

# The problem of flint in the Mesolithic of the Vistula and upper Warta basins

Krzysztof Cyrek

This paper is an abridgement of the Ph.D. dissertation that under the same title has been written at the University of Warsaw. In view of the character of the Symposium special emphasis has been put on such problems as the occurrence and characteristic of raw materials as well as their exploitation and distribution, whereas the technique of flint working, cultural differentiation of raw material economy and socio-economic interpretation of these processes have been marginally treated.

The basic object of the study undertaken by this writer was to determine which varieties of flint were used in the production of particular artifacts and to examine the raw material structure of closed assemblages. As a result it has been possible to establish the varieties of flint that were used by Mesolithic communities in the area under discussion. Consequently, other questions arose, namely:

- where did the outcrops of these materials lie and in which way were they exploited?
- how far and in which direction did the distribution of particular raw materials reach?
- is it possible to speak about provinces of raw materials in the Mesolithic? (i.e. about zones characterized by a specific structure of the materials used).

The final object was an attempt at constructing models of raw material economy of the Mesolithic societies.

The study has been based on artifacts of flint and occasionally of stone derived from 259 inventories, of which 44 are chronologically and culturally closed assemblages. The remaining ones are fragments of assemblages collected from the surface of sandy sites. These materials were chiefly obtained during excavations conducted many years ago, usually unmethodically, and

therefore their source value is limited. They are mainly useful for defining the extents of usage of particular varieties of flint. The analysis of other problems was based on the information provided by certain closed assemblages.

The character of sources and the specificity of the problematics have determined the selection of research methods and the way of presenting the results. Beside purely archaeological methods of particular importance were here statistical and cartographical methods. Basic information was supplied by the classification of all Mesolithic artifacts from the point of view of the material used. This classification was made possible thanks to the macroscopic petrographic analysis on the basis of which particular assemblages have been assigned to groups of raw materials.

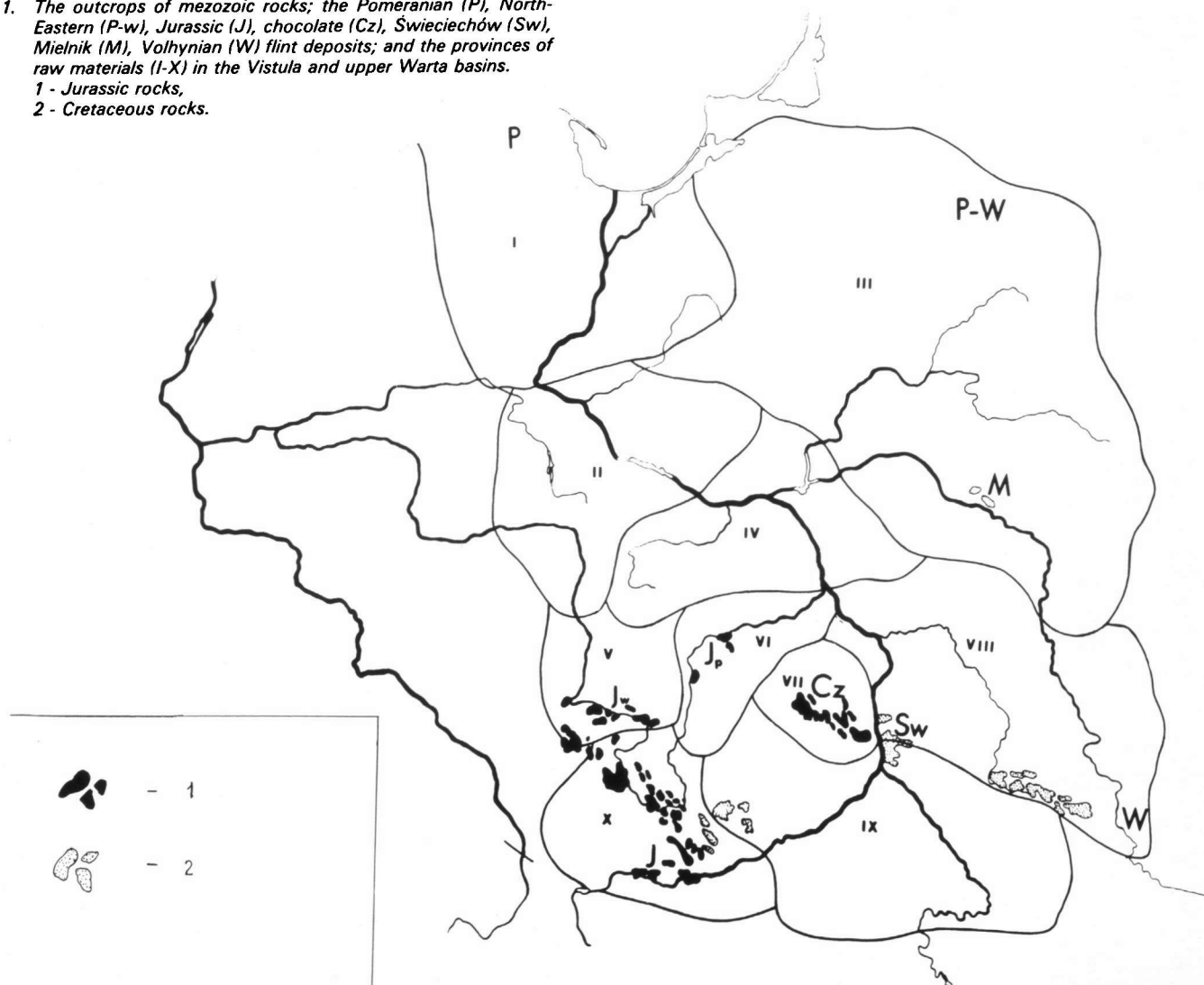
Prior to their characterization, attention should be drawn to an important element of the environment in which the Mesolithic societies lived, i.e. to certain features of the geological formation of subsoil. (Atlas geologiczny Polski nos. 9-10). I mean here cretaceous and Jurassic outcrops of limestone and marl which were the natural sources of flint (Fig. 1).

These are (besides the Carpathians):

1. The environs of Cracow - limestone with flint (upper Jurassic-Raurak)
2. Western part of the northern fringe of the Świętokrzyskie Mountains - compact tabular limestone (upper Jurassic-Oxfordian).
3. Eastern part of the northern fringe of the Świętokrzyskie Mountains - detritic, pellicular and oolitic limestone (upper Jurassic-Oxfordian-Kimmeridgian), limestone (Raurak), as well as spongy and marly limestone (Oxfordian).
4. Cracow-Częstochowa Upland as far as Wieluń - massive limestone (Oxfordian-Raurak).
5. Miechów Basin, Nida Basin - siliceous chalk with inclusions of limestone and marl (upper cretaceous-Turonian).
6. Lublin Upland on the Vistula - limestone (upper cretaceous-Turonian).

Fig. 1. The outcrops of mezozoic rocks; the Pomeranian (P), North-Eastern (P-w), Jurassic (J), chocolate (Cz), Świeciechów (Sw), Mielnik (M), Volhynian (W) flint deposits; and the provinces of raw materials (I-X) in the Vistula and upper Warta basins.

- 1 - Jurassic rocks,
- 2 - Cretaceous rocks.



7. Lublin Upland, environs of Rachów - limestone (upper Jurassic).
8. Lublin Upland, upper Wieprz and Bug region - chalk and limestone (upper cretaceous-Turonian).
9. Middle Pilica - limestone (upper Jurassic).

Of the flint deposits mentioned above the following were exploited in the Mesolithic (Fig. 1);

- 1 - Jurassic flint from the environs of Cracow (denoted by the symbol J).
- 2 - chocolate flint (Cz)
- 4 - Jurassic flint from the upper Warta region (Jw).
- 6 - Świeciechów flint (Św).
- 8 - Volhynian flint (W).
- 9 - Jurassic flint from the Pilica region (Jp).

As follows from this list, not all of the mentioned flint deposits were exploited in the Mesolithic.

The comparison of the position of pre-Quaternary formations which according to geologists contained flint concretions with the situation of flint deposits used in the Mesolithic (Fig. 1) throws some light on the availability and knowledge of particular varieties of flint among Mesolithic communities. The far greater variety of the kinds of flint in southern Poland is the direct result of a large number of uplifts of older rocks (Cracow-Wieluń Jura). Outcrops of mesozoic rocks are virtually absent from the northerly areas with the exception of Oxfordian rocks in Kuyavia, upper cretaceous limestone in the environs of Łódź - both probably without flint concretions - or upper cretaceous formations laying near the surface on the Baltic coast in the vicinity of Trzebiatów from which probably comes a part of the erratic Baltic flint.

The survey of artifacts has induced the author to distinguish 18 categories of raw material. With few exceptions this division has been based on kinds and varieties already distinguished and described in literature (B. GINTER, J.K. KOZŁOWSKI, 1975). The criteria used here were as follows:

- geological age of the rock where a particular variety of flint had formed;
- geographical position and character of the deposits (primary or secondary);
- size and shape of the concretion;
- character of the cortex and state of its preservation;
- colour, lustre and degree of transparency of the flint mass;
- certain visible macroscopic elements of texture and structure of the flint mass
- character of fracture;
- capability for regular splitting.

In view of the specificity of this study and in order to avoid repetition of description, in the characterization of flint varieties special attention was paid to the selected attributes whereas others were omitted.

The following categories of raw material have been distinguished:

### 1. The Baltic flint (B)

This is cretaceous erratic flint, easily available in the whole area under discussion and due to its availability very popular in the Mesolithic (it was present in 28 out of 29 assemblages that were analysed in detail). Its secondary deposits occur in the moraine and fluvoglacial formations of the two last glaciation and in accumulation river terraces. It was obtained by collecting from the surface (mainly small-sized pebbles) or by exploitation of shallow pits or of exposed profiles in river valleys (larger concretions).

An interesting example of the exploitation of this flint is provided by the selective use of its concretions on site Wieliszew XI/1, situated on the Vistula terrace. Of the various concretions among which also large pieces were present, only small oval specimens were selected. (S.W. KRUKOWSKI, 1976).

Different conditions under which this variety of flint occurred were chiefly responsible for its differentiation as to the size of the concretions, the state of cortex, colour of flint mass, degree of inner thermic cracking and the presence and character of patina. As a result of the long-lasting glacial transport and occurrence on or near the surface the flint had acquired properties which made its working difficult. Therefore, in comparison with that of other flint varieties in the basin of the Vistula and upper Warta its use value was the lowest.

### 2. The cretaceous 'north-eastern' flint (P-W)

This variety has been distinguished for the first time. Its age is probably the same as that of the Baltic flint, and its outcrops have not yet been localized. It was used in north-eastern Poland for the production of blanks and tools. Analogous in colour, it differs from the Baltic flint in a number of other properties such as the larger size of concretions, less polished cortex and a better state of the flint mass (absence of cracks). This indicates that the concretions were transported by glacier over a short distance to the area of north-eastern Poland where they occurred in moraine formations. Thanks to the above described properties its use value was high.

### 3. The Mielnik flint (M)

In outer appearance this upper cretaceous flint resembles both the north-eastern and the Baltic flint. In the Early Holocene it occurred in surface deposits of the middle Bug terrace and in natural exposures of decomposed cretaceous rocks in the moraine of this area. Probably because of its rather poor quality (inferior to P-W) it was only locally used.

### 4. The Volhynian flint (W)

This is another upper cretaceous flint, this time, however, of high use value. In the Mesolithic it was only marginally and locally used in south-eastern Poland.

### 5. The Pomeranian flint (P) (L. DOMAŃSKA, 1979)

This cretaceous flint is distinguished by the honey colour of its mass and by the characteristic regularly oval shape of its very small concretions. In the Early Holocene its use was virtually limited to Western Pomerania. It was exploited from secondary surface deposits localized on cliff sea shores and on the surface of moraines. It should be added that in the working of this flint the 'on anvil' technique, which was quite exceptional in the Polish Mesolithic was employed.

### 6. The Świeciechów flint (Św) (B. BALCER, 1975)

The last in the group of cretaceous materials is the grey-white-spotted Świeciechów flint. According to petrographers this is rather a spongiolite. This would indicate that the origin of the rock was purely organic. In order to comply with the archaeological tradition the term 'the Świeciechów flint' has been retained.

The morphology of Mesolithic artifacts made of this flint suggests that they were chiefly manufactured of comparatively large erratic concretions easily available in the region of its original outcrops (right bank of the Vistula, a little to the north of the junction of the San). The flint from secondary deposits was of inferior quality (inner cracks). This was probably one of the reasons why its use - single finds excepting - was principally limited to south-eastern Poland (Fig. 2) where it co-occurs with the Jurassic and chocolate flint.

### 7. The chocolate flint (Cz) (R. SCHILD, 1976)

On account of its very good quality this Jurassic (upper Oxfordian or Kimmeridgian) flint was utilized during the whole Stone Age. Also in the Mesolithic it enjoyed - beside the Baltic flint - the widest extent covering nearly the whole area under discussion (of the 29 analysed assemblages it occurred in 23) (Fig. 3). It was obtained by collecting from the surface or by mining. The erratic chocolate flint occurs in the form either of small pebbles with worn cortex and with highly polished outer surface or of fragments of large crumbled concretions brought to the surface by erosion and scattered by water over the neighbourhood. The latter are derived from the upper layers of decomposed rock which was the primary bed of this flint. Small pieces of this material could also be found in the natural exposures of the Jura. The erratic variety of the chocolate flint was used in the Early Mesolithic (mainly in the assemblages of the Komornica tradition).

On the other hand, the second part of the Mesolithic (primarily in the Janisławice tradition) of major importance was the flint extracted by mining and occurring in the form of tabular cortical concretions of particularly high use value. They were extracted from residual clay deposits by mining with the use of shafts analogous to those found at Tomaszów, province of Radom, and assigned by R. Schild to the Linear Pottery culture (R. SCHILD 1977). The great variety of the chocolate flint on particular sites seems to suggest that it was derived from various places in the whole area of its incidence (western part of the north-eastern margin of the Świętokrzyskie Mountains).

It seems that the process of the distribution of the chocolate flint played a major part in the life of many Mesolithic communities.



Fig. 2. The spread of the artifacts made of the Świeciechów flint in the assemblages of:

- 1 - Janisławice culture,
- 2 - Komornica culture,
- 3 - Chojnice-Pienki culture,
- 4 - Indefinite culture.

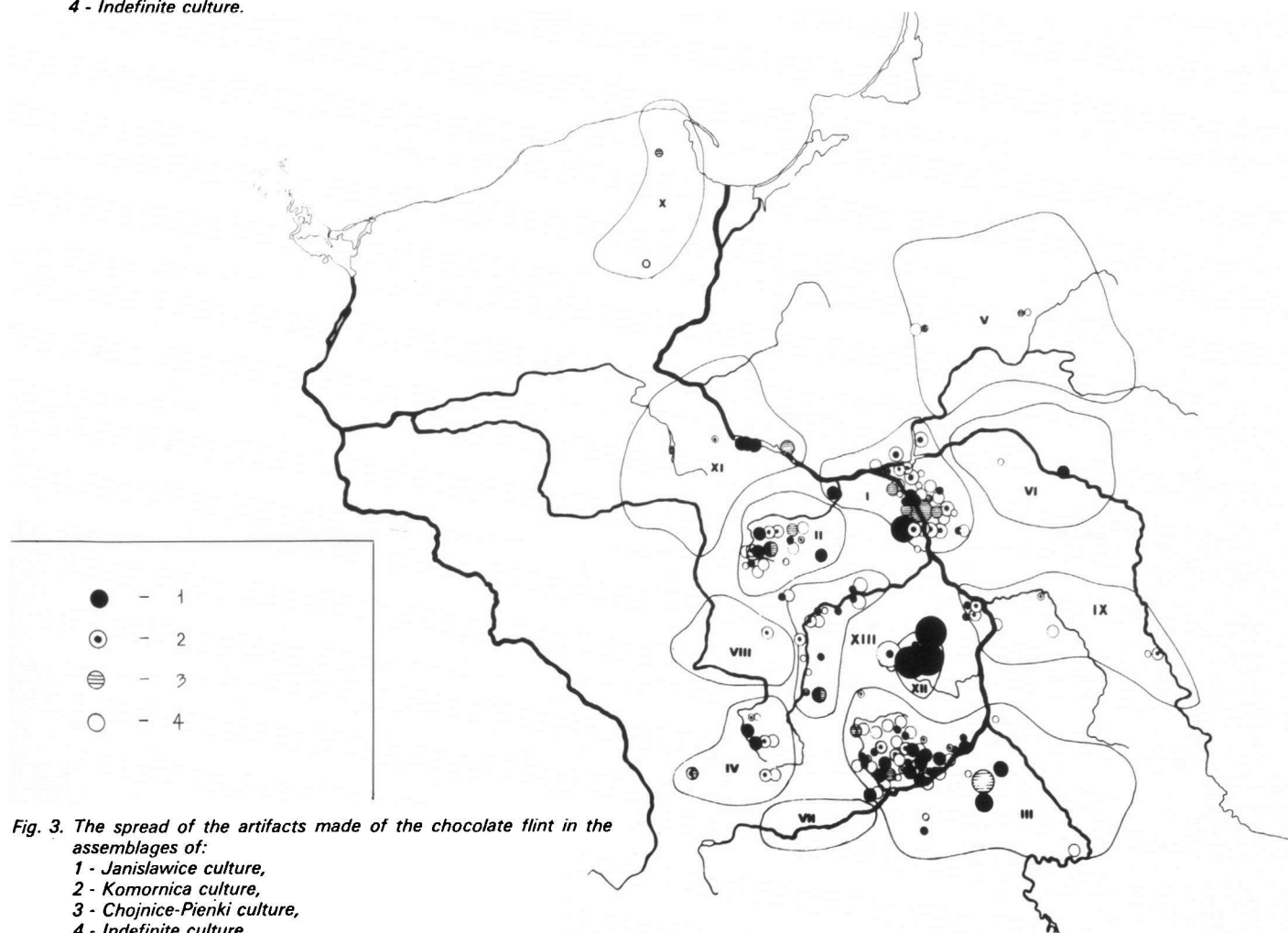


Fig. 3. The spread of the artifacts made of the chocolate flint in the assemblages of:

- 1 - Janisławice culture,
- 2 - Komornica culture,
- 3 - Chojnice-Pienki culture,
- 4 - Indefinite culture.

## 8. The Jurassic flint (J)

There are many varieties of the upper Jurassic flint which differ from one another in geographical position and the kind of natural deposits as well as in number of morphological properties such as colour, size and shape of the concretion, transparency and degree of impurity of the flint mass and organogenetic inclusions. From this variety follows the different workability of particular kinds. Of decisive importance were here the kinds of deposits which contained this flint. Thus the relatively big, mat and opaque concretions from the upper Warta region were obtained from rock debris by exploiting shallow pits and natural exposures in the valley of the Warta which, moreover, had repeatedly transported and deposited single pebbles of this flint on its banks. In the Mesolithic its use was confined to the region of the upper Warta. This rather limited distribution (Fig. 4) was mainly due to considerable difficulties in the working of the flint, arising among others from the irregular shape of the concretions, and from the presence in the flint mass of numerous calcite precipitations. The Jurassic flint from the region of the middle Pilica differs considerably from the flint described above. This group includes yellow-white materials with weakly developed silica and with properties of the gaize as well as dark brown and light brown flint which in the shape of nodules characterized by transparent flint mass with organogenetic inclusions occurred in the upper Jurassic limestone. Small amounts of this flint were locally used on the sites of the Pilica valley.

The Jurassic flint from the Cracow region, which was classified and described in detail in relevant literature. (M. KACZANOWSKA, J.K KOZŁOWSKI, 1976) was used on Mesolithic sites in the southern part of the Vistula basin, particularly intensively in the environs of Cracow. The examined flint artifacts showed properties which indicate that they were made of materials either derived from secondary local deposits or transported by glacial or fluvial water. The latter, occurring abundantly on the surface, were easily available but were of poorer quality.

The above list is probably incomplete and in all probability there exist many other kinds of the Jurassic flint whose outcrops are still unknown. Because of the great differentiation of this flint (though certain constant and similar attributes do exist) and of

the occasional difficulty in distinguishing it from the chocolate flint (in case of small-sized artifacts) there exists a probability of committing single errors in the classification of the analysed artifacts.

To this list we should add the so-called flint-like rocks, i.e. hornstone, chert and others (e.g. sandstone). Hornstone and chert were extremely rarely used, mostly where only limited quantities of good quality material were available. They occur only in a few rich assemblages where they account for a small percentage of the whole.

Such artifacts as 'anvils', hammerstones and grinders were made of sandstone, granite, slate and less frequently of limestone (flakes made of sandstone or chalk are very occasional).

This rich assortment of flint materials available in the area under discussion was to a very small degree supplemented by imports of radiolarite (Rd) and obsidian (Ob). They were erratic varieties of these desirable materials derived from western Slovakia and Moravia.

The analysis of the raw material structure of 34 closed assemblages has revealed that they were far more differentiated in southern than in northern Poland. For example, the assemblage of Janislawice and Chojnice-Pieńki cultures in the forks of the Vistula and San show a constant presence of at least four varieties of flint (chocolate, Świeciechów, Jurassic and Baltic). Of quite different, monotonous character (nearly 100% of chocolate flint) are the structures of the workshop assemblages of the Janislawice and Komornica cultures in the region where the chocolate flint was extracted. Also the assemblages of the Chojnice-Pieńki culture in Eastern Pomerania show a very specific structure, composed as they are exclusively of the local Baltic and Pomeranian varieties of flint. Of similar structure, composed of two parts, are Janislawice inventories on the middle Bug (Local Baltic and Mielnik flint). Similar in character are the structures of the Janislawice and Chojnice-Pieńki assemblages from Central Poland (on the Bzura and middle Vistula). Their position between the north, dominated by the Baltic flint, and south, with a considerable share of the chocolate flint, is reflected in the slight preponderance of the former over the latter.



Fig. 4. The spread of the artifacts made of the Jurassic flint in the assemblages of:

- 1 - Janislawice culture,
- 2 - Komornica culture,
- 3 - Chojnice-Pieńki culture,
- 4 - Indefinite culture.

The question now arises of the relation, if any, between the ratio of a given variety of flint in particular assemblages and the distance of the latter from its deposits. A detailed analysis of this problem as regards the chocolate flint, with the use of diagrams and statistical indexes, has revealed the existence of a distinct correlation of this kind in the Janisławice and Pieńki-Chojnice cultures. On the other hand, this correlation is much less distinct in the Komornica culture. The ratio of the chocolate flint in particular assemblages was greatly influenced by their distance from its deposits, however, it was also conditioned by the position of the sites in relation to the outcrops of other good quality varieties of flint and in relation to certain water ways.

The groups of the Chojnice-Pieńki culture seem to have been particularly mobile and far-reaching 'bearers' of the chocolate flint. On the other hand, its role was particularly important among the majority of the societies of the Janisławice culture. Similar inter-relations can be noted with regard to the Świeciechów flint, whose extent, however, was much more limited than that of the chocolate variety.

As follows from the map (Fig. 3) where all sites with the chocolate flint have been plotted, its extent is larger than that of all other varieties of flint (apart from the Baltic flint) and covers nearly the whole area under discussion. The extreme point which the chocolate flint has reached is at Orle in Eastern Pomerania at a distance of 450 km (as the crow flies) from its deposits. The main directions in which the chocolate flint had spread show certain tendencies. The major route ran north-westwards of the deposits along the Pilica to its lower course where it branched off: one route ran into the upper Bzura region and the other in the direction of the middle Vistula. Smaller amounts were exported towards south-east, primarily because of the competition of the nearer deposits of the Świeciechów flint. Attention should be drawn to the important part played by the Vistula and the Pilica in the distribution of the chocolate flint.

The extent of the Świeciechów flint was considerably smaller (Fig. 3). Its main area extended over southern Poland, and its small quantities occurred in a narrow belt stretching towards north-west along the Vistula which played an essential part in the distribution of this flint over considerable distances. The farthest point which the Świeciechów flint has reached is at Wistka Szlachecka, distant about 270 km from its deposits.

The area where the Jurassic flint was utilized (Fig. 4) is similar in extent to that of the Świeciechów flint, and generally it coincides with the local occurrence of its deposits.

Because of the commonness of its deposits the Baltic flint had the widest extent. The only site where no artifacts of this flint were found is the workshop of the chocolate flint at Tomaszów. A general regularity has been noted, namely the proportion of the Baltic flint in the assemblages in a given area depends on the presence at the spot or nearby of the outcrops of better quality flint (Świeciechów, chocolate or Jurassic). In closed assemblages the Baltic flint supplements other varieties and only where they are difficult to obtain it constitutes the main component.

Single artifacts made of imported radiolarite were found on only 7 sites (distributed over an area stretching from Central Poland to the environs of Warsaw). The use of obsidian was similar (present on 6 sites). The relatively larger amount of obsidian noted in the Janisławice assemblages at Rydno XIII/59 may indicate that it was obtained by barter for haematite. It is possible that both radiolarite and obsidian were obtained in the course of contacts with Neolithic communities or alternatively, they were collected on Palaeolithic sites. Characteristically, in none inventory the two varieties co-occur. This may indicate either that they originated from geographically different deposits and arrived in the area under discussion by different ways or that they were utilized in various periods.

For the purpose of clarity the area under discussion has been divided into 13 regions (cf. Figs. 2, 3 and 4). These are separate territorial units comprising particular groups of sites usually concentrated along larger rivers or on lakes. Most of them are distinguished by a definite specificity of raw material. At the same time certain units are characterized by close similarities. Due to this it has been possible to isolate the so-called zones (or provinces) of raw material. These are areas which differ from one another in the specific set of materials used (Fig. 1). Another important factor which bore on the decision to join certain regions into provinces was their neighbourhood. It should be stressed that in the division into provinces the chronological

aspect has not been taken into account because of the lack of a sufficient number of absolute dates for the Mesolithic in this area.

For the sake of brevity the other conclusions drawn from the analysis have been summed up as follows:

1. During the Mesolithic there operated a complicated system of flint distribution, slightly different within particular cultural traditions and provinces of raw materials.
2. Certain features of the techniques of flint working are characteristic of particular raw materials (irrespective of the cultural identity of the assemblage) and on the other hand certain technical features are typical of particular cultural traditions (irrespective of the variety of the material used).
3. The sites were functionally differentiated, this being linked with the dominance of workshop activities on some of them.
4. The cultural tradition played a decisive part in the shaping of the morphology of the inventories; however, it was influenced (mainly with respect to the size) by the properties of the flint used.
5. The communities of the Janisławice culture sought good quality flint (mainly chocolate and Świeciechów), the communities of the Komornica tradition used local varieties of flint irrespective of their quality (mainly the Baltic flint), and the communities of the Chojnice-Pieńki culture oscillated between the two tendencies.
6. The Mesolithic flint working technique is marked by distinct elasticity associated with the relatively important role played by local raw materials, offering different possibilities of working.
7. In the time-span from the Early to Late Mesolithic two tendencies might be detected:
  - the growing differentiation in the range of the materials used and of the technique of working;
  - the growing intensity of the use of the Świeciechów flint;
8. There are certain premises which allow us to reconstruct models of the socio-economic aspects of raw material economy. Assuming the existence in the Mesolithic of local human groups occupying certain definite areas, the following models of obtaining and distribution of the desirable flint can be constructed (this refers primarily to chocolate flint):
  - the organisation of far-going expeditions in order to accumulate directly stocks of necessary raw materials in the area of their occurrence;
  - the obtaining of flint by indirect barter in the course of inter-group contacts (in the case of groups removed from the deposits)
  - the obtaining of flint by direct barter (in the case of groups neighbouring with the regions of deposits).

In this study the problematics mentioned in the title has been barely sketched. In order to analyse it thoroughly certain research tasks should be fulfilled. The essential task is the detailed and dynamic analysis of newly discovered and some previous assemblages from the point of view of the materials and techniques used. Another is the constant prospecting for and description of so far unknown flint deposits and their identification within inventories of archaeological sites.

Another problem is how to present the detailed characteristic of particular varieties of flint. It seems that the microscopic-petrographic analysis can be useful to the archaeologist only when it allows to localize deposits of the flint which was used in the production of artifacts found on a site. However, in view of the close similarity in the structure of particular varieties of flint this does not seem feasible and therefore the microscopic analysis should be used with great caution.

To conclude, I would like to stress that the problem of raw materials used by prehistoric societies is a fascinating one, providing a strong impulse to further studies.

#### BIBLIOGRAPHY

- BALCER B., 1975 - *Krzemień swieciechowski w kulturze pucharów lejkowatych*, Wrocław, Warszawa, Kraków, Gdańsk.  
 DODLEZ R., DAYCZAK-CALIKOWSKA K., DEMBOWSKA J., 1962 - *Atlas geologiczny Polski*, z. 9 - Jura, Warszawa.  
 DOMAŃSKA L., 1979 - *Krzemień pomorski w kulturach środkowej i młodszej epoki kamienia na niżu polskim*, praca doktorska napisana w Katedrze Archeologii Uniwersytetu Łódzkiego (w maszynopisie), Łódź.

GINTER B., KOZŁOWSKI J.K., 1975 - *Technika obróbki i typologia wyrobów kamiennych paleolitu i mezolitu*, Kraków.  
KACZANOWSKA M., KOZŁOWSKI J.K., 1976 - *Studia nad surowcami krzemiennymi południowej części Wyzyny Krakowsko-Częstochowskiej*, Acta Archaeologica Carpathica, t. XVI.  
KRUKOWSKI S. W., NOWAKOWSKI A., 1976 - *Skam 71. Zbiór rozpraw prehistorycznych*, Wrocław, Warszawa, Kraków, Gdańsk.  
POZARYSKI W. 1962 - *Atlas geologiczny Polski, z. 9 - Kreda*, Warszawa.

SCHILD R., 1976 - *Flint Mining and Trade in Polish Prehistory as Seen from the Perspective of the Chocolate Flint of Central Poland. A Second Aproach*, Acta Archaeologica Carpathica, t. XVI.

Dr. Krzysztof Cyrek  
Muzeum Archeologiczne  
i Etnograficzne  
Łódź - Poland

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