Slovak Geol. Mag., 10, 1–2(2004), 73-80

A General Review of the Neolithic in the Old Continent. A Review of the Raw Materials Used: Regional Aspects. Poland

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Abstract: The paper emphasizes that the rock material used in the Neolithic has not been properly studied yet, and that most authors discuss flint tools as a category separate from those made of non-silicic rock; only in very few monographs are the two types of finds approached as a single group. While there is already a substantial literature on the subject of the usage of rock material in the Neolithic, further investigations would be in order. The research project summarized in the paper has established that non-silicic rock was imported from distant locations (up to 700 km away from the sites of certain finds), although it was of mediocre practical value, and that local postglacial stone was the most common type of material throughout the territory of Poland, and particularly in the lowland areas: postglacial erratic boulders were preferred in the Lowlands of Poland, and weathering formations encountered at the outcrops of rock, in the mountains and highlands.

Key words: rock material, silic rock, Polish Lowland, Neolithic

In terms of geology and geography, the most important natural conditions affecting the development of human settlements in the territory of Poland during the Neolithic, and indirectly also the prospecting for, excavation, cutting, transportation and use of rock, included:

1. The arrangement of the morphological areas in transverse stripes, closed up by the barrier of the mountains in the south;
2. Varied geological characteristics, determined by geomorphological features (mountains, highlands and superglacial plains);
3. The considerable size of the Polish territory along the North-South" axis, amounting to 650 km and resulting in a diversity of the climate.

Human settlements appeared principally in highlands and at the foot of the mountains, or in the southern areas of Poland; due to this fact, as well as to the perseverance of the customs of the Paleolithic period, the rock material quarried and used during the Neolithic was mainly flint and other types of silicic rock, including hornstone, radiolarite, jasper, obsidian, quartzite etc., all of them fairly hard, cleavable and homogeneous, and quite easy to cut.

Because of the warming of the climate and other reasons, humans subsequently migrated to the north, into typical superglacial lowland areas, where rock is hardly available in situ, but loose postglacial material abounds; accordingly, the people of that time adapted to the new circumstances by learning to collect erratic boulders.

The postglacial erratic boulders were seldom made of flint, or the type of rock which humans had known and preferred previously; therefore Neolithic people attempted to identify flint among the local material, imported it from the south (mainly from the Holy Cross Mountains), or tried to replace it with other material, and principally with crystalline magmatic and metamorphic rock.

The Usage of Flint Material

The matter of the usage of silicic rock in the territory of Poland during the Neolithic has already been discussed in detail, particularly by Balcer (1983), Lech (1983), Ginter & Kozlowski (1990) and Kruk & Milisauskas (1999).

The subject of the excavation of flint has been investigated the most extensively in the Holy Cross Mountains, where two areas of quarrying have been identified: the northern area of the range of the Lysogory, extending at a length of 30 km, with deposits of chocolate flint, and the eastern area of the range of the Lysogory, extending at a length of 25 km, with outcrops of striped, Ozarow and Swieciechow flint. Striped and Swieciechow flint were the most commonly used materials in the Neolithic. Balcer (1983) also mentions the highlands of the Jura of Krakow and Czestochowa, the region of Glubczyce, and Western Pomerania including the region of the Lower Warta (Fig. 1).

A petrological and geological classification of flint related to the various archeological classifications is a complex subject requiring a separate monograph. For the purposes of the present paper, we will merely list after Cyrek (1983), the types of flint known from the basins of the Vistula and the upper Warta:

1. Baltic flint: Cretaceous, easily available;
2. north-eastern flint: Cretaceous;
3. Mielnik flint: Cretaceous, exposed in the terraces of the central Bug;

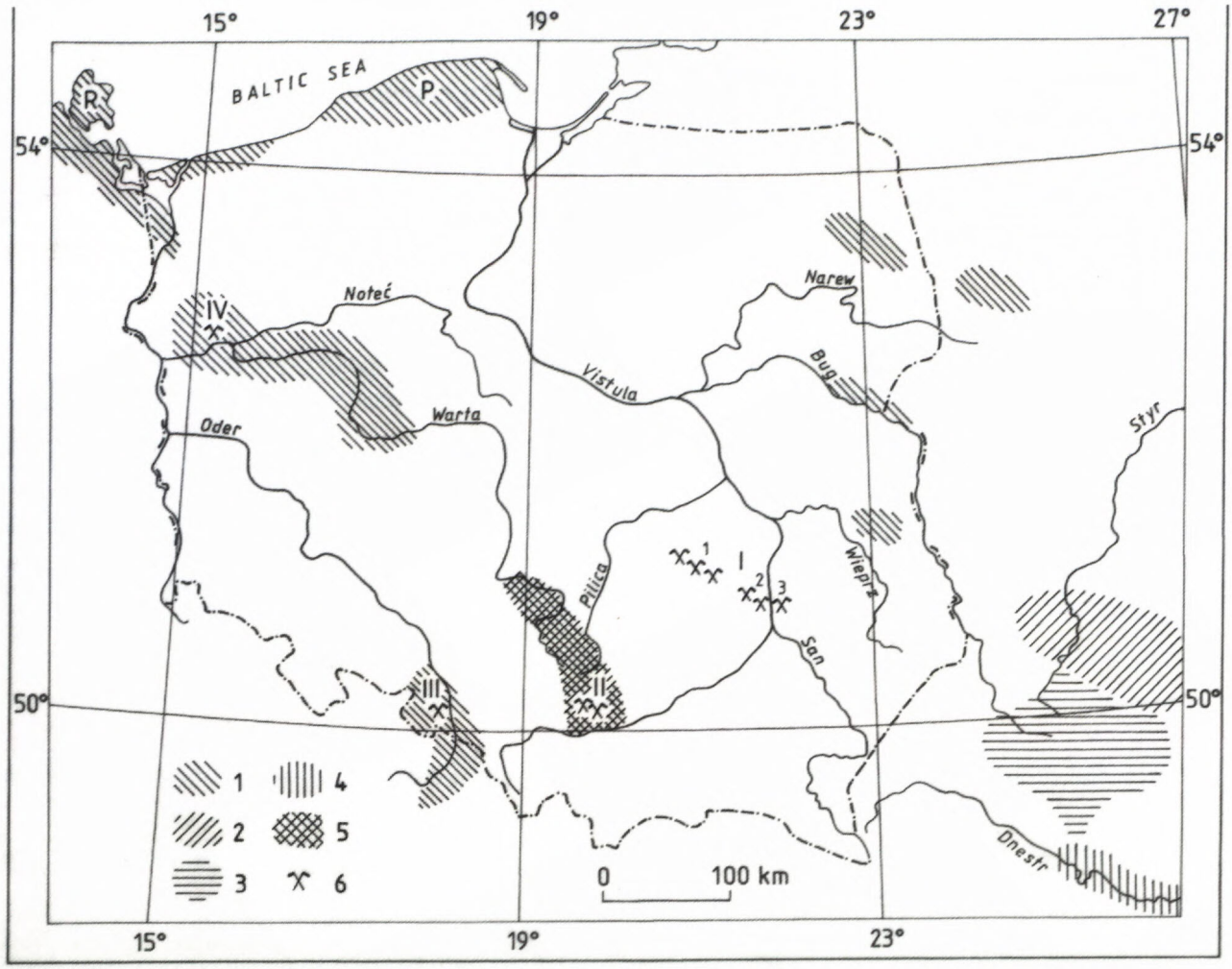

Fig. 1. The locations of the principal deposits and areas of the excavation of the flint used in the territory of Poland in the Neolithic (after Balcer, 1983, p. 46). 1. Baltic flint: R: Rugen, P: Pomeranian; 2. Volhynian flint; 3. Podolian flint; 4. Dnestr flint; 5. Jurassic flint; 6. areas of excavation: I. the Holy Cross Mountains: 1. the northern Lysogory, Lysogory flint, 2. the eastern Lysogory, striped flint, 3. Sieciechow; II. the Jurassic region (the Jura of Krakow and Czestochowa); III. the region of Glubczyce; IV. the Warta.

4. Volhynian flint: Cretaceous, of great value for human applications;
5. Pomeranian flint: Cretaceous, honey-colored;
6. Swieciechow flint: in the Holy Cross Mountains;
7. chocolate flint: in the Holy Cross Mountains;
8. other types of Jurassic flint.

Other types of silicic rock were used as well, including hornstone, obsidian, radiolarite etc.

In Lech's view (1983), Jurassic and Cretaceous flint, which was of primary importance for the Neolithic human communities, was quarried from three types of deposits:

1. Jurassic parent limestone, e.g. in Krzemionki;
2. Tertiary rock-weathering formations of Jurassic limestone and Cretaceous marl, e.g. in Swieciechow;
3. Quaternary till, sand and postglacial gravel, e.g. in the regions of Gorzow Wielkopolski and Poznan-Staroleka.

Lech (1983) emphasizes that excavation was conducted mainly from rock-weathering formations, at the outcrops. Such sites were preferred not only because of the good quality of the material, but also because of its availability.

According to Ginter & Kozlowski (1990), the criteria of the classification of flint must include its age, which may determine its appearance and physical characteristics, as well as the size of the concretions. A possible reconstruction of the age of the quarried flint is outlined in Table 1 (Ginter & Kozlowski, 1990, p. 18). The authors remark that their list does not include many type of rock, e.g. the radiolarite from the mountain ranges of the Tatra, the Holy Cross and the Pieniny.

Less significant material from the territory of the neighboring states includes the Senonian flint of Rugen, the deposits of Turonian flint from the upper Dnestr and Prut, and the hornstone and quartzite of middle and northern Moravia (Fig. 2).

The distribution of the various types of flint is probably the most relevant indicative of their importance and practical value. Chocolate flint is encountered in an area of the radius of app. 450 km, in the archeological

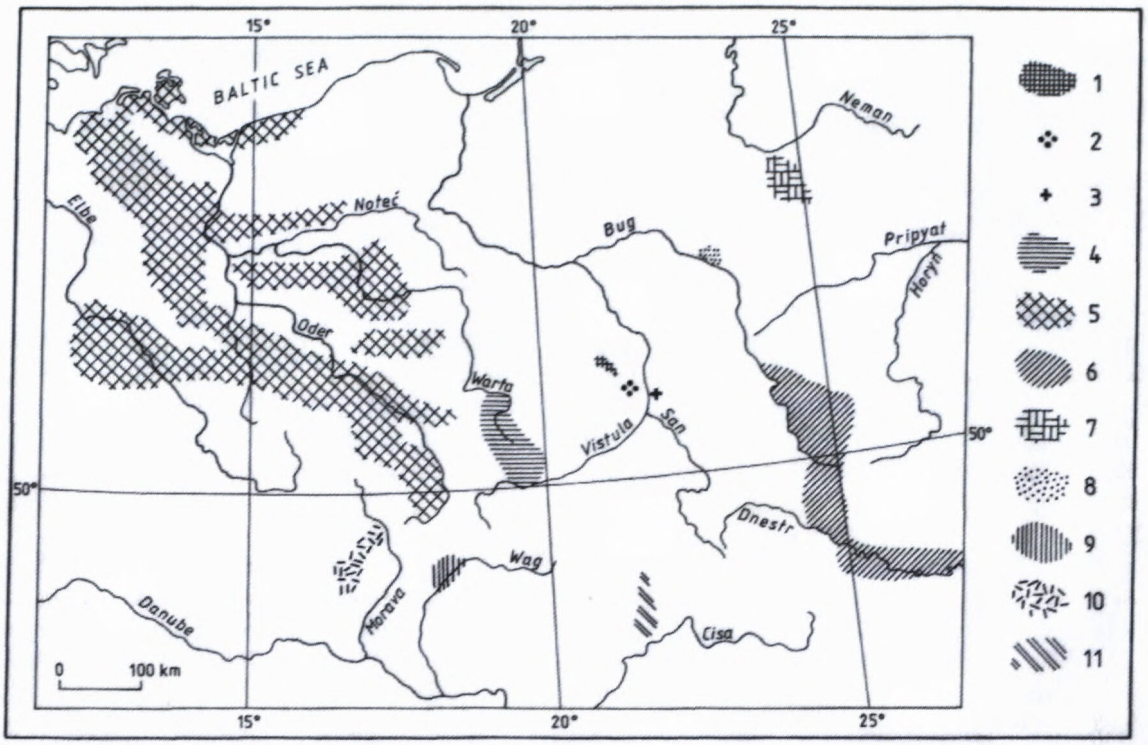

Fig. 2. The principal types of silicic rock (after Ginter & Kozlowski, 1990, p. 29, somehow simplified). 1. chocolate flint; 2. striped flint; 3. Swieciechow flint; 4. Jurassic flint; 5. Baltic flint; 6. Volhynian and Dnestr flint; 7. flint from the river Ros; 8. Mielnik flint; 9. radiolarite; 10. Moravian quartzite and hornstone; 11. obsidian; 1-4. The areas of the excavation of: 1. Jurassic and Krakow flint; 2. chocolate flint; 3. Volhynian flint 4. Dnestr flint; I-IX. regions of settlement: I. Krakow; II. Rzeszow and Przemysl; III. Zamosc; IV. Sandomierz; V. West Lublin; VI. Kuiavian; VII. Glubczyce; VIII. Lower Silesia; IX. Pyrzyce. The arrows mark the routes of transportation.

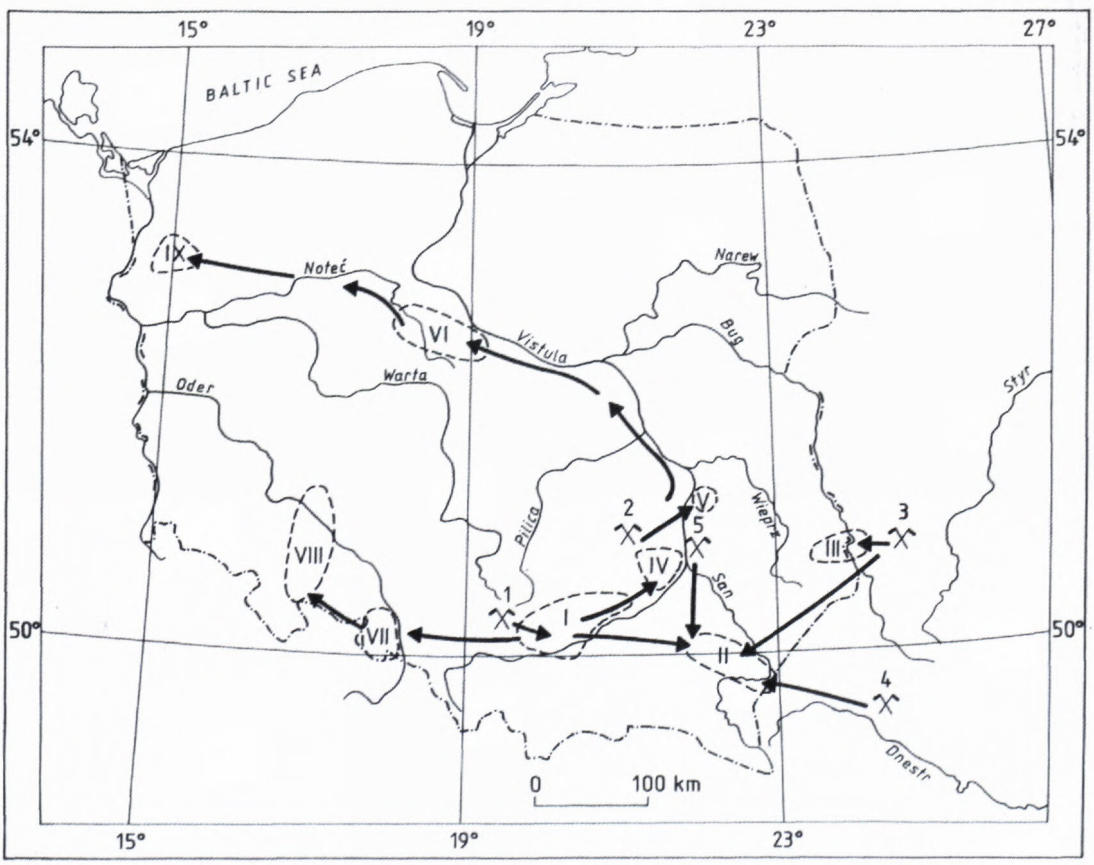

Fig. 3. The principal routes of the transportation of flint in the territory of Poland at the time of the BPC (after Balcer, 1983, p. 78).

sites of the Band Pottery culture (BPC, Fig. 3). The area of the occurrence of Jurassic, Volhynian and Dnestr flint and of obsidian is much smaller, enclosed within a radius of a mere 250 km. The artifacts of the communities of the Funnel Beaker culture (FBC) made of Volhynian flint have been encountered 600 km away from the outcrops of the rock, and made of Swieciechow flint, 570 km away from the deposits. Objects ascribed to the Globular Amphorae culture (GAC) appear 500 km away from the deposits; interestingly, the number of the sites featuring tools made of this material does not decrease with the distance from its source. Conversely, products of the Corded Ware culture (CWC) made of Swieciechow flint have been found only within the radius of 150 km. The geographical distance of the material from the original quarries diminished even further in the early Bronze Age.

Balcer (1983) states that in the 1st stage of the early Neolithic, stone cutters depended largely on local material, and long-distance trade in rock was of minor economic importance. As specialization developed in the 2nd stage, the expansion of trade may have been caused by an increase in the plant production. Finally, the exchange of flint material decreased again in the 3rd stage.

Obviously, flint cutting was only one of the many aspects of the archeological culture of the Neolithic, and accordingly any studies of the use of this material must take the broad context of this period of the prehistory. Investigations of the use of flint in the Neolithic confirm that southern and south-eastern influences were profound at that time, and particularly in the BPC, the FBC, the Striped Pottery culture (SPC) and the CWC.

Kruk & Milisauskas (1999, p. 157) offer interesting insights into the use and exchange of flint material, in particular in the FBC settlement in Bronocice, located at a distance of 25-60 km from the nearest areas of the excavation of Jurassic flint, and of more than 270 km from the farthest ones on the Bug. The same authors establish that the importation of flint object in the periods 2900-2500 BC and 3640-3060 BC was not higher than, respectively, 15 and 47 items, which amounts to one imported artifact per, respectively, 13 and 11 persons. These tentative estimates are illustrative of the scope and extent of the developments under discussion.

The migration of the Neolithic human settlements into the lowlands took place at a time of significant technological and ecological breakthroughs and of a major expansion of the agricultural economy. This process took place in numerous areas in an independent manner. A symptom of it is the increasing share of non-silicic rock material in the production of stone artifacts.

In the Lowlands of Poland, very distant from the mountains and the highlands, there was a certain demand for imported flint and silicic rock of uniform visual and physical properties. With time, the predominant rock material used for the making of tools became postglacial pieces of rock and boulders of varying petrographical composition, accidental shapes and sizes, and diversified physical and technical characteristics, colors, luster and frequency of appearance.

The usage of non-silicic rock material in the Lowlands of Poland during the Neolithic has been studied in detail in Great Poland and Kuiavia under a long-term project of petrographical research.

The Usage of Non-Silicic Rock Material during the Neolithic

The results of the studies of the usage of non-silicic rock material in mid-western Poland during the Neolithic were already published on several occasions (Prinke & Skoczylas, 1978, 1979, 1980, 1986). A complete catalog of the material used for the making of tools in this part of the country has been compiled, covering both the entire period of the Neolithic and the individual chronological-and-cultural groups. This is a list of 109 types of rock, including 25 most frequent ones. The essential material used for the making of axes, hammers, adzes, hoes, chisels and clubs was crystalline rock, e.g. amphibolite, basalt, diabase, gabbro and gneiss.

We now proceed to discuss the results of a study of non-silicic Neolithic tools from the Kuiavian settlement-and-cultural mesoregion. The chronological scope of the study are the periods of middle- and late-Neolithic groups of the Funnel Beaker culture (FBC) and of the Globular Amphorae culture (GAC) in the late Neolithic and at the end of that age, or between app. 4000 BC and 2350 BC (Chachlikowski, 1997; Chachlikowski & Skoczylas, 2001 a, b, c).

In the late Neolithic, the people of Kuiavia used a wide assortment of rock material for their stonecutting activity, selecting the types suitable for the specific final products. Twenty-one essential types of rock in many varieties have been identified as used by these communities.

The populations in question showed a marked preference for quartzitic sandstone and quartzite, as well as for gneiss and granitoid rock. Other types of rock were of much less importance. While the choice of stone material had become very standardized among the communities of the FBC and GAC, their artifacts differ considerably both in terms of their sizes and of the usage of the various types of non-silicic rock.

The available material proves that the communities of the FBC used quartzitic sandstone as their most common material; it accounts for 37.74% of the corpus of archeological finds. Quartzitic sandstone and the various types of quartzite provided the material for almost a half (46.24%) of all non-silicic artifacts of the late Neolithic in Kuiavia (Table 2). While gneiss was less popular, almost every fourth stone item (23.36%) was made of this material. About one eighth (13.21%) of the corpus of archeological finds are objects made of granite. A small percentage (3.85%) of the tools of the FBC were produced of amphibolite. Table 2 breaks down the rock material used by the communities of the FBC and the GAC.

Table 1

The Mesozoic			Type of flint
Period	Epoch	Floor	
Cretaceous	Upper	Senonian	Cretaceous Baltic flint
		Turonian	Volhynian flint Gray white-spotted (Swieciechow) flint
	Lower		
Jurassic	Upper	Kimmeridgian	Lysogory "chocolate" flint
		Lower Astartian	Krzemionki striped flint
		Rauracian	Various types of "Jurassic" flint from the limestone of the Jura of Krakow and Czestochowa
		Oxford	
	Middle	Dogger	Flint and hornstone at the western edge of the Jura of Krakow and Czestochowa
	Lower		
Triassic	Upper		
	Middle	*Muschelkalk*	Flint in the dolomite beds of the Silesian Highland
	Lower		

Table 2. The breakdown of the material of Neolithic rock artifacts

	Rock	FBC		GAC		Total	
		Number	%	Number	%	Number	%
1.	Amphibolite	67	3.85	15	2.19	82	3.40
2.	Aplite	–	–	1	0.15	1	0.04
3.	Basalt	30	1.72	4	0.59	34	1.40
4.	Biotite gneiss	76	4.37	17	2.48	93	3.83
5.	Diabase	20	1.15	9	1.31	29	1.20
6.	Diorite	28	1.61	9	1.31	37	1.50
7.	Gabbro	54	3.10	16	2.34	70	2.90
8.	Gneiss	348	19.99	196	28.61	544	22.36
9.	Granite	230	13.21	90	13.14	320	13.20
10.	Mudstone	20	1.15	–	–	20	0.82
11.	Pegmatite	16	0.92	18	2.63	34	1.44
12.	Porphyry	18	1.04	12	1.75	30	1.23
13.	Quartzite	148	8.50	85	12.91	233	9.60
14.	Quartzitic sandstone	657	37.74	172	25.11	829	34.17
15.	Schist	7	0.40	7	1.02	14	0.57
16.	Syenite	–	–	34	4.96	34	1.44
17.	Other	22	1.25	–	–	22	0.90
	Total	1741	100.00	685	100.00	2426	100.00

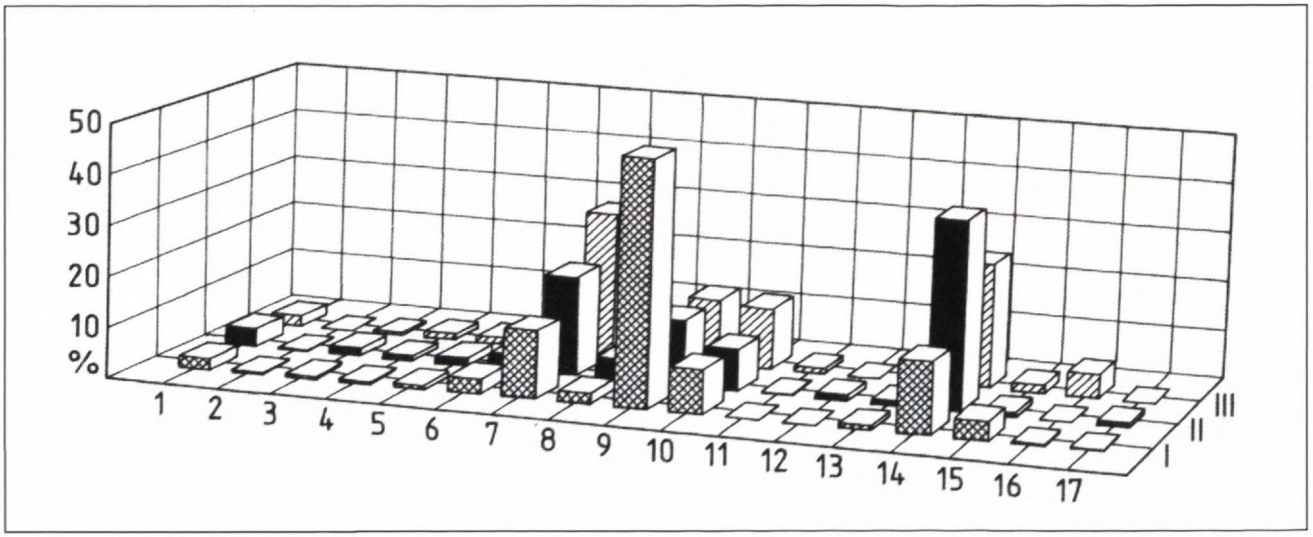

Fig. 4. A comparison of the breakdown of the material of erratic boulders and of the Neolithic stone tools of the FBC and the GAC from Kuiavia (Chachlikowski, 1997). I. the breakdown of the material of erratic boulders; II. the breakdown of the material of the stone tools of the FBC; III. the breakdown of the material of the stone tools of the GAC; rock: 1. amphibolite; 2. aplite; 3. basalt; 4. diabase; 5. diorite; 6. gabbro; 7. gneiss; 8. biotite gneiss; 9. granite; 10. quartzite; 11. crystalline schist; 12. mudstone; 13. pegmatite; 14. quartzitic sandstone; 15. porphyry; 16. syenite; 17. other.

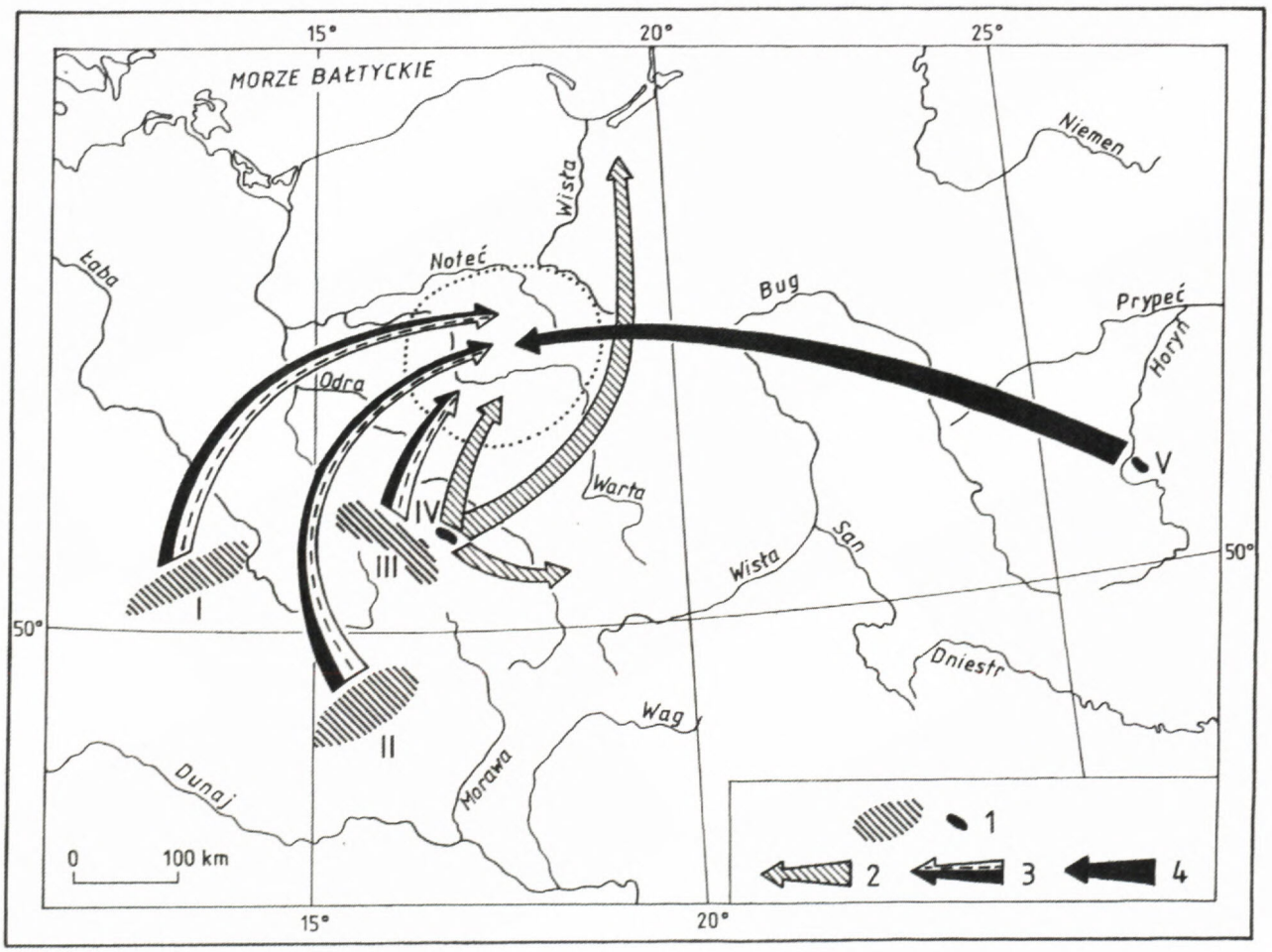

Fig. 5. The routes of the transportation of non-silicic rock into north-western Poland in the Neolithic. 1. outcrops and other areas of the occurrence of the imported rock; 2. the routes of the transportation of serpentinite and jade; 3. the routes of the transportation of basalt and amphibolite; 4. the routes of the transportation of non-olivine basalt; I. northern Bohemia; II. Moravia; III. western Sudetes (the Kaczawa Mountains); IV. the Gogolow-Jordanow massif; V. basalt quarries in Volhynia (Berestovec, Janova Dolina etc.)

Similar tendencies are observed in the corpus of the artifacts of the GAC, where quartzitic sandstone is again the predominant material, although it was used less frequently (25.11%); combined with quartzite (12.91%), it accounts for 38.02% of the entire rock material of this culture identified by archeological studies. The share of gneiss (31.09%) was visibly larger. Granitoid rock provided the material for app. 13.11% of the rock products of the GAC, which figure is very similar to that for the FBC.

A most general account of the usage of rock material in Kuiavia in the late Neolithic emphasizes the decided preference for quartzitic sandstone and quartzite, which provided some 43.77% of the total rock material in the corpus of archeological finds from that area and period. Tools and weapons were also fairly commonly made of gneiss, which constitutes the material of 36.19% of the finds. The third most popular type of stone was granitoid rock, accounting for 13.2% of the total number of finds (Table 2).

The four essential types of rock (quartzitic sandstone, quartzite, gneiss and granite) provided the material of app. 93.16% of the total number of late-Neolithic stone artifacts in Kuiavia.

Incidentally, the stonecutters of the FBC used andesite and mudstone, too, while a conspicuous amount of chipped-off syenite is noticed in the archeological finds of the GAC; the latter rock was hardly used by the communities of the FBC. The people of the FBC were also much more interested in basalt, biotite gneiss and quartzitic sandstone as the material of their tools, that those of the GAC. Conversely, the cultural layers of the communities of the GAC contain significant quantities of gneiss, quartzite, schist and pegmatite, which are less noticeable in the sources from the time of the FBC.

The increasing share of cut quartzite sandstone in the settlements of the FBC was obviously accompanied by a decline in the use of gneiss. The GAC showed the opposite tendency, for superseding quartzitic sandstone with gneiss, quartzite, and particularly syenite.

It is also known what tools the studied communities made of the various types of rock. The principal classes of tools which both cultures produced of quartzitic sandstone, gneiss and quartzite (although in various numbers), were querns and polishing plates (the latter made exclusively of quartzitic sandstone and quartzite). Among the cutting tools, the FBC preferred basalt and biotite gneiss as the material for its axes, and the GAC used diabase, diorite and schist for this purpose, and additionally amphibolite to produce adzes.

The quantitative usage of the less popular types of stone, including gabbro, granite, diabase, diorite and porphyry, was very similar in both the FBC and the GAC.

Having determined the categories of the stone artifacts made in certain areas of Poland, we will now attempt to establish from where that rock material came, how it was prospected for, identified and excavated.

The Neolithic people of the Mid-European Lowlands supplied themselves with rock material from at least three sources:

1. erratic boulders brought by the continental ice sheet: these abounded throughout the Lowlands of Poland, and appeared in more concentrated deposits in moraine formations and in river valleys;
2. areas south of the lowlands, mainly at the foot of mountains and in the mountains of southern Poland, south-eastern Germany, Bohemia and western Ukraine;
3. a few types of rock encountered in the direct deposits in the lowlands: Poznan silicified variegated clay, mudstone and Tertiary quartzitic sandstone.

A simple comparison of the material of the Neolithic stone tools from Kuiavia with the erratic boulders encountered in this area suffices to establish that the populations in question preferred local postglacial rock.

Because of the geological conditions in Kuiavia, local erratic boulders, found in postglacial deposits, constituted the essential source of non-silicic rock used by the prehistoric stonecutters. This was the most common material of all types of stone artifacts, both in the FBC and in the GAC.

The two cultures used the easily available local postglacial material to make such essential household tools as grindstones and querns, polishing plates, hammerstones or polishers. The material provided by the Kuiavian erratic boulders included quartzitic sandstone, gneiss, granite and quartzite. The most common types of erratic boulders were made of granite, accounting for almost 49% of the corpus of the studied rock material, or nearly four times more than its share among the rock artifacts (13.2%). Less popular materials were quartzitic sandstone, gneiss and quartzite, represented in the corpora of rock products of the two cultures in higher amounts than among erratic boulders (Fig. 4).

When making tools and weapons more specific of their cultures (typically with a blade or a point), the people of the communities in question showed a marked preference for gneiss, but also used amphibolite, basalt, diabase, diorite, gabbro and schist, mainly supplied by erratic boulders. A petrographical study of both the erratic boulders of Kuiavia and the late-Neolithic stone artifacts of this region suggests that the available rock material from erratic boulders were more than sufficient for stonecutting activity, in terms of both the amounts and the quality.

While the erratic boulders of Kuiavia are seldom made of diabase, basalt, diorite or crystalline schist, this rock material appears fairly frequently in the corpora of the artifacts of the FBC and the GAC. The stonecutters of the FBC were particularly fond of these types of rock. Thus, the small content of erratic boulders made of basalt, diabase, diorite, schist and syenite in the overall composition of ice pavement, e.g. in Goszczewo, may be construed as due to either the low percentage of such types of rock among the erratic boulders of Kuiavia in general, or possibly the peculiarity of the area from which the more than 1500 erratic boulders have been collected for the petrographical study.

The FBC and GAC communities in Kuiavia probably attempted to replace certain types of rock which they imported from the south, with their local substitutes. We emphasize that imported rock used the most commonly in the early- and mid-Neolithic Kuiavian settlements belonging to the Danubian cultures, included-beside amphibolite - basalt, serpentinite, jade and crystalline schist (Chachlikowski, 1997; Majerowicz, Prinke & Skoczylas, 1981, 1987; Prinke & Skoczylas, 1978, 1979, 1980). In turn, the late-Neolithic communities of the same region managed to identify stone of high quality in the local postglacial material. Thence, their demand for and use of imported stone was apparently a result of religious rather than technical or economic considerations.

Certain material which was encountered locally, e.g. mudstone, most probably did not appear in erratic boulders.

The above conclusion challenges the traditional view that some types of rock were imported from distant locations. In fact, the discussed data indicate that the extent of the importation from the south decreased with time during the Neolithic, as the nature of stonecutting activity evolved, and customs and the economic necessity of the importation of suitable rock material were replaced by experience and a growing awareness of the potential of the local deposits of rock, which could easily substitute the material brought from other areas.

While basalt has been identified in 314 locations in Lower Silesia, microscopic studies suggest that the basalt used for making tools in the Lowlands of Poland was excavated in the area of Luban Slaski, and particularly at the quarry in Lesna. A few tools have been found, produced of non-olivine basalt which apparently comes from Volhynia (Berestovec and Janova Dolina). The material of the equally scarce items made of serpentinite probably originates from the Gogolow-Jordanow massif, and more specifically from the areas of the heights of Winna Gora and the heights of Naslawice and Tomice, as petrographical and archeological studies have established: Sites of prehistoric excavation of serpentinite have been identified on the slopes of Janska Gora (Wojciechowski, 1988).

Jade, in turn, was quarried near Jordanow (Skoczylas et al., 1992, 2000; Foltyn et al., 2000; Fig. 5). It has been suggested that certain tools discovered in Great Poland, were made of amphibolite and diabase brought from the Kaczawa Mountains.

Quartzitic sandstone, quartzite, gneiss and granite from erratic boulders account for 93,16% of the material used by the stonecutters in the late-Neolithic communities of Kuiavia, while erratic boulders themselves constituted up to 99% of the available rock material. Nevertheless, it has been evidenced that non-olivine basalt was imported from Volhynia to Great Poland (over a distance of 600-700 km as the crow flies), and that the people of Kuiavia also acquired foreign Sudetes basalt (200-300 km), serpentinite and jade (100-400 km), and amphibolite from the Kaczawa Mountains (200-300 km). Certain tools made of basalt, diabase and amphibolite might have been produced of material imported from the territory of Slovakia and Moravia (Fig. 5).

Contrary to the general opinion, stone was seldom excavated in the proper sense of the term, or by being chipped off a face of solid rock; much more often loose blocks and pieces of rock were picked up near outcrops. Large and unweathered blocks of rock had as much practical value as pieces excavated in situ from a face (Kulczycka-Leciejowiczowa, 2002).

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