

NIE TYLKO KRZEMIENIE

NOT ONLY FLINTS

**Instytut Archeologii Uniwersytetu Łódzkiego
Łódzka Fundacja Badań Naukowych
Stowarzyszenie Naukowe Archeologów Polskich
Oddział w Łodzi**

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NOT ONLY FLINTS**

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PIOTR CHACHLIKOWSKI

MINING OF LITHIC ERRATIC RAW MATERIAL IN THE POLISH LOWLAND IN PREHISTORY – A PRECEDENT OR COMMON PRACTICE?

PRELIMINARY COMMENTS

Communities in the Polish Lowland in prehistory, and within a broader perspective the general population that inhabited the areas that had been covered by the last Pleistocene glaciation, exploited raw materials for stone production mainly by way of extensive exploitation of the local resources of erratic blocks¹ (e.g. Chachlikowski 1994, 1997, 2000, 2007; 2013; Chachlikowski, Skoczylas 2001a; 2001b; further references therein). Far less common among the inhabitants of the area was the exploitation of rock raw material evidenced by exogenous provenance that was procured by way of “import” from the areas that were rich in stone resources and were largely situated south of the Polish Lowland².

The basic source, and until the early middle age period effectively the only source of stone raw materials for the inhabitants of these areas, was – because of the geological conditions of the areas of early glacial earth surface in the Polish Lowland – the local boulders and pebbles deposited in glacial clays and fluvio-glacial sediments. The use of the erratic raw material close at hand in prehistoric

¹ That is Fennoscandian erratic stones – rock blocks present in glacial formations that formed numerous configurations of the glacial landscape in the Polish Lowland. For erratic rocks (synonymous to erratic boulders and pebbles) mapped in glacial sediments in Poland, the areas of relevant corresponding natural resources are: Scandinavia with the Baltic states and the Baltic basin, i.e. the area of the so-called Fennoscandian Shield or Baltic Shield. Fennoscandian erratic boulders and pebbles assemblages in the Polish Lowland represent all petrographic types of rock (Chachlikowski 2013: 9-10, 28-39 – further references therein).

² We already know that the use of exogenous rocks, i.e. of the provenance from outside the Polish Lowland, by the local population was a phenomenon that was not only nonhomogeneous (both in terms of the assortment of raw materials and the area of their origin and the intensity or chronology of the reception of “import” in the environment of the prehistoric societies in the Lowland), but also – what is particularly important – with just marginal significance in the stone raw material economy among early agrarian societies of the Lowland (Chachlikowski 1996; 1997; 2013; Chachlikowski, Skoczylas 2001c; further references therein).

stone production, and in particular among the Neolithic societies that inhabited the Polish Lowland to which they constituted the primary source of raw material, was wide and common, regardless of the type of the final product to which they were used.

Things as they are, however, the research and studies on the procurement and usage of stone raw material by the societies of the Polish Lowland in prehistory have scarcely addressed the questions and issues pertaining to the methods for the exploitation of erratic rocks deposited in the sediments forming numerous forms of early glacial landscape. Until quite recently, materials documenting the study on the settlement of the Globular Amphorae Culture (GAC) population from phase IIb/IIIa-IIIa at Goszczewo, county Aleksandrów Kujawski, Kujawsko-pomorskie voivodeship, site 13 were the key and also the only one source on the prehistory in the Polish Lowland that documented prehistoric (or more accurately late Neolithic) mining technologies used for the exploitation of the local resources of erratic boulders that formed the so-called moraine residua, i.e. glacial stone pavements. The methods for the extraction of the local erratic boulder involved a near-surface extraction by way of digging up small hollows or shallow dug-up holes that allowed appropriate (in terms of lithological and size-related features) stone concretions to be extracted³ (Chachlikowski 1994; 1997: 149-171).

In understanding prehistoric methods for exploitation of glacial erratic rock resources, the results of the field studies that have been conducted over the past several years over the areas of some sections of the Kujawy region and the Lubusz Land of the Polish Lowland have brought immense and significant contribution⁴. The source material obtained as a result of the relevant research studies, provided by the excavations of successive settlements-mines, attests to – already announced by the present author in the beginning of the 1990s (Chachlikowski 1991; 1994) – prehistoric stone work activity of the local societies manifested by mining activities aimed at extraction of the Fennoscandian erratic stones in the Polish Lowland. Culturally different regional groups from the era of the Upper Paleolithic, Mesolithic, Neolithic and the early Bronze Age that inhabited site 8 at Chłopiny, county Lubiszyn, Lubuskie voivodeship, were involved in a near-surface exploitation of boulders and pebbles deposited in the sediments of the fluvioglacial accumulation (Chachlikowski 2008). Here, the stone material extracting technologies, similar to those recorded at site 13 at Goszczewo, were

³ The results of this research have inspired at the same time researchers to verify the lingering in the literature and until recently commonly accepted view that occasional gathering of erratic stones right from the surface of the earth was in the Polish Lowland the exclusive way of exploiting this particular group of raw materials by the inhabitants of the area in prehistory (e.g. Prinke, Skoczylas 1980: 76, 77; Skoczylas, Prinke 1979: 100-105).

⁴ Conducted mainly in the 1990s and in the first decade of the 21st century following a decision to embark on a pre-emptive rescue operation along the course of the planned construction works – the Kuiavian section of the Yamal – Western Europe gas transit pipe line and the section of the A2 motorway and the S3 expressway in the Lubusz Land.

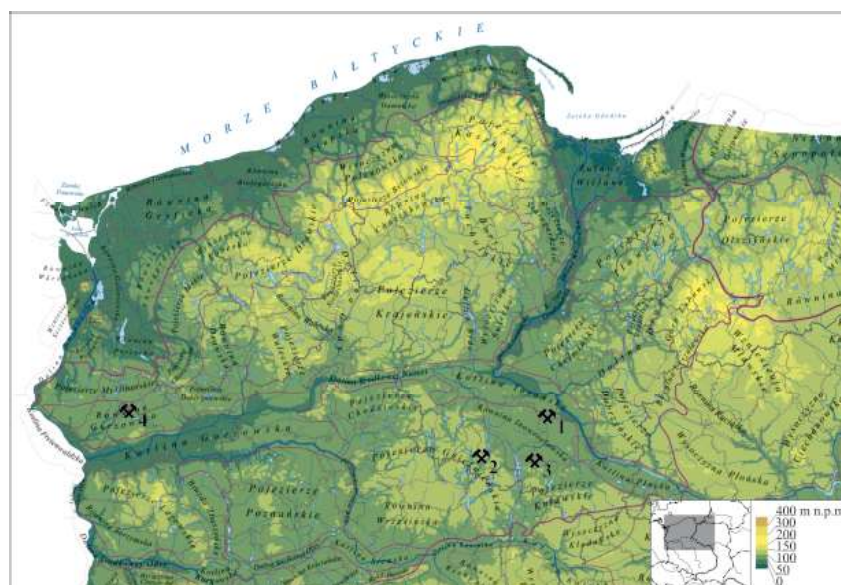


Fig. 1. Location of prehistoric mines of erratic stones in the area of the Great Valley Belt in the Polish Lowland

Key: 1 – Gószczewo, Aleksandrów Kujawski County, Kujawsko-pomorskie voivodeship, site 13; 2 – Strzelce-Krzyżanna, Mogilno County, Kujawsko-pomorskie voivodeship, site 56; 3 – Opatowice, Radziejów Kujawski County, Kujawsko-pomorskie voivodeship, site 42; 4 – Chłopiny, Lubiszyn County, Lubuskie voivodeship, site 8

distinguished and identified. Similar to the Gószczewo, technologies (though not identical) were also the remnants of the activities aimed at extracting erratic boulders and pebbles. In this way, erratic stone raw material was also exploited by Late Beaker societies of the Funnel Beaker (FBC) at site Opatowice 42, county Radziejów Kujawski, Kujawsko-pomorskie voivodeship near Prokopiak's Hill (Chachlikowski 2007). In turn, for the documentation of the Middle Neolithic mining of erratic boulders, of significant importance are the materials from site 56 at Strzelce-Krzyżanna, county Mogilno, Kujawsko-pomorskie voivodeship (Fig. 1).

The present publication is aimed to present the results of the aforementioned investigations at site 56 at Strzelce-Krzyżanna situated in the eastern part of Gnieźnieńskie Lakeland (cf. Figs. 1 and 2). The recorded relics from Strzelce-Krzyżanna, linked and associated with the mining of erratic stones assemblages in the form of stone pavements in glacial sediments located on the edge of the upland adjacent to Lake Pakoskie trough, provide strong evidence supporting the argument to emphasize the fundamental determinations that the study on the local sources have contributed to the general knowledge of the glacial past of the region.

STONE EXTRACTION IN THE MORAINÉ PAVEMENTS ON LAKE PAKOSKIE

The moraine pavements on Lake Pakoskie were discovered during archaeological excavations works of Middle-Neolithic settlements of the groups of the FBC population from Phase I, established by this population at site 56 at Strzelce-Krzyżanna⁵ (Fig. 2). The argumentation for the proposed chronological determination of these local settlements of the FBC societies within the framework of relative time are their technological and stylistic features characteristic for vessel pottery. In terms of the absolute chronology, however, the Beaker phase of the findings from site 56 should be rather related to the period between 4000-3800/3700 cal. BC, or more precisely – on the basis of radio-carbon dating – to the years 3800-3700 cal. BC (Chachlikowski 2013: 98; Rzepecki 2004: 102).

Site 56 is located in a particular (i.e. not well researched) landscape area. The uniqueness of the location of the relics of the Early Beaker Culture recorded in this settlement lies in the fact that the settlement site located in a place rare to be found in other settlement locations of this particular period of the Neolithic⁶. The thing is that other local settlements were typically located on an upland and though quite near the edge of the vast and deep valley of the Noteć River (that forms in this place a lake backwater, i.e. Lake Pakoskie), but on a significantly elevated place more to the bottom of the valley⁷ (cf. Fig. 2).

The relics of the small settlements examined at site 56 at Strzelce-Krzyżanna were established by Early Beaker Culture groups of settlers on a very high edge of the tunnel valley of Lake Pakoskie, within the area of an extensive flattening of the terrain shaped in a form of a headland adjacent to the edge of the upland (Figs. 2 and 3). The adjacent areas of the site include podzolic soils with sand bedding, whereas in the western part – the highest elevation point – sand and clay. There is access to water in its closes proximity – the distance to the present bank line is 600 m, while the little pond, probably usable for the population (in the Atlantic period) was within the distance of about 300 m south west to the local FBC settlements.

⁵ Excavation research at site 56 was conducted in the years 1995-1996 and 1998. The goal of the examination was to determine the character and chronology of the FBC settlement in the collision zone with the course of the Kuyavian part of the Yamal-West Europe natural gas pipe line being then under construction (cf. Fig 2).

⁶ It was just this uniqueness of the location of the site that was decisive in the decision of the inclusion of the site in the plans for excavation works, since the rock material from the unearthed moraine pavement was dominant on the surface, while the cultural material occurred in a decidedly lower number – only a few fragments of FBC pottery were recorded on the site and, moreover, it was not possible to date them accurately.

⁷ At the bottom and in the lower parts of the faults of the valley there occur, more or less contemporary to the settlements of middle-Neolithic FBC, forms of settlement of the societies from the Late Band Potter Culture (LBPC), such as, for example, a settlement Rządkwini, better researched (within the aforementioned excavations on the course of the gas pipe construction site), located on the opposite east bank of Lake Pakoskie, right in front of the discussed site 56 (cf. Fig. 2).

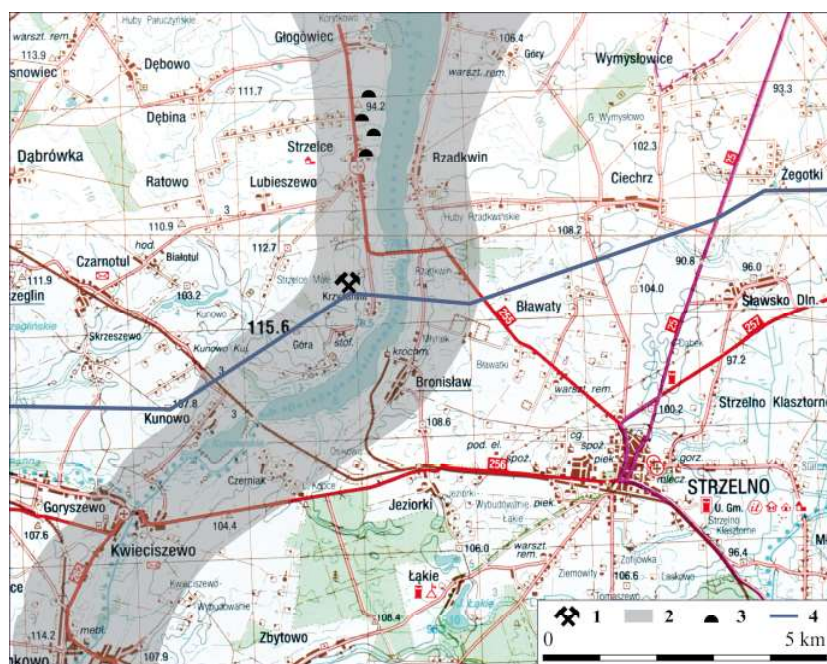


Fig. 2. Strzelce-Krzyżanna, Mogilno County, Kujawsko-pomorskie voivodeship, site 56. Location of the mines of erratic material in relation to the ecumene of the Middle and Late-Neolithic groups along the Lake Pakoskie trough. Key: 1 – erratic stone mine, 2 – Middle and Late-Neolithic settlement concentration, 3 – megalithic tombs (boulder burial sites) GAC, 4 – the course of the Yamal- Europe natural gas pipeline

The remains of stone layer, i.e. moraine pavements, are best documented within the borders of the excavations that were examined in the most elevated part of site 56, i.e. in its western and north-western part that covered the south-eastern edge of the culmination of the terrain formation under investigation⁸ (Figs. 3 and 4). The varied rock concretions, in terms of size, were deposited nearly in all area of the examined site. However, the area covered by stone pavements within the natural composition of the layers at the site, was impossible to be determined precisely – largely because of the specific nature of the conducted excavation works (performed within the framework of the so-called linear investment and with imposed limited space frame – cf. Figs. 2 and 3), and also because

⁸ The exceptionally high accumulation of erratic boulders on the surface of site 56, and also in its closest proximity, not to be found in other, well-penetrated, terrain formations of the surrounding areas, made it possible to assume the existence of erratic boulder deposits that sat in the form of a stone pavement *in situ*. This conclusion was also supported by the close examination of morphological features of some of boulders and pebbles, and in particular specimens where the occurrence of flat, polished surfaces, sometimes having distinct rifts, i.e. the so-called smoothing was identified. The character of the shape of the surface of some of erratic boulders (effected by friction between stone material and the bed during glacial movements) reveals glacial origin of the pavements (cf. Chachlikowski 1994: 65-67; cited references therein).

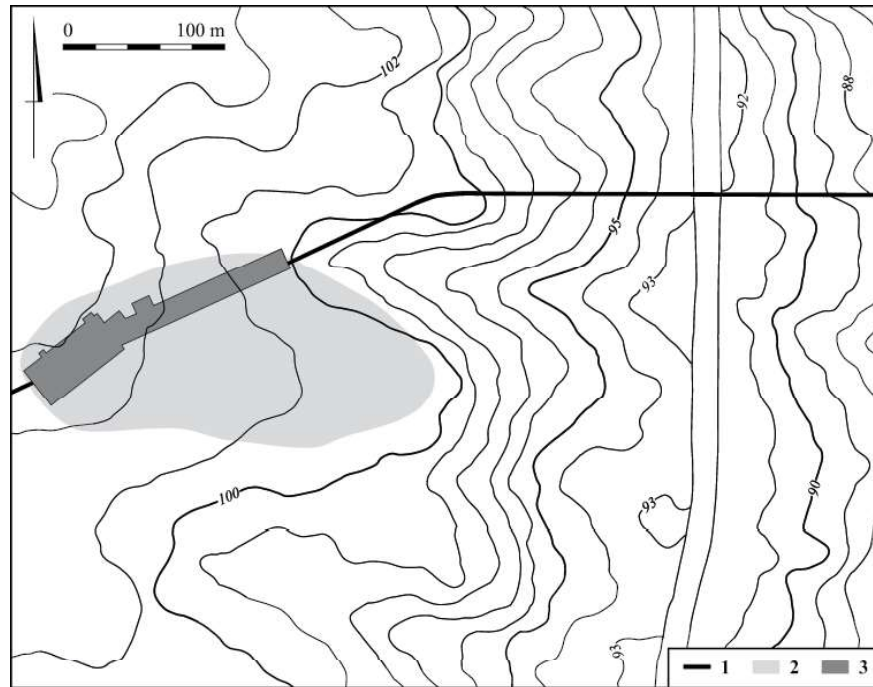


Fig. 3. Strzelce-Krzyżanna, Mogilno County, Kujawsko-pomorskie voivodeship, site 56. Site and height guidelines. Key: 1 – the course of the Yamal-Europe natural gas pipeline, 2 – site extent, 3 – identified excavation area

of much advanced intrusion of agricultural engineering works detrimental to the stratigraphy of the site (in particular in its highest parts), caused by near-surface occurrence of stone pavements in these places⁹. Nevertheless, on the basis of the observation of the space distribution of erratic boulders and pebbles unearthed on the surface of the moraine residuum, it can be assumed that it the original stratigraphic composition of the site, natural accommodation of rock blocks – in the form of stone layer – covered the whole area of its sand and clay substratum unearthed in the most elevated parts of the examined terrain formation (cf. Figs. 3 and 4).

Similarly as in the case of relics of the extraction of erratics at Goszczewo in the Kujawy region and at Chłopy in the Lubusz Land, and also at Strzelce-Krzyżanna, the stone-bearing layer composed of rock concretions of different size, sat relatively shallowly, i.e. on the surface of soil within the arable surface or closely under it. Even here the erratic material was not covered uniformly within the

⁹ This in particular applied to erratics that were deposited on the surface of humus, inside it and shallowly under it. One may assume that in the natural stratigraphic composition the degree of saturation of site 56 with erratic boulders and pebbles was far more higher than that determined during the examination. The main reason behind the devastation of the composition of deposited erratic rocks, beside the actual Neolithic extraction, was intense field cultivation manifested in ploughing up and removing stone material from the arable layer, among others.

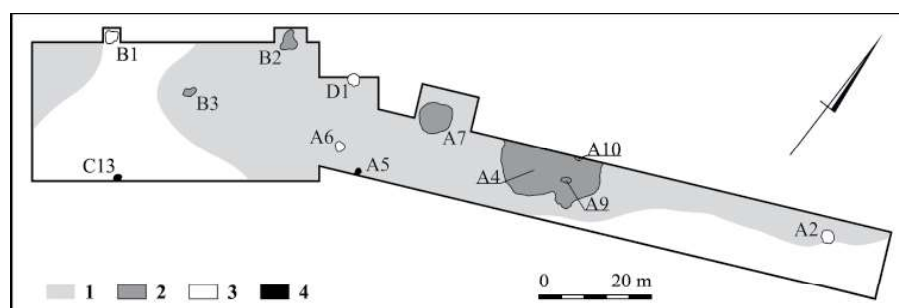


Fig. 4. Strzelce-Krzyżanna, Mogilno County, Kujawsko-pomorskie voivodeship, site 56. The range of erratics forming the boulder clay viewed against the background of the arrangement of objects within the excavation site. Key: 1 – range of erratics forming boulder clay, 2 – excavation of open cast mines and pits, 3 – pits, 4 – fireplaces

whole area of the examined space. The examination of the natural composition of the layers of the exploited parts of the site showed then fragments of sediments of sand and gravel that did not include any rock material or those in which it was rare (cf. Fig. 4).

The largest number of boulders and pebbles was recorded in the near-surface zone of excavations that occupied, in general, the central point of the area under examination. Within this area, they created relatively dense concentrations of erratics embedded in the form of moraine pavements in the ceiling (upper part) of the sand and clay bedding plane. Within their closest proximity dug-in objects (extraction facilities) were discovered – original trenches that could be interpreted as pits – excavation sites¹⁰ dug out to facilitate extraction of stone raw material from among boulders and pebbles that formed the local glacial residua (cf. Fig. 4).

Excavation pits unearthed at site 56 at Strzelce-Krzyżanna are the remnants of intentional human interference into the natural composition of the layers that included stone pavement resulting from near surface extraction of erratic rock (more on that in e.g. Chachlikowski 1994; 1997: 154-164; 2008). The local traces of anthropogenic deformation to the natural stratigraphy of the site, i.e. the excavation pits for boulder and pebble extraction are identified with a number of possibly 4-6 hollows (cf. Fig. 4) made in the ceiling of sand and clay deposits following human activity to extract stone raw material¹¹. Trenches – excavation pits,

¹⁰ A given category of objects was identified (and singled out) on the basis of the morphometric criterion and natural and cultural contents of their filled-in places, as well as the location and nature of the anthropogenic deformations in the stratigraphy within the examined space of the site. A possibility of a secondary reuse of some of these objects as the so-called refuse pits was also taken into consideration.

¹¹ The reservation, however, is that an excavation pit – as we understand the term – is not equal to a single excavation object, but rather defines exclusively an exploitation area identified within a space that was originally formed by a large number of remnants, as it is proved by the observations from Goszczewo in the Kujawy region (Chachlikowski 1994, 1997: 154-164) and Chłopiny in Lubusz

identified in the form of hollows that deformed the natural composition of layers, had varied sizes and irregular shapes and were basically basin-shaped cross-sectional, hollow and had irregularly shaped bottom parts. They were filled in with different from of humus mixed with argillaceous (clayey) sand of the substratum (bedding) and chaotically arranged infrequent erratic rocks from the stone pavement.

The recorded traces of the early FBC settlement at site 56 most probably represent relics of small groups of this population that were engaged in exploitation of local assemblages of erratic stones and in processing thus extracted rock blocks¹². These Middle-Neolithic FBC societies extracted stone raw material by way of the so-called near surface extraction of boulders and pebbles using shallow-pit technology. The method for extracting Fennoscandian erratic stones documented at Strzelce-Krzyżanna should be classified as the so-called near surface exploitation (already of mining type) of lithic raw material in the shallow-pit technology, identified in the systematics of Neolithic technologies of flint rock mining (cf. Fober, Weisgerber 1980; Lech 1981: 60-68, 89-90; further references therein). This method was based on excavating small trenches (dug-ins) or shallow excavation pits to identify and extract appropriate stone concretions (in terms of preferred raw material type and their shapes) from among the erratic material that composed residuum pavements deposited in moraine sediments of the last Pleistocene Scandinavian glaciation¹³.

An interpretation of these objects as traces (vestiges) of extraction of rock blocks preferred by the local population is suggested not only by the presence of appropriate stone raw material within the area under investigation, with regard to the assortment composition, shapes and dimensions (Chachlikowski 2013: 93-94, Tables 2, 6 and 8), but also by the fact that the moraine pavements discovered under humus are decidedly thinned out by erratic stone extraction exactly in the areas of the location of the excavation pits. The stratigraphic composition of the site in the places identified as post-exploitation areas is distinctively disturbed mechanically, whereas natural deposition (*in situ*) of erratic concretions in moraine pavements is basically characterised by regular arrangement of strata (Chachlikowski 2013: 40-59; cf. also Chachlikowski 1994; 1997: 149-171, 2008). The claim of the actual extraction of stone raw material in these areas can be also

Land (Chachlikowski 2008), related to erratic rock extraction. In addition, it should not be excluded that some of the local post-exploitation traces, i.e. extracting objects might have come unnoticed during excavations because of their shallow occurrence of the stone layer.

12 For a wider argumentation on the relationship between the local remnants of the exploitation of erratic boulders and the manifestations of the activity of the early FBC groups, cf. Chachlikowski 2013: 101-102.

13 In this way, stone erratic raw material was exploited by late Neolithic groups of the GAC population at site 13 in Goszczewo (Chachlikowski 1994; 1997: 149-171). Near-surface exploitation of boulders and pebbles was also present in culturally varied groupings at site 8 at Chłopiny (Chachlikowski 2008). Similar, though not identical, were the remains of the activity targeted at extracting rock material by late FBC societies that settled the area at site 42 at Opatowice (Chachlikowski 2007).

supported by more general observations on low frequency, or even absence, of certain lithological and dimensional categories among erratic stones occurring within the area of the extraction objects (mining pits), i.e. the ones that potentially would have been most useful in Neolithic stone production¹⁴.

It can be assumed that the location and size of the surface of the extraction pits used for the exploitation of erratic stones at site 56 at Strzelce-Krzyżanna, as well as the method for the extraction of rock blocks from the local resources (moraine pavements), depended on the litostratigraphic situation of the area under investigation, namely on the limited horizontal range of the stone-bearing layer and on the limited surface area of the occurrence of erratic easily available. The shapes and sizes of the objects – extracting pits, depended on the actual surface area and degree of saturation in erratic stones of a specific outcrop within the section of site 56 that was exploited at the time. A concentration of extraction pits for erratic stone exploitation in the places of the most intensified near-surface occurrence of the rock material, i.e. in the highest section of the site, is clearly noticeable. The economy of exploitation of moraine pavements might have caused the excavation area rich in erratic stones to be greatly extended, which, considering the shallowness of the stone-bearing layer in these places, was a fully reasoned operation. The way erratic stones were extracted at Strzelce-Krzyżanna blurred the original stratigraphic composition of the outcrop (independently of the later, i.e. historical or modern damages). Because of the above reasons, the surface areas of the exploitation areas, extraction pits formed in deposits, are impossible in most cases to be accurately determined – largely due to advanced devastation of the outcrop caused by the shallow, near-surface deposition of stone pavement in these places¹⁵.

What seems to be the most probable is that at Strzelce-Krzyżanna exploitation covered exclusively moraine pavements that were deposited in the near surface area, i.e. on the whole of the surface area of directly available deposit (on the surface of humus, inside it and just below humus). Thus it can be assumed that the concentration of post-exploitation traces in the most highest elevated part of the examined site (that included south-eastern edge of the culmination of the terrain formation under investigation) is effected by the limited occurrence range of erratic stones that were available for near-surface exploitation¹⁶.

¹⁴ A mention should be made of the relatively frequent occurrence of tool forms for stone processing at the site – hammerstones and polishing plates. Additional argument that should be taken into consideration is the location of the site within the zone that was very distant – as for the available conditions in this area – from the source of water, which in the case of settlements that were inhabited relatively steady, would be a circumstance of small practicality.

¹⁵ As we can learn from the practice of archeometry, vestiges of erratics extracted in this way are very hard to identify in research activities, while in most cases remain even impossible to identify (cf. Chachlikowski 1994; 1997: 149 – 171; 2007; 2008). Hence, the post-exploitation vestiges were identified exclusively in those cases when strong anthropogenic deformations to the vast area of the natural composition of layers that included the moraine pavements was documented.

¹⁶ This conclusion can be also supported by similar observations made during the excavation

In all and considering the fact that in the general body of source manifestations of early FBC settlements at site 56 erratic stone exploitation relics are decidedly dominant, it can be stated that we can document a particularly highly specialised domain of stone production activity as far as procurement of rock raw material is concerned, most probably for the needs of the production of multifunctional tool instrumentation¹⁷. This, in turn, provides reasonable grounds to classify the Middle-Neolithic FBC settlement at Strzelce-Krzyżanna as a mining site¹⁸.

Any proper research investigation on extraction of erratic raw material at Strzelce-Krzyżanna should consider an inclusion of the essential question on the efficiency of the local mine and distribution of the extracted stone material. The crucial question is whether the local extraction pits sufficiently satisfied the demand for rock raw material exclusively to a small community engaged in exploitation of erratic stones or, additionally, to other local Early Beaker groups or even to the general population that inhabited the surrounding areas of the mine at Strzelce-Krzyżanna in the Middle Neolithic.

What can be assumed is that the open cast mines at site 56 fully satisfied the demand for stone raw material of not only small groups of people engaged in the procurement of erratic rocks, but also of other neighbouring regional groupings of the Middle Neolithic FBC, and additionally, other groups of the Late Band Pottery Culture (LBPC) communities, undoubtedly contemporary to them, that inhabited the surrounding areas to the mine at Strzelce-Krzyżanna, i.e. the areas covering the bottom and the lower parts of the slopes of the Lake Pakoskie valley. The thing is that the erratic boulders and pebbles available in the local outcrops could constitute a substantial source for the procurement of raw materials for stone production¹⁹ for the whole of the Middle Neolithic population that inha-

works at the mine of erratic stones at Goszczewo in the Kujawy region and at Chłopy in the Lubusz Land (cf. footnote 13).

17 It can be assumed that the moraine pavements deposited at the edge of the upland adjacent (near Strzelce-Krzyżanna) to the Lake Pakoskie trough were exploited in the Neolith not only for stone industry. They could have just as well composed a source for the procurement of building material used to erect stone elements of megalithic tombs built by the population of late Neolithic GAC (from phases IIb-IIIa) in the surrounding areas of Głogówek and at Strzelce on Lake Pakoskie (Prinke, Wiślański 1973: 15-16, 37-39; Wiślański 1966: 161, 165-169), in a close vicinity of the extraction pits for erratics discovered at site 56 at Strzelce-Krzyżanna (cf. Fig. 2).

18 It is worthwhile to relate at this point to the unequivocally formulated opinion made by Bogdan Balcer on the classification of the functions of similar settlements as typically mine-related (Balcer 2006: 76-77), more specifically referring to the extraction pits left by the exploitation of erratic stones at site 13 at Goszczewo (Chachlikowski 1994; 1997: 149-171). The formulated evaluation of the function of the FBC settlements at Strzelce-Krzyżanna is well substantiated in the definition of a "mine" given by Adam Chętnik, according to whom it is "[...] in general, a place where in larger or smaller pits [...] valuable minerals and other geological materials [...] were scouted at the time" (Chętnik 1951: 443).

19 As it is proved in the results of the examination of the Pleistocene residuum unearthed at site 10 at Torzym (county Sulęcín, Lubusz voivodeship) in Lubusz Land, the moraine pavements in the Lowland constituted an extremely rich and versified resources, in terms of assortment, of stone raw material. It is enough to say that on the area of 1150 square meters – occupied by boulders and pebbles that form the local stone pavement – 15,368 rock blocks useful, in terms of their sizes and appropriate type of raw material, for the local Neolithic stone industry were deposited (more on that: Chachlikowski 2013: 40-59).

bited the adjacent area to the outcrop at Strzelce-Krzyżanna. It is more than likely that these local groups of FBC population exploited erratic rock boulders in other areas of occurrence of moraine pavements deposited in the sediments of glacial accumulation on the edge of the upland adjacent to the Lake Pakoskie glacial trough. Therefore, I am of the opinion that the mining pits of the FBC population at site 56 – as well as presumably other early beaker excavation facilities (objects) located within the area of the edge of the upland – represent an excavation facility targeted at satisfying much wider, agglomerative needs for raw material that was operating presumably in the settlement system of the Middle Neolithic ecumene of the area surrounding Lake Pakoskie and the adjacent upland, i.e. the regional groupings of the Early Funnel Beaker Culture and – related to them by economic cooperation in the procurement of stone raw materials – the Late Band Pottery Culture societies (Fig. 5).

The reasoning in support of the hypothesis on the probable cooperation of both Middle Neolithic communities in raw material procurement formulated above requires at this point a reference to the general knowledge on the cultural situation in the Kujawy region during the Middle Neolithic. Let us recall then that the mine (for extraction of erratics) of the FBC population at site 56 at Strzelce-Krzyżanna operated during substantial cultural transformations that were taking place in the environment of the societies of the Middle Neolithic – those of the Beaker Culture and Late Band Pottery Culture in the Kujawy region. It is this period of the development of FBC and LBPC in the Kujawy region that was accompanied with intense aggravation of processes that led to the formation of a particular cultural mosaic (more on that in: Czerniak 1994; cf. also Czerniak 1980; 1990; 1996; Czerniak, Koško 1993; Szmyt 1996 and Rzepecki 2004). For beside a relatively significant taxonomic diversity of the sources of contemporary Early Beaker Culture societies, a phenomenon of a coexistence of some of them with groups of the Late Band Pottery communities is clearly observable, when the latter one was just entering the stage of cultural transformation (i.e. a decline of LBPC and the beginning of the formation – with involved FBC tradition – of the Middle Neolithic GAC as the successor of the Late Band Culture groups; cf. Czerniak 1980; 1990; 1994; 1996; Szmyt 1996; cited references therein). It is most likely that the coexistence of some of these Middle Neolithic societies in the Kujawy region, i.e. LBC and Early Beaker Culture, was related to an economic cooperation (oriented at raw material) between the population groups within both cultures (cf. the remarks below)²⁰.

²⁰ A case in point of a coexistence of groups of population from different cultures (mainly those of easily distinguished distinctiveness in the food economy base, i.e. societies of breeders and cultivators – agrarian societies) would be, for example, late Neolithic groupings that inhabited loess uplands in Lesser Poland (Kadrow 1995: 110-112; Kruk 1980: 325). This cooperation, essential for surviving for pastoral settlers of the Corded Ware Culture (CWC) was based on getting agricultural products from more economically versatile local groupings of the Baden Culture and those of the Funnel Beaker Culture. A similar type of relationship, based on economic cooperation, was characteristic for late FBC

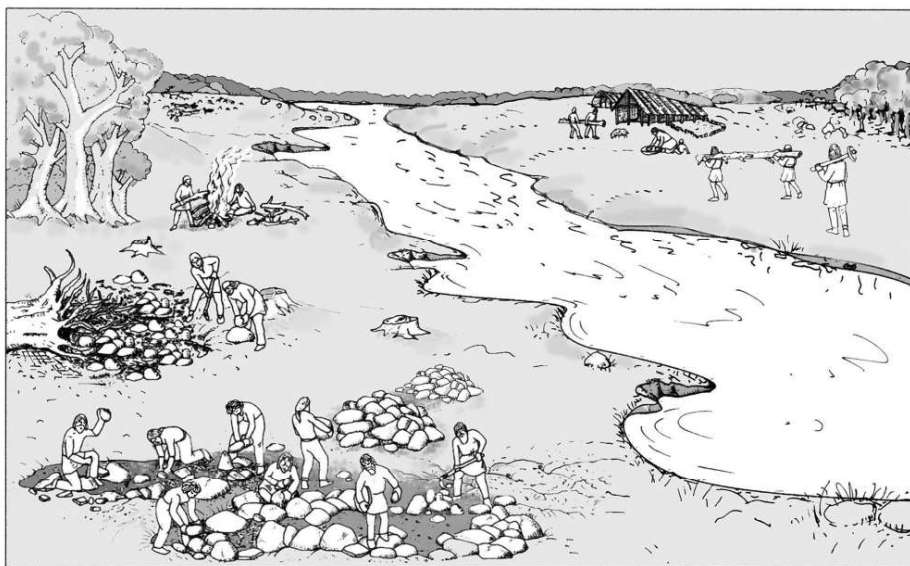


Fig. 5. Mining of stone pavements on Lake Pakoskie. An attempt at a reconstruction – artist's image (drawn by B. Bednarczyk)

This possibility of a coexistence of groups of FBC and LBPC populations that inhabited the areas near Lake Pakoskie, based on an economic cooperation in the procurement of raw materials for stone industry, can be even more corroborated by the assumptions resulting from the ecological and special relations of the LBPC and Early Beaker Culture ecumene in this region. The thing is that the settlements-mining pits of the Funnel Beaker Culture at site 56 are located in the closest proximity to a number of settlements – most likely also contemporary to them – of the LBPC, while the latter are situated on the bottom or in the lower parts of the slopes of the Lake Pakoskie valley. However, the Middle Neolithic FBC societies established their settlements on the edge of the upland, within the landscape zone that was not exploited by the LBPC groups that were chronologically contemporary to them (cf. Figs. 2 and 5).

It can be assumed that the location of the early FBC excavation pits for erratic stones in the area close to the edge of the upland adjacent to the Lake Pakoskie trough had regard for some defined rules concerning absence of competition (cooperation) within settlements. It is highly probable that these rested upon a division of some highly specialised economic tasks (activities) undertaken by these two Middle Neolithic groups in different ecological zones of the area of the Lake Pakoskie trough and the adjacent edges of the upland. An excellent

groups in the Kujawy region (mainly that of the Radziejów group) and the population of early CWC (Czebreszuk 1996: 235-236, 241, 245-246). In turn, a possibility of mutual non-competitive cooperation (tolerance) of the societies of the FBC Radziejów groups and the contemporary GAC societies, seem to be proposed by Danuta Prinke and Marzena Szmyt (Prinke, Szmyt 1996).

example of the cooperation (interoperability) between the local, possibly not so distant genetically²¹, groups of early FBC and late LBPC cultures is the excavation pit (mine) at Strzelce-Krzyżanna. The results of the research study conducted at site 56 indicate then a certain current of economic cooperation between population groups of both cultures, namely the phenomenon of specialization in stone production, executed with a broader inter-group cooperation between these local societies concerning the procurement of stone raw materials. Its source-based corroboration is supported by the relics of the mining of stone-bearing resources deposited near glacial settlements situated in the glacial sediments located on the edge of the upland and remaining within the exclusive occupation of the early FBC population for which partners would have been the local groups of the Late Band Pottery Culture population inhabiting the settlements in close vicinity, located at the bottom and the lower parts of the slope of the Pakoskie Lake trough (cf. Figs 2 and 5).

On a wider perspective, the sources from Strzelce-Krzyżanna can be viewed as a manifestation of a particular tendency in the development of social and organisational structure – the beginning of formation, in the Kujawy region (more broadly: the Polish Lowland) in the Middle Neolithic period, of a complex system of inter-group (intercultural) forms of economic specialisation. Even if this hypothesis seems too bold at first glance, or is to become far too controversial (in particular in the opinion of the relatively early chronology, i.e. Middle Neolithic, of the coexistence of the societies of the Polish Lowland and based on economic cooperation between some of the groups of this population), then it is surely attractive enough in terms of its cognitive value, and should not be too hastily discarded and is definitely worth considering in the present submitted publication.

SUMMARY AND CONCLUSIONS

We already know that a particularly abundant source of stone raw material for the communities that settled the areas of Central European Lowlands in the past, and in the narrower scope that is within our interest – the Polish Lowland areas, included stones and boulders that were largely diversified in terms of their assortment and size and which were deposited in the form of their natural

²¹ Which can be corroborated by the fact that the FBC vessel pottery from Strzelece-Krzyżanna shows a number of references to the traditions of the LBPC pottery. These references to the rules of late band pottery making from the area are particularly visible in the formula for the pottery pulp (the use of admixture of fine sand). The genetic relationships of these two Middle Neolithic cultures is highlighted even more in the results of the analysis of flint materials from Strzelce-Krzyżanna (initial characteristics provided in: Domańska 1995). A specific feature of the local stone industry, that would suggest certain manifestations of the relationship between the local early Funnel Beaker Culture groups and the LBPC tradition, is an exceptional technological and raw material structure occurrence (nearly exclusive use of the erratic Baltic flint) with the rules for the flint production of the late LBPC population, a feature decidedly different from other early FBC groups, among which nearly 100% frequency of chocolate raw material has been observed (Domańska 1995; 1996: 108-112; 2016; Rzepecki 2004; cited references therein).

assemblages of rock blocks that constituted the so-called moraine pavement, i.e. stone “layers” brought in by the Fennoscandian continental glacier (glacial and fluvio-glacial) in the form of numerous formations of the early glacial landscape. The results of studies on the structure and abundance of the moraine residues in the Lowland (and more precisely: the Lubusz and Kujawy residues) provide enough proof that those local accumulations of lithic material constituted extremely rich, and at the same time – what is important here – varied in terms of its petrographic composition, reservoirs of raw material useful in prehistorical stone industry. They also found their diversified application in the then building industry as material used in constructing structures of different purposes: in settlements (living quarters and farming and household structures) and funeral purposes (or more broadly: ceremonial).

The erratics that composed glacial pavements examined at Torzym in the Lubusz Land and at Strzelce-Krzyżanna in the Kujawy region provide the source material that is important not only for a better understanding of the structure (frequency and assortment) of the inventory of erratic boulders and stones in the two areas. The significantly high number of rock formations (blocks) and their lithological diversity used by the local stone industry in prehistory, identified among erratic blocks that constituted the two aforementioned residual pavements, and in particular available in the Lubusz residuum, all prove exceptional abundance and diversity of these reservoirs in materials necessary for stone industry in the communities that settled in the Polish Lowland in the past. One may expect that the abundance of these natural assemblages of Fennoscandian rocks deposited, following glacial and fluvio-glacial accumulation, among a great number of forms of early glacial formations in the Polish Lowland, was by no means less resourceless in terms of its abundance than the rocky outcrops of corresponding rock raw material deposited in the areas of stone resources in the South. More than that, I am of the opinion that boulders and pebbles to be found in Pleistocene pavements in the Polish Lowland constituted not only a comparable and equally attractive source of lithic raw material – in terms of its abundance and assortment diversity – for the local societies in the past, but also represented material that matched in its physical and technical properties the excellent stone raw material procured from their natural source deposits that were located, generally speaking, south of the Polish Lowland (mainly in the following regions: Sudety and the surrounding areas and Volhynia).

A case in point here is the boulders and pebbles that constitute the moraine pavement near Torzym situated within the Lubusz section of the Polish Lowland where, within a relatively small area of about 1150 square meters only, nearly 15,500 erratic concretions were deposited. These concretions could have been used – due to their assortment composition, shapes and sizes – to produce all known products of the stone industry in the Polish Lowland in prehistory. Therefore, it would not be groundless to claim that this exceptionally rich and diversified assemblages of glacial rock material could have been and undoubtedly

constituted not only abundant but also long-term raw material resources exploited by the local communities in their local stone industry as well as used as stone building material.

It can be stated that the exploitation of the lithic residues in the Polish Lowland fully supplied the demand for stone material for both small groups of people who were involved in the procurement of appropriate rock blocks (in terms of size and assortment) from among erratic stones that constituted the local Pleistocene pavements and for the inhabitants of a single or even a cluster of contemporary neighbouring settlements functioning within some larger agglomerations of micro-regional communities. As prove the results of the examination of the Torzym residuum, as well as the relics of the mining industry of glacial erratic pavements that have been identified in the Kujawy region, i.e. at Strzelce-Krzyżanna on Pakoskie Lake, similarly in the nearby Goszczenie, and in the Lubusz Land – at Chłopiny near Gorzów Wielkopolski, these local accumulations of lithic material were characterized by rich and diversified enough resources of raw material that could have constituted a significant source for rock raw material exploitation necessary for the population inhabiting the surrounding areas of the outcrops of the stone pavements exploited at the time. It seems highly probable then that the extraction pits of erratic stones – relics of the rock raw materials of the mining industry in the Polish Lowland - satisfied the more broader, agglomeration-derived demand for raw material, thus indicating a complex system of inter-group (also inter-cultural) forms of economic specialization in the making. Indeed, it cannot be excluded that mines of erratic stones were already there in the settlement system of not only those communities that were primarily targeted at exploitation of local stone pavements, but also of a number of groups – that must have been in economic co-existence with the latter – of populations representing other cultures but somehow coupled by cooperation in stone raw material procurement.

The estimates that provide information on the abundance of Pleistocene moraine pavements in rock material hold significant importance not only for the general evaluation of the advantages of the inventory of local erratic raw material. It is our opinion that additionally they are not irrelevant in an attempt to identify potential preferences of the population of the Polish Lowland in prehistory, and within a much broader reference, the whole of the areas that were within the reach of the last Pleistocene glaciation, in possible ways of supply of the stone raw material available locally. It can be followed from the above that for the groups of people that inhabited the areas of early glacial landscape, the dominant method for lithic raw material procurement (for stone industry and building purposes alike) was the near-surface mining of erratic stones extracted from the soil from shallow residual pavements, and not, as it has been believed until quite recently, procured by way of commonly practiced gathering of rock blocks and stones directly from the face of the earth.

And though the relics of mining of erratic raw material are exceptionally hard to evidence within any given area, and as practice tells us more often than not simply impossible to identify, then with a great degree of certainty, having in mind the vestiges of mining activity and methods of exploitation of these rock residuals in the Lowland, we can state that these relics do not belong any more to a category of unprecedented, or even controversial objects on the archeological map of the Polish Lowland, which was the case quite recently. On the contrary, there is more and more evidence of fossil relics from the area that are associated (either directly or indirectly) with dug-up and early mining technology of extracting boulders and pebbles from the local assemblages of erratic lithic raw material (cf. Fig. 1). All this seem to confirm that this method for the extraction of rock raw materials was relatively common within the societies that inhabited the areas that had been covered by the last Pleistocene continental glaciation in the past. For it should not be forgotten that the Fennoscandian residues, similar to those in the Lubusz Land or the Kujawy region – pavements that had been created from erratic stones and boulders – belong to the formations that are quite frequently to be found in the early glacial countryside of the Polish Lowland.

x x x

The current state of the knowledge on the stone inventory in the Polish Lowland confirms the extraordinary abundance of the local early glacial environments in a significantly high number of erratic rock raw material, at the same time appropriately diversified lithologically, necessary for stone production as well as for building material. The evaluation of the Fennoscandian erratics available in the Pleistocene residues in the Polish Lowland leads to an unequivocal conclusion that the local glacial “resources” represent substantially abundant sources for raw material used by the contemporary inhabitants of the region in the local stone industry, both in terms of the general number of all rock concretions useful for this production and with regard to the substantial abundance of the whole of the assortment of rocks available among erratic boulders and pebbles.

The abundance and lithological richness of erratic raw materials available in the early glacial areas expressly exhibit the so far underestimated status and attractiveness of the local raw material inventory in satisfying the demand for appropriate materials for the stone production in the local prehistorical societies. Things as they are, however, these determinations are particularly important in an evaluation of the lithic resources in the Polish Lowland. For they provide convincing arguments to claim that the local erratics constituted not only an inventory of stone material necessary for the local societies close at hand, but were also the basic source for the procurement of raw material for stone production, regardless of the size and tool profile (assortment) to be produced, or regardless of the typological composition of appropriate (i.e. preferable by the stone worker) rock raw material.

The resources of Fennoscandian erratic boulders and pebbles available in the early glacial areas effectively eliminated any necessity to import raw materials from areas of their natural deposits to the areas of the Polish Lowland. These lithic relics of the glacial past of the Polish Lowland (or more broadly: that of Central European Plain) – represented by extremely abundant rock material useful for the stone production and diversified in terms of its available assortment - completely satisfied the demand of the local inhabitants for stone raw material, in this way limiting to the minimum the demand for imported rock raw material by the local stone worker.

One may expect that the knowledge on the erratic raw materials in the Polish Lowland, as well as the range of identification of the geology of local Pleistocene formations abundant in the stone pavements that were available for the communities of prehistoric stone maker facilitated wide and common exploitation of these local early glacial environments rich in stone. For the prehistoric inhabitants of this area, the widespread method for stone raw material procurement, and undoubtedly effective enough, was the near-surface, but already of mining character, open cast mining and exploitation of extremely rich and lithologically differentiated Pleistocene moraine pavements in the Polish Lowland, glacial accumulations of boulders and pebbles, by way of surface mining technology.

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