

Ryszard F. Mazurowski

## HISTORY, STATE AND FURTHER DIRECTIONS OF RESEARCH ON AMBER WORKING IN THE STONE AND EARLY BRONZE AGES IN EUROPE<sup>1</sup>

For the last dozen or so years a very fast increase of interest connected with the problems of development of social-economic relations among the population groups of the Stone and Early Bronze Ages has been observed in European archaeology. The example might even be works devoted to exploitation, working and distribution of various kinds of flint and stone, obsidian, faience and copper. In literature dealing with the subject it is stressed that the very prominent factor in studying the development of social-economic ties linking population groups of various regions in Europe is research devoted to problems of exploitation, working and distribution of amber. The growing number of publications dealing with this subject proves this<sup>2</sup>. Most of them submit the hitherto achievements in this field for criticism. The reasons lie not only in prominent growth of new reference materials. Numerous circle of explorers realize that in the field of our interest exist considerable negligences, and quite many circulating in literature hypotheses often originated in intuition inference. That is why it seems to be advisable to sum up the hitherto state of research on the problems of amber working in the Stone and Early Bronze Ages in Europe. This task and also an attempt to define further research directions are undertaken in this publication.

The first wider descriptions dealing with the problems of amber working in the Stone and Early Bronze Ages were carried out during the last 30 years of the 19th c. It coincided with a great interest in amber in natural sciences, and in particular with an explanation of the origin of mineral resin (succinite), its physical structure and chemical constitution and its distribution in Europe. With an interdisciplinary character of interest of numerous explorers it was a circumstance promoting the development in research on primaval amber.

<sup>1</sup> In this article comprehensive fragments of one chapter of the author's doctor's thesis „Exploitation, Working and Distribution of Amber in the Vistula Basin in the 4th and 3rd millennium B. C.”, „Pozyskiwanie, przetwórstwo i dystrybucja bursztynu w dorzeczu Wisły w IV i III tysiącleciu p.n.e.”/The said thesis was written under the scientific leadership of Professor doctor Waldemar Chmielewski in the Institute of Archaeology of Warsaw University. Let me express my cordial thanks to the conferring a degree Professor for extensive help and kindness in the course of preparing the mentioned work.

<sup>2</sup> Loze 1969; Okulicz 1973; Schuldt 1974; Rottländer 1975; Sarnowska 1975.

In 1872 A. P. Madsen<sup>3</sup> incidentally described mesolithic and neolithic finds of ornaments made of this mineral and discovered on the Jutland Peninsula. However, ten years later O. Tischler's and R. Klebs's works were published, which had an important impact upon further development of ideas concerning the whole complex of problems connected with exploitation, working and mainly distribution of amber in the Neolithic and in the Early Bronze Age<sup>4</sup>. Particularly important up to the present day has been R. Klebs's publication „Der Bernsteinschmuck der Steinzeit von der Baggerei bei Schwarzort und anderen Lokalitäten Preussens". It includes the first descriptions — made according to quite general typological division — of 434 specimens of amber half-products and amber ornaments extracted by excavators from the bottom of the Kuroń Artificial Lake in the vicinity of Schwarzort (now Juodkrante) in the years 1880 - 1882. They were owned by museums in Königsberg and Berlin. However, undefined number of ornaments of this finds enriched private collections and have never been subjects of archeological research<sup>5</sup>. In spite of the fact that being at the author's disposal amber products represented stylistic and technological variety, they were classified among neolithic finds. Half-products of ornaments representing various stages of working make it possible to reconstruct their production process. Next, a prominent stock of the author's information concerning physical and chemical characteristics of amber became basic for carrying raw material classification of the examined products. Together with precise drawings of ornaments and their scrupulous description, even now — after nearly a hundred years — we are able to reconstruct and describe again reference material concerning these finds. After carrying the comparative analysis of occurrence of succinite ornaments in Northern Europe, the author came into consideration that in this part of the continent 3 regions with the occurrence of different types of ornaments can be separated: East-Baltic, West-Baltic and British. Known to R. Klebs ornaments from the Polish lands were included among those from the East-Baltic region<sup>6</sup>. According to R. Klebs and O. Tischler, produced on the eastern coast of the Baltic Sea (the Kuroń Spit, the Sambian Peninsula) amber ornaments were distributed by means of trade contacts of contemporary neolithics population to the Polish lands, Ukraine, far eastwards (nearly up to the Ural Mountains) and northwards (Scandinavia)<sup>7</sup>. Similar R. Klebs's ideas are also included in his next work<sup>8</sup>.

In 1888 K. Neergaard describes in his work „Ravsmykkerne i Stenalderen" neolithic finds of amber ornaments from the West-Baltic region with particular regard to the Jutland Peninsula and nearby islands<sup>9</sup>. O. Olshausen, however, carried a wide

<sup>3</sup> Madsen 1972.

<sup>4</sup> Tischler 1882, 1883; Klebs 1882.

<sup>5</sup> According to press informations in 1977 in Gettingen (FRG) some relics from Juodkrante were found which before the 2nd World War were stored in Königsberg museums.

<sup>6</sup> Klebs 1882, p. 41-49, 51-52 and appropriate tables.

<sup>7</sup> Klebs 1882, p. 41.

<sup>8</sup> Klebs 1892.

<sup>9</sup> Neergaard 1888.

analysis of occurrence of amber, gold and bronze products in neolithic and early bronze graves in Central and Northern Europe<sup>10</sup>. Very rare cooccurrence of amber, gold and bronze products is in his opinion the proof of frequent trade contacts between the West-Baltic coast and Central and Southern Europe. According to O. Olshausen this is confirmed by prominent decrease of amber ornaments number in culture groups of the Bronze Age in Jutland in comparison with their mass occurrence in neolithic graves and hoards. In the Bronze Age they are replaced by gold and bronze products received by means of amber exchange with population of the Kimerian Peninsula, the Alps and Transylvania. The beginnings of this exchange took place in the Late Neolithic, when amber scattered from the North, along the Elbe to Central Europe.

O. Olshausen's ideas were criticised by M. Much – an advocate of German ethnic school in prehistory<sup>11</sup>. He supposed that the first distribution of amber beyond the Baltic area was connected with migration of Aryan tribes who formerly lived in Northern Europe, west from the Vistula. The mentioned migrations of Indo-Germanic people (tantamount for him to Indo-Europeans) began in the Neolithic Age, and the result of them was occurrence of amber ornaments in various places of Central and Southern Europe, also in Mycenae. A little later mediate trade developed. It enabled affluence of amber from the Baltic coast. According to M. Much exchange had to be carried on by stages because in Northern Europe there isn't even a single gold or bronze object with characteristics typical of Mycenaean culture. East-Baltic coast, inhabited by tribes of very primitive farming culture (in comparison to the Aryans), did not participate in trade contacts with Southern Europe at all, until the Period of Roman Influences. However, the working of amber in the Neolithic Age hardly supplied the needs of local population.

Similar ideas were also represented by A. Hedinger and G. Kossinna<sup>12</sup>. The first of them supposed that after inhabiting new territories Indo-Germanic population was deprived of possibilities to exploit the mineral from the Baltic coast and this made them seek and utilize amber resurces in a new environment. But G. Kossinna in both of his mentioned works uttered his opinion that it were northern Indo-Germanic tribes (and mainly of the so called 2nd migration) to dominate as amber distributors in the Neolithic Age to widespread territory of Europe. Especially significant was the population of the Globular Amphora Culture which after moving to the territory of contemporary Polish lands and of Eastern Galicia did not want to get rid of native amber ornaments. In order to import amber from the territory of the Vistula estuary and from Sambia, the population of this culture had to exchange it for „banded flint”<sup>13</sup>. Kossinna was the first to give a broader specification of neolithic finds of amber products from the Polish territories<sup>14</sup>.

<sup>10</sup> Olshausen 1890, 1891.

<sup>11</sup> Much 1904, p. 117 - 134.

<sup>12</sup> Hedinger 1903; Kossinna 1909, 1910, 1919.

<sup>13</sup> Kossinna 1919, p. 149 - 150.

<sup>14</sup> Kossinna 1910, p. 104 - 106; 1919, p. 149 - 151.

Very essential for the problem of neolithic amber working in the Baltic basin as a whole are A. W. Brögger's works<sup>15</sup>. Examining very carefully collections of neolithic amber ornaments in all Baltic countries, the author numbers two stylistic trends so far as the working of the mineral is concerned: naturalistic (Arctic) – shaped in native tradition, and schematic – shaped under influence of South-European cultures. Except for the occurrence of different beads, pendants and spacers the West-Baltic region differs from the East-Baltic region in the lack of naturalistic and schematic anthropomorphic representations and also in dissimilarity of zoomorphic plasticity. According to Brögger on the East-Baltic coast there existed a very strong production centre and ready ornaments were imported from there to the Polish territory and westwards up to the central part of contemporary Germany. That centre also supplied the whole Eastern Europe with amber ornaments. The explorer dated the occurring on the East-Baltic coast amber products from the end of the 2nd period of the Neolithic – according to Montelius's division – to the beginning of the Bronze Age. Describing button-shaped beads with V-shaped perforation the author stated that they appeared in the East-Baltic region earlier than on the Jutland Peninsula. However, V-shaped perforations were known to populations inhabiting various parts of Europe. This indicates that most probably such a type of perforation could generate in various regions of the continent irrespectively of each other. A. W. Brögger was the first to introduce the division of pendants including symmetrical and assymetric forms.

In the 20-ties and 30-ties of the 20th c. the ideas of up to now mentioned explorers were to various degrees accepted and developed by German archeologists: A. Götze, W. La Baume, M. Ebert and W. Gaerte<sup>16</sup>.

Among Polish explorers, W. Antoniewicz was very much occupied in examining problems of ancient amber. In 1921 and 1923 he published 2 chapters of doctor's thesis „The Significance of Amber in Prehistoric Times in Europe” (O znaczeniu bursztynu w czasach przedhistorycznych Europy) – written in 1917<sup>17</sup>. Apart from discussing the occurrence of various kinds of fossil resin on the European territory and of their physical and chemical characteristics, the article includes critical description of the level of research on amber significance in prehistoric times. Among others, very accurate are W. Antoniewicz's doubts concerning chemical analysis of the mineral and made of it ornaments found in graves of various European cultures. I shall return to this subject once again in further part of the article.

In synthetic study of prehistory of the Polish lands published in 1928 W. Antoniewicz accepts O. Tischler's and A. W. Brögger's ideas about the origin of amber ornaments discovered on neolithic and early bronze sites from the territory of the right-bank of the Oder basin and the Vistula basin<sup>18</sup>. According to this explorer on

<sup>15</sup> Brögger 1908, 1909.

<sup>16</sup> Götze 1924; La Baume 1924; Ebert 1926; Gaerte 1933.

<sup>17</sup> Antoniewicz 1921, 1923.

<sup>18</sup> Antoniewicz 1928.

the Sambian Peninsula and at the Gdańsk Bay there existed at the turn of the Neolithic workshops producing amber ornaments and statues, which were exported to wide territories of Northern and Central Europe. The main producer of ornaments was then the population of the Comb-marked Pottery culture. As the result of exchange of amber ornaments, the Baltic producers received among others originating from Kujawy salt. A great number of various succinite products in megalithic graves of the Globular Amphora Culture in Kujavia and neighbouring regions prove this. Migrations of tribes from the North to the South and East resulted in amber distribution on the territories where it had not been known earlier. According to W. Antoniowicz there exist close parallels between amber statues from Juodkrante and some statues of people and birds found in caves near Mników. As it is widely known „Mników relics” are false.

In 1934 J. Brøndsted enumerates 3 phases of development of amber trade on the Jutland Peninsula, two first of which refer to the Neolithic Age, and the last one fell in I-III period of the Bronze Age (according to Montelius)<sup>19</sup>. The earliest phase falls in the period of the oldest dolmen graves or in not much earlier times. Then stores of goods numbering several thousands of amber ornaments were characteristic. They are located in Northern and Western Jutland, that is in the vicinity of production centres scattered on the western coast of the peninsula. The second phase falls in the period of long barrow and cist graves, at which time amber ornaments occur in masses in the southern part of Scandinavia. However, it was not earlier than in the 3rd phase, when amber became on a large scale a trade object with South-European countries. This exchange is proved by a large number of gold, copper and bronze products in graves of the West Jutland Peninsula compared with a very rare occurrence of amber. While expressing his opinion on amber trade for the 2nd time, the explorer changed his earlier ideas a little<sup>20</sup>. He changed the date of the beginnings of amber exchange with the population of Central — and West-European cultures to the 2nd half of the 3rd and the beginning of the 2nd millennium c. B. C., when copper products occur in greater number in the northern group of the Funnel Beaker culture and in the Single Graves Culture.

In the years 1935-39 appear W. La Baume's<sup>21</sup>, B. Richthoffen's<sup>22</sup>, E. Šturms's<sup>23</sup>, and O. Gandert's<sup>24</sup> publications, in which the authors relying on the earlier explorers' ideas discuss the occurrence of amber ornaments in smaller local areas or investigate selected problems. From the point of view of territorial and chronological sphere essential is W. La Baume's work in which neolithic and later amber ornaments included in the collection of the former Museum für Naturkunde und Vor-

<sup>19</sup> Brøndsted 1934, p. 150.

<sup>20</sup> Brøndsted 1960.

<sup>21</sup> La Baume 1935.

<sup>22</sup> Richthoffen 1935, 1939.

<sup>23</sup> Šturms 1937.

<sup>24</sup> Gandert 1939.

geschichte in Gdańsk are described in the catalogue way. In the result of the war military operations the whole collection got lost irrevocably. Then B. Richthoffen classified the mass finds from Juodkrante completely among the Comb-and-Pit-marked Pottery culture, similarly as the hoard from Konczanskoje described by Spitsyn in 1903<sup>25</sup>. According to Richthoffen the Juodkrante „hoard” is distinguished by stylistic and technological unity so that we can speak about the so called „Juodkrante style”.

The 40-ties of the present age brought further development of research on the problems of our interest. L. Hajek described amber ornaments of the Bell Beaker culture in Central Europe, and P. V. Glob gave characteristics of amber working production of the Single Graves culture on the Jutland area<sup>26</sup>. Especially the last explorer's work is extremely valuable because it includes a very penetrating chronological analysis of succinite ornaments occurrence. It was carried on the basis of relative dating of grave groups including among others various types of stone axes and beakers. P. V. Glob deserves the credit for carrying out a detailed typological division of the examined ornaments according to exactly marked morphological and metrical criteria. The author selected among others several ring specimens of various chronology. He also supposed that discs of lenticular cross-section occurred earlier than flattish-convex specimens. Later M. P. Malmer accepted this explorer's ideas. He analysed amber ornament forms of the Battle-Axe culture on the area of Sweden<sup>27</sup>. He also gave definitions of some ornament forms.

In 1945 A. Äyräpää expressed his opinion on the East-Baltic area. According to him the greatest role in amber exchange on this area and in Finland played the population of the Comb-marked Pottery culture<sup>28</sup>. Into this culture he included all the joint finds from this part of Europe as well as separate finds. The strongest exchange development is connected with the period of population existence of this culture, which utilized the pottery of the 2nd style (according to him — the years 2250-2000 B. C.). A. Äyräpää represented similar ideas also in later times<sup>29</sup>. But according to A. J. Briusov — the East-Baltic region of amber working in the Neolithic, up till now treated as a whole, should be divided into two production centres: South-East-Baltic area (the Sambian Peninsula, the Kuroń Spit and the Kaliningrad Rejon) and Latvian (Sarnate)<sup>30</sup>, since the produced in both centres ornaments show clear typological differences. On the basis of the earlier assignations (among others Klebs's and Brögger's ones) the explorer defines separate features among the main amber working regions on the Baltic. In his analysis he devotes much time to succinite products finds discovered in grave groups of the Globular Amphora culture on the

<sup>25</sup> Spitsyn 1903.

<sup>26</sup> Glob 1944; Hajek 1941.

<sup>27</sup> Malmer 1962, p. 270 - 280.

<sup>28</sup> Äyräpää 1945.

<sup>29</sup> Äyräpää 1960.

<sup>30</sup> Briusov 1951.

Polish area. In his opinion oval double-axe beads known from the graves of this culture in Mazovia (in Kosewo among others) clearly refer to West-Baltic Circle so far as the way of perforating is concerned. He also thought that these forms are proof of mixing on the Polish areas influences from West- and East-Baltic production centres. Frequent lack of button-shaped beads with V-shaped perforations in the Globular Amphora culture and the Kujavian culture (the so called Funnel Beaker culture), which according to Briusow are the oldest ornament forms in the East-Baltic Circle, prove a later chronology of the mentioned cultures in relation to the period of production centres existence on the Kuroń Spit and the Sambian Peninsula (the decline of the 3rd and maybe the beginning of the 2nd millenium B. C.). And so the groups lacking button-shaped beads originated in the period following the termination of finished ornaments affluence to the Oder and Vistula basins from these centres.

E. Šturms<sup>31</sup> devoted many of his works to the interesting us problems. They mainly refer to the East-Baltic Circle which used to be the source of large quantities of ornaments transferred by the Globular Amphora culture population to the Polish territories up to the Carpathian Range. According to E. Šturms the Globular Amphora culture is the leading „amber culture” on the East-Baltic areas. Its population profited a lot by mediation in exchanging amber for „banded flint”. He stressed the fact that in comparison to later epochs and economic relations of this culture as a whole, that trade was territorially limited and had local economic meaning. The contacts with productive centres on the Kuroń Spit are proved among others by round discs with pointed cross and large trapezium-shaped pendants ornamented with analogous lines of points along the edges which were found in Juodkrante. On the basis of ornament and character of farming and religion the Globular Amphora culture includes zoomorphic pendants from North-Western Poland and a number of finds having nothing to do with this culture<sup>32</sup>. Besides the general typological division of amber products of the Globular Amphora culture into cylindrical beads, button-shaped beads with V-shaped perforation, pendants, spacers, double-axe beads and discs, they were also classified among two basic groups according to their appropriation. And so E. Šturms specified two groups of ornaments — of sacral and laic character. Those from the first group are met neither in the Rzucewo culture nor in the Corded Ware culture. This explorer deserves the credit for revealing that the „treasure” from Juodkrante, which includes not only classified by him among the Globular Amphora culture products, but also ornaments of the Comb-marked Pottery culture and specimens representing the cultures of the Bronze Age and the cultures of the Early Iron Age, had multicultural character and originated in different epochs. Most probably the excavators seeking natural amber at the bottom of the Kuroń Artificial Lake cut a few culture layers. According to E. Šturms, amber trade develo-

<sup>31</sup> Šturms 1953, 1955, 1956.

<sup>32</sup> Šturms 1956, p. 13 - 20.

pment took place on a large scale not before the Bronze Age, when the succinite ornaments in graves disappear, and when in the settlements occur almost exclusively natural amber. It then became an export article.

Except for the publications of reference character<sup>33</sup>, a few works concerning broader problems of amber working of the Stone and Early Bronze Ages were written<sup>34</sup>. I. Arnal proved irrefutably that V-shaped perforations (i.e. button-shaped beads) could be initiated irrespective in different parts of Europe, no matter what sort of raw material was used. Then T. Sulimirski was of opinion that on the Polish territory a great role in amber trade with the population of the Unietyče culture in Bohemia and with Aegean countries — Crete and Troja, played the population of the Rzucewo culture and the Globular Amphora culture. The first one possessed the whole rich in amber southern and eastern Baltic coast, whereas the other culture mediated in exchange trade with in the south of the Carpathians situated areas. The mentioned author marked out three routes of exchange. The extracted on the sea littoral amber reached Italy via Western Poland, Saxony or Bohemia, then via Bavaria and the Alps. From there it was freighted to the centres of the Mycenaean culture. Another route was the old Danubian route, known from the beginning of the Neolithic Age. The extracted by the Rzucewo culture population succinite reached the South, up to the Black Sea, also through the East, that is via the territory occupied by the Globular Amphora culture, and then along waterways — the Aegean countries. It was used in the 14th c. B. C. It is obvious that these, now unacceptable, outlooks were the result of assuming that the Globular Amphora culture and the Unietyče culture were contemporary.

M. Gimbutas's<sup>35</sup> book includes many very controversial ideas being quite often results of unsatisfactory knowledge of reference materials. The following examples prove that these are not empty words. Writing about the Jordanów-Brześć Kujawski group, the author states what follows: „...In Jordanów, Brześć Kujawski and on other sites most frequently occurred as (grave-the author's complement) furnishing, copper and amber beads...” Up till now three specimens of amber ornaments from the Brześć Kujawski group of the Lengyel culture are known, while the Jordanów group lacks them completely<sup>36</sup>. The Rzucewo culture settlement in Suchacz was classified among the Globular Amphora culture. Unacceptable is also the idea of contemporaneousness of the last culture with the Bell Beaker culture — in Lower and Middle Vistula region. According to M. Gimbutas, the result of close contacts of both cultures is the imitating of V-shaped bone beads of the Bell Beaker culture by the population of the Globular Amphora culture.

<sup>33</sup> Żurek 1954; Kilian 1955; Bohnsack 1956; Krzak 1958; Kersten 1958.

<sup>34</sup> Arnal 1954; Gimbutas 1956; Spekke 1957; Sulimirski 1957 - 1959; Kaleas 1959.

<sup>35</sup> Gimbutas 1956, p. 118 and the following.

<sup>36</sup> Gimbutas 1956, p. 118. Two closely undefined amber ornaments occurred in grave VII (13) on site 4 in Brześć Kujawski — compare with Jażdżewski 1938, p. 8, table VI: 2d. According to oral information of R. Grygiel M. A. in Archeological and Ethnographic Museum in Łódź in 1978 in a Lengyel Culture pit in Brześć Kujawski, a zoomorphic amber pendant was uncovered

In the author's opinion the Globular Amphora culture population and the Bell Beaker culture population took part in amber exchange between the Baltic coasts and southern areas. Amber equivalents were following: „banded flint”, copper, bronze, and bone azureblue medallions. Then the proof of penetration of the Bell Beaker culture population on the Baltic coast is presence of bone forearm bracers in neolithic settlements on Lower Vistula and Oder, and on South-Eastern Baltic (Juodkrante) – their imitation of amber. Moreover, in the last region the author notices existence of reminiscence of ornamented gold plates (so called *Votivplattchen*) known from the graves of the Bell Beaker culture in Moravia. The expansion of produced on the Kuroń Spit ornaments was also within the reach of Latvia, Estonia, Finland and northern Russia.

In her next work M. Gimbutas gave much attention to amber distribution and exchange in Early Bronze Age<sup>37</sup>. At that time amber products occurred in masses in the *Unietyče* culture groups and in Southern Europe, among others in the Mycenaean culture. The most essential role played then the *Unietyče* culture population, which being one of the main amber users mediated in its exchange with the population of the Early Bronze cultures of Southern Europe. It is proved by a large number of bronze and gold imports in *Unietyče* groups on the Bohemian and Moravian territory, in Poland and westwards from the Oder. Although the main role in amber exploitation and working was played by the West-Baltic Circle, these activities also brought profit to the inhabitants of southern and south-eastern Baltic coast.

In recent years M. Gimbutas's ideas were accepted in a little modified version by W. Sarnowska<sup>38</sup>.

It should be added that at the end of the 50-ties also A. Spekke in his work „The Ancient Amber Routes and the Geographical Discovery of East Baltic”, published in 1957 in Stockholm<sup>39</sup>, accepted the earlier announced ideas on amber exchange in the East-Baltic Circle. However, T. Mathiassen, mainly on the basis of the ornament stylistic analysis, included in the *Maglemose* or *Gudena* Culture several dozen amber pendants of geometrical forms and specimens of zoomorphic plasticity which occurred on the Jutland area and on neighbouring islands<sup>40</sup>. In this explorer's opinion also zoomorphic pendants from West Pomerania should be included in the *Maglemose* culture, as well as ornamented trapezium-shaped specimens from Gdańsk. Regarding part of the Jutland finds, it was proposed much earlier by J. Brøndsted who confirmed his ideas in 1960<sup>41</sup>.

The last fifteen years were distinguished by considerable intensification of comprehensive research on Neolithic and Early Bronze settlement in various regions

<sup>37</sup> Gimbutas 1960, 1965.

<sup>38</sup> Sarnowska 1975, p. 23 - 26.

<sup>39</sup> Spekke 1957, p. 47 - 49. The author accepted among others amber distribution routes in Europe marked out by J. M. De Navarro (Navarro 1925).

<sup>40</sup> Mathiassen 1959.

<sup>41</sup> Brøndsted 1934, 1960.

of Europe. However, the way of elaboration of amber products and methods and scope of interpretation of social-economic phenomena connected with exploitation, working and distribution of this mineral are still the same, as in earlier years. To a high degree this is because of reasons of objective nature. First of all, we should mention concentration of individual prehistorians' research problems on monographic elaborations of single cultures, culture groups or in various ways separated settlement regions. Then characteristics of a broader culture complex phenomena get lost. The mentioned monographs of cultures or their groups almost always show tendency to unequal deal with made of different raw materials relics. And so traditionally, in the Neolithic materials analysis, the greatest attention is paid to pottery which is the basis of chronologic-cultural divisions. In the case of Early Bronze cultures this role is played by pottery and metal objects. Flint, stone, bone, amber and other products were studied very superficial. That is why they usually are not considered to be valuable sources showing inner chronological differentiations of particular cultures and relations among them. It seems to be possible after precise investigation of the studied phenomenon on wide-spread area and taking into consideration a wide range of time. In Late Neolithic in the basins of the Oder and the Vistula, and on the neighbouring areas, these possibilities arise thanks to growing demand for amber among the population groups of several cultures. I certainly do not aim at contesting fundamental role of pottery in chronological division of the Neolithic cultures, since it is the most numerous category of movable sources for the discussed section of prehistory. I would only like to express my opinion that the mentioned divisions would be more firm and more reliable if movable sources of other minerals, also those made of amber, and pottery were considered on equal terms. This possibility was not taken into consideration so far as our territories are concerned, in hitherto elaborations of the Globular Amphora culture, as well as the Złota culture<sup>42</sup>. Amber ornaments are numerously represented in grave groups of those cultures. Hardly better were these problems solved in the case of the Neolithic settlement of adjoining territories.

Because of the lack of exact classification or typology of Neolithic amber products from the Polish territories, in literature became accepted the idea of using similar forms by populations of the following cultures: the Globular Amphora culture, the Złota culture, the Rzućewo culture and the Funnel Beaker culture<sup>43</sup>. To a certain degree it was the result of the assumption that in the Neolithic Age only amber resources on the Baltic coast, mainly between the Gdańsk Bay and the Kuroń Spit were exploited<sup>44</sup>.

According to T. Wiślański the Globular Amphora culture played the essential role in this mineral distribution, bringing about greater activity of the amber coast

---

<sup>42</sup> Wiślański 1966, 1970; Nosek 1967; Krzak 1970b, 1976.

<sup>43</sup> Wiślański 1970, p. 225; Krzak 1976, p. 151 - 152.

<sup>44</sup> Wiślański 1969, p. 249; 1970, p. 225; Krzak 1976, p. 151

in the Vistula estuary. Organizing expeditions to the sea, the Neolithic up-country population could collect amber on the shore but more often they purchased it by exchange from the local fishermen. Frequent contacts among populations of various cultures in Lower Vistula region led not only to the stylistic standardization of amber ornaments originating in local workshops, but they effected the whole of material culture of existing there tribes. In Late Neolithic the result of this phenomenon was formation of the Rzucewo culture. Amber products from the Polish territories show mixed characteristic features of the Maglemose-Kunda culture, the Danubian cultures and the Funnel Beaker culture. T. Wiślański supposed that part of the ornaments of the Globular Amphora culture, the Złota culture and the Corded Ware culture were produced in workshops of the Rzucewo culture. He also emphasized that some workshops had existed before this culture was separated. We can assume from further course of this explorer's reasoning that they were connected with the Globular Amphora culture<sup>45</sup>. An exchange object was not only natural amber but finished ornaments as well. In exchange for amber population groups of the Rzucewo culture could achieve surpluses from breeding and farming, but flint was not such an object of the said exchange contacts. The discussed contacts could be of direct and indirect character.

Similar ideas represented Z. Krzak, who deserves the credit for elaboration of reference materials of the Złota culture key-sites, and also for monographic introduction of the connected with it problems as a whole<sup>46</sup>. The explorer believes that numerous amber ornaments originated on the Baltic coast because: all their forms occurred on the Baltic; amber ornaments on the Baltic were used by populations of many simultaneously existing cultures; distribution routes part from the Baltic coast; in the vicinity of the sea coast (Stegna) a treasure of amber pendants with V-shaped perforation were discovered; the Baltic amber ornaments were discovered on the Neolithic and originating in the Early Bronze Age sites in Southern Europe.

An exchange object was also raw amber material. In Z. Krzak's opinion the Globular Amphora culture and the Corded Ware culture were the main distributors of the said mineral in Central Europe, and in their inventories the best equivalents of the Złota product's style are found. He also adds that in spite of their own production of numerous ornaments, the Globular Amphora culture population knew neither rectangular pendants (known in the Radial-Decorated Pottery culture) nor characteristic of the Corded Ware culture rings. Next, in the latter all the forms of the Globular Amphora culture ornaments except axe-shaped beads are known.

J. Okulicz relatively widely represented the problems of neolithic amber working in his work "Prehistory of Prussian Territory from Late Palaeolithic till 7th c. A. C." (Pradzieje ziem pruskich od późnego paleolitu do VII w. n. e.)<sup>47</sup>. Accepting Brögger's division into naturalistic and schematic currents in the Baltic amber working pro-

<sup>45</sup> Wiślański 1969, p. 249 - 251; 1970, p. 224 - 226.

<sup>46</sup> Krzak 1958; 1961; 1970a, b; 1976, p. 151 - 153.

<sup>47</sup> Okulicz 1973, p. 103 - 104, 133 - 149, 152 - 153.

duction, the author believes that in transmitting of southern influences (elements of schematism), the population of the Lengyel culture and to some extent also of the Funnel Beaker culture played a serious role. Moreover, direct influences from the Tripole culture circle (anthropomorphic plasticity) can be observed. J. Okulicz accepts B. Richthoffen's idea of the existence on the Prussian territory of the so called Juodkrante style, for which almost all the forms of amber ornaments known from the Neolithic and Early Bronze Age are characteristic. The creator of this style was The Comb-marked Pottery culture population. These ornaments occur in the Jutland centre and in the Globular Amphora culture later. The last mentioned culture did not create any new variants or types of amber ornament. Through the mediation of the Globular Amphora culture population on the whole territory of Central Europe were distributed finished ornaments produced in amber workshops of the Comb-marked Pottery culture, and then the Rzucewo culture, located on the Kuroń Spit, the Sambian Peninsula, in the vicinity of Palanga and at the Gdańsk Bay. To smaller degree raw amber material was the object of exchange. The Baltic producers received for the finished ornaments among others attractive flint products, including mainly wide-head axes. And so, through the mediation of the Globular Amphora culture population, and the also the Corded Ware culture, the Juodkrante style popularization took place on the wide European territories.

From the analysis of other fragments of the said work arises lack of the author's firm outlook about the role of the Globular Amphora culture in the amber working development. Writing about the ornaments of the Pomeranian-Prussian group, the explorer stated that they were produced most probably beyond the reach of the mentioned culture settlement. However, we can read on: „We cannot, however exclude the local amber working of this culture, based on its own raw material resources, because the reach of this culture is in line with the richest in fossil amber region of the Mazurian Lake District. Also wide scattering of separately found on the Sambian Peninsula and the Prussian Lowland axes with wide heads, and strong influences of the Globular Amphora culture on its contemporary Rzucewo culture, let reasoning the first of these possibilities rather, that is exchange trade of the Globular Amphora culture population with the Baltic region... Next J. Okulicz states: „Still earlier, before the Globular Amphora culture, amber working practised by the „Comb” population is undoubted. Although we cannot negate that the Globular Amphora culture tribes had their own productive skills, it should be accepted that amber reached them through mediation of their Baltic neighbours in form of natural amber or finished products. At the same time taking over of all the forms and workshop skills from the „Comb” population is obvious<sup>48</sup>.

J. Okulicz is of opinion that amber working in the Rzucewo culture is a full continuation of the production initiated by the Comb-marked Pottery Culture population. This explorer devoted a lot of attention to the group find from Juodkrante, which

---

<sup>48</sup> Compare with Okulicz 1973, p. 104 and 154.

he considers to be culturally and chronologically mixed. It can be remnant of a long-existing settlement or the spot of the gifts gathering cult. The genesis has been discussed on the wide comparative background. The zoomorphic statues from west Pomerania and Gdańsk were included in the Mesolithic Age on the basis of stylistic differences in relation to neolithic specimens. A little earlier S. K. Kozłowski represented a similar opinion<sup>49</sup>.

Among the Polish explorers the following ones used to express their opinion on the neolithic amber working: S. Nosek<sup>50</sup>, E. Kempisty<sup>51</sup>, E. Noworyta<sup>52</sup> and M. Gula<sup>53</sup>. According to S. Nosek in the Globular Amphora Culture, and mainly in the Warmian-Mazurian group (according to his territorial division) amber working was highly developed in connection with a easy reach of natural amber. Finished ornaments were exchanged for „banded” flint axes with the population of the Great Poland-Kujawy and Mazovia-Lublin group.

Whereas E. Kempisty expressed her opinion of a possibility of utilizing by the Mazovia-Podlasie population group of the Globular Amphora culture occurring within their settlement's reach amber. Whereas E. Noworyta believes that amber ornaments do not bear any cultural marks and in principle are not so important in chronology fixing. We may only add, that the above mentioned statements are quite truly rendered by hitherto advance degree of research on the neolithic amber working in the Oder and the Vistula basin. It should also be mentioned about not long ago published M. Gula's article, in which the author just as E. Šturms and M. Gimbutas declared herself for the affiliation of zoomorphic statues from West Pomerania and Gdańsk to the Globular Amphora Culture<sup>54</sup>. The affiliation of anthropomorphic statues from Gdynia, Kruklanki, Nidzica and Wielki Kack was similarly defined<sup>55</sup>.

In other countries during the last 15 years a prominent grow of research on the interesting us problems has been observed. Besides earlier discussed works, new publications concerning West-Baltic<sup>56</sup>, East-Baltic<sup>57</sup>, and including the territory of th-

<sup>49</sup> Kozłowski 1972, p. 152 - 153.

<sup>50</sup> Nosek 1967, p. 333, 347, 365.

<sup>51</sup> Kempisty 1970. A similar outlook in relation to the settlement of the Globular Amphora Culture population especially in the Mazurian Lake District, West Pomerania, Mazovia, Kujavia and Great Poland, was also represented by this article's author — compare with Mazurowski 1977, p. 170 - 171.

<sup>52</sup> Noworyta 1976.

<sup>53</sup> Gula 1977.

<sup>54</sup> Gula 1977, p. 337.

<sup>55</sup> Gula 1977, p. 338. In my opinion specimens from Gdynia and Wielki Kack may be stylized cross representations from early Middle Ages, but schematic representations of human shapes originating in Nidzica and Kruklanki have the closest equivalents among tremble idols from the circle of the Cyclades Culture (compare with Höckmann 1968, p. 59 - 74, fig. 1 - 2, table 1:2, 6-8, 12, 13; 4:6). They may be related to the settlement of early Bronze Age in North-Eastern Poland. I shall broader assume my attitude towards the problems of amber plasticity from the Polish territories in being prepared to publication monography „Amber in the Stone Age on the Polish Territories” (Bursztyn w epoce kamienia na obszarze ziem polskich).

<sup>56</sup> Van Regteren Altena and others 1962; Lamberg — Karlovsky 1963; Newton, Renfrew 1970; Schuldt 1974.

<sup>57</sup> Loze 1969, 1975; Vankina 1970; Rimantiene 1970.

whole Europe<sup>58</sup> appear. Part of them is devoted to the exchange development among different regions of the Baltic coast and Central- and South-European cultures in the Neolithic and Early Bronze Age. The research method and final conclusions of these works are identical or similar to those appearing in earlier discussed publications. A very often met in them element is the idea of exchanging amber for faience beads pouring in to the areas situated northwards from the Carpathians and the Sudeten<sup>59</sup>. Much earlier such a possibility had been suggested by G. J. Becker<sup>60</sup>.

Therefore, we should now concentrate on the elaborations, which present new assignments and achievements to the research on the problems of amber working of the Stone and Early Bronze Ages. One of them is E. Schuldt's monographic elaboration of neolithic amber ornaments from the Meklemburg area<sup>61</sup>. The explorer permits of independent exploitation and working of raw amber material by some groups of local population of the Globular Amphora culture, the Funnel Beaker culture and Single Graves culture. Earlier, a conviction dominated that ornaments from this region were Jutland imports. After analysing the occurrence of amber resource on the Dutch area J. A. Brongers and P. J. Woltering<sup>62</sup> declared for its local working of the Funnel Beaker culture, Vlaardingeng culture and The Bell Beaker culture. Next R. C. A. Rottländer in his doctor's thesis „Der Bernstein und seine Bedeutung in der Ur- und Frühgeschichte", questioned amber exchange in the Neolithic and even Early Bronze Age on the European territory<sup>63</sup>. In his opinion, from Middle Paleolithic Age amber products and raw amber material finds in archeological complexes do not exceed the zone of the natural expansion of this fossil resin. However, on the Jutland territory and on neighbouring islands local copper resources could be exploited. It was most probably R. C. A. Rottländer who came to these conclusions while using unclear range of the notion "amber" by which he could understand various fossil resins. This may be illustrated by the map included in the mentioned work<sup>64</sup>. We can accept only partly R. C. A. Rottländer's ideas because of lack of detailed analysis of the correlation between localization of archeological amber sites and its natural resources in the nearest vicinity, lack of estimation of the latter abundance and their accessibility, and rough treatment of comparative analysis of ornaments from culture complexes on the basis of detailed typological or classificational division.

In the result of intensification of archeological research on the neolithic settlement in the European part of the USSR, a very rich reference material was achieved, which enabled the Soviet explorers to carry out a renewed elaboration of problems connected with neolithic amber working. Besides publications of amber products

<sup>58</sup> Rottländer 1975.

<sup>59</sup> Lamberg-Karlovsky 1963; Newton, Renfrew 1980.

<sup>60</sup> Becker 1954.

<sup>61</sup> Schuldt 1974.

<sup>62</sup> Brongers, Woltering 1975, p. 29 - 34.

<sup>63</sup> Rottländer 1975, p. 11 - 14.

<sup>64</sup> Rottländer 1975, p. 12, fig. 1.

from Sarnate<sup>65</sup>, and Šventoji<sup>66</sup> which have been discussed on a wide comparative background, I. Loze's<sup>67</sup> works became worthy. The explorer separated a new ornaments production centre on the Lubana Lowland, the so called Lubana Centre<sup>68</sup>. In that centre many ornaments were produced and utilized, which were strange to neolithic cultures from the south-eastern Baltic coast. In her second work, on the basis of detailed typological division the author discussed the question of chronology of using particular ornament forms, their culture differentiation, and also social-economic problems connected with exploitation, working and distribution of amber in the Lubana Centre<sup>69</sup>.

Both I. Loze's works and E. Schuldt's article contain besides a number of accurate statements, well justified on the basis of sources analysis — very controversial outlooks which characteristics is incomplete utilization of the reference basis while considering the whole complex of technological-organizational and social-economic problems. It especially refers to I. Loze's ideas dealing with the production specialization of the Lubana Centre and amber exchange development in North-Eastern Europe. I expressed my reservation concerning the mentioned explorers' ideas in separate reviews, therefore it is probably not necessary to introduce them again<sup>70</sup>.

Some attention should be paid to amber investigation by chemical and physical methods, used already from the end of the 19th c. by scientists from various countries. By means of results achieved by these methods the origin of amber occurring in archeological complexes in Europe, and possibilities of distinguishing it from other fossil resins are defined. In Polish literature there are some publications presenting in historical bearing the state of research on this problem<sup>71</sup>. So we can explain only a few remarks connected with the problems of using the mentioned methods, and with hitherto achievements in this field.

O. Helm while analysing chemical composition of various fossil resins occurring in Europe, came to consideration that only the Baltic amber, and more precisely — succinite, contains 3.0-8.2 per cent of succinic acid —  $C_4H_6O_4$ <sup>72</sup>. In the following years however, the proved that amber products from Mycenaean graves and from several sites in Italy<sup>73</sup>, also contained an amount of the mentioned acid within this interval. Therefore, raw amber material used in their production (or finished ornaments) had to be imported from Northern Europe where natural succinite resources are found. However, analysis of amber or ornaments carried out by other explorers, besides often analogous results, had also quite different results from O. Helm's introductory

<sup>65</sup> Vankina 1970.

<sup>66</sup> Rimantiene 1970.

<sup>67</sup> Loze 1969, 1975; Vankina 1970; Rimantiene 1970.

<sup>68</sup> Loze 1969.

<sup>69</sup> Loze 1975.

<sup>70</sup> Mazurowski 1976, 1978a.

<sup>71</sup> Antoniewicz 1923; Moberg 1957; Masicka 1975.

<sup>72</sup> Helm 1881, 1882.

<sup>73</sup> Helm 1889 a and b, 1901.

assumptions<sup>74</sup>. In the light of these data, in the following years, proportional contents ratio of succinic acid was accepted to be useless in investigation of amber (succinite) origin in prehistoric times. However, already W. Antoniewicz<sup>75</sup> stressed the fact that quantitative divergences in the contents of succinic acid may be the result of the oxidation process of the examined samples. S. S. Sawkiewicz<sup>76</sup> proved this experimentally. The next reason of such a state of affairs may be the earlier mentioned unclear range of the notion "amber" or "the Baltic amber". This name was often given to different in respect of the origin and characteristics fossil resins, such as gedanit, krancyt, glessyt, bekeryt, rumenit, succinite, stantienit. Their common feature is occurrence on the Baltic. In agreement with many explorer's outlooks the notion "amber" should refer only to the most frequently met variety of fossil resin in Europe, that is to succinite. That is why I believe that the criterion of proportional contents of succinic acid is helpful in distinguishing amber from other resins, providing that two conditions are fulfilled: 1/ the examined samples should not carry any traces of oxidation, 2/ analyses carried out in different laboratories should be realized on the same terms.

The critique of O. Helm's outlooks resulted in search for new physical and chemical methods enabling achievement of the required results. Among others an attempt to distinguish amber from other fossil resins on the basis of the analysis of the chemical composition of elements had a negative result<sup>77</sup>. It is not out of the question that investigations carried out by method of infra-red spectra, initiated a dozen or so years ago in FRG and developed particularly by C. W. Beck and his collaborators in the United States<sup>78</sup>, are about to reach this goal. An analogous research was experimentally realized also in our country<sup>79</sup>.

In C. W. Beck's opinion, the Baltic amber as the only one fossil resin, during investigation by method of infra-red spectra, reveals a specific course of spectrum within the range of  $1250 - 1150 \text{ cm}^{-1}$  ( $8 - 9 \mu$ ), providing that the sample had not undergone the oxidation process. The vertical run of absorption curve between 8 and  $8.5 \mu$ . is followed by absorption peak at  $8.7 \mu$ . This feature separates the Baltic amber from other resins, even if they contain succinic acid.

Two Soviet explorers — S. S. Savkevič and I. A. Šaks<sup>80</sup> came out with criticism of some of C. W. Beck's ideas. They questioned correctness of the use of the notion "amber" while referring to fossil resins representing different from succinite physical and chemical characteristics. In a convincing way they supplied documentary evidence for the fact that there are no differences in the run of absorption curves of "the Baltic amber" and "the Ukrainian amber", since in both cases the same

<sup>74</sup> Hedinger 1903; Antoniewicz 1923; La Baume 1935.

<sup>75</sup> Antoniewicz 1923.

<sup>76</sup> Savkevič 1970, p. 84 and following.

<sup>77</sup> Schwochau, Haevernick, Ankner 1965.

<sup>78</sup> Beck and others 1964, 1965; Beck 1965, 1966, 1969, 1970, 1972.

<sup>79</sup> Malinowski 1968, 1972; Jaworski, Krauze and others 1972.

<sup>80</sup> Savkevič, Šaks 1970.

kind of fossil resin, that is succinite, is meant. We can add that the same refers to the so called "amber from the North Sea" separated by K. Schwochan, Th. E. Haevernick and D. Ankner<sup>81</sup>.

The above mentioned reservations deidely confirm S. S. Savkewič's investigation on succinite from various geological formations<sup>82</sup>. Faint deviations of absorption curve of some samples of succinite in the range 8 - 5.5  $\mu$ , may be the result of hardly perceptible initial stadiums of the oxidation process. And so the method of infra-red spectra is the only one to answer the question if the object is made of succinite. Even in the case of a positive answer, it should be treated as partial problem solution concerning of the natural amber. The amber resources are not limited to those on the Baltic and the North Sea. Sometimes large quantities of it occur on the wide European territories, as the result of the activity of numerous natural factors. In some of the Polish regions of the European continent regions thickness of quaternary formations is very slight, therefore tertiary drifts of Pliocene, Miocene and even Oligocene sometimes occur on the depth of 1 m<sup>83</sup>. Also on these spots it was possible to exploit amber, which is proved by the presence of glauconite sands and the so called "blue earth". The logical result of this is that infra-red spectra does not define even the region in which amber of the investigated archeological complex originated, but only shows that while considering the origin of succinite, a prehistorian may exclude one third of the European continent. Therefore, also in the case of prehistoric amber finds in the countries of Southern Europe, spectrophotometrical analysis results indicate only broadly understood direction of "northern" contacts of the local population. The range of further prehistoric interpretation of social-economic contacts, connected with amber exchange, is so unlimited as during investigation without using this method. If we take into account that absorption infra-red spectra may be reliable in the case of non-oxidized samples, the utilization of the discussed method in archeology is still more limited and less helpful. It refers particularly to earlier epochs. For example, majority of neolithic amber products are completely oxidized, and often the whole resin substance has been converted into a substance of features resembling external bark. A similar phenomenon is observed in the case of a great number of Early Bronze Age ornaments.

It is evident that in the present experimental stage of using physical and chemical methods, in defining the origin of fossil resins (including succinite) from culture complexes, the archeologists should concentrate mainly on investigation of elementary character. I include among them activities mentioned on the 1st stage of the proposed further in the article research programme. They should also precede research by accepted in exact sciences methods. In this way achieved results may enable explicitness of questions, which can be possibly answered by physics and chemistry.

<sup>81</sup> Schwochau, Haevernick, Anker 1956.

<sup>82</sup> Savkewič 1970, p. 119 - 125

<sup>83</sup> Areń 1956, p. 72 - 73, fig. 9.

I simply believe that we cannot passively await from these sciences a general solution of problems, which to great degree may be explained thanks to methods available in today's archeology and prehistory.

The presented mosaic of various explorer's ideas on Neolithic and Early Bronze amber working in Europe and mainly development of social-economic relations, being the result of amber exchange, shows negligency in research in this field. It should be honestly admitted, that in this field in comparison with the initial state from the end of the 19th c., we have hardly made any progress. It will not be exaggeration on the author's side to state that there still exists a great disproportion between the meaning (standing) of generally accepted ideas concerning amber role in the development of intercultural contacts in the Stone and Early Bronze Age in Europe, and the degree of the research of primary character promotion. It will be enough to mention that ideas concerning exchange development were mainly based on the analysis of expansion of some, very inaccurately defined types of products and the assumption of dominating role of seaside settlement complexes in exploitation, working and exchange of ornaments or less frequently natural amber. Such notions as „trade”, „production workshops”, or “production centres” in reference to the seaside societies on the Blatic, suggest the existance within their reach far advanced group or even individual specialization within these fields of economy. Penetrating analysis of reference basis and social-economic relations of particular cultural individuals as a whole, mainly in the Stone Age, do nor provide us with any convincing arguments which would allow to accept such an idea as well-founded. Lack of precise, homogeneous classification or typology of amber ornaments for the whole European continent makes it impossible to realize reliable comparative analysis of their occurrence not only in individual taxonomic units, but also on separated in various degrees macroregional units. Highly unsatisfactory is the state of research on chronology of utilization of particular ornament forms, what in addition to the above introduced defects, and to examination of amber working problems separately from other aspects of social-economic life of contemporary population groups, causes that the present picture of development of this field is very static.

The hithero critical remarks, omitting or neglecting possibilities of exploitation of the discussed raw material from the inland “deposits”, situated even very far from the Baltic coast and the North Sea, to a high degree questions the motive of occurring in literature generalizations.

So it is necessary to resume detailed research on this interesting us problem. I suggest to carry it at two main stages.

#### Stage 1

1. Cartographic and descriptive analysis of occurrence of secondary resources of amber and other fossil resins on the European territory or in a chosen macroregion, basing oneself on the historical and ethnographical sources, geological elaborations and various other information (for example oral information). This research should estimate the abundance of “deposits”, their depth and conditions

of occurrence, ways of exploitation in historical and present times, geological age of formations in which succinite occurs. These data will allow to estimate the access-degree of exploitation of particular resources and their potential productiveness in prehistoric times, taking into account the degree of social-economic and technological development of the examined populations.

2. Accumulating all the data about amber occurrence (raw amber material, half-products and products) in culture complexes of the Stone and Early Bronze Ages, both in descriptive and cartographic formulation. Carrying out formal classification (or typology) of products and half-products considering their morphological features, on the basis of detailed classification list for the whole examined area.

Raw material classification based on the defining of the kind of succinite (or coexisting in one block specimens) as regards the degree of transparency (transparent, clouded, foamy, bastard, osseous)<sup>84</sup>. Raw material classification may deliver a number of valuable information about selection criteria of succinite among population groups dealing with its exploitation and about criteria which were followed while selecting particular specimens for precisely planned ornament forms production. Its results provide moreover many pieces of information about amber working techniques, namely about technological limitations caused by knowledge of characteristics of particular specimens.

Functional classification of defined forms of products should be carried out on the basis of analyses of the best preserved grave complexes, written records and ethnographic data.

In research on amber working essential is chronologic-chorological analysis of particular ornament categories occurrence. The time qualification of utilizing of various forms on the basis of relative and absolute chronology of archeological complexes in which they were found, after taking into consideration other culture aspects, will create circumstances for learning changes occurring in amber working, in relatively short periods. Simultaneously it will be the basis for reconstruction of external decoration changes of contemporary population. To a high degree consideration of the above mentioned problems is made easy by quantitative and qualitative analysis of amber products and natural amber occurrence on the sites of individual culture units. The received in result of this structures of collections enable separation of features eliminating culturally, chronologically and territorially.

3. Defining the relation of settlement of particular cultures utilizing natural amber towards rich in the discussed fossil resin microregions. In this case very helpful is especially izochoric correlation ratio between localization of the closest, natural amber "desposits" and relative situation of culture complexes and finds with products of this raw material. In geographical sciences methods of izochronic correlation are used in order to estimate mutual connections among phenomena, of which only one has quantitative term. In our case the last phenomena are: a) number

<sup>84</sup> Klebs 1887, 1889; Savkevič 1970, p. 101.

of archeological complexes and finds with succinite ornaments, b) number of originating in them ornaments. While covering a map of natural amber distribution with a map of marked finds and complexes including interesting us material, the distance between the latter and the closest natural amber "deposits" should be defined. This correlation should be examined in distance categories expressed in kilometres: 0 km – resources; 1 - 10 km; 10 - 20 km; 20 - 30 km and so on. Next, an amount of complexes and finds is estimated in numbers and percentage, which appear in particular distance categories for:

- a) the whole examined collection of complexes and finds,
- b) individual culture units, and even their development phases,
- c) separated stages of amber exploitation and working development on the examined area.

At the same time and in the same way number of amber ornaments connected with culture complexes and finds of defined izochors (distance category) is estimated. The achieved through these activities results together with the data of multi-complexional resource classification may be a basis for considering the subject of amber exploitation by the Stone and Early Bronze Age cultures. They also represent essential value by interpretation of social-economic relations development, the basis of which was growing demand for amber among population groups lacking possibilities to exploit it from the "deposits" located in the vicinity of their occupation zones. Moreover, very essential for the whole complex of questions connected with exchange development is the analysis of occurrence of various forms of products having character of imports on the rich in natural amber areas.

#### Stage 2.

Comprises examination of amber by various physical and chemical methods in order to distinguish prehistoric products made of oligocene succinite, available in the interesting us time interval exclusively on the sea-shore precipice and beaches of the Baltic and the North Sea, as well as of the succinite from Miocene and earlier formations, occurring quite commonly also on very distant away from the sea areas.

To this and several dozens of succinite samples originating from Oligocene layers and sea-shore beaches, Miocene and younger inland resources, several dozens of natural amber samples and ornaments from archeological sites localized on earlier separated izochors, should be chosen. All these samples ought to be subjected to an examination by the same methods and in the same conditions so that the results could be comparable and objective. Samples should be cut off from the nonoxidized amber parts and should be of the same size. The order of examinations is as follows:

1. Quantitative analysis of succinic acid ( $C_4H_6O_4$ ) contents and infra-red spectra analysis. Both methods will finally let to state, than the examined samples represent succinite.
2. Microscopic analysis with big enlargement will enable qualification of the kind

of amber in examined specimen. In many cases visual analysis is sufficient. Microscopic examinations may be carried out also at the first stage of the procedure.

3. Examination of hardness scale in  $\text{kG/mm}^2$ , mainly maximal hardness. For "surface" amber the maximal hardness ( $H_{\text{max}}$ ) should be almost always above  $28.00 \text{ kG/mm}^2$ <sup>85</sup>.

S. S. Savkevič experimentally stated that between amber from Oligocene layers and from Miocene and younger ones (so called „vskryšnij jantar”) there occur differences in hardness scale, and in proportional contents of sulphur (S)<sup>86</sup>. For "surface" amber, that is for amber from Miocene and younger formations, maximal hardness exceeds  $28.00 \text{ kG/mm}^2$  and sulphur contents is between 0.35-0.55 per cent, while for oligocene amber proportional ratio of sulphur most often does not exceed 0.30, and maximal hardness does not reach higher than about  $27.24 \text{ kG/mm}^2$  values.

4. Proportional analysis of contents of chemical elements: coal (C), oxygen (O), hydrogen (H), sulphur (S) and nitrogen (N). From our point of view the most essential is in this case proportional contents of sulphur.

If the same samples have maximal hardness ratio ( $H_{\text{max}}$ ) above  $28.00 \text{ kG/mm}^2$  and sulphur contents between 0.35-0.55 per cent, then they represent amber from Miocene and younger formations. Presence of such concurrence as regards to natural amber samples and ornaments from archeological sites situated in the nearest in relation to resources isochors, will be essential case for amber exploitation in local Miocene, Pliocene or Quaternary "deposits". In this way can be confirmed results achieved at the first stage of research procedure while using isochoric correlation method.

The discovery in archeological complexes of amber which with its characteristic features resembles samples from Oligocene layers, proves that it comes from the Baltic coast or the North Sea. So far no amber has been discovered in easily accessible Oligocene layers situated far from the coast line.

The weak point of the proposed research procedure (stage 2) is exclusion of possibilities of analysing almost completely oxidized relics samples. But, as it was mentioned earlier, oxidation process causes very serious changes in chemical composition of amber and in its physical features: dislodgement of other elements by oxygen including sulphur, proportional grow  $\text{C}_4\text{H}_6\text{O}_4$ , changes in hardness.

It should be objectively stressed, that hitherto application of chemical and physical methods for prehistoric amber examination is still at its tentative exploratory stage. After broader inspection of it, it may turn out that at the same stage given by the author proposals are found. After all, they are based on theoretical data and S. S. Sawkiewicz's research on amber from the Sambian Peninsula. Only some of the chosen methods were checked on archeological material by other explorers.

Warsaw 1979.

<sup>85</sup> Savkevič 1970, p. 154 - 155, table 17.

<sup>86</sup> Savkevič 1970, p. 85 - 87, table 3, p. 154 - 155, table 17.

## BIBLIOGRAPHY

- Antoniewicz W., 1921: *Stan badań nad znaczeniem bursztynu w czasach przedhistorycznych Europy*, „Wiadomości Archeologiczne”, t. VI, pp. 199 f.
- 1923: *Pochodzenie i gatunki bursztynu w Europie*, „Wiadomości Archeologiczne”, t. VIII, pp. 113 f.
- 1928: *Archeologia Polski. Zarys czasów przedhistorycznych i wczesnodziejowych ziem Polski*, Warszawa.
- Areń B., 1958: *Trzeciorzęd*, in: *Regionalna geologia Polski*, t. II, *Region Lubelski*, pp. 70 f., Kraków.
- Ayräpää A. (Europeus), 1945: *Die Verbreitung des Bernsteins im Kammkeramischen Gebiet*, „Suomen Muinainmuistoyhdistyksen Aikkakauserä”, Finska Fornminnesföreningens Tidskrift” t. 45, pp. 10 f.
- 1960: *Neue Beiträge zu Verbreitung des Bernsteins in Kammkeramischen Gebiet*, „Światowit” t. XXIII, pp. 235 f.
- Beck C. W., 1965: *The Origin of the Amber found at Gough Cave, Cheddar, Somerset*, „Proceedings of the University Bristol Speleological Society”, vol. 10, pp. 272 f.
- 1966: *Bemerkungen zur infrarotspektroskopischen Herkunftsbestimmung von Bernstein*, „Jahrbuch des Römisch – Germanischen Zentralmuseums Mainz”, Bd. 13 pp. 292 f.
- 1967: *The Provenance of Mycenaean Amber*, “Year Book American Philosophy Society for 1967”, pp. 456 f.
- 1970: *Amber in Archaeology*, „Archaeology”, vol. 23, no. 1, pp. 7 f.
- 1972 *Amber from the Eneolithic Necropole of Laterza*, “Art and Archaeology Technical Abstracts”, vol. 9, pp. 142 f.
- Beck C. W., Wilburg E., Meret S., 1964: *Infra-red Spectra and the Origin of Amber*, „Nature”, vol. 201, pp. 256 f.
- 1965: *The Infra-red Spectra of Amber and the Identification of Baltic Amber*, „Archaeometry”, vol. 8, pp. 96 f.
- Becker C. J., 1954: *A segmented faience bead from Jutland (With notes on Amber beads from Bronze Age in Denmark*, “Acta Archaeologica” København), vol. XV, pp. 244 f.
- Bohnsack D., 1965: *Vorund Frühgeschichtlicher Bernsteinschmuck*, „Rheinische Forschungen zur Vorgeschichte”, 5. *Documenta Archaeologica Wolfgang La Baume dedicata*, pp. 13 f.
- Brjusov A. Ja., 1951: *Svajnoe poselenie na reke Modlone i drugie stojanki w Čarozerskom rajone Vologodskoj oblasti*, in: „Materialy i Issledovanija po Archeologii SSSR”, No. 20.
- Brongers I. A., Woltering P. I., 1975: *Prehistory in the Netherlands: An Economic – Technological Approach*, „Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek”, Jg. 23, pp. 7 f.
- Brögger A. W., 1908: *Et norsk raufund fra Stenaldern*, „Bergens Museum Aarbok”, Christiania.
- 1909: *Den arktiska Stenalder i Norge*, Christiania.
- Brøndsted J., 1934: *Inadita aus dem Dänischen Nationalmuseum I*, „Acta Archaeologica” (København), Fasc. 1-2, pp. 145 f.
- 1960 *Nordische Vorzeit*, t. I, *Steinzeit in Danemark*, Neumünster
- Ebert M., 1926: *Konczanskoje*, w: *Realexikon der Vorgeschichte*, Bd. VII, pp. 22 f.
- Gaerte W., 1933: *Der Bernstein als Schmuck und Handelsgut vor 3000 Jahren*, „Das Heimatland”, no. 32, pp. 3 f.
- Gandert O. P., 1939: *Nordischer Schmuck der Steinzeit*, w: *Tracht und Schmuck im nordischen Raum*, 1 Band. *Tracht und Schmuck der Germanen in vorund frühgeschichtlicher Zeit*, Leipzig pp. 71 f.
- Gimbutas M., 1956: *The Prehistory of Eastern Europe. Part I. Mesolithic, Neolithic and Copper Age Cultures in Russia and the Baltic Area*, Cambridge-Massachusetts.

- 1960: *A Survey of the Bronze Age Culture in the Southeastern Baltic Area*, „Światowit”, t. XXIII, pp. 389 f.
- 1965: *Bronze Age Cultures in Central and Eastern Europe*, Hague.
- Glob P. V., 1944: *Studier over den jyske Enkeltvsgrakultur*, ”Aarbøger for Nordisk Oldkyn-dighet og Historie” 1944, København 1945, pp. 1 f.
- Götze A., 1924: *Bernstein und Bernstein Artefakte*, in: *Reallexikon der Vorgeschichte*, Bd I, pp. 430 f.
- Gula M., 1977: *Bursztynowa plastyka figuralna epoki kamienia w Polsce*, „Archeologia Polski”, t. XXII, z. 2, pp. 369 f.
- Hajek L., 1941: *Bernsteinfunde in der mitteleuropäischen Glockenbecherkultur*, ”Sudeta”, t. 2, pp. 21 f.
- Hedinger A., 1903: *Die vorgeschichtlichen Bernsteinartefakte und ihre Herkunft*, Strasburg.
- Helm O., 1881: *Mitteilungen über Bernstein*. III. *Glessit, ein neues in Gemeinschaft von Bern-stein vorkommendes fossiles Harz*. IV *Über sicilianischen und rumänischen Bernstein*, ”Schriften der Naturforschenden Gesellschaft in Danzig”, Bd V, H. 1-2, pp. 291 f.
- 1882: *Mitteilungen über Bernstein*. V. *Über sicilianischen Bernstein*. VI. *Über die elemen-tare Zusammensetzung des Ostsee – Bernsteins*. VII. *Über Apenninen – Bernstein*, ”Schriften der Naturforschenden Gesellschaft in Danzig, Bd V, H. 3, pp. 8 f.
- 1889a: *Über seine chemischen Untersuchungen des Bernsteins aus den alten Königsgräbern von Mykenae*, ”Schriften der Naturforschenden Gesellschaft in Danzig, Bd VII, H. 2, pp. 32 f.
- 1889b: *Über Bernsteinartefakte aus den prähistorischen Nekropolen Ober- und Mittelita-liens*, ”Schriften der Naturforschenden Gesellschaft in Danzig, Bd VII, H. 2, pp. 32 f.
- 1901: *Chemische Untersuchung von Bernsteinperlen aus alten Tempelruinen Babyloniens und aus Gräbern Italiens, sowie Verfahren zur Bestimmung der Bernsteinsäure im Bernstein*, ”Ze-itschrift für Ethnologie”, Bd XXXIII, pp. 400 f.
- Höckmann O., 1968: *Zu Formenschatz und Ursprung der schematischen Kykladen plastik*, ”Jahrbuch für Vor- und Frühgeschichte”, Bd 8, pp. 44 f.
- Jaworski M., Krauze J., Lempka A., Richter S., 1970: *Badania metodami chromatograficzną i spektrofotometryczną przedmiotów bursztynowych pochodzących z wykopalisk archeo-logicznych*, ”Fontes Archaeologici Posnanienses”, vol. XXI [1972], pp. 230 f.
- Jażdżewski K., 1938: *Cmentarzyska kultury ceramiki wstęgowej i związane z nimi ślady osadnictwa w Brześciu Kufawskim*, „Wiadomości Archeologiczne, t. XV, pp. 1 f.
- Kaelas L., 1959: *Hunebedden en Trechterbekarcultur*, ”Antiquity and Survival”, vol 2, nos. 5-6, pp. 75 f.
- Kempisty E., 1971: *Kultura amfor kulistych na Mazowszu i Podlasiu*, ”Materiały Starożyt-ne i Wczesnośredniowieczne”, t. 1, pp. 7 f.
- Kersten K., 1958: *Die ältere Bronzezeit in Pommern*, Hamburg.
- Kilian L., 1955: *Haffküstenkultur und Ursprung der Balten*, Bonn.
- Klebs R., 1882: *Der Bernsteinschmuck der Steinzeit von der Baggerei bei Schwarzort und anderen Lokalitäten Preussens aus den Sammlungen der Firma Stantien und Becker und der Phy-sikalisch-Ökonomischen Gesellschaft, zu Königsberg*. Königsberg.
- 1887: *Über Farbe und Imitation des Bernsteins*, ”Schriften der Physikalisch – Ökonomis-chen Gesellschaft zu Königsberg, Bd XXVIII, pp. 37 f.
- 1889: *Der Bernstein und seine Geschichten*, Danzig
- 1892: *Der Bernsteinschmuck der Steinzeit*, Königsberg.
- Kossinna G., 1909: *Der Ursprung der Urfinnen und der Urindogermanen und ihre Ausbrei-tung nach dem Osten*. I. *Urfinnen und Nordindogermanen*, ”Mannus” t. I, pp. 17 f.
- 1910: *Der Ursprung der Urfinnen und Urindogermanen und ihre Ausbreitung nach Osten*. III., ”Mannus” t. II, pp. 62 f.

- 1919: *Meine Reise nach West- und Ostpreussen und meine Berufung zu Generalfeldmarschall v. Hindenburg in August 1915*, "Mannus", t. IX, pp. 119 f.
- Kozłowski S. K., 1972: *Pradzieje ziem polskich od IX do V tysiąclecia p.n.e.*, Warszawa.
- Krzak Z., 1958: *Cmentarzysko kultury złockiej na stanowisku „Grodzisko” II we wsi Złota, pow. Sandomierz*, „Archeologia Polski”, t. II, z. 2, pp. 329 f.
- 1961: *Materiały do znajomości kultury złockiej*, Wrocław.
- 1970a: *Cmentarzysko kultury złockiej „Nad Wawrem” w Złotej*, Wrocław-Warszawa-Kraków.
- 1970b: *The Złota Culture*, in: *The Neolithic in Poland*, Wrocław-Warszawa-Kraków pp. 333 f.
- 1976: *The Złota Culture*, Wrocław-Warszawa-Kraków-Gdańsk.
- La Baume W., 1924: *Bernstein und Bernstein – Artefakte. A: Europa Allgemeine*, in: "Reallexikon der Vorgeschichte", Bd I, pp. 430 f.
- 1935: *Zur Naturkunde und Kulturgeschichte des Bernsteins*, "Schriften der Naturforschenden Gesellschaft in Danzig Bd 20, pp. 5 f.
- Lamberg-Karlovsky C. C., 1963: *Amber and Faience*, "Antiquity", vol. 37, No. 148, pp. 301
- Loze I. A., 1969: *Novyj centr obrabotki jantaria epochi neolita v vostočnoj pribaltik e.* "Sovetskaja Archeologija", no 3, pp. 124 f.
- 1977: *Neolithic Amber Ornaments in the Eastern Part of Latvia* „Przegląd Archeologiczny”, t. 23, pp. 49 f.
- Madsen A. P., 1872: *Antiquites prehistoriques du Danemark*, København.
- Malinowski T., 1969: *O badaniach bursztyków pochodzących z wykopalisk archeologicznych*, „Sprawozdania z posiedzeń komisji naukowych (Oddziału PAN w Krakowie)”, t. 12, z. 1, pp. 9 f.
- 1972: *Kwestia pochodzenia bursztyków z wykopalisk jugosłowiańskich*, „Fontes Archaeologici Posnanienses”, vol. XXI [1970], pp. 219 f.
- Malmer M. P., 1962: *Jungneolithische Studien*, "Acta Archaeologica Lundensia", N° 2 Lund, pp. 1 f.
- Masicka H., 1975: *Przegląd niektórych ważniejszych metod badawczych bursztyku*, "Pomorania Antiqua", t. VI, pp. 355 f.
- Mathiassen T., 1959: *Ravsmykker fra ældre stenalder*, "Aarbøger for Nordisk Oldkyndighet og Historie", pp. 184 f.
- Mazurowski R. F., 1976: [Review:] E. Schuldt, *Der Bernstein im neolithikum Mecklenburgs*, "Bodendenkmalpflege in Mecklenburg", Jg 1973 [1974], pp. 49 f., „Przegląd Archeologiczny”, vol. 24, pp. 217 f.
- 1977: *Cmentarzysko kultury amfor kulistych w Zabrze, woj. ciechanowskie*, „Wiadomości Archeologiczne”, t. LXII, z. 2, pp. 155 f.
- 1978a: [Review:] I. Loze, *Neolithic Amber Ornaments in the Eastern Part of Latvia*, „Przegląd Archeologiczny”, vol. 23, 1975, pp. 49 f. „Przegląd Archeologiczny”, vol. 26, pp. 191 f.
- 1978b: *Pozyskiwanie, przetwórstwo i dystrybucja bursztyku w dorzeczu Wisły w IV i III tysiącleciu p.n.e.*, (The typescript of the doctor's thesis).
- Moberg C. A., 1957: *Skąd pochodzą bursztyki w południowoeuropejskich znaleziskach z epoki brązu i żelaza?*, „Postępy Archeologii”, nr 6, pp. 156 f.
- Much M., 1904: *Die Heimat der Indogermanen im Lichte der urchichtlichen Forschung*. Jena-Berlin.
- Navarro J. M., 1925: *Prehistoric Trade Routes between Northern Europe and Italy as defined by the Amber Trade*, „Geographical Journal”, vol. 56, No. 6, pp. 481 f.
- Neergard C., 1888: *Ravsmykkerne i Stenalderen*, "Aarbøger for Nordisk Oldkyndighet og Historie", pp. 281 f.

- Newton R. C., Renfrew C., 1970: *British Faience Beads Reconsidered*, "Antiquity", vol. 44, pp. 199 f.
- Nosek S., 1967: *Kultura amfor kulistych w Polsce*, Wrocław-Warszawa-Kraków.
- Noworyta E., 1976: *Nowe odkrycia kultury pucharów dzwonowatych na Śląsku*, „Silesia Antiqua”, t. 18, pp. 49 f.
- Okulicz J., 1973: *Pradzieje ziem pruskich od późnego paleolitu do VII w.n.e.*, Wrocław-Warszawa-Kraków-Gdańsk.
- Olshausen O., 1890: *Über den alten Bernsteinhandel der cimbrischen Halbinsel und seine Beziehungen zu den Goldfrunden*, "Zeitschrift für Ethnologie", Bd 22, pp. 270 f.
- 1891: *Zweite Mitteilung über alten Bernsteinhandel und Goldfunde*, "Zeitschrift für Ethnologie", Bd 23, pp. 286 f.
- Richthoffen B. von, 1935: *Die Deutung der jungsteinzeitlichen Bernsteinschnitzereien vom Schwarzortler Stil*, "Altpreußen – Vierteljahresschrift für Vorgeschichte und Volkskunde", Bd 1, pp. 3 f.
- 1939: *Das genauere Alter der jungsteinzeitlichen Bernsteinschnitzereien von Schwarzort aus der Kurischen Nehrung*, "Prusia", Bd 33, H. 1-2, pp. 256 f.
- Rimantiene R. K., 1970: *Issledovanie stojanok kamennogo veka v Šejantoji Kretinskogo rajona*, in: *Archeologičeskie otkrytija 1969 goda*, Moskva, pp. 313-315.
- Rottländer R. C. A., 1973: *Der Bernstein und seine Bedeutung in der Ur- und Frühgeschichte*, "Acta Praehistorica et Archaeologica", vol. 4 [1975] pp. 11 f.
- Sarnowska W., 1969: *Kultura unietycka w Polsce*, t. I, Wrocław.
- 1975: *Kultura unietycka w Polsce*, t. II, Wrocław.
- Savkevič S. S., 1970: *Jantar*, Leningrad.
- Savkevič S. S., Šaks J. A., 1970: *K voprosu o vozmožnosti ispol'zovanija IK- spektrov jantarla dlja opredelenija ego proischoždenija v archeologičeskich ob'ektach*, "Sovetskaja Archeologija", no 1. pp. 165 f.
- Schuldt E., 1973: *Der Bernstein im Neolithikum Mecklenburgs*, "Bodendenkmalpflege in Meckleburg", [1974], pp. 49 f.
- Schwochau K., Haevernick T., Ankner D., 1963: *Zur infrarotspektroskopischen Herkunftsbestimmung von Bernstein*, "Jahrbuch des Römisch – Germanischen Zentralmuseums Mainz", Jg 10, [1965], pp. 171 f.
- Spekke A., 1957: *The Ancient Amber Routes and the Geographical Discovery of the Eastern Baltic*, Stockholm.
- Spitsyn A. A., 1903: *Mednyj vek v verchniem Povolže*, "Russkoe Archeologičeskoe Obščestvo", t. V, 1.
- Sulimirski T., 1959: *Polska przedhistoryczna*, cz. 2, Londyn.
- Šturms E., 1927: *Schwarzort*, in: "Reallexikon der Vorgeschichte", Bd 8, pp. 373 f.
- 1953: *Der Ostbaltische Bernsteinhandel in der vorchristlichen Zeit*, "Comentationes Balticae", vol. I, pp. 167 f.
- 1955: *Die neolithische Plastik im nordischen Kulturkreis*, "Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz", Jg 2, pp. 21 f.
- 1956: *Der Bernsteinschmuck der östlichen Amphorenkultur*, "Rheinische Forschungen zur Vorgeschichte", 5. Documenta Archaeologica Wolfgang La Baume dedicata, pp. 13 f.
- Tischler O., 1882: *Beitrage zur Kenntniss der Steinzeit in Ostpreussen und den angrenzenden Gebieten*, „Schriften der Physikalisch-Ökonomischen Gesellschaft zu Königsberg”, Bd XXIII, pp. 17 f.
- 1883: *Die neusten Entdeckungen aus der Steinzeit im Ostbaltischen Gebiet und die Anfänge der plastischen Kunst in Nord – Europa*, „Schriften der Physikalisch – Ökonomischen Gesellschaft zu Königsberg”, Bd XXIV, pp. 89 f.

Vankina L., 1970: *Torfjanikovaja stojanka Sarnate*, Riga.

Wiślański T. 1966: *Kultura amfor kulistych w Polsce północno-zachodniej*, Wrocław-Warszawa-Kraków.

— 1969: *Podstawy gospodarcze plemion neolitycznych w Polsce północno-zachodniej*, Wrocław-Warszawa-Kraków.

— 1970: *The Globular Amphora Culture*, in: *The Neolithic in Poland*, Wrocław-Warszawa-Kraków, pp. 178 f.

Żurek J., 1954: *Osada neolityczna w Rzucewie, w powiecie wejherowskim*, „*Fontes Archaeologici Posnanienses*”, vol. IV, pp. 1 f.

## РЕЗЮМЕ

Настоящая статья частично опирается на разработку одной из глав докторской диссертации автора „Добыча, обработка и распределение янтаря в бассейне Вислы в IV и III тысячелетии до н.э.”, написанной в 1978 году.

В первой части статьи рассматривается история исследований над проблематикой янтарного производства в каменном веке и в ранний бронзовый период. Автор утверждает, что с последнего тридцатилетия XIX века до наших дней не замечается значительных качественных изменений в исследованиях над этой проблемой, хотя наблюдается весьма существенный количественный прирост новых материалов и источников.

В литературе посвящённой этому предмету преобладает точка зрения о доминирующей роли приморских центров заселения (над Балтийским и Северным морями) в области добычи, обработки и распределения янтаря на территории Центральной и Южной Европы. При том всё ещё существуют большие разногласия по поводу значения общепризнанных взглядов на роль янтаря в развитии межкультурных связей в Европе каменного века и раннего бронзового периода, и степенью развития фундаментальных исследований. Достаточно сказать, что по вопросу развития товарообмена мнения опирались главным образом на анализе распространения некоторых, очень приблизительно определённых, типов изделий и на предполагаемой возможности добычи янтаря лишь в поясе морских пляжей. Такие понятия, как „торговля”, „производственные мастерские”, „производственные центры”, применяемые по отношению к прибрежному населению Балтики и Северного моря, предполагают существование среди него очень развитой групповой или даже индивидуальной специализации в этих отраслях экономики. Внимательный анализ начальных источников и совокупности общественно-экономических отношений отдельных культурных единиц, особенно в каменный век, не даёт никаких убедительных доводов, которые позволили бы признать эту точку зрения обоснованной.

Отсутствие точной, единой классификации или типологии янтарных украшений для всего европейского континента не даёт возможности проведения авторитетного сравнительного анализа их выступления не только в отдельных таксономических единицах, но также в единицах макрорегиональных.

В высшей степени неудовлетворительным является также состояние исследований над хронологией использования определённых форм украшений, что в совокупности с представленными недостатками и рассматриванием проблемы янтарного производства вне других аспектов общественно-экономической жизни современного населения является причиной того, что картина развития этой области в наше время представляется очень статичной.

Также недостаточно выяснены организационно-технические вопросы касающиеся добычи, обработки и распределения янтаря. Критические замечания, замалчивание или же недооценка возможностей эксплуатации континентальных „залежей” сырья, расположенных вдали от побережья Балтики и Северного моря, в значительной степени оспаривают

обоснованность выступающих в литературе обобщений. Часть из них в значительной степени основана на интуитивных умозаключениях. Поэтому становится необходимым предпринятие новых детальных исследований по этому, несомненно интересному и существенному, вопросу. Автор предлагает их проведение в двух основных этапах.

#### I этап

1. Картографический и описательный анализ выступающих на территории Европы или избранного макрорегиона вторичных ресурсов янтаря (сукцинита) и других видов ископаемой смолы на основе исторических и этнографических источников, геологических разработок и других материалов. Эти исследования должны включать оценку величины ресурсов „залежей”, глубины и условий их залегания, способов эксплуатации известных по письменным источникам и в наше время, геологический срок залегания структур, в которых выступает сукцинит.

Эти данные позволят определить степень пригодности конкретных залежей к разработке и их потенциальную производительность в древние времена, разумеется с учётом уровня общественно-экономического и технического развития исследуемых популяций.

2. Собрание всех данных о выступании янтаря (сырья, полуфабрикатов и готовых изделий) в культурных объектах каменного века и раннего бронзового периода, так в описательном как и картографическом отношении.

Проведение формальной классификации (или типологии) изделий и полуфабрикатов на основе их морфологических признаков и детально разработанного классификационного списка для всей исследуемой территории.

Существенное значение имеет также классификация сырья, определяющая виды сукцинита (или же виды выступающие одновременно в одной глыбе) с точки зрения его прозрачности (сукцинит прозрачный, облачный, пенистый, бастард, костяной).

Благодаря этому можно получить много ценной информации о критериях отбора сукцинита группами населения, занимавшимися его эксплуатацией, а также о критериях отбора определённых видов для производства конкретных форм украшений. Результаты сырьевой классификации дают, кроме того, много данных о технике обработки янтаря, а также о технических трудностях связанных со знанием свойств определённых его видов.

Функциональная классификация определённых форм археологических памятников должна исходить из анализа наиболее хорошо сохранившихся погребальных комплексов, письменных источников и этнографических данных.

Существенное значение в исследованиях янтарного производства имеет хронологически-хорологический анализ выступления определённых категорий украшений. Определение времени использования различных форм изделий на основе относительной и абсолютной хронологии археологических комплексов, в которых они выступали, с учётом других культурных аспектов, создаёт предпосылки для выявления изменений происходящих в янтарном производстве в относительно короткие периоды. Это послужит одновременно основой для реконструкции изменений типов украшений и способа их ношения современным населением. Количественный и качественный анализ выступления янтарных изделий и сырья на объектах отдельных культурных единиц облегчает рассуждения над этими вопросами. Полученные таким образом структуры археологических экспонатов позволяют выделить их свойства в культурном, хронологическом и территориальном плане.

3. Определение отношения между заселением отдельных культур, использующих янтарное сырьё, к микрорегионам богатым в янтарь. В этом случае весьма пригодным является прежде всего показатель изохорической корреляции между размещением ближайших натуральных „залежей” янтаря и расположения по отношению к ним культурных комплексов и находок в виде изготовленных из него изделий. В географических науках метод изохорической корреляции применяется для определения взаимосвязей между явлениями, из которых только одно выражено в количественном отношении.

В данном случае таким явлением являются:

- а) количество археологических комплексов и находок изделий их сукцынита и сырья;
- б) количество украшений найденных в археологических комплексах.

Пути нанесения на карту натуральных месторождений янтаря мест обнаружения находок и археологических комплексов содержащих интересующие нас материалы, следует определить, на каком расстоянии от ближайших „залежей” сырья находятся эти материалы. Зависимость эту следует рассматривать в изохорических категориях (изохоры) исчисляемых километрами: 0 км — в залежах, 1 - 10 км, 10 - 20 км, 20 - 30 км и т.д. Затем рассчитываются (численно и в процентах) комплексы и находки выступающие в разных категориях расстояний: а) для совокупности археологических комплексов и находок; б) для отдельных культурных единиц и даже этапов их развития; в) для выделенных этапов развития добычи и обработки янтаря на изучаемой территории. Одновременно, тем же способом подсчитывается количество янтарных украшений связанных с культурными комплексами и находками соответствующими определённым изохорам.

Полученные таким образом результаты, кроме данных из многоплановой классификации источников, могут стать основанием для размышлений по вопросу эксплуатации янтаря населением двух эпох. Они являются также очень ценными при толковании развития общественно-экономических отношений, которых основой был растущий спрос на янтарь среди групп населения лишённых возможности его эксплуатации из „залежей” расположенных вблизи зоны их заселения.

Для комплекса вопросов касающихся развития товарообмена существенное значение имеет, кроме того, анализ выступления разных форм памятников, имеющих характер импортов, на территориях изобилующих в янтарное сырьё. Такой анализ косвенно указывает направления, в которых распространялся янтарь из районов его эксплуатации.

## II этап.

Охватывает исследования янтаря с помощью разных физико-химических методов с целью отличить доисторические изделия производимые из олигоценового сукцынита, доступного в рассматриваемый нами период исключительно на крутых берегах и пляжах Балтики и Северного моря, от сукцынита миоценового и более младших, выступающих относительно часто также в регионах значительно отдалённых от морского побережья.

Для этого следует отобрать несколько десятков образцов сукцынита добытого из олигоценовых слоёв и морских пляжей; миоценовых и более младших континентальных месторождений; несколько десятков образцов сырья и украшений с археологических объектов локализованных в ранее выделенных изохорах. Все образцы следует затем исследовать с помощью тех методов и в одинаковых условиях, чтобы получить вполне сравнимые и объективные результаты. Одинаковые по величине образцы должны быть вырезаны из неокислённой части янтаря. Порядок исследований должен быть следующий:

1. Количественный анализ содержания янтарной кислоты ( $C_4H_6O_4$ ) и спектрофотометрический анализ в инфракрасном излучении. Каждый из этих методов позволяет окончательно установить, что исследуемые образцы представляют собой сукцынит.

2. Микроскопический анализ при большом увеличении даст возможность определения вида исследуемого янтаря. Во многих случаях достаточным оказывается визуальный анализ. Микроскопический анализ может производиться также в I этапе исследования.

3. Определение степени твёрдости в  $кГ/мм^2$ , особенно максимальной. Для „поверхностного” янтаря (ис миоценовых и младших слоёв) максимальная твёрдость ( $H_{max}$ ) должна почти всегда превышать  $28,00 кГ/мм^2$ .

С. С. Савкевич экспериментально установил, что между янтарём из олигоценовых и миоценовых и более младших слоёв (так называемый „вскрышный янтарь”) существует разница в степени твёрдости, а также в процентном содержании серы. Для „поверхностного” янтаря характеристична максимальная твёрдость свыше  $28,00 кГ/мм^2$  — и содержание серы в пре-

делах 0,35 - 0,55%, в то время как в олигоценовом янтаре содержание серы не превышает 0,30%, а максимальная твёрдость составляет не более 27,24 кГ/мм<sup>2</sup>.

4. Процентный анализ содержания элементов: угля, кислорода, водорода, серы и азота. С нашей точки зрения наиболее существенным в этом случае является содержание серы.

Если в этих самых образцах максимальная твёрдость ( $H_{max}$ ) будет достигать 28,00 кГ/мм<sup>2</sup>, а содержание серы в пределах 0,35 - 0,55%, то они представляют собой янтарь миоценовой эпохи и более молодых. Наличие такого совпадения относительно сырья и украшений из археологических объектов находящихся в изохорах ближайших по отношению к месторождению, будет существенным аргументом в пользу эксплуатации янтара из местных миоценовых и плиоценовых залежей, или залежей четвертичного периода. Таким образом могут быть подтверждены результаты полученные в I этапе исследования, с применением изохорической корреляции. Обнаружение в археологических комплексах янтара характеризующегося свойствами образцов из олигоценовых слоёв позволяет предполагать о его месторождении на Балтийском побережье или на побережье Северного моря. До сих пор ещё не удалось обнаружить янтара в легко доступных олигоценовых слоях, расположенных вдали от береговой линии.

Автор статьи придерживается точки зрения, что спектрофотометрический метод в инфракрасном излучении даёт лишь возможность отличить сукцынит от других видов ископаемой смолы. Вопреки суждениям Ц. В. Бэка, а также К. Швохау и его сотрудников, нет существенной разницы в прохождении спектров поглощения „балтийского янтара“, „украинского янтара“ и „янтара с побережья Северного моря“. Такой вывод вытекает, между прочим, из анализов проведённых С. С. Савкевичем и Я. А. Шаксом. Другие мнения в литературе по этому предмету в значительной степени являются результатом применения слишком приблизительного понятия „янтарь“. Вслед за С. С. Савкевичем и другими исследователями, под понятием „янтарь“ автор понимает только сукцынит — как наиболее часто встречающийся вид ископаемой смолы над Балтийским и Северным морями.