

THE INFLUENCE OF THE ENVIRONMENT ON THE HUMAN POPULATION AROUND LAKE KRETUONAS DURING THE STONE AGE AND THE BRONZE AGE

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Abstract

New data from archaeological, zooarchaeological and palynological studies of the archaeological sites around Lake Kretuonas (in eastern Lithuania) show that environmental conditions had a great influence on the formation of the economy, settlement and cultural life of its inhabitants. This paper analyses the causes of the changes in environmental conditions and their influence on the population in the Lake Kretuonas area in the Stone Age and Bronze Age.

Key words: East Lithuania, Lake Kretuonas, Stone Age, Bronze Age, economy, environment, cultural landscape.

Introduction

Lithuania has few works so far regarding the cultural landscape and its evolution. Some of them are dedicated to elucidating the evolution of the cultural landscape of the Lake Biržulis area (The Evolution of the Samogitian Highland's Cultural Landscape, 2004) and the areas around lakes Duba, Glūkas, Varėnis and Veisiejis in southern Lithuania (Baltrūnas *et al.* 2001). When speaking of the cultural landscape in this article, we emphasise the diversity of the landscape that formed due to society's economic activities, and when speaking of the natural landscape, its environmental diversity. A varied type of cultural landscape forms in a corresponding area based on the environment, its peculiarities, and socioeconomic activities. This could be agrarian, urbanised or industrial. In this article, we touch more broadly on the formation of the agrarian landscape in a small part of the Lake Kretuonas basin in the Stone Age and Bronze Age.

In investigating the Lake Kretuonas area as one microregion, from archaeological (Girininkas 1990, 1996, 2002, p.187-196), geological, palaeogeographical (Garunkštis, Stanaitis, Pociukonienė 1974, p.5-39), palynological (Kabailienė 2006, p.366-370; Antanaitis-Jacobs, Stančikaitė 2004 p.251-266), macrobotanical (Antanaitis-Jacobs, Stančikaitė, Kisieliene 2002, p.5-21), zooarchaeological (Daugnora, Girininkas 1996; 2004a) and economic (Girininkas 2005, p.149-196, 269-275; Daugnora, Girininkas 2004b, p.233-250) points of view, it is notable that people inhabited the area throughout the entire prehistoric period. Such inhabited microregions are very rare in Lithuania. Interdisciplinary investigations help in answering the main

questions raised in this article: How did the people living in the Lake Kretuonas area change their environmental surroundings, and how did changes in the environment affect people's way of life? Detailed research shows that the environmental conditions in the Stone Age and Bronze Age were good enough to live there: people could subsist on the natural resources around them, on the fish in Lake Kretuonas and other water bodies in its basin, the many varieties of flora and fauna living in the mixed forests, and, starting with the Neolithic, from the fields and pastures around the settlements. The problems examined in this article deal with the consequences of people's economic activity on the flora and fauna, as well as the influence of the natural resources on the people in the formation of their economy, social structure and intercultural relations with other communities living in similar microregions in the Eastern Baltic (those of Šventoji in Lithuania, and Lubans in Latvia). The research mentioned above shapes our understanding of the formation and evolution of the cultural (agrarian) landscape around Lake Kretuonas.

Physical-geographical conditions and the geomorphology of the Lake Kretuonas area

The Lake Kretuonas basin is on the boundary between eastern Lithuania's Švenčionys and Ignalina districts, between the Švenčionys-Naročius highland and the Žeimena lowland. Its length is 15.5 kilometres and its width is 10.4 kilometres, and it belongs to the basin of the River Žeimena (Plate III:1). From a geologi-

cal point of view, the approximately 50-metre-thick glacier of the Würm glaciation formed the morainic clayey and sandy loams, clays, sands and gravels that were left behind. The bottom layer that formed in this period is more clayey, while the top layer is washed and sandy. These layers are thickest on the hills, and thinnest in the depressions. In the western part of the Lake Kretuonas basin, where the ground surface is 170 metres above sea level, they are covered with sand and gravel, most of which is of limnoglacial origin, and a small part of which is fluvioglacial.

The lowest part of the basin is Lake Kretuonas' deepest ravine, at 135 metres above sea level. The water level of Lake Kretuonas is stable, at 145 metres above sea level. A terraced plain encircles the lake. The relief of the Kretuonas basin rises in an easterly direction, where there are both hills and 22 small lakes that lie between the hills. Flowing between the small lakes are rivulets, which are highest in the spring. Four rivulets flow into Lake Kretuonas, while one rivulet, the Kretuonėlė, flows into Lake Žeimenas (Fig. 1). The relief by the eastern edge of Lake Kretuonas reaches a height of 220 metres.

Lake Kretuonas and the other bigger lakes of Vajuonis and Kretuonykštis, as well as currently silted-up lakes, comprise one microregion, in which separate communities lived from the Late Palaeolithic to historic times. Approximately 60 archaeological sites, belonging to all the prehistoric periods, have been found in this microregion (Fig. 2). Very few microregions like this exist in Lithuania: one is at Lake Biržulis (western Lithuania, in the Telšiai district), and another at Lake Duba (in southern Lithuania, in the Varėna district). Usually, sites from only one prehistoric period are found in any one environmental microregion. What influenced the fact that the communities living around Lake Kretuonas could settle and live well enough throughout all of prehistory? First of all, it was the very favourable environmental surroundings that formed and were formed by the people living there.

Lithological and surface geomorphological research into the Kretuonas basin are important in discerning the people's economic activity and way of life. Organic sediment, peat, has extended over the very lowest of the lake shores on Lake Kretuonas' southern, southwest and northeast sides. Peat is also found on the shores of Lake Kretuonykštis. Limnoglacial sediments are widespread in the northern and western part of the Kretuonas basin, in the outwash plain. In the southwest part, they slowly transform into clayey loams. Sandy sediments also dominate the lake's southeast coast, despite the separate hills there being formed from clayey loams. The largest clayey loam plots cover the Kretuo-

nas basin's eastern part, especially near lakes Vajuonis and Kretuonykštis. Many bogs surround lakes Kretuonas and Kretuonykštis (Fig. 4). The various postglacial sediments that formed later conditioned the heterogeneous formation of the soil. In the larger part of the basin where morainic clayey loam hills dominate, turfy, ashen grey, weakly podsolized soils also dominate. In the southwest part of the lake and basin, where sandy parent material dominates, ashen-grey soils dominate. The depressions contain marshy, ashen-grey soils. Different vegetation grows in the different soils. Dry pine forests are widespread in the basin's western part, which transform into deciduous trees, hazel, birch and alder, covering the low-lying marshland around Lake Kretuonas in the southwest. Juniper groves grow in the basin's eastern part, especially on the morainic hills, while pine forests grow between them in the sandy tracts. Five zones of vegetation can be distinguished in the lakes, especially in Lake Kretuonas: shallow water, reed-rush, water lily (spatterdocks, floating pondweed), broad-leaved pondweed, and limnetic.

The evolution of the Kretuonas basin's depression. Stone Age and Bronze Age settlement topography

Late Palaeolithic

Lake Kretuonas lies in the depression that was formed by the last glaciation and its melting waters, on the west side of the old Švenčionys highland, which was a huge obstacle in the last glaciation, breaking up the edge of the glacier into separate tongues (Kabailienė 2006, p.367). Several significant places remain around Lake Kretuonas (Veršelis Hill, the plains near the village of Akmeniškiai) where, when the edge of the glacier was in eastern Lithuania around 16,000 years ago, a near-glacial 170-metre hypsometric level lagoon stretched to the southeast of the ice sheet (Fig. 4a). Signs of ancient water activity, bands of sand bars formed by surf, can be clearly observed there. When the water level fell to 160 metres above sea level, the Kretuonas-Vajuonis depression began to break off from the Žeimenis valley further to the west, along which the glacier's melting waters would flow heavily to the south. Channels formed between the Kretuonas-Vajuonis and Žeimenis highland that emerged. When the water level fell to 154 metres above sea level, one unified large lake stretched between Kretuonas-Vajuonis and Kretuonykštis (Fig. 4b). The pedogenesis processes intensified, and the washing out of carbonates from the top layers started only in the Allerød (11,900 BP), when the water level reached 152 metres above



Fig. 1. Lake Kretuonas: inflowing and outflowing rivers.

sea level. The tundra and forest-tundra were replaced by sparse birch-pine forests.

In the Dryas III period (10,900 to 10,000BP), when the climate cooled once again, the water level of the Kretuonas basin fell to 150 metres above sea level (Fig. 5c). In this period, Kretuonas separated from Lake Vajuonis, and only the small Vajuonėlė rivulet formed between them. Extrazonal features can be observed in the Lake Kretuonas area in this period. The pine forests that spread in the Allerød flourished only on the hills' southern slopes. Vegetation characteristic of forest-tundra grew in plots with a more level relief: fir trees, birch and dwarf birch (for a broader description of the vegetation, see the next section).

The first inhabitants appeared in the Lake Kretuonas area during the Dryas III period. They established their habitation sites on the hills' southern slopes. These are the people who left behind the Ahrensburgian and Swiderian technocomplexes (Šatavičius 1996, p.30-31). Traces of their habitation include the Rėkučiai 1 site, located near the former Lake Vajuonis and Lake Kretuonas channel (Fig. 2), on the northern shore of

Lake Kretuonas. The site is currently on the second terrace, presently three to four metres above the lake's water level. Three stages of human occupation can be discerned in the latter site's cultural layer: Ahrensburgian and Swiderian, which belong to the Late Palaeolithic, and the Preboreal stage of Kunda Culture. Arrowheads with narrow tangs made from blades that were flaked from cores with two platforms are attributed to the Ahrensburgian cultural layer's artefacts. Scrapers and burins, whose cutting edges were formed in the corners of broken blades, were found. Points with a clearly distinguished tang belong to the Swiderian complex. These features indicate this culture's affiliation with the early period. The Pulli-type points found here are attributed to the Mesolithic layer.

According to investigations at this settlement, the Late Palaeolithic inhabitants established themselves in a favourable location from an environmental

point of view: on a former hill's southern slope, near a channel where it was also possible to fish.

The reindeer antlers found along the eastern shore of Lake Kretuonas belong to this period (Daugnora, Girininkas 2005, p.121). This would suggest that reindeer herds roamed near the lake during the Dryas III period, and that hunters, who used to live in the oval contoured dwelling with a hearth found at the Rėkučiai 1 camp site, would have stayed here (Šatavičius 1996, p.30-31).

Mesolithic

Palynological and diatom research data suggests that the water level of Lake Kretuonas in the Preboreal and Early Boreal periods was low: scanty precipitation meant little accumulation in the Kretuonas basin. At this time, the sandy soils became calcified, thus very favourable conditions formed for forests to become firmly established. Birch dominated around the lake in the Preboreal, while pine forests spread in the Early Boreal. During this period, the inhabitants established themselves on the second and third terraces of the lake.

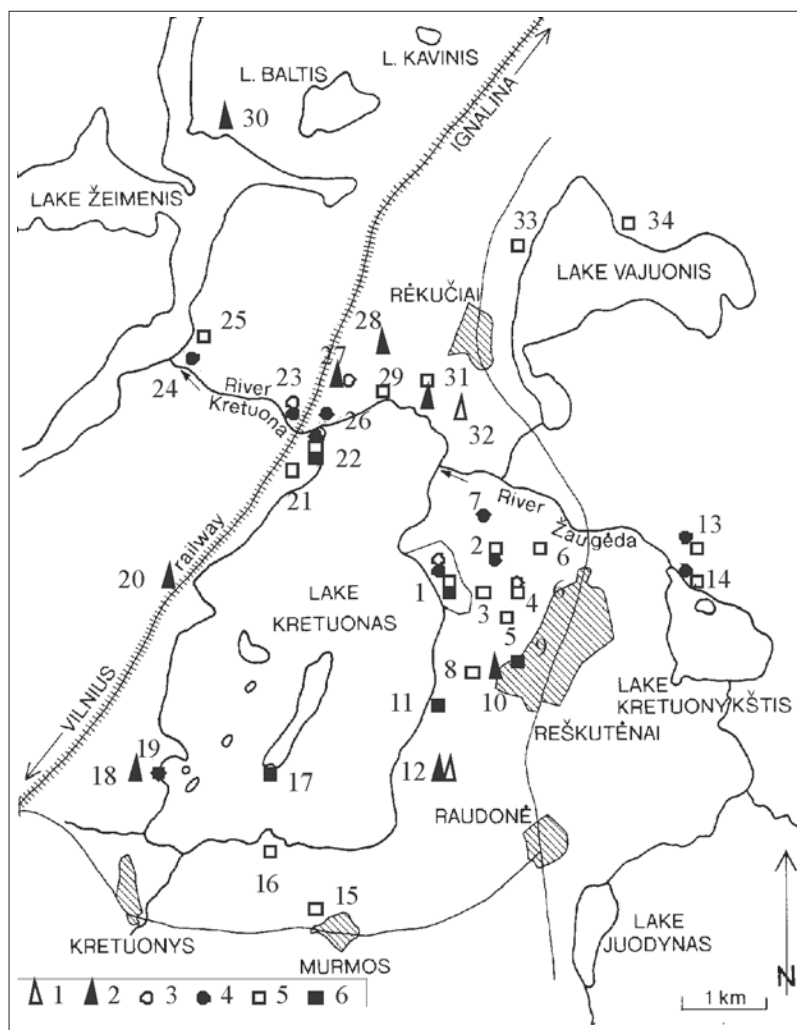


Fig. 2. Archaeological sites in the Lake Kretuonas basin: 1 Late Palaeolithic: 32 Rėkučiai 1st, 12 Bielenišės; 2 Mesolithic: 10 Rėškutėnai hill-forts, 12 Bielenišės, 18 Kretuonys 2nd, 20 Pakretuonė 5th, 27 Pakretuonė 4th, 28 Pakretuonė 6th, 30 Lake Žeimenis 3rd, 31 Rėkučiai 2nd; 3. Early Neolithic: 1 Kretuonas 1st, 4 Žemaitiškė 3rd, 23 Pakretuonė 7th; 27 Pakretuonė 4th; 4 Middle Neolithic: 1 Kretuonas 1st, 2 Žemaitiškė 1st, 7 Žemaitiškė 6th, 13 Kretuonykštis 1st, 14 Kretuonykštis 2nd, 19 Kretuonys 1st, 22 Pakretuonė 1st, 23 Pakretuonė 7th, 26 Pakretuonė 3rd, 24 Lake Žeimenis 1st. 5 Late Neolithic: 1 Kretuonas 1st, 2 Žemaitiškė 1st, 3 Žemaitiškė 2nd, 4 Žemaitiškė 3rd, 5 Žemaitiškė 5th, 6 Žemaitiškė 6th, 8 Rėškutėnai 3rd, 13 Kretuonykštis 1st, 14 Kretuonykštis 2nd, 15 Murmos 1st, 16 Murmos 2nd, 21 Pakretuonė 2nd, 22 Pakretuonė 1st, 25 Lake Žeimenis 2nd, 29 Rėkučiai 3rd, 31 Rėkučiai 2nd, 33 Lake Vajuonis 1st, 34 Lake Vajuonis 2nd. 6 Bronze Age: 1 Kretuonas 1st, 9 Rėškutėnai 1st, 11 Rėškutėnai 2nd, 17 Big Island 1st, 22 Pakretuonė 1st.

One of this period's habitation sites, Kretuonas 1, is found along the southwest shore of Lake Kretuonas not far from the Kampupė rivulet tributary. Discovered in the site's flint inventory were a point characteristic of Kunda Culture and an Early Mesolithic Neumunas Culture inventory: microblade inserts (microliths), scrapers and retouched burins. Microlithisation is characteristic of the entire site's flint inventory. It is interesting that the inhabitants of this period established themselves near lake tributaries or sources: apparently fishing was important in their migration paths. Another

habitation site, Pakretuonė 4, is located on the northwest side of Lake Kretuonas, near to where the Kretuonėlė rivulet flows out from Lake Kretuonas. Here, just as at the Rėkučiai 1 site, over 1,000 Kunda (Pulli) type artefacts were found: points made from blades, cores with one platform, wide scrapers, burins whose cutting edges were formed in the corners of broken blades, knives and vertically retouched microblades (Fig. 5). This period's palynological data shows that the still rare hunter-fisher-gatherer communities that had established themselves in the postglacial forest plots barely changed the environment, even though wood was used both in the economy and for fuel.

Conditions for broadleaved trees to grow improved markedly during the second, warmer half of the Boreal. Once the climate became warmer and wetter in the Late Boreal, hazelnut, alder and elm began to spread, but little grass pollen has been found. Some of the deeper ravines between the hills began to get waterlogged, bogs started to form near the lake, and peat began to form. This process continued even more rapidly in the Early Atlantic period. Because of the wetter climate, the water level of Lake Kretuonas rose between one and 1.5 metres. This is why the vegetation that had begun to expand near the lake in the second half of the Boreal was flooded, and the silting-up process began. Pollen diagrams show the domination of alder, elm,

oak and pine, and an increased amount of grass pollen (Fig. 6). The inhabitants in this period moved higher up the hill. Middle and Late Mesolithic sites are found on the higher, third terrace along Kretuonas' western and eastern shores. One of these is Pakretuonė 4, where over 3,000 Mesolithic Neumunas Culture artefacts were found in its middle cultural layer: lanceolate points, scrapers, burins, knives, a large amount of microblades or microliths which have survived from bone and antler spearheads, and harpoons and knives. The remains of an oval, semi-subterranean dwelling with a hearth

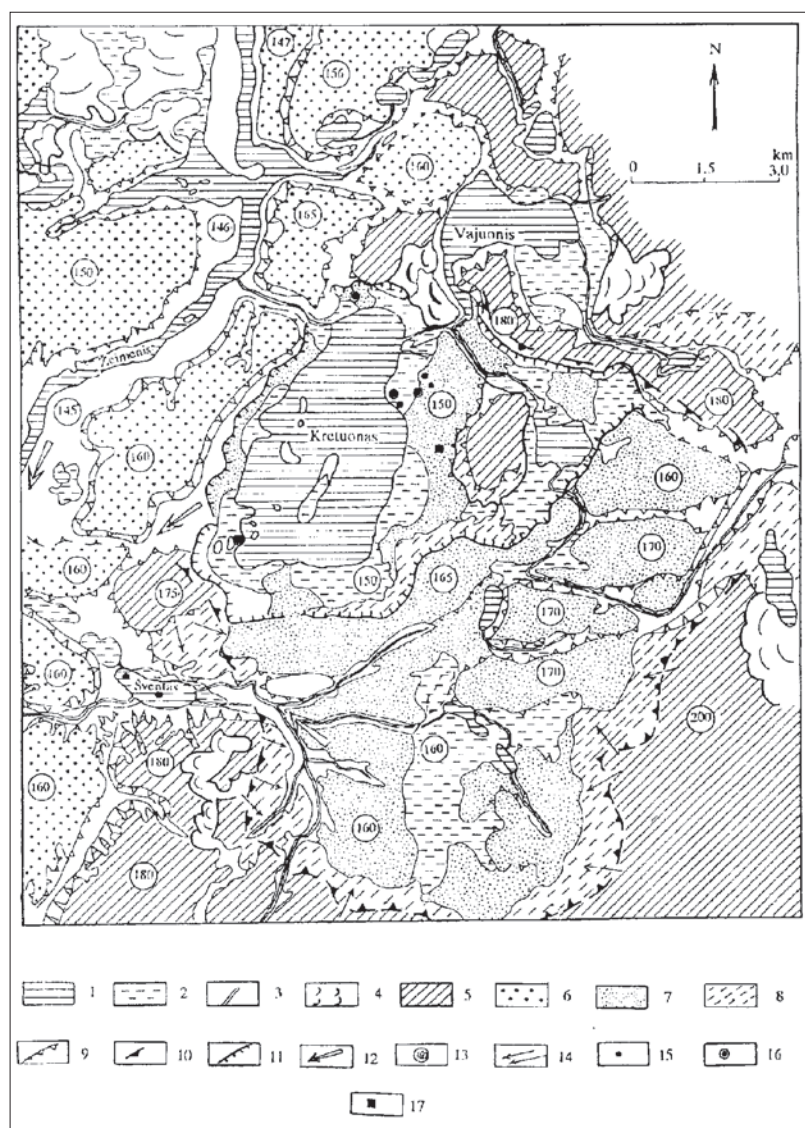


Fig. 3. Geomorphology of the environs of Lake Kretuonas; lakes, marshes, rivulets and locations of stratigraphical profiles where palynological analyses were performed (by R. Guobytė, 1992): 1 lakes, 2 swamps, 3 rivulets, 4 areas of recent morainic topography, 5 plateaus of old topography, 6 outwash plain, 7 limnoglacial plain, 8 abrasion topography, 9 erosion slopes, 10 signs of ice-dammed lake shores, 11 lake hollow at the beginning of the Holocene, 12 directions of glacial meltwater flow, 13 absolute height of the surface, 14 surface incline directions, 15 -locations of the stratigraphical sequences with pollen data, 16 stratigraphical sequences studied by authors (Guobytė and Girininkas), 17 Rėškutėnai settlement.

were found at the site. Another site from the same period, Pakretuonė 5, was discovered more to the south of the outflowing Kretuonėlė rivulet, also on the third terrace. In the nearly 16-square-metre excavated plot of the site, a cultural layer was found in which there were over 250 flint artefacts: lanceolates, scrapers, microblades, one-platformed cores, and the remains of a former hearth. The remains of yet another Mesolithic site of the time were found along the eastern side of the lake, below the bottom cultural layer of the Rėškutėnai hill-fort. Thirty-four Late Mesolithic flint artefacts were found here: lanceolates, vertically retouched

microliths, and fragments of single-platformed cores (Girininkas 2001, p.155). According to the amount of artefacts, former dwellings and hearths, all the camp sites could be considered stable and long-term.

Features of a foraging economy, hunting, fishing and gathering, can be observed in places inhabited by people in the Mesolithic. The food resources that existed in Lake Kretuonas' basin in the Mesolithic could have fed a large number of inhabitants. However, the clear human effect on the environment was felt already in the Mesolithic. In addition to sedge (*Cyperaceae*) pollen, a large amount of heather (*Calluna*) and bracken fern (*Pteridium*) pollen is also observed in the pollen diagrams of Lake Kretuonas' Early and Late Atlantic periods' chronozones. The spores of these latter two spread via forest fires. Thus, the Atlantic period's pollen diagrams reflect the facts of forest burning and the formation of open, treeless localities around Lake Kretuonas. Mugwort (*Artemisia*), which spreads near camp site dwellings and paths, is also found in pollen diagrams corresponding to the Late Mesolithic. The large amount of grasses shows the appearance of forestless plots, which can be associated with human economic activity (Fig. 7). The latter palynological data suggests the existence of a rather large amount of

inhabitants, paths and burnt forest clearings around the lake in the first half of the Atlantic, all of which signify busy human activity.

The Neolithic

The beginning of the Neolithic near Lake Kretuonas is associated with the second half of the Atlantic period. The mean annual temperature at that time could have been 3°C higher than now, with precipitation about 100 millimetres higher than today. It turns out that, according to these environmental features, Lake Kretuonas' water level should have been very high. This was not

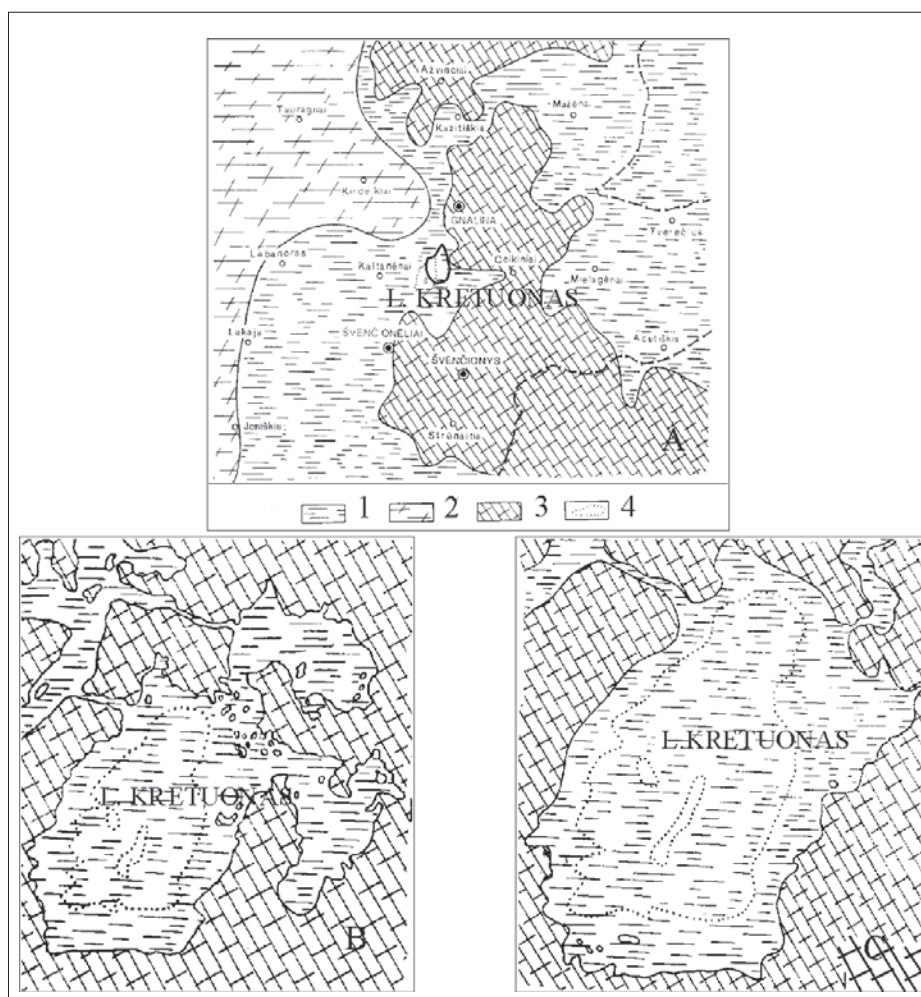


Fig. 4. Water level of Lake Kretuonas: A 170 metres above sea level; B 154 metres above sea level; C 150 metres above sea level. 1 water; 2 glacier; 3 land; 4 Lake Kretuonas.

the case, however. The stronger circulation of the water increased the abundance of inflowing and outflowing river water, and consequently the Kretuonėlė rivulet deepened its bed, which did not allow the water level of Lake Kretuonas to rise higher. At that time, phytoplankton flourished, and various species of aquatic and land creatures multiplied in the lake, while a band of rushes, reeds and cattails continued to widen along the edges of the lake, where a great number of birds propagated. Islands emerged in the lake.

The first half of the Subboreal period was marked by a continental climate. The temperature did not differ much from the moist Atlantic, although the precipitation declined. This decreased the flow of the Kretuonas basin's accumulated amount of water through Lake Kretuonas. Because of this, the formation of peat that had begun at the end of the Atlantic intensified even more. This is very well reflected in sediment profiles from the northern and western lakeshore area. Early Neolithic inhabitants still established themselves on the second or third terrace. Only the inhabitants of the Early-Middle Neolithic boundary lived in the area of

the current lake's backwater and on the first terrace, which is currently one to 1.5 metres higher than the water level.

In analysing palynological data from the former Lake Žemaitiškė's Neolithic sites Žemaitiškė 1, Žemaitiškė 2 and Žemaitiškė 3 zones, it was established that in the northeast part of the Lake Kretuonas basin, above the freshwater lime that accumulated in the Preboreal to the beginning of the Atlantic, sandy peat formed, transitioning to peat without sand towards the top (Fig. 9). Sandy peat began to accumulate in the Atlantic because the maximum amount of elm (*Ulmus*), lime (*Tilia*) and oak (*Quercus*) pollen, as well as much alder (*Alnus*) and hazel (*Corylus*) pollen, is found in it. Sedge (*Cyperaceae*), meadow grass (*Poaceae*) and spruce (*Picea*) pollen increased in the Early Subboreal. Spruce (*Picea*) decreased in the middle of the Subboreal, but pine (*Pinus*) and birch (*Betula*) pollen increased at the same time. Palynological research data from the sediment profiles shows that peat started to form more intensively around Lake Kretuonas in the second half of the Atlantic period. Far more indicators

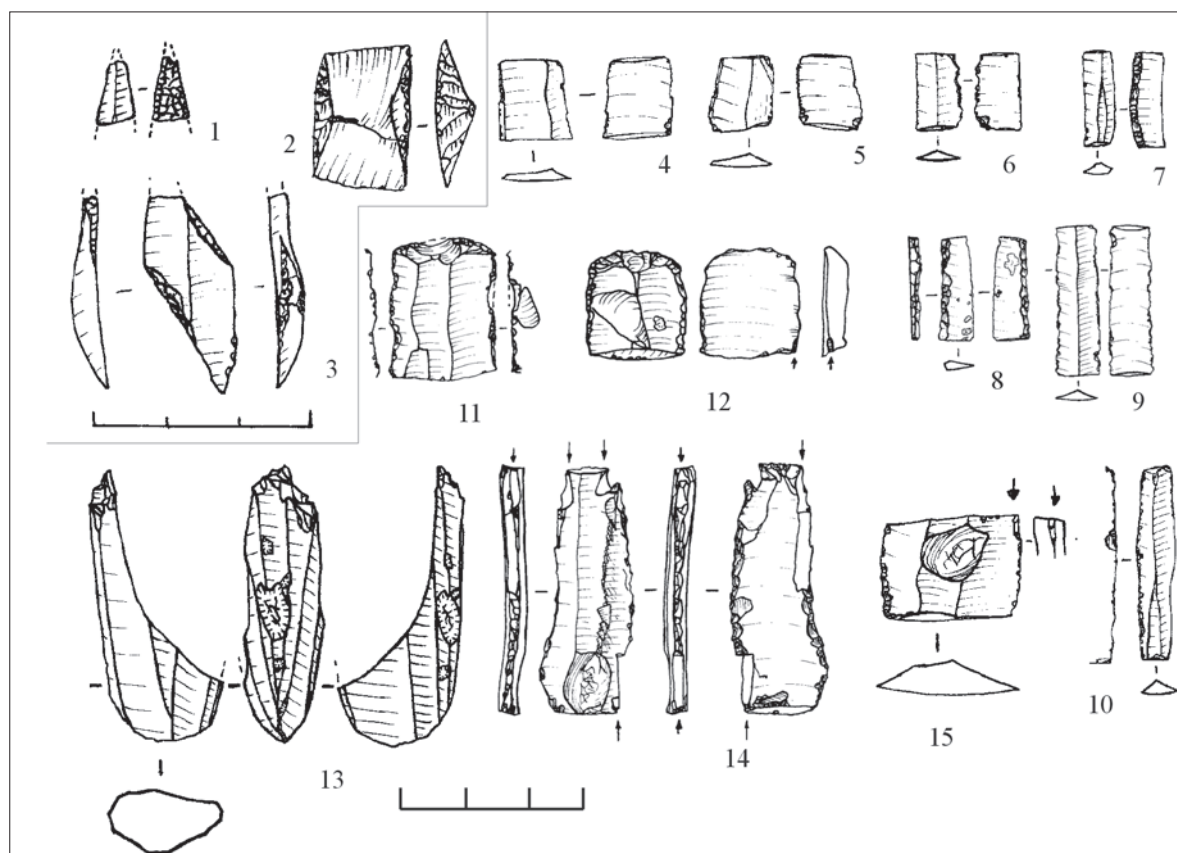


Fig. 5. Flint artefacts from Pakretuonė 4: 1 Pulli-type arrowhead; 2, 3 microliths; 4-10 backed microliths; 11, 12 scrapers; 13 core; 14, 15 burins.

associated with human economic activity are found in the sediment profiles from the end of the Late Atlantic and Early Subboreal. The pollen of plants typically found near paths and dwellings was already abundant. Wet meadows and pastures spread around the lake, although indicators of dry pastures and a small amount of arable land have also been observed. Meadow grass (*Poaceae*), sedge (*Cyperaceae*), sorrel (*Rumex*), plantain (*Plantago*) and clover (*Trifolium*) habitats indicate the spread of pasture, while cereal (*Cerealia*) pollen testifies to the existence of cultivated land.

Zooarchaeological research also corroborates this data. The ratio of wild game and domestic animals used for food by the inhabitants of the Lake Kretuonas area started to change at the transition from the Early to the Middle Neolithic. Domestic animal bones of cattle (*Bos bovis*), sheep/goats (*Ovis aries et Capra hircus*), pigs (*Sus suis*) and horses (*Equus caballus*) increased: they comprise up to 4% of the osteological material (according to the minimum number of individuals or MNI, the percentage would be smaller) (Daugnora, Girininkas 1996, p.27; 2004, p.105). In the Late Neolithic, the amount of domestic animal bones by MNI had already reached approximately 15% (Daugnora, Girininkas 2004, p.137). This suggests that pasturable livestock breeding spread slowly in the Neolithic, al-

though it still did not comprise the main branch of the economy.

According to current archaeological data, the number of habitation sites increased markedly in the Neolithic. Early Neolithic inhabitants still established themselves on the higher terraces. An Early Neolithic cultural layer can still be found at Pakretuonė 4. However, at the boundary of the Atlantic and Subboreal periods, the Kretuonas 1, Pakretuonė 1, Pakretuonė 3, Lake Žeimenis 1, Kretuonai 1 and Pakretuonė 6 sites were already located much closer to the shores of the present lake. Pile dwelling sites, whose remains were found in abundance in the area of the former Lake Žemaitiškė and eastern Lake Kretuonas, and which date from the very Early Neolithic through to the Early Bronze Age, have been found around Lake Kretuonas. Four sites with pile dwelling remains have been found there (Fig. 10): Žemaitiškė 1, Žemaitiškė 2, Žemaitiškė 3 and Kretuonas 1C. The most significant example of a pile dwelling construction is Žemaitiškė 2 (Girininkas 2004, p.26-32), in which an installation was found beside and in addition to the pile dwellings: an enclosure for catching fish near the rivulet flowing out of Lake Kretuonas. The enclosure existed during the Early Bronze Age, Neolithic and Late Mesolithic.

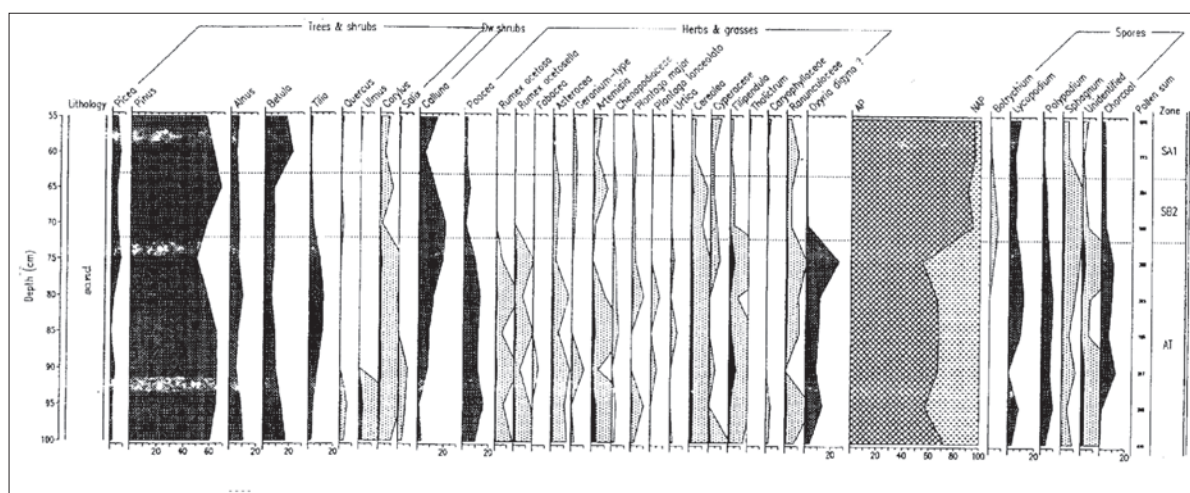


Fig. 6. Pollen diagram from Pakretuonė 4 (analysed by A. Grigienė).

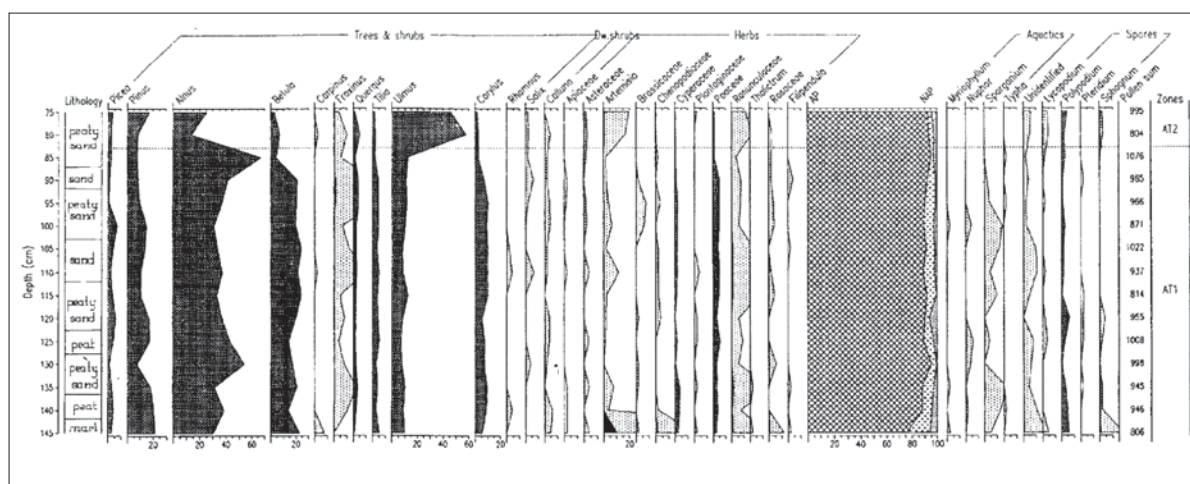


Fig. 7. Pollen diagram from the area of Kretuonas 1 (analysed by A. Grigienė).

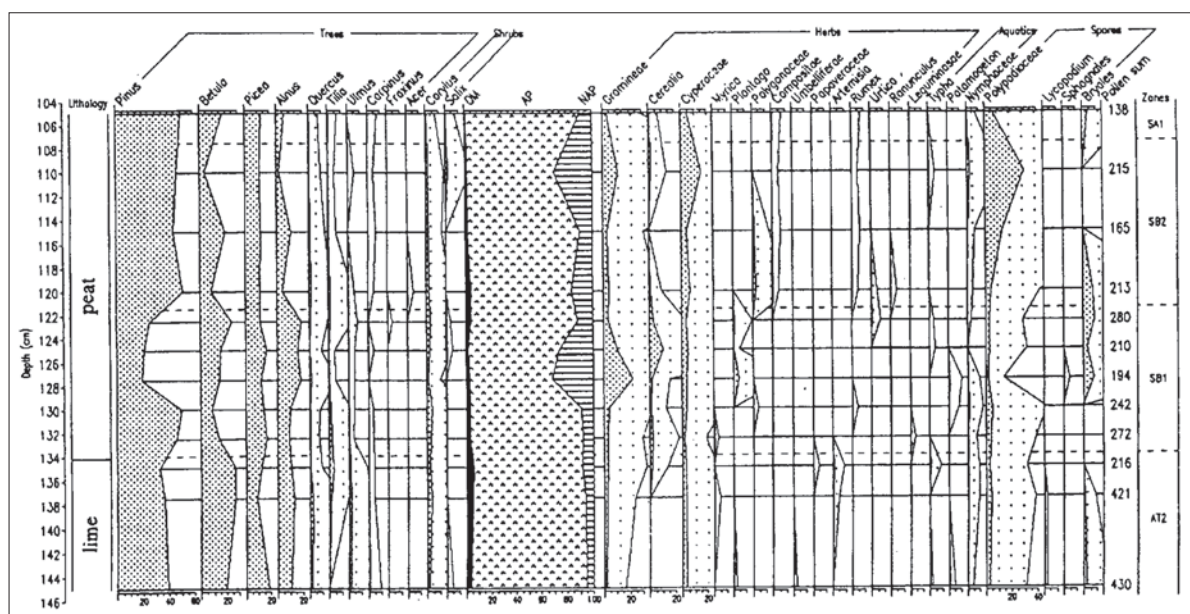


Fig. 8. Pollen diagram from Žemaitiškė 3 (analysed by M. Kabailienė and P. Pūkys).

Bronze Age

The Bronze Age is associated with the Late Subboreal. Birch and pine forests spread around Lake Kretuonas, and peat formation continued in the bog zone, although it became drier, while alder dominated and spruce groves increased in the depressions of the lake basin. Linden and elm groves yielded in the drier soils to birch and pine groves, while oak groves changed little. The largest amount of grass pollen in the entire prehistoric period in the Kretuonas basin is observed in the sediments from this period. This fact is undoubtedly associated with the increased plots of cultivated land and pasture. Zooarchaeological data also confirms this. At Kretuonas 1C, which is the most distinct Bronze Age site in the area, the amount of domesticated animal bones increased up to 18% (MNI) (Daugnora, Girininkas 2004, p.155, 165) and the amount of pollen of cultivated cereals increased. The inhabitants still populated the lake shores where Neolithic habitation sites are also found. This is very clear from the topography of Kretuonas 1C and Pakretuonė 1. A large amount of artefacts characteristic of the Early Bronze Age have been found at Kretuonas 1C: Late Narva Culture ceramics, flint, bone and antler, stone tools, and metal-casting tools (Fig. 10).

Inhabitants of the Middle Bronze Age lived on the first terrace, just as they had done in the Early Bronze Age. Meanwhile, during the transition from the Middle to the Late Bronze Age, the inhabitants resettled further from the places mentioned to higher locations (Fig. 3). An example of this is the Reškutėnai 1 settlement along the eastern side of Lake Kretuonas, where pots of an intermediate Narva and Streaked Pottery Culture form were found, along with flint and stone artefacts (Fig. 11). Apparently, this was already related not to environmental conditions, but more to the subtleties of a food producing economy.

The evolution of the cultural landscape in the Kretuonas basin. The formation of an agrarian landscape

The 10,000-year-old material from the Stone Age has reached researchers into prehistory unequally preserved. New data obtained from research into the Lake Kretuonas area and from different periods of the Stone Age, as well as exhaustive evaluations of already accumulated palynological, zooarchaeological and archaeological material, enables us to present the conclusions of the latest research regarding human lifestyles in a natural environment.

Man and the environment in the Lake Kretuonas area

The Palaeolithic settlement perspective

From the very time they moved into a rigorous climate zone, the people around Lake Kretuonas were forced to adapt to the environmental conditions and to function in that environment. The main source of food for Late Palaeolithic inhabitants was reindeer, to whose lifestyle the people who came to Lithuania were already adapted. Living near the migration routes of the reindeer, hunters used their technical and natural provisions to ensure their existence in the rigorous climatic conditions.

The Žeimena-Vokė-Neris-Nemunas lateral old valley formed from the melting of the glaciers and the powerful water currents during the recession phase of the Žiogėliai glaciation in east-southeast Lithuania. This valley was part of the Švenčionys-Vilnius-Berlin-Hamburg Urstromtal ice-marginal streamway, and the powerful water torrents of the melting glacier flowed down from it in the direction of the North Sea (Švedas, Baltrūnas, Pukelytė 2004, p.6-15). The movement of the fauna and the people of the time occurred at the edges of this depression. This is why the very earliest flint technocomplexes are found only along this former valley, in eastern and southern Lithuania. The Kretuonas basin is right alongside this old lateral valley.

The Kretuonas basin could have been the place where reindeer kills took place seasonally in the spring and autumn near former fords, as the reindeer were moving across the water basin, possibly via the River Žeimena or narrow passages between lakes, as in the case, for example, of the Kretuonas-Vajuonis lakes. It is thus no surprise that Ahrensburgian, Swiderian, and other technocomplexes characteristic of the Late Palaeolithic, as well as reindeer skeletal parts, can be found in these places where reindeer herds migrated. Two reindeer bones were found while investigating the Kretuonas 1 site (Daugnora, Girininkas 1996, p.27).

The change in the environment is illustrated by the change in artefact technocomplexes. More massive work tools were used in the Late Palaeolithic Rėkučiai 1 site, although comparatively light points of up to six grams show the existence of adaptation and specialisation. Artefact types necessary for hunting reindeer and working hide, fur, bone, and antler are typical finds of Late Palaeolithic Ahrensburgian and Swiderian technocomplexes.

Later, as the glacier receded in a north-northwest direction, the lifestyle of the Late Palaeolithic inhabitants changed. During the Bölling, and especially during the

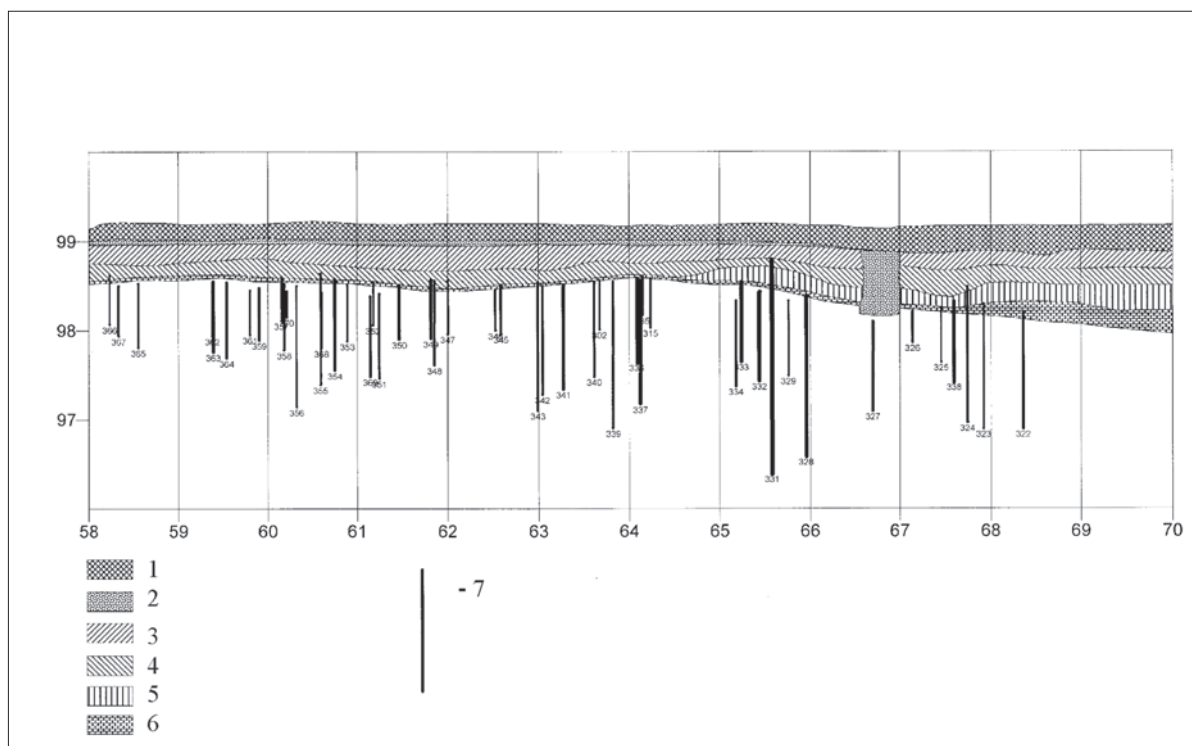


Fig. 9. Remains of pile dwellings: a while excavating Žemaitiškė 2; b east-west cross-section of Žemaitiškės 2 pile dwelling site.

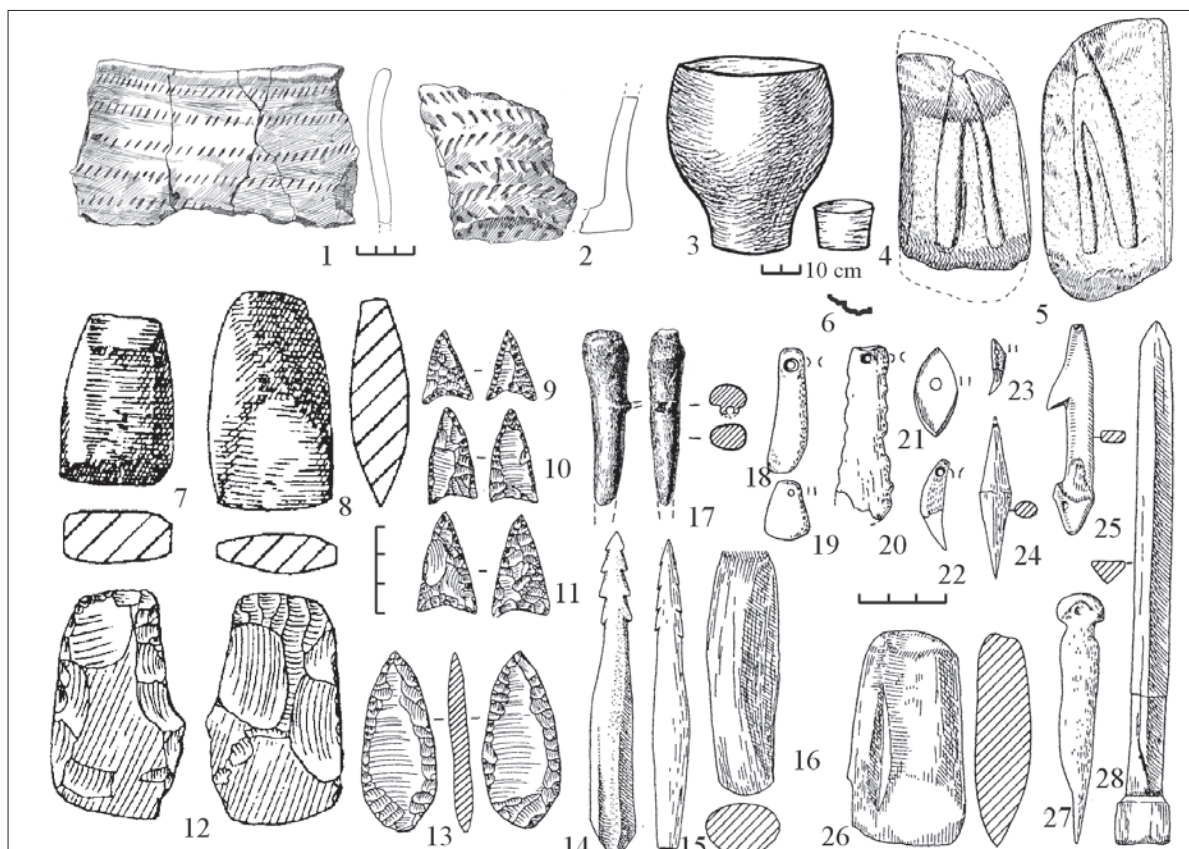


Fig. 10. Archaeological find inventory from Kretuonas 1C: 1-4 Late Narva style pottery; 5 stone mould; 6 bronze wire; 7-8 stone axes; 9-11 flint arrowheads; 12 flint axe; 13 flint spearhead; 14-15 bone harpoons; 16 bone chisel; 17 drawing pin; 18-23 pendants; 24 bone arrowhead; 25 bone harpoon; 26 bone axe; 27 bone awl; 28 bone needle for nets.

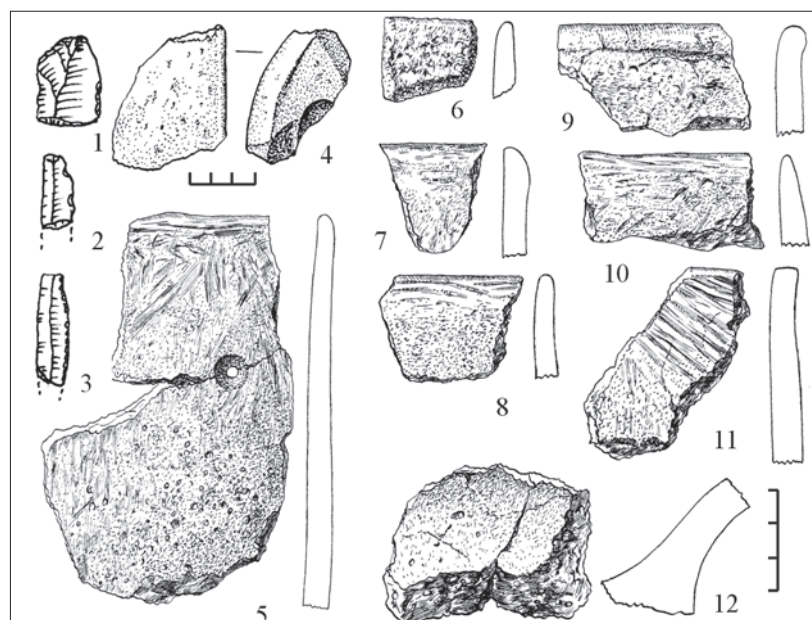


Fig. 11. Rēškutēnai 1 artefact inventory: 1 end-scraper; 2, 3 retouched blades; 4 part of a stone shaft-hole axe; 6-12 pottery shards with lined surfaces.

Alleröd period, not all the inhabitants could migrate any more, following the reindeer herds. There, in the open woodlands that were already forming in places, other species of fauna could be hunted as well: elk, brown bear, beaver, large-horned red deer, and small mammals and birds. In this way, the inhabitants, especially those who had left the Swiderian technocomplexes, did not all migrate after the reindeer, but rather lived alongside their migration routes from season to season. Inhabitants with Swiderian technocomplexes were the last who spread widely throughout a large part of the Eastern Baltic and northeast Europe and who remained to live in the forest landscape that was then forming. This period, which marked the beginning of microlithisation, is the very one that reflects the environmental changes to which the inhabitants of the end of the Late Palaeolithic and beginning of the Early Mesolithic had to adapt and change their technology, both in the manufacture of hunting tools and in lifestyles.

What did the Late Palaeolithic Swiderian Culture habitation site and its surroundings look like around Lake Kretuonas?

The habitation site, which was comprised of one larger structure, was established on the northern shore of Lake Kretuonas, on the hill's southern slope, on a band of alluvial sand that extended below a gravel-covered hill. The building was slightly submerged in the sand, oval-shaped, with a lower corridor-type entrance in its southern part. The structure's framework consisted of slim flexible birch timbers whose tops were tied and whose entire surface was covered with reindeer hides. There was a hearth inside, encircled by stones. Un-

worked flint, exchanged for dried meat and worked hide by reindeer hunters who had recently returned from the north, lay buried in the sand near the entrance. A small pine grove, several junipers, and white blossomed dryad octopetals (*Dryas octopetala*) grew near the structures on the hill's southern slope. Sparse groves of spruce mixed with birch grew further from the hill, to the east and west. Dwarf birch, common sea buckthorn and pale willow grew on the gently sloping northern side of the hill, while tundra covered with mugwort, goosefoot, lesser club moss (*Selaginella selaginoides*), sedge and meadow grass extended on the plateau beyond Lake Vajounis. Pygmy willows grew near the river that flowed from Lake Vajounis into Lake Kretuonas and whose current eroded the banks.

Mesolithic settlement

The people that took up residence in the forests, lakes and rivers that surrounded Lake Kretuonas in the Mesolithic adapted to a new lifestyle. They became more settled, they used rivers as their paths of communication, and they adapted their technological capabilities, and thus strengthened their subsistence economy. The quarry and their methods of hunting changed in the Mesolithic. Hunting became more specialised, as did its tools. The people adapted to the changed environment, which was heterogeneous in the Kretuonas basin. The diverse flora and fauna that favoured it formed under the influence of the different soils there. The pine and birch groves that grew in the sandy western and northern part of the basin, later with broadleaved vegetation, created very good conditions for hunting red deer and fishing in the lakes and rivers that formed. As

mentioned, the foraging economy became specialised during this period. The inhabitants who had left behind both the Kunda (Pulli) and Nemunas technocomplexes did everything they could so that their communities could survive from foraging in the huge forested areas. This forced them to be inventive and to produce efficient and effective tools and weapons. The forests were burned, and from the investigated microscopic charcoal within the sediments we find evidence of “pioneer” trees that appeared in the resulting clearings: hazel, ash, birch and mountain ash. Goosefoot, mugwort and nettles appeared near the sites of habitation. This is very clear from research into the Pakretuonė 4 environment.

The specialisation of artefacts changed in the Mesolithic. A larger and more varied amount of technocomplexes appeared, due to life in the forest zone. This feature is also associated with changes in the environment. Encircled by forests and engaging in intensive fishing, the people became more sedentary. While united through one main trait of microlithisation, associated with specialisation in a foraging economy and obtaining as much as possible from the existing natural resources, people’s technocomplexes varied, depending on the environmental conditions of different forest zone microregions. The Mesolithic technocomplexes around Lake Kretuonas can be compared with the work and hunting tools left behind by the inhabitants of the Lake Duba area in southern Lithuania, for example. We can see clearly that the technocomplexes around Lake Kretuonas are finer, that the usage of raw materials and tools was very expedient, that many microliths were allocated for fishing tools, and a large amount of tools have indications of secondary usage. This is not noticeable in the flint tools found around Lake Duba, because this area was plentiful in raw flint material, and thus the people there did not have to conserve it as much as the communities that lived around Lake Kretuonas did. This shows that environmental peculiarities (like the abundance of lakes and rivers) and the possession or non-possession of raw material in the mentioned regions of Lithuania presupposed a technological variety that was different in the communities of the Lake Kretuonas fishermen-hunters and the Lake Duba hunter-fishermen. Both of these groups were linked by the foraging economy. The Mesolithic and Neolithic communities of Kretuonas used seasonal habitation sites, to which they would return regularly, depending on the local fish, animal migration and collectable food resources, as well as the time of their availability. They also had stable habitation sites, however, whose cultural layers are more impressive for the amount of their artefacts: even rubbish heaps with pottery, bone and antler scraps have been found. Meanwhile, a larger

amount of ceramic or flint artefacts that date from the same period are rarely found in contemporary communities of southern Lithuania. This suggests that inhabitants of southern Lithuania were more mobile, and that the main form of their economy could be considered to be hunting, while that of the communities around Lake Kretuonas was fishing.

What did the Late Mesolithic Pakretuonė 4 habitation site and its surroundings look like?

The habitation site was established on the third terrace, on the flat, sandy ground of a peninsula jutting out into the lake, on the right bank of the Kretuonėlė rivulet, near the river’s source of Lake Kretuonas. The two structures of the site were semi-subterranean, shaped like irregular ovals, with hearths inside and other hearths outside and near the structures. Thin timbers were used to build the structures, they were dug vertically into the soil and could have held the roof. Stones which might have fortified the base of the buildings were found near the structures. Many flint flakes were found scattered both in the surroundings of the site and within the structures themselves, while flint cores, scrapers, knives, microblades, burins, arrowpoints and the remains of accumulated bones and antlers left after the gutting and cleaning of game were found in the site’s production loci.

The habitation site was surrounded by pine forests. The slope of the terrace was covered with hazel, the river bank with elm and alder, and the southern part of the slope with lime and oak. The undergrowth of the surrounding pine grove comprised hornbeam and young oak, while the lower areas of the woods’ duff included peat moss and ferns. In addition to hazel and alder, birch grew in places along the northern shores of the former Kretuonas bay. Individual fir trees flourished only on the northern slope of the peninsula. South of the river, the pine grove’s previously burnt clearing was thick with hazel and mountain ash, and the forest’s edges with ash and elm, while the open ground had a meadow in places with mugwort, bracken, sorrel and heather. The lake shores were waterlogged, and a strip of bulrushes and reeds extended along the water’s edge. Various wild animals lived in the forests, but red deer and boar comprised the majority. Near the bay, not far from the site, were boats, and a hammered together weir with creels in its gaps near the outflowing Kretuonėlė rivulet.

Neolithic settlement

The amount of food products in the Kretuonas basin at the end of the Mesolithic and beginning of the Neolithic was apparently quite large, since there was no sudden leap in the transition to a farming economy. This proc-

ess must have started even before the appearance of the first biologically domesticated animals and plants in Lithuania. Palynological and archaeological data from that time indicates the clearing and burning of woodland, by which the landscape was changed. This enabled a change in the composition of the vegetation, a more fertile soil (eg the productivity of hazel was spurred by a more fertile soil), and the proliferation of certain species of young animals. There is no doubt that communities were not isolated during the transition from the Mesolithic to the Neolithic. Thus, the concept of a transition to a farming economy and individual data that relates to a food producing economy that are traced to the Late Mesolithic and Early Neolithic are the result of ties between communities. The concept of animal breeding and its advantages influenced the change in habitation sites and their surroundings. It is noteworthy that the effects of a farming economy on the environment around Lake Kretuonas can be significantly more clearly observed in the Forest Neolithic (Narva, Nemunas cultures) habitation site environment than in the environment of the so-called Agrarian Neolithic communities (Corded Ware, Globular Amphora cultures). Agrarian Neolithic inhabitants would come to the Lake Kretuonas area by means of water transit, and would usually stay in the surroundings of the landscape created by the Forest Neolithic communities where there were already fields designated for pasture. This is clear from research into the Kretuonas 1A and Pakretuonė 1 sites, in which traces of Corded Ware and Globular Amphora Culture inhabitants are found. Unlike Agrarian Neolithic inhabitants, who appeared in the forest zone in the Late Neolithic, Forest Neolithic communities were already developing stable stock breeding and increasing the fields necessary for breeding grazing livestock, thereby changing and beginning to expand the agrarian landscape. The appearance of Agrarian Neolithic communities could only have stimulated the development of an agrarian economy; it was not the agrarian economy's main driving force. From the end of the Late Neolithic and especially at the beginning of the Early Bronze Age, in the original areas covered with forests in the Kretuonas basin, centres of an Agrarian Neolithic landscape appeared. On the basis of palynological and zooarchaeological research data, these agrarian centres can be linked with the spread of a food producing economy and demographic changes in the communities. This is why the communities that appeared that are associated with Agrarian Neolithic did not have a great influence on Lithuania's cultural landscape. The landscape was formed by Forest Neolithic inhabitants, who slowly developed the specific features of an agrarian economy.

Palynological research into sediments around Lake Kretuonas shows that fields designated for grazing animals stretched alongside the habitation sites; the infertile soils, consisting of light sand, sandy loam or light clayey loam, still did not enable the spread of agriculture. Narrow-leaved plantain (*Plantago lanceolata*) and common heather (*Calluna vulgaris*) were found in the fields. The composition of the soil which predetermined the variety of vegetation was the main factor contributing to people's economic activity, which developed in the direction of livestock breeding and agriculture in the Lake Kretuonas area.

Throughout the entire Stone Age in Lithuania, the surroundings formed by man and the surroundings formed by nature itself were different. This is reflected in summaries of zooarchaeological and palynological research data, by which the main and most widespread hunted animal species in separate regions have been determined. By comparing zooarchaeological data and fauna depicted in the art of Neolithic communities, we notice that in the areas where species of fauna represented in art are widespread, they correspond to the zooarchaeological data: the red deer is the most represented in eastern Lithuania (in the Lake Kretuonas area) (Girininkas 1990, p.93; 1994, p.240), while the elk is the most represented in western Lithuania (the River Šventoji delta) (Rimantienė 1996, p.195). This confirms that the natural environment had a major influence not only on the development of art, but also on the main features of spiritual life. The animal species most valued economically were shown in art.

The Neolithic in Lithuania was not marked by a sudden change in material culture. Communities that lived in a heterogeneous environment still rather profitably took advantage of the foraging economy during the Atlantic period. This was a period when they could get the necessary amount of food via a foraging economy, but at the same time favourable environmental conditions existed (in the Atlantic period) to begin to experiment and assimilate the merits of Agrarian Neolithic. This is why the material culture also did not change suddenly. Sickles with flint microliths, hoes, milling or grinding stones, and spindle whorls necessary for a food producing economy slowly made their way into the tools used in hunting and fishing (Girininkas 1997, p.16-35) (Fig. 12). The first cereal (*Cerealia*) pollen appeared around Lake Kretuonas at the end of the second half of the Atlantic (Fig. 8).

Constructions changed in this period. Quadrangular overground buildings appeared in the Middle Neolithic. Till then, buildings in the area had been oval-shaped and semi-subterranean (Fig. 13).

When the climate worsened and natural resources lessened in the Subboreal, the need for a farming economy grew, although it still did not become a causal factor in the economy of the Forest Neolithic communities. Distinctive cultural landscape areas with different material cultures used by communities began to form in the environmental regions. Fishing, amber gathering and seal hunting occupations, with their characteristic tools, stand out in the region of the Lithuanian sea shore. An inventory characteristic of a hunter-fisher economy as well as of agriculture and livestock breeding is found in the Samogitian Highlands, and hunter-fisher and livestock breeders' work and household tools in southern Lithuania. Fisher-hunter and animal breeder inventories are found in southwest Lithuania, as they are in the Kaliningrad area and the wooded, lake-filled Suwalki territory of Poland, while a very clear fisher-hunter and livestock breeder inventory is found in eastern Lithuania (around Lake Kretuonas).

What was the environment of the Middle Neolithic according to research data from the Kretuonas 1B habitation site?

The habitation site was established on the eastern shore of Lake Kretuonas, on the first terrace, on a small sandy hill which appeared as a consequence of spring ice drift near the right shore of the mouth of the Žaugėda rivulet. Everything else around the settlement's former terrace was silted up. Elm, lime and oak grew in the surroundings of the settlement, pine on the sandy rises, alder on the banks of the lake and rivulet. A small meadow

plot, designated for animals and possibly with a fence, was near the settlement. Parts of three quadrangular pole-construction dwellings and 12 hearths were found in the settlement, and approximately 9,000 items of Narva Culture ceramics, bone, horn, flint and stone artefacts, along with Comb-and-Pit Culture artefacts, were found both near the dwellings and hearths as well as in the vicinity of the site. A small cemetery in which six people were buried was also found in the area of the settlement. There were boats near the site, and a weir for catching fish near Lake Žemaitiškė, from which the Žaugėda rivulet flowed. Some of the weir's poles have been dated to the Middle Neolithic. The area of the settlement took up half a hectare, while its production loci were either beside the site or a kilometre from it. The inhabitants not only hunted and fished, but also raised animals (sheep/goats, pigs and horses) and maintained trading ties both with related communities and with those of the Funnel Beaker and Comb-and-Pit Pottery cultures.

Palynological research data shows that there were wet meadows, pastures and paths around the settlement, as well as plants characteristic of settlement dwelling surroundings: *Poaceae*, *Cyperaceae*, *Rumex*, *Plantago*, *Trifolium*. A small field of cereal was grown in hoed earth near the site. Hazel grew in burnt plots in the woods, and water chestnuts were collected in the lake, while the marshy and peaty lake shores had many boar, and the sparser woods had red deer and elk. The

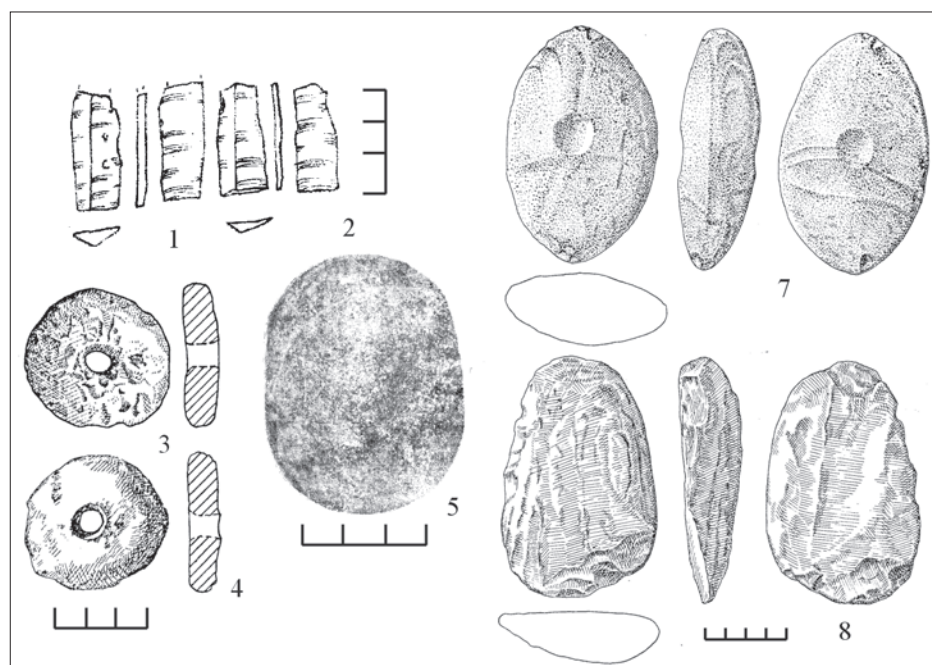


Fig. 12. Farming tools: 1-2 sickle microliths; 3-4 spindle whorls; 5 grinding-milling stone; 7-8 hoes.

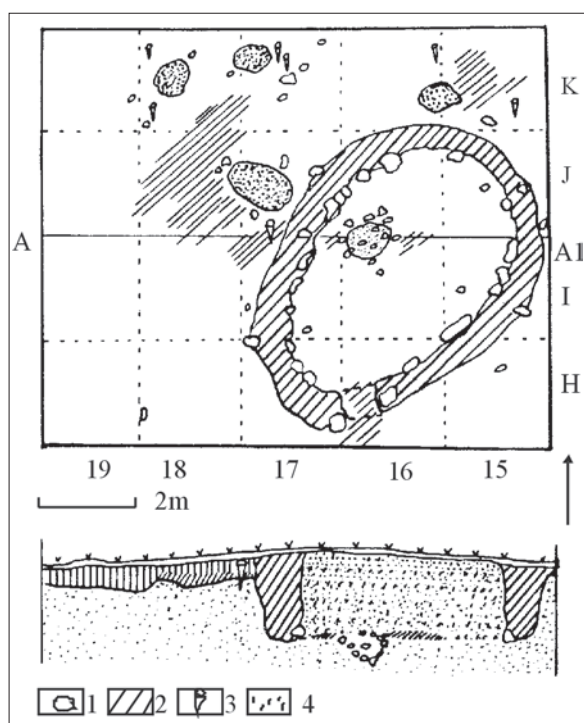


Fig. 13. Profile of structure found at Pakretuonė 3.

inhabitants hunted aurochs and bear, as well as smaller fur-bearing animals.

Bronze Age settlement

The communities of the Kretuonas 1C, Žemaitiškė 2, Kretuonas 1D, Kretuonas 1I, Reškutėnai 1 and Pakretuonė 1 settlements that, according to radio-carbon-dated material, lived from 2000 to 1200 BC, should have been larger in population than they were in the communities of the Late Neolithic, traces of whose habitation have been found right alongside the Bronze Age settlements.

Although the communities of the Early and Middle Bronze Age settlements still subsisted mainly through fishing and hunting, they were already paying more attention to livestock breeding, cultivating domesticated plants, and recasting metal. Apparently, not enough food was acquired from foraging by the communities that lived near Lake Kretuonas, who were forced to subsist by breeding livestock. Moreover, these communities maintained strong ties with others, acquiring flint material and manufactured items from the tribes that lived to the south of them, and items manufactured from shale from the tribes who lived to the north of them. Evidently, they still obtained very rare items manufactured from amber from the communities who lived in the Lubans lowland, while they had become familiar with metallurgy from the inhabitants of the upper and middle Dnieper regions.

With the lack of natural resources, and especially in trying to conserve them, as well as by slashing bushes and chopping down trees in the forest to make meadows, the plots of land obtained were very valuable and protected. The tribal community, its territory, and especially accumulated wealth, had to be protected. Apparently, one of the reasons why the settlements had to have pile dwellings was that the animals raised were safer there from the spring and autumn floods and from hostile communities: natural obstacles, the lake and river channels that flowed alongside it, protected the settlement.

In contrast to the seaside lowland and Samogitian highland, the economy of the Early Bronze Age in eastern Lithuania (in this case the communities of the Lake Kretuonas area) gained momentum. We can observe the same processes as around Lake Kretuonas in northern Byelorussia and the south Pskov area (Долуханов, Микляев 1985 p.55; Чарняўскі 1997 pp.320-321). It is probable that these latter differences were closely connected with the economic changes in the upper Dnieper and with the trade occurring among the communities living in the Dysna-Daugava-Berezhna-Dnieper basins.

What was the environment of the Early Bronze Age according to research data into the Kretuonas 1C settlement?

The settlement was established on the east shore of Lake Kretuonas, right next to the mouth of the Žaugėda rivulet. It was a pile dwelling site, on a sand bar of the flooded rivulet and lake. Birch groves grew around the settlement, pine groves in the higher places, and alder, hazel and much oak alongside the lake, with the addition of fir trees on the slopes of the morainic hills. Abundant ash groves (*Fraxinus excelsior* L.) grew on the first terrace; they flourished in hewed-out, burnt-out and abandoned plots. Meadows with fences could be found east of the settlement, with a hoed-up field nearby. An agrarian type of landscape extended around the settlement. This is confirmed by zooarchaeological and palynological data. Domesticated animals already comprised up to 18% (by MNI) of all known osteological material, that is, approximately one-fifth of meat products were obtained from animals raised by the settlers. Cultured cereal plant pollen is found in the sediments of the settlement's cultural layer. In addition to growing cereals and rearing animals, the people hunted and fished intensively. A creel was found right next to the settlement in the channel of a rivulet, while most hunted game comprised of elk and red deer. The people also hunted many fur-bearing animals, which they needed for trading in order to get items manufactured from metal.

In living here approximately 300 years, the people of the Early Bronze Age Kretuonas 1C settlement left a rather impressive cultural layer, already very similar to the agrarian type of settlements of Central Europe. It was from five to 120 centimetres thick, with many and various artefacts (Daugnora, Girininkas 2004:233-250). Large rubbish heaps were found near the settlement, in which were found many broken shards of pottery, along with items made from bone, horn, stone, wood and flint.

According to archaeological research data from Kretuonas 1C, it can be said that this was a settlement base near which there were animal enclosures and winter dwellings for the animals, which protected them from wild beasts and hostile tribes. With its surrounding fields, enclosures, metal recasting and fishing loci, we can call this settlement a large and unified economic unit. Research conducted in the surrounding areas makes possible the assertion that an entire line of economic products existed not in the settlement itself, but in this tribal community's controlled territory. Thus, the Kretuonas 1C community can be considered a local territorial community, with a strictly defined and owned territory for the acquisition of raw material and land suitable for farming, in which existed a clear division of labour and social differentiation.

An entirely different situation came about at the end of the Middle Bronze Age. Settlements that existed from the Early Neolithic to the end of the Middle Neolithic changed their location. Late Narva and Trzciniec Culture people still lived on the first terrace, but at the end of the Middle Bronze Age and the beginning of the Late Bronze Age, settlements like Reškutėnai 1 changed their topographical location. Settlements are encountered on the second terrace, they were established in turfy ashen grey or slightly podsolised soil zones. Clear environmental or aquatic oscillations are not observed around Lake Kretuonas in the second half of the Subboreal. Thus, this process of changing settlement locations can be associated only with the development of farming and the acquisition of new lands and territories necessary for the growth of more progressive livestock breeding and agriculture.

Conclusions

1. The Late Palaeolithic inhabitants around Lake Kretuonas had a minimal impact on their natural surroundings. The Early Mesolithic communities of the Lake Kretuonas area, who lived surrounded by Preboreal and Early Boreal forests, made maximal use of the environment's resources (flora and fauna), and the conse-

quences of their exploitation of the environment were minimal.

2. The natural environment of the Lake Kretuonas area experienced its first changes under the influence of people in the Middle and Late Neolithic. The first clearings appeared in the area around Lake Kretuonas as a consequence of human activity. The vegetation was deliberately altered, as was the fauna necessary for man's food (the expansion of hazel and edible grass habitats, the population increase, and the beginnings of the domestication of boar). Heather (*Calluna*) and bracken fern (*Pteridium*) appeared in the clearings and burnt plots, while vegetation characteristic of prolonged human activity appeared around the habitation sites and paths: goosefoot (*Chenopodiaceae*), mugwort (*Artemisia vulgaris*) and nettles (*Urtica*).

3. A landscape of an agrarian nature began to form during the Early to Middle Neolithic. The first *Cerealia* pollen appeared at this time, and meadows suitable for livestock breeding began to develop. Meadows and plants characteristic of meadows spread along the moister places along the lake sides up to the Middle Bronze Age. Shrubs and trees that appear in the aftermath of chopping and burning down forests grew around the settlements, while flint microliths for sickles and stone hoes appeared in the tool assemblages.

4. Production loci spread from the Early Neolithic: jetties, structures for catching fish, and a number of places related to flint knapping, pottery production and processing wild and domesticated animal meat. These also had an effect on the surroundings. Accumulations of waste-rubbish heaps formed around the habitation sites (at Kretuonas 1B, Žemaitiškė 2, Kretuonas 1C).

5. Starting from the end of the Middle Bronze Age, the settlements along Lake Kretuonas moved to areas of turfy ashen grey and slightly podsolised soils. This indicates that the technique of livestock breeding and agriculture changed. The agrarian landscape finally formed at this time. Forest plots decreased around the settlements. The forest plots were changed by mixed forests, and shrubbery developed.

Translated by Indrė Antanaitis-Jacobs

Received: 28 May 2008; Revised: 6 September 2008

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GAMTINĖ ĮTAKA KRETUONO APYEŽERYJE GYVENUSIEMS ŽMONĖMS AKMENS IR BRONZOS AMŽIAIS

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Santrauka

Rytų Lietuvoje esančiame Kretuono ežero baseine žinomi 34 akmens ir bronzos laikotarpio archeologiniai paminklai (2 pav.). Šių paminklų archeologiniai, palinologiniai ir zooarcheologiniai tyrimai įgalino nustatyti gamtos poveikio čia gyvenusioms bendruomenėms ir žmogaus poveikio gamtinei aplinkai lygmenį ir šių procesų laiką. Šiems procesams nustatyti svarbią reikšmę turi vėlyvajame pleistocene ir ankstyvajame bei viduriniame holocene vykę geologiniai procesai, sudarę palankias gamtines sąlygas žmonių gyvensenos plėtotei.

Kretuono apyežeryje vėlyvojo paleolito laikotarpiu gyventojai gamtinei aplinkai turėjo minimalią įtaką, savo poreikiams pasinaudodavo gamtinės aplinkos teikiamomis gėrybėmis – rinkdavo maistą, versdavosi šiaurės elnių medžiokle ir žvejyba. Net ankstyvojo mezolito laikotarpiu Kretuono apyežerio bendruomenės, jau gyvendamos preborealiniu ir ankstyvojo borealio laikotarpiu miškų apsuptyje, maksimaliai naudodavo esančią augmeniją ir gyvūniją, kurių eksploatacijos pasekmės gamtai buvo minimalios.

Nuo vidurinio ir vėlyvojo mezolito laikotarpio dėl žmonių poveikio gamtinė aplinka Kretuono apyežeryje patiria pirmuosius pokyčius. Kretuono apyežerio teritorijoje pasirodo pirmosios dėl žmogaus veiklos atsiradusios laukymės, kuriose sąmoningai buvo keičiama augmenija, o kartu ir gyvūnija, reikalinga žmogaus mitybai (laidynų, žolinių valgomųjų augimviečių plėtimas, šernų populiacijos didinimas ir jaukinimo pradžia). Kirtimuose ir išdegintuose plotuose pasirodo viržis (*Calluna*), šakys (*Pteridium*), aplink gyvenvietes, keliukus augmenija dėl ilgos žmogaus veiklos poveikio taip pat pasikeitė: augo balandiniai (*Chenopodiaceae*), paprastieji kiekiai (*Artemisia*) ir dilgėlės (*Urtica*).

Agrarinio pobūdžio gamtovaizdis prie Kretuono ežero pradeda formotis ankstyvojo – vidurinio neolito ribo-

je. Šiuo laiku pasirodo pirmosios *Cerealia* žiedadulkės (8 pav.), aplink gyvenvietes želia pievos, tinkamos aptvarinei-rišamajai gyvulininkystei plėtoti. Pieves ir joms būdingi augalai augo drėgnesnėse paežerių vietose iki vidurinio bronzos amžiaus (6, 8 pav.). Aplink gyvenvietes augo miškų kirtimams būdingi ir po jų deginimo išaugę krūmai, medžiai, o tarp darbo įrankių pasirodo titnaginiai ašmenėliai pjautuvai, akmeniniai kapliai, trintuvai, moliniai verpstukai (12 pav.).

Nuo ankstyvojo neolito plečiasi ir skaičius gamybos objektų: prieplaukų, žuvų gaudymo įrenginių, titnago skaldymo, keramikos gamybos ir išdegimo, gyvulių ir žvėrių mėsinių vietų. Tai taip pat darė poveikį aplinkai. Aplink Kretuono 1B, Žemaitiškės 2, Kretuono 1C gyvenvietes formuojasi atliekų-šiukšlynų sankaupos.

Nuo vidurinio bronzos amžiaus pabaigos Kretuono paežerių gyvenvietės persikelia į velėninių-jaurinių ir silpnai sujaurėjusių dirvožemių plotus. Tai rodo, kad pakito gyvulininkystės ir žemdirbystės technologija. Tuo metu galutinai susiformavo agrarinis kraštovaizdis. Aplink gyvenvietes mažėjo miškų plotai, kuriuos keitė krūmynai.