KLAIPĖDA UNIVERSITY

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IDENTIFICATION OF TECHNOLOGICAL DEVELOPMENT OF ECONOMY IN THE EARLY HOLOCENE PERIOD GROUNDING ON THE EXPERIMENTAL-TRASOLOGICAL INVESTIGATION OF THE ARCHAEOLOGICAL MATERIALS OF THE EAST BALTIC REGION

Doctoral Dissertation
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ANKSTYVOJO HOLOCENO TECHNOLOGINĖS ŪKIO RAIDOS PAGAL RYTŲ PABALTIJO ARCHEOLOGINĖS MEDŽIAGOS EKSPERIMENTINIUS-TRASOLOGINIUS TYRIMUS NUSTATYMAS

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Introduction

Investigation of archaeological materials is hardly imaginable without employment of new technologies, application of various methods of physical and natural sciences. In order to reveal the characteristics of people’s lifestyles back in prehistoric and historic times as detailed as possible, representatives of archaeology science collaborate with geologists, geographers, biologists, chemists, mathematicians, physicists etc. The trasology method, a method for investigation of the functional purpose of prehistoric artefacts, has been started to be used in examination of archaeological materials in greater detail in Lithuania and the East Baltic region only in the late twentieth and early twenty-first centuries. Trasology (also, use-wear) is a method that allows detailed examination of the function of an archaeological tool intended for work in great detail. For this purpose, microscopes of various capacities are used; they can magnify the image of an object under examination and enable more detailed observation of the traces remaining on the surface of an artefact left by work activities. Even more detailed functional analysis of an artefact can be carried out by using the experimental-trasological method. The essence of this principle is based on production of experimental artefacts and their practical application; later, being facilitated by a microscope, comparison of utilisation (work) traces of both experimental and authentic archaeological tools is carried out.

The trasological method is usually opposed by the typological method which is the basis for attributing artefacts to one group according to certain external features\textsuperscript{1}. On the ground of the typological method, there are frequent attempts to estimate the function of an artefact, too. However, it is often wrong because the artefact was being used to perform various works, sometimes unrelated to the ascribed typology. Without examination of the purpose of an artefact by the trasological method, the typology presented by archaeologists is usually inaccurate. Therefore, only employment of the trasology method enables accurate evaluation or substantial rejection of the already formed typological scheme of artefacts and still being used by archaeologists until now. The typological scheme still being currently used does not

reflect the purpose, or function, of use of an actual artefact. Therefore, the function of artefacts is often wrongly identified, and this leads to misrepresentation of the features of development of the economy. Microblades set in a sickle can be an example of this: whether they facilitated mowing of grass, cat’s tails or cultured crops? The typological method used in archaeology until now cannot answer the question. Usually, archaeologists attribute such microliths to the appropriated or production economy, grounding on the overall complex of artefacts. If it is among Mesolithic artefacts, it is attributed to the appropriated economy, and if it is among Neolithic artefacts, then it is of the production economy. However, having assessed the artefacts from the trasological point of view, this division is usually inaccurate and, thus, distorts the features of the economy. Nevertheless, it is highly important to estimate whether such tools were used for mowing grass or cultured crops. Such typological characteristics of artefacts are faced also when investigating development of the economy in the early Holocene not only on the territory of Lithuania\(^2\).

The latter method is especially useful for investigation of archaeological inventory taken from the objects where no materials of organic origin have been found. Perhaps, Stone Age sandy type settlements in Southern Lithuania could be treated as best example in Lithuanian archaeology; in these settlements, archaeological materials are mechanically mixed, and only flint and ceramics artefacts are mostly found. Without finding artefacts made of bone, antler or wood, it is quite difficult to dispose the data on the model of economy that was being promoted in single settlements. Trasological investigation of flint artefacts provides an opportunity to examine the development of the economy, use of artefacts, dominating production technologies thousands of years ago in greater detail.

**Chronological frame of the research.** The current study uses the data of experimental-trasological investigations taken from the Early Holocene: Upper (Final) Paleolithic – Late Mesolithic and Early Neolithic period monuments examined on the territories of Lithuania,

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Latvia, Belarus, Russia (Annex, Fig. 1). This is a period encompassing the periods of the Holocene epoch: Preboreal, Boreal and Atlantic (9600–4400/4200 BC).

Partly, the discussed period of technological development of economy stands between two climatic periods: Dryas III and Sub-Atlantic I. In the material culture development approach, this period is between the micro-lithic technology and occurrence of ceramic artefacts; in the economic approach, it is between the most developed appropriated economy of the forest zone and the beginning of production farming; in the social development approach, it is between nomad communities of hunters, fishermen and food gatherers and the beginning of formation of communities of settled stockbreeders and agriculturalists. In this period, a man as a biological creature adjusted to living in a changed natural environment: from declining tundra and forest-tundra vegetation to prevailing broad-leaved forests.

Over the period under discussion, communities had quite hard times to survive on the appropriated farming economy. This forced the communities residing in the East Baltic region to be creative, produce rational and efficient work tools and armaments. Technological skills of production of work tools that have been formed back in the Preboreal period, when the territory of the East Baltic region was covered with

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forests, remained until the late Atlantic. Later, in the Middle Neolithic period, when the production farming mode started forming, areas of fields allocated for stockbreeding and agriculture increased, the technology of production of flint tools and armament as well as their form were changing. The study will be limited within investigation of the changes in the economy technology related to development of the appropriated economy throughout the Early Holocene period because the material of this particular period has not been examined in detail so far. However, in order to compare the technologies of production of flint artefacts and the characteristics of the use of these artefacts in the Early Holocene period with the later, Neolithic period, technologies of production of artefacts and their use, the research will employ the material from Šarnelė, Daktariškė settlements (Telšiai District) of the later period and the flint material of settlements (Latvia, Belarus and Russia) in the earlier period – the Late Pleistocene.

Research methods. The research employed the following major methods: technological, experimental, trasological, comparison, analysis, synthesis, induction and deduction. The study describes experimental and trasological investigations involving the mentioned methods carried out in the laboratory for examination of archaeological materials in the Institute of Baltic Region History and Archaeology at Klaipėda University. The Annexes present the drawings and photographs of flint artefacts; the photographs have been taken using a microscope OLYMPUS SZX16. This device facilitated the estimation of the trasological examination of the artefacts and their functional characteristics. Trasological examination of the artefacts and their functional characteristics were carried out and estimated by using the comparable collection of flint artefacts mostly made by the author of the current study himself in an experimental way in the laboratory of examination of archaeological materials at the Institute of Baltic Region History and Archaeology. The current research employed single

elements of experimental andtrasological methodology taken from the experience of work with flint artefacts accumulated in S. A. Semenov’s works and present-day St Petersburg Institute for the History of Material Culture, laboratories of Poznan Archaeological Museum, by other West European scientists. Moreover, the experiments were carried out with fish, naturally dead and hunted animals by disembowelling, gutting them, extracting tendons etc., also when expanding practical knowledge on the technologies of slaughtering, use of flint tools to form carcasses after hunting in the Early Holocene period.

**Research object.** Legacy of Lithuanian archaeology comprises archaeological monuments, collections of archaeological finds stocked in museums, museum expositions and archive materials of archaeological scientific research. The research focuses on the research object comprising the finds of all types of flint artefacts of the Early Holocene – Mesolithic and Early Neolithic – period found in archaeological monuments of Lithuania, North-West Poland, Latvia. These are raw materials, artefacts of flint, residues of production which are highly important in reconstructing the technology of production of the artefacts. Entire materials stocked in museum funds have been

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6 Семенов, С. А. 1957. Первобытная техника (опыт изучения древнейших орудий и изделий по следам работы). *Материалы и исследования по археологии СССР*, № 54. Москва, Ленинград: Академия наук СССР;
examined in a complex way. Information recorded in archaeological research reports and scientific publications should also be attributed to the research object.

**Research problem.** The key problem in the current research study is to find out the technological development of flint artefacts in the East Baltic region in the Early Holocene period as well as their change in the work process of the population over the discussed period. Solution the problem and carrying out the investigation were facilitated by acquired new technologies enabling effective and detailed examination of major flint materials of the Early Holocene period collected by archaeologists until now.

**Novelty** of the work comprises employment of the experimental-trasological method in examination of flint artefacts of the Early Holocene. By applying the above-mentioned method, the study aimed at identification of the technology of production of flint artefacts and their function in the Early Holocene period. Until now, not a single research study on investigation of the Stone Age in Lithuanian archaeology dealing with the technology and trasology of production of artefacts dating back to separate archaeological periods or attributed to one typological group of artefacts was presented. The current study will present the data of the mentioned research on major flint artefacts dating back to the Early Holocene period: knives, perforators, awls, scrapers, axes and burins. By applying the experimental-trasological method, it is possible to find out and reveal the lifestyle, economy of prehistoric population, to assess technological innovations in greater detail.

**Research aim.** The aim of the current research is to identify the technological development of the Early Holocene period by analysing major artefacts of that period applying the experimental-trasological method.

**Research objectives.** To achieve the aim, several objectives have been raised; they define the following stages of work’s experimental-trasological investigation:

1. To identify and reconstruct the technology of production of major flint artefacts aiming to make experimental artefacts.
2. According to the work tools used back in the Early Holocene period and estimated technology, to prepare the replicas of work tools
intended for flint knapping and producing artefacts of that period by using the technology which is characteristic to that period.

3. To use replicas of the major artefacts (perforators, burins, scrapers, knives, awls, axes) for carrying out experimental investigation, processing fur, skin, wood, bone-antler aiming to identify the characteristics of the work technology in the Early Holocene period.

4. By using the trasology microscope, to examine the trasological traces detected on artefacts of the Early Holocene period stocked in museum collections and to compare them with the traces found on produced replicas.

5. To find out and specify the typology of major artefacts of the Early Holocene grounding on the data of experimental and trasological data.

6. To specify the technology used in economies of the Early Holocene communities.

**Major statements to be defended:**

1. Typology of flint artefacts of the Early Holocene period does not correspond to the purpose of the artefacts found by the experimental-trasological method. The typology of the artefacts of that period was formed according to the morphology of artefacts and not to trasological features because the trasological research method is later.

2. Identified trasological features point out the specificity of the use of a particular artefact. The artefacts can be identified according to the lesions on the work surface because materials of various densities leave different identifiable features.

3. By employing the experimental method, it is possible to prove the origin of occurrence of the trasological traces observed on the surface of the artefacts. In this particular case, the comparative method is applied by interval recording of the change of the surface of the artefacts.

4. The experimental-trasological method details the function of an artefact estimated by the classical typology method.

5. The experimental-trasological method facilitates a broader approach to the technological and processual development of economy. As the development of economy changed, technological adjustment to the changing environment proceeded, too.

Even though experimental investigations of prehistoric artefacts started quite long before the formation of the trasological method, by using microscopic equipment\(^7\), nevertheless, only the middle of the twentieth century is universally recognised as a result of combination of experiments and microscopic equipment, which is called experimental trasology. A Russian scientist S. A. Semenov is considered to be the founder of this method throughout the world; scientist’s life path is closely connected to Lithuania. In the middle of the twentieth century, he prepared and published the first paper dedicated to the experimental-trasological method\(^8\). Soon, the same publication of S. A. Semenov was reissued several times in the English and Spanish languages\(^9\). In this work, the scientist discussed the methods of application of the trasological method in examination of flint tools of the Palaeolithic period. He found out that the experimental method as the only one could not reveal all subtleties of the use of that tool. A comprehensive analysis of such flint tool requires using a microscope which enables a more systematic view to the usage of prehistoric artefacts.

Later, in the late nineteen-eighties, as the political situation in Europe was undergoing changes, this method spread in other regions as well; therefore, the method is widely applied throughout the world in examination of ancient tools of the prehistoric humanity\(^10\). Meanwhile,

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\(^8\) Семенов, С. А. 1957. Первобытная техника (опыт изучения древнейших орудий и изделий по следам работы). *Материалы и исследования по археологии СССР*, №. 54. Москва, Ленинград: Академия наук СССР.


European archaeological scholarly institutions accepted major methods of experimental and trasological investigation which were formulated by the Trasological Investigation School in St Petersburg. Later, each European centre of scientific research started deepening and developing a certain aspect of this method. Trasologists of the Netherlands paid a special attention to functionality of artefacts and not the purpose of a work tool\textsuperscript{11}. Trasologists of the University of Oxford dealt with identification of the purpose of the function performed by artefacts grounding on development of recent technical innovations used in the trasology method.\textsuperscript{12} Polish trasologists, like Russian scientists, paid a special attention to development of the experimental-trasological method\textsuperscript{13}. Throughout the world, hundreds of scientific articles and monographs have been published, various specific scientific conferences and summer schools based on development of the problems of experimental trasology research are held each year.

In the course of scientific progress in the field of trasology, investigation and developing opportunities provided by this method, it commenced to be applied not only in examination of tools made of rock and minerals but also in analysis of artefacts of organic origin and metalwork\textsuperscript{14}. This method in examination of osteological material was started being used in searching for microscopic traces of the slaughtering technology and production of tools, i.e. signs of hacking, paring, cutting, which are formed on bones while processing a hunted animal or producing an artefact out of bone/ antler\textsuperscript{15}. Such experimental and

\textsuperscript{12} Moos, E. What Microwear Analysis Look At. Early Man News, 1986, 9/10/11, p. 91-96.
trasological investigations of osteological material are carried out in Lithuania, too\textsuperscript{16}.

Moreover, trasology is successfully applied in investigations of ceramics. Here, this method is mostly employed in dealing with the technology of production of ceramic artefacts and composition of clay mass\textsuperscript{17}. Currently, the method of the functional purpose has been improved in a way that after a microscope enables finding small residues on prehistoric fastening materials (e.g. birch tar) or even residual blood and having taken their samples, it is possible to date by the AMS (\textit{Accelerator Mass Spectrometry}) method\textsuperscript{18}. These innovations in examination of archaeological material open new opportunities to a more detailed approach to the lifestyle of people in prehistoric and historical times. As the technologies develop and interdisciplinarity of science increases, in the future the trasological method should provide even higher diversity of cognition of material heritage of the past.

In the cases of investigation of Lithuanian archaeological material, the trasological material is still little used. Only over the latter three years the number of published research on the field increased. This progress should be related to occurrence of appropriate technological equipment in research institutions of Lithuania. All known archaeological objects on the territory of Lithuania, the inventory of which or at least part of it was examined by the trasology method, are presented in the designed map (Annex, Fig. 5).

The first published cases on the method of identification of the functional purpose in Lithuanian archaeology should be searched for back in the late twentieth century. In Spiginas 4\textsuperscript{th} (surroundings of Biržulis Lake, Telšiai District) grave dated the Late Mesolithic period, the dead person’s goods, i.e. knife-shape splits with retouched tops and


base, and with partly side edges, have been found\textsuperscript{19}. After trasological examination carried out in the Institute for the History of Material Culture of Russian Academy of Sciences in St Petersburg it was found out that these artefacts actually were knives and they were intended for processing wood\textsuperscript{20}. In the same laboratory intended for trasological research, investigation of flint inventory found in the Late Neolithic settlement Kubilėliai (Šakiai District) was carried out, too. Almost 40,000 units of artefacts made of flint have been found in this settlement and mostly analysed in the technological principle\textsuperscript{21}. In the last decade of the twentieth century, a detailed trasological analysis of archaeological flint inventory found in Žeimenis Lake 1 settlement (Švenčionys District) was carried out\textsuperscript{22}. By applying the experimental-trasological method, scrapers, perforators, awls, microliths, grinders, borers, chisels, burins, knives of various types etc. were examined.

Moreover, examination of flint inventory was conducted in the laboratory in St Petersburg. To provide more details on the trasological laboratory in this city, attention should be focused on one important fact. In periods 1980–1981 and 1985–1986, prof. Algirdas Girininkas was on secondment in this institution of prehistoric investigation. According to his data, the work in the laboratory proceeded by using a trasological microscope and working with experimental and archaeological artefacts, comparing the utilisation traces of these artefacts. According to the scientist, a basis of some over 500 units of experimental artefacts has been accumulated at that time in the institution; they enabled performing the research (A. Girininkas’ personal information). Currently, scientists of the trasological investigation laboratory in St Petersburg, the Institute for the History of Material Culture of Russian Academy of Sciences, continue successfully conducting examination of prehistoric tools grounding on this


method. Recently, experimental and trasological investigations have been and still are being carried out by G. F. Koropkova, V. E. Shchelinskiiy, A. K. Filipov, N. N. Skakun etc. The major aim of these scientists is to reconstruct production of tools, carry out examination of the artefacts related to production and appropriated economy. Trasological and experimental investigations are carried out in St Petersburg while involving various materials: flint, quartz, quartzite, dolomite, sandstone, nephrite, aleorite, ceramics, bone, antler, wood etc.

In the beginning of the twenty-first century, examination of Lithuanian archaeological material by applying the trasological method still was fragmentary. In the first decade of this century, micro-lithic inventory of Kabeliai 2nd and 23th, Bakšiai, Pamerkinė and Pypliai 1st C was investigated. The data of the trasological analysis shows (investigations have also been carried out in St Petersburg) that majority of this inventory had the purpose of hunting and fishing. The use of flint artefacts in daily

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26 Ibid.
living in not only a phenomenon characteristic to the Stone Age; moreover, tools were being made out of this material and used in later periods characteristic of metals. Trasological investigation of such cases was conducted when examining flint artefacts found in Kernavė and Naudvaris (Jurbarkas District) monuments. The results obtained in a laboratory run in Poland, Nicolaus Copernicus University in Torun, show that these artefacts were mostly intended for cutting and scraping\textsuperscript{27}.

As may be noticed, all mentioned works of the trasological character have been conducted on the ground of the research results obtained in foreign laboratories. Since 2010, a laboratory of experimental archaeology and trasology was founded in Klaipėda University Institute of Baltic Region History and Archaeology (BRIAI). In this first of a kind laboratory in Lithuania, staff members work with \textit{Olympus SZX 16} microscope with attached \textit{Olympus DP72} photo camera. Using this camera, one can record the utilisation traces of flint artefacts which can hardly be visually defined or impossible at all. This microscope can magnify the image of the examined object up to 690 times. The laboratory stocks the basis of experimental data accumulated over the years of investigation; it facilitates the rendering of a greater amount of more accurate data on the function of an archaeological tool. Currently, the experimental inventory comprises flint knives, scrapers, various types of microliths, axes, awls, perforators. The experimental basis of artefacts also consists of the tools made of organics: bone spearheads and antler tools for retouching flint. All these experimental artefacts, both flint and organic, were used to do a certain work, have their single entries and places of storage, are used in functional investigation of the artefacts found during archaeological investigations. Moreover, this laboratory stocks and explores material of archaeological investigations of Katra 1\textsuperscript{st} \textsuperscript{28} and Pakretuonė 4\textsuperscript{th} \textsuperscript{29} settlements.

In the Klaipėda University experimental-trasological laboratory, quite a large part of investigations on the functional purpose of artefacts has already been carried out; majority of them cover prehistoric, also some historical epochs. Grounding on the experimental-trasological method, several unretouched broken splits bearing utilisation traces have been examined after finding in Kartra 1st settlement as well as flint inventory dated Late Palaeolithic and Middle Mesolithic period and found in Aukštumala bog (Šilutė District) have been investigated. These investigations are supplemented by technological examinations of microliths from mentioned Katra 1st (Varėna District), Aukštumala (Šilutė District) and Tytuvėnėliai (Kelmė District) campsites and settlements of the Stone Age. When talking about Katra 1st settlement, grounding on the archaeological material obtained from this monument, technological and functional analysis of scrapers and flint axes was carried out. Moreover, over recent years, experimental-trasological testing of set-in microliths while sticking fish was conducted and, for the first time in the history of investigation of Lithuanian archaeological material, detailed functional analysis of Late Mesolithic – Early Neolithic trapezium-shape arrow heads was carried out. Investigations exploring the functional purpose were also applied in examination of the first Lyngby type axe of the Upper Palaeolithic period found in Nemunėlio Radviliškis (Biržai District) made of reindeer’s antler.

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33 Ibid.
analysis enabled finding out the function of this artefact, which, perhaps, had to be related to wood processing in the Aleroyd-Dryas III period\textsuperscript{36}. Investigations of early prehistoric development of economy also employed experimental-trasological analysis during which experimentation with flint and bronze knives proceeded while slaughtering animals. The investigation results allowed asking questions concerning the priority of tools made of different raw materials in the Late Bronze Age period\textsuperscript{37}.

The material found during archaeological investigations of Lithuanian historical times (Medieval and Modern times) still has not been analysed from the functional aspect in detail. The trasological method in examination of archaeological materials is applied as successfully as in analysis of prehistoric artefacts. In 2014, a vast amount of materials was accumulated during archaeological investigations on Klaipėda castle site\textsuperscript{38}; only a small part of this material was examined by applying the trasological method. The latter method was used in Klaipėda University laboratory of experimental archaeology and trasology to examine the fragments of leather footwear found on Klaipėda castle site. By using this method, it was possible to present particular conclusions on the use of certain animals’ skin in production of leather footwear in Medieval and Modern times in Klaipėda city\textsuperscript{39}. The experimental data base formed in Klaipėda University laboratory of experimental archaeology and trasology allows presenting more detailed data on the function of artefacts, including harness of materials, interval of work time, characteristics of holding a tool during work process or the place of hafting and shafting etc.


As observed, since the second decade of the twenty-first century, investigations of the functional purpose of artefacts became more intensive in Lithuania due to quite obvious reasons: occurrence of appropriate technological equipment. Until then, all research works in that field were being carried out in foreign laboratories, i.e. Russian and Polish, scientific institutions\textsuperscript{40}. An identical situation of the area of such investigations can be found also while exploring historiographical materials in neighbouring Latvia. Trasological analysis in this country still is applied when investigating inventory of Salaspils Laukskola and Zvejnieki cemeteries\textsuperscript{41}.

Much is done in the area of experimental-trasological research conducted in Western Europe and the United States of America.

Great Britain’s school of trasological investigations stands out for its innovativeness. There, trasological investigations began raising interest after S. A. Semenov’s study published in English. One of the most famous founders of British trasology, L. H. Keely\textsuperscript{42}, was working in the


area both in the UK and the USA, forming the trasological information base. He established the Trasological Investigations Centre in the University of Oxford. One of the first analyses conducted by L. H. Keely was examination of the use-wear of Stone Age flint artefacts. Experimental research was continued by M. H. Newcomer who investigated the causes of formation of polished surfaces of artefacts, also by R. Tringham, E. Moss etc. Historical beginnings of this trasological school are also related to the methods applied by S. A. Semenov in St Petersburg (Leningrad at that time) in prehistoric archaeology. This was a significant innovation which enabled more detailed cognition of development of prehistoric technology, identifying the function of artefacts.

In France, experimental-trasological investigations were conducted by P. Anderson–Gerfaud, P. A. Jeron, H. Plisson. The latter scientist was S. A. Semenov’s disciple who was on internship in St Petersburg,


gaining the fundamentals of this method in the experimental-trasological laboratory. Later, he applied this method in his further experimental-trasological examinations. He founded the school of the trasological investigation method, where a special attention was focused on the discussion concerning the use-wear level in edges of flint artefacts (knives, axes, scrapers etc.) attributed to various periods, also formation of various trasological traces on surface blades of various tools, estimated the significance of phyto-trasological traces in examination of micro-blades of sickles.

In recent years, this method of investigation of prehistory was applied by Japanese scientists, too. Fundamentals of trasological investigation have been relatively recently laid by K. Akoshima and Y. Kanomata47. In the area of trasological-experimental investigation, the latter scientists, also grounding on the fundamentals of St Petersburg’s experimental-trasological school, formed an alternative methodology for examination of micro-surface.

In the United States of America, grounding on fundamentals of British experimental-trasological school, D. Cahen, J. Gysels, L. Keeley and R. W. Yerkes48 dealt with development of people’s technological skills in the prehistoric times, substantiating on the data of experimental archaeological investigations. This school was also largely influenced by S. A. Semenov’s study which was published in English in 1964. Despite political confrontation and scientific competition between the Soviet Union and the Western world at that time, investigators of West European prehistory innovatively accepted the research method employed by this scientist and successfully continued this in their archaeological investigations. Since that time, experimental-trasological schools started emerging in various European and North American countries, grounding on the fundamentals of the experimental-trasological methods designed by S. A. Semenov.

1.1. Natural and Cultural Situation of the Early Holocene in the East Baltic Region

The beginning of the Early Holocene is marked by the event of 10640 BP (8690 BC), when the waters of the Baltic glacial lake near Bilingen Hill in South Sweden rushed through the strait. Therefore, the level of the Baltic glacial lake dropped down by 25 m and quite warm salty water of the Atlantic Ocean started penetrating the former lake which turned to the Yoldia Sea (named after Yoldia (Portlandia arctica) mollusc). In the East Baltic region, especially its south-west part, the level of water dropped down by some 35–50 meters. These events are recorded by recent underwater archaeological investigations at Lithuanian seaside49. This regression of the Baltic glacial lake marks the beginning of the Holocene. At that time, in the south-west part of the Baltic Sea, the Øresund Strait disappeared; therefore, the European continent merged with South Scandinavia.

There are no sediments of the Yoldia Sea found along Lithuanian seaside; also neither remains of settlement along the Youldia Sea coast at that time were discovered. Due to a low level of the Yoldia Sea water, the coast line was far north from the present-day east coast of the Baltic Sea. The junction of the ocean and the Yoldia Sea that lasted for some 800 years ceased in ca. 9500 BP and, on the site of the current Baltic Sea, Ancylus Lake (the title originated from a mollusc Ancylus fluviatilis) was formed in 10700–9000 BP50. When the Baltic Lake was

50 Lemke, W. Die kurze wechselvolle Entwicklungsgeschichte der Ostsee - Aktuelle meeresgeologische Forschungen zum Verlauf der Litorina-
flooded with water again, excess of it ran to the ocean along the Dana River and other junction canals. Later, the mentioned junction canals of Ancylus Lake provided conditions for formation of a new phase of the Baltic Sea, the saltwater Littorina Sea (the title originates from a mollusc *Littorina littorea*)⁵¹. These natural changes took place in the Early Mesolithic – Early Neolithic period. During the Preboreal period, the species of plants characteristic to tundra and forest-tundra decayed, wood plants increased⁵². Throughout Lithuania, especially on the south-east part of the territory, birch forests with rogue pines grew. At that time, underwood comprised juniper, wicker, fern and green moss. During the Boreal period, the amount of pine trees increased, and in the second half of the Boreal elm, lime and oak trees appeared. In the first half of the Atlantic, on the territory of East Lithuania, pine woods spread even more, and on the south-west and western parts of Lithuania alders spread. The amount of broad-leaf forests highly increased in South-East Lithuania⁵³. As the climate was changing, fauna of forests changed, too. In the Mesolithic period, after forests spread, single or small herds of forest animals dispersed. In Lithuania and other neighbouring territories, forests of the Preboreal period were home to bear, moose, beaver and wild boar, and later, throughout the Early Atlantic period, as leafy forests spread, wild boar, moose, red deer, marten, beaver, aurochs, roe dominated⁵⁴.

Since the natural environment changed throughout the Mesolithic period, the ratio of settled and seasonal camping altered. Residents on the Lithuanian territory had to adjust to the forest environment. After individual hunting and fishing spread, community people would move at a smaller radius because it was limited by the territories being

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⁵¹ Ten pat, p. 43-54.
protected by neighbouring communities and locations of food resources belonging to single communities. Mesolithic period settlements are found near larger bodies of water, where fishing and hunting were available (Biržulis, Kretuonas, Grūda, Dūba lakes, watery rivers). Back then, people would live in major settlements, also they would build more seasonal camp sites where inhabitants would stay during gathering of food, fishing and hunting.

Over the Mesolithic – Early Neolithic period, high significance was given to natural micro-regions rich of raw resources. Such locations were the sites of flint mining in South Lithuania: Titnas, Margionys (Varėna District), Ežerynas (Alytus District)\textsuperscript{55}; in Belarus: Krasnaselye and Lichitsy, not far from the Ros’ River, the left tributary of the Nemunas River. The communities on whose territories raw flint was found became centres of attractions for large regional communities; there, the mining, primary processing of raw material and realisation of semi-manufactures developed on the basis of exchanges with communities residing further north on the East Baltic region.

In the Mesolithic period, after forests widely spread, forest animals living as single individuals or in small herds became main targets for hunters. Therefore, in this period, trap (pits), round-upping of beasts to favourable locations for hunters, bow shooting, use of a spear and a dagger, other methods became major means of hunting. During the Mesolithic period, some forest beasts were larger than reindeer mostly hunted in the Upper Palaeolithic period; but the heads of rectangular forms and microliths were used while adapting to individualised hunting or hunting in small groups. Living conditions of reindeer and forest beasts as well as their lifestyle were different; therefore, the ways of hunting used in the Palaeolithic period no longer could be applicable. The form of hunting had to change, too. Hunting became more individualised, the number of involved people reduced, and the hunted fauna essentially changed over the Early Holocene period\textsuperscript{56}. This was

the reason why the hunting tools, the technology of their production and the community structure of residents changed.

Throughout the Mesolithic period, fishing highly spreads and its means change, too. This can be concluded according to abundant fishing inventory. During the Mesolithic period, the same fishing means were used like in the present day: nets, creels, fishing rods, gates etc. The Mesolithic period is the time when fishing flourished because hunting as the only means could not meet the residents’ demand for food supply. The use of nets is shown by the case Netiesos 1st settlement where a piece of well-processed bass fibres was found in a Mesolithic fireplace; this bass fibre exactly was used for knitting nets. Fish were shot by bow arrows and stuck with spears. Bone heads of arrows with barbs and spearheads with barbs as well as flint set-in microliths were used for fishing. In South Scandinavia and on the southern Baltic Sea and North Sea coasts, barriers-traps for catching fish with creels were used. The same barrier could be set in Žemaitiškė 2nd settlement (Švenčionys District) where poles of the former, perhaps, barrier for catching fish were found.

In the beginning of the Early Holocene, a rapidly changing climate and environmental conditions, especially spread of forests, forced reindeer withdraw from the territory of Lithuania. These natural changes, i.e. the climate warming, in the Uppre Palaeolithic period directly impacted the reindeer hunters from Svidrai, Arensburg cultural

57 Загорская, И. А. 1983. Костяные орудия охоты и рыболовства каменного века на территории Латвии. Автореферат кандидатской диссертации исторических наук. Вильнюс.
60 Загорская, И. А. 1983. Костяные орудия охоты и рыболовства каменного века на территории Латвии. Автореферат кандидатской диссертации исторических наук. Вильнюс, с. 47-49, 64.
monuments to move towards north and north-east directions in the East Baltic region. After migration processes following reindeer herds ended, some inhabitants of the Svidrai culture stayed remaining and had to slowly adapt to the local conditions – living in diverse forests. Not only natural environment, flora, fauna underwent changes, but also the technologies of production of the artefacts intended for these branches of economy, still very little investigated, changed.

Technologies of production of artefacts changed not only in the place, while residents immediately were adapting to new natural conditions, but also due to communication with neighbouring communities of the Baltic Sea region. This was largely impacted by various commute ways. These were rivers or their banks. The seaside became a highly favourable location for living, travelling and communication. Even though the coasts of the former Yoldia Sea and Ancylius Lake at that time were under water, still, coasts of a vast body of water were more convenient for easier travelling than along lakes and rivers on the inland territory covered with forests and bushes. Therefore, contacts of the residents with the southern and south-eastern coasts of the Yoldia Sea and banks of Ancylius Lake were intensive. Highly favourable conditions for travelling and contacts were available for residents of Maglemosė, Kunda, Butovo, Mesolithic culture of the Nemunas River. In Mesolithic period communities of Lithuania and East Baltic regions more emphasised communication is observed in the west and east directions. The later groups of people from Svidrai, Arensburg cultures, using technological experiences of western and eastern neighbours, soon adapted to the changed environment and accepted the features of the hunting economy of the forest zone. In the East Baltic region, the Kunda culture characteristic of specific features formed. On the ground of radiological, natural sciences data, this technological transformation is dated as far back as the middle of the eighth millennium BC. In the second half of the Preboreal, groups of Kunda residents reached South Finland, later spread in the north-east direction towards southern banks of Ladoga and Onega lakes, reached the basin at the source of the Volga River and influenced the Butovo culture. With regard to the process of microlitization of the south-eastern region of the Baltic Sea, it is observed that both in Nemunas (Janislawice) cultures
were largely impacted by Maglemožė industry\textsuperscript{63} which, like Komornice and Kudlajevka cultures, were influenced by the same Arensburg culture. In the middle of the Boreal period, a new technological wave of flint processing, which was characteristic to Maglemožė culture, occurred on the territory of Lithuania. If compared the Early Mesolithic Nemunas and the Late Mesolithic Nemunas cultures, we would notice that they had changed, too. The process of microlitization that started as far back as in the Upper Palaeolithic period\textsuperscript{64} very strongly impacted the Late Mesolithic culture of the Nemunas River, too. It was a slow process. Technological innovations were accepted and adapted in a specific way. In the second half of the seventh millennium BC, the East Baltic region was reached by the technology of ceramics production; the cultural complex of the Nemunas River in the Late Mesolithic period started slowly transforming to local Neolithic cultures of Narva and Dubičiai forests, which sustained themselves on the appropriated economy and the same Mesolithic industry of flint processing for a long time. Throughout the Mesolithic period, human’s lifestyle, i.e. dwelling, work tools, armament, food, ways of socialising and communication changed. More diverse forms of economy developed. A man had to rationally use all available capacities to survive, i.e. to eat and take care of offspring. Therefore, they had to adjust not only to the living environment, but also to develop a specific technology of work tools, which ensured welfare of Mesolithic communities.


\textsuperscript{64} Šatavičius, E. 2001. \textit{Vėlyvojo paleolito kultūros ir jų likimas ankstyvajame mezolite}, Daktaro disertacijos santrauka: Humanitariniai mokslai, istorija (05 H Istorija), Vilnius.
2. Use of the Experimental-Trasological Method in Investigation of the Technological Development of Economy in the East Baltic Region in the Early Holocene

The current study, exploring artefacts of the Early Holocene, reviews the largest macro-lithic groups of artefacts: knives, scrapers, burins, awls, perforators and axes. Trasological-experimental investigations of these groups of artefacts were carried out. The technologies of production of archaeological findings and their micro-surface were examined. After examination of the artefacts found in the settlements by applying the trasological method, their replicas have been made and, finally, experiments with them have been conducted. After conducting the experiments, the replicas were examined by applying trasological investigation methods, and their results were compared with the artefacts found in archaeological monuments of Lithuania and East Baltic region.

2.1. Equipment

The method of identification of the functional purpose of artefacts dating back to the Early Holocene period conditionally requires a small amount of devices to carry out quality trasological analysis of an object. As mentioned earlier, major equipment devices are: microscope, fixation device attached to the microscope and specialised software enabling processing the information obtained from the mentioned devices. It is important that the used microscope could magnify the object’s image at least up to 200 times and be able to retain certain differences of heights. Otherwise, due to the mentioned differences of heights it would be impossible to fixate microscopically identified trasological traces. It is possible to level the difference of heights by using an operating data processing system. It can be done when fixating the same size of an object and gradually fixating heights from the highest place to the lowest which can be seen in the ocular. After this photo fixation, photographs are merged and, as result, we obtain one joint image of a surveyed object.
2.2. Application of the Method in Practice

Preparation of an object for investigation is one of primary stages of the trasological analysis; it is important and makes impact on the quality of results. Trasological investigation can be applied to almost all archaeological artefacts, even in a case of materials of archaeological finds and their surfaces are different. Artefacts of organic and non-organic origin are prepared in different ways, for instance, surfaces of flint artefacts can be washed with ichtyol, and osteological material can be washed with distilled water or spirits. Non-organic artefacts, such as minerals and rock, which are usually covered with particles of soil, can be soaked and mildly washed with a washing means, e.g. a soft toothbrush. Obviously, according to the procedure of acceptance of finds to Lithuanian museums, finds are given already washed; however, when examining artefacts in a trasological method, various microscopic crannies are filled up with various soil residues; therefore, this obstructs noticeability of some utilisation traces. The washing of artefacts must be thorough and careful because certain utilisation traces may be left on an artefact by a washing means (e.g. the mentioned toothbrush), such as scratches, polishing or even particles of fabric of the washing means. Usually, flint artefacts are stored in museums kept in boxes or bags in separate piles. Artefacts touch, rub or even break at each other. Without knowing the circumstances of storing or cleaning a particular artefact, when performing trasological analysis an investigator may obtain misleading results.

When applying investigation of the functional purpose for flint artefacts, quite informative results may be obtained. By using flint artefacts in trasological investigation, first of all, attention should be paid to technologies of production of an artefact and its morphology. When splitting and retouching flint, macro- and micro-traces remain on it; they become more strongly visible when examining an artefact through a microscope and can be similar to the traces of use. Preparation of sample for examination is possible using spirits or ichtiolu which removes contemporary organic and non-organic compounds from the surface. Artefacts are selected for examination by a researcher himself/herself. Often, a group of artefacts, which has already been singled out according to the classical typology, is chosen. This way an artefact may be examined by employing all surface area and edges or only certain morphological parts of an artefact, such as edge, tangs, places of fraction
etc., may be investigated. Several different examples of investigation of artefacts can be taken from S. A. Semenov’s\textsuperscript{65} and V. Rots’\textsuperscript{66} published works. Research studies of these authors well reflect examination of the entire surface of an artefact and artefact’s fragmentary (of certain places) analysis. It is important to note that when carrying out trasological analysis of flint artefacts, there is a certain angle of a source of the light. After directing a flow of light along the artefact’s surface at a sharp angle, trasological traces can be noticed and highlighted, which sometimes cannot be noticed even after magnifying the object’s surface more than 100x (Annex, Fig. 1 and 1.1).

On the other hand, destructive preparation of a sample for trasological analysis is practiced in ceramics investigations. This is applied only in a case when aiming to estimate density of a moulded vessel, the amount of impurities, differences of burning temperatures, thickness of glaze, engobe or juncture of moulding (Annex, Fig. 2). Since the fractured place is grainy due to clay mass and impurities in ceramics, one part of the edge may be smoothed down by using a diamond rasp or fine sandpaper. After that, a sample is thoroughly washed with water, suggested to use distilled water. Later, the sample is prepared for microscopic analysis. When preparing the surface for examination, it is enough to polish the surface up to 5 mm. When working with a microscope, the examined surface can be sufficiently magnified from 7 to 50x.

Osteological material comprises quite a large part of archaeological materials which can be functionally examined. Several directions for investigation of this prehistoric material are available. The first is more related to the trasological analysis of bone material itself, by examining the traces of technologies in detail. Another is related to artefacts of the osteological origin. Technological and use-wear micro-traces on produced bone and antler artefacts as an object of investigation do not require a highly powerful microscope. For this purpose, it is enough to magnify the examined surface from 7 to 50 times, almost identically like in a previously discussed case of ceramics. Nevertheless, it should be added that the task of examination and

\textsuperscript{65} Семенов, С. А. 1957. Первообытная техника (опыт изучения древнейших орудий и изделий по следам работы). Материалы и исследования по археологии СССР, №. 54. Москва, Ленинград: Академия наук СССР.
recorded objects cardinally differ. When examining ceramics through a microscope, its use is rarely analysed and more focus is laid on technological and petrographic nuances. In a case of investigation of osteological material, usually it is possible to record trasological traces remaining on the artefact’s surface. When working with material of organic origin, no doubt, the problems of the conditions of conservation and storage are faced. Artefacts made of bone or antler and undergone conservation usually are covered with conserving chemicals which cover the surface and partly hide micro-traces. Due to this reason, part of information becomes beyond reach. If conservation materials were used quite lately (e.g. over the latter 15 years), they were likely to be removed from surface by applying various dissolvent, without damaging the surface of that artefact. Unfavourable conditions of storage are one of the strongest harms made to an artefact. In such a case, a bone/antler dries out and starts crumbling, and all information on the surface of that find crumbles down with the trasological traces.

It can be stated that trasological investigation usually depends on the aims and objectives raised by a researcher. Since the purpose of the artefacts is varying, each analysis of an artefact and trasological traces are also different. An artefact from Katra 1st settlement, a flint axe, can be presented as an example. The axe (Annex, Fig. 3) was made of a split part of a larger flake, edges were formed by the tranche type split from the reverse side. Utilisation splits are seen on edges even without using the microscope; however, after magnifying artefact’s edges 40x and more times, the traces could be noticed. Still, when examining edges of the same artefact and the remaining negatives, having magnified by 20x, polish was found on the negative left on the averse side (Annex, Fig. 3.1). After magnifying the polished area up to 115x, single linear features in the polish and polish as a result of rubbing could be seen (Annex, Fig. 3.2). This shows that these trasological features left as a result of an intensive work with wood. Linear features were found formed at an angle of 40–50 degrees in respect to the axe edge. The traces became visible due to the angle of an axe cut and its elevated edge. During the process, this site was the most favourable for these marks to form. Such features were not found on the edges themselves because they split too soon, whereas characteristic utilisation features usually remain on crumbled flakes of edges. These presented insights have been proven by carrying out experiments with replicas of flint axes. When examining the artefacts using the trasological methods, it is
recommended to have collected a certain base of experimental data (replicas) as a comparable material, which would enable drawing more precise conclusions in the proceeding of the investigation.

A comparative method in experimental-trasological investigation is very important. In this case, groups of artefacts singled out in an examined prehistoric monument by a simple typological method with groups of artefacts which are singled out after experimental-trasological investigation of the same monument are compared. Usually, artworks which after typological analysis were treated as splits, flakes, chisels, knives, perforators, awls, then, after experimental-trasological investigations, their identified function would be attributed to completely different types of artefacts. This typological mismatch of artefacts demonstrates that only after examination of artefacts by applying the experimental-trasological method, one can more accurately identify the true function of artefacts, and also expand the amount of typological artefacts. This is very obvious not only from the data on the analysis of six major artefacts of the Early Holocene presented in the current research study, but also from other scientists’ research works, who, investigating materials of prehistoric settlements, employed experimental-trasological investigation methods\textsuperscript{67}.

2. 3. Production and Fixation of Experimental Artefacts

Technological reconstruction, fixation and use of an artefact, fixed time interval are an important task of every conducted experiment. When consistently carrying out the process of production of an experimental artefact, a detailed copy of an artefact is made first of all by using technologies of that period: splitting, carving, forging, casting etc. If it is related to attempts to estimate a function of an artefact, then the same artefacts are made in greater numbers. When carrying out experiments, it is necessary to do this because fixation of different time intervals, too. Flint knives can be presented as an example. 10 such tools

\textsuperscript{67} Girininkas, A. 1997. Žeimenio ežero 1-oji gyvenvietė. Kultūros paminklai, Nr. 4, p. 32; Лычагина, Е. Л., Поплевко, Г. Н. 2012. Комплексный анализ каменного инвентаря, неолитической стоянки Чашкинское Озеро IV, Записки Института истории материальной культуры РАН, № 7, с. 19.
must be made; this lasts from 5 min. until the final product aimed to be created. The time up to half an hour is calculated and fixed every 5–10 min. After half an hour, the time is being fixed in larger intervals – every 20–30 min. The work with several replicas proceeds until the moment when a tool intended for work becomes no longer functional: e.g. when performing skinning of an animal, removal of tree bark, obtaining bass or preparing wood for other work etc. During fixation, a journal or notes are being kept; they must accompany the experimental artefacts and photographs. When working under field conditions, more time for fixation is needed to fixate positions of artefacts at single time intervals (utilisation, occurrence of micro-traces etc.) by using a microscope. If conditions permit, during performance of experiments in a laboratory, artefacts can be fixated in the trasological method, and after fixation to continue work with the same artefact under field conditions. Identification of the purpose of a tool must use several different materials for processing. Using flint knives, meat, wood, bone-antler, skin, grassy plants etc. are being cut (Annex, Fig. 4, 4.1, 4.2). After conducting such testing, a separate base of experimental trasological data is formed; it is employed as comparable material in analysis of archaeological finds.

As already mentioned in this study, investigation on estimation of the functional purpose is still very little applied in Lithuania, if to compare with the amount of fossil materials stocked in museums. The gap in these investigations is pointed out by still modest historiographic materials dedicated to this method. In world practice, the trasological investigation method is usually applied for flint, bone/antler, ceramics artefacts; however, employment of this method is also possible for artefacts made of amber, metal, wood, shell, stone etc. Still, when facing each different material, new specific methodical characteristics, such as the impact of environment and time on material, retained surface, minimal destruction of an artefact etc., emerge. The trasological investigation method can encompass a larger part of archaeological material of non-organic and organic origin and be used for different periods. This method of investigation is relatively universal and multidisciplinary. By using it, it is possible to identify technological features, purpose of artefacts, to specify their typological features, to identify composition of artefacts or single out morphological parts according to trasological traces found on surface of an artefact.

Trasological-experimental investigations mostly were carried out with artefacts of the Early Holocene period in the East Baltic region. To author’s mind, this geological period, is far more accurate when defining the research object because people of that time had a much closer relationship with nature and processes taking place in nature, which made impact on technological progress of their economy. Throughout this entire period, the climate was slightly warming and in the Atlantic period it reached its height. A changing natural environment and fauna presupposed their technical skills. This idea on human adaptation is not new. This is quite an old topic both in foreign and Lithuanian archaeological literature. Often, to prove such statements, other areas of science, such as anthropology, zooarchaeology, paleobotany, are used. Investigations of such a character are successfully being implemented in these archaeological monuments where organic material remains and which are well-preserved. In Lithuania, Latvia, Belarus, there is still a big problem that monuments dated the Early Holocene period are still not classified, and organic material is poorly preserved. Thus, in such a case the material should be surveyed in a different angle and observe this change from the technological approach. Of course, one of the pieces of evidence that technological development proceeded lies in several archaeological cultures that have been singled out according to types of artefacts and used technology.

Often, technological development of the Early Holocene period is investigated in archaeological material in the aspect of establishment of microlitisation. However, the technique of production of microliths is also quite more ancient than the beginning of the Holocene period, like that of other major tools intended for work and daily economy activities. When dealing with not microlithic material, many types of artefacts dominating in all periods of the Stone Age are found. In the community of hunters-gatherers, various flint tools used in economy changed their forms; nevertheless, in certain moments they retained the same traditions of flint knapping. Over the entire period of Early Holocene, we observe that technological skills of flint processing impacted the
purpose of the artefacts used in economy, e.g. retouch, flint knapping. When examining archaeological material, it is noticed that, when shaping artefacts in the Late Pleistocene, in order to sharpen or renew them, the cutting splitting technique and perpendicular retouch remaining throughout the entire Early Holocene period were used. The types of artefacts used in the economy can be specified in greater detail only by using the methods of the trasological-experimental investigation. Application of these methods enables surveying the function of artefacts and specifying in detail the typology of flint artefacts being currently employed by archaeologists.

When conducting experimental investigations, scientists attempt to carry out them in as natural environment as possible (in a forest, glade), making them closer to the environment of the surveyed period. It is necessary because environment often conditions occurrence of micro- and macro-traces, e.g. scraping of skin in a meadow. For the first instance it may seem like an insignificant matter, but in a moment of work some small amount of heavy particles of soil appear on that skin, e.g. sands occurring between skin and edge of scraper form micro-traces. It is important because people of that time also had “unsterile” environment where they carried out their economy activities.

When examining flint artefacts by the trasological-experimental method, many diverse traces are found; grounding on them one can decide about their formation and classify them to separate groups. Formation of traces is mechanical and chemical because, undergoing impact of rubbing, silicon present in environment and/or split from an artefact combines with nitrates in organic material and water quickens this reaction (Annex, Fig. 121–121.2)\(^68\). Under the impact of such conditions, polish and/or linear traces fond by a microscope are formed.

When investigating artefacts by the trasological method, “classical” micro-trasological traces are recorded more rarely. More often, micro-traces are found; they are less expressive and help to minimally interpret the features. The first glance suggests that this investigation is not well appropriate for the theme of development of economy because it is already well known that hunters-gatherers used tools to process wood, bone, antler,

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skin and cut food products. Still, after reviewing technological development of economy, certain technological features having ancient traditions can be found. Continuity involving a certain technical “interpretation” can be noticed. Two major technological nuances could be distinguished: cutting splitting technique and \textit{tranche} type blow.

On the ground of trasological traces, it was found out that in frequent cases tools of a double purpose, such as scrapers-cutters, knives-cutters, were more often used as knives of scrapers only, and the part of them formed by the cutting spilt method were used as hafting and shafting. With regard to campsites of the Upper Palaeolithic period in Russia (Koromka, Janovo, Nesilovichi 1\textsuperscript{st} etc.), it is observed that at that period the burin-made technique of splitting was widely used. The layers of the campsite display both splits and flakes with shaped cut corners and parts of split artefacts (Annex, Fig. 122). However, this material has not been examined trasologically yet, therefore it is hard to define the purpose. As noticed, this technology remains until the beginning of the Neolithic period.

Also it is observed that the burin-made splitting technique was also used to form edges of a flint perforator. This technology is more reflected in the Early Holocene, and in the later archaeological material it is observed that this technology is substituted by flat retouch. Nevertheless, even in the Middle or Late Neolithic period, burin-made splitting is still noticed on retouched heads of knives or arrows formed as protective hafting and shafting. Thus, this way of shaping hafting and shafting of tools has quite ancient traditions that were recorded by using the trasological-experimental investigation.

The main aim of the current research study was to find out whether the typology of major artefacts of the Early Holocene period designed by archaeologists until now corresponds to its functional purpose after conducting it by the experimental-trasological method. Out of the types of artefacts attributed to the Early Holocene period by the typological method, major tools used for work at that time, i.e. exes, scrapers, awls, perforators, burins, knives, have been selected. After carrying out experimental-trasological analysis, this data was obtained.

After examination of perforators of the Early Holocene period by using the experimental-trasological method, it was found out that majority of them typologically cannot be attributed to the artefacts used to perform the function of perforation. Trasological features show that majority of perforators have no the traces trasologically characteristic to
them. If talking about macro-traces, they should manifest at least in two out of three or four edges (Annex, Fig. 11, 17.2). If talking about micro-traces, they should manifest through the polished surface of flat places of these perforators (Annex, Fig. 16.1). Also, if perforators were used to process hard material, linear traces should have been formed on perforator’s basils situated horizontally along edges (Annex, Fig. 20.2). It should be noted that some birch tar remain on the hafting and shafting part of perforators (Annex, Fig. 16.2) and macro-traces of utilisation are seen. Unfortunately, when examining materials considered as perforators from settlements of the period under investigation by employing the trasological method, majority of them do not display the above-mentioned features. When approaching perforators from the technological aspect, three different ways of formation of perforators can be distinguished: 1. When perforators are being formed by naturally splitting a flake or using the upper part of a split having a triangular crosscut (Annex, Fig. 18 and 22); 2. When perforator’s working surface is being formed by retouch (Annex, Fig. 16 and 15); 3. When perforator’s surface is being formed by a burin-made flake (Annex, Fig. 13 and 21). After carrying out experimental investigation, it was found out that the perforators that had been formed by employing the burin-made technique performed their function more effectively that those formed by other ways. Perforators formed by the burin-made technology in the Early Holocene period settlements are encountered quite often. However, perforators which technologically could be pointed out after formed by retouch, after investigation by the trasological method it was found out that were affected by the utilisation process, but actually they had been formed in the burin-made manner.

Having investigated awls of the Early Holocene period by applying the experimental-trasological method it was found that they were usually produced from flakes or micro-blades. After examining them by applying the trasological method, we observe that they are usually characteristic of macro-utilisation features and very rarely of micro-utilisation features. If to specify with details on the macro-traces, usually they are the broken part of a spike (Annex, Fig. 60), and one edge is with single utilisation-related splits (Annex, Fig. 65.1). If to provide details on the micro-traces, they manifest on the part of a spike or on corners of a broken spike (Annex, Fig. 62.1). Trasological traces on awls’ spikes manifest through polishing to each other and, rarely, by single linear
traces which are formed on awls in the spiking direction. The term of awls is not typologically defined in literature. Usually any sharp pointy fragment of a flake or split made of flint can be attributed to this type. This typological problem can be solved only by using the trasological method. Experimental investigations show that the use of awls was specific because they would pierce only a relatively thin skin.

Having examined scrapers of the Early Holocene period by applying the experimental-trasological method, several different types of them were identified. Types of scrapers that received most of the attention during the investigation are the double-purpose artefacts: scrapers-burins (Annex, Fig. 27), scrapers-knives (Annex, Fig. 22). After carrying out trasological investigation it was observed that quite a big part of scrapers were of a double-purpose, even though typologically it was not identified by archaeologists. Usually, basils of double-purpose burins’ edges have traces of utilisation. Deciding from the utilisation traces, these artefacts whose edges were cut like knives were used for cutting skin or meat. These scrapers which had a burin-shaped part had no utilisation traces characteristic to scrapers (Annex, Fig. 27.1 and 39.1). This burin-made technique was used as protective and for shaping the hafting and shafting part (Annex, Fig. 28–28.2 and 34–34.3). Detailed characterisation of the ways of shaping scraper’s edges requires mentioning that some part of the scrapers has no retouch; nevertheless, the working edge was used for skin processing, as suggested by trasological traces (Annex, Fig. 27 and 40). If an artefact turned to be no longer functional, its working edges would be renewed by retouch. Therefore, the types of scrapers most usually identified by archaeologists are these artefacts that have retouch. The tranche type blow is a more seldom used method of formation of scrapers’ edges; in Lithuanian and foreign archaeological literature it is almost not mentioned (Annex, Fig. 30). Caused by skin processing, the scrapers receive usually micro-traces or more rarely macro-traces (Annex, Fig. 38.1). The polishing should be treated as micro-traces on the working edges, whereas macro-traces are found on single utilisation-related splits of their edges (Annex, Fig. 53.1). During experimental work with scrapers, trasological features and the change of scrapers’ working edge have been found. Dense and relatively fine linear traces form on the working edges of scrapers in rarer cases (Annex, Fig. 35.1).
After investigation of scrapers of the Early Holocene period by employing the experimental-trasological method, it was found out that they are typologically well pointed out in scientific literature. However, grounding on trasological investigation, not all typologically pointed out scrapers meet their function. Regarding the data of trasological investigation, in the Early Holocene burin-made splitting was more often used as a technological means for forming the hafting and shafting part of artefacts (Annex, Fig. 81, 81.1) or renewal of the working part of the artefacts (Annex, Fig. 22). Trasological investigations demonstrate that the working part of scrapers usually has some macro-traces which manifest by macro-splits (Annex, Fig. 94.1, 94.2). Micro-traces are found on the working part of scrapers quite seldom (Annex, Fig. 96.1). The found micro-traces manifest by polish (Annex, Fig. 101.1) or linear features (Annex, Fig. 95.2). Experimental examination of scrapers shows that micro-traces form very seldom.

Archaeological literature scarcely mentions the Early Holocene flint knives. Grounding on morphological-trasological features, separate types of knives have been distinguished: knives intended for wood, bone/ antler shaving, skinning knives. Other types of knives can be distinguished only by applying the trasological method according to micro- and macro-traces. Bits which were intended for processing of bone/ antler bear strongly pronounced micro-trasological traces manifested through polish and linear features (Annex, Fig. 79) and macro-traces manifested through rough splits (Annex, Fig. 80.2). Skinning knives bear rare single splits on their edges and a polished basil (Annex, Fig. 81.2). The type of this artefact is singled out among flake knives (Annex, Fig. 76). The knives intended for processing meat and fish bear no more strongly pronounced trasological traces. Experimental investigation of the knives allowed interpreting trasological traces and their functionality.

Having investigated the knives of the Early Holocene period by applying the experimental-trasological method, it was found that they were mostly made of massive flint flakes, split parts. They are found in archaeological material seldom, most often parts of their edges morphologically formed by tranche type blow. Trasological investigation of flint axes of the period mostly point to the manner of their use rather than the material of processing. When examining axes, the typological problems appeared: whether knives were used either as
adzes or axes. It is hard to identify this problem in the case of early axes without trasological examination. Trasological investigation of axes shows that macro-traces remain on their edges (Annex, Fig. 106.1), and linear micro-traces are found above the edges, on more stable surface of basils (Annex, Fig. 107.1). On the surface of axes, single sites of specular polish are located (Annex, Fig. 105.1). Experimental examination of axes facilitated clearer understanding of the places and causes of location of trasological traces.

CONCLUSIONS

1. Grounding on experimental-trasological investigation of archaeological material in Lithuania and the East Baltic region, technological development of the Early Holocene period economy is explored for the first time. In the flint processing industry of the period under analysis, no cardinal changes happen; however, a specific technological manner of forming tools appears (flint knapping technology for artefacts dominates, the artefacts are shaped by using the burin blow technique, microliths technology establishes), which, referring to archaeological material of the East Baltic region, was analysed by scientists neither from East Baltic nor neighbouring countries. This technological development was caused by natural environment and people’s lifestyle. In the Early Holocene period, nature has cardinally changed, flora flushed, the territory of the East Baltic region occurred in the forest zone. Emerging new specific branches of economy, i.e. hunting, fishing and gathering in the forest environment, impacted the change in technologies of the flint processing and production of other tools in that period.

2. Analysed and repeated technologies of flint knapping, retouch dating back to the Early Holocene period allowed estimating that communities of that period used hard, semi-pressure and pressure technique of knapping. In complexes of artefacts of that period, perpendicular or semi-perpendicular, in rarer cases flat retouch method is observed on made work tools. These technological features were used to produce as accurate artefacts intended for experiments as possible.

3. After carrying out experimental investigation, tools similar to those used for processing of organic materials in the Early Holocene
period have been made. The following technological features have been identified during testing: 1. The change of the working surface throughout the work process. The working surface of flint artefacts is changing in the course of work as a result of the contact with processed materials of different density, e.g. during wood shaving or bone cutting, various lesions form on a flint tool’s edge. 2. Hafting and shafting parts of an artefact and its effective use in the process of work. In classical typology, accommodative parts underlining functionality of an artefact are seldom distinguished. When effectively using artefacts with hafting and shafting parts, more accurate their purpose can be estimated because formation of trasological traces depends on the manner of hafting and shafting, too, e.g. when an accommodative part of one artefact is formed on the upper and lower parts utilisation during work evenly forms over the overall working surface. When working with non-shafted artefacts, irregular features of lesions form on different sites of artefact’s edges. 3. Specific use of an artefact in the process of work, grounding on the classical typology. When estimating functionality and effectiveness of the classical typology, it was aimed to technologically recreate the artefacts and to perform tests with them according to their primary classification. Such method of analysis of the artefacts helped in more clearly pointing out technological (retouch, purposeful knapping when forming an artefact, burin made blow) and trasological (utilisation retouch, ragged rough utilisation retouch, single fractures) stages of formation of the artefacts. Therefore, such examination of the tools from the production process to the final their use made impact on the designed classification of the artefacts.

4. When carrying out trasological investigation of the Early Holocene flint materials stocked in museum collections in the East Baltic region and conducting trasological investigation of replicas of the artefacts, the following have been found out: 1. Classical typology of artefacts not always complies with conclusions of trasological investigation. Artefacts of the Early Holocene East Baltic region have never ever been analysed by employing the trasological method so far. Until now, archaeological material did not include any specifically singled out types of these artefacts: awls, knives, adzes, unretouched scrapers, perforators shaped in a burin made manner. 2. Trasological investigation facilitated detailed examination of the function of the artefacts (e.g. a knife for meat, a knife for bone/antler, a knife for skin, a knife for
wood). Detailed identification of work tools according to macro- and micro-lesions of the working surface, such as rough irregular crumbling and formation of a specular polish surface enabled creating new functionality of the artefacts. 3. According to trasological features, a new typology of flint artefacts was designed (unretouched scrapers, scrapers with burin-made hafting and shafting part, perforators made by a burin-made blow, axes-adzes, awls, knives). According to recent data of research, a new typology of the artefacts could be distinguished by referring to trasological and technological features: unretouched scrapers, scrapers with burin-made hafting and shafting part, perforators made by a burin-made blow, axes-adzes, awls and knives. In the East Baltic region, the types of these artefacts have not been pointed out so far. The latter newly pointed out groups of the artefacts also were attributed with technological trasological features after detailed examination, and their minimal change in the Early Holocene period was estimated. The following characteristics of the artefacts have been distinguished: for perforators – the working perforating part was formed by a burin, retouch or partly natural edge. For awls – a group of the artefacts formed of flakes, burin-made blow or tranche type flakes are sometimes used for their production. For scrapers – the working part would be used unretouched and only in the later phase it would be renewed by retouch. One side edge of the artefact would be used as a knife, and the hafting and shafting part was formed by a burin. For knives – usually made of splits, and the hafting and shafting parts are shaped by perpendicular (protective) retouch or burin-made splitting. For axes – usually formed as biphasic artefacts, and edges are formed in two ways: tranche type splitting or splitting flakes from edges towards the centre of the artefact. For burins – the working part of these artefacts is shaped by splitting only. In rarer cases, the base is retouched, and then the knapping is applied.

The following have been identified after the discussion of the change of flint artefacts in the Early Holocene period:

– flint axes get a specific shape only in the beginning of the Early Holocene period, when their central part was formed narrower (clenched) or with leaning edges. And in the later phase of this period axes of a lentil, relatively symmetric form, appear. In the middle phase of the Early Holocene, there are no typically pointed out forms of axes which would suggest designing their typology;
– in the beginning of the Early Holocene period, end scrapers are formed with a burin hafting and shafting part, and in the later phase of the period they are less frequent or disappear at all;
– in the case of perforators, a similar method of shaping is observed. In the early and middle phases of the Early Holocene, they are formed in a burin-made manner, and in the later phase a retouched working surface is found.
– in the Early Holocene period, for burins, the working part intended for purposeful use is less covered with utilisation micro-traces. In the late phase of the Early Holocene period, typical forms of burins form, and utilisation traces are found on their edges;
– in the early phase of the Early Holocene, knives bear no clearly pronounced form, and their accommodative parts are formed by perpendicular retouch or burin-made splitting; in the late phase of the period, burin-made splitting is substituted by semi-flat and flat retouch.

5. Grounding on the data of experimental-trasological investigation, it was identified that in the Early Holocene period major types of the artefacts were characteristic of specific features of micro- (linear traces, polished surface, combined features of polished surface and linear traces) and macro- (regular and irregular crumbling, rough and deep utilisation retouch, rounded edge) traces. The trasological features enabled dividing the artefacts according to their functional purpose, and, having merged them with the technological data, it was possible to more broadly assess the change of formation of the groups of artefacts in the Early Holocene period in the East Baltic region.

6. In the East Baltic region in the Early Holocene period it was observed that the technologies which had been accepted from the Late Pleistocene were adapted to another technological purpose. This is observed in application of burin-made splitting for the hafting and shafting part and formation of the working surface of the artefacts, adjustment of the tranche type technique for the groups of specific artefacts (axes, scrapers). Later, this technological innovation was accepted from the communities of the Middle Holocene but used not so widely as in the Early Holocene period.

Translated by Monika Gruslytė


Iš dalies aptariamas technologinės ūkio raidos laikotarpis įsiterpia tarp dviejų skirtingų klimato – driasos III ir subatlančio I – laikotarpių. Materialinės kultūros raidos požiūriu šis laikotarpis yra tarp mikrolitinės technologijos ir keramikos dirbinii atsiradimo; ūkio požiūriu – tarp labiausiai išplėtoto miškų zonos pasisavinamovo ūkio ir gamybinio

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ūkininkavimo pradžios; visuomeninės raidos požiūriu – tarp klijoklių medžiotojų, žvejų ir maisto rinkėjų bendruomenių ir sėścių gyvulių augintojų bei žemdirbių bendruomenių formavosi pradžios. Šiuo laikotarpiu žmogus, kaip biologinė būtybė, prisitaikė gyventi pakitusioje gamtineje aplinkoje – nykstant tundros ir miškatundrės augmenijai iki įsigalint plačialapiams miškams.

Aptariamuoju laikotarpiu laikotarpinės bendruomenės išgyvenčioji iš pasisavinamojo ūkio buvo gana sunku. Tai vertė Rytų Pabaltijyje gyvenusias bendruomenes būti kūrybiškoms gaminantis racionalius ir veiksmingus darbo įranga ir ginklus. Technologiniai darbo įrankių gaminimą išsuka, susiformavę dar preborealyje, kad Rytų Pabaltijo teritorija apaugo miškais, išliko iki atlenčio pabaigos. Vėliau, jau vidurinio neolito laikotarpiu, pradedant formuotis gamybinio ūkininkavimo būdai, didėjant laukų plotams, kurie buvo skirti gyvulininkystei ir žemdirbystei, keičiasi ir titnaginių darbo įrankių ir ginklų gamybos technologijai bei į ją forma. Darbe bus apsiribojama ankstyvojo holoceno laikotarpio ūkinės technologijos kaitos tyrimais, susijusiems su pasisavinamojo ūkio raide, nes šio laikotarpio medžiaga detaliai nėra nagrinėta. Tačiau tam, kad galima būtų palyginti ankstyvojo holoceno laikotarpio titnaginio dirbinių gamybos technologijas bei dirbinių panaudojimo ypatumus su vėlesnėmis, jau neolito laikmečio, dirbinių gamybos ir jų panaudojimo technologijomis, darbe bus panaudota ir vėlesnio laikotarpio medžiaga iš Šarnelės, Daktariškės 5-osios gyvenviečių (Telšių r.) bei ankstyvesnė – vėlyvojo pleistoceno stovyklaviečių titnaginė medžiaga (Latvijos, Baltarusijos ir Rusijos).

**Tyrimų metodai.** Darbe buvo taikomi šie tyrimų metodai: technologinis, eksperimentinis, trasologinis, palyginamasis, analizė, sintezė, indukcija ir dedukcija. Darbe aprašyti eksperimentiniai-trasologiniai tyrimai, panaudojant šiuos metodus, atlikti Klaipėdos universiteto Baltijos regiono istorijos ir archeologijos instituto


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Eksperimentai buvo atlikti ir su žuvimis, nugaišusiais ar medžioklėje sumedžiotais gyvūnais, juos išdarinėjant, mėsinėjant, išimant sausgyšles ir kt., taip praplečiant praktines žinias apie ankstyvojo holoceno laikotarpio medžiotojų naudojamas skerdimos technologijas, titnaginių darbo įrankių panaudojimą skerdenų suformavimo procese po medžioklės.

**Tyrimų objektas.** Lietuvos archeologijos paveldą sudaro archeologijos paminklai, muziejuose saugomi archeologinių radinių

33 Семенов, С. А. 1957. Первобытная техника (опыт изучения древнейших орудий и изделий по следам работы). Материалы и исследования по археологии СССР, № 54. Москва, Ленинград: Академия наук СССР;

**Darbo problema.** Pagrindinė šiame darbe kelia problema – išaiškinti Rytų Pabaltijo ankstyvojo holoceno titnaginių dirbinių technologinę raidą ir jų kaitą to meto žmonių darbo procese. Šią problemą spręsti ir tyrimus vykdyti įgalingo įsisavintos naujos technologijos, suteikiančios galimybę efektyviai ir nuodugniai išsirti pagrindinę iki šiol archeologų sukauptą ankstyvojo holoceno laikotarpio titnaginę medžiagą.

Darbo naujumą sudaro eksperimentinio-trasologinio tyrimo metodo naudojimas tyrinėjant ankstyvojo holoceno titnaginius dirbinius. Darbe, taikant minėtą metodą, buvo siekiama nustatyti ankstyvojo holoceno titnaginių dirbinių gamybos technologiją ir jų funkciją. Iki šiol Lietuvos archeologijos akmens amžiaus tyrimuose nebuvo pateikta nė vieno mokslinio darbo, nagrinėjančio atskirų archeologinių laikotarpinių ar vienos dirbinių tipologinę grupęs gamybos technologiją ir trasologiją. Šiame darbe bus pateikti minėti tyrimų duomenys apie ankstyvojo holoceno laikotarpio pagrindinius titnaginius dirbinius: peilius, grąžtelius, ylas, gremžtukus, kirvius ir rėžtukus. Taikant eksperimentinių-trasologinių metodų imanoma tiksliau pažinti ir atskleisti priešistorės žmonių gyvenseną, į kurią įvertinti technologines inovacijas.

**Darbo tikslas.** Šio darbo tikslas – nustatyti ankstyvojo holoceno laikotarpio technologinę ūkio raidą, analizuojant pagrindinius šio laikotarpio dirbinius eksperimentiniu-trasologiniu metodu.

**Darbo uždaviniai.** Tikslui pasiekti buvo keliami uždaviniai, nusakantys šio darbo eksperimentinių-trasologinių tyrimų etapus:

1. Nustatyti ir rekonstruoti pagrindinių ankstyvojo holoceno titnaginių dirbinių gamybos technologiją, siekiant pagaminti eksperimentinius dirbinius.
2. Pagal ankstyvajame holocene naudotus darbo įrankius ir nustatytą technologiją paruoštį to meto darbo įrankių replikas, panaudojant tam laikotarpiui būdingą titnago skaldymo ir dirbinių gamybos techniką.

3. Su pagrindinėmis dirbinių replikomis (grąžtais, rėžukais, gremžtukais, peiliais, ylomis, kirviais) atlikti eksperimentinius tyrimus apdorojant kailius, odą, medį, kaulą-ragą, siekiant nustatyti ankstyvojo holocene darbinės technologijos ypatumus.

4. Trasologiniu mikroskopu nustatyti muziejų rinkiniuose ant ankstyvojo holocene laikotarpio dirbinių esančius trasologinius pėdsakus ir palyginti juos su pėdsakais ant pagamintų replikų.


6. Patikslinti ankstyvojo holocene bėduomenių ūkyje naudotą technologiją.

**Pagrindiniai ginamieji teiginiai:**

1. Ankstyvojo holocene laikotarpio titnaginių dirbinių tipologija neatitinka eksperimentiniu-trasologiniu metodo nustatytos dirbinių paskirties. Šio laikotarpio dirbinių tipologija buvo sudaryta pagal dirbinių morfologiją, o ne pagal trasologinius požymius, nes trasologinis tyrimo metodas yra vėlesnis.


4. Eksperimentinis-trasologinis metodas detalizuojoa klasikiniu tipologijos metodo nustatytos dirbinių funkciją.

**Disertacijos struktūra.**


**Išvados**

1. Anksto holoceno technologinė ūkio raida, remiantis archeologinės medžiagos eksperimentiniais-trasologiniais tyrimais Lietuvoje ir Rytų Pabaltijyje, atliekama pirmą kartą. Analizuojamoje šio laikotarpio titnago apdirbimo industrijoje kardinalių pokyčių neįvyko, tačiau atsiranda savitas technologinis įrankių formavimo būdas (vyrauja dirbinių skeltinė technologija, dirbiniai formuojami naudojant rėžtukinę techniką, įsigalė mikrolitinė technologija), kuris, remiantis Rytų Pabaltijo archeologine medžiaga, nebuvo analizuojamas nei Rytų Pabaltijo, nei kaimyninių šalių mokslininkų. Šią technologinę raidą

2. Analizuotos ir atkartotos ankstyvojo holoceno laikotarpio titnago skaldymo, retušavimo technologijos leido nustatyti, kad šio laikotarpio bendruomenės naudojo kietą, pusiau kietą ir minkštą skaldymo techniką. To laiko dirbinių kompleksuose ant pagamintų darbo įrankių dažniausiai aptinkamas statmenas arba pusiau statmenas, retesniais atvejais ploščias retušavimo būdas. Šie technologiniai ypatumai buvo panaudoti gaminant kuo tikslesnius eksperimentams skirtus dirbinius.


Aptariant titnaginių dirbinių kaitą ankstyvojo holoceno laikotarpiu nustatyta, kad:
titnaginiai kirviai savitą formą turi tik ankstyvojo holoceno pradžioje, kai jų centrinė dalis buvo formuojama siauresnė (pergniaužta) ar su pasvirusiais ašmenimis. Šio laikotarpio vėlyvajame etape išryškėja lešio santykinai simetriškos formos kirviai. Ankstyvojo holoceno vidurinėse etape nėra tipiškai išskirti kirvių formų, pagal kurias būtų galima sudaryti jų tipologiją;

galiniai gremžtukai ankstyvojo holoceno pradžioje yra formuojami su rėžtukiniu įtvaru, o vėlyvajame etape jie rečiau aptinkami ar išvis išnyksta;

grąžtelės formavimo būdas irgi panašus. Ankstyvojo ir vidurinio ankstyvojo holoceno laikotarpio jie formuojami rėžtukiniu būdu, o vėlyvuoju laikotarpiu aptinkamas retušuotos darbinis paviršius;

rėžtukų ankstyvojo holoceno laikotarpio tikslinio panaudojimo darbinė dalis rečiau būna su utilizciniais mikropėdsakais. Vėlyvajame ankstyvojo holoceno etape susiformuoja tipinės rėžtukų formos, o ant jų briaunų matyti utilizacinių pėdsakų;

peiliai ankstyvajame ankstyvojo holoceno etape neturi ryškios formos, o jų akomodacinės dalys yra formuojamos statmenu retušu arba rėžtukiniu nuskėlimu. Vėlyvuoju šio laikotarpio etapu rėžtukinių nuskėlimą nuskėlėjimą pakeičia pusiau paplokščias ir plokščias retušas.

5. Remiantis eksperimentinių-trasologinių tyrimų duomenimis buvo identifikuota, kad ankstyvojo holoceno laikotarpio pagrindiniam dirbinių tipams būdingi mikro- (linijiniai pėdsakai, gludintas paviršius, kombinuoti gludinto paviršiaus ir linijinių pėdsakų požymiai) ir makro- (reguliarūs ir nereguliarūs ištrupėjimai, grubus ir gilus utilizacinius betušas, užapvalinta briauna) pėdsakų išskirtinumai. Trasologiniai požymiai dirbiniai padėjo suskirstyti pagal jų funkcinę paskirtį, o juos sujungus su technologiniais duomenimis buvo galima plačiau įvertinti dirbinių grupių formavimosi kaitą Rytų Pabaltijyje ankstyvojo holoceno laikotarpiu;

Trumpos žinios apie doktorantą


Nuo 2018 m. sausio mėn. Klaipėdos universiteto BRIAI jaunesnysis mokslo darbuotojas.

Nuo 2007 m. dalyvauja archeologininėse ekspedicijose ir vykdo archeologinius mokslinius tyrimus. Nuo 2009 m. dalyvauja tarptautinės eksperimentinės archeologijos projektuose ir festivaliuose Lietuvoje, Latvijoje, Lenkijoje, Rusijoje, Norvegijoje, Danijoje, Prancūzijoje. Skaitė mokslinius pranešimus konferencijose Turkijoje (Stambule), Švč. Šventosios Marijos altorės kunigaikščio ir Šventosios Marijos kelio (Olštyne). 2017 m. stažavosi Sankt Peterburgo Istorijos ir Archeologijos materialinės kultūros tyrimo instituto eksperimentinės archeologijos ir trasologijos laboratorijoje.


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Mokslo populiarinimo straipsniai


Mokslines konferencijos

1. SLAH Gvidas. „Titnaginių grąžtelių gamybos technologijų rekonstruokija ir trasologiniai tyrimai, remiantis Katros 1-os gyvenvietės archeologiniais duomenimis“. Penktasis istorijos ir archeologijos studijų doktorantų nacionalinis seminaras. Klaipėdos universitetas. 2014-04-10,


4. SLAH Gvidas. „Examples of experimental archaeology in Lithuania. Tarptautinė konferencijai „Key to history – key to the future tourism development“. Olsztyn, 2015-06-09–11.


IDENTIFICATION OF TECHNOLOGICAL DEVELOPMENT OF ECONOMY IN THE EARLY HOLOCENE PERIOD GROUNDING ON THE EXPERIMENTAL-TRASOLOGICAL INVESTIGATION OF THE ARCHAEOLOGICAL MATERIALS OF THE EAST BALTIC REGION

Summary of doctoral dissertation

ANKSTYVOJO HOLOCENO TECHNOLOGINĖS ŪKIO RAIDOS PAGAL RYTŲ PABALTIJO ARCHEOLOGINĖS MEDŽIAGOS EKSPERIMENTINIUS-TRASOLOGINIUS TYRIMUS NUSTATYMAS

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