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BETWEEN THE COPYING, USE AND INNOVATION. A CONTRIBUTION TO THE STUDIES ON THE STONE TOOL INDUSTRY IN NEOLITHIC SOCIETIES OF THE GLOBULAR AMPHORA CULTURE IN THE POLISH LOWLAND (KUYAVIA)

ABSTRACT

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This article focuses on a section of studies on the Globular Amphorae Culture (GAC) stone production in Kuyavia. The source materials from this area provide evidence of heretofore unknown activity of stone workers of this culture engaged in production of adzes that copied the forms typical of Late Band Pottery Culture. The resulting observations challenge the view that GAC communities did not produce stone adzes of their own, but allegedly restricted themselves only to using ready-made adzes of other Neolithic cultures. The sources under discussion also provide documented information on an innovative contribution of Kuyavian GAC stone workers in the assortment of tool products. This assortment includes polishing plates with the shapes and dimensions that essentially differentiated them from the corresponding tools used in the area in the Neolithic. Nevertheless, the claim that the local GAC communities did not produce type of the stone adze that would be characteristic of their own still remains as valid as ever.

Keywords: stone industry, Globular Amphorae Culture, Polish Lowland, Neolithic

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INTRODUCTION

There is a prevailing view among the scholars doing their research on the earlier stages of the Stone Age that, as opposed to the majority of other Neolithic groups settled in this area, the societies of the Globular Amphora culture (GAC) in the Polish Lowland did not produce or develop characteristic types, respective of their own culture, of stone products (or more precisely, made of non-flint raw materials). The occurrences of “working” adzes only slightly differentiated morphologically and in a manner quite insignificant in terms of taxonomy and functionality traits, or forms of adzes characteristic for the communities of other Neolithic cultures, such as: Late Band Pottery culture (LBPC), Funnel Beaker culture (FBC), or perhaps Corded Ware culture (*e.g.*, Cofta-Broniewska and Koško 1982; Nosek 1967; Wiślański 1966; 1970; 1979; Szmyt 1996), have been reported and documented only sporadically in the source materials. It is only fair to acknowledge here a number of controversies, not further discussed in this article, regarding a certain cultural affinity of culturally ambiguous adzes with the so-called comb-like axe head (type D, according to Åberg 1918) with GAC. In the scholarly debate among Central European archaeologists that has centered on this particular question (*cf.* Åberg 1918; Behrens 1973; Brandt 1967; Herfert 1962; Jązdzewski 1936; Nilius 1971; Siuchniński 1972; Wiślański 1966; Zápotocký 1966; 1992), it was only Karl Heinz Brandt that was inclined to link the adzes of type D (similarly to those of type C) to the population representing this culture in north-west Germany (Brandt 1967, 41-43).

Similar reservations apply to the production of axes in GAC communities in the Polish Lowland that include inter-cultural forms with thick butt (with faceted or rounded edges) that in fact lack any significant diagnostic value (Chachlikowski 1990; 1991a; 1997; 2000; 2013; 2016; Wiślański 1966; 1970; 1979). Products of this type were made of both flint raw material and non-flint rock (conventionally referred to as stone). However, what is indicative is the fact that the predominant raw material for axes in Kuyavia used by GAC tool makers was indeed non-flint rock raw material (Chachlikowski 1990; 1991a; 1994b; 1997; 2000; 2013; 2016; 2017; Prinke and Skoczylas 1980a; 1980b). This is hardly surprising given the geological background of this area that lacks in natural deposits of preferential first-class non-flint rock raw material suitable for the production of macrolithic tools. Our current knowledge of the absolute dominance of non-flint materials in the production of axes among the Kuyavian GAC communities clearly contradicts the belief – established as early as the 1960s – about the alleged preponderance of flint rock raw materials (in particular with reference to striped flint) used for their production in the Polish Lowland (*e.g.*, Wiślański 1966; 1970; 1979; *cf.* also Balcer 1983). The import of axes made of striped flint among these communities was relatively insignificant, and in this regard unequally reported and studied within the Kuyavian GAC oecumene. In addition to the observations on the significant disproportions in the intensity in the use of macrolithic tools made of striped flint among the GAC communities in the area of what is now Kuyavia, it is also

necessary to point to distinct differences in the archaeological context in which they occurred in this area. One may come to this conclusion on the basis of the analysis of the distribution of these tools north and south of the River Zgłowiączka – Kanał Bachorze (more on that in: Chachlikowski 1990, 246, fig. 27; 1991a, 173, fig. 27; Szmyt 1996, 49-51, fig. 26; *cf.* also Fig. 1 in this article). With respect to the whole area of Kuyavia, these observations have shown the preponderance of the finds of macrolithic products made of striped flint south of the River Zgłowiączka that, significantly, were registered mainly in the GAC tomb assemblages. At the same time, north of the Zgłowiączka River, these finds are predominantly represented by the so-called loose finds, *i.e.* those that have no specifically documented archeological context of their unearthing, and by fragments of damaged “striped” macroliths unearthed within the premises of the settlements of FBC and GAC communities (Chachlikowski 1990, 246 and fig. 27; 1991, 173 and fig. 27; Szmyt 1996, 49-51 and fig. 26).

In the past, this inadequate level of knowledge of GAC stone products mainly resulted from the lack of available framework of appropriate methodical, purposeful and plan-oriented structured studies, properly documented in the source material, on the issues related to the sourcing and use of non-flint rock raw material in the area of the Polish Lowland in the Neolithic. The actual commencement of such studies with regard to Kuyavia was made possible following long-term archaeological excavation research focused on this particular problem and carried out between the 1970s and 1990s (*cf.* Chachlikowski 1989; 1990; 1991a; 1992; 1994a; 1994b; 1997; 2007a; 2007b; 2013). As a result of these investigations, rich and diverse source materials were gathered and examined. Today, this collection of source materials provides evidence of the manifestations of the activity of these communities with regard to stone tool industry, scarcely documented in the past. Since then, new areas of interest in research on the stone production among the inhabitants of the Polish Lowland have been delineated and formulated, both in terms of their methodological aspects (initial assumptions for the taxonomy of the sources and the recommendations as to their further proper analysis), as well as in conceptual assumptions (*i.e.*, the way sets of arguments for the explications of diverse, and complex manifestations of particular practices in stone production are framed). In addition, no less significant sources for improving our knowledge on the stone industry of early-agricultural societies inhabiting the region have been furnished by archaeological rescue excavation work (predominantly those that were carried out from the second half of the 1990s) at a number of sites along the course of large linear developments that crossed Kuyavia (such as the Yamal – Europe gas pipeline and the A1 and A2 motorways) as well as the archaeological rescue work carried out along the courses of less significant gas pipelines (*cf.* for example: Chachlikowski 2000; 2004; 2016; 2017).

The present article focuses on a certain section of past and current research on the stone industry of GAC settlements in Kuyavia and explores those sources that include tool profiles, *i.e.* the typological and formal assortment of stone products representing this par-

ticular production. The source material that comes from the region can serve as evidence of the already recognized phenomenon of the acquisition and use by this population of final products, *i.e.* the adzes indicative of the societies of other Neolithic cultures inhabiting the region (or more precisely those of LBPC and FBC). In addition, these sources supply documentary evidence about the range of activity of local GAC stone workers in production of stone adzes that related to the forms conventionally linked to LBPC, *i.e.* the somewhat poorly explored issue that has not yet been properly scientifically addressed and researched. Other important observations also consider the finds that would corroborate the assumption of the production and use by this population of specifically shaped polishing plates with their shapes and dimensions that are not to be found within this particular category of tools in societies of other cultures in this area in the Neolithic. The research values of the presented sources documenting the GAC stone industry in the Polish Lowland sufficiently justify further discussion on the issues indicated in the title of the present article.

1. DATASHEET OF SOURCES

The present study is based on an investigation of the collection of material remains evidencing the stone industry of GAC communities in Kuyavia that come from the excavation work at eleven archaeological sites (Fig. 1; Tables 1 and 2). In addition, a single stone relic representative of the FBC society in the form of a fragmentarily preserved adze (*cf.* Table 1), found on one of the GAC sites is also taken into account in this article (more on that in the remarks below).

The source materials include exclusively specimens whose exact location was firmly established and their treatment could be clearly interpreted as evidence of intentional use, and those that could have been relatively surely or potentially identified and linked to the manifestations of a particular stone industry of an exclusively single culture, *i.e.* those that formed relatively homogenous inventories. The basis for the cultural classification of these items, or plausible validation of the presumption of this classification, was the scrutiny of the planimetric floor plan of the archaeological excavations and on stratigraphic assumptions (in fact, the vast majority of the material had been unearthed in discrete features, whereas the instances of finds loose in a layer were sparse). The applied classification was also based on typological premises and those pertaining to the raw material used that were applicable to part of the finds (more on the assumptions of these premises and their relevance to the studies on the stone industry of early agrarian societies in Kuyavia, see *e.g.*: Chachlikowski 1992; 1994a; 1994b; 1997; 2000; 2007a; 2007b; 2016; extensive literature cited therein). The stone products under examination have all been relatively well documented within their archaeological context of their discovery, *i.e.*, the place where they have been unearthed. This have made it possible to pinpoint relatively accurately their cultural and chronological affiliation (*cf.* Tables 1 and 2).

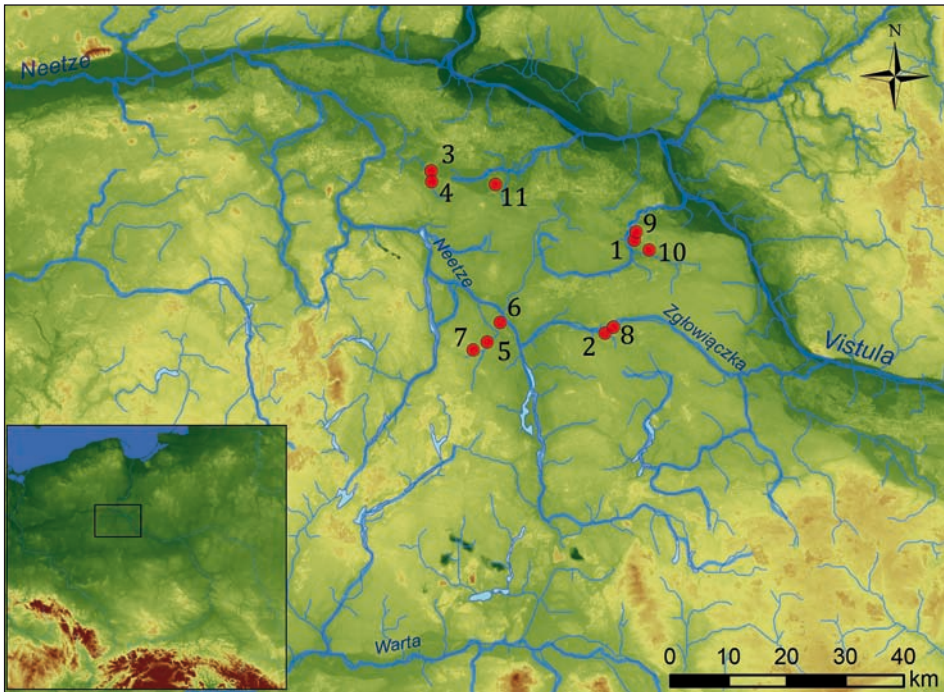


Fig. 1. Map showing GAC archaeological site locations in Kuyavia mentioned in the text from where the stone materials discussed in the article were extracted (drawing by J. Niebieszczański).

Note: Site numbers in the figure correspond to identification numbers of sites in Tables 1 and 2

The source materials that are discussed in this study represent a vast array of divergent assortment of products (in terms of their typological and formal features as well as the degree of the processing they have undergone) that are conventionally linked to the production and exploitation of non-flint rock raw material. By examining the full body of the sources linked to stone industry, it was possible to categorise them into individual groups on the basis of the following criteria: raw material used, typological, technical and functional features discussed and validated in the earlier works (Chachlikowski 1990; 1991a; 1992; 1994a; 1994b; 1997, 31-37; further extensive references therein). In all, they represent a non-uniform assortment of products (in terms of their typological and functional features) included in this production, namely those related to the production and use of adzes and polishing plates. These finds were documented in both the form of their final products (or their damaged specimens) and unfinished forms (or their damaged specimens).

There are two items in the group of adzes. The first is an unfinished form of an adze made of gneiss by a GAC stone worker and found in a pit identified as a relic of a stone workshop, unearthed within the perimeter of a settlement of this culture from Phase IIb at

Table 1. Sites of Globular Amphora communities in Kuyavia where the stone adzes were found, with their cultural and chronological affiliation, presenting their formal, technical and raw material characteristics (cf. Fig. 1). Notes: ^a Numbers of the sites in Table 1 correspond to the reference numbers of the sites shown in Fig. 1; ^b All localities within the administrative boundaries of the Kujawsko-Pomorskie voivodeship; ^c Petrographic characterisation of the raw material for all stone products was performed using the macroscopic method (by the naked eye or with the aid of a magnifying glass). Examinations of the type of rock of the sources were performed by the present writer with consultation of Prof. dr hab. Janusz Skoczylas of the Institute of Geology at the Adam Mickiewicz University in Poznań

Item No ^a	Location site, commune ^b	Culture/phase (after Szmyt 1996)	Formal and technical qualification (after Chachlikowski 1997)	Raw material qualification ^c	Figure
4.	Tarkowo 31, commune Nowa Wieś Wielka	GAC/IIb (or IIb/IIIa)	unfinished (initial) form	gneiss	2:1
10.	Przybranowo 10, commune Aleksandrów Kuj.	FBC/?	ready-made product (fragment of a blade)	diabase	3:3

Table 2. Sites of Globular Amphora communities in Kuyavia where the polishing plates characteristic for this population were found (cf. Fig. 1). Notes: see notes in Table 1

Item No ^a	Location site, commune ^b	Chronology (phase, after Szmyt 1996)	Raw material used ^c	Source (literature)	Figure
1.	Podgaj 6A, commune Aleksandrów Kuj.	IIb	quartzitic sandstone	Chachlikowski 1994a; 1997	Fig. 3:2
2.	Smarglin 51, commune Dobre	IIb	quartzite	Chachlikowski 1997	
3.	Tarkowo 49, commune Nowa Wieś Wielka	IIb	quartzitic sandstone	Chachlikowski 1997	
4.	Tarkowo 31, commune Nowa Wieś Wielka	IIb (or IIb/IIIa)	quartzitic sandstone	Chachlikowski 1990; 1991a; 1997	Fig. 2: 1, 2, 7
5.	Bożejewice 28, commune Strzelno	IIb-IIIa	quartzitic sandstone	Chachlikowski 2000	Fig. 3:4
6.	Janowice 2, commune Lubanie	IIb-IIIa	quartzitic sandstone	Chachlikowski 2016	
7.	Żegotki 2, commune Strzelno	IIb-IIIa	quartzitic sandstone	Chachlikowski 2000	Fig. 2:6
8.	Dęby 29, commune Dobre	IIIa	quartzite, quartzitic sandstone	Chachlikowski 1992; 1997	
9.	Goszczewo 13, commune Aleksandrów Kuj.	IIIa	quartzite, quartzitic sandstone	Chachlikowski 1990; 1991a; 1994b; 1997	Fig. 2:5
10.	Przybranowo 10, commune Aleksandrów Kuj.	IIIa	quartzite, quartzitic sandstone	Chachlikowski 1990; 1991a; 1997	Fig. 2:3, 4 Fig. 3:1, 6
11.	Liszkowice 24, commune Rojewo	IIIb	quartzitic sandstone	Chachlikowski 1990; 1991a; 1997	Fig. 3:5

Site 31 at Tarkowo, Nowa Wieś Wielka commune (*cf.* Table 1 and Fig. 2: 1; more see Section 2). The other specimen is a fragment of the blade of an adze of FBC population made of diabase, registered in a GAC settlement from Phase IIIa at Site 10 at Przybranowo, Aleksandrów Kujawski commune (*cf.* Table 1 and Fig. 3: 3; see Section 2 of this text).

A separate typological and functional category of the discussed sources includes the finds related to the production and use of polishing plates manufactured by the GAC population inhabiting the region (more see Section 3 of this text). This group of stone products is presented in a separate listing in Table 2. The table provides information on the following: the location of individual sites from where the discussed finds were extracted, their chronological affiliation and the type of raw material of which they had been made. A part of these sources is presented graphically in Figs. 2: 2-7; 3: 1, 2, 4-6 (*cf.* also Fig. 4).

2. THE COPYING AND USE

Products linked to the stone industry of Globular Amphorae communities in Kuyavia include those manifestations, relatively well documented in sources, of the production and use of adzes, *i.e.* the products rarely reported on in scholarly literature (*cf.* Chachlikowski 1997; 2000; 2013; Cofta-Broniewska and Koško 1982; Nosek 1967; Szmyt 1996; Wiślański 1966; 1970; 1979). In the stone inventories of this culture, predominantly from the classical amphorae phase stage of its development (*i.e.* from Phases IIb-IIIa, after Szmyt 1996), artefacts have been identified that testify to both the local indigenous production of adzes (from Phase IIb GAC) that typologically were related to the products of LBPC communities as well use of the forms of adzes characteristic for the FBC population (from Phase IIIa GAC).

The production of tools with late linear pottery features by the GAC population in Kuyavia can be supported by the evidence provided by the find of stone objects recorded in a Globular Amphorae settlement from late Phase IIb (or from the turn of Phase IIb/IIIa) at Site 31 at Tarkowo. This involved adze-like specimens with their features being typical for the forms of tools used by the communities of the Kuyavian LBPC groups. The material includes an unfinished (initial) form of an adze made of gneiss (*cf.* Table 1 and Fig. 2: 1), deposited within the premises of a stone workshop (see the remarks below). For its execution, a single rock block with the shape and dimensions that matched the dimensions of the final products as much as possible was used, hence no significant modifications were needed. The half-product of an adze under discussion represents a block with a low degree of treatment. Along its natural planes, traces of macroscopically discernible surface knapping and crushing were identified (discernible by the naked eye or revealed by the magnifying glass) that had been performed to remove natural roughness of the block. The sizeable dimensions of the half-product, its chunky irregular head that retained the natural surfaces of the original rock block suggest obvious similarities with the adzes produced by the population of LBPC (*e.g.*, Brandt 1967; Czerniak 1980; Grygiel 2008).

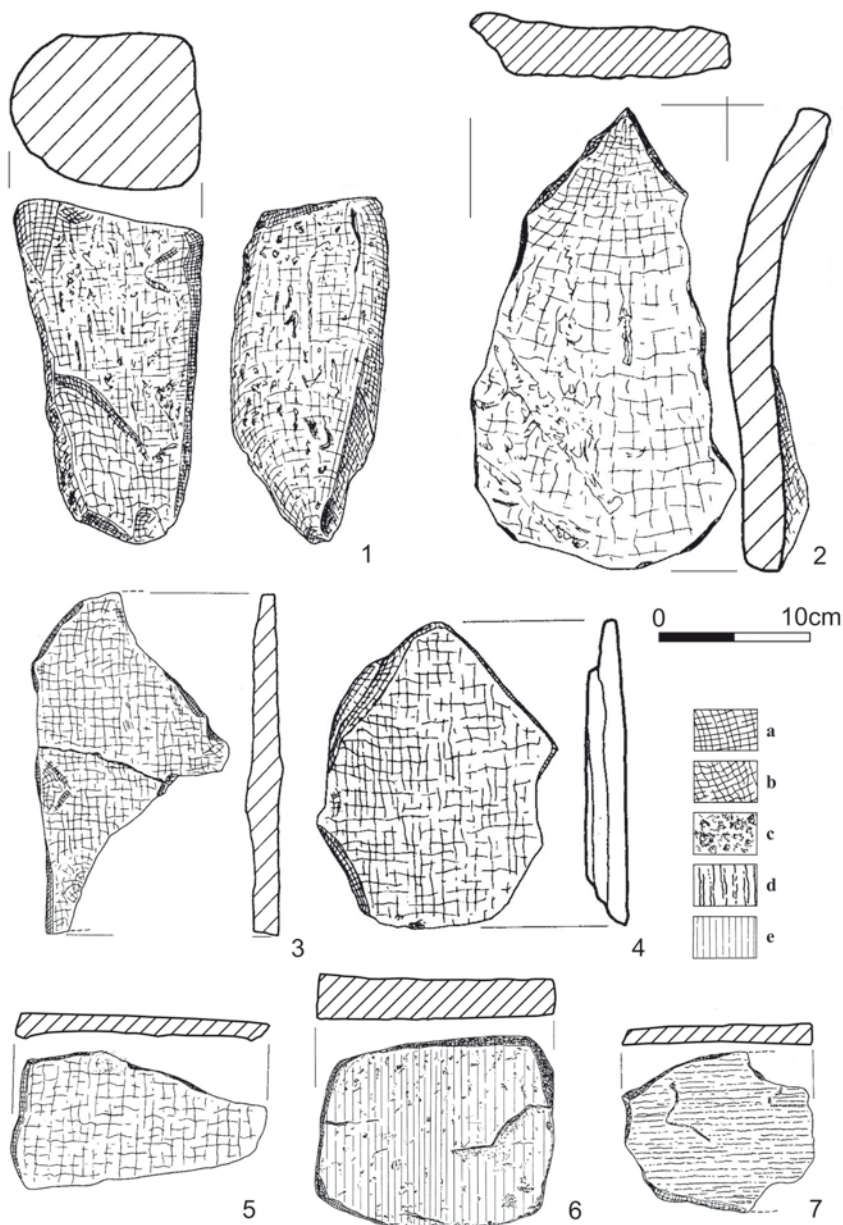


Fig. 2. Stone products of GAC population (drawings by P. Chachlikowski, J. Wierzbicki). Detailed information on the sites where individual products were unearthed as well as their chronology are shown in Tables 1 and 2. 1 – unfinished (initial) form of adze; 2-5 – unfinished forms (semi-products) of polishing plates; 6 – polishing plate; 7 – fragment of a polishing plate. Raw materials: gneiss – 1; quartzite – 3, 4; quartzitic sandstone – 2, 5-7. Key: a – natural surface; b – negative surface; c – breaks; d – surface with traces of stripping (grinding); e – surface with traces of polishing

The unfinished Tarkowo adze was found among the remnants of a supposed working place of a local stone worker, *i.e.*, a stone production workshop. The relics of the local stone processing workshop included a range of stone items deposited in a storage pit. Beside blocks of semi raw-material and unfinished forms of tools (that included beside the mentioned adze, also axes, grinders and polishing plates), other tools used for stone treatment (polishing plates) and chipped stone debitage fragments (small in amount), *i.e.*, debris from stone tool production, flakes and other material removed during the course of reducing larger stone blocks into finished tools, were also present (*cf.* Chachlikowski 1991a, fig. 2; 1997, Table 26, figs. 35-38). In the immediate vicinity of the storage pit, *i.e.* in a place where rock blocks were stored and processed until the required dimensions were achieved, the remnants of a light pole structure erected on the surface of the earth (a kind of a shed) that can be interpreted as a ground shelter for the working place of the stone worker were also reported (Chachlikowski 1997, fig. 100).

The half-product from Tarkowo is as yet the only, but a tangible, piece of evidence and proof of the production of stone adzes by late Neolithic GAC population in Kuyavia that would relate typologically and formally to the stone adzes used in LBPC groups. One also might mention at this point the find of an unfinished adze at Site 1 at Tuczno, Kujawsko-Pomorskie voivodeship (Wiślański 1966, 40, fig. 11: 20) that would suggest the possibility of the production of the adzes associated with FBC by the communities of the oldest GAC groups (those from Phase I) in the region. But the rather ambiguous context surrounding the circumstances of the find of the FBC adze half-product (Wiślański 1966, 40), and the lack of sufficient publications documenting the source materials from the study at the GAC settlement at Tuczno, inspire caution in accepting the interpretation of the cultural and chronological qualification for this particular find.

However, it is worth citing again the older data obtained from Site 1 at Tuczno that seem to corroborate the possibility of use of stone tools (or perhaps even production?) of the "late linear pottery culture" type by the local GAC communities from Phase I (Wiślański 1966, 40, fig. 11: 19; *cf.* also Cofta-Broniewska and Koško 1982; Czerniak 1980; 1994). For the same reason, the find of a fragment of an adze (a section of its butt) at Site 5 at Kuczkowo, Kujawsko-Pomorskie voivodeship (Chachlikowski 2000, 405) is worth mentioning here. This product was reported to have been found in the so-called household pit (Feature A178) in association with GAC pottery dated probably to the Early Amphorae horizon (*i.e.* Phases I-IIa). What is interesting, the form of this specimen, with broad irregular unpolished head and made of biotitic gneiss, suggests some distinct analogies with stone adzes linked to the LPCB communities (*e.g.*, Brandt 1967; Czerniak 1980; Grygiel 2008). However, the culturally inhomogeneous character of the ceramics excavated from Feature A178 from Kuczkowo (beside the fragments of GAC utensils in question, there is a decidedly less frequent number of materials of the Linear Pottery Culture and Late Linear Pottery Culture) does not allow us to establish a definite link between the Kuczkowo adze and the local settlements of GAC population. Despite the inevitable doubts surrounding

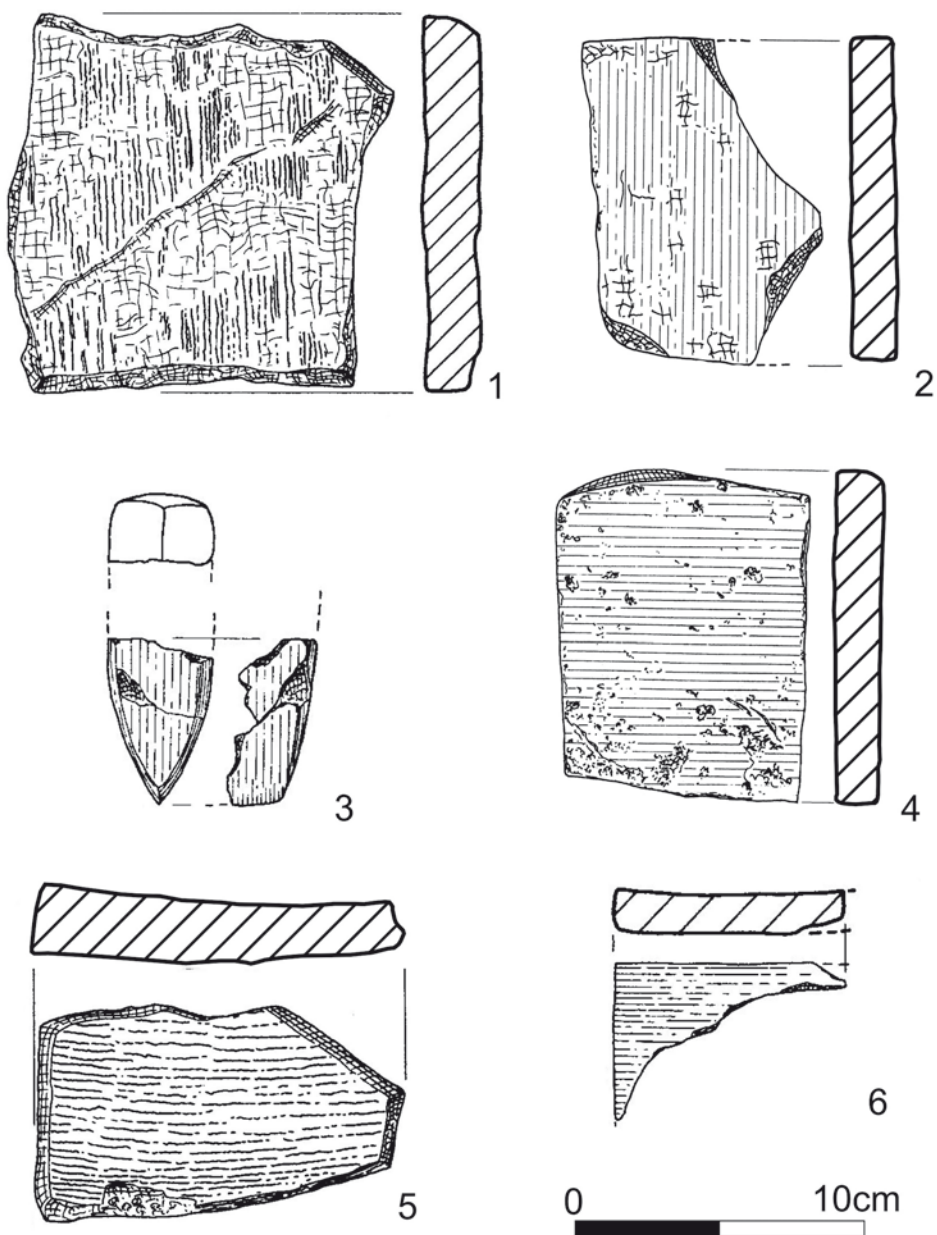


Fig. 3. Stone products of GAC population (drawings by P. Chachlikowski, J. Wierzbicki). Detailed information on the site individual products were unearthed as well as their chronology are shown in Tables 1 and 2. 1, 5 – polishing plates; 2, 4, 6 – fragments of polishing plates; 3 – fragment of an adze. Raw materials: diabase – 3; quartzite – 6; quartzitic sandstone – 2-5



Fig. 4. Przybranowo, Kujawsko-Pomorskie voivodeship, Site 10. Polishing plate (its initial form) made of quartzitic sandstone (cf. Fig. 3:1) (photo by P. Chachlikowski)

the above quoted materials from Tuczno and taking into consideration the evidence provided by the chronologically later stone sources from Tarkowo, an educated guess might be that there was indeed a relationship between the adze from the pit A178 and the “amphorae” stage of the settlement at Site 5 at Kuczkowo, and that this hypothesis is not at all groundless. Even though there is indeed ambiguous cultural and archaeological context involved here, it is still a scholarly justifiable assumption that clearly needs further research.

The phenomenon of the use of adzes typical for FBC settlements by the Kuyavian GAC communities from Phase IIIa was identified in the stone material unearthed on the multi-dwelling settlement of this population at Przybranowo, Site 10. The find in question is a damaged specimen of an adze (or more precisely, a fragment of the blade) made of diabase (cf. Table 1 and Fig. 3: 3). The find occurred in the layer in the immediate vicinity of two GAC habitation structures (Features Nos. 11 and 16) that represent habitation structures of the type of their construction that were partly semi-subterranean (Chachlikowski 1990, fig. 22; 1991a, fig. 22). The relationship of this particular specimen with the FBC can be validated by its stylistic traits (to be found, for example, in the tendency to preserve the symmetry of the product), and also by the raw material from which the object had been made. In view of what is currently known on non-flint rock raw materials used in the manufacture of products more characteristic culturally and/or typologically in the Polish Lowland in the Neolithic (with particular reference to stone products with chipped blade), diabase (beside amphibolite, basalt, diorite, gabbro, gneiss, biotitic gneiss and schist in its different varieties) was the type of raw material that was most frequently exploited by FBC communities, whereas it was significantly less common with the tool workers of other Neolithic cultures in this area (Chachlikowski 1994a; 1997; 2000; 2007a; 2007b; 2013;

2018; Chachlikowski and Skoczylas 2001; *cf.* also Prinke and Skoczylas 1980a; 1980b). In addition, it is important to remind the reader that with the communities of the “Funnel Beaker” culture, diabase was decidedly the dominant material (beside gabbro) in the production of stone adzes, despite the fact that it is rarely to be found among Fennoscandian erratics available in the Polish Lowland (Chachlikowski 2013; 2018).

A number of hypotheses can potentially account for the finding of the FBC adze in the GAC settlement at Site 10 in Przybranowo. The first of them assumes that what we encounter within the space of the site is the superimposition of successive GAC settlements (from Phase IIIa) built on top of the relics of the earlier settlements of FBC population, or alternatively, what would the second hypothesis postulate, the phenomenon of the abandonment of damaged final product by the populace of developmentally late FBC groups that can be registered at the site. The third hypothesis, in turn, would indicate the possibility of the production of adzes by the local GAC stone workers that imitated the forms typical for the FBC societies. Furthermore, one cannot exclude the possibility of the phenomenon of the re-utilisation of the product in question, *i.e.* instances of reusing existing FBC adzes by the inhabitants of the GAC settlement in Przybranowo. Finally, the fifth hypothesis would take into consideration the phenomenon of the use of the adze (ready-made final product) by the inhabitants of this GAC settlement that had been acquired by way of barter from contemporary late-beaker FBC groups.

The latter hypothesis seems in my opinion to be the most probable, taking into account the context of the find of the discussed FBC adze at Site 10 in Przybranowo (in the immediate vicinity of the local GAC living quarters), and also quite episodic manifestations of the FBC population settlements at this particular site (documented on the outskirts of the GAC population settlement), as well as the raw material traditions of the FBC stone industry in Kuyavia in the production of adzes (which would exclude the possibility of copying of the adzes from this culture by GAC stone workers). This hypothesis assumes that the finding of the FBC adze in the GAC settlement in Przybranowo documents the phenomenon of use of ready-made adzes produced by FBC stone workers by the inhabitants of this GAC settlement. Even if this hypothesis seems too bold at first glance, or is far too controversial, then it is surely attractive enough in terms of its cognitive value, that should not be too hastily discarded and is definitely worth considering.

3. INNOVATIVENESS

In the light of the most current and advanced studies on the stone industry of GAC communities in Kuyavia, it is possible to put forward a suggestion about “typological” cultural and chronological identification of the tool forms that so far have been considered to be culturally undistinguishable and uncharacteristic, as supposedly being taxonomically irrelevant for purposes of scientific explanation due to lacking a cultural identity.

From among the products that served as polishing stones and were used by this society, a number of polishing plates with specifically formed morphometric characteristics have been reported, *i.e.* those with quadrilateral shapes that are relatively small in dimensions and thickness not exceeding 2 cm. These were represented by finished products that had unmistakable features of previous use, evidenced by the traces of polishing or grinding (*cf.* Table 2; Figs. 2: 6, 7; 3: 1, 2, 4-6 and 4), as well as unfinished forms, *i.e.* half-products, with different degrees of treatment to achieve the desired shape and dimension of the future tool (*cf.* Fig. 2: 2-5; see the remarks below). The form and dimensions of these products of the Kuyavian GAC stone industry make them distinctively different from the corresponding tools used by the societies of other cultures inhabiting this area in the Neolithic (*e.g.* Chachlikowski 1990; 1991a; 1992; 1994a; 1994b; 1997; 2000; 2007a; 2007b; 2013; 2016; Szydłowski 2017).

Production and use of these polishing plates has been identified in the materials linked to the classical stage of the development of the local population of this culture, *i.e.* with Phase IIb-IIIa (*cf.* Table 2). Products of this type occur sporadically and do not always have the delimiting morphometric parameters (mainly in relation to their shape) in the GAC stone materials from Phase IIb (Podgaj, Site 6A; Smarglin, Site 51 and Tarkowo, Site 49). However, the most frequent finds of this particular tool form have been unearthed in the settlements of “Globular Amphora” communities from the turn of Phase IIb/IIIa (Tarkowo, Site 31) and Phase IIIa (Dęby, Site 29; Goszczewo, Site 13 and Przybranowo, Site 10). Their infrequent occurrence has also been reported among the products of the GAC stone industry from the beginning of Phase IIIb (Liszkowice, Site 24). Some of the discussed polishing plates have been reported in the inventories that are essentially linked to Phases IIb-IIIa (Bożejewice, Site 8; Janowice, Site 2 and Żegotki, Site 2).

To produce the grinding and polishing plates under discussion, GAC stone workers used exclusively quartzite and quartzitic sandstone (*cf.* Table 2), commonly available in glacially deposited rocks found in the Polish Lowland (Chachlikowski 2013; 2018). The identification of the raw material used for these tools can now be validated by the relatively well identified phenomenon of the selection of particular rock raw materials used by stone tool makers in the Polish Lowland in the Neolithic (more on that in: Chachlikowski 1997; 2013; 2018; Chachlikowski and Skoczylas 2001; *cf.* also Prinke and Skoczylas 1980a; 1980b). The above also applies to the products used as polishing plates, where we can also observe manifestations of the selection in the types of rock that were most suitable for the purpose (*i.e.* future function or operation). Given the circumstances and due to these scientifically verified dependencies, this immediately triggers the conclusion that the local population decidedly preferred only some, carefully selected, raw materials for the production of this particular tool form.

The quartzites and quartzitic sandstones used in the production of the polishing plates had specific features (technical and physical) that were particularly sought by the producers, and that these particular features sufficiently met the expectations of their users. The

raw materials used for these tools belong to the types of rock that split in a natural way into slabs (with any possible thickness, *cf.* Fig. 2: 2-5). They have a natural separation (the so-called joints) that made it possible for GAC stoneworkers, the producers of the polishing plates, to obtain the required shapes and dimensions of future products more easily (Bolewski and Parachoniak 1982; Skalmowski 1937; 1972; Wojno and Pentlakowa 1956). It is easy to obtain the required form of the surface of the future tool by whittling down a large chunk of quartzite or quartzitic sandstone using a stone pestle along its natural fissures of the used raw material (typically discernible by the naked eye). The direction of the hit was to be parallel to the joint planes in a body of rock. Then, the plates obtained in this way and initially reduced to suitable pieces, were given the required shape (in this particular case, quadrilateral or quadrilateral-like) by touching up dulled edges by striking them in the opposite direction to the natural fissures in the raw material (the direction of the hit was at an angle perpendicular to the natural fracture in a body of rock). Moreover, quartzites and quartzitic sandstones are characterised by outstanding polishing or grinding properties (Skalmowski 1937; 1972; Wojno, and Pentlakowa 1956), and hence, they served as an ideal material for processing of non-flint rocks or products that would have been fabricated from flint, bone and antler.

SUMMARY AND CLOSING COMMENTS

Until as early as the initial years of the 1990s, the characteristics of the GAC stone industry in the Polish Lowland were only rarely addressed in the literature. Our knowledge was largely limited to the production of taxonomically irrelevant tools for every-day use, such as axes, polishing plates, querns or grinders, commonly used items in the household, or possibly (but equally rarely) the use of the forms of adzes by these communities that were characteristic for the societies of other Neolithic cultures inhabiting the area.

A watershed moment in the research on the stone industry of the communities inhabiting the Polish Lowland at the times of their early agrarian stage of development came with the results of long-term investigations (on site and laboratory studies) conducted in Kuyavia. With regard to the tool assortment of the GAC stone industry, the source materials discussed in this article suggest the possibility of the use (in the form of their final products) of adzes by this society linked to LBPC and FBC, earlier based only on supposition and indeed academic conjecture. However, the sources from this region mainly document manifestations, as of yet unknown among the GAC population in Kuyavia (or within a broader context, the Polish Lowland), in their attempts to produce stone adzes that would copy the types of adzes typical for LBPC communities. Equally significant conclusions refer to the GAC communities innovative contribution to the assortment of tool products in the stone industry in the Polish Lowland. This refers to polishing plates with their shapes and dimensions that significantly departed and differed from corresponding tools used by the communities of other cultures in this area in the Neolithic.

The observations presented in this article strongly support the hypothesis that assumes a continuation of the tradition of the use (production?) tool forms (adzes) characteristic of late-band pottery societies by the population of earlier GAC groups (*i.e.* those from Phase I-IIa), and later GAC groups (*i.e.*, from Phase IIb) in their development in Kuyavia. When it comes to the specimens of the GAC population evidenced at Site 31 at Tarkowo, the manifestations of the production of adzes that were characteristic in their form of LBPC have been undeniably identified. At the same time, the Tarkowo stone materials challenge the view, heretofore firmly established in literature, that the Lowland communities representing this culture did not produce stone adzes of their own, but confined and restricted themselves to acquiring and using ready-made products that came from other cultures (*i.e.* LBPC and FBC).

The evaluation of genetic relationships of the globular amphorae stone industry somewhat supports the mid-Neolithic conception of the origins of GAC that assumes “late-band” succession of this culture in Kuyavia, and at the same time a long-lasting and lingering time contact with FBC (more on that in: Chachlikowski 1991b; Czerniak 1994; Szmyt 1996; further literature therein). The conception of the origins of GAC (or more precisely of the beginning of its formatting period) as the successor of LBPC (with the fair share of FBC, Phase IIIA) also finds a fuller justification in, among other things, the assumptions about the use and production of a “late-band” form of stone tools. At the same time, it is proper to mention the earlier observations on the genetic relationships between the raw material structure of the stone production of LBPC and GAC communities of the Early Amphorae horizon (from Phases I-IIa). The identified relationships allow us to even put forward a hypothesis about a full succession of the tradition of LBPC stone industry among the earliest GAC communities in Kuyavia (more on that in: Chachlikowski 1990; 1991a; 1997; 2000; 2013). In turn, the manifestations of the relationship between the stone production of GAC communities (most thoroughly documented for the classical amphorae stage of development of these communities) and the tradition of contemporary stone industry of FBC communities seem to involve mainly the practices of rock raw material selection for the production of products with separated edges. This selection refers primarily to the use of diabase and biotitic gneiss in the production of adzes and axes (Chachlikowski 1990; 1991a; 1997; 2000; 2007a; 2007b; 2013; 2016; 2018; Chachlikowski and Skoczylas 2001, see also Prinke and Skoczylas 1980a; 1980b; Szydłowski 2017). A good example of the manifestation of the continuation in practice of the traditions of FBC stone industry by GAC communities is the use by this population of forms of stone adzes of the funnel beaker type, or possibly even their production (*e.g.* the unfinished Tuczno adze, Site 1, mentioned earlier in the text – Wiślański 1966, 40, fig. 11: 20).

This picture of the genetic relationships of GAC stone production in Kuyavia outlined above shows the diversity of production traditions impacting the activity of the stone worker of the “globular amphorae” communities. As valid as ever is, however, the claim that the Kuyavian GAC communities did not produce a type of the adze that would have

characteristic features of its own and would thus constitute a proper diagnostic cultural identifier (Chachlikowski 1990; 1991a; 1997; 2000; 2013; 2016; Cofta-Broniewska and Koško 1982; Czerniak 1980; 1994; Nosek 1967; Szmyt 1996; Wiślański 1966; 1970; 1979).

The above cannot be claimed, however, with regard to the products made by GAC communities that were used as polishing stones. This primarily refers to the polishing plates, typical for the Kuyavian globular amphora groups, with characteristically shaped morphometrics that would substantially differentiate them from the corresponding types of tools produced and used by societies of other cultures in the region in the Neolithic. In the light of the current knowledge on the stone industry of GAC communities, plates of this type occur in the materials linked to the classical stage of development of the population of this culture in Kuyavia, *i.e.* with Phases IIb-IIIa, most frequently though from the transition time of these two phases, and from Phase IIIa. They are only sporadically reported in the lithic inventories of "Globular Amphorae" communities dated to the beginning of Phase IIIb. It is worth adding at this point that similar products were used by the population of the Trzciniec Cultural Circle at Rybiny, Site 14 and Site 17, in the Kujawskie Lake District (Chachlikowski 1989; Makarowicz 1989; 1998; 2000). There is no doubt, however, that the polishing plates of this type found within the perimeter of Trzciniec settlements relate to the tradition of GAC communities, and are also recognized in the pottery industry (more precisely in the technology involved) of these communities from Rybiny. Hence, one may conjecture that this innovative tool offer presented by Kuyavia-based GAC stone workers found its continuation in the stone production of local population groups inhabiting the area in the early Bronze Age.

The production and use of polishing plates linked to the GAC coincides with the time span of the unprecedented increase in the processing of rock raw materials by the communities of this culture at the time of the classical amphorae stage of their development in Kuyavia. Stone production among these communities reaches a scale not found in earlier and later phases of their development (more on that in: Chachlikowski 1990; 1991a; 1994b; 1997, 2000; 2013; 2016). This phenomenon has been identified so far by, among other things, a generally recognized increase in the processing of rock raw materials, primarily for products used as axes, milling utensils (querns and grinders) as well as multifunctional tools (such as polishing plates, hammerstones, polishers or stone pads), with the concurrent use of the most diversified assortment of lithic materials for the manufacture of these products. It is with this particular period of the development of the Kuyavian GAC that we can also associate the manifestations of the activation of these communities in acquisition and use of "imported" raw materials (*i.e.* those of other than Lowland provenance) from the source areas that were rich in stone deposits and located south of the Polish Lowland (Chachlikowski 1990; 1991a; 1996; 1997; 2013). The increase in the interest of these communities of the time in the production of items of stone can also be documented in the manifestations of complex (more specialised) forms of sourcing (open pit mining of local erratics) and processing of stone raw materials (in the form of separate

stone workshops). Significant identifiers of this pronounced progress in the late Neolithic GAC stone industry in Kuyavia include additionally the fact that the materials started to include specifically formed (in terms of shape and dimensions) polishing plates that undoubtedly were an innovative contribution to the stone production in the Polish Lowland in the Neolithic.

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