Slovak Geol. Mag., 7, 4 (2001), 381–392

Neolithic rock raw materials from the Kujawy region (Polish Lowland)*

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Abstract: The choice of the raw material for stone implements production among the communities was not thus accidental but intentional and depended, among other things, on physical and technical properties of individual rocks to be used. Manifestations of the selection of the most suitable raw material for a final product have been distinguished in a specific selection of raw materials. The presented relationships between the function of the choice and the type of the material used for its production fully justify the assumption that the Late Neolithic communities of the region had a high level of practical knowledge about the available rock raw material.

Key words: petroarchaeology, erratic rock raw material, utilisation, Lowland Poland, Neolithic.

Introduction

Advances and developments in pre-historical studies are nowadays, unlike other fields of science that deal with the history and culture of mankind, dependable on the possibilities and achievements in natural science as well as in physics and chemistry. The branches of science supporting studies in prehistory, especially in relation to taxonomic research, and in particular chronology establishment as well as the selected aspects of economy and some production (processing) issues have been found of the well-established usefulness.

Studies on the reconstruction of the environmental conditions of the existence of pre-historical and early-historical communities have also gathered momentum in their significance. The contribution of the relevant studies to the knowledge of manifold and complex manifestations of the activities of man and the surrounding nature in which he shaped his presence appears to be unshakeable and by no means unimportant.

Geological sciences are given the ever-increasing interest in the studies upon the economy of pre-historical and early-historical communities of the river-basin of the Vistula and Odra rivers, especially when it comes to the methods used in petrography. The co-operation between archaeologists and geologists encompasses the increasing number of joint research subjects, which illustrates well the phenomenon of pursuing new fields of interests currently taking part in the contemporary pre-history studies. This tendency is also exemplified by the scientific description of the origins and utilisation of stone raw material in the past which is labelled as petroarchaeology.

Petroarchaeology can be thus placed within the study of the phenomena characteristic for modern science, which lead to a creation of new study areas, in this case of natural science, and the sciences which deal with material remains of the past (made of rock or minerals). The research issues formulated within the interests of petroarchaeology must be then solved by way of the complementary use of research methods proper for geology, especially petrography, and archaeology.

Petroarchaeology is thus an interdisciplinary branch of science placed somewhere between the sciences whose primary interest lay upon the earth's crust and those which focus their attention on products (objects of rock or minerals) of man's activity in the pre-historical past.

A conception of the actual placement of petroarchaeologiocal studies - in terms of its formal and cognitive status and the scope and subject of its application - was presented essentially by Chachlikowski (1994a; 1994b; 1996; 1997). The presentation of the "research space" of petroarchaeology outlined in the works allows us to understand better the placement of the said studies within the "archaeology of stone and mineral raw material" as well as the complexity of its methodical and theoretical position within the sciences dealing with man's development in the past.

Rock raw material, primarily of all siliceous rocks and other non-siliceous rocks, found application in those lines of production whose source manifestations represent those which are best documented in archaeological material (ceramics, pottery, stone industry products, mortar, building materials). In the case of older epochs they form, basically, the only relics of the history of the past. Thus the range of potential petroarchaeological studies appears to be wide enough and includes a number of different economic activities of man - in relation to, primarily, pottery, flint tools production, and stone production, i.e.

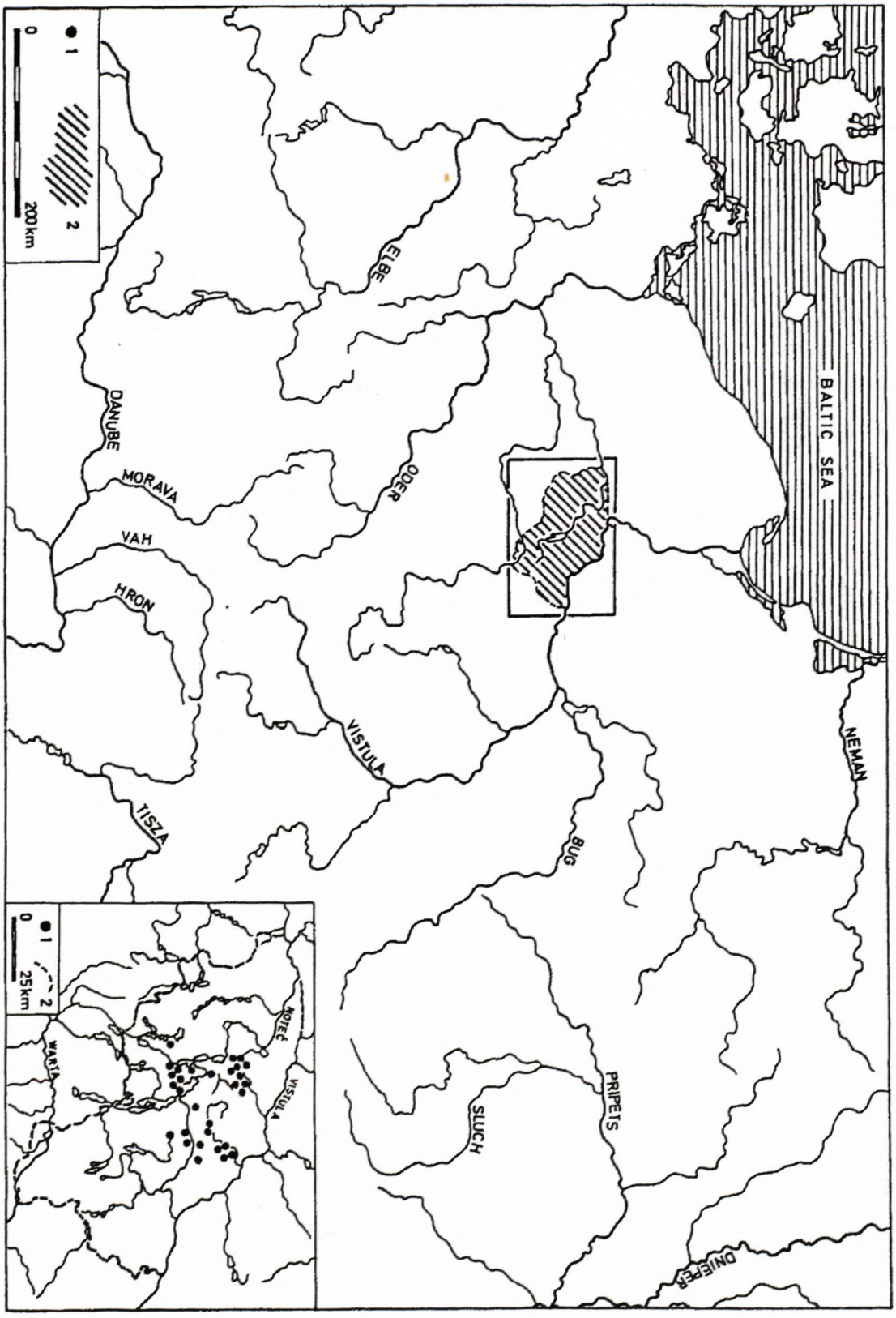


Fig. 1 Distribution of the settlements-sites of FBC and GAC populations in the Kujawy region the sources included in the present work refer to.
Legend: 1- settlement-sites; 2 – ranges of the Kujawy settlement and cultural mesoregion..

those activities which were very important to create foundations for the basic spheres of existence of the prehistorical and early-historical communities.

Rock and mineral raw-materials, along with their importance in satisfying material conditions of living, were also valuable for the production of items that indicated status, prestige or wealth of their owners, *viz.* amber-processing, glass making, jewellery, architecture and others.

An attempt at a broader application of geology in studies on stone material was made within the study project on exploration, exploitation and the use of stone raw-materials in pre-historical communities of the Kujawy region (Central Poland) (Chachlikowski 1989; 1991; 1992; 1994a; 1994b; 1996; 1997; 1998; 2000). The works presented a new approach towards the studies on rock raw material in the past both in the methodological and conceptual aspects.

The subject for the petroarchaeological studies introduced in the Kujawy project is the activity of human communities documented in the sphere of exploitation and utilisation of non-siliceous rock raw material. The stone production activity is studied here through a comprehensive analysis of the sources testifying to the whole of the manifestations of practices linked with this particular sphere of human economic activity. In the analysis, a vast array of stone findings with the established intentionality, including the sources so far left out or disregarded in the syllabuses for petroarchaeological studies, is taken into consideration. Thus, not only final products are put into investigation, as has been a normal practice so far, but also natural rock concretions, production waste, and unfinished products. All these sources are subjected to a complex analysis from the point of view of the ways of the exploration of the raw materials, differentiation in their types and kinds, used techniques in stone processing, sizes and assortments of the production and of the range of the forms of organisation of the activities in relation to exploration and processing of the stone raw material. Furthermore, additional research is done aimed at distinguishing and describing the preferences that were used in the selection of raw material in relation to the kinds of tools to be produced.

The general characteristics of stone sources of the late-Neolithic communities of the Kujawy region.

The archaeological excavations carried out in the Kujawy region have unearthed rich and varied source material, which proves the use of a series of production followed by the pre-historical inhabitants of the region (Fig. 1). They have also revealed the whole of variety and complexity of the activities connected with exploration and utilisation of stone raw-materials in the communities.

The presented selection of the results obtained in the course of the Kujawy project of petroarchaeological studies deal with stone raw-materials that were used in the stone industry of the local communities of late Stone Age, i.e. the peoples of the Funnel Beaker Culture (FBC) and the peoples of the Globular Amphorae Culture (GAC), who inhabited the region from around 4000 BC to 2500 BC. In the present approach, the establishments of the previous research conducted from the point of view of the identification of the dependencies between the function (appropriation - purpose) of a product and the kind of rock used for its production have been stressed and emphasised. The results of the research indicate preferences the Late-Neolithic inhabitants of the region had in the selection of stone raw material used in the production of the specific kinds of tools.

Base source for the present study is the stone material obtained in the course of the excavation works conducted at 31 sites (Fig.1). In sum, 66 stone inventories, including 23 that document stone production of FBC settlements and 43 of those of GAC, were put to investigation. Eventually, 1,753 items were ascribed to FBC, while 778 objects were documented as representing GAC. The total weight of 2,531 stone products under scrutiny was 800,35 kg (Chachlikowski 1997; 2000)

The majority of the studied sites is situated within eolithic forms - dunes or forms capped with a layer of covering sands of eolithic origin (Chachlikowski 1991; 1992; 1997; 2000). In terms of geology the places of the findings, can be regarded as natural sediments are highly improbable. Eolithic forms, from nature, lack rock fractions - stone macroliths - which are suitable for stone tools production in terms of their size. Moreover, the bulk of the studied material was characterised, beyond any reasonable doubt, by clearly identified intentional man's activity represented by traces of different processing techniques or by their use.

Stone production of FBC and GAC communities in the Kujawy region was primarily targeted at the production of multifunctional tools of every-day use, which were used in households. In the settlements of these communities the processing of rock raw materials in order to produce polishing plates, hammerstones and polishers, mill tools (querns and grinders) and hand axes was clearly dominant. The production of axes or hammers among the communities of FBC was done on a much smaller scale (Fig. 2).

In late Neolithic period the communities of the region used in their stone industry a variety of assortment of stone raw material (Fig. 3, see also Table 1). Among the stone raw- materials used by these communities 21 types of individual types of rocks have been recognised. Quartzite sandstone, gneiss, granite and quartzite were most frequently used for the production of weapons and tools. All in all, they constituted 78.66 per cent of the rock raw-materials collection which were used in the stone production of the FBC and GAC communities in the mentioned region (1991 articles out of the total number of 2531).

Biotite gneiss, amphibolite, gabbro, syenite, diorite, basalt, pegmatite, paleozoic basalts and porphyry were used less frequently. The processing of the remaining number of 8 kinds of rock took place on a much smaller scale (Fig. 3, see also Table 1).

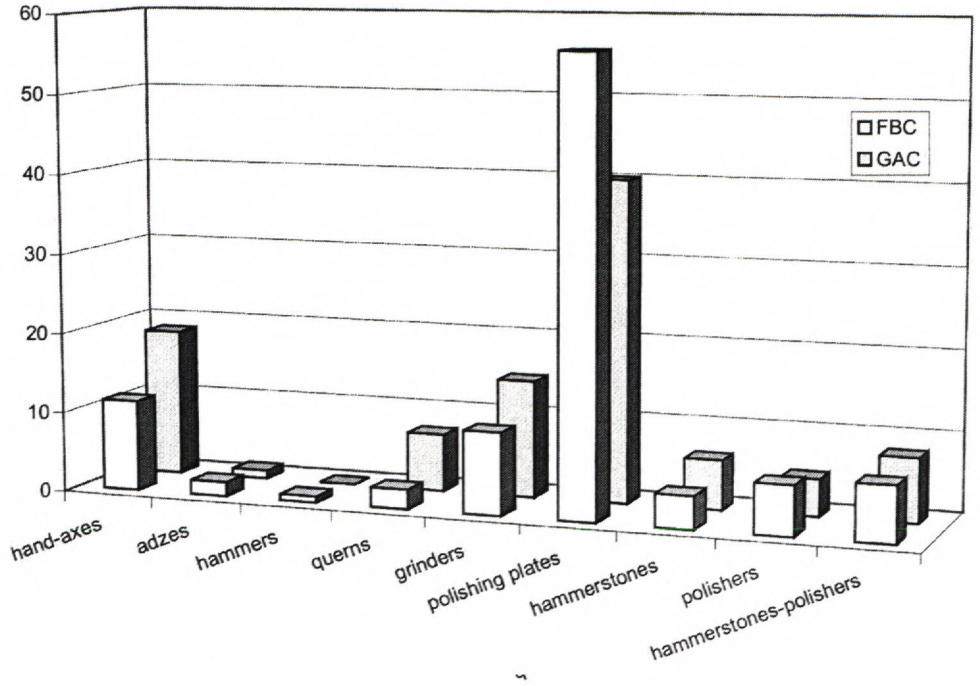


Fig. 2 Comparison of the share of the articles made from stone among the products of the stone industry of the FBC and GAC communities in the Kujawy region (expressed in percentage).

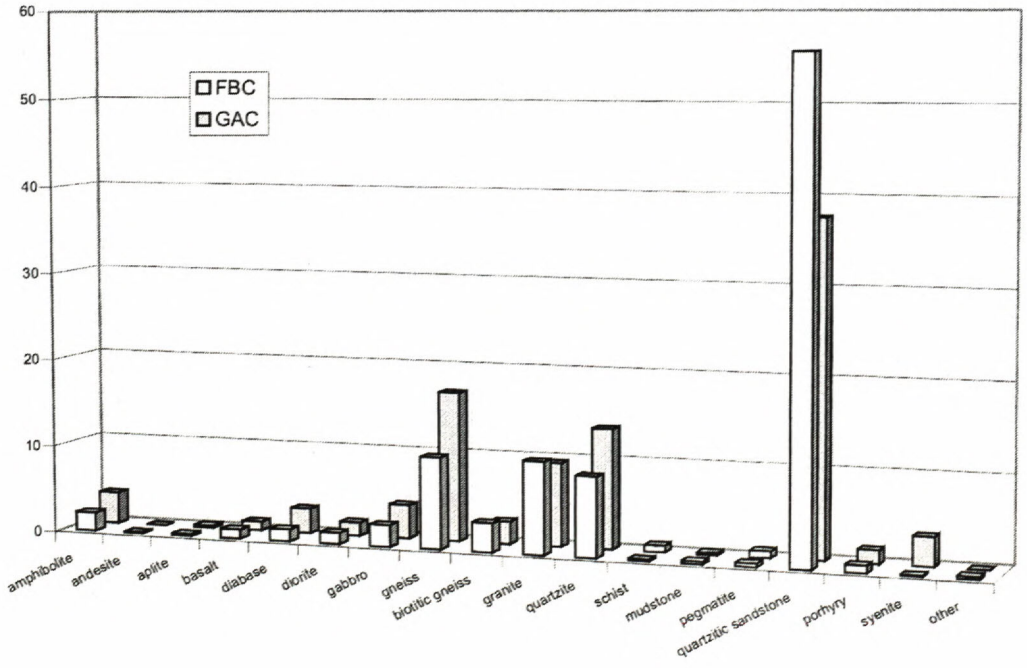


Fig. 3 Comparison of the share of stone raw-materials among the stone production of the FBC and GAC communities in the Kujawy region (in percentage).

The use of rock raw material in the Kujawy region in late Neolithic period. Their typological, functional and cultural aspects

A distinct relationship between the function (appropriation - purpose) of a product and the kind of rock used for its production has been recorded among the products of the stone production of the Late-Neolithic period. Apparently, the structure of rock raw material utilised by local FCB and GAC communities shows clear and close relationship to the tool structure (Table 1, see also Figs. 4-11).

Within the rock raw-materials utilised by the Kuiavian communities of FBC and GAC two groups with pronounced different application in the stone industry can be distinguished (see columns, Table 1).

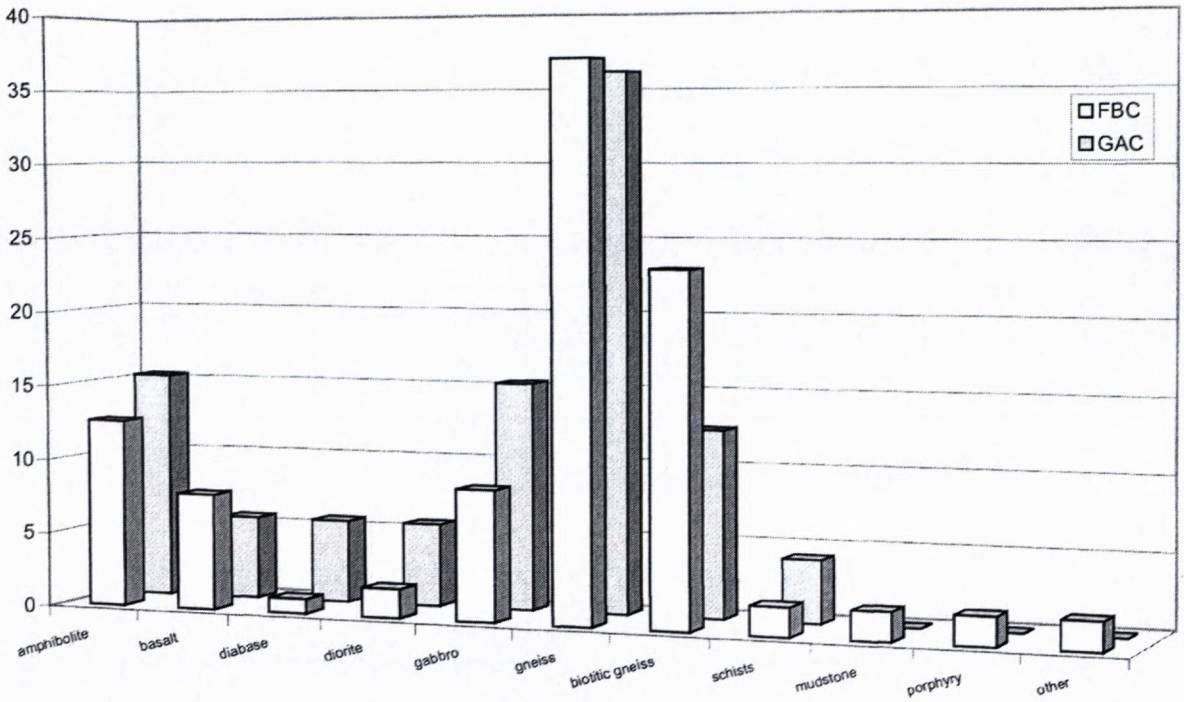
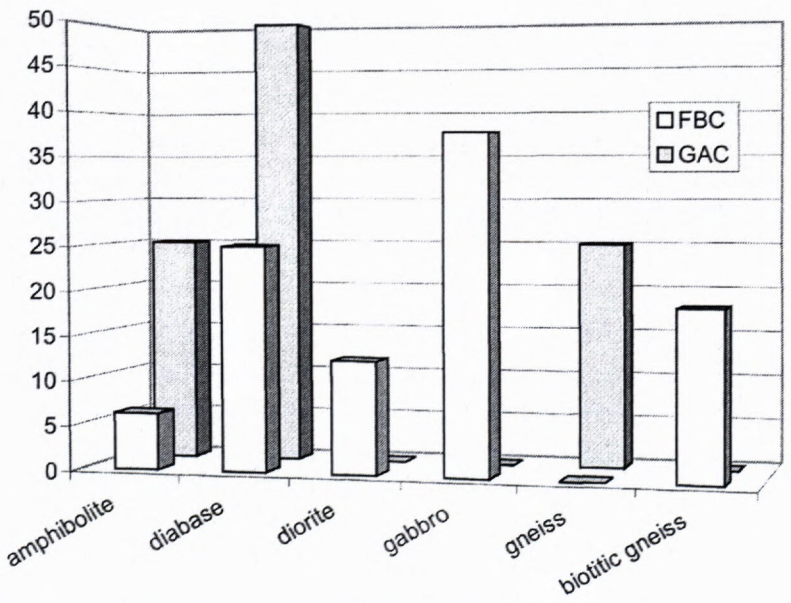


Fig. 4 Comparison of the share of stone raw-materials among hand axes of FBC and GAC communities of the region (in percentage).

Fig. 5 Comparison of the share of stone raw-materials among adzes of FBC and GAC communities in the region (in percentage).



The first group is represented by: amphibolite, andesite, basalt, paleozoic basalts, diorite, gabbro, gneiss, biotite gneiss and schist. These raw materials were used by the local communities mainly in the production of tools with retouched blade (with secondary trimming or shaping applied to stone implements), i.e. with hand axes and adzes. Andesite, basalt, biotitic gneiss, and schist were used at the same time exclusively for the production of these types of products. However, most probably, when not only axes but also adzes were made of amphibolite, paleozoic basalts, diorite, gabbro, gneiss, biotitic gneiss and, possibly, basalt; schist was used exclusively for the production of axes. Only few tools which served as hammerstones, polishers or hammerstone-polishers were made of amphibolite, paleozoic basalts, diorite, gabbro or gneiss. Similarly, diorite and gabbro were used only on a small scale for production of grinders.

Tools made of amphibolite, hand axes predominate in the Kujavian communities of FBC and GAC (see Table 1). They were followed, though on a much smaller scale, by hammerstone-polishers, hammerstones, adzes and

Table 1: The characteristics of the use of stone raw-materials in stone industry of the communities of the region in late Neolithic times (in percentage).

Type of raw material Type of product	Amphi-bolite	Aplite	Basalt	Diabase	Diorite	Gabbro	Gneiss	Biotitic gneiss	Granite	Quartzite	Schist	Mudstone	Pegmatite	Quartzitic sandstone	Porphyry	Syenite	Other	Total
Hand-axes	70,59	-	85,71	20,84	33,34	52,63	39,26	80,49	-	-	100,00	50,00	-	-	14,29	-	50,00 [a]	
	13,71	-	*6,86*	*2,86*	*3,43*	*11,43*	*36,57*	*18,86*	-	-	*2,86*	*1,14*	-	-	*1,14*	-	*1,14*	*100,00*
Adzes	5,88	-	-	25,00	11,11	15,79	0,61	7,32	-	-	-	-	-	-	-	-	-	
	10,00	-	-	*30,00*	*10,00*	*30,00*	*5,00*	*15,00*	-	-	-	-	-	-	-	-	-	*100,00*
Axes/adzes	5,88	-	14,29	8,33	-	2,63	3,68	9,75	-	-	-	-	-	-	-	-	-	
	11,76	-	*11,76*	*11,76*	-	*5,89*	*35,30*	*23,53*	-	-	-	-	-	-	-	-	-	*100,00*
Hammers	-	-	-	-	-	-	0,61	-	2,22	2,17	-	-	-	-	-	-	-	
	-	-	-	-	-	-	*14,28*	-	*42,86*	*42,86*	-	-	-	-	-	-	-	*100,00*
Querns	-	-	-	-	-	-	12,89	-	17,04	-	-	-	-	0,15	-	35,72	-	
	-	-	-	-	-	-	*42,00*	-	*46,00*	-	-	-	-	*2,00*	-	*10,00*	-	*100,00*
Grinders	-	33,33	-	-	22,22	7,90	20,86	-	41,48	7,25	-	-	71,44	3,90	21,43	57,14	-	
	-	*0,67*	-	-	*2,67*	*2,00*	*22,67*	-	*37,33*	*6,67*	-	-	*3,33*	*17,33*	2,00	*5,33*	-	*100,00*
Querns-grinders	-	-	-	-	-	-	3,07	-	2,96	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	*55,56*	-	*44,44*	-	-	-	-	-	-	-	-	*100,00*
Polishing plates	-	-	-	-	-	-	-	-	-	63,04	-	-	-	86,81	-	-	-	
	-	-	-	-	-	-	-	-	-	*13,06*	-	-	-	*86,94*	-	-	-	*100,00*
Hammerstones	5,88	33,33	-	12,50	22,22	5,26	5,52 [b]	-	14,81	7,97 [b]	-	-	14,28	0,30	35,70 [b]	-	25,00 [c]	
	3,28	*1,64*	-	*4,92*	*6,56*	*3,28*	*14,75*	-	*32,79*	*18,03*	-	-	*1,64*	*3,28*	*8,19*	-	*1,64*	*100,00*
Polishers	2,94	-	-	-	-	-	6,14 [b]	2,44	5,19 [d]	9,42 [d]	-	50,00	-	5,70 [b]	14,29 [b]	-	-	
	1,35	-	-	-	-	-	*13,51*	*1,35*	*9,46*	*17,57*	-	*2,70*	-	*51,36*	*2,70*	-	-	*100,00*
Hammerstones -polishers	8,83	33,33	-	33,33	11,11	15,79	7,36	-	16,30	10,15	-	-	14,28	3,14	14,29	7,14 [e]	25,00 [c]	
	3,19	*1,06*	-	*8,51*	*2,13*	*6,39*	*12,77*	-	*23,41*	*14,89*	-	-	*1,06*	*22,34*	*2,13*	*1,06*	*1,06*	*100,00*
Total	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	

In Rows: in terms of the differentiation of the assortment of stone raw-materials within individual types of products.
In Columns: in terms of the differentiation in the assortment of products (product range) within individual types of rocks.
Note: [a] Andesite and lydite. [b] One of the products also used as a base-plate. [c] Granite-gneiss. [d] Two of the products also used as a base-plates.
[e] Product used as a base-plate.

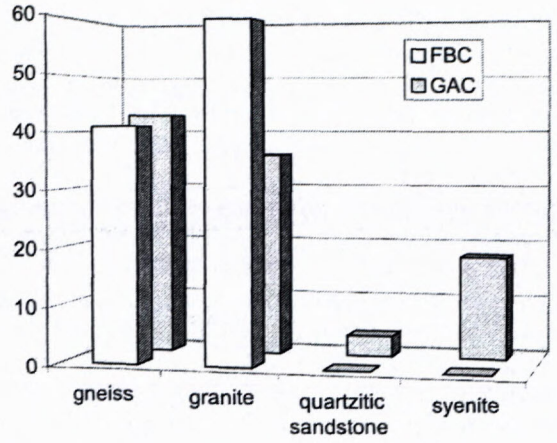


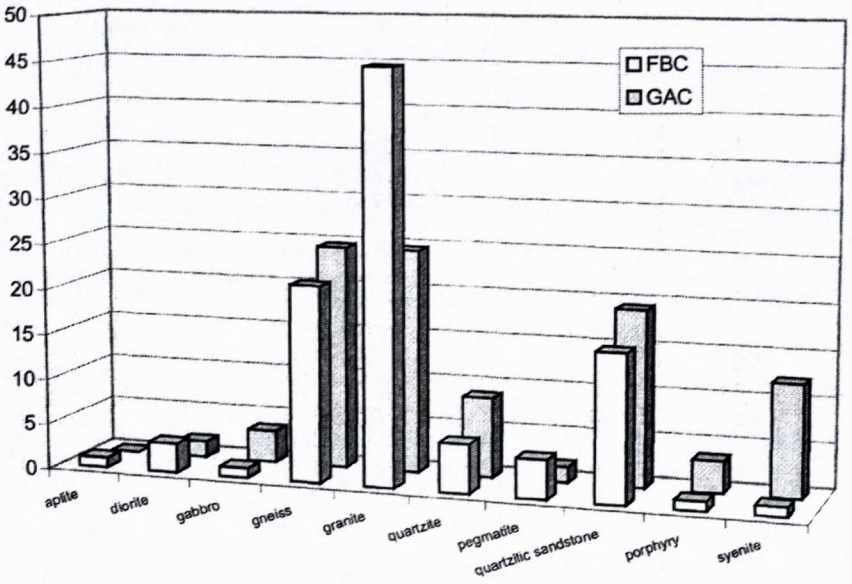
Fig. 6 Comparison of the share of stone raw-material among querns of FBC and GAC communities in the region (in percentage).

sporadically. Only among articles made of gabbro and gneiss the forms with retouched blade are in preponderance over the remaining kinds of tools, whilst the frequency of hand axes, adzes, querns and grinders as well as hammerstones and polishers among diorite and porphyry is similar.

However, among the late-Neolithic communities of the Kujawy region, the production of tools made of gneiss had the most functionally diversified range (see Table 1).

With the stone workers of FBC and GAC gneiss was commonly used in the production of all kinds of tools except polishing plates. Gneiss was most frequently used in the production of hand axes but querns, grinders, hammerstones and hammerstone-polishers. Adzes and massive hammers which were used as drop-hammers (pile-drivers) were least frequent. It is worth remembering at this point, however, that this particular raw-material was, along with quartzitic sandstone, most frequently used in

Fig. 7 Comparison of the share of stone raw-material among grinders of FBC and GAC communities in the region (in percentage).



polishers. Similar assortment of tools is represented by articles made of paleozoic basalts, though the rock was used on a larger scale in the production of adzes rather than axes and, what is more, they only slightly outnumber hammerstones and hammerstone-polishers.

Among the Kujavian communities of late Neolithic period the following raw-materials were utilised on a larger scale: diorite, gabbro, gneiss and porphyry (see Table 1). These raw materials were utilised not only in the production of hand axes, adzes or hammerstones, polishers or hammerstone-polishers but also in the production of mill tools, i.e. querns (gneiss) and mainly grinders (diorite, gabbro, gneiss and porphyry). However, at the same time, diorite and gabbro were used in a more versatile way by the communities of FBC, which utilised these materials in the production of all kinds of these tools, except querns, while the GAC communities used diorite and gabbro for the production of axes, and in the production of grinders and hammerstones used them only

the stone production of the region in the late Neolithic period (cf. Fig. 3).

Articles made of aplite, granite, granite-gneiss, quartzite, mudstone, pegmatite, quartzitic sandstone and syenite represent totally different functional assortment (production range) of tools (see Table 1). The inhabitants of the region did not use the aforementioned raw materials in the production of articles with retouched blades, i.e. hand axes and adzes, at all. However, these raw-materials were used in the production of large quantities of querns and grinders, polishing plates as well as tools that served as polishers, hammerstones or base-plates.

Among the products made of granite, querns and grinders were represented most frequently, while hammerstone-polishers, hammerstones, and polishers were less frequent. Hammers were least numerous within the range of products made of granite. Similarly, a wide range of utilisation in the stone production of the Kujavian communities of FBC and GAC went to quarzite

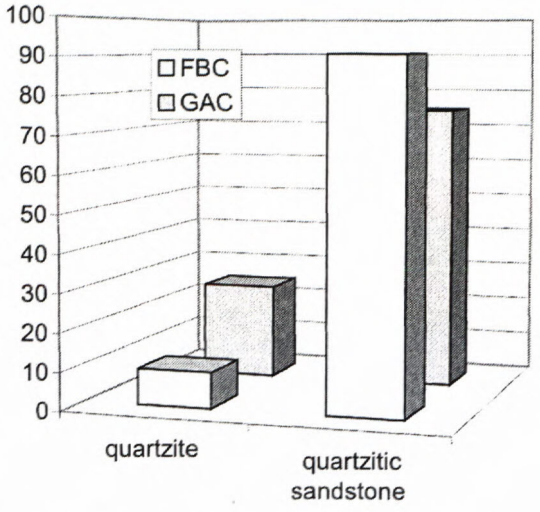


Fig. 8 Comparison of the share of stone raw-material among polishing plates of FBC and GAC communities in the region (in percentage).

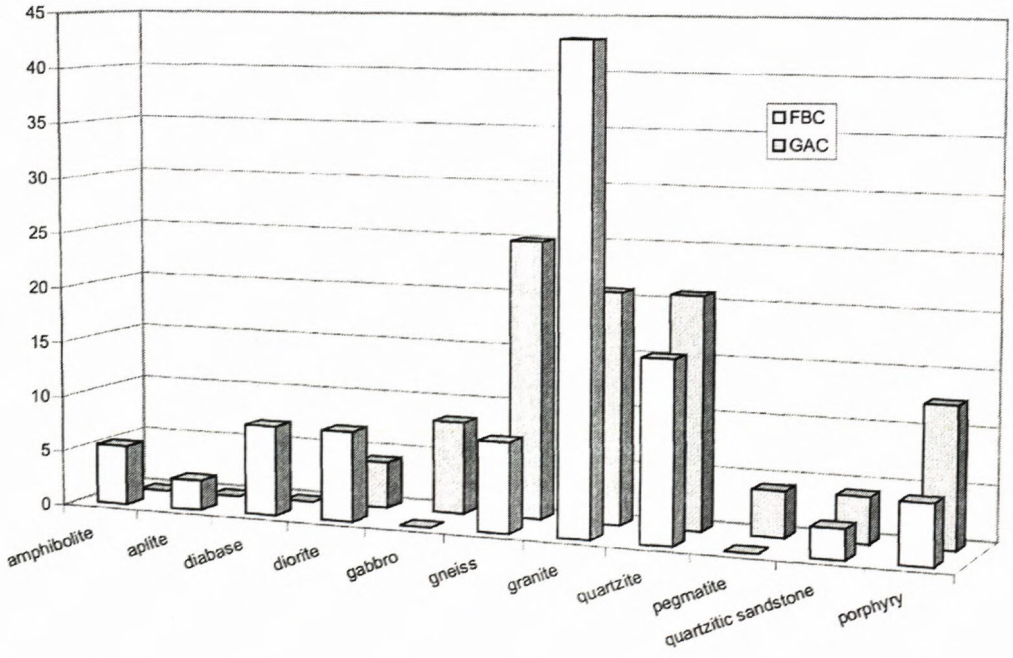
the production of hand axes in the Late-Neolithic communities of FBC (Chachlikowski 1997).

FBC and GAC communities of the region used in their stone production not only a relatively diversified but also carefully selected set of raw-materials. They were used selectively depending on the function of the final product (see rows, Table 1, Figs. 4-11).

A strong and marked preference in the selection of raw materials is to be observed in the production of polishing plates (see Table 1, Fig. 8). Only two types of stone were used for their production quartzitic sandstone, which was absolutely dominant, and quartzite, used on a much smaller scale. Similarly with hammers, we can detect a relatively limited assortment of stone raw materials, which were used for the production of the tools. The most frequent raw material was granite and quartzite, sporadically gneiss.

Narrow selection is also visible in the selection of raw-materials for the production of hand axes (see Table 1, Fig. 4). And though the tool local communities used more diversified set of rock raw-materials (eleven types of

Fig. 9 Comparison of the share of stone raw-material among hammerstones of FBC and GAC communities in the region (in percentage).



and quartzitic sandstone though they were used primarily for making polishing plates scarce. Scarce products made of pegmatite and aplite, represented a relatively narrow scope for tools production. The former were represented mainly by grinders and, sporadically by hammerstones and hammerstone-polishers. The latter was used by the inhabitants of the settlements under investigation for the production of grinders, hammerstones and hammerstone-polishers alike. On the other hand, the production of tools made of syenite was very limited to the settlements of GAC communities, and it was represented virtually by querns and grinders only with one exception in the case of a single base-plate. Mudstone, on the other hand, was mainly used in the production of polishers. What still remains unanswered is the possible use of mudstone in different rocks have been distinguished), still axes made of gneiss, biotitic gneiss, amphibolite, gabbro or basalt were the most frequent. Diorite, paleozoic basalts and schist were less frequently used here and porphyry, andesite and, possibly, mudstone, were used only sporadically. In the production of adzes, paleozoic basalts and gabbro were most frequently used and were followed, on a much smaller scale, by biotitic gneiss, diorite and gneiss (see Table 1, Fig. 5).

For the production of querns, granite and gneiss were common syenite much smaller scale and sporadically, quartzitic sandstone (see Table 1 and Fig. 6). Among grinders, a strong predominance of articles made of granite as well as gneiss and quartzitic sandstone is recorded. The remaining stone raw-materials such as quartzite, sy-

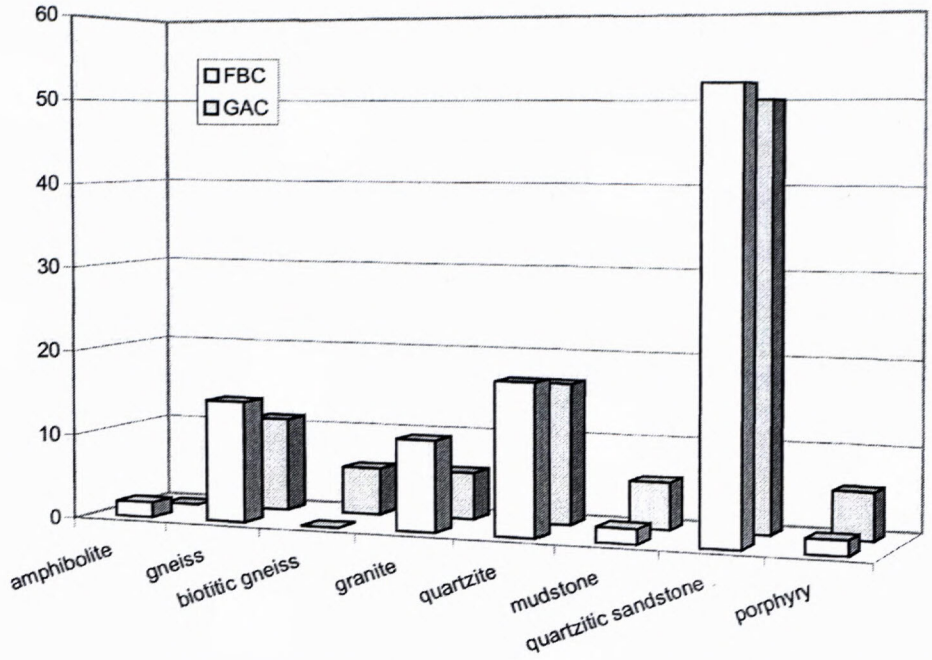


Fig. 10 Comparison of the share of stone raw-material among polishers of FBC and GAC communities in the region (in percentage).

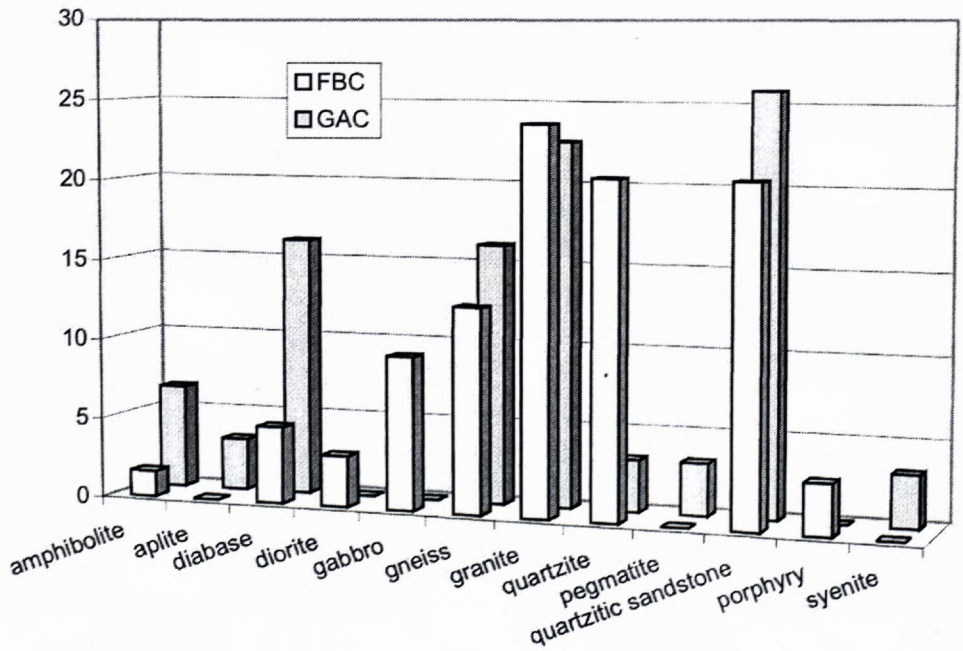


Fig. 11 Comparison of the share of stone raw-material among hammerstone-polishers of FBC and GAC communities in the region (in percentage).

enite, pegmatite, diorite, porphyry, gabbro and aplite, is easily distinguishable (see Table 1 and Fig. 7).

An extremely differentiated assortment of stone raw-materials was used by the inhabitants of the Kujawy region of the late-Neolithic period in the production of multifunctional tools such as hammerstones and polishers similarly as production of articles which combined the function of a hammerstone with that of a base-plate (see Table 1 and Figs. 9-11). A much broader range of raw-materials was used for production of the hammerstones and hammerstone-polishers production than in the case of polishers and base-plates. For the hammerstones 12 different kinds of individual rocks were used. Granite, quartzite, and gneiss were most widespread; diorite, por-

phyry, paleozoic basalts, amphibolite, gabbro and quartzite sandstone were less frequent. The remaining raw-materials, such as aplite, pegmatite, granite-gneiss were represented, in each instance, only by a single specimen of the tools. For the production of hammerstone-polishers, granite, quartzite sandstone and quartz were used and, to a lesser degree, gneiss, paleozoic basalts and gabbro. The least number of this kind of tools was made of amphibolite, diorite, porphyry and aplite. For polishers, quartzitic sandstone and quartz, followed by gneiss and granite were used. Amphibolite, mudstone and porphyry were used only sporadically for the tools that served a similar function. For base-plates, gneiss, granite, quartz, quartzitic sandstone, porphyry and syenite were most common.

It is worth noticing that for the production of the widest range of tools - hand axes, adzes, grinders, hammerstones or polishers - the FBC communities of the Kujawy region a substantially richer set of rock raw-materials than the GAC communities of the region (cf. Figs. 4, 5, 7, 9, 10 and 11). The FBC communities most of axes were made of gneiss, biotitic gneiss, amphibolite, gabbro and basalt, while in the GAC communities more axes were made of gabbro and amphibolite than of biotitic gneiss. For the production of the tools the paleozoic basalts, diorite and schist in the GAC communities were used in larger scale than it was noticed in FBC communities (cf. Fig. 4). On the other hand, for the production of adzes, gabbro, paleozoic basalts, biotitic gneiss, diorite, possibly basalt and gneiss, were the most common as raw-materials in the FBC communities, while for the production of the same type of tools among the GAC communities only paleozoic basalts, amphibolite and gneiss were utilised (cf. Fig. 5). The occurrence of syenite in the production of querns and grinders in the GAC communities is also remarkable. This raw-material was not used by the FBC communities (cf. Figs. 6 and 7). Only with the instance of the production of querns, the GAC communities used more varied in type raw-materials. Though gneiss and granite were clearly dominant, syenite and quartzitic sandstone were also distinguished, while among the FBC communities only granite and gneiss were used.

Discussion and conclusions

As it can be evidenced on the basis of obtained results the structure of the stone raw-materials used in the region in late Neolithic times was closely related to the profile of the product range of the local stone production. The manifestations of the selection of individual rocks most suitable for the production of the final product were distinguished in the selection of the raw-materials in terms of their type and grade and in their utilisation in the production of, basically, all types of products. These dependencies lead to a conclusion that for the production of specific forms of tools local stone workers deliberately preferred only a selection of the available types of raw-materials. A concurrence in preferences of local stone workers in the range of the selection of specific types of individual rocks used in the production of different tools and weaponry is also clearly visible.

The FBC stone workers used, as we pointed out earlier in the text, more varied assortment of stone raw-material for the production of the majority of tools. However, the most important differences among the communities of FBC and GAC deal only with the volume of the utilisation of some of the individual types rocks in the production of the same articles, predominantly hand axes, adzes and mill tools. But for the production of multifunctional tools of everyday use such as polishing plates, hammerstones or polishers as well as the majority of querns and grinders the said communities used basically the same assortment of stone raw-materials, making use of specific types of rocks to a similar degree, though with different intensity within every type of the tools.

The presented results may support the assumption of intentionality in the selection of stone raw-materials used by the late-Neolithic communities of FBC and GAC in the Kujawy region. The selection was based, among other things, on the future function of the of the final product to be produced.

The question of the selection of stone raw-materials in the production of the same types of tools and weapons (mostly forms with retouched blades) in Polish Lowland (Niż Polski) in the Neolithic period was formerly analysed by Prinke and Skoczylas (Prinke & Skoczylas 1978; 1980a; 1980b; Skoczylas & Prinke 1979). They believed that the most sought-after features that had decided on the selection of specific types of rocks in the production of the said articles was for the local stone workers: high tightness (minimal porosity) and low absorbability, which secured substantial resistance to physical effects of frost and weathering, and high specific weight which allowed high hitting power despite the limited size of the tool. Another important feature was good fissility, which was very helpful in processing of the raw material, and relatively high denseness and compactness for the sake of the article's durability. All of the mentioned features are to be found in basalt which makes this kind of trap rock the most suitable, almost ideal or exemplary raw material, very much in need of a Neolithic stone worker (Prinke & Skoczylas 1974, 1978; 1980b; Skoczylas & Prinke 1979; Skoczylas 1990a, 1990b; cf. also Chachlikowski 1996; 1997).

Other raw materials that were used in Polish Lowland in the production of tools with retouched blades in Neolithic times such as amphibolite, paleozoic basalts and, to a lesser degree, diorite, gabbro or gneiss possess similar physical properties to basalt (Chachlikowski 1997). It is then proper to assume that the said raw materials were carefully and accurately selected by the stone workers of FBC and GAC from among other types of rocks at their disposal in the available erratic material. The next step was to carefully choose them from the point of view of their appropriation (purpose), i.e. as regards their workmanship (depending on technical possibilities of their processing) and as regards their future use (considering the effectiveness of their application and durability of ready-made products) in application to axes, adzes and

other tools with retouched blades. Similar criteria were most probably decisive in the selection of stone raw material used by the communities of FBC in the production of hammers, i.e. in the selection of granite, quartzite and gneiss (Chachlikowski 1997).

A deliberate selection in the raw materials depending on the future application of the tools to be made has also been distinguished among the remaining tools which were used as polishing plates, polishers or hammerstones (Chachlikowski 1997). These raw materials that were used in the production of the said tools possessed physical and technical properties which sufficiently met the expectations of their users. And it was polishing plates that were represented exclusively by quartzitic sandstone, less frequently by quartzite which have high grinding and polishing properties. On the other hand, for hammerstones and other tools which combined the function of a hammerstone and a polisher, raw materials were selected that were distinguished not so much by their good polishing or grinding properties but also a high degree of hardness and high compactness or in the resistance of the rock material to blows or hits.

The whole of the remarks described hitherto confirms the feasibility of the assumption that the choice of stone raw materials in the stone production of the FBC and GAC communities of the region was not accidental but intentional and depended on the function of the final product. The dependencies of this kind were distinguished in the choice of the types of raw material used by the local stone workers in the production of, basically, all types of functional tools (see Table 1 and Figs. 4-11).

In keeping with the above assumption is the reasoning that the preferences of the local stone makers in the selection of local raw materials were shaped not only by cultural factors, i.e. symbolic and communicative factors, but also by technological and utilitarian criteria. The thing is that physical and technical properties of specific raw materials were decisive in the choice made in their selection for special purposes in the production of specific tools and weapons. It was because of those specific properties of different types of rocks that a narrow selection of stone raw materials took place. The selection was targeted functionally, i.e. in relation to the available assortment.

The shown relationships between the function of a tool and the type of rock used for its production prove beyond any doubt that the late-Neolithic inhabitants of the Kujawy region had a high practical knowledge on stone raw material in the Lowland. They also prove that the knowledge on the erratic raw material of the area that the local stone workers possessed allowed them to repeat a specific choice, always the same, of a given assortment of individual rocks. Geological specificity of the Polish Lowland which lacks natural deposits of the majority of stone raw material used in the Neolithic stone industry required from the local stone workers an advanced empirical knowledge of the local resources of erratics. The exploration of stone raw materials for the production of tools and weapons by the exploitation of local erratic blocks was linked with the necessity of continual selection of certain kinds and types of stone raw-materials (believed to be of better suitability in the production of specific articles) among other available lowland erratics.

Note: The present article is a summing up of a selected aspect of the research work carried out within a research project No. 1 H01H 015 15 sponsored by the KBN (Committee for Scientific Research)

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