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LIVING ON THE LAKE AND FARMING THE LAND. ARCHAEOBOTANICAL INVESTIGATION ON LUOKESAI I LAKE DWELLING SITE

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The archaeobotanical investigation of a Lake Luokesai settlement I core sample has resulted in the extraction of useful pollen and macrobotanical data. Interpretation of these two sets of data has provided some mutually supporting conclusions concerning the palaeoenvironment, human diet and human activities at this site.

Keyworks: Archaeobotany, pollen, macrobotanical remains, emmer wheat, lake dwellings, diet, farmers, environment, Late Bronze Age, Early Iron Age.

Archeobotaniniai kerno iš Luokesų ežero I polinės gyvenvietės tyrimai suteikė nemaža įdomių palinologinių ir makrobotaninių duomenų. Gautos duomenų serijos leido atidžiau pažvelgti į klimato raidos, žmonių maitinimosi ir veiklos ežero apylinkėse ypatumus.

Reikšminiai žodžiai: archeobotanika, žiedadulkės, makrobotaninės liekanos, kvietys, ežerinės gyvenvietės, mityba, žemdirbiai, gamtinė aplinka, vėlyvasis bronzos amžius, ankstyvasis geležies amžius.

BACKGROUND INFORMATION

Luokesai is situated in the eastern part of Lithuania in the Molėtai district; 45 km north of the capital city of Vilnius. The Molėtai district is well known for its plentiful number of lakes, which were formed by the retreating edge of the last glacier about 12–14 thousand years BP (Motuzaitė-Matuzevičiūte, 2004) (fig. 1).

The Luokesai I settlement is situated on a moraine shoal in the northern part of the lake (fig. 2) (Baubonis *et al.*, 2001). The shoal is as a narrow ribbon in shape that stretches from the shore to one of the islands in the lake. The depth here is between 110 cm and 190 cm, with a steep drop-off down to a depth of 10–15 m along both sides of the shoal (Menotti *et al.*, 2005). The settlement itself is situated about 45–55 m from the shore, in the part where ribbon-shaped shoal forms an outward bulge into the deeper portion of the lake.

So far, only two sites are known, dated back to the transition period from the end of Bronze to the Early Iron Age. The first lake dwelling site was discovered in the Lake Luokesai in the year 2000, and another discovery followed the year after on the opposite side of the same lake (Baubonis *et al.*, 2002).

The remains of the lake dwellings are situated in 50 cm layer of acidic peat, which is incorporated into an alkaline (>7 pH), calcareous lake marl, accumulated on the bottom of the lake from carbonatic minerals of the surrounding hills of Lake Luokesai. In such an anoxic environment all kinds of organic

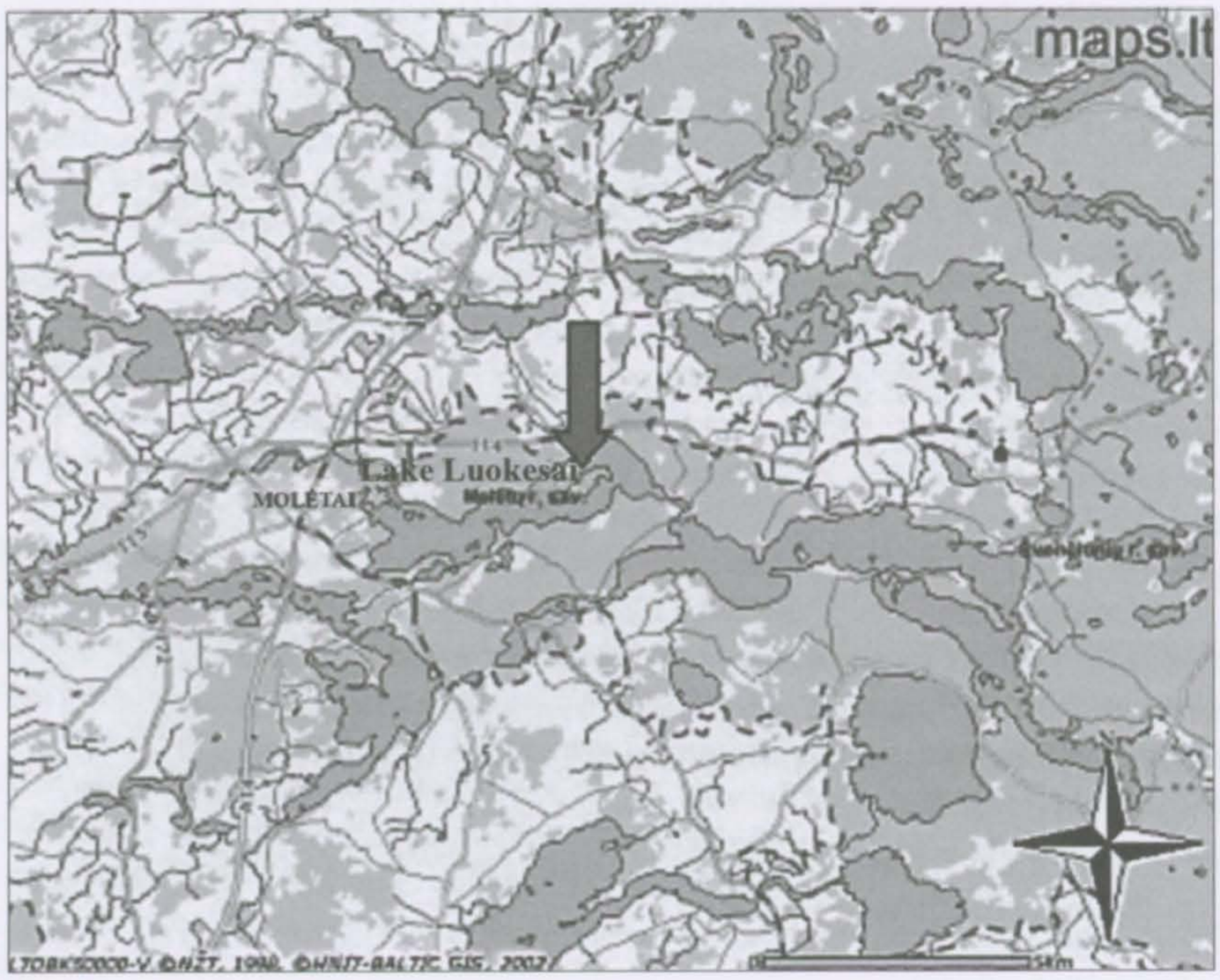

Fig. 1. Lake Luokesai and its surroundings (after www.maps.lt).

material is well preserved, such as plant remains, wood, beetles, parasite eggs, as well as bones and shells allowing the indepth analysis of the environment history and past human activities at the lake.

SHORT DESCRIPTION OF APPLIED METHODS

The core sample was taken by the author from the territory of the Lake Luokesai site I in the year 2005. The sample was transported to the University of Cambridge and kept in the McBurney lab cold room for a couple of months. One half of the core was left for archiving and micromorphological analysis of the site. The other half of the core was used for pollen, magnetic susceptibility, loss on ignition and archaeobotanical investigations. The core is 7 cm in diameter, 29 cm long, taken randomly from the territory of the Luokesai I settlement. The core stratigraphy starts with a top layer of 7–8 cm white lake sediments, containing fresh water molluscs. The next 8–29 cm is a dark brown peaty layer with some visible periodic inwashes of sand. The bottom part of the core is white lake marl. Pieces of charcoal were detected throughout the stratigraphy, indicating human coexistence with the formation of this peaty stratigraphy.

Four pollen samples from a depth of 7–8 cm, 12–13 cm, 17-18 cm, and 22–23 cm were taken, chemically treated, and extracted by the author. For determining the pollen concentration, 1 cm^3 of material was taken from each level and 10000 exotic *Lycopodium* spores were added to each sample. Up to 169 pollen grains were counted from each level (table 1–4).

Macrobotanical investigation of the bulk sediment samples from Luokesai I settlement core, took place in the McDonald Institute, Pitt-Rivers Laboratory. Plant remains were wet sieved through 1 mm, 500µm, 300µm mesh and collected from the sediments. The core was distributed into four levels. The macrobotanical data from the first level is from the 7–12 cm depth zone; the volume of the sample is 53 ml. The second group of plants come from the 12–16 cm depth zone; the volume of the sample is 40 ml. The third sample is from the 16–22 cm depth zone, the volume of the sample being 66 ml. The plant remains from the fourth sample come from the 22-28 cm depth zone, with the volume of the sample being 40 ml.

Before starting the analysis and the interpretation of archaeobotanical remains it is very important to note that during the analysis of the plant remains derived from the core macroscopic and microscopic peaces of charcoal were detected throughout the stratigraphy. The charcoal remains are of anthropogenic origin and indicate past human activity at the site. Knowing that humans occupied the site more or less all the time throughout the formation of the core helps to link the analysed archaeobotanical remains with

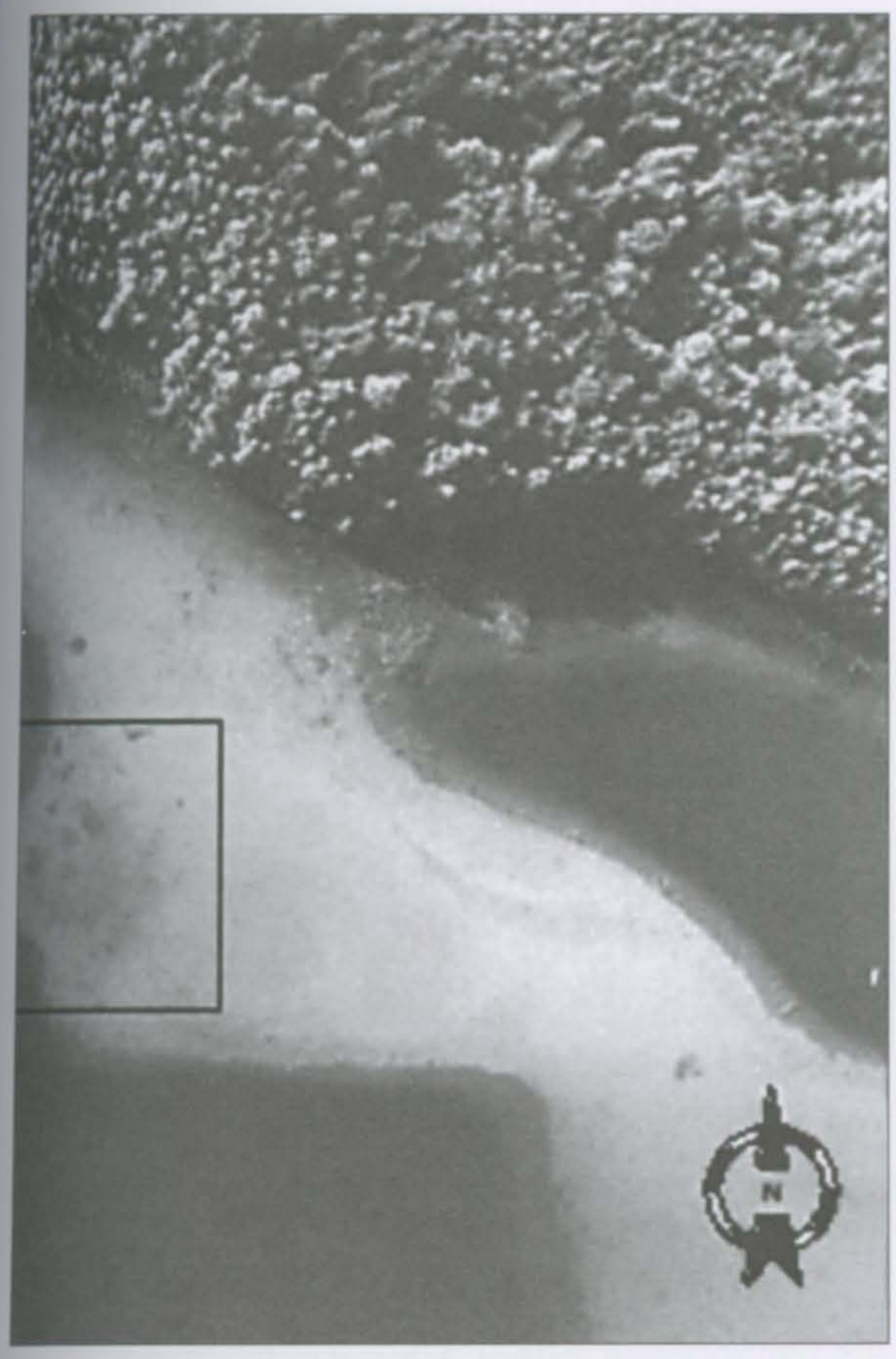

Fig. 2. The shoal of Lake Luokesai settlement. The squire on the picture indicates the territory of the site (photo by Giedrė Motuzaitė-Matuzevičiūtė).

the radiocarbon dates of timber house structures, the remains of which are incorporated in the stratigraphy. Unfortunately, only 7 radiocarbon dates have been received from the Luokesai I settlement (Menotti *et al.*, 2005). The dates were obtained by dating timber randomly without accurately detecting the depth of the wooden structures and their correlation with the absolute chronology. Therefore, it is impossible to attach the analysed archaeobotanical remains with a particular dated layer. The analysis of the archaeobotanical remains follows the trend that the age of the plant remains is defined by their depth in the stratigraphy. As it was mentioned above, all dates from the Luokesai I settlement fall into the period between the 8–th BC, therefore, it can be assumed that the plant remains from the deeper layers would be from the 8–7th BC. In the future, each stratigraphic layer from every 2–3 cm should be dated and linked with the dates from archaeological material. It also should be taken into account that due to trampling and other human activities, the layer from the top could have been mixed with the layer below. In that case, the interpretation of the dynamics of the palaeoenvironment would be inaccurate, but the interpretation of used plants and human agricultural activities would remain the same.

SUMMARY OF POLLEN DATA (SEE TABLE 1–4)

The uppermost 7–8 cm layer is characterized by a high concentration of pine and fir/spruce tree pollen grain, which is the highest number in comparison to the other three levels. In this layer a high concentration of birch tree and alder tree pollen was also observed. From this birch tree pollen, both silver and dwarf birch trees were identified. Some herb pollen grains, mostly from the grass family, were identified, in which 5 pollen grains from domesticated cereals were detected (fig. 3). Among the herbs, some species associated with open pasture fields and domestic environment were identified, such as *Chenopodium* or *Plantago* genus plants (Pini, 2004). In this zone 169 pollen grains were counted, from which 100 pollen grains are that of pine, fir/spruce, birch and alder tree, 25 of other deciduous trees, 23 or herb pollen, and 22 spores (table 1).

In the 12–13 cm zone, a distinct increase in willow pollen grains and a decrease in pine and fir/spruce pollen grains by 80 % was seen. A decrease in the number of birch and alder pollen was recorded as well. Herb pollen species, related to open grass fields or domestic environments were also identified, such as clover, nettle, and ribwort. Among the herb pollen, 2 cereal pollen grains were identified. Plant species which grow only on damp/swampy soil as well as aquatic plants appeared in the pollen data, such as sedge, arrow/pod grass and buttercup. The total amount of pollen grains counted in the 12–13 cm zone were: 120:11 coniferous tree pollen grains, 48 de-

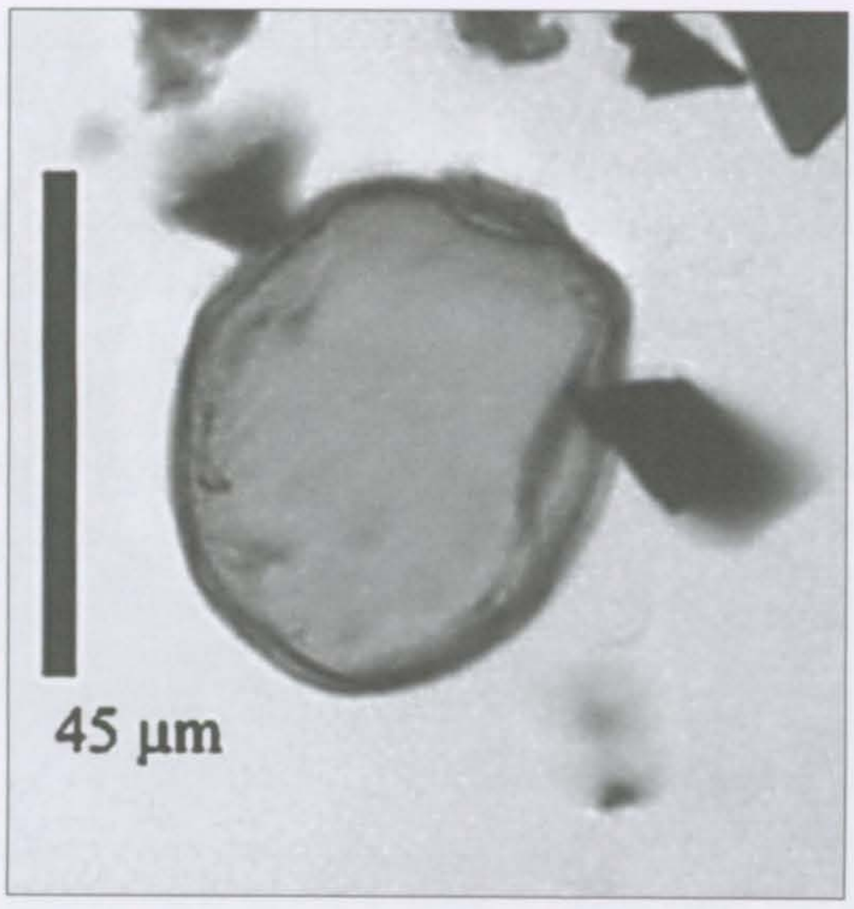

Fig. 3. Cereal pollen grain discovered in the Luokesai Lake dwelling site at the 7–8 cm depth layer (photo by Giedrė Motuzaitė-Matuzevičiūtė).

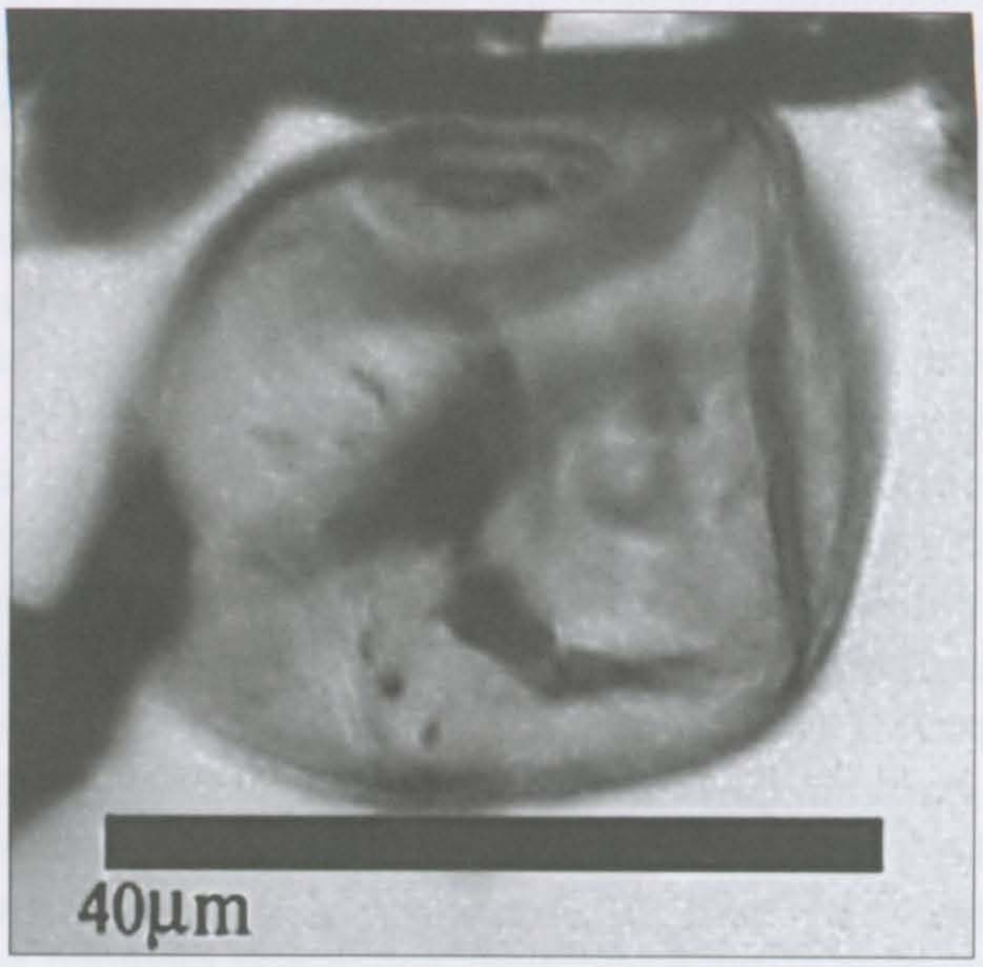

Fig. 4. Cereal pollen grains identified in the 7–8 cm layer (photo by Giedrė Motuzaitė-Matuzevičiūtė).

ciduous tree pollen grains, 17 spores, 12 water plant pollen grains, and 38 herb pollen grains (table 2).

In the 17–18 cm zone a slight increase in pine pollen together with alder pollen and a decrease in willow pollen was detected. Nevertheless, the discovery of herb pollen and spore taxa shows that the environment around the lake was pretty damp, which can be seen from the discovery of species such as fern spores, alexanders, heather, hazel and willow pollen. Some pollen grains of aquatic plants were identified, such as sedge and arrow-grass. An increase of grass family plant pollen associated with open grass fields was detected among the herb pollen. The total amount of pollen grains counted 148:26 of coniferous, 48 of deciduous tree pollen grains, 24 of pores, 12 of water plants, 38 of herbs (table 3).

The 22–23 cm depth zone contains the oldest pollen samples. The variety of tree pollen species discovered was similar as in the zones above. Some aquatic plant species, such as white lily, were detected. The fourth layer also displays an increase in the variety of herb pollen. Five cereal pollen grains were identified among the grass family plant species (fig. 4). The total amount of pollen grains counted: 124:25 of coniferous, 42 of deciduous, 19 of spores, 3 of water plants, and 35 herb pollen grains (table 4).

SUMMARY OF MACROBOTANICAL PLANT REMAINS DESCRIPTION (SEE TABLE 5)

Plant species from the Lake Luokesai I settlement core were macrobotanically analyzed by dividing the core sample into four different levels. Plant seeds from the 4 levels were counted and listed in the table following the Stace (1991) plant classification method, catalogues and habitat descriptions by Van Geel *et al.*, 1986.

In the topmost 7–12 cm depth sample, 19 plant species were identified. The most abundant species are wild strawberry (*Potentilla sterilis*) (28 seeds counted), sedge (*Carex* genus) (19 seeds counted), and knotgrass (*Polygonum* genus) (17 seeds counted). In the 7–12 cm zone, 1 charred cereal grain (5 mm long), possibly of hulled emmer wheat (*Triticum dicoccum*), was found (fig. 5). Cereal grains, due to their starchy consistency, usually do not preserve well in a waterlogged environment (apart from seed hulls and bran), therefore, cereal from the Luokesai sample was preserved due to being charred prior to

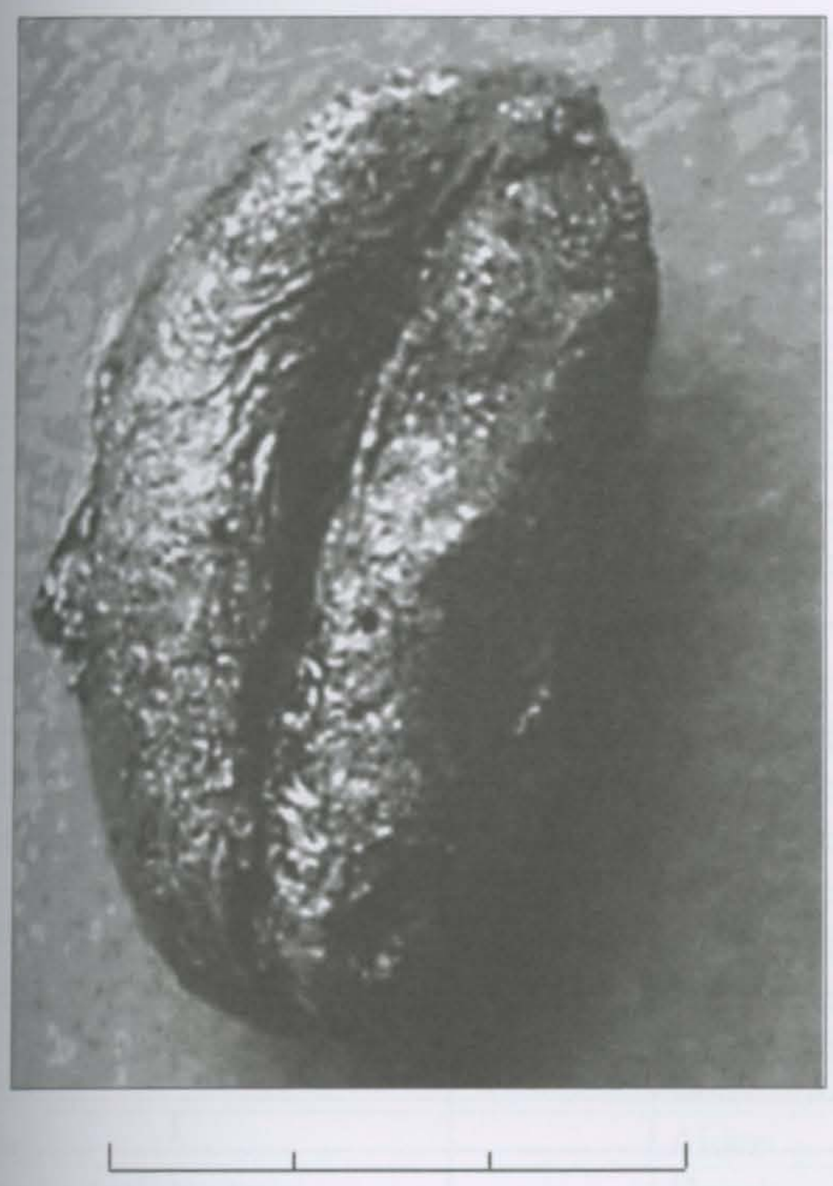

Fig. 5. Charred grain of emmer wheat (*Triticum dicoccum*) from the Luokesai I lake dwelling site (photo by Giedrė Motuzaitė-Matuzevičiūtė).

deposition. In the same levels three waterlogged glume bases (3,2 mm length and 1,7 mm width), probably of emmer wheat, were discovered (fig. 6). Six fragments of hazelnut shell were discovered in the 7–12 cm zone.

In the 12–16 cm zone, plant species that grow in man-made/disturbed environments and open grass fields were found. Only 3 fractions of hazelnut shells can be linked with some aspects of human diet. In total, 10 plant species were identified in the 12–16 cm zone.

In the 16–22 cm depth zone, plant remains from forest and aquatic/damp environments, as well as man-made-habitats, were found. The seeds of stone bramble/blackberry found in this level could have been consumed by inhabitants of the lake dwelling. In total, 5 plant species were identified in this zone.

In the deepest 22–29 cm level, some cereal remains were found, consisting of a fragment of cereal grain and three cereal glume bases, probably that of emmer wheat. From all the plant species identified in this level, two species (mint and marsh cinquefoil) were connected with a wet/damp environment and the rest of the plants were associated with domestic and open grassland environments. In total, 7 species of plants were identified in this zone.

It should be mentioned that throughout the stratigraphy the remains of plant stems, reed roots, buds, as well as leaves of trees and other plants (probably cranberries) were identified.

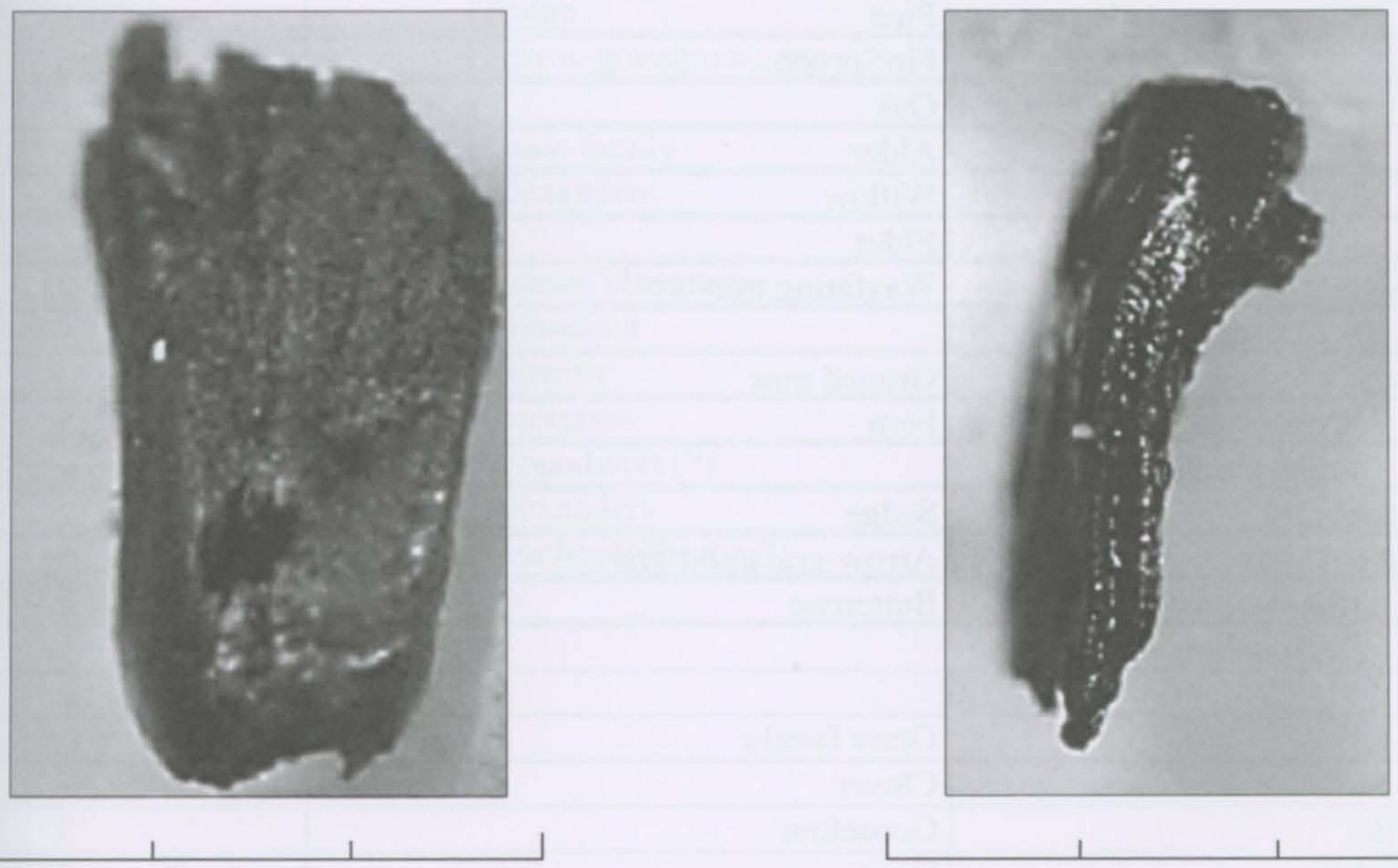

Fig. 6. Waterlogged glume bases of emmer wheat *(Triticum dicoccum)* from the Luokesai settlement site (photo by Giedrė Motuzaitė-Matuzevičiūtė).

Table 1. Pollen data from Luokesai, core 7–8 cm.

Latin name	English name	Pollen number
Tree pollen		
Betula pendula/Betula nana	Silver birch/ Dwarf birch	20
Pinus	Pine	40
Abies/Picea	Fir/Spruce	20
Ulmus	Elm	5
Quarcus	Oak	5
Tilia	Linden/lime	3
Alnus	Alder	20
Corylus avellana type	Hazel	6
Salix	Willow	5
Spores		–
Lycopodium	Ground-pine	20
Pteridophyte	Fern	2
Herb pollen		–
Poaceae (Gramineae)	Grass family	10
Cereal		5
Chenopodium	Goosefoot	3
Poa annua (?)	Annual bluegrass	2
Humulus lupulus	Hop	1
Plantago	Ribwort	2
TOTAL POLLEN COUNTED		169

Table 2. Pollen data from Luokesai, core 12–13 cm.

Latin name	English name	Pollen number
Tree/shrub pollen		
Betula pendula/ Betula nana	Silver birch /Dwarf Birch tree	16
Pinus	Pine	5
Abies/Picea	Fir/Spruce	6
Quarcus	Oak	1
Alnus	Alder	7
Salix	Willow	15
Sambucus	Elder	1
Viburnum lantana	Wayfaring tree	2
Spores		–
Lycopodium	Ground pine	12
Pteropsida	Fern	5
Water plants		–
Carex (inapertutrate)	Sedge	2
Scheuchzeria palustris	Arrow-grass/pod-grass	5
Rununculus	Buttercup	5
Herb pollen		–
Cereal		2
Poaceae	Grass family	17
Trofolium	Clover	1
Chenopodium	Goosefoot	3
Humulus lupulus	Hops	1

Continuation of table 2

Latin name	English name	Pollen number
Tree/shrub pollen		
Urtica dioica	Stinging nettle	3
Stachys genus	Woundwort (?)	3
Plantago	Plantain	4
Poa annua (?)	Annual bluegrass	2
Listera cordata (?)	Heart leaf twayblade	1
Ericaceae calluna	Heather	1
TOTAL POLLEN COUNTED		120

Table 3. Pollen data from Luokesai, LEVEL 7–8 cm.

Latin name	English name	Pollen number
Tree/shrub pollen		
Betula pendula/Betula nana	Silver birch/ Dwarf birch	7
Pinus	Pine	15
Abies/Picea	Fir/Spruce	11
Tilia	Linden/lime	3
Alnus	Alder	22
Corylus avellana type	Hazel	6
Salix	Willow	10
Spores		–
Lycopodium	Ground-pine	21
Polypodium	Fern	2
Pteropsida	Fern	1
Water plant pollen		–
Nymphaea alba	White water-lily	1
Carex (inapertutrate)	Sedge	9
Scheuchzeria palustris	Arrow-grass/pod-grass	2
Herb pollen		–
Poaceae (Gramineae)	Grass family	12
Smyrnium	Alexanders	2
Cereal		2
Poa annua (?)	Annual bluegrass	2
Chenopodium	Goosefoot	3
Plantago	Ribwort	6
Polygonum	Knotgrass	3
Stachys genus	Woundwort (?)	4
Smyrnium	Alexanders	2
Ericaceae	Heather/Bilberry (?)	2
TOTAL POLLEN COUNTED		148

Table 4. Pollen data from Luokesai, core 22–23 cm.

Latin name	English name	Pollen number
Tree/shrub pollen		
Betula pendula	Silver birch	15
Pinus	Pine	15
Abies/Picea	Fir/Spruce	10
Tilia	Linden/lime	3
Alnus	Alder	7
Corylus avellana type	Hazel	6
Salix	Willow	9
Solanum nigrum	Blachshade	2
Spores		–
Lycopodium	Ground-pine	15
Sphangum/pteridium	Peat moss/fern	4
Water plant pollen		–
Nymphaea alba	White water-lily	1
Scheuchzeria palustris	Arrow-grass/pod-grass	2
Herb pollen		–
Poaceae (Gramineae)	Grass family	10
Cereal		5
Poa annua (?)	Annual bluegrass	2
Chenopodium	Goosefoot	3
Plantago	Ribwort	2
Polygonum	Knotgrass	3
Stachys genus	Woundwort (?)	7
Smyrnium	Alexanders	2
Allium type	Wild garlic	1
TOTAL POLLEN COUNTED		124

Table 5. Luokesai I (B) settlement sample. The depth 0–29 cm. Macrobotanical data from samples: 7–12 cm, 12–16 cm, 16–22 cm, 22–28 cm.

Latin name	English name	Depth and volume-ml	Habitat according to (Stace, 1991).	Number of individuals and page number in Stace (1991)	Notes
Cultural plants					
Triticum dicoccum	Emmer (hulled) (?) wheat	7–12 cm/53 ml	Indication of cereal cultivation.	2 (1)	Charred
Triticum dicoccum glume base	Emmer wheat glume base	7–12 cm/53 ml	Indication of cereal processing.	3	Waterlogged
Wild plants					
Thalictrum lucidum/flavium	Common meadow-rue	6–12 cm/63 ml	Fens, streamside and wet meadows.	1/117	Waterlogged
Urtica dioica	Common nettle	7–12 cm/53 ml	In hedge banks, woodlands, grassy places, fens, and near buildings, especially where the ground is covered by litter or rubble, cultivated ground and where animals defecate.	1/144	Waterlogged
Betula pubescens = B. aurata	Downy birch	7–12 cm/53 ml	Spread in Central and northern Europe, tolerant to cold and wet conditions.	5/152	Waterlogged
Betula nana	Dwarf birch	7–12 cm/53 ml	Mountain moors. Very rare species in Lithuania (almost extinct and *included in the "red book* of endangered species").	1/153	Waterlogged
Corylus avellana	Hazel cob-nut	7–12 cm/53 ml	Woods, scrubs and hedges, *on damp or dry basic and* damp neutral or moderately acid soil.	6 *fragments/156*	Waterlogged
Chenopodium rubrum/glaucum (?)	Red goosefoot or oak-leaved goosefoot	7–12 cm/53 ml	Most species grow in man made habitats on the rich waste and cultivated ground, farmlands.	30/165	Waterlogged
Polygonum bistorta	Snake-root, eastern-ledges, common bistort	7–12 cm/53 ml	In meadows and grassy roadsides.	1/225	Waterlogged
Polygonum lapathifolium	Pale persicaria	7–12 cm/53 ml	Grow in waste, cultivated and open, especially damp ground, near the rivers and lakes.	15/226	Waterlogged, some glumes are still preserved on the seed.
Polygonum aviculare	Knotgrass	7–12 cm/53 ml	All sorts of open grass	1/229	Waterlogged
Salix pentandra (?)	Bay willow	7–12 cm/53 ml	Streams, marshes, fens and wet woods.	1/286	Waterlogged
Rubus saxatilis L.(?)	Stone bramble	7–12 cm/53 ml	Grows in hilly areas around stones.	1/402	Waterlogged, fractionated
Potentilla sterilis	March cinquefoil/ strawberry	7–12 cm/53 ml	Fens, marshes, where it is occasionally locally dominant, bogs, wet heaths, and moors.	28/409	Waterlogged

Latin name	English name	Depth and volume-ml	Habitat according to (Stace, 1991).	Number of individuals and page number in Stace (1991)	Notes
Solanum nigrum	Black nightshades	7–12 cm/53 ml	Waste and cultivated ground.	10/626	Waterlogged
Stachys arvensis	Field woundwort	7–12 cm/53 ml	Arable land fields.	1/663	Waterlogged
Veronica polita/hererifolia (?)	Grey field-speed-well	7–12 cm/53 ml	Cultivated grounds.	2/717	Waterlogged
Hieracium pilosella	Mouse-ear hawkweed	7–12 cm/53 ml	Grassy pastures and heaths, banks.	1/833	Waterlogged
Carex paniculata	Greater Tussock-sedge	7–12 cm/53 ml	Grows by lakes and streams, in fens and wet woods, on usually base rich soil.	6/962	Waterlogged
Carex type	Sedge	7–12 cm/53 ml	Plant of damp ground marshes.	4	Waterlogged; Drops seeds directly upon it
Corylus avellana	Hazel cob-nut	12–16 cm/30 ml	Woods, scrubs and hedges, on damp or dry basic and damp neutral or moderately acidic soil.	3 fragments/156	Waterlogged and charred, shell pieces
Chenopodium rubrum/glaucum?	Red goosefoot or oak-leaved goose-foot	12–16 cm/30 ml	Most species grow in man made habitats on rich waste and cultivated ground, farmyards.	4/165	Waterlogged
Polygonum bistorta	Snake-root, easter-ledges, common bistort	12–16 cm/30 ml	In meadows and grassy roadsides.	1/225	Waterlogged
Polygonum lapathifolium	Pale persicaria	12–16 cm/30 ml	Grows in waste, cultivated and open, especially damp ground, near rivers and lakes.	1/226	Waterlogged; Some glumes are still preserved on the seed.
Polygonum mite	Water pepper	12–16 cm/30 ml	Inhabits damp places and shallow water, often shaded.	4/227	Waterlogged; Preserved with spikelets
Potentilla anserine/Comarum palustris	March cinquefoil	12–16 cm/30 ml	Fens, marches, where it is occasionally locally dominant, bogs, wet heaths, and moors.	16/609	waterlogged
Solanum nigrum	Black nightshades	12–16 cm	Waste and cultivated ground.	2/626	Waterlogged
Centaurea scabiosa (?)	Grater knapweed	12–16 cm	Grassland, rough ground, road sides mainly on calcareous soil. Common throughout Europe.	2/812	Waterlogged
Crepis foetida (?)	Stinking hawk's-beard	12–16 cm/30 ml	Waysides and rough ground.		Waterlogged
Sonchus arvensis	Perennial sow-thistle	12–16 cm/30 ml	Arable and waste land, waysides, ditches and river-banks.	1/823	Waterlogged

Continuation of table 5

Latin name	English name	Depth and volume-ml	Habitat according to (Stace, 1991).	Number of individuals and page number in Stace (1991)	Notes
Betula pendula	Silver birch	16–22 cm/66 ml	Woods, especially on the lighter soils, rare on chalky soil, colonizing heath land and often forming woods there as a succession stage to sessile oak woodland.	2/152	Waterlogged
Chenopodium rubrum/glaucum?	Red goosefoot or oak-leaved goosefoot	16–22 cm/66 ml	Most species grow in man made habitats on the rich waste and cultivated ground, farmlands.	12/165	Waterlogged
Rubus saxatilis L.(?)	Stone bramble	16–22 cm/66 ml	Grows in hilly areas around the stones.	1/402	Waterlogged
Lythrum salicaria	Purple Loosestrife	16–22 cm	Grows in reed-swamp at the margins of lakes and slow-moving rivers, and in fens and marshes, often forming large stands. Spread almost throughout Europe.	4/518	Waterlogged
Potentilla anserine/Comarum palustris	March cinquefoil	16–22 cm/66 ml	Fens, marshes, where it is occasionally locally dominant, bogs, wet heaths, and moors.	4/609	Waterlogged
Triticum dicoccum (?)	Emmer wheat (?)	22–28 cm/40 ml	Indication of cereal cultivation.	1	Very fragmented, charred, waterlogged. Bran and glumes preserved (?)
Triticum dicoccum glume base	Emmer wheat glume base	22–28 cm/40 ml	Indication of cereal processing.	2–3	Waterlogged
Betula pubescens = B. aurata	Downy birch	22–28 cm/40 ml	Spread in Central and northern Europe, tolerant to cold and wet conditions.	1/152	Waterlogged
Chenopodium rubrum/glaucum?	Red goosefoot or oak-leaved goosefoot	22–28 cm/40 ml	Most species grow in man made habitats on the rich waste and cultivated ground, farmlands.	4/165	Waterlogged
Potentilla anserine/Comarum palustris	March cinquefoil	22–28 cm/40 ml	Fens, marshes, where it is occasionally locally dominant, bogs, wet heaths, and moors.	3/609	Waterlogged
Solanum nigrum	Black nightshades	22–28 cm/40 ml	Waste and cultivated ground.	1/626	Waterlogged
Mentha valutina (?)	Mint	22–28 cm/40 ml	Grow in waste-land, damp areas.	1/860	Waterlogged

OVERALL RESULTS

The archaeobotanical investigation of the Lake Luokesai settlement I core sample has led to some important insights into the past environmental situation which surrounded these lake village humans, and has also revealed some aspects of their diet. As can be seen from the pollen and archaeobotanical analysis, these two data sources partially support each other.

While interpreting the palaeoenvironment[1] from both pollen and macrobotanical data, it can be noticed that the upper layer contains the highest amount of tree pollen species, mostly coniferous, birch and alder, as compared to the other three layers below it. The abundance of tree pollen indicates the presence of a dense forest around the lake during this time period (Pini, 2004). During macrobotanical investigation of the upper layer, some seeds and pollen grains of dwarf birch were found. Dwarf birch is now almost extinct in Lithuania and only a few small nickes is presently known where it is habitant (Balevičius, 1992). This plant usually grows in cold climate zones and mountainous regions (Stace, 1991). The archaeobotanical data from the upper layer of the core exhibit features of a cold and dry second half of Sub-Boreal climate, which existed in Lithuania during lake dwelling occupation (2500–500 BC) (Stančikaitė, 2000).

According to the tree pollen data received from the deeper parts of the core, a decrease in coniferous trees and simultaneous increase in deciduous trees (alder, willow) was seen, indicating their growth in a wet environment around the lake (Stace, 1991). It can be noticed that no water plant pollen was discovered in the upper parts of the core (7–8 cm), whereas in the deeper layers pollen grains of reeds and even white lily were found, indicating wetter environmental conditions in the older periods which are more characteristic of the first half of the Sub-Boreal climate zone (Šimkūnas *et al.*, 2005).

Important information from both the pollen and macrobotanical data can be drawn by looking at the herbal species discovered at the lake dwelling site. Plants associated with pasturelands, open grass fields, as well as man-made environments were identified throughout the stratigraphy. Their appearance in the lake dwelling territory might be associated with hay, which might have been brought as animal fodder (Robinson *et al.* 1989). The existence of plants associated with pasture and manmade-environments in the forest zone of East Lithuania might indicate human influence on the environment, connected with woodland clearance and the formation of arable and pastureland around the lake.

While trying to interpret past environmental conditions around Lake Luokesai, it is very important to note that from the 4 layers of pollen data and a relatively small set of macrobotanical samples, we cannot draw concrete conclusions about the palaeoenvironment during these periods. We cannot reconstruct gradual environmental changes due to the gaps between the samples, lack of comparative material and absence of radiocarbon dating of the stratigraphical sequence.

An important discovery, connected with human diet and activities, was discovering the remains of emmer wheat (*Triticum dicoccum*) (cereal grains, glume bases and also cereal) in the analysed core samples. It is interesting to note that emmer wheat was

[1] While analysing the palaeoenvironment from archaeobotanical remains in an archaeological context, we should be aware of the fact that certain plant species might have been brought to the site from areas further away from the site, and do not necessarily represent the environmental situation which existed in the immediate area.

one of the most important crops in the lake dwelling sites of Switzerland, and it is often associated not only with personal human preferences but also with the specific soil qualities which existed around the lakes of Switzerland (Karg and Märkle, 2002). However, due to the lack of research, one can only assume that the growth of the emmer wheat in the catchment area of Lake Luokesai might partly be associated with the specific environment of carbonatic soil and swampy lowlands.

At the Luokesai lake dwelling site cereal pollen grains were identified in levels 7–12 cm, 12–13 cm, and 22–28 cm, with levels 7–8 cm and 22–29 cm having the highest number of cereal pollen grains (table 1, 2). It is interesting to note that the cereal pollen data coincide with the macrobotanical data, where cereal remains were found only in the upper and lower levels of the stratigraphy.

Before being completely sure that the pollen grains identified in the Luokesai core are really those of cereal, it is important to mention that lots of palynologists have tried to identify cereal from wild grass pollen. Cereal pollen grains are considered to be much larger than grass – at around 35–50 μm in diameter with an annulus being not smaller than 8 μm in diameter (Edwards, 1989). The diameters of the cereal pollen grains from the Luokesai lake dwelling site reach 40–45 μm, with their annulus being about 8 μm. Therefore, they seem to be the pollen grains of domesticated cereal (fig. 3, 4). Evidence of cereal cultivation is clearly provided by the macrobotanical data (fig. 5, 6).

While talking about pollen data as an indicator of cereal cultivation at the Luokesai Lake dwelling site, it is interesting to note some important aspects of their appearance at the site. Studies of modern pollen samples have show that cereal-type pollen grains travel a very short distance from their host plants, in comparison to other plant pollen. There have been quite a few experiments performed to show that the number of cereal pollen decreases very rapidly within a short distance from agricultural areas (Lange, 1986). Therefore, while counting pollen grains extracted from a sample taken close to the early farming areas, cereal grains are usually found in very low frequencies. The ratio of total pollen count to cereal grain is usually 500:1 to 1000:1, showing that the chance of detecting cereal pollen at the site among the other plant pollen is very low, especially if the settlements' agricultural fields were further away (Edwards, 1989). Five cereal pollen found in the lake Luokesai I settlement samples in the 7–8 cm zone (out of 169 counted in total) and in the 22–23 cm zone (out of 127 counted total) indicate that the ancient agricultural fields of the lake dwellers might have been situated very close to the Luokesai lake shore. It can also be assumed that cereal processing, most likely pounding and threshing activities, could have taken place in the lake dwellings, and therefore, the pollen grains were deposited on the immediate area of the site (Jones, 1985; Harvey *et al.*, 2005).

Six fragments of hazelnut shells discovered in this relatively small sample indicate that nuts might have constituted an important part of human diet at the site. It can also be confirmed by the fact that during the excavation of Lake Luokesai settlement I in 2004, an entire well-preserved ceramic bowl full of hazelnuts was retrieved from the underwater sediments (Baubonis, 2003).

CONCLUSIONS

The archaeobotanical investigation of a Lake Luokesai core sample has resulted in the extraction of useful pollen and macrobotanical data. Interpretation of these two sets of data has provided some mutually supporting conclusions concerning the pa-

laeoenvironment, human diet and human activities at this site.

It can be concluded that throughout the existence of the lake village at Luokesai (8th–4th century BC) the environmental conditions around the lake were dynamic. Pollen and macrobotanical data from the upper part of the core showed the existence of colder and drier environmental conditions and denser woodland around the lake as compared to the deeper zones of the core. In the three deeper/older zones of the core, wetter and warmer climate plants were detected, in comparison to the upper zone of the core. Plant seeds and pollen associated with open grass fields, cultivated land, and domestic environments were found in all levels, indicating the possible existence of pastureland, cultivated fields, and human intervention in the environment via wood clearance.

The investigation of archaeobotanical remains from the Luokesai lake village presented very important information about cereal cultivation and possible food processing activities (pounding and threshing) carried out by the inhabitants of the lake dwellings. Pollen data indicate that the settlement's arable fields were situated very close to the shore of the lake. A suitable environmental situation for cereal grain cultivation around the lake might have been the main reason for the establishment of the lake dwellings at the Luokesai Lake.

Cereal grain and glume bases from the Luokesai I settlement are the first discovered wheat remains among all prehistoric material of East Lithuanian archaeology. This discovery of domesticated cereal remains will help to shed some light in analysing the domesticated species used in prehistoric farming in Lithuania. Further archaeobotanical investigation might reveal more aspects of the food production methods of the prehistoric wetland community.

Apart from identified cereal remains, other plant species found in the Luokesai lake village core sample can be associated with human diet, such as hazel nuts, blackberry, bilberry, wild strawberries, and wild garlic, and confirm the importance of gathering in the survival strategies of these lake village humans.

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EŽERO GYVENTOJAI – ŽEMDIRBIAI. LUOKESŲ EŽERINĖS GYVENVIETĖS ARCHEOBOTANINIŲ TYRIMŲ DUOMENYS

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Santrauka

Lietuvoje šiuo metu žinomos dvi ežerinės gyvenvietės, atrastos 2000 m. Luokesų ežere, Molėtų r., datuojamos bronzos amžiaus pabaiga – ankstyvojo geležies amžiaus pradžia. 2005 metų vasarą buvo paimtas 29 cm ilgio ir 7 cm skersmens kernas iš Luokesų I polinės gyvenvietės žiedadulkių ir vandenyje užsikonservavusių augalų liekanų tyrimams. Archeobotaniniai tyrimai parodė, kad klimatas Luokesų ežero pakrantėje keitėsi iš drėgnesnio ir šiltesnio į šaltesnį ir sausesnį. Apie žmonių veiklą Luokesų ežero pakrantėje liudija žiedadulkės ir sėklos augalų, susijusių su dirbamais laukais ir ganyklomis. Aptikti kviečio (*Triticum dicoccum*) grūdai bei žiedažvyniai patvirtino, kad Luokesų ežero gyventojai buvo žemdirbiai. Javų žiedadulkių gausa gyvenvietėje parodė, kad javai galėjo būti auginami krante greta gyvenvietės ir kuliami jos teritorijoje. Žemdirbystei palanki gamtinė aplinka (atviri paežerės plotai) galėjo būti viena iš pagrindinių priežasčių, lėmusių ežero gyventojų pasirinkimą apsigyventi Luokesų ežere. Be kviečių, buvo nustatytos ir kitos augalų rūšys, tokios kaip žemuogės, lazdynai, bruknės, laukiniai česnakai, kurios parodė rankiojimo svarbą Luokesų ežero gyventojams.

ILIUSTRACIJŲ SĄRAŠAS

1 pav. Luokesų ežero apylinkės (pagal www.maps.lt).
2 pav. Luokesų I polinės gyvenvietės sekluma. Keturkampis nuotraukoje žymi gyvenvietės teritoriją.
3 pav. Javų žiedadulkė iš 7–8 cm kerno gylio.
4 pav. Javų žiedadulkė iš 21–22 cm kerno gylio (Giedrės Motuzaitės-Matuzevičiūtės nuotrauka).
5 pav. Suanglėjęs *kietojo kviečio* grūdas (*Triticum dicoccum*) iš Luokesų I ežero gyvenvietės.
6 pav. Vandenyje išlikusių kviečio (*Triticum dicoccum*) lukštų/žiedažvynių dalys.

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