívaného zejména kulturou šňůrové keramiky v pozdním eneolitu. Technologicky i esteticky působivé produkty pozdního eneolitu dokládají význam dálkového importu v pozdním eneolitu. Velkou roli zde hrál výběr suroviny, která určovala prestižní hodnotu artefaktů. Tento aspekt se odráží v pohřebním ritu, kdy jsou zesnulí vybaveni nástroji vyrobenými ze silicitu nejvyšší kvality. Sídlištní lokality vykazují oproti inventářům z hrobů tendenci k ekonomičtějším využívání silicitů z nejbližších dostupných zdrojů.

Preference výběru suroviny představiteli kultury šňůrové keramiky v západním Malopolsku nelze plně vysvětlit ekonomickými důvody, dostupností zdrojů suroviny nebo technologickými parametry jednotlivých využívaných silicitů. Volbu suroviny ovlivňoval i nadregionální trend v preferenci materiálu určitého vzhledu, případně i barvy. To vedlo ke zvýšené exploataci a následné dálkové distribuci výrobků z vybraných druhů silicitů, jako jsou například sekery ze świciechowského silicitu.

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