The background of the cover is a photograph of a lake. In the foreground, there is a dense thicket of tall green reeds. A small, dark wooden boat is moored at the edge of the water, partially obscured by the reeds. The water is calm, reflecting the sky. In the distance, a line of trees is visible on the horizon under a sky with soft, white clouds.

Interaction between hunter - gatherers and the environment in the Lake Lubāns basin, eastern Latvia

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Abstract

The largest Stone Age micro region in Latvia, has been discovered and extensively investigated during the 1960s -1980s in the Lake Lubāns basin. This master thesis discuss the interaction between hunter-gatherers and the environment in the developing stages of the Lake Lubāns. The literature studies have been carried out in attempt to find out whether people adapted to the environment and ecological circumstances versus more dominant people role in the landscape exploitation. The factors that attracted hunter-gatherers to the Lake Lubāns, settlement location, specialisation, seasonality aspects have been discussed and comparative studies carried out.

The results from this study show an active hunter-gatherer participation in the environment exploitation. Beneficial river network, shallow lake, rich in different sorts of fish, various flora and fauna have been advantageous aspects for hunter-gatherer subsistence in the Lake Lubāns basin. Settlements have been situated in ecologically or strategically favourable places that were suitable for people activities. Specialised and long duration settlements seems to appear in the Lake Lubāns basin since the Late Mesolithic. There are indications about highly developed bone and antler industry, specialisation in fishing, waterfowl hunt and pottery making during the Atlantic period. Lack of flint probably encouraged the Lake Lubāns basin inhabitants to specialise in amber working and to take a middleman role in the exchange network between the Baltic Sea coast and the Upper Volga regions.

Keywords: Stone Age; hunter-gatherers; environment; Lake Lubāns; Latvia.

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Introduction

I have grown up in Īdeņa - a little island, that have been surrounded by Lake Lubāns (fig. 1) for thousands of years. I have often thought about people lives there in the past, what the lake looked like during the Stone Age and how it has changed over time. I have always wondered about this unique place, where people and the lake have coalesced so much. I have also wondered whether lake have forced people to take this lifestyle or whether they themselves chose to live by the lake, considering the fact that fishing, hunting and gathering are still the main occupations, and are a way for the local people to gain important resources. Exactly as it for 1000 and 9000 years ago... Curiously, but so it is!



Figure 1. Location of the Lake Lubāns. (Background map from <http://www.grida.no/baltic/htmls/maps.htm>).

Even though these occupations have developed, such as rifles being used for hunting, motor boats for fishing and other technical achievements, it is interesting to consider why people still choose to live at the lake, in this particular environmental condition, where the Lake Lubāns still plays an important role in people's lives. Perhaps it is the ecological conditions that have decided the lifestyle and development there or maybe people have chosen this way of life themselves and have had to adapt and exploit this landscape according to their needs. I know that some people who live in Īdeņa have chosen this way of life. For instance, my father, grandfather and grand grandfather all did, and most likely other ancestors did as well. In fact, their lifestyle by the lake is something that they would never choose to part with because it stands as part of who they are. My father indeed chose to live and stay in this particular location because of the lake.

Local people have always felt a sense of pride about their regional history, with most of them having been in contact or in some way involved with archaeologists when excavations have taken place around the Lake Lubāns. Thus quite early in my childhood, I got acquainted with different stories about the archaeological excavations around the lake and the legends that inhabitants tell about the history of Īdeņa and the Lake Lubāns. Even nowadays when the tourists come to this region for the first time, they get a “lesson” in Latvia's prehistory and leave with plenty of interesting information and material for contemplation... and many mosquito bites...

I believe that Īdeņa and the Lake Lubāns basin is an interesting case for ethnographical studies about people and nature relations and interactions, that can be traced in a thousands of years long perspective. In this place it is possible to see the development of people and environment coexist and to see how interaction between nature and people have shaped the appearance of it. Thus my curiosity has led me to this research in attempt to find out hunter - gatherer and the environment interaction during the Stone Age at the Lake Lubāns and its surroundings.

Lake Lubāns is situated in the Eastern Latvia Lowland and is the biggest lake in Latvia. Lake Lubāns Wetland territory has been formed in the course of thousands of years and cover an area of approximately 100 000 ha. In the Stone Age the Lake Lubāns hydrological system (fig. 4) was formed by seven river inlets and one outlet - Aiviekste - that connect the lake with Daugava that is the largest river in Latvia. The river begins in Valdai Hills in western Russia and flows into the Gulf of Riga. Lubāns surroundings are covered by peat bogs and marshy meadows, that are consequence to the floods that the territories have encountered. This has preserved the Stone Age remains within this region. As a result of the annual floods of the lake, the development of this territory has been complicated. Thus in the beginning of the 20th century begun the drainage works with straightening and deepening of the river beds that led to the discovery of the Stone Age settlements. Systematical archaeological excavations were initiated by flood prevention works in the Lake Lubāns basin in the mid 1950s, but systematical excavations actually started in the beginning of 1960s and continued nearly without a break to the end of 1980s. This work was mostly carried out by archaeologists, namely, - Dr.habil.hist. Ilze Loze and Dr.hist. Francis Zagorskis. As a result of this work 29 Stone Age settlements (fig. 2) were discovered and investigated, in addition to

the findings of sites from later periods. Findings cover the time period from the Late Palaeolithic to the Iron Age and later periods. Thus, Lake Lubāns basin seems to be one of the most densely populated regions in the Stone Age in the East Baltic.

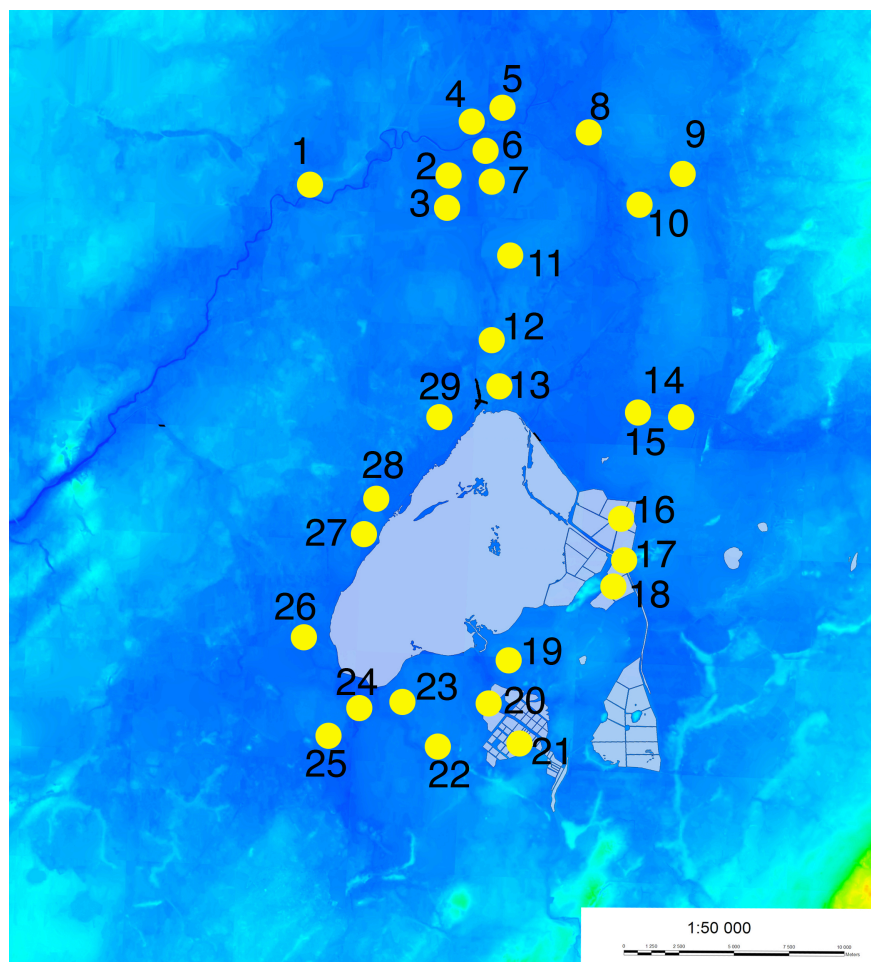


Figure 2. Stone Age settlements in the Lake Lubāns basin.

1. Licagals, 2. Abaine I, 3. Abaine II, 4. Dzedziekste II, 5. Dzedziekste I, 6. Abora I, 7. Abora II, 8. Lagaza, 9. Osa, 10. Piestina, 11. Nainiekste, 12. Eini, 13. Zvidze, 14. Upesgala licis (Ica II), 15. Ica, 16. Kvapani II, 17. Kvapani I, 18. Idena, 19. Zvejsalas, 20. Leimaniski, 21. Jasubova, 22. Sulagals, 23. Sulka, 24. Malmutas griva, 25. Malmuta I, 26. Lisina, 27. Asne I, 28. Asne II, 29. Smaudzi. (After Loze 1988, Grube 2006).

Before I continue, some notes and information should be mentioned. First of all, I need to explain the chronology of Stone Age in Latvia (fig. 3), which differs from Swedish and most other countries. The Mesolithic finds in the territory of Latvia belong to the Kunda culture, which is named after the settlement in northern Estonia where this culture was traced for the first time. The shift to farming and stock-breeding in Europe is one of the main

indicators of the Neolithic (Price 2000). Appearance of first ceramic around 5500–4900 calBC mark the shift from the Mesolithic to the Neolithic in Latvia. First pottery discovered in Latvia reveals the Narva culture, named after the settlement in the north-east Estonia. This culture was followed by the Comb Ware pottery in the Middle Neolithic approximately 4400–4150 calBC and Corded Ware c. 3200–2900 calBC, which characterise the Late Neolithic culture in Latvia. Arrival of the first farming and domesticated animals correspond to the Middle Neolithic in the chronology of Latvian Stone Age.

Although the title of my thesis states that I will discuss the interactions between the hunter-gatherers and environment, other settlements from the Middle and Late Neolithic will also be examined to provide a better picture of the full history of the Lake Lubāns Stone Age settlements. I agree with Ph.D. Valdis Berzins (2008:37) when he claims in his dissertation that the shift to farming and stock-breeding is still not a completely understood phenomenon in Latvian archaeology. Thorough evidence about this form of economical subsistence is still scanty, and findings from the Lake Lubāns settlements testify that hunting-gathering have been the most important subsistence strategy through the all Neolithic (Zagorska 2000), allowing me to discuss the settlements also from the Middle and Late Neolithic under this title. In addition, it will be interesting to analyze the patterns in people and environment interactions caused or affected by appearance of new economical base of subsistence.

With regards to territorial limitations in my study area, I have used Lozes' (1988, 2008) maps that include Stone Age settlements located in the Lake Lubāns Wetland. Although there have been many different names used to designate this territory, as lowland (Zagorska 1993), depression (Loze 2000c), plain (Seglins *et al.* 1999), wetland (Loze 2008), I have choose to use term “basin” discussing the Lake Lubāns surroundings.

There are different names mentioned in the thesis from different countries. To avoid technical problems, spelling of the names sometimes can be not grammatically correctly. During the work I had some difficulties with chronology of events mentioned in the literature, because different authors have used diverse dating systems. Some have used BP, some BC, other calibrated data. I have choose to calibrate the data that were in the BP, using OxCal 4.1. program (2 sigma). The original numbers are mentioned in the parenthesis, and if possible, the laboratory index, as well as the range of errors are given. In the bibliography, author has performed translations of the article and book titles.

Cal BC	BP	LATVIAN ARCHAEOLOGICAL CHRONOLOGY	SWEDEN	STAGES OF BALTIC BASIN	CHRONOZONE
1000	3000	BRONZE AGE	BRONZE AGE	Baltic Sea	Subatlantic
1800 2000	3500	Late NEOLITHIC Corded Ware Culture	Late NEOLITHIC	Litorina Sea	Subboreal
2900 3000	4000		Middle NEOLITHIC		
4000	4300	Middle NEOLITHIC Comb Ware Culture	Early NEOLITHIC		
	5000		Late MESOLITHIC Ertebölle Culture		
4100	5300	Early NEOLITHIC Narva Culture			
5000	6000				
5400	6500	Late MESOLITHIC Beginnings of the Narva Culture	Middle MESOLITHIC Kongemose Culture		
6000	7000	Middle MESOLITHIC Kunda Culture	Early MESOLITHIC Maglemose Culture	Ancyclus Lake	Boreal
7000	8000				
8000	9000	Early MESOLITHIC Pulli Culture	PALEOLITHIC Ahrensburg Culture	Yoldia Sea	Preboreal
8300	9600				
9000	10 000	PALEOLITHIC Earliest known habitation	PALEOLITHIC Bromme Culture	Baltic Ice Lake	Younger Dryas
10 000	10500				
11 000	11 000				

Figure 3. Latvian Stone Age chronology. (After Graudonis 2001, Andersson et al. 2004, Larsson & Zagorska 2006).

Aim and problem statement

Landscape is always dynamic and in changing process, affected by nature rules, as well as by animal and human activities. Interactions between nature and human beings is inevitable, although it is unclear the significance of the role of humans in these processes. Is it the nature that forces people to adapt their life and occupation to the landscape or is it humans that choose the environment fitting to their needs?

Some landscapes are more sensitive to the influences and changes that humans or other natural forces can bring about than others. Due to the climate changes and geological conditions some landscapes can have the same appearance as for 7000 years while others are totally transformed. These factors affect the development and use of the environment and humans play a certain role in these changes. Society is always in process of the development, as well as the nature.

Lake Lubāns and its surroundings have been considerably affected by the water level oscillations of the lake. This factor has substantially influenced development of the Lake Lubāns basin until the present. Even though the landscape around the Lake Lubāns is very modified, an annual flood is no longer a danger for the people and their subsistence. However, how did Stone Age hunter-gatherers handle this issue?

The main subject of my master thesis is to analyze interaction between hunter-gatherers and the environment in the developing stages of the Lake Lubāns. I will discuss whether people adapted to the nature and ecological circumstances versus more dominant people's role in the landscape exploitation.

There are several issues that I would like to discuss during my work:

- An important subject is the aspects that made the Lake Lubāns surroundings attractive for hunter-gatherers.
- Settlement location and factors that decided position of them in the landscape are also of importance. I will try to see if there is some pattern in settlement location during the different stages of the development of Lubāns and analyse if the shift to agriculture brought some changes in the settlement location.
- Another field of interest is the settlement seasonality. There can be the base settlements and seasonal or special purpose sites that served for some certain task. What are

the possibilities to find information about that and how can osteological material help to investigate that?

- I also want to look into whether there are some indications in the archaeological material about settlement specialisation and how the location of settlement affected the occupation of inhabitants.

- Some settlements have been inhabited during a long period while others took just a short period of time. The reasons and prerequisites for the long-existence of some sites will also be an interesting question to analyze.

- Comparison with other inland and coastal hunter-gatherer settlements in Latvia, Eastern Baltic and Southern Sweden will be carried out to look for the similarities and differences in settlement location and specialisation and to highlight the place of the Lake Lubāns Stone Age complex at a wider-scale analysis.

Choice of material: potential and limitations

Due to the extensive rescue excavations caused by melioration works, large amount of material has been accumulated. Annual publications, articles and monographs about the excavations, written mainly by Loze and other authors, compose the base of material for my thesis. The largest part of material comes from the publications by Loze, who has devoted large part of her life towards the extensive research and excavations around the Lake Lubāns. Important archaeological work has also been carried out by Zagorskis, and earlier by Professor Edvards Šturms. Significant work has also been carried out by Lucija Vankina, who systematised bone and antler stray find collection that were gathered in the Lake Lubāns during the 1930s. She has also led small excavations in the Lake Lubāns basin.

Environment and landscape changes in this region are very important and thus geologist investigations provide essential information. Significant geological and geomorphological research in the Lake Lubāns surroundings has been carried out by Dr.habil.geogr. Guntis Eberhards. Paleobotanic material as pollen and spores, fruits and seeds from Lubāns settlements have been discussed by Levkovskaja (1987), and recently Professor Laimdota Kalnina has made a pollen analysis for this region. Very useful material for my work comes from the MA thesis of Gunta Grube (2006), Faculty of Geography and Earth

Sciences, University of Latvia. She has carried out a modelling of the Lake Lubāns development from Late Glacial period until the present.

The geologist surveys, pollen analysis and publications about lake transformation processes by meliorators form the base information about lake geological and hydrological conditions. Information about research history comes from annual excavation reviews and comprehensive books about Latvian archaeology.

For the comparative studies, similar inland lake complexes, such as the Lake Kretuonas in Lithuania and Lake Ringsjö in Southern Sweden are discussed. Examples from the Lake Burtnieks in Northern Latvia, coast settlements such as Sarnate in Latvia and Sventoji complex in Lithuania, as well as Pulli, Kunda, Narva and islands of Estonia also are analysed.

Potential

Advantageous for this thesis is the large amount of material that has been accumulated during the intensive excavations carried out in 1960s -1980s. Different types of settlements that cover long time period with the rich archaeological material have been discovered in the Lake Lubāns basin and most of this information have been widely discussed within literature. There are generously described different artefact categories in the publications (Loze 1979, 1988, 2008b), as well as many articles deal with a particular fields of interest (Loze 1995, 1997, 2006a, 2008a). It is a micro complex in Latvian Stone Age archaeology and it is interesting to study Lubāns basin as an entirety. There are many outstanding finds discovered in Lubāns settlements and this material has been of great importance building the knowledge about Latvia's first inhabitants and their culture.

Since most of the settlements were discovered through melioration works, it indicates that there is probably waist areas that still store the undiscovered evidences about the ancient people life in the Lake Lubāns basin.

Limitations

Excavations around the Lake Lubāns were mainly carried out during 1960-1980's and reports written during the Soviet times. This means that they have most likely been affected by the political system and archaeological methods of that time. In addition, most of the publications about the Lake Lubāns Stone Age settlements come from only one author. Another limitation

is the fact that certain aspects of material preservation, for example, in some settlements bone or organic material have not been preserved. Thus problems can arise with interpretations of the arrival of farming and animal domestication. Misinterpretations can occur, because some remains are so fragile or little, that probably have not survived the taphonomic processes, as well as the excavation methods can affect the assemblage of archaeological material.

There are extensive descriptions about different artefact groups in the literature, however information about refuse layers and graves, that could be important for this study is not widely discussed within the literature.

Although the material from Lubāns Stone Age complex is very rich, in a certain ways it is also very limited. Nearly all archaeological investigations in the Lake Lubāns basin have been rescue excavations. These finds have been discovered by exploitation activities and not through the scientific research, thus probably revealing just a part of the Stone Age habitation activities within this region. For example, the stray find collection indicate more intensive people activities during the Mesolithic, but so far there are just a few settlements discovered from this period. The archaeological survey works have not been carried out on the shoreline of the ancient Lake Lubāns or its islands which probably could have been inhabited during the Stone Age. It is also important to bear in mind that extensive melioration works have heavily changed the appearance of the lake and its' surroundings. That could complicate a possibility for archaeological surveys, since forests and peat bogs mostly cover the territory of the ancient lake. The Stone Age settlements are probably covered with large amount of peat which limits the chances to find some new sites.

Theoretical perspective

The theoretical approach in archaeology is an essential aspect, and it is necessarily to find the right theories that fit to the study material. Matter of necessity and relevance of the theory or applied method can sometimes emerge during the research. In the beginning of my thesis I was quite confused between all theories and currents of ideas, trying to find the ones that were suitable for my research material and how they could contribute to my thesis.

To begin with, it is important to understand the need and application of the theories within the archaeological studies. For me, I found helpful theory and method application on archaeological material in Liv Nilsson Stutz doctor thesis (2003). Concerning the

understanding of mortuary practices and need of theories and methods for these studies she says “we are studying the material remains of actions, (...) we need methods and theories that focus on these actions that created the archaeological record - methods to visualise them and theories that problematize and explore their social, cultural, ecological, emotional and, most basically, their human dimensions”(Nilsson Stutz 2003:3). Again quoting Nilsson Stutz “We need the archaeological material, and methods appropriate to explore it, to allow us a firm contact with the archaeological past, (...) we need theories to bring this past back to life”.

Theoretical perspectives that I have found useful for my thesis I have divided in several groups:

- Processual and post-processual archaeology ideas about hunter-gatherers and their subsistence strategies
- Seasonality of settlements
- Neolithization
- Landscape archaeology

Processual and post-processual archaeology ideas about hunter-gatherers and their subsistence strategies

Different interpretations about the human and environment relationship could be observed through the development of archaeological thought. Discussions about role of environment and ecology analyzing ancient cultures increased during Neo-evolutionism and New Archaeology period. Application of the neo-evolutionary theory in the archaeology was expressed through the formula where the reconstruction of the technology and environment was the key to understand the culture (Trigger 1992:290 ff.). Processual or New Archaeology pointed out nature superior roll in the ancient culture systems, while post-processual view was more oriented on people increasing roll in the landscape exploitation. According to the New Archaeology, changes in all aspects of cultural systems were interpreted as adaptive responses to alterations in the natural environment or adjacent and competing cultural systems (Trigger 1992:289 ff.). Trigger emphasize the New Archaeology way to treat human beings as passive victims of forces that mostly lie beyond their understanding and control. Processual archaeology did not discuss the interactions between the societies (Trigger 1992:326 ff.).

Processual archaeology was inspired by marxism and functionalist theory. Lewis Binford provided the theoretical bases for the New Archaeology in general (Nilsson Stutz 2003:111). In the processual archaeology economic importance of the Mesolithic was emphasised. Binford discussed the social complexity correlation with forms of subsistence production and distinguished between groups according to their subsistence practices: hunters and gatherers, shifting agriculturalists, settled agriculturalists and pastoralists (Binford 1972:227).

Post-processual archaeology emphasize the belief that all knowledge is a subjective construction. The focus was not longer on knowing the past, but on reading, interpreting, re-writing and experiencing it (Nilsson Stutz 2003:120). British archaeologist Richard Bradley (1984:11) summarized statements about Mesolithic in literature, saying that "successful farmers have social relations with one another, while hunter-gatherers have ecological relations with hazelnuts", however he also stated that this approach was no longer acceptable, emphasizing the role of population. People significance in the Mesolithic environment and not only the nature superiority have also pointed out British archaeologist Marek Zvelebil (cited in Carlsson 2007:15) when he stated "Time has come to put man before fish".

The active people participation in the creation of their surroundings reflects the agency theory. Agency became the theoretical perspective in archaeology during the 1980s, but origins of this theory can be traced back to the 1970s by the statements of Giddens and Bourdieu. Giddens discussed the consciousness of actors monitoring their own actions, while Barrett admit that archaeologists should be aware of the presence of knowledgeable agents within the operation of the social conditions that are before us (Hooder 1986:71 f.; Barrett 2001:141 f.).

Thus the post-processual archaeology approach with Agency theory I have found useful discussing the interaction between hunter-gatherers and the environment in the Lake Lubāns basin.

Seasonality of settlements

One of the important issues of my thesis is the settlement location and specialisation and thus matter about settlement strategies and seasonality is of importance. A typical picture about hunter-gatherers has been that they were moving frequently and farmers had a more sedentary lifestyle. This has been the dominant view for a very long period, but discussions

during the last 30 years have brought some changes into this opinion. The idea about dynamic hunter-gatherers began with a statement of a Danish archaeologist Worsae in the excavation report about “kitchen middens” in Denmark that determined the use of a middens during the autumn, winter and spring, but not summer (Trigger 1992:82).

Many discussions have been devoted to the mobility and sedentary life of the Stone Age people. Just as hunter-gatherers do not need to be just mobile, neither do farmers need to be sedentary (Carlsson 2007:44). Thus, it is important to remove these strict divisions and stereotypes about hunter-gatherers and farmers and analyze the unity of the place and circumstances that have affected its existence.

The development of different methods, analysis of animal bones, stable isotopes, pollen, etc. has provided new knowledge about hunter-gatherer lifestyle and has made it possible to reinterpret the statements about the movements of Stone Age people. For example, analysis of animal bones can reveal the time of their slaughtering and thus indicating seasonality (Magnell 2006, 2010). Kristina Jennbert (1984:97) has listed three factors that should be present to be able to call the settlement permanent: it should be located in a favourable ecological environment; have large, expanded settlement area and have a graveyard in the vicinity of settlement. Summarising sedentism indicators shows that permanent settlements must have had a large, well exploited area, with accumulation of rubbish, tools and waste of their production, presence of graves, position in a favourable environment that lay in association to several diverse biotopes. Large amount of identified fauna species within the settlement has also been considered as beneficial factor for permanent habitation, as well as a possibility to travel by canoe over the longer distances (Carlsson 2007:41 ff.)

Neolithization

The shift from hunting-gathering to farming and stock-breeding has been one of the most discussed topics in the worlds prehistory. There are many theories, ideas and opinions about this process, but usually Neolithization has been connected to the technological developments as appearance of pottery and polished stone tools and arrival of first farming and domesticated animals (Price 2000:2 ff.). There are disagreements about the concept of Neolithization, because some researchers interpret this concept with social, while others with ideological or conceptual changes (Zvelebil & Lillie 2000:60). Latvia and other Baltic states

are still an exception in this matter, because the Neolithic in these countries begun with the appearance of ceramics and the first traces of domesticated animals and farming have been observed since the Middle Neolithic (Loze 1979, 1988).

Zvelebil admit that in the eastern Europe Neolithization is still defined by technological, rather than social or economical grounds. Subsistence mode is still the method to distinguish between hunter-gatherers and farmers in this region. Zvelebil and colleagues (1998:3) argue that agro-pastoral farming played little or no economic role in the eastern Baltic, although the effect of domesticates as a social resource may have been considerable. Thus such communities flourished for a long time until the end of the third, or even the second millennium BC, which demonstrates that agricultural transition become an enduring way of life.

There has been great debate around the the way this transition took place and the length of time it took. The earliest theories supported the colonization model, whereby foreign colonists arrived to the new territories with the “Neolithic package” that included knowledge, tools, ceramics, domesticated animals and plants, permanent villages. Another model represents the indigenous adaptation when local hunter-gatherer communities slowly introduced with this new way of life (Price 2000:4 f.). Zvelebil and Rowley-Conwy (1984) present one of such a models which includes three stages - availability, substitution and consolidation. During the availability phase the first contacts between hunter-gatherers and farmers appear such as exchange of materials and information. At the end of this stage major elements of farming have been adopted by foragers. Substitution phase includes replacement of hunting-gathering with farming practices, but consolidation represents a full shift to dependance upon agriculture. According to Zvelebil, in the eastern Baltic the substitution phase was more extended (700-1500 years) with an existence of mixed forager-farmer groups (Zvelebil 1998:10 f.).

Landscape archaeology

Landscape and ecology studies have recently become more popular. This can also be useful for the archaeological studies, especially for the prehistory when there were no written sources or they were at least limited. Ecology studies can contribute significant information about the landscape and lifestyle of people in the past. Landscape archaeology or theoretical reflections about landscape as an object within the archaeology has emerged during the last

two decades (Thomas 2001:165). There have been ideas of the passive and active roles of Man in the landscape. Zimmerman (1985:250) has stated that nature is something that exists for people: as a home and a store of resources. There are two different understandings about the term “landscape”. One of them is a territory, - which can be apprehended visually, and other as a set of relationships between people and places (Thomas 2001:181).

Since my attempt is to discuss the interactions between hunter-gatherers and the environment I found it appropriate to look at the theories of the archaeology of the landscape, because people often identify themselves with some certain space or place that they own or belong to. The concept of place is not just a thing or an entity: - it is relational. People are shaping a formless space into a meaningful place, thus creating the relation to their landscape (Thomas 2001:173 ff.).

Thus within the surroundings of Lake Lubāns', people have arrived to a certain environment (a place) and during their activities shaped their landscape. The way that these relations were created is a field of interest of my thesis. Was it adaptation to the environment or people exploit and shape it according to their needs, creating their landscape that involved more complex identity?

Method

Empirical work with published material about the Lake Lubāns archaeological and geological investigations form the base for my research. No work with actual archaeological material and excavation reports has been carried out, due to the limitations of time and the length of the thesis. There is an extensive amount of published sources to analyse this theme. The main attention in the analysis is paid to the settlements that belong to the classically considered hunter-gatherer period - Mesolithic and Early Neolithic. Although the first evidences about farming and stock-breeding in the Lake Lubāns basin appears during the Middle Neolithic, hunting-gathering has been the main mode of subsistence through the entire Neolithic. To get better understanding of the Lake Lubāns Stone Age complex as an entirety and see the relations between the hunter-gatherers and early farmers, settlements from the latter part of Neolithic are discussed, although on a much smaller scale. In the publications, first of all, I pay attention to the settlements position in landscape. In attempt to get some indications on

the settlement specialisation, information about finds - artefacts, osteological material and other special features - are also significant.

In spite of post-processual archaeology critique about the use of analogies, I have found it as appropriate study method for my subject. I use analogies and comparisons with other regions and similar sites to be able to better understand the situation in the Lake Lubāns basin. Hunter-gatherer settlements in other regions of Latvia, and main Stone Age complexes from Lithuania and Estonia, as well as Southern Sweden are analysed. The main attention in comparative studies is paid to the settlement location in the landscape, seasonality and specialisation aspects.

Since the title of my thesis is about environment and people interaction, large attention is paid to the geological conditions of the research area. A multidisciplinary approach is very useful analysing oldest periods of prehistory, because often the archaeological record can be scanty or poorly preserved. Geologist investigations can help to reconstruct the picture of past and improve archaeological interpretations. I base my studies on the interpretations of different authors and also try to make my own conclusions.

My thesis is mainly thematically structured, but chronological approach is also used in the topics of my thesis. I present the background about geological and hydrological conditions about the studied area and short research history about archaeological investigations in the Lake Lubāns basin. The analysis section consists of four parts, where the first looks at the aspects that made the Lake Lubāns attractive to the early settlers, followed by the description of the settlement location, specialisation and seasonality, and concluding with the comparative studies. The discussion chapter deals with the issues stated in the problem statement, which I then try to discuss from a theoretical perspective. Thus aspects about settlement location and specialisation, seasonality, arrival of farming and domesticated animals, contacts with coastal areas, adaptation versus exploitation are the topics for discussion.

Background

Lake Lubāns hydrology and geological development

Lake Lubāns and its surroundings have gone through an interesting and complicated process of development. Lake Lubāns is the largest lake in Latvia and is situated in Lubāns Plain, which covers approximately 1427 km² large area in a central part of the Eastern Latvia Lowland. The plain stretches approximately 55 km in north-south direction, and 45 km in east-west. The Lubāns Plain is morphologically and geobotanically homogenous, and mires are covering large part of the area (Seglins *et al.* 1999:105). The plain boundaries coincide with the ancient shoreline and is located at 95-97 m a.s.l. (Eberhards 1969:59 ff.). Lubāns Plain territory has been free of ice since the Alleröd period around 15085/14789 - 13593/12932 calBC (13 771 - 12 736 BP) (Grube 2006). Extensive archaeological and geological investigations have been carried out in the Lake Lubāns basin. Detailed studies of the development of bogs in Lubāns Plain have made it one of the best known place in Latvia for Holocene sediments.

During the latest phase of lake's geological development, melting and retreat of the glacier formed proglacial basins. The water from these basins flow together and created Lake Lubāns proglacial basin that covered wider area than the latest paleolake (Seglins *et al.* 1999:105). The highest water level of these basins has been recorded at 113 m a.s.l. Gradually water level receded and during the Younger Dryas sat at the 89 m a.s.l. At the end of the Late Glacial, glaciolacustrine basins decreased and the Lake Lubāns was approximately 30 km in length, 15 km in width and 6-8 m deep (Seglins *et al.* 1999:109). At this time the Malta, Pededze and Bolupe River (fig. 4) valleys started to form. The Aiviekste River valley begun to form during the Alleröd, when meltwater ran from the proglacial basin.

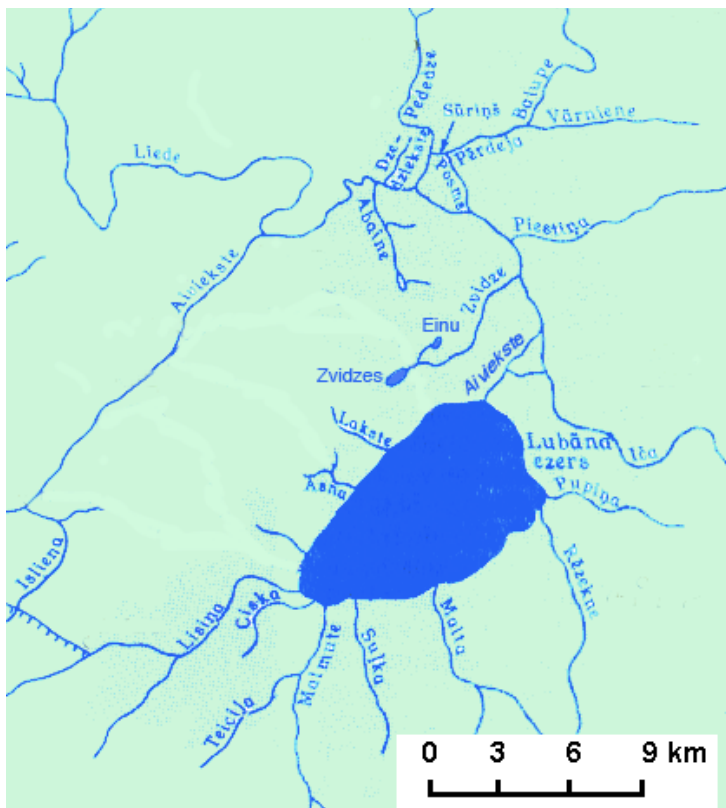


Figure 4. River network in the Lake Lubāns basin. (After Markots, 1995).

Under the climatic conditions of the Alleröd and Younger Dryas, the depositions of grey lacustrine clay and fine, silty sand started to accumulate. Appearance of Lubāns Plain during the Younger Dryas, was quite similar to the present, except without bogs (Eberhards 1985).

The altitude of the lake reached 95 m a.s.l. during the Preboreal c. 9500 - 8200 calBC (10 000-9000 BP), marking its first Holocene transgression (fig. 5). In this period the river network formation begun. Lake surface during the Preboreal reached its maximum, covering 700 km². The lake had many bays and approximately 50 islands. Fine sand and clay continued to be deposited in the lake at that time, while in the immediately adjacent area of the Teichi Reserve the formation of Hypnum peat, sedge-Hypnum peat, wood-sedge peat and gyttja begun (Seglins *et al.* 1999:109). Climate was more humid and warmer than in Younger Dryas. Preboreal landscape in the initial phase was characterised by more or less open mixed pine-birch forests, but in the later phase closed birch forests became dominant (Seglins *et al.* 1999:120).

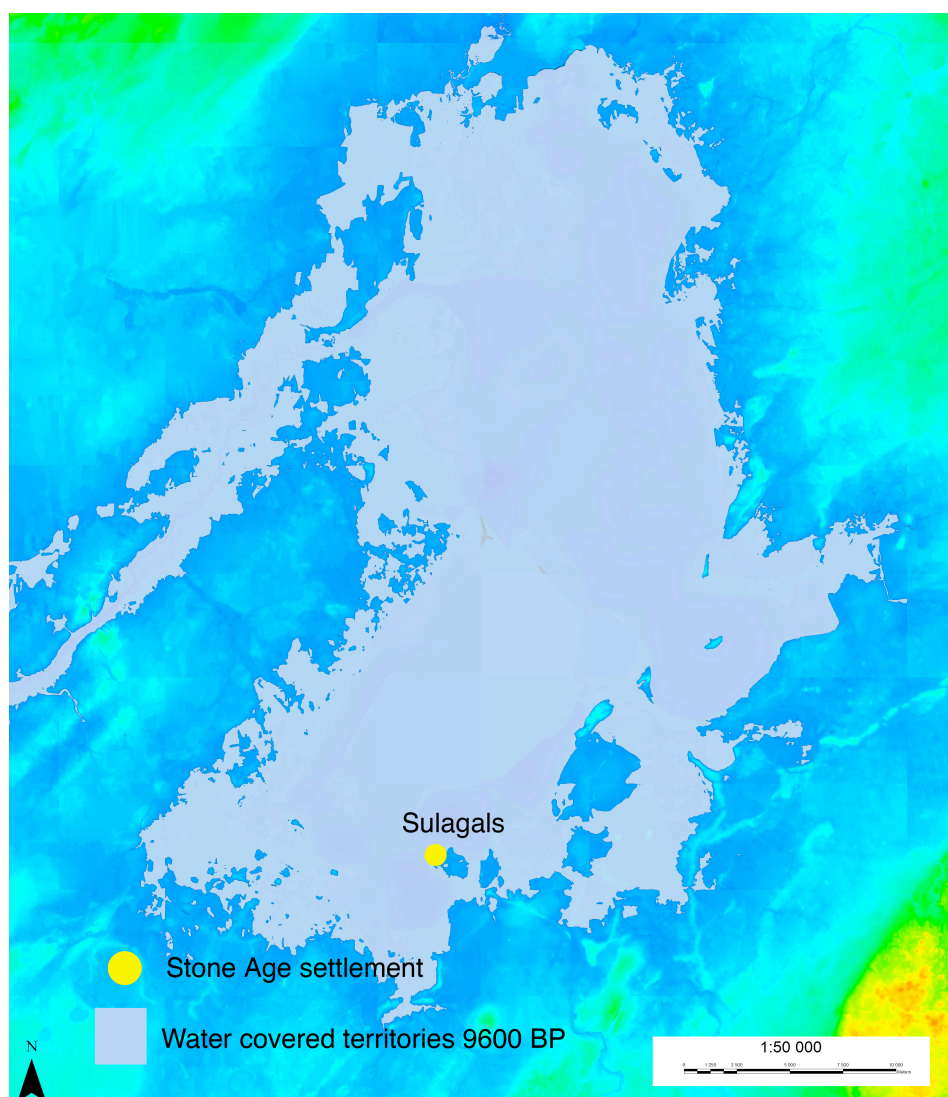


Figure 5. Lake Lubāns during the Preboreal period, 9600 BP, (c. 9150-8841 calBC), 95 m a.s.l. (After Grube, 2006).

Clay and gyttja continued to deposit in the lake during the Boreal period 8200-6900 calBC (9000-8000 BP). Landscape was dominated by pine forests during the Early Boreal period and charcoal finds at some settlements suggest that pine trees were affected by forest fires (Seglins *et al.* 1999:120). In the shoreline of the lake, the formation of fen peat and development of mires occurred. Lake Lubāns water level at the lowest rate could have been 91 m a.s.l., but optimum at 94 m a.s.l. (fig. 6). In the southern part of the lake several islands and raised areas appeared, which were suitable for early settlements. They were formed by glaciolacustrine silty sand, loam and clayey sand (Seglins *et al.* 1999:110).

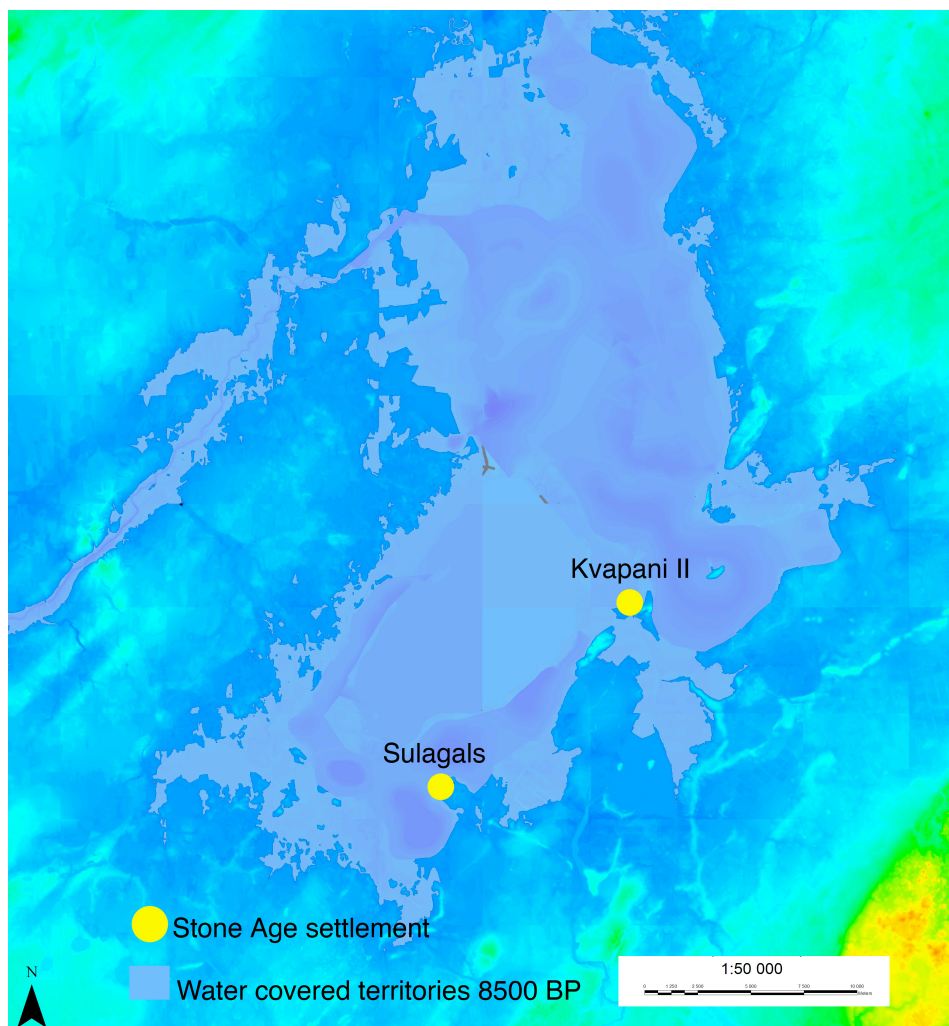


Figure 6. Lake Lubāns in the beginning of the Boreal period (8500 BP), 94 m a.s.l. (After Grube, 2006).

A regression of the Lake Lubāns, when water level prolapsed to the 90,3 m a.s.l. (fig. 9), mark the shift between Boreal and Atlantic periods. Ancient lake territory decreased and in the lowest parts formed small lakes - Zvidzes, Einu, Veju (fig. 4), that later overgrew. Plain territory was covered with lake sediments. Due to the warm and humid climate (optimum), large territories become boggy, and fen-type peat was replaced by forest-reed and reed peat. In the landscape broad-leaved trees were widespread, such as elm, lime, oak. Extension of wet areas continued in the second part of the Atlantic period, when new transgression were recorded with water level rise up to the 92,2 m (fig. 7). Boggy areas become dominated by a transitional forest-Sphagnum peat (Seglins *et al.* 1999:110).

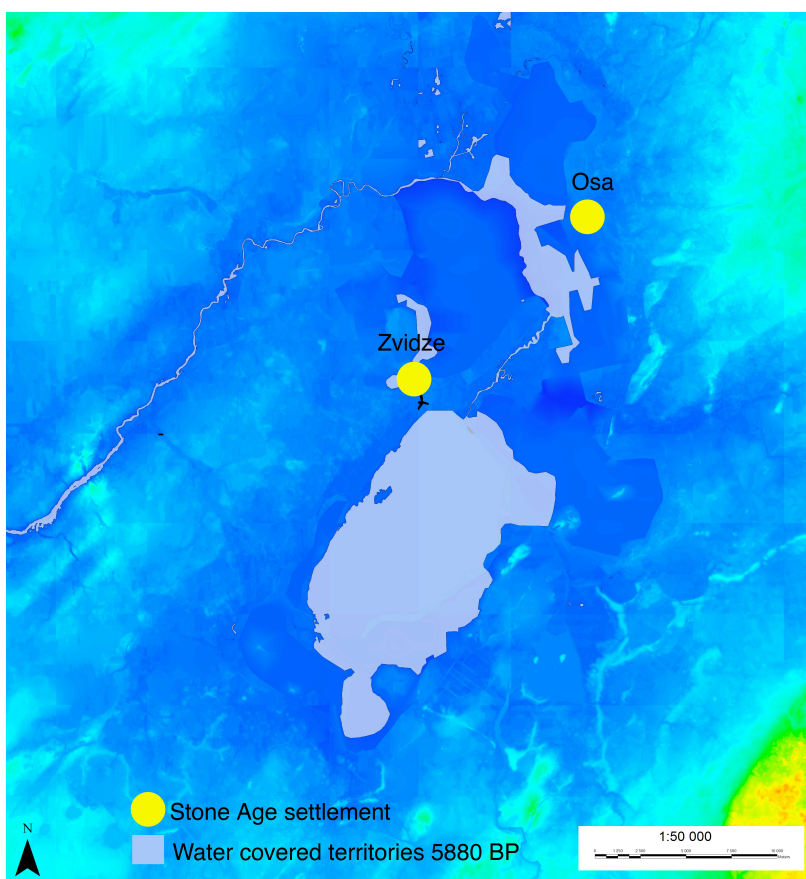


Figure 7. Lake Lubāns in the middle of Atlantic period (5880 BP), 92,2 m a.s.l. (After Grube, 2006).

Silty gyttja represents transitional material from the rivers that continued to be deposited in the lake. In the final stage of the Atlantic period, water level dropped to 90,5 m a.s.l. The water area gradually reduced by overgrowing processes in the shallow areas. Water level oscillations, promoted overgrowing of small bays, and also the central part of the lake became more shallow (Grube 2006). At the first part of the Subboreal period, new transgression appeared, with water level raise to the 91,8 m a.s.l. (fig. 8) (Eberhards 1985).

Climate optimum was changed by colder, but still dry weather and broad-leaved forests were replaced by coniferous forests. Due to the protection from highlands and plain structure, in the humid phases it was drier in this area, while in dry phases, it was - more humid, while in colder phases there were milder conditions (Grube 2006). In the middle of the Subboreal period water level fell to the 91,3 m a.s.l., but seasonal fluctuations in lake water level were not greater than 1-1,5 m. (Seglins *et al.* 1999:110). Peat growing was much faster during the Subboreal than Atlantic period and silty gyttja continued to deposit in the lake.

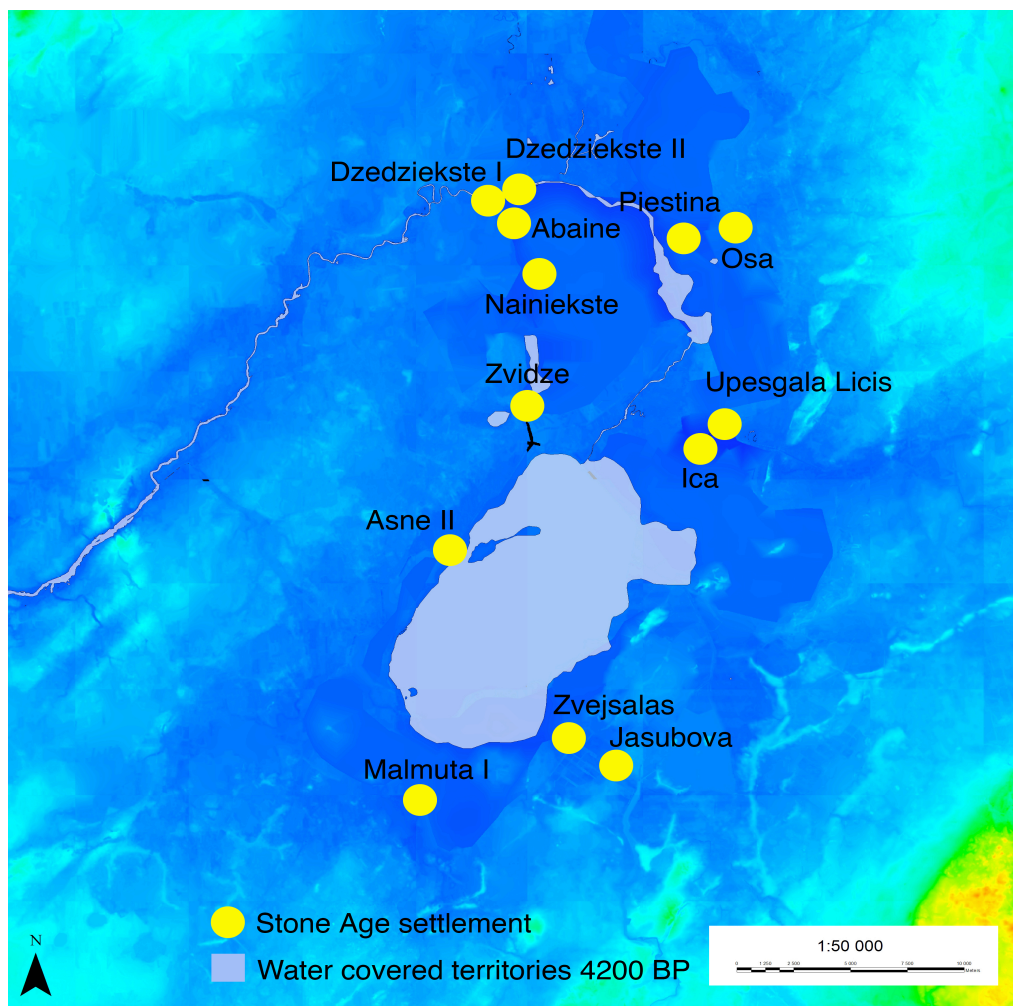


Figure 8. Lake Lubāns in the beginning of the Subboreal period (4200 BP), 91,8 m a.s.l. (After Grube, 2006).

A new transgression (fig. 9) is recorded at the beginning of the Subatlantic period, when water level reached 92 m a.s.l. (Eberhards 1985). Growth of large tracts of bog and partial filling of the Aiviekste river bed with sediments transported by the Rivers Pededze and Bolupe caused this transgression. These sediments occluded Aiviekste water leakage to the River Daugava. In the north part of the lake, there are evidences of meanders and river beds, that occluded water from Lubāns. Most of the tributaries of the River Aiviekste have similar character. In the Lubāns Plain territory they are shallow and in the spring floods all water courses connects. For example, Aiviekste outlet had similar pattern before melioration works in 20th century, when spring floods enlarged Lubāns territory around 25 km along the Aiviekste. In such a case, lake surface increased up to six times (Grube 2006).

Thus within 2500 years hydrological conditions had developed: these remained characteristic until the beginning of the 20th century. Water level oscillations during this

period reached 2-2,5 m. Favourable climate conditions promoted the accumulation of peat and the deposition of gyttja. Due to the Subatlantic period climatic conditions, the separate small lakes that had remained in some depressions of the large glaciolacustrine basin, such as Eini and Zvidze (fig. 4), became overgrown (Seglins *et al.* 1999:111).

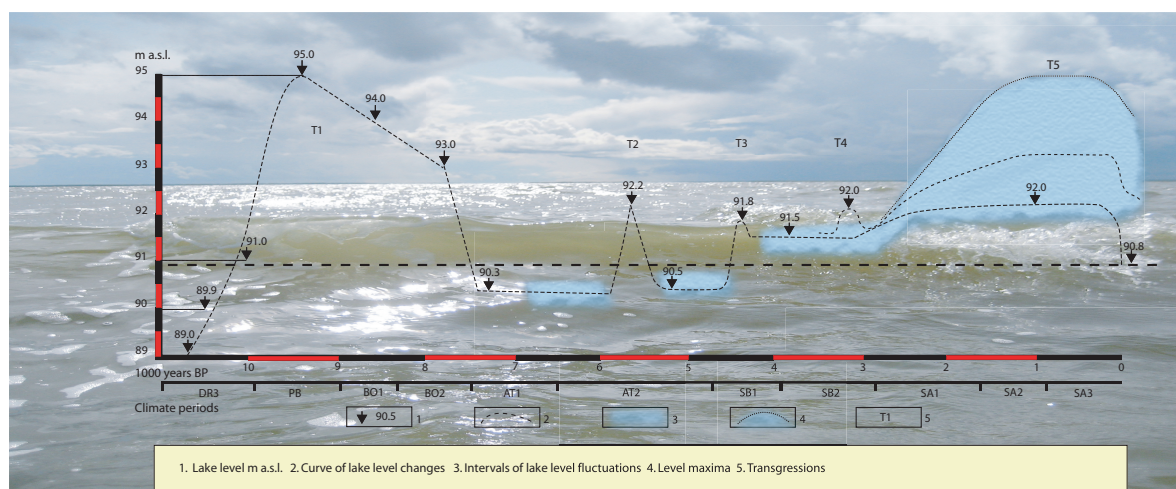


Figure 9. Lake Lubāns water level fluctuations. (After Eberhards, 1985).

Until the last century huge water level fluctuations have been one of the essential Lake Lubāns problem. Comparing to the 20th century flood levels, Subboreal period water levels have been 2 - 2,5 m lower than nowadays. Intensive peat formation has reduced abilities for the water accumulation in the Lubāns Plain. The flatness of Lubāns Plain and small lean of the River Aiviekste, as well as the deforestation of large territories in the Lake Lubāns basin, have been mentioned as reasons for the seasonal floods (Bielis 1974:28; Rieksts 1974:12; Grube 2006).

Regular flooding of Lubāns surroundings have become a “Lubāns problem”. The first attempt to solve this problem was already in 1856 by digging up the Meirani channel. Another attempt was in 1923, when engineer Antons Kursiss developed Lubāns water level reduction project. This project included Aiviekste River straightening, but did not solve Lubāns problem completely. Lubāns Lowland draining scheme was developed in 1956, which included four construction stages. The last stage consisted of the building of Nagli fishing company that was established in 1969. Thanks to this project, more than 40 000 ha of

land have been saved from the floods and many Stone Age settlements were discovered (Bielis 1974:125).

Solution for the “Lubāns problem” have created the space for new projects and development plans, but this time concentrating on Lubāns Wetland natural resources and their sustainable use and management. There are 11 nature reserves in the wetlands territory to protect flora and fauna (Rezeknes Rajona Padome 2001). According to the Latvia Minister Cabinet Regulations No.135 “Regulations of Nature Reserve Lubāns Wetland Protection and Exploitation” from 2009, nature reserve was established to protect the largest wetland complex in Latvia (<http://www.likumi.lv/doc.php?id=188931>, visited 08.04.2011.).

Presently the Lake Lubāns covers an area of 8210 ha, stretching 14,2 km in south-west-north-east direction, with a width of 7,9 km in north-south direction. The maximum depth in Lubāns is 2,5 m. The lake has one island - Akmensala - four kilometres in a length. In the beginning of the 20th century lakes' surface was 90,4 km² and the depth 3,5 m (Grube 2006).

Research history

The development of Latvian archaeology has a close connection with the historical and political background of Latvia. Generally, four periods, marked by changes of political power in the territory of Latvia, can be divided in Latvian archaeology: 1) Baltic German research - 19th century to 1914; 2) the period of the Republic of Latvia 1918 to 1940; 3) the Soviet occupation of Latvia 1940 to 1991 and 4) period of the restored Republic of Latvia 1991 to the present day (Graudonis 2001:428).

The first archaeological investigations in Latvian territory began in the 19th century, but the first evidence about archaeological excavation in the Lake Lubāns surroundings spans back to 1911, when little investigation were made at **Licagals** (fig. 2, 10) settlement by Felkerzams. This settlement was situated in the north-east side of the Lubāns Plain on the bank of River Aiviekste. Comb Ware ceramics were found at Licagals and had the most complete ornamentation known in Latvia at that time (Eberts 1926:7).

The end of the First World War and the establishment of the Republic of Latvia marked the beginnings of the Latvian national archaeology. During the period 1918 – 1940, the culture heritage protection began and scientific investigations in the archaeology

increased considerably. Sturms conducted excavations at Licagals in 1927 and 1936 (Sturms 1927:15; 1936). He also excavated the **Ica** (fig. 2, 10) settlement in 1938 - 1939, that was discovered due to the melioration works. This settlement revealed large quantities of finds and several layers of the habitation that contained stone, flint and bone artefacts as well as Comb Ware pottery (Sturms 1938:50).

Large stray find collection were gathered during the years 1937 to 1940, when the lake water level was lowered. Most of the finds came from the drained south-western part of the lake laying on the sandy lake-bed. More than 3500 various bone and antler artefacts were collected. This collection is unique not only in terms of the form diversity and ornamentation, but also with its wide chronological span (Vankina 1999:21). Although there were stray finds from the Mesolithic period, certain information about settlements from this period was missing. Sturms pointed out that most likely Mesolithic settlements could be found in a vicinity of the Lake Lubāns (Sturms 1939:42).

Soviet occupation change the development of Latvian archaeology. The amount of excavation considerably decreased and several archaeologists left the country in a fear of soviet terror and some became repressed. In 1946 the Academy of Sciences was established as well as Institute of History and material culture. Since the 1950s amount of archaeological excavations increased, mostly due to the extensive melioration and construction works (Graudonis 2001:14).

Since the 1960s archaeological excavations in the Lake Lubāns basin increased greatly. Extensive melioration works in the attempt to solve the flood problem and construction of Nagli fishing company promoted discoveries of the Stone Age settlements in the surroundings of the Lake Lubāns. Most of the archaeological investigations were rescue excavations that were carried out nearly without a break until the end of the 1980s. Since the 1960s Loze has carried out a major work in the Lake Lubāns basin, discovering and excavating archaeological remains in this area over a period of 40 years. During the 1960s 18 new Stone Age settlements were discovered near the Lake Lubāns and most of them were investigated by Loze - **Abaine I, Abaine II, Abora I, Abora II, Asne I, Asne II, Jasubova, Nainiekste, Upesgala līcis (Ica II), Malmuta I, Malmutas river mouth, Sulka, Eini, Lagaza, Zvejsalas** (fig. 2, 10). The first Neolithic burials were discovered at Abora. Very important work carried out also Zagorskis at Ica, **Osa** and **Piestina** (fig. 2, 10) settlements.

Especially significant were finds from Osa, that proved the Mesolithic habitation at this site. In the **Leimaniski** (fig. 2, 10) a small excavation has been led by Vankina.

The next decade did not reveal as many new Stone Age monuments near the Lake Lubāns. Deeper investigations in the previously discovered sites were intensive during the 1970s. The excavations continued in the Late Neolithic settlement and burial ground Abora I. One of the most important Stone Age settlements near the Lake Lubāns - **Zvidze** (fig. 2, 10), was discovered in 1973, but extensive investigations continued in the following years and next decade by Loze (1973:41;1983:98; 1988). Due to the construction of fish pounds in the south-east coast of the Lake Lubāns, three new settlements - **Kvapani I**, **Kvapani II** and **Kvapani III** (fig. 2, 10) and the Neolithic burials in Kvapani II - were found and excavated (Loze 1975:56, 1977:45 f., 1979:53f., 1980:52 ff., 1987:36). New settlements were also found at the **Dzedzickste I**, **Dzedzickste II**, **Idena**, **Smaudzi** (fig. 2, 10) (Loze 1972:87). However, at the end of this decade the first Early Mesolithic site was discovered at **Sulagals** (fig. 2, 10) and excavation continued also in next year (Loze 1982:90).

Analysis of the already accumulated archaeological material characterise the 1980s. There were no new settlements discovered in the Lake Lubāns basin, but Loze continued excavations in the multilayered settlement Zvidze in 1981 - 1984 (Loze 1982:91; 1988), Ica (1993a:19), but Zagorskis excavated the Osa settlement in 1981-1982 (1982:154). These excavations were mostly carried out with a purpose to gain samples for radiocarbon dating or pollen analysis (Loze *et al.* 1984, Zagorskis *et al.* 1984).

Collapse of the Soviet Union brought large changes in the Latvian archaeology. The amount of the excavations declined markedly. Lack of great building projects, money and resources meant a decrease in rescue excavations. The 1990s was a transfer period from the old system to modern research standards. The largest attention was paid to the typology, systematisation and chronology aspects of already accumulated material. Since the 1990s analytical articles discussing, for example, the economic development of the Lake Lubāns basin (Loze 1995; Vasks *et al.* 1997) appeared in the archaeological literature. The excavations in the Lake Lubāns basin had a scientific character as a part of the larger research projects. For example, excavations at Eini in 1996 were a part of the interdisciplinary project "Neolithic man and the impact on the surroundings". Geologists carried out the geomorphological investigations, taking samples for pollen analysis and radiocarbon dating, while geophysicist group performed a radar sensing by recording the mineral surface profile

of the study area (Loze 1998:44). In 1990 Loze excavated Upesgala līcis (Ica II) settlement that was discovered already in the 1960s and three burials were recovered in the settlement layers (Loze 1992:63 ff.). The Zvidze settlement was excavated in 1999 within the project of the “Environment Management Plan for Lubāns Wetland Complex” (Loze 2000a:33). Small excavations in the Zvidze was conducted also in 2007 by Loze (Loze 2008a:10).

MESOLITHIC			NEOLITHIC			BRONZE AGE
Early	Middle	Late	Early	Middle	Late	
Sulagals						
	Zvidze					
	Osa					
	Ica					
	Zvejsalas					
	Lisina					
	Kvapani II					
	Kvapani I					
	Kvapani III					
	Licagals					
	Malmuta I					
	Malmutas griva					
	Nainiekste					
	Asne II					
	Piestina					
	Upesgala līcis					
	Sulka					
	Idena					
	Jasubova					
	Dzedziekste I					
	Dzedziekste II					
	Abaine I					
	Abaine II					
	Abora II					
	Abora I					
	Asne I					
	Eini					
	Lagaza					
	Leimaniski					

Figure 10. Stone Age settlement chronology in the Lake Lubāns basin. (After Loze, 1988).

Analysis

What made the Lake Lubāns attractive for hunter-gatherers?

Territory of Latvia became free from ice approximately 15200 - 11500 calBC (14,000-12,000 BP), but there are no traces of human activities from the Alleröd period (Zagorska 1999:131,154). Retreat of the ice sheet created basins rich with waters, like the Lake Lubāns that was surrounded with water rich river network. The first inhabitants in territory of Latvia come from the south, along the banks of the large rivers as Daugava, Venta and Lielupe. Some of the first reindeer hunters probably continued their way along the River Aiviekste that is one of the largest tributaries of the River Daugava, and thus reached the Lake Lubāns basin. Aiviekste is the only river that flows out of the Lake Lubāns and has many tributaries that belong to the Lake Lubāns basin.

Drainage of the Lake Lubāns is closely associated with the River Daugava that originates in the Valdai Hills in Russia and flows into the Gulf of Riga. Thus, a very advantageous water way connected the Lake Lubāns with other territories (Zagorska 2001:26 f.). Lake Lubāns basin had many favourable aspects that attracted the first hunter-gatherers to settle in this region. A beneficial river network, shallow lake, rich in different sorts of fish, various flora and fauna made ideal conditions for hunter-gatherer subsistence in the Lake Lubāns basin.

In the earliest period of the habitation near the Lake Lubāns, reindeer have dominated among the game. Reindeer hunting was carried out from the middle of the Younger Dryas to the middle of the Preboreal, when reindeer disappeared from the East Baltic (Paaver 1965:281 ff.; Zagorska 1999:154). First evidences about the human activities in the Lake Lubāns basin comes from the stray find collection. Twelve harpoons belonging to the Palaeolithic period have been found in the Lake Lubāns pointing to the first human presence in this region already in the end of the oldest Stone Age (Vankina 1999). In this period the Lake Lubāns water level (fig. 9) was lowest that have been ever observed (Eberhards 1985).

Mixed pine and birch forests dominated the Preboreal landscape. Lake Lubāns water level reached the highest level in the Preboreal period (fig. 5, 9) and the lake had many bays and islands that probably could have been a good settlement places for the hunter-gatherers. But so far, the survey work has not been carried out along the ancient coastline or islands.

This territory was mostly covered by forests or peat bogs, which complicate the survey work or finds of the new settlements. Elk was the main game, but also wild boar, beaver, brown bear, roe deer were hunted in the Lake Lubāns surroundings (Loze 1988:113, 1995:19). Pike, perch, bream, tench and other fishes were available in the water bodies, but edible plants, mushrooms and berries were available in forests (Zagorska 2001:46).

During the Boreal period pine forests were dominant and hazel immigration begun. First ruderal and meadow plant appearance in the end of the Boreal period indicate some human activities in the environment. Birch forests increased in the final phase of the Boreal period when climate cooled. Elk, beaver, wild boar, aurochs, roe deer, red deer were hunted during Boreal period, but pikes, crucian, zander, perch were usually caught during their spawn in the lake and rivers. The only domesticated animal was the dog. In this period waterfowl become an important complement for the hunter-gatherer diet (Loze 1995:19).

The Atlantic period is also known as climate optimum when broad-leaved forests expanded. Elm, alder, hazel, lime and oak were main trees in these forests. The expansion of oak trees in the late Atlantic indicate a dry climate. The water chestnut was a very common plant during the Atlantic period. Traces of this plant were found in the Zvidze and Apora settlements and Seglins and colleagues (1999:125) have indicated the possibility that water-chestnut could have been cultivated as well. Hazelnuts have also been an important product for gathering, as well as wild strawberries, raspberries, dogberries, blackberries (Zagorska 2001:60). Nettles, hemp, calendula, cattail roots, goose tansy, pigweed, sorrel are some of the plants that contributed to the hunter-gatherer diet (Loze 1995:19). Wild boar become more dominant among game, as well as red deer, elk, brown bear, aurochs, and smaller fur-bearing animals, such as marten, hare, otter, badger, fox. Water bodies were rich in different waterfowl and fishes, among which still dominated pikes, zander, perch and bream.

During the Subboreal period the broad-leaved forests were gradually replaced by dense spruce forests with pine, alder, oak and hornbeam. Wild fauna and flora still constituted the largest part of the diet. Although the first *Cerealea* pollens show the agricultural activities (Seglins *et al.* 1999:121 f.), finds of animal bones that first domesticates, such as cattle, pig, sheep and goat were present at the Neolithic settlements in the Lake Lubāns basin (Loze 1988:114 ff.).

Settlement location

Nowadays when people are choosing where to settle - there are always some aspects that affect this choice. For some people it would be centre of city in order - to get access to the infrastructure, for others it would be the vicinity of kindergarten or school, while some would choose the seaside or house in a countryside. This choice usually is deliberately made to suit best to the people's lifestyle, their needs, wishes or occupation.

Similar pattern can be traced through the history. People always tend to stay around the place that meets their lifestyle. The first reindeer hunters often settled in a spots where the reindeers were crossing rivers. Thus these places were strategically selected to provide the maximum benefit. Such settlements often were seasonal, or had a special purpose, for example, as animal slaughtering place (Zagorska 2001:27 ff.).

There are several analysis carried out by geologists and archaeologists to prospect the location of the settlements of the Lake Lubāns basin inhabitants during the Stone Age. Eberhards has distinguished two large groups of settlement location in the Lake Lubāns basin. The first group include sites that have been situated in Lubāns Plain in the aquatory of the ancient Lake Lubāns. Eberhards divide this group into three subgroups: 1) flood-plains (deltas) of rivers and in this group Eberhards include, for example, the Middle Neolithic settlement Piestina; 2) former islands or peninsulas of the ancient Lake Lubāns - the Middle Neolithic site Nainiekste, 3) present-day shoreline of the Lake Lubāns - Middle Neolithic settlement Sulka. Other group includes the shore zone of the ancient lake during the Preboreal-Boreal and in the beginning of the Atlantic periods with two subgroups: 1) shoreline of the ancient Lake Lubāns (95 m a.s.l.) - the multilayer settlement Zvidze; 2) flood-lands (deltas) of rivers that flowed into the ancient lake - the settlements Osa and Sulagals (Eberhards 1989:84).

Loze has also tried to arrange the Lubāns settlements and has partially followed and based her research on Eberhards division. With regards to the group where settlements were located on the islands or peninsulas (situated on 93,5-94 m a.s.l.), she added the Middle Neolithic sites Kvapani II, Malmuta I, Zvejsalas, Ica I and Ica II (Upesgala līcis). To the group of settlements situated on the present-day shoreline (92,9-93,4 m a.s.l.) two sites were added - Asne I, Asne II. Loze discusses just one group of settlements that were located on the

banks of the rivers that flows into the ancient Lake Lubāns (92,7-93 m a.s.l.) and incorporate Osa, Piestina, Dzedziekste I, II in this group (Loze 2008a:10).

Comparing the material from Upesgala licis (Ica II) site with the finds from Kvapani I, II and Zvejsalas, Loze believes that these four settlements form the group among the Lubāns settlements, because all of these settlements are located on the same vertical lines on a mineral land elevations, and is believed to relate to the same period of time (Loze 1992:63 ff.).

The Early Mesolithic settlement Sulagals (fig. 5) have been situated on a small, island shaped elevation in the south-eastern part of the lake Lubāns. A site has been located in the north-west side of this island that rose 95-96 m a.s.l. and was formed by limnoglacial clay, silt and sand. According to the geomorphological analysis, settlement have been located on the bank of the ancient Lake Lubāns. During the Boreal period, shoreline of the lake was situated more on the north-west side of settlement with height marks 93,7-94 m a.s.l., but in the Atlantic period, site have been abandoned, because water level of the lake dropped about 3-4 meters and shoreline of Lubāns resigned to the North (Eberhards 1989:74 f.).

There are two settlements in the Lake Lubāns basin belonging to the Late Mesolithic. Zvidze and Osa (fig. 7, 10) are multilayered sites that have been inhabited during several Stone Age periods. The multilayered settlement Zvidze was situated in the periphery of an undulate moraine plain in the terraced slope of the ancient Lake Lubāns (Loze 2000b:111). This place correspond to the shoreline of the ancient lake and settlement have covered an area 100-200 m in length and 30-50 m in width (Eberhards 1989:76). The settlement was situated near the overgrown Lake Zvidzes (fig. 4), which in the beginning of Holocene formed the deepest part of the Lake Lubāns (Eberhards 1989:76 ff.).

The geological and geomorphological structure of the settlement is complicated. Loze (2000b:111) has distinguished 17 lithographical layers at settlement, the lowest two belonging to the Mesolithic, seven layers to the Early Neolithic and five to the Middle Neolithic. The lowest layers have formed mainly in the peat and sapropel (gyttja) deposits, but in the periphery of the moraine, cultural layer formed in loam. Culture layer in the settlement reached two meters, but marsh and lake sediment thickness were 6-7 m. Water level changes have washed out the lower layers of the site. Geomorphological research showed that during the Younger Dryas lake water level have been lower than in the Boreal and Atlantic periods. Lake regressions were discovered in sand and gravel layers with

amplitude 1, 5 - 2 m. One regression was observed during the shift from the Early to the Middle Neolithic and two during the Middle Neolithic. Layer with 5-20 cm grey, dense clay revealed the presence of the short transgression of the lake during the second part of the Subboreal period (Eberhards 1989:80).

According to Loze, people have settled here also in the Middle Mesolithic and evidences for this statement come from finds of the antler axe, arrowshaft straightener, Kunda - type bone spear-head and the fragment of a basket woven from birch-bark and other finds in the lowest layers of the settlement (Loze 2000b:110 ff.). Loze believes that Zvidze settlement may have covered more than 0.5 ha large area. Culture layer formation in the peat and sapropel is a sign that Zvidze settlement have been located near the shoreline of the ancient Lake Lubāns in the Late Mesolithic and the Early Neolithic (Loze 2006a:33).

The Osa settlement lie in the north-east part of Lubāns Plain, in 50-60 m wide flood-lands in the valley of the River Piestina. The settlement has been located on the sandy elevation, that is a terrace of the transgression between the Preboreal and Boreal periods with height marks of 93-94 m a.s.l. In the time of establishment of the site, it was situated around 1-1,5 km from the shore of the lake (Eberhards 1989:80). In the later periods with water level marks at 91-92 m a.s.l. shoreline have resigned 250-300 m to the North (Zagorskis *et al.* 1984:55 f.). The Mesolithic layer was uncovered in a 20 m long and 6 m wide zone along the right river bank, at the depth of 1.35 - 1.65 m. Mesolithic layer was formed of coarse-grained sand containing a mixture of peat and wooden particles, just laying on the sapropel (Zagorskis *et al.* 1984:table 1). Habitation of this site continued also in the Early and Middle Neolithic.

When the water level was low during the Early Neolithic period, settlements such as Ica and Lisina (fig. 2, 10), were located nearer to the shoreline of the ancient lake. The Neolithic settlement Ica is located in the eastern part of the Lake Lubāns basin. Settlement have been situated on the left riverbank in the downstream of the River Ica. This river is the left tributary of the River Aiviekste. The site laid in the last bend of the former riverbed approximately 300-350 m upstream from the River Vejupite inlet into the River Ica (Loze 2000c:203). During the Middle Neolithic the River Ica was one of the largest tributaries of the Aiviekste, but in the Early Neolithic when the water level was lower, settlement possibly could have been situated on an island, thus explaining the great damage that water have done to the settlement (Loze 2006a:22). Occupation layers were discovered - not only on this

island, but also on the plain immediately north-west of it. When the water level fell, the habitation on the lower part of the bank was also possible. At the top of the slope of the former bed of Ica, accumulation of the occupation layers were discovered. It have been determined that a settlement site formed as an island covered an area of 2300 square meters. Excavations have been carried out also at a shoal in the former bed of the River Ica in the immediate vicinity of its new, straightened bed, where a thick layer of refuse had accumulated, probably washed out of the occupation layers of the site as the riverbed meandered (Loze 2000c:203).

The Neolithic settlement Zvejsalas (fig. 2, 10) has been situated on the right bank of the River Malta, approximately five kilometres from its inlet in the Lake Lubāns. This site was located on the mineral land uplift created by the peninsula protuberance. The Early Neolithic layer was separated from Middle Neolithic layer by gravel, indicating the sharp fluctuations of lake water level during the Atlantic period (Loze 1975a:54 ff.). One find of Kunda-type spearhead and several flint artefacts of Post-swiderian-type, found in the elevated part of the settlement, could indicate the habitation during the Mesolithic (Loze 2006a:27).

The Early Neolithic layers have been distinguished also in the Lisina and Kvapani II (fig. 2, 10) settlements. The Lisina site was located near the inlet of the river into the south-west side of the Lake Lubāns. Settlement have been partly destroyed during the melioration works. Sediment depositions showed that culture layer have formed above gravel and silt, before the peat formation, allowing to add Lisina to the Early Neolithic settlements within the Lake Lubāns basin (Loze 2006a:28). Kvapani II was situated on a former island in the Lake Lubāns, near the inlet of the River Rezekne into the Lake Lubāns. This site was totally destroyed during the construction of the Nagli fishing company pounds and nowadays is under water (Loze 2008a:12). Kvapani II site culture layer have formed in a sandy clay layer and according to Loze (2008b:46) settlement was inhabited all year round.

Number of settlements markedly increased during the Middle Neolithic (fig. 10) and most of them were situated in the aquatory of the ancient Lake Lubāns, in the basin of the River Aiviekste. In a comparison to multilayer sites Zvidze and Osa, most of these sites were inhabited just during the Middle Neolithic.

The Late Neolithic settlements were situated in the northern side of the Lake Lubāns, near the River Aiviekste or its tributaries. Such a settlement location was probably dictated by the participation in the exchange network. Loze (2008b:69) consider that location of the

Abora settlement might have a connection with economic activities. A possibility to control the incoming and outgoing movements in this region could influence the settlement situation near the Aiviekste.

Settlement specialisation and seasonality

Hunter-gatherer settlements or habitation places could have different characters. Some sites might have been permanently inhabited, some could be visited repeatedly, while others could have served for the special purpose or have been used during a certain season. It is not an easy task to find out what can be called the settlement with specialisation and which could be the factors that indicate the traces of specialisation. The archaeological and osteological find assemblages, in my opinion, can be used to gain the knowledge about the settlement character and probably indicate if the settlement have had some certain specialisation.

So far, the only known Early Mesolithic settlement Sulagals revealed clear, undisturbed artefact complex corresponding only to this period. According to the radiocarbon dating, the oldest habitation in Sulagals refer to the time period c. 9231/8739 calBC (TA-1317, 9575± 80 BP) (Loze & Liiva 1990:81). Different bone and antler artefacts, flint tools and animal bones give some indications about the economic activities of Sulagals inhabitants (Loze 1988:15 ff.). The main game have been elk, markedly dominating in the assemblage of animal bones. Wild boar, beaver, roe deer, black bear, fox, otter, marten, hare have also been hunted by Sulagals inhabitants (Loze 1988:113). The Sulagals settlement does not really correspond to Carlsson's (2007:41 ff.) summary about the factors that indicate the long-existing or permanent settlement. The artefact and animal bone assemblage do not give clear evidences about some certain specialisation, but probably the hunting have been very important activity of Sulagals inhabitants.

The Early Mesolithic finds also come from the Lubāns stray find collection, including needle-shaped points, slotted points, smoothed spearheads, spearheads with a triangular cross-section and harpoons with wide barbs (Vankina 1999). These artefacts probably have been lost in the fishing or hunting activities that people have performed in the ancient lake. These evidences allows for a presumption that fishing has also been an important activity and source of food. Fish catches consisted mostly of the large fishes, such as pike, sheath-fish, tench, zander. The amount of the Early Mesolithic artefacts in the stray find collection also

indicate that probably there have been more settlements in the Lake Lubāns basin during this period. Since the water level was highest during the Preboreal period, settlements from this period could be found on the coast of the ancient lake or on the islands.

Evidences about people living in the Lake Lubāns basin during the Middle Mesolithic comes from stray find collection and several artefacts found at Zvidze settlement (Loze 1988:23, 100; Vankina 1999). Similar finds come from Zvejnieki II settlement in northern Latvia, also from finds near the Lake Great Ludza (fig. 11:7), River Dviete (fig. 11:6) in the southern parts of Latvia, suggesting the find simultaneity (Sturms 1939:34 ff.; Zagorska 1993:107). Although no settlement have been discovered with certain traces of habitation, several finds from the stray find collection belong to the Middle Mesolithic group. This little material does not allow to draw some conclusions about the activities or specialisation of Lubāns inhabitants during the Middle Mesolithic.

The Late Mesolithic material in the Lubāns settlements give more indications about the settlement specialisation and sedentism. Large quantities of accumulated archaeological material and settlement location in a favourable environment with the access to various resources could indicate the permanent character of the Zvidze and Osa settlements. A wooden sledge runner has been found at Osa site, thus indicating the winter habitation in this settlement (Zagorskis *et al.* 1984:59).

There are no or very few flint tools represented at the Late Mesolithic settlements in the Lake Lubāns basin (Zagorskis 1973:65). Several slate tools were also discovered from the Late Mesolithic layers indicating the contacts with other territories or people movements, since the slate is not naturally available in Latvia (Loze 2000b:112 ff.). The Late Mesolithic fishing and hunting equipment mainly consisted from bone and antler artefacts. At the Zvidze settlement mainly bone and antler artefacts were discovered, including spearheads, tools with a working edge cut to an angle of 45° (used perhaps for cutting bast), a dagger, and a chisels (Loze 2000b:112 ff.). Similar situation reflect the Osa settlement where the Late Mesolithic layers contained mainly bone and antler artefacts - spearheads with symmetrical barbs, needle shaped, and biconical arrowheads, small harpoon - heads with curved barbs, daggers, thin knives, awls, antler chisels with asymmetric blades, hammer shaped tools, and wild boar tooth pendants (Zagorskis *et al.* 1984:59). Thus probably it could be possible to speak about the specialisation in the bone and antler tool making in the Lubāns settlements from this period and also from the Early Neolithic.

Along the favourable climate conditions, developed mixed conifer and deciduous forests and fauna enriched with the great number of wild boar, aurochs, roe deer, red deer, pine marten. These animal bones have been found in the Mesolithic layers of Zvidze and Osa settlements, with a little dominance of the wild boar bones (Loze 1988:114 ff.). Since the Lubāns settlements did not have an access to the flint resources, the need for the bone and antler raw materials must have been very important. Thus the animals were hunted not only for the food, but probably also to gain the supplies. Increased amount of finds of wild ducks and swans among the waterfowl at Zvidze indicate the growing importance of birds in the subsistence and possibly could indicate the specialisation in the bird hunt. Fish bone finds also represents a greater variety of species that were represented by pike, perch, zander, bream, crucian, catfish etc. Pike have dominated among the fishes in the Late Mesolithic layers and even more in the Early Neolithic when 93,8 % from all fish bones in Zvidze and 94 % at Osa settlement consisted of pike (Sloka 1986:127 f., 1988:89). Especially the fishing equipment finds from the Early Neolithic layers in Zvidze, indicate the importance of fishing in this settlement. There is a find of the fence-type fish weir in the settlement territory, indicating the pike fishing during the spawning. Fish trap and large amount of fish bones were discovered adjacent to this place (Loze 1993b:122 ff.).

The Early Neolithic layers of Zvidze and Osa contained rich bone and antler artefact assemblage. The largest part of the artefact assemblage from the Ica settlement also formed the bone and antler implements. These finds indicate their use in hunting activities, because there are many finds of arrowheads - biconical, leaf-shaped with narrow tang etc. Everyday activities reflects in the finds of antler polishers, artefacts with a blade bevelled at a 45 degree angle, daggers and awls. Antler polishers were mostly manufactured from tines of elk antler and from red deer antler. These finds are characteristic for the Early Neolithic settlements, as assure the finds from Zvidze and Osa in the Lake Lubāns basin and Kääpa settlement in the south-east Estonia (Loze 2000c:204 ff.). An interesting aspect is that the antler chisels were one of the most common finds in the Early Neolithic layer at the Osa. The antler is very hard and durable material, so the large amount of these finds probably indicate their use instead of flint or stone tools, which finds at Osa were very scanty (Zagorskis 1973:57 ff., Zagorskis *et al.* 1984:60 ff.). Little amount of flint artefacts have been collected in the Ica settlement, containing blades with obliquely truncated and retouched ends, micro-burins, micro-scrappers,

end scrapers, a tanged point, blades with edge retouch, although it is more that in other sites from this period (Loze 2000c:204 ff.).

The culture layers at Osa were rich with pollen of wild flora, large amount of water chestnut remains pointed out the gathering importance in this settlement. There are evidences that people were making pinfolds for forest animals in the Early Neolithic. Pollen analysis show the decrease of elm values in this period that Levkovskaja (1987:19, 59) explained by the fact that elm was used as a fodder for the animals that were kept in pinfolds.

Early Neolithic pottery in the territory of Latvia was first discovered in Osa and thus was named after this settlement. Osa pottery was a local variant of the ceramics of the Narva Culture (Zagorskis 1973:57 ff.). The pottery finds marked the main difference between the Mesolithic and the Early Neolithic layers within Lubāns settlements. The vessels were made of clay mass with an admixture of ground shells or other organic material. Large pots had pointed bottoms and cauldron-shaped form with S- or C-shaped edge profile, or with straight walls. Clay pots, small lamps, together with bone and antler artefacts reflected the typical assemblage of Narva culture (Loze 2000b:113).

There are three different ceramics producing techniques that have been observed at the Early Neolithic settlement Zvejsalas (Loze 1975a:59). The small amount of bone and antler artefacts, several unique pottery ornaments, that have not been observed in other Lubāns settlements and different ceramic production techniques indicate the unique character of this settlement. The pottery making traditions continued in the following periods when large amount of Comb Ware ceramic and local Piestina-type ceramic were discovered at this settlement (Loze 1975a:52). Thus probably it could be possible to presume that pottery making has been an important activity, maybe even the specialisation of the Zvejsalas settlement. Loze has distinguishing that there have been two different ceramics complex within the Lake Lubāns basin during the Early Neolithic, where Ica and Osa belonged to one, but Zvejsalas to another (Loze 1975a:62). The Osa probably emerged from the initial part of the Early Neolithic, but Zvejsalas from the latest part (Loze 1975a:63). In my opinion, the distinct character of Zvejsalas probably could have some correlation with the location of this site. The Zvejsalas was situated in the southern coast of the lake in difference form the well investigated Early Neolithic settlements at Zvidze, Osa and Ica which were located in the north-east side of the Lake Lubāns.

Situation during the Middle Neolithic in Lubāns basin show some changes from the previous periods. Although this period is connected with arrival of the first farming and domesticated animals, hunting-gathering continued to be the main subsistence mode for the inhabitants of the Lake Lubāns basin until the end of the Stone Age. One of the largest difference from the previous periods is the presence of the large quantities of amber in Lubāns settlements with a clear specialisation in this field.

Amber become available in the East Baltic just at the end of the Early Neolithic, due to the transgression of Litorna Sea and currents that transported amber northwards (Berzins 2008:350). Prehistorical Baltic amber came usually from the coast and littoral lagoon lakes and waterlogged meadows in Latvia, Lithuania, Poland and Ukraine. A large exchange network were established in Baltic and North East Europe forest zone during this period. To be able to participate in this exchange process, equal goods were vital. Flint, amber and stone were the most common equivalencies, but slate, leather, furs and other important goods were also exchanged.

There are no natural flint available in the Lake Lubāns basin. Thus the development of such a system was probably dictated by the necessity to obtain flint for tool manufacturing (Loze 2008b:19). Advantageous geographical situation let the Lake Lubāns basin inhabitants have connections with the coastal communities and obtain amber there, process it in their settlements and exchange it further to the North and East Europe. Traces of amber working have been found in 18 sites around the lake. Loze (2008b) has divided the amber working between the settlements of Comb Ware Ceramic culture and Post-Narva culture settlements. Post-Narva culture sites - Zvidze, Nainiekste and Piestina were main amber processing sites during the Middle Neolithic. A common characteristic for the amber working settlements was their location in the vicinity of River Aiviekste – main waterway to River Daugava.

The largest amber workshop was found at Zvidze, but traces of the amber processing were found also in Abaine, Kvapani II, Ica, Sulka, Dzedziekste, Abora. In the Sulka, high quality flint artefacts were found indicating the high technological skills in flint working (Loze 2008a:26). Probably the flint workshop have been situated at this site, although there are little information in the literature about the flint refuse materials that should be present at the workshop, to draw some more certain conclusions. The flint industry in the Lake Lubāns basin markedly developed due to this exchange activities. Most of the flint discovered in the Middle Neolithic settlements come from the Upper Volga region, but the Late Neolithic flint

has originated from south-east Europe in the Middle Dniepra region.

The Middle Neolithic layers at the Zvidze settlement contained very rich material with fragmented pottery, flint, slate, antler, bone and wooden artefacts. The appearance of amber and flint artefacts in the Middle Neolithic layers mark the changes in the people occupation and settlement character. During this period inhabitants of Zvidze probably were specialised in the amber and flint working. Loze argue that Zvidze could have been the base settlement and organised the distribution of flint or amber to the other settlements in the Lake Lubāns basin (Loze 2008b:62).

The presence of the first domesticated animal bones in the Middle Neolithic layers at Zvidze point out the significance of this settlement and probably have arrived to this site through the exchange contacts. There were estimated 18 individuals of pigs (*Sus domesticus*), 25 of cattle and five individuals of sheep/goat (Loze 2000b:114), forming the 1,9 % of the all animal bone finds at the Zvidze (Loze 1997:22). Thus the hunting-gathering formed the base of subsistence for the inhabitants of this settlement. The fishing equipment in Zvidze give indications about the collective and individual fishing, while fish bone finds show that pike lost its dominance among fishes, with the increasing amount of zander (pike-perch) in the catches (Loze 1988:118 f.).

There are several finds of the graves form the Middle Neolithic in the Lake Lubāns basin but unfortunately the information about these burials in the literature was quite parsimonious. Since the Lubāns basin has scanty amount of the burials, this information could be very valuable. The Middle Neolithic graves were found in the settlements of Kvapani II and Upesgala līcis (Ica II). In Kvapani II were discovered 15 burials in the culture layer, within the remains of buildings. No grave goods were discovered in a relation to these burials. Similar character had three burials from the Upesgala līcis (Ica II) settlement, where deceased have been buried near the house (Loze 2008a:12 ff.). These two settlements and the Abora I from the Late Neolithic are the only settlements within the Lake Lubāns basin that correspond to the all criteria for the permanent settlement.

Rapid decrease in Lubāns basin habitation can be traced at the end of the Neolithic and in the beginning of the Bronze Age. During the Late Neolithic hunting-gathering still formed the economical base. Amber processing continued in the settlements, among which Abora I took a major place (Loze 2008a:69 ff.). Inhabitants of the Lake Lubāns settlements

continued to participate in the exchange network, indicated by the high quality flint finds at the Late Neolithic sites.

Comparative studies

In an attempt to obtain better understanding about the hunter-gatherer and environment interactions in the Lake Lubāns basin, comparative studies is also of importance. Differences and similarities in the settlement character and location of the Stone Age sites in other parts of Latvia and Baltic Sea region are discussed below.

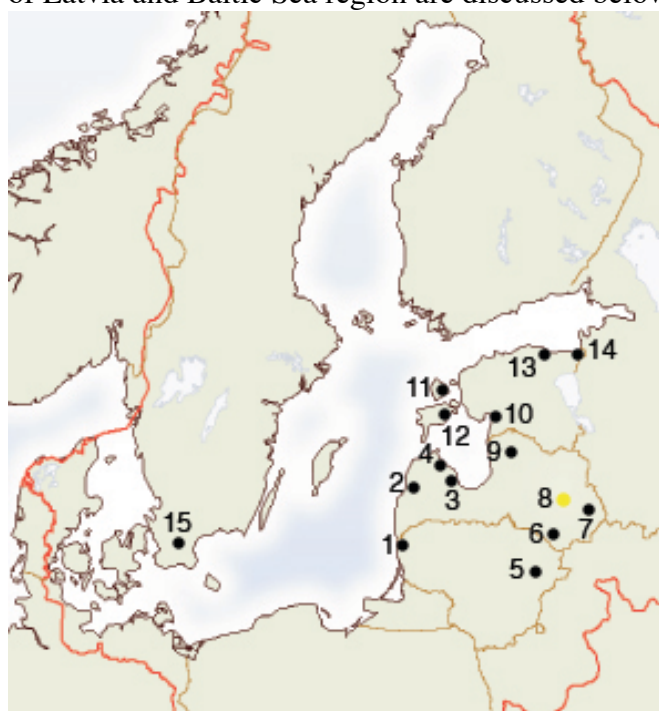


Figure 11. Places mentioned in this chapter: 1. Sventoji, 2. Sarnate, 3. Silinupe, 4. Purciems, 5. Lake Kretuonas, 6. Dviete, 7. Lake Great Ludzas (Kreici), 8. Lake Lubāns, 9. Lake Burtnieks, 10. Pulli, 11. Hiiumaa, 12. Saaremaa, 13. Kunda, 14. Narva, 15. Lake Ringsjö. (Background map from <http://www.grida.no/baltic/htmls/maps.htm>).

The pattern of hunter-gatherer settlement location in general has been quite common in the East Baltic and North Europe. Environments, suitable for the hunter-gatherer lifestyle, in the river valleys and shores of the shallow lakes have been places where the most of the ancient settlements have been situated. The first settlements in Latvia, as well as in other Baltic states, have been situated on the banks of the largest rivers. Banks of the River Daugava in Latvia, Nemunas in Lithuania, River Pärnu in Estonia have been settled by the

first reindeer hunters (Rimantiene 1998; Satavicius 1998; Raukas *et al.* 1999b; Zagorska 1999).

Near the Lake Burtnieks (fig. 11:9) in the Northern Latvia, an important Stone Age complex has been extensively investigated. Zvejnieki complex include two settlements from the Mesolithic and Neolithic, as well as the Stone Age cemetery (more than 300 graves) that is one of the largest in the Northern Europe. This complex is situated on the bank of the fifth largest lake in Latvia that lies in the central part of the Burtnieki Drumlin Field (Eberhards 2006:25). Shoreline of the ancient Lake Burtnieks had many peninsulas, narrow bays, as well as islands similarly to the Lake Lubāns in the Preboreal and Boreal periods. Both ancient lakes have been extended in the north-south direction, with a deepest places in the southern part (Eberhards 2006:28, fig.7; Grube 2006). The northern part of the ancient Lake Burtnieks, after the water level dropping, has turned into the boggy plain (Eberhards 2006:33). Zvejnieki complex has been situated on a long, gently-sloping former island of the ancient Lake Burtnieks, forming the natural barrier separating the deeper, present Lake Burtnieks, from the uneven bed of the former shallow northern part of the paleolake. The pebble and gravel deposits cover the ridge of this former island. There have been other Stone Age settlements located on such a small islands or on the shore of the ancient Lake Burtnieks (Eberhards 2006:35, 44 f.). The only kitchen midden site known in Latvia - Rinnukalns, also lies on the northern shore of this lake. There are around 100 burials discovered at this settlement. The most of them belong to the 16th -17th century, but according to the grave goods at least four of burials could have been from the Stone Age (Sturms 1927:8).

In the Preboreal period water levels in the Scandinavian and Central Europe lakes have been lower, due to the relatively warm and dry climate, but the Lake Burtnieks and also Lubāns reached their highest level comparing with subsequent periods (Eberhards 2006:39; Grube 2006). According to Eberhards (2006:42) spring floods have been one of the main reasons for the interruptions of the habitation in Lake Burtnieks basin, as well as in Lubāns.

In the west coast of Latvia the hunter-gatherer settlements was closely associated with water bodies and often were located near the former lagoon lakes or in the lowland area (Murniece *et al.* 1999:38). In the western part of Latvia archaeological excavations in the Stone Age settlements have not been carried out as extensive as in the eastern part. Many stray finds and extensively excavated Neolithic settlement Sarnate (fig. 11:2), form the knowledge about the Stone Age near the Baltic Sea coast.

The Sarnate was located in the former lagoon and in the Subboreal period settlement was situated on a narrow strip of land between three lakes, which nowadays are nearly overgrown. The location place of Sarnate has been inundated by the waters of the Ancyclus Lake and transgression of Litorina Sea (Berzins 2008:334 ff.). There are 53 waterlogged dwellings discovered in Sarnate with a concentration of artefacts in a vicinity of the hearths. Dwellings were situated unequally along a 900 m stretch parallel to the edge of Sarnate Bog (Berzins 2008:78; Murniece *et al.* 1999:57). Berzins (2008:194) recently have reinterpreted this settlement, paying more attention to the environment resource analysis and seasonality aspects. Such approach allow tracking the yearly cycle of people activities, thus giving the indications about the settlement sedentary character or specialisation in certain activity during some season. The artefact distribution also can help in the analysis of the settlement character. There was a distinct pattern in the artefact distribution in Sarnate, where domestic utensils were arranged around the central hearth, while most of the fishing and hunting gear were found around the perimeter of the dwelling (Murniece *et al.* 1999:57). Some of the dwellings showed specialisation in craft-working, particularly in amber working. This fact leave no doubt that Sarnate was a part of the wide exchange network, where flint and slate served as the medium of the exchange (Berzins 2008:373 f.; Murniece *et al.* 1999:61).

The pottery finds at Sarnate belonged to the western variant of the broad Narva culture group that was named Sarnate Ware and Comb Ware ceramics. The Sarnate Ware had some similarities with the Early Neolithic Osa-type ceramics found in the Lake Lubāns basin, since they both belonged to the Narva culture and formed its local variations. It was possible to distinguished the distribution of ceramics among the dwellings in Sarnate. The Comb Ware pottery was found in the drier part of the settlement where no organic material or significant structural remains have been preserved. The dwellings containing this pottery were situated a little bit aside from the dwellings with Sarnate Ware pottery (Berzins 2008: fig.19.). The Comb Ware ceramics are considered as partly contemporaneous and partly later than Sarnate Ware (Berzins 2008:77). Similar pottery and artefact assemblages have been discovered in the others East Baltic coastal settlements such as Purciems (fig. 11:4) (Sturms 1937) and Silinupe (fig. 11:3) (Zagorska 1990) situated on the coast of Gulf of Riga and Sventoji (fig. 11:1) settlements in the western Lithuania (Berzins 2008:145 f.).

The situation in the Lithuania during the Stone Age shows some similarities and differences. Similar pattern reveals the Palaeolithic and Mesolithic settlement location in the

great river valleys and in a vicinity of the paleolakes (Rimantiene 1998:144). There are more Palaeolithic evidences in Lithuania than in Latvia, probably due to the local flint resources obtainable in the southern part of Lithuania. These sites correspond to the earlier years than Latvian settlements, even to the final phase of the Alleröd. Flint availability apparently has influenced the settlement location and the most flint found in Latvia has probably come from this region (Rimantiene 1998:145). Lithuanian Mesolithic settlements belonged to the Maglemose or local Nemunas culture, while the Palaeolithic sites to Swidry, Ahrensburg and Bromme cultures (Rimantiene 1998:145 ff.).

A very interesting material for the comparative studies comes from the Stone Age complex near the Lake Kretuonas (fig. 11:5) in the north-east Lithuania. According to Lithuanian archaeologist Algirdas Girininkas, favourable conditions have promoted the people settling near the lake. More than 100 sites from different periods have been discovered in the surroundings of the Lake Kretuonas (Girininkas 1998:172). Lake Kretuonas covered larger territory during the Stone Age than today, just as the Lake Lubāns. In the Boreal period people had settlements near the river mouths that were flowing into the Lake Kretuonas. Finds from the Lake Kretuonas Mesolithic settlements are similar to the Pulli-type (Estonia) of the Kunda culture (Girininkas 1998:174).

There are several similarities between the Stone Age complexes in the basins of the Lake Lubāns and Lake Kretuonas. Both lakes are located in the lowlands with some landscape uplifts in the surroundings, with flat and boggy shores and river network flowing in and out of the lakes. Drainage and river straightening works have been carried out in the surroundings to reclaim the land for economic activities (Girininkas 1998:171). In the Mesolithic and the Early Neolithic settlements were located beside the water, similarly to the Lake Lubāns basin, but later people moved their settlements further from the shores of the lake.

The peat formation in the lake surroundings begun in the Early and Middle Atlantic climatic period, that coincide with peat formations in the Lake Lubāns basin (Girininkas 1998:174; Rieksts 1974:11). Lake Kretuonas also had several water level regressions and transgressions that have affected the settlement location and Girininkas emphasize people adaptation to the environment that have influenced their occupation (Girininkas 1998:175).

An interesting fact is that it has been possible to distinguish among the people occupation and activities in the different sides of the lake. The palynological and osteological

analysis showed that hunting has been the main occupation in the western side of the lake, where sparse pine forests with underwood dominated in the landscape and where the red deer were multiplying. Amount of the hunted elk formed just a quarter of the quantity of the deer amount, probably due to the less prevalence of the forests, where lived elk, in the western side of the lake (Girininkas 1998:175 f.). As show the analysis of the vegetation development around the Lake Kretuonas, on the west side of the lake vegetation remained unchanged during the Subboreal, while in the east side it slightly changed, revealing greater amount of the birch, alder and spruce. That affected forest fauna as well, with increasing amount of the elk and declining red deer population (Girininkas 1998:177).

Another similar aspect between these two lake complexes is the increase in the number of settlements during the Subboreal period. During this period appear the first evidences about farming and animals domestication, although the domesticated animal bones represent just 1-3 % form the total amount of the animal bones (Girininkas 1998:176 f.). Girininkas connect the spread of the domesticated animals in the Lake Kretuonas basin with the influences from the Funnel Beaker culture and admit that inhabitants of the Kretuonas lakeside remained hunters and stock-breeders longer than than the inhabitants of western Lithuania, Latvia and former Russia (Girininkas 1998:179). Girininkas explain the delay of the arrival of agriculture in the Lake Kretuonas basin with the lack of the fertile soil in a countryside of sand, swamp and forest. Abundance of the nature resources in the forests promoted the maintenance of the hunter-gatherer subsistence mode longer, as opposed to agriculture which required much work in the prevailing soil conditions (Girininkas 1998:180).

Girininkas point out the geological and nature aspects, as well as the ethno-cultural processes that must have influenced the development in the different parts of Lithuania (Girininkas 1998:179). The autonomous development of the Lake Kretuonas basin has been explained by the differences in the underlying geology of the eastern Lithuania, that differs from Latvia and western Lithuania. For example, the development of the Narva culture were different in the western and eastern Lithuania (Rimantiene 1998:149). Similar pattern can be traced also in coastal areas of Latvia and inland territories such as the Lake Lubāns and Burtnieks basins. The Sventoji Stone Age complex in the north-west Lithuania has more similar character to Sarnate, than the settlements from the Lake Kretuonas or Lubāns basins.

There are several well-known Stone Age habitation regions in Estonia, that have contribute also with a names to the East Baltic Stone Age cultures. Kunda (fig. 11:13) and Narva (fig. 11:14) sites are situated in the north-east Estonia, but Pulli (fig. 11:10) is located in the south-west side. The Mesolithic settlements were mostly situated on the banks of rivers and lakes, and immediate sea coast and small islands, that offered ideal conditions for fishing and seal-hunting (Lang 1999:335).

The oldest known Stone Age settlement in Estonia is Pulli (fig. 11:10) site, dated to 9276/8644 calBC (TA-245, 9600 ± 120 BP) and has been situated on the lower reaches of the Pärnu river in the Pärnu Lowland. The evolution of the Baltic Sea and changes in the local hydrology have affected the location of human settlements during the Stone Age in Pärnu area (Raukas *et al.* 1999b:15). Similarly to the situation at Sulagals, elk have been the main game in Pulli, closely followed by beaver. Bones from the wild boar and brown bear also have been collected at the settlement. Pike-pirch dominated among the fishes 95 %, and bream 5 %. Pike absence can be explain with the fact that pike have been spawning during the spring high water season, when it was impossible to live and catch fish at Pulli, but pike-pirch and bream must have entered the Pärnu river to spawn only after the water level in the river had subsided (Raukas *et al.* 1999b:25 f.).

The famous Middle Mesolithic site Kunda-Lammasmägi (fig. 11:13) was situated on a low hill in the ancient Lake Kunda that have formed after the isolation of a lagoon from the Baltic Ice Lake (Moora & Moora 1996:231). The animal bone assemblage showed the similar pattern to the Pulli and Sulagals settlements with a elk dominance among the game, but in difference more animal species have been distinguished in Kunda with a larger amount of the osteological remains. Presence of the all parts of the elk skeleton assure that whole animal has been carried to the settlement and processed on the place. Although the Kunda have been regarded as a seasonal site, the osteological analysis has shown the possibility for the nature resource availability at the settlement all year round. However the materials are still insufficient for summer and midwinter activities to consider this settlement as permanent (Lougas 1996:274 ff.). The distribution in the bone material show the larger quantities of the animal bone fragments in the western slope of the hill and no finds at the top of the hill (Åkerlund *et al.* 1996, fig.2). Flourishing seasonal settlement at the Kunda ceased to exist due to the catastrophic water level drop in the end of the Boreal period (Moora *et al.* 1996:241).

Another large Stone Age settlement complex has been located in the lower course of the Narva River, near the Gulf of Finland. The Early Neolithic culture was named after this place. The artefact assemblages show more similarities with the finds from the Late Mesolithic and Early Neolithic settlements in the Lake Lubāns basin, while settlement location reveal the pattern of the coastal settlement location in the sandy ridges formed by the water level fluctuations of the Litorina Sea, that nowadays correspond to the banks of the River Narva and Torvajoe (Kriiska 1996:361 ff.).

The Mesolithic sites in Estonian have showed larger amount of the hunted elk and beaver than the Late Mesolithic site from the Lake Lubāns basin where wild boar have been the dominant game. An interesting aspect is that very scanty finds reveal marine diet even in the coastal settlements during the Mesolithic in Estonia (Lougas *et al.* 1996:399 ff.). Another situation can be observed on the largest Estonian islands Saaremaa (fig. 11:12) and Hiiumaa (fig. 11:11) where several Mesolithic and Neolithic settlements have been found indicating the seasonal specialisation particularly in the seal hunt. Seal hunters probably used these settlements in the early spring, when seals are migrating and the pups are born (Kriiska & Lougas 1999:166 ff.).

In the southern Scandinavia, Stone Age research has been quite extensive. An interesting region for the comparative studies is the largest inland lake in Scania which reveal abundance of the Stone Age remains. Lake Ringsjö (fig. 11:15) is situated in the central part of the Scania and similarly to the Lake Lubāns basin, northern part of the ancient lake has turned into the bogs of Ageröd and Rönneholm that nowadays have been extensively used for the peat extraction. River Saxån creates a natural border between these two bogs and connects the Lake Ringsjö with the Sound. Large archaeological excavations in the Ageröd bog were carried out in the 1970s, while in Rönneholms bog investigations begun in the 1990s (Larsson 1978, 1983; Sjöström 1995, 2004).

Ageröds settlements have been located on a solid ground, except Ageröd V, which is believed to have been situated on an island in the Lake Ringsjö. Finds from the Rönneholms bog show that settlements or short residence places have been situated in the lake. Settlements Rönneholm 7 and Rönneholm 8 were located 800 m from solid land (Sjöström 1995:7). The Mesolithic finds from Rönneholms peat bog are very similar to the Ageröd V (Sjöström 2004:43). The Rönneholms sites have revealed relatively smaller amount of the find concentrations than settlements of Ageröd I and Ageröd III which were located on a solid

ground. Thus probably the Rönneholm sites served as residence places during the fishing, gathering or hunting activities in the lake. During the surveys in Rönneholms peat bog many short residence or resting places has been discovered, with traces of fireplace often with sand and artefacts (Hammarstrand Dehman & Sjöström 2010:23 ff.). Many activities in the lake did not leave any or at least very little traces and thereby stray finds discovered in the peat all over the Rönneholms bog probably reflects the activities carried out from the canoes (Sjöström 2004:44). This pattern recalls with finds from the Lubāns stray find collection. Probably there could have been the small activity areas with hearths and finds as in the Rönneholms bog, but so far such a discoveries have not been made in the Lake Lubāns basin. It is important to bear in mind that such a finds in the Rönneholms bog have been possible due to the peat extraction works. Although even if there is lack of the Middle Mesolithic settlements in the Lake Lubāns basin, bone artefacts from the stray find collection point out the intensive activities during this period in the lake.

Finds at the Lake Ringsjö surroundings, have offered an opportunity to discuss the seasonality aspects of the settlements and seasonally-dictated settlement-movements between inland and coast (Larsson 1983:116). The relative proximity of the sea coast and beneficial water route through the River Saxån, could have been a reason for the hunter-gatherer movements. Evidences suggest the limited occupation in the Ageröd during the spring with an intensification in the autumn (Larsson 1983:116 ff.). In the coastal sites, such as Segebro, activity intensification was the highest during the spring and early summer. Seal hunt have been an important subsistence at the coastal sites, indicating the habitation during the winter as well (Larsson 1983:133 f.).

Archaeological investigations at the Ageröd complex reveal the seasonal occupation, but still discussable is the question of the movements between coast and inland sites or between various inland settlements (Larsson 1983:134). The settlements from Ageröd I complex which were situated on a lake shore (Ageröd I:HC, I:B) indicated the habitation during the late spring and summer, but smaller sites, as Ageröd V and Ageröd I:D could have been occupied during the late summer and autumn (Larsson 1983:135). There are also the possibility that permanent settlements in Scania might have been already in the Atlantic period (Larsson 1983:137).

Discussion

To be able to discuss people and environment interactions in the Lake Lubāns basin, I have distinguished several fields of interest as already mentioned in the aim and problem statement. Here I will discuss the issues about settlement location, specialisation, seasonality, early farmers around the Lake Lubāns, as well as the contacts with coastal settlements and conclude with discussion about adaptation versus exploitation.

Settlement location

The location of the hunter-gatherer settlements could have been affected by different factors. Discussions about the Stone Age settlement location involve the topic of environmental conditions that have influenced or even forced people to settle in some certain places (Girininkas 1998; Kriiska & Lougas 1999). Reasons could be the adaptation to the certain environment (Raukas *et al.* 1999a) or people's own choice to settle in a carefully selected place (Larsson 1983, Rimantiene 1998). In my opinion, people awareness choosing the settlement location have been underestimated or predominated by the adaptation issues within these discussions. The favourable environment, rich in the nature resources and strategical settlement location in the landscape has been the most important aspects deciding this choice. Of course the climate and geographical conditions have changed through the time affecting the settlement location, but I would like to presume that not only these conditions decided the abandonment of the settlements. People's lifestyle and needs change through the time, and probably a certain ecosystem after some time was not anymore able to provide people with the desirable resources.

Discussing the Mesolithic settlements in the Southern Sweden, Larsson has emphasized people observance in the choice of the settlements. Location of the settlement have been chosen out of consideration for the easier accomplishment of their tasks which could be practised at or in the immediate vicinity of the site (Larsson 1983:124). Rimantiene discussing the Palaeolithic and Mesolithic settlement location in Lithuania point out that people chose the place, that was suitable for their lifestyle and needs. Thus people settled in a vicinity of resource rich ecosystems suitable for animal life and accordingly good hunting (Rimantiene 1998:144). In Sarnate, at least during the latest phase of occupation, dwellings

were situated very close to the water and Berzins (2008:336) presume, that people have chose to settle in such conditions to gain better access to the lake resources and transport route. People awareness in the settlement location also have been admitted by Loze (2008b:61). She consider that the choice to settle in the Lake Lubāns basin have been strategically selected, at least during the Middle Neolithic, as a beneficial place for the participation in the exchange network.

As a pattern for the location of the earliest settlements location emerge the river vallies (Pasielai, Maximonys in Lithuania, Laukskola in Latvia), lake shorelines (Lake Kretuonas basin in Lithuania), as well as the islands in paleolakes (Kunda-Lammasmegi in Estonia, Sulagals in Lubāns basin, Zvejnieki in Lake Burtnieks, Ageröd V and Rönneholm sites in the Lake Ringsjö) and sea coast (Pulli in Estonia) (Larsson 1983, Loze 1988; Sjöström 1995; Girininkas 1998; Rimantiene 1998; Raukas *et al.* 1999b; Zagorska 1999, 2000). Some of the settlements were inhabited just for a short period, such as Sulagals, Pulli during the Early Mesolithic, but others have covered longer time span, for example, Zvejnieki II.

Settlement location in the Lake Lubāns basin has been markedly affected by water level fluctuations. Examination of the water level curves gives essential information about the landscape in the past. Such studies have been carried out for the Lake Lubāns, some Lithuanian lakes and rivers, and several lakes in southern Sweden. A remarkable rise in the water level in the Lake Ringsjö, occurred at the middle of the BO 2 (fig. 12), followed by a sharp sinking of the water level at the end of the Boreal period. Analysis from two other south Swedish lakes showed the similar pattern (Larsson 1983:151; Nilsson 1967:63). Comparison between Lake Ringsjö water level (fig. 12) with a water level curves from the Lake Lubāns (fig. 9, 12), do not show any similar pattern, except the rise of the water level during the Subatlantic period. Water level changes in the Lake Lubāns basin was characterised by several sharp water level transgressions, but not as many as have been traced in the Lithuanian Lake Kretuonas (fig. 12) (Girininkas 1998). The very low water level in the Lake Kretuonas during the Boreal period changed with the rapidly increasing in the Early Atlantic period, in opposite to the Lake Lubāns level fluctuations (Girininkas 2008).

The variations in the different water level curves can depending to the lake depth. In a shallow lakes, as the prehistoric Ageröds bog, Lake Lubāns, Lake Kretuonas in Lithuania, can even changes of less amplitude be traced in the stratigraphic succession, while in the

deep lakes only changes taking place over a long period of time can be observed (Digerfeldt 1972:57).

The Lake Lubāns water level reached its maximum in the Preboreal period (fig. 9). There are some inconsistencies with the settlements from this period. Sulagals is the only well known site from this period, but recently Loze (2006) have added two more settlements - Zvejsalas and Kvapani II, to the Early Mesolithic habitation in the Lake Lubāns basin. In the lake development models created by Grube (2006) these sites are not visible and according to her measurements must have been under water. That possibly could be explained with a fact, that lake models were created according to the certain water level, but these sites probably could have been used during the lower water level periods or correspond to the beginning of the Preboreal when the water level was 94 m a.s.l. Although the archaeological evidences about the activities within these settlements are very scanty and thus it is difficult to discuss their habitation.

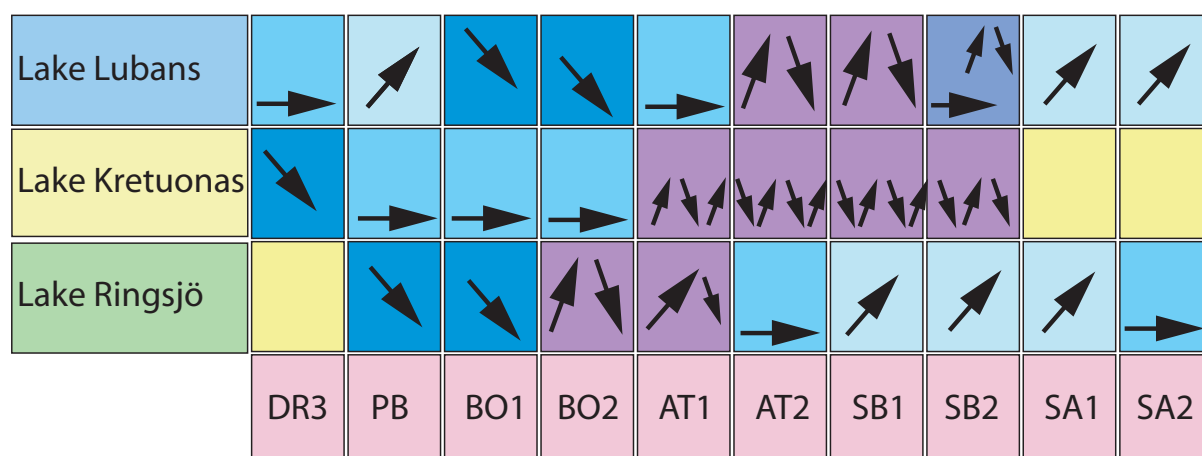


Figure 12. Water level fluctuations in the Lake Lubāns, Lake Kretuonas and Lake Ringsjö. (After Nilsson 1967, Eberhards 1985, Girininkas 1990).

In the Atlantic period, when the water level markedly dropped (fig. 9), settlements have not been situated in a direct proximity to the lake shoreline. Zvidze and Osa sites have been located on elevations in areas that started to be marshy. Habitation from this period is also traced in Ica, Lisina and again inhabited was Zvejsalas. The finds of the low water level period settlements are affected also by the fact that nowadays these territories probably are covered with water or wetlands, thus complicating the chances to find them.

The densest habitation in the Lake Lubāns basin can be observed during the Subboreal period (fig. 10). Settlements in this period have been located mostly on the river

banks, and not on the shoreline of the lake. Grube (2006) consider that location of the settlements further from the lake shore can be explained with a fear of the floods. An opposite pattern can be seen in the Lake Kretuonas basin in Lithuania where settlements were placed closer to the lake shore in the Middle Neolithic and continued to exist there in the Bronze Age as well (Girninkas 2008:21).

There is an interesting pattern, whereby most of the settlements with amber and flint working specialisation were located in the banks of the tributaries of the River Aiviekste. This shows the importance of the settlement location in the vicinity of good waterways and most of the new settlements that come into the use during the Middle Neolithic period also were situated in the northern side of the Lake Lubāns.

Settlement specialisation

Swedish archaeologist Arne Sjöström has pointed out, that character of the settlement do not necessarily reflects in the amount of the discovered finds. The content, composition and distribution can be the better indicators for the interpretation (Sjöström 2004:43). Although the Lake Lubāns settlements have revealed an abundance of the different archaeological remains, more detailed analysis of their distribution and composition possibly could provide a new knowledge about the settlement context. Such approach has proved to be useful for the interpretations of the find assemblages from Sarnate (Berzins 2008). Literature analysis have not revealed that much information about the settlement specialisation, but actual archaeological material studies probably could help to trace the places in the settlement where certain activities have been performed, thus indicating the specialisation within the settlement.

Literature studies have offered some indications about the certain activities within the Lubāns settlements and probably the settlement specialisation within this region could be discussed since the Late Mesolithic. However more obvious specialisation appears during the Middle and Late Neolithic.

There are not so clear evidences about the settlement specialisation during the Mesolithic within the Lake Lubāns settlements, as for example, in Estonian island Hiiumaa (fig. 11:11), where define specialisation in the seal hunt can be seen during the Mesolithic (Kriiska & Lougas 1999:166). There are no natural flint pebbles available in the Lake Lubāns

surroundings, and that can explain the scanty amount of the flint discovered at the Lubāns settlements. Thus within Lubāns settlements bone and antler industry have been highly developed and probably it could be possible to speak about the specialisation in this field. The most of the bone and antler artefacts belong to the hunting and fishing equipment, thus indicating the importance of these activities in the Mesolithic sites. I suppose that hunting have been a very important activity not only for the diet, but also to obtain the raw materials for the tool production. Lack of flint resources might have been one of the main reasons for the development of the exchange network that flourished during the Middle Neolithic (Loze 2008b).

The archaeological and osteological evidences from the Early Mesolithic settlement Sulagals show that hunting, particularly elk hunt, has been an important occupation. Although the dominance of the elk bones also could be explained with a fact that bird, fish and smaller animal bones have not been preserved or collected during the excavation process. In Lithuania the Late Palaeolithic artefacts found in the surroundings of the Lake Kretuonas showed the specialisation in the reindeer hunt while the Mesolithic communities were mainly fishing (Girininkas 2008:23 ff.).

There were no clearly dominant animal among the game in the Zvidze settlement, indicating that there were no specialisation in the hunting of some certain animal. Relatively high amount of the beaver and marten bones indicate the need in furs that probably served as an exchange goods. Thereby it could be possible to speak about the specialisation in the waterfowl hunt and fishing during the Atlantic period at the Zvidze settlement. There are large amount of different waterfowl bones discovered in Zvidze thus emphasizing the importance of birds in the subsistence for the inhabitants of this settlement.

The Late Mesolithic and Early Neolithic could be considered as the period when fishing have been a very important activity. Large amount of the bone and antler fishing equipment have been discovered in the Lake Lubāns basin. The finds of fish traps and weirs at the Zvidze settlement Early Neolithic layers, as well as the fact that pike have dominated among the fishes emphasize the importance of fishing at this settlement. Similar situation reflects the Osa settlement where pike bones formed the 94 % among the fish bones (Sloka 1986:127 f., 1988:89).

The archaeological finds in the Lubāns settlements indicate that fishing in the Mesolithic could have more individual character, when mainly the fish spears, hooks and

harpoons were used, but in the Early Neolithic have become more collective activity, using the fishing nets, weirs and traps. The finds of the sinker stones in the Rönneholms sites show the use of the fishing nets in the Early Atlantic period (Hammarstrand Dehman & Sjöström 2010:42 f.). Thus I presume that nets and weirs might have been used already in the Mesolithic in the Lake Lubāns settlements. At the Zvidze even one fish hook made from the slate have been found, but sinker stones and floats from pine have been identified at Zvidze, Osa and Piestina (Loze 1988:118). Thus it could be possible to conclude that fishing could have been the specialisation for Zvidze and Osa during the Late Mesolithic and especially the Early Neolithic.

Among the Early Neolithic settlements in the Lake Lubāns basin, the Zvejsalas settlement might have been specialised in the pottery making. The different pottery making techniques, unique ornaments, as well as not so pronounced fishing and hunting equipment assemblage, probably could indicate the importance of pottery making in this site.

Clear pattern in the settlement specialisation can be observed during the Middle and Late Neolithic with amber and flint working. Several settlement from this period revealed the large amount of the amber and flint thus allowing to consider them as specialised in the particular field. The Middle Neolithic settlement Nainiekste has been interpreted as specialised amber working site with a seasonal character. The limited amount of the artefacts, character of the culture layer, as well as the faint traces of dwellings suggests the temporal residence in this settlement. Loze consider that amber have come to this seasonal site probably from the base settlement, that in this case could have been Zvidze, because was situated just six kilometres from the Nainiekste (Loze 2008:32). This suggest that amber working have not been carried out just in the permanent settlements, but also in a seasonal or special task sites, while exchange and distribution of amber and other materials was controlled and organised by the base sites. Settlement specialisation in the amber working can also be traced in the Middle Neolithic settlements at the coastal areas. Such a amber workshops were found at the Sarnate, Silinupe in Latvia and Sventoji in Lithuania (fig. 11) (Vaninka 1954, 1970; Rimantiene 2005; Berzins 2008).

The high quality flint artefacts have been found in many Middle Neolithic settlements, indicating the specialisation in this field. However the amount of the available information in the literature, do not allow me to discuss more widely the flint working within Lubāns settlements. The information about the flint waste is missing to prove that flint have been

processed at the site. Otherwise it is possible that already finished artefacts have been exchanged and thus reached the Lake Lubāns basin.

Seasonality

One of the questions that I would like to discuss is about the seasonality of the hunter-gatherer sites. As I mentioned in theory part, there are several ideas and thoughts about seasonality or sedentism character among the hunter-gatherer communities. Latvian Stone Age researcher Zagorska, according to the archaeological material, and particularly evidences of fishing, consider that already in the Middle Mesolithic in the eastern Baltic, for example, Zvejnieki II in Latvia and Kunda-Lammasmegi (fig. 11:13) in Estonia were stabile and permanent settlements. She also state that permanent settlements have been mostly situated inland, while coastal sites could have a seasonal character (Zagorska 2000:12 f.). The osteological material from Kunda partly support this statement with a representation of the yearly cycle of resource availability, but still the information is insufficient to confirm this assumption (Lougas 1996:288 f.). Lithuanian archaeologist Girininkas (2008:19) according to the amount of artefacts, dwelling and hearth constructions, consider the Mesolithic settlements around the Lake Kretuonas as stabile and long duration. Another information comes from the Lake Ringsjö in Scania, where the Mesolithic settlements show repeated habitation during some certain season. Thus Rönneholm 23 site have been probably inhabited during the low water season in the summer and autumn, because stratigraphy and hut constructions do not indicate longer residency (Hammarstrand Dehman & Sjöström 2010:58, 66).

Berzins in his doctoral thesis have discussed the seasonality aspects, site location in the past landscape and the resource availability that indicated the permanent habitation at Sarnate and allow to consider it as a base settlement (Berzins 2008:331 ff.). He founds evidences for this statement in approval of yearly cycle of resource availability and management. For example, eel fishing was possible to conduct in the winter and in spring time there were good waters for catching fishes during their spawning, summer was providing the wide range of edible plants, for example, water chestnuts. Hearth structures in the dwellings indicate the winter habitation, but renewal of houses is evidence for the long term residence (Berzins 2008:337). This example emphasize people awareness and choice to

locate their settlements in ecological environment that could provide them with necessarily resources all year round.

The Lake Lubāns settlement seasonality haven't been widely discussed subject within the literature. One example comes from Lozes (2000c:216) article where, the question about the Ica seasonality have been discussed. She suggest the possibility that Ica have been a satellite camp at the same time as the people living at Osa were occupying a base camp. Loze also emphasise the fact that Ica inhabitants have been the successors of the Mesolithic culture, that can be seen in the flint, bone and antler industry, as well as in the Mesolithic dot technique of bone ornamentation also traced in the Early Neolithic pottery in Lubāns settlements (Loze 2000c:216). The larger amount of the flint finds at Ica than at Osa, cause reflection about the credibility of this assumption, because flint have been very rare find among the Mesolithic and the Early Neolithic settlements in the Lake Lubāns basin. Why there are nearly no flint finds at the base site Osa, while in its seasonal site appears the larger amount of so rare material as flint?

The archaeological and osteological material from Zvidze settlement offer possibilities to reconstruct the yearly cycle of activities. Thus waterfowl hunt might have been the most active during the spring and autumn coinciding with the bird migration periods. Hunting of the mammals could been the autumn activity, because the main game at Zvidze have been wild boar and elk. Fishing should be the most successful during the spawning period in the spring. The sheatfishes could be caught in the early summer when they have migrated from the deeper water for the spawning in the shallow waters of the littoral. June could have been the best period for the zander fishing, during their spawn, but in the other periods fishes could be caught with fish traps (Sloka 1986:128 ff.). Gathering of edible plants and seeds have been the summer activity, when water chestnuts, hazelnuts, strawberries, raspberries etc. could be collected (Loze & Jakubovska 1984:88 ff.). These evidences indicate the possibility to stay in this settlements all year round. Similar character could be applied to Osa settlement, except the lack of evidences about waterfowl hunt. Winter habitation at this site also indicate the find of the sledge runner.

It is difficult to make some conclusions about the seasonality of the Sulagals. It is the only, so far known, settlement from the Early Mesolithic in the Lake Lubāns basin and thus it is not enough knowledge to discuss its character. According to Jennbert (1984) and Carlsson (2007) criteria for the permanent settlement, there are just three sites - Abora, Kvapani II and

Upesgala līcis (Ica II) (fig. 2, 10) - from the Lake Lubāns basin, that fulfil all of them. Lack of the graves in the vicinity of settlements is only hindrance to call other Lubāns settlements as permanent. However the character of Zvidze, Osa, Ica and Zvejsalas (fig. 2, 10) with well exploited settlement territory, large find assemblages and settlement location in a favourable environment with a good access to water ways indicate their long duration. Thus I could conclude that stable and long-existing settlements appear in the Lake Lubāns basin since the Late Mesolithic. During the Middle Neolithic increase amount of seasonal or special purpose settlements which were mainly connected with amber processing, while the Late Neolithic settlements also indicate long-existing and stable settlements.

Early farming and stock-breeding

Domestication of the animals and the arrival of the early farming have been one of the most discussed subjects within the Stone Age archaeology. Lithuanian researchers Seibutis and Savukyniė (1998), as well as Levkovskaja (1987) consider that the first attempt to domesticate animals could be carried out already in the Atlantic period. Levkovskaja (1987:19, 59) interpret the decline in the elm pollen curves caused by the use of elm branches as a fodder for game animals. Although Swedish archaeologist Friman (1996:13) have analysed the discussions about the elm decline and conclude that it was most likely caused by some elm disease, which could have been aided by different local climatic changes and perhaps also by human activities.

Girininkas (2008:27) consider that Forest Neolithic inhabitants slowly developed the conditions for the agrarian economy. Lithuanian researchers consider that "Amber route" have been the way how seeds have got to the eastern Baltic from the south, thus rejecting the assumptions of the diffuse spreading of the early farming in the Sventoji (Seibutis & Savukyniė 1998:56 ff.).

According to the pollen analysis, the first evidences of agriculture in Lubāns Plain appears approximately 4360 calBC (5500 BP), at the end of Atlantic period, corresponding to the Early Neolithic, when some initial land use have begun alongside the fishing, hunting and gathering (Seglins *et al.* 1999:125). Sure evidences about crop cultivation in Latvia are dated to the c. 2570 calBC (4000 BP), when barely grains were found at the Kreici Middle

Neolithic settlement in the south-east Latvia (Zagorskis 1963:23 ff.). This information coincide with archaeological evidences.

Seglins and colleagues (1999:126) consider the transition from gathering economy to a producing in the Lake Lubāns basin as a multistage question that should be also correlated with the transitions and regressions of the Lake Lubāns and changes in the areas of land suitable for habitation and for other uses. People movements in this region were probably affected by lake water level oscillations and search for the more suitable living and farming territories. Levkovskaya (1987) state that beginning of the shift to agriculture and stock-breeding in Lubāns lowland coincide with a sudden changes in the structure of biotopes, when during the lake regression, contacts with neighbours become stronger and new inhabitants arrived promoting the many innovations.

I partly could agree with Seglins and colleagues (1999), but more with Girininkas (1998) statements that people slowly developed conditions for the agrarian economy. Perhaps the prudent use and management of the available resources during the Atlantic period ensured the existence of hunter-gatherer communities in the Lake Lubāns basin and promoted their development. Thus during this period formed the basis for the Middle Neolithic exchange activities that probably contributed to the arrival of farming and domesticated animals to the Lake Lubāns basin.

Loze in her article about indo-europeans in Eastern Baltic, state that the Lake Lubāns basin and Sventoji lagoon in western Lithuania were main regions where early agricultural efforts were made, pointing out the close connection with changes in social structure, ideology and language (Loze 1997:17). She presume that arrival of the agriculture in the Lake Lubāns region was a result of a diffusion, when local Post-Narva tribes acquired skills from the Funnel Beaker culture, while in Sventoji lagoon arrival of agriculture was a result of activities of bearers of Globular Amphora culture coming to the Post-Narva culture territories (Loze 1997:18). The finds from the Zvidze settlement, indicate that the first efforts in the farming and stock-breeding have been made in the long-existence sites. Since Zvidze also have been considered as a one of the most important sites that organised the exchange contacts, appearance of the *Cerealea* pollens and domesticated animal bones in this site is not surprising.

The discovery of the domesticated animal bones at Zvidze indicate that this long-existing site had a certain role among the Lubāns settlements and the environment suitability

to the farming and stock-breeding was adjusted gradually. Thus the Late Neolithic settlements in the Lake Lubāns basin were situated in new places, which probably were more suitable for these activities. Although the number of the domesticated animal bones in these sites are scanty and wild animal bones still dominate. This information probably could indicate that domesticated animals had more social than economic meaning. Even more, the location of the Abora settlement in a strategically advantageous place for controlling the movements in this region, could indicate that fertile lands for the agriculture activities had an underlying role in settlement location during the Late Neolithic. This example shows that exchange activities still were very important.

According to Zvelebil's availability model and bearing in mind that domesticated animal bones discovered in Zvidze formed just 1,9% from total amount, this settlement could be considered as belonging to the availability phase. In the Late Neolithic settlements Abora I, Eini and Lagaza the amount of the domesticated animal bones do not exceed the 5 % (Loze 1979:124 ff.) border thus corresponding also to the availability phase. Total transition to farming in Latvia/Estonia, correspond to the end of the Bronze Age in this model, while availability phase is covering the largest part of the Neolithic (Zvelebil 1998, fig.1.4.). In the Bronze Age fortified settlement Brikuli, which was situated in the Īdeņa - former island in the Lake Lubāns, already in the early phase the domesticated animal bones constituted 86,7 % (Vasks 1994:57). The position of this settlement on the elevation, the fortifications, traces of bronze casting, as well as large amount of domesticated animal bones reflect the social and economical changes that probably contributed to the abandonment of the Late Neolithic settlements in the Lake Lubāns basin.

In my opinion the shift to farming and stock-breeding in the Lake Lubāns basin was a long process where people activities during the Neolithic slowly developed the necessary conditions for the shift to agrarian economy, that do not appear in this region before the Bronze Age. Little amount of domesticated animal bones and a fact that settlement location in the Middle and Late Neolithic seems to be not primarily chosen for the soil quality, could indicate the secondary role of these activities. Perhaps domesticated animals had more social than economic value for the inhabitants of the Lake Lubāns Neolithic settlements.

Contacts between coast and inland

Contacts between coast and inland settlements have been widely discussed subject in southern Sweden (Larsson 1978, 1983, 1988). Discussions have arose about settlement location and people movements from coastal settlements to the places that were located near the lakes inside the land. Examples from Scania and Northern Latvia highlight these statements. Hunter-gatherers from the sites that were located near the sea in the Southern Scania, probably have moved from their coastal sites to the Lake Ringsjö area during the summers as indicate the finds from Ageröd and Rönneholm peat bog sites. There are finds of the sinker flints that naturally do not occur in the Ringsjö surroundings, thus indicating that they have been brought to this place from coastal areas (Hammarstrand Dehman & Sjöström 2010:42).

At Zvejnieki Stone Age cemetery in Northern Latvia, seal bones have been found, thus assuming the connections between coast and inland settlements (Lougas 2006:88). Studies about dog dietary from Zvejnieki cemetery also show the connections with coast, since the values of marine diet have been discovered in the dog bones (Eriksone & Zagorska 2003:48). However the distance between coast and Lake Burtnieks settlements is around 50 kilometres and can be reachable easily through the waterways. The situation with the Lake Lubāns is different, because the distance to the Baltic Sea coast is around 220 km, even there are good waterways through the Rivers Aiviekste and Daugava that are able to connect these areas.

The Middle and Late Neolithic have been considered as a period when contacts between inland and coastal settlements were getting stronger (Zagorska 2000:18). This statement fairly reflects in the Lake Lubāns basin. Large quantities of amber finds from the Middle Neolithic settlements in the Lake Lubāns basin confirm the intensive contacts between this region and coastal areas. Finds of amber and its processing at the coastal settlements is not uncommon, but so extensive amber accumulation and traces of the local amber working so far from the sea is an interesting case. The intensification in the amber use in the Middle Neolithic settlements were connected with this material availability in the East Baltic after the transgression of the Litorina Sea (Berzins 2008:350).

Loze (2003; 2004; 2008b) has widely described and discussed the amber working in the Lake Lubāns settlements. Her interpretations of the amber working increase in the Lubāns

settlements during the Middle and Late Neolithic are that inhabitants of this region were taking a middleman role in this large exchange system between the Litorina Sea coast and inhabitants of River Volga and Dniepr basins (Loze 2008b:60). The main reason to participate in this exchange system probably have been the need to obtain flint resources. The regions of Valdai and Upper Volga were famous for their high quality flint. Thus during the Middle Neolithic main exchange roads led to the River Volga basin, but in the Late Neolithic to the South–East Europe, down to the River Dniepr basin since the other type of flint typical from the Sozhi region, appeared in Lubāns settlements, but tooth-shaped and key-head amber pendants characteristic of the Late Neolithic have been found in Strelica burial ground in the Middle Dniepr basin. An interesting fact is that the best amber workshops in Lubāns basin also had the best quality flint that have originated from the Upper Volga region (Loze 2008b: 63).

Amber finds from the Stone Age cemeteries in the present day Russia territory represent these contacts. Amount of amber finds at Konchanska burial ground indicate that amber was considered as a highly prestigious product. In this cemetery 166 from totally 267 burials were adorned with amber artefacts. Also in Repsiches burial ground 118 from 204 burials had amber grave goods, showing the access to amber artefacts in their everyday life and importance of it in the burial rituals as well. Amber artefacts have been localised in other burial grounds and settlements in North-East Europe, as far North as White Sea and as far East as Ural mountains, and probably most of them have come from Lubāns amber working centre (Loze 2008b:62 ff.).

There are several examples from the Stone Age cemeteries Zvejnieki in the northern Latvia and Kreici in eastern part of Latvia, where amber artefacts have been used as grave goods (Zagorskis 1961,1987, 2004; Larsson 2010). More interesting fact is that in the Lake Lubāns basin, where the largest amber manufacturing centre was located, amber artefacts were found just in 13 burials from the totally 61 graves discovered at the Late Neolithic cemetery Abora (Loze 1979:43 ff.).

Evidences about amber processing, finds of the domesticated animal bones, as well as fragments of Baltic sturgeon discovered in the Middle Neolithic layers in the Zvidze, indicate the importance of the settlement in the exchange contacts. Loze (2008b) also have mentioned Zvidze as one of the leading amber workshops and distributor of the raw materials within the Lubāns basin. Thus I presume that Zvidze could have been one of the main participants or

even organizer of the exchange activities. In the Late Neolithic, Abora I, probably replace it, since the location of the settlement allowed to control the main water way and thus all the movements within the Lake Lubāns basin. I also wonder about the scanty amount of the grave goods in the Abora Late Neolithic cemetery, especially the flint artefacts. Since the large amount of the amber artefacts occurs in the Stone Age cemeteries in the regions that were famous for the quality of the flint, why flint artefacts, appears just in three graves in Abora? Unfortunately, it is no answer available about this question because of the little amount of discovered graves goods. The fact still remain that amber was obviously highly valued by the inhabitants of the Upper Volga and the Middle Dniepra regions.

Adaptation versus exploitation

In the archaeological literature discussing the life of the early hunter-gatherers occurs very often the term adaptation. Nearly always it has been the adaptation to the environment issues as water level fluctuations, climate or vegetation changes that have forced people to move from their settlements. Raukas and colleagues (1999a:102) use term adaptation describing the Estonias' early inhabitant life during the rapidly changing shoreline of the Ancylus Lake. Zvelebil also use the term adaptation describing the process when local hunter-gatherers changed their way of subsistence to farming (Zvelebil 1998:9).

There are evidences about people adaptation to the environment, as well as people participation in the formation of the landscape within the Lake Kretuonas basin (Girininkas 2008). This statement, in my opinion, clearly shows the complex nature of this discussion. It is not possible to distinguish people or environment dominance. The interaction could be the key word discussing the environment and hunter-gatherer relations during the Stone Age. Girininkas considers, that environmental changes forced people to be inventive and to develop their tool industry to survive in these conditions. Thus development of the microlitization in the Lake Kretuonas basin could be linked with the changes in the environment, particularly fauna. Hunting become more specialised in the Mesolithic and tool industry needed to be suitable for this activity (Girininkas 2008:25 f.).

According to the similarities between the Lake Kretuonas and Lake Lubāns basin, such a pattern could be applied to the hunter-gatherer communities within the Lubāns basin. Although, instead of flint, the highly developed bone and antler industry shows people

attempts to provide the successful hunting and fishing with available resources within the Lake Lubāns basin.

Tom Carlsson (2007) in his dissertation discusses the questions about adaptation versus exploitation during the Mesolithic and admits that people are ones who stay, while environment and landscape are changing all the time (Carlsson 2007:14 f.). In my opinion, the constant changes in the nature and dynamic development of the interaction have formed the relations between Stone Age hunter-gatherers and environment in the Lake Lubāns basin. I consider that humans in their course are tended on the development, to reach the maximal effect with minimal resources. I agree with a statements within the Agency theory about people active participation in the creation of their surroundings and awareness of their actions. Thus I would like to believe that Lubāns hunter-gatherers were choosing the environment that was suitable for their needs and lifestyle, while changes within the environment contributed to the development in the tool industry or dwelling constructions. Perhaps, the favourable conditions for the hunter-gatherer communities in the Lake Lubāns basin during the Atlantic period, as well as people deliberate actions created the circumstances for the expansion of settlements and active participation in the exchange activities with other regions during the Middle and Late Neolithic. However when the resources finished, was not available or actual anymore, people needed to adjust themselves to the new conditions. Thus the development of the exchange activities during the Middle Neolithic was caused perhaps by the increasing need for flint and Lubāns inhabitants made use of the beneficial location of their settlements to achieve their goal.

It is not just climate or environment changes that force people to adapt to the certain conditions, it is also their own choice and decision that influence their actions. Of course along with a changes people adjust to them and find the best solution from the situation. However these processes usually take a longer time period and interaction between people and the environment shapes gradually.

Conclusions

The abundance of the archaeological evidences from the Lake Lubāns basin have offered good possibilities to study the interaction between hunter-gatherers and the environment. During my research I have discussed just a little part of this extensive material about Stone Age in the Lake Lubāns basin and there are considerable scope for further research. The main conclusions from this work are:

- The settlement location have been affected by water level fluctuations in the Lake Lubāns. During the Mesolithic, the settlements have been mostly situated on the shoreline of the ancient lake, on the elevations or on the islands in the lake. During the Neolithic settlements were located not in a proximity of the lake. The Middle Neolithic activities with participation in the exchange network have probably influenced the settlement location, since many sites were situated near the River Aiviekste or its tributaries.

- Indications about the specialisation in the Early Mesolithic settlements are scanty. Since the Late Mesolithic it is possible to discuss the specialisation within the Lake Lubāns settlements. There are indications about the highly developed bone and antler industry, and importance of the fishing during the Atlantic period. Some settlements reveal evidences about the specialisation in waterfowl hunt and pottery making. The define specialisation in the amber working within the Lubāns settlements appears during the Middle and Late Neolithic.

- In spite of the little amount of the Stone Age burials in the Lake Lubāns basin, the location of the settlements in a favourable ecological environment, with large, well exploited habitation areas and accumulation of rich archaeological material indicate the permanent character of the settlements since the Late Mesolithic. There are more seasonal or special purpose sites, probably connected with amber working, within the Lake Lubāns basin during the Middle Neolithic.

- Due to the exchange activities, the intensification in the contacts between coast and inland can be traced since the Middle Neolithic.

- First evidences of the domesticated animals and farming comes form the Middle Neolithic. Probably due to the exchange contacts seeds and domesticated animals have reached the Lake Lubāns basin. However hunting-gathering have been the dominant mode of subsistence through the Neolithic and total transition to farming do not appear before the Bronze Age.

- Lake Lubāns basin indicates an intense human participation in the environment exploitation and landscape creation. People have choose to settle in the certain environmental conditions or strategically favourable places that suited to their needs and promoted their activities. Thus the Middle Neolithic settlements were situated in the River Aiviekste basin, probably to get better access to the water ways which were essential for the participation in the exchange activities.

- The abandonment of the Lake Lubāns settlements could have been affected by environmental and social aspects. The water level fluctuations, lack of suitable soils for the farming as well as the changes in the social structure are some of the influencing factors.

There would be nothing in the Lake Lubāns basin without human intervention. I could agree with Julian Thomas (2001:173.ff.) that people are the ones who give character and significance to a place, creating the relation with it. Thus Stone Age hunter-gatherers created the Lake Lubāns surroundings to a meaningful place. The place that served for their economic, social and spiritual needs. Especially that reflects in the development of the exchange activities during the Middle Neolithic. Even nowadays in Īdeņa, where people still continue to shape their meaningful place, their home, it is possible for the generations to come and archaeologists of the future, to trace people and environment interaction.

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