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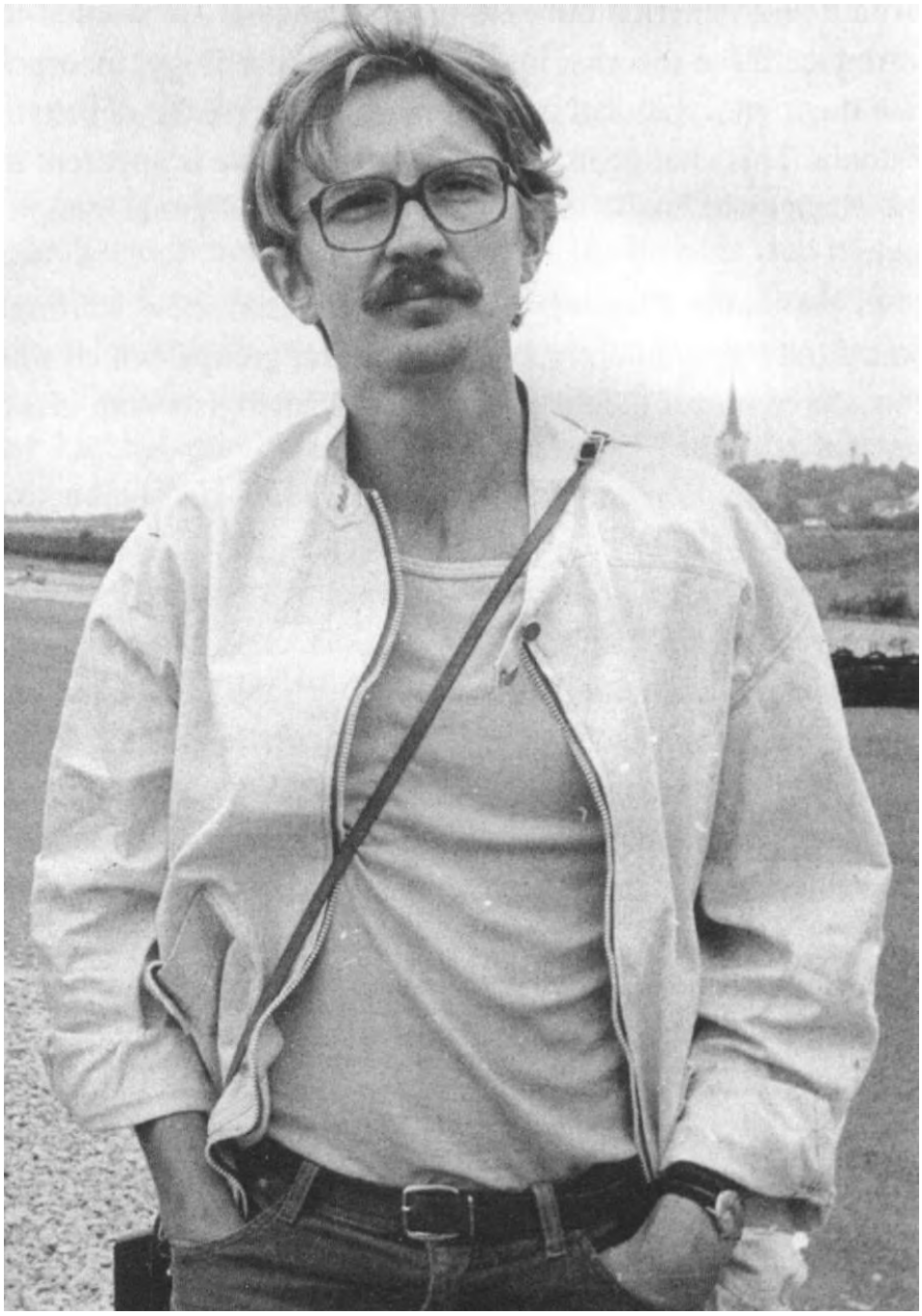

In Memoriam Priit Ligi (24 May 1958 — 28 September 1994)

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Editor's Foreword

This volume contains the majority of the papers presented during a conference that took place on 16th-21st May, 1997 in Łódź, Poland. The conference was organized by the Institute of Archaeology, University of Łódź and Departement d'anthropologie, Universite de Montreal (Canada). The conference was funded by the University of Łódź and by IREX (International Research & Exchanges Board), which also supported this publication. The publication was partly founded by the University of Łódź and by the Foundation of Adam Mickiewicz University, too.

The major questions of the conference were, 1) what is the current evidence for eastern or southern influences in the development of eastern European Mesolithic and Neolithic populations, and 2) to what extent are current political trends, especially the reassertion or, in some cases, the creation of ethnic and national identities, influencing our interpretations of the prehistoric data.

The idea for such a conference came into being through the co-organizers' long-term studies of the development of those prehistoric human populations which inhabited the vast region stretching north and east from the Oder river and Carpathian Mountains to the foothills of the Urals. In a tradition established in modern times by Gordon Childe, virtually all of the transformations of Eastern Europe's Neolithic Age human landscape have been assumed to be responses to prior developments in the Balkan peninsula and Danube basin. We think that a body of new evidence requires a renewed analysis of the distributions of cultural products, peoples, and ideas across Eastern Europe during the Mesolithic through the Early Metal Age within a much wider geographic context than previously has been the case. This includes giving adequate attention to the far-ranging interactions of communities between the Pontic and Baltic area with those located in both the Caucasus and the Aralo-Caspian regions.

We hope that this volume will contribute to such a redirection of future analyses.

Lucyna Domańska
Ken Jacobs

Editorial comment

1. All dates in the *B-PS* are calibrated [see: *Radiocarbon* vol.28, 1986, and the next volumes] (other versions are cited for the wish of authors). Deviations from this rule will be point out in notes.

2. The names of the archaeological cultures (especially from the territory of the Ukraine) are standarized according to the English literature on the subject (e.g. Mallory 1989). In the case of a new term, the author's original name has been retained.

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Ilze Loze

THE ADOPTION OF AGRICULTURE IN THE AREA OF PRESENT-DAY LATVIA (THE LAKE LUBANA BASIN)

The process involved in the initial adoption of agriculture and the various aspects of research on this subject represent one of the most discussed questions in the literature devoted to European prehistory.

The adoption of agriculture has been discussed against the general background of plant cultivation and animal domestication. Such origins are viewed only as a part of the much wider process of domestication [Hodder 1990:20-41]. The latter includes not only the acquiring of the plant cultivation skills and keeping of domestic animals, but also, most importantly, social domestication even before the domestication of plants and animals [Chapman 1994:133].

The origins of agriculture are seen not only as an aspect of the economy or as a means of obtaining the production, but as a part of a much wider process of domestication, carried out by social groups with an outlook based on the importance of social status.

The aim of this paper is to sketch in the origins and beginnings of agriculture in the area of present-day Latvia, utilising the accumulated archaeological, fossil seeds and palynological material, as well as to indicate the possible character of the early agriculture.

Use is made of material obtained through archaeological excavation in a special micro-region of Neolithic sites: the Lake Lubana depression and its environs which has so far not been discussed in archaeological literature.

The location of Neolithic settlement sites in wetland areas of the Lake Lubana basin has ensured the preservation of organic remains, which is very important for identification and analysis of indications of agriculture.

1. THE SETTLEMENTS OF THE FIRST FARMERS

The settlements of the first farmers in the Lake Lubana depression are sites with long-term occupation on isolated headlands or areas of higher ground in the vicinity of the lake or major rivers, with substantial post-built dwellings, hearths

of round stones and areas suitable for agriculture in the vicinity. Such sites must also provide sufficient evidence of the skills involved in the early agriculture and the practice of this economic activity. There are four such settlement sites: Abora I and Lagaza [Loze 1979:11-38], Ica [Loze 1993a:21] and Zvidze [Loze 1988a:18-74], which are considered not only permanent sites, but also central places during one particular period of the Neolithic or even during several periods (Zvidze) (Fig. 1). These settlements also stand out in terms of the character of the occupation layer, its thickness and density of finds, and in having a tightly bounded, possibly enclosed space.

Building construction at these sites utilised posts and stakes of elm, spruce, alder and aspen, as well as alder planks (wood samples from Zvidze, 1982 excavations)[1]. Pines and birches were also felled (wood samples from Lagaza, 1968, and Abora, 1970)[2], and these species were used for structural elements of buildings.

These are settlements with closely spaced buildings, between and within which the deceased members of the community were buried (Abora I, Ica, Lagaza and Zvidze) [Loze 1979:43-60; 1988a:21-23].

The structures were considerably elaborated. The buildings had a ridged roof with overhanging eaves, an annex at one end or the other, one room (at Zvidze) or several rooms (at Lagaza), and a specially constructed entrance at the end of the building (at Zvidze). An unusual building was also constructed, consisting of two wings laid out at a wide angle to each other. The building had a double wall facing the side of the settlement that had no natural protection (at Lagaza) [Loze 1978; 1998b]. The massive timbers of deciduous wood supporting the roof at the settlement of Lagaza, as well as the six metres long ridge-pole (?) and splitted planks, and the perfectly sharpened ends of posts and stakes at this site testify to developed skills in building and shaping of structural elements of dwellings.

There was a large concentration of material remains at these settlements, found within buildings and in special areas for working particular materials. A fairly chaotic distribution of implements and pottery can be seen in the upper part of the occupation layer.

The everyday utensils, hunting and fishing equipment of the inhabitants number in the thousands. The mass finds of pottery and their density as well as their presence in numerical terms between the centre and periphery of the settlements points to the intensive use of pottery and storage of products.

A developed system of exchange of amber for flint from the Upper and Middle Volga and the Dnieper basin, and amber for slate from Karelia testifies to intensive activity by the inhabitants of the Lake Lubana depression for subsistence needs, creating a strategically advantageous system of communications between their own area and those of their neighbours to the east, south-east and north [Loze 1998a].

The inhabitants of all of the sites mentioned were familiar with domesticated animals: cattle, sheep/goats and pigs [Loze 1995b:13-15]. The minimal number of

[1] Wood samples identified by dr M. Buss.

[2] Wood samples identified by dr M. Buss, and by A. Rozens.

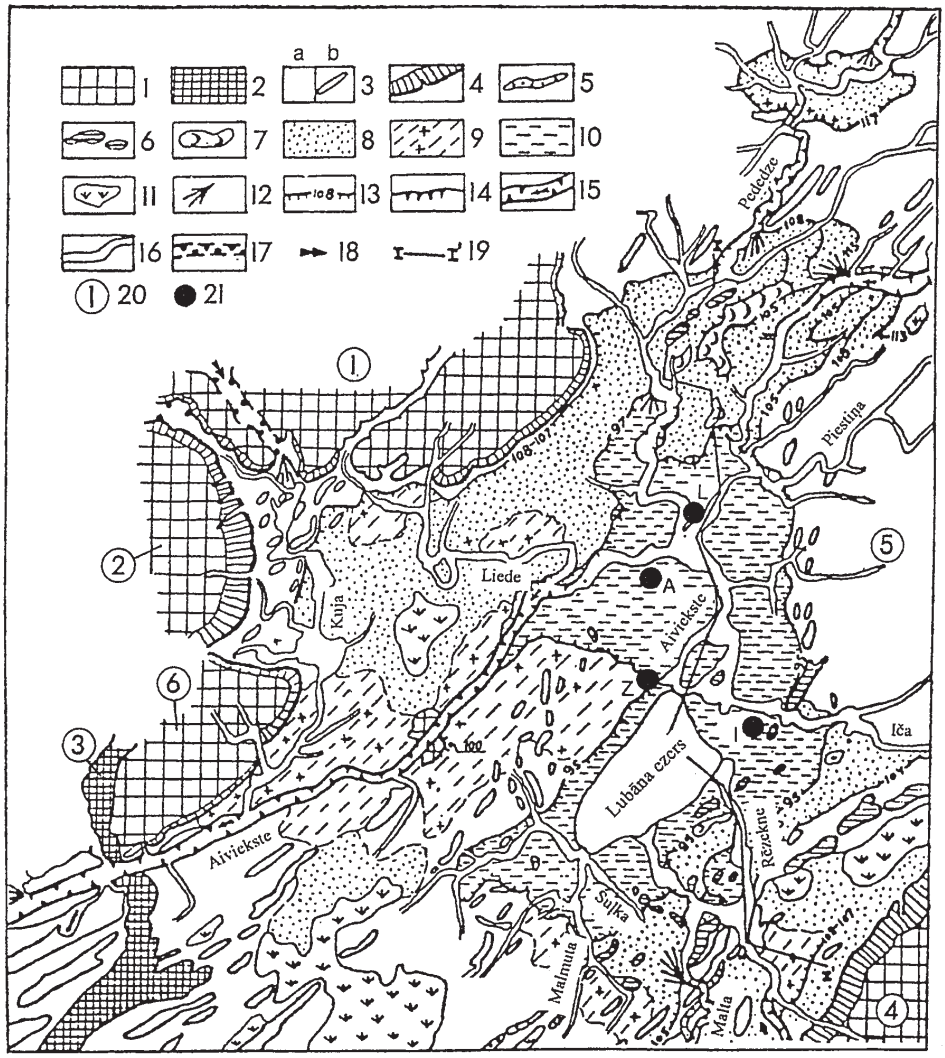

Fig. 1. The distribution of settlements of the first farmers in the Lake Lubana depression in relation to the geomorphology of the region [Eberhards 1972]. 1 - till and kame relief, 2 - range of glaciofluvial hills, 3a - undulating and gently sloping moraine plain, 3b - undulating moraine plain with pronounced moraine uvals and moraine ridges, 4 - slopes of uplands, 5 - eskers, 6 - isolated glaciolacustrine hills, 7 - eolian relief, 8 - sandy late-glacial basin plain, 9 - abraded moraine plains with intermittent thin covering of sand and boulders, 10 - the Lake Lubana and wetland depression, 11 - wetland plains, 12 - deltas, 13 - shorelines of late-glacial and post-glacial water-bodies and their height above sea-level, 14 - abraded hollows, 15 - outflow valleys of late-glacial basins, 16 - small, poorly distinct post-glacial flood-plain valleys and river flood-plains of the Lake Lubana depression, 17 - valley-like hollows, 18 - direction of meltwater flow, 19 - geological sections, 20 - geomorphological regions (1 - Gulbene Ridge, 2 - Vidzeme Central Uplands, 3 - Madona-Trepe Ridge, 4 - Latgale Uplands, 5 - North Latgale Plateau, 6 - Prauliene Hills), 21 - Neolithic sites (Z - Zvidze, A - Abora I, L - Lagaza, I - Ica).

individuals of domestic animals is not great: 25 at Zvidze, 34 at Abora and 9 at Lagaza [Loze 1979:Tables 12, 13; 1988a:Table 22]. However, not all of the animals were necessarily slaughtered: animals were possibly also kept for milk and wool. The rich hunted fauna in the Lake Lubana depression, including birds and fish, could have created special conditions for supplying food resources and stabilising the subsistence strategy.

The social organisation, as seen from the burials at Abora I settlement (61 individuals) [Loze 1979:43-52], was oriented towards recognition of social status.

Only one male grave (no. 3) was furnished with rich grave goods (including a string of 27 technically well-made button-shaped beads) [Loze 1979:Fig. 40]. The deceased was laid in a grave together with three other individuals, including two women, and a piece of wood (a plank?) was found in this grave, resembling box-wood (*Buxus sempervirens*) [Loze 1995a:35], a characteristic central European species considered exotic to the eastern Baltic.

Burial no. 3 can be considered an individual of high status, which is confirmed by the fact that one of the children (burial 18) was buried with a particularly rich and fine array of grave goods (2 bulging and 2 snake-like pendants) [Loze 1979: Table 5], indicating that high status could be inherited. Possibly, this is a reflection of a social structure based on a a simple form of chiefdom, at a time when patrilineal organisation had already become dominant.

2. CHRONOLOGY AND THE SEQUENCE OF NEOLITHIC CULTURES

The earliest Neolithic culture in the Lake Lubana depression with pottery, exhibiting a considerable number of anthropogenic indicators (factors indicating human intervention in the environment), is described as the Narva culture, dated to the period 4585-4100 BC* [Liiva, Loze 1988].

In this case the datings from the multi-layered settlement of Zvidze, including nine inter-laboratory comparison datings, have been used [Veksler, Punning 1988:16, 17]. Since they correspond only partially with the radiocarbon datings from Osa, the other Early Neolithic settlement in the Lake Lubana basin [Liiva, Loze 1988:Table 4], we must assume that they reflect the original and thus the earliest stage of development of the Narva culture, which was in existence up to 3780±50 BC.

The next culture in the Lake Lubana depression was the Comb-and-Pitted Pottery culture. This culture is dated differently, since at both Zvidze and Osa the respective layers occur above the layers with Narva pottery, and its chronological boundaries are set considerably later: 3370-2800 BC.

This culture is followed by the Post-Narva culture (represented in the central part of the eastern Baltic by a pottery ware known from the sites of Piestina and

* The author used an uncalibrated version of ^{14}C chronology (Editor).

especially Zvidze in the Lake Lubana depression). Compared with the Pit-and--Comb Pottery culture, its upper and lower chronological boundaries are set later: 2800-2480 BC [Loze 1988a:Table 16, Fig. 74].

On the basis of radiocarbon dates from Abora I, Ica and Lagaza, the age of the Late Neolithic complex, including the Corded Ware culture is between 2540 (?) / 2300 and 1910 / 1820 BC [Loze 1991]. According to radiocarbon dates from Lagaza settlement, Lubana Ware of the Early Bronze Age was being made 1690-1390 BC [Loze 1979:121, 122].

3. ECOLOGICAL ZONES

Several different ecological zones can be distinguished in the Lake Lubana depression and the surrounding area. Settlements were usually sited at the transition between different environments. The Zvidze site, of particular interest here, is on the very edge of an abraded moraine plain at the transition to the former bed of Lake Lubana, which in the Neolithic was already filled with deposits of gyttja and peat (Figs 1, 2).

The edge of the moraine plain in particular, covered with mixed forest and scrub, was in terms of soil character the place that provided the opportunity for clearing the forest at some stage for fields.

However, other ecological niches, too: the nearshore and shore zones (with shoreline and aquatic vegetation) and wetlands with their soils, particularly during the dry Subboreal Period, provided favourable conditions for general development of the economy of the people inhabiting the site. Such zones offered considerable economic potential, providing the opportunity to utilise particular ecological zones in particular seasons.

It is considered that an area within a 1 km radius of a site is intensively utilised for agriculture, and this is often described as the "site catchment area", where trees were felled and the first fields laid out.

On the other hand, the Abora I settlement was on small isolated rise on the right bank of the 60-70 m wide Aiviekste River, consisting of deposits of clay loam within the Lake Lubana depression (a low area of lakes and bogs). Different ecological zones can be distinguished here, too. These are also reflected in a floral analysis of vegetation represented by seeds of 40 different species [Loze, Yakubovskaya 1984:Table 3].

Tree and scrub floras, together with those of forest grasses and shrubs, make up 12%, with 27% consisting of bog and wet meadow floras and 58% representing the dominant shore and open water floras.

The rising proportion of aquatic plants is possible evidence of changes in the hydrological regime: a rise in the water level in the Aiviekste River and in the

whole of the continental water system. This is also shown by research on fossil seeds at this site [Loze, Yakubovskaya 1984:Table 3]. Also, a study of *Pediastrum* algae as indicators of hydrological conditions and ecological changes in water-bodies has shown that the Lake Lubana was originally a warm, eutrophic basin. These eutrophic conditions were still in existence in the Sub-boreal Period when the water temperature gradually fell and a transition began to a cold, oligotrophic type basin [Yakubovskaya 1996].

However, this fact has not affected the utilisation by the inhabitants of the site of the economic potential of the various ecological zones during different seasons, although the changes in water level eventually led the inhabitants of the Neolithic — Bronze Age site to abandon the Lake Lubana depression entirely.

The following ecological zones were found within a 1 km radius around the Abora site: forest and scrub (i.e. suitable for agriculture), bog and wet meadows (suitable for pasture), and a shore and open water zone.

The environs of the settlements at Ica and Lagaza can be similarly classified, the geographical situation no doubt having been chosen in order to facilitate utilisation of different ecological niches.

4. THE DISTRIBUTION OF SOIL TYPES

The Lake Lubana depression is filled with fen and transitional bog peats (Tza and Tzh, so-called hydromorphic soils), covering quite a considerable area: 55% [Nomals 1943:223-225, 257-261; Zarins 1974] (Fig. 2). These soils have been formed in depressions and in the lowest parts of the plain, where the depression has gradually bogged-up through the long-term effect of flooding and high groundwater level. There is no doubt that during the dry Subboreal Period at least a proportion of this area could have been used for small fields or pasture and hay-meadows. The conditions under which these wet soils were formed were dependent on the climate. A dry climate had a favourable effect on the development of wetland soils (mineralisation of organic matter increases, aeration improves). At the present day sod-gley and gley soils (Glg and Glv, so-called semi-hydromorphic soils) cover less than one quarter of the previously mentioned area: 12%. These are formed under very wet conditions over carbonaceous substrates, as well as on sand and loam under the influence of mineral-rich groundwaters.

Sod-podsolic gleysolic and sod-podsolic gley soils formed on higher ground (Pgg and Pgv, so called automorphic soils) over loam and sand in coniferous forest.

Table 1 gives a scheme of soil type distributions for the environs of Zvidze Neolithic site [Karklins 1995], which clearly shows that during the Sub-boreal period in the vicinity of the site forest clearance was possible on the till, as well on the fen peat soils of the former bed of the Lake Lubana (Fig. 2).

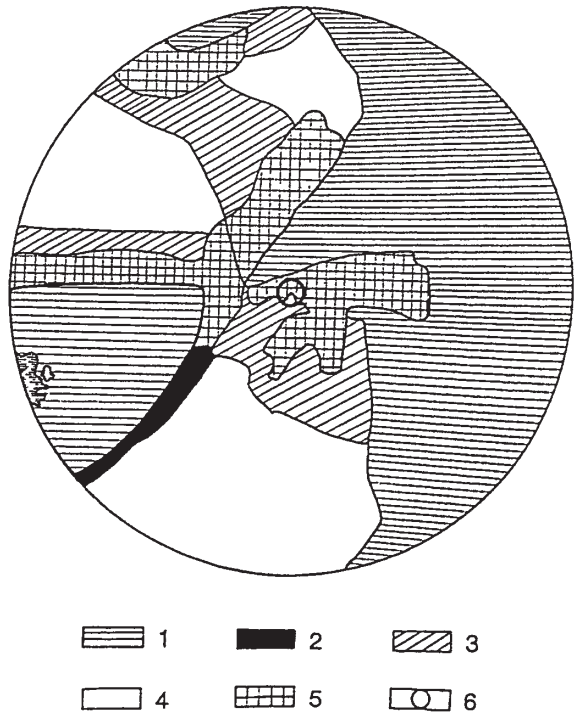

Fig. 2. Soil map of the environs of the Zvidze site 1 - lowland bog humus soil, 2 - sod-podsolic gleysolic soil, 3 - sod-gleysolic soil, 4 - sod-gley soil, 5 - lowland bog mucky-humus gley soil, 6 - the Zvidze site. Drawing by Daiga Pjatkovska.

Possibly the peat layer in such soils already exceeded a thickness of 0.50 m and could also have been used for pastureland and meadows.

The distribution of soil types in the Lake Lubana depression would not be complete without mentioning alluvial soils (Type 09, according to the Latvian soil classification), which formed in periodically flooded river valleys on alluvium consisting of clay and loam. These occur over deposits of gleyed clay or clay loam.

There is a low degree of soil improvement in the Lake Lubana depression and the lake basin [Mezals, *et al.* 1970:443], but the large-scale land improvement work and the cultivation of meadows and wetlands has presently altered this view [Rubenis 1964].

Evidently, in the dry Sub-Boreal period, when the former bed of the Lake Lubana had already become bogged-over, covered by a soil characteristic of transitional bog, the conditions were different, since, as recent research shows, such soils can be tilled if they are not subject to flooding.

Table 1

The distribution of soil types in the vicinity of the Zvidze site

Symbol*	Soil sub-types**	Sub-type numbers	Soil types***
PGg	sod-podsolic gleysolic soil	8.1	0.8 podsolic gleysolic soil
PGv	sod-podsolic gley soil	8.4	
GLg	sod-gleysolic soil	7.1	07.
GLv	sod-gley soil	7.4	gley soils
TZa	lowland bog mucky humus gley soil	10.2	10. lowland bog peat soil
TZh	lowland bog humus soil	10.3	

* After the FAO classification.
** After a soil map compiled by the Land Use Planning Institute for the 'Aiviekste' State Farm, Madona Region, No. 419/3, 1990.
*** After the classification of soil types in Latvia [Karklins 1995:167-168].

5. THE NEOLITHIC LANDSCAPE

Reconstruction of the particular features of vegetation development in the Lake Lubana depression and the surrounding area has involved pollen analysis and the study of fossil seeds, as well as radiocarbon datings of the boundaries between pollen zones. This has permitted characterisation of the landscape in various phases of the Neolithic.

In the initial phase of the Neolithic (second half of the Atlantic Period) the landscape in the vicinity of the Lake Lubana depression was characterised by mixed forest with deciduous trees, particularly elm and oak, with pine and hazel stands declining at this time. This period coincides with the climatic optimum, when aspen stands were dominant, with a high proportion of oak, lime, elm and hazel. The landscape of this time was characterised by hemp, plantain, buttercup, groundsel and primulas, all reflecting human activity [Yakubovskaya 1997]. The amount of birch increased in the middle of the Atlantic Period. Herbacaeous plants of the time included hemp and plantain, and especially mugwort and goose-foot. The presence of aquatic plants and water-chestnut is indicative of the early stages of lake transgression.

At the transition from the Early to the Middle Neolithic the landscape was characterised by an increase in spruce and pine, with aspen and birch decreasing. The presence of oak and lime was high in the Middle Neolithic, but the amount of elm decreased. The elm decline is seen as one of the first indications of human intervention in the environment, or else is taken to reflect elm disease on a global

scale. The decline of the elm (Sb_{1a}) in the Lake Lubana basin is dated to the period 4750±60 – 4430±50 BP.

At the end of the first half of the Subboreal Period (Sb_{1b}), with an increase in the amount of hazel, elm and aspen, there was a decline in spruce. In the second half of the Sub-boreal the amount of spruce and pine increased once again, pollen diagrams showed a decrease in the curves for birch, aspen and mixed forest.

That people were active in shaping the open landscape of that time it is reflected by the presence of mugwort, buttercup and groundsel. Ruderal, as well as forest and wet meadow, components consist of nettles and grasses, while plants of fallow-land include spurry, sheep's sorrel, ribwort and *Polygonum* [Yakubovskaya 1997].

Thus, indicators of early farming activities appear in pollen diagrams. Of these indicators, pollen analysts stress plantain in particular as being very hardy in pasture land in comparison with other plants [Andersen 1993:74].

According to palynologists, communities with these and other plants are linked to forest clearance and the creation of an open landscape, not only for plant cultivation, which interests us here, but also for pasture.

In the Middle Neolithic an open landscape was formed, and it was precisely at this time, as seen from pollen data, that the first small fields appeared. The area of forest decreased, the amount of oak and aspen fell, but an increase is seen in the amount of pine.

6. ARCHAEOLOGICAL INDICATIONS

Archaeological evidence for characterising the first farming in the environs of the Lake Lubana includes possible farming implements. These can be divided as follows: tools for forest clearance, tools for land tillage, tools for harvesting cereals, grain processing tools and tools for working hemp and flax.

Forest clearance tools. The required wood felling tools for forest clearance are represented by good quality flint axes (celts) which were fixed in a wooden shaft. These are the straight thin-butted axes (Jaunsvirlauka in Zemgale and Lejasciems in the Vidzeme uplands) and thick butted axes (Nigrande and Ramtas in Kurzeme) (Fig. 3). These have been carefully polished. Rarer are examples with additional facets on the sides. This technique of flint knapping — grinding and polishing — is known in Europe, including southern Scandinavia, from the time of the Funnel Beaker culture. Such axes were in use for over 500 years [Nielsen 1977:69, 70]. Their age in southern Scandinavia is attested by over 50 radiocarbon dates. The pointed--butt and thin-butted forms are considered to be earliest, while the thick-butted axes are taken to be later. The latter are characteristic both of the Funnel Beaker culture and the Corded Ware culture during the period 2500-1800 BC [Nielsen 1977:6].

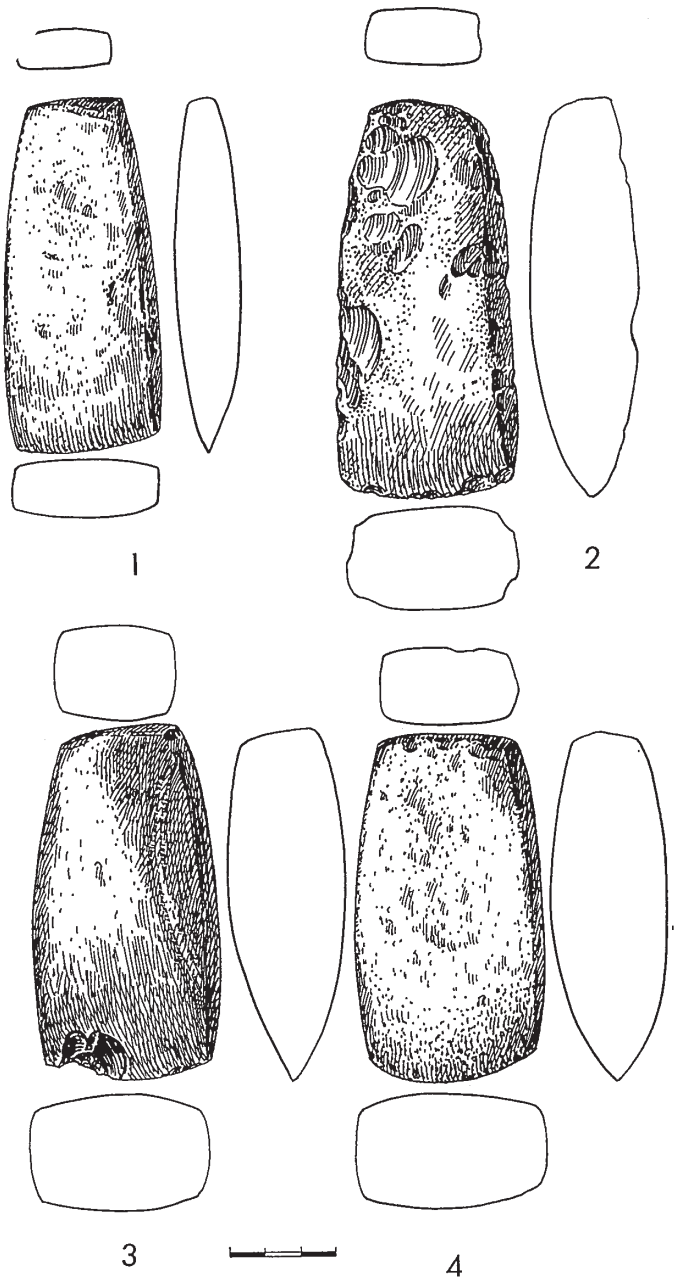

Fig. 3. Flint axes in the area of present-day Latvia (Collections of the History Museum of Latvia, Department of Archaeology, nos. A 10670, CVVM 59026, A 9841, A 3530): 1 - Jaunsvirlauka, Jelgava Region, 2 - Vecsaules Sili, Bauska Region, 3 - Nigrandes Mezlauzi, Liepaja Region, 4 - Upmales Pavari, Kuldiga Region. Drawing by Marta Jankalnina.

Thus, the flint working technique mentioned, grinding and polishing, could have appeared in the Lake Lubana depression already at the time of the Funnel Beaker culture. This was not impossible, in view of the character of flint technology at this time and the character of the spread of innovations in this field. Experiments in Denmark have reproduced the technique of manufacturing such axes [Madsen 1984; Hansen & Madsen 1983]. It may already have been employed in the Middle Neolithic in the eastern part of present-day Latvia, since high quality pointed-butt and thin-butted axes have been obtained at Lejasciems in Gulbene Region, Jaunsvirlauka in Jelgava Region, Vecsaule in Bauska Region etc.

On the other hand, as indicated by stray finds from Ramtas in Tukums Region, Pampali in Kuldiga Region, Milzkalne District in Tukums Region, Nigrande in Liepaja Region and Vecsaules Seli in Bauska Region, thick-butted, wedge-shaped flint axes belonged to the people of the Corded Ware culture (Fig. 3:3, 4).

The hafts into which flint axes were fixed have been found mainly at settlement sites and in hoards in Denmark and Switzerland. These have been made of ash, only one being hewn from beechwood.

Experiments conducted by the Danish researcher Svend Jorgensen in southern Jutland relating to preparation, length and working of the haft, tree felling, traces of use on the axe blades, blade breakage, sharpening and grinding, the use-life of the axe etc. all indicate that special skills were required for hafting flint axes, and that the right balance was required between the weight of the axe and the length of the shaft [Jorgensen 1985:25-51].

Lime and oak (hard woods) were easily felled, which was not the case with birch, alder and ash (soft woods). Elm (having very resistant wood) was even more difficult to fell, while beech sometimes presented difficulties and sometimes was easy to fell.

The flint axes of Denmark and Switzerland were hafted in the same fashion [Wyss 1988:41, 42]. The ratio of the length of the shaft to the hafting place was 5.5:1.5. The shaft was slightly bent, its thickened hafting place being spoon-shaped in profile. The hole was cut out in the middle of the shaft, adjusted for the thickness of the axe to be hafted.

Another type of hafting is found in the Lake Lubana depression, at the Abora site. Only part of this haft has survived, and judging by the dimensions of the hole, it held a 2.5 cm thick and 3.2 cm wide stone pick (Inventory no. 76:3855; Fig. 8:1). An unfinished 56 cm long haft for a flint axe (?) (Zvidze site, no. 118:1371) is an evidence of a different form of hafting (Fig. 5:1).

Soil tillage tools. Digging, hoeing and soil loosening tools are represented by a wooden spade, wooden, antler and stone mattocks, wooden sticks and antler implements with a hole for attachment to a haft.

A slightly rounded *wooden spade* with a partially preserved haft from the site of Zvidze (Fig. 4:2) did not have its surface exposed to fire [Loze 1988b:Fig. 4]. It is very primitive in form in comparison with those from the Swiss Neolithic sites, in particular that found at Egolzwil 3 [Wyss 1988:45]. The blade of the spade was 16.5 cm wide and 12.5 cm high, the shaft having broken off in antiquity.

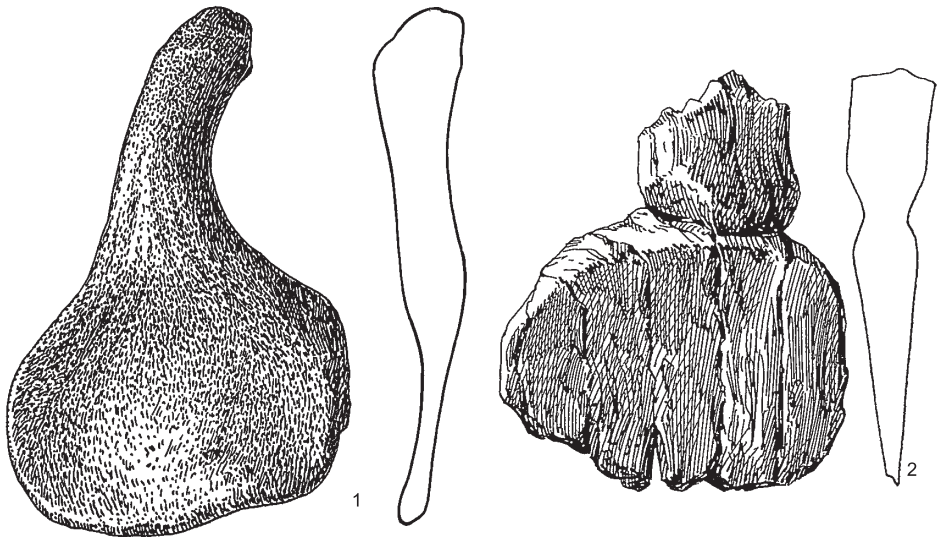

Fig. 4. Spades made of elk antler (1) and wood (2) from the Neolithic sites of Abora and Zvidze (Collections of the Institute of History of the University of Latvia, Department of Archaeology, nos. 76:3685, 188, collection of wooden artefacts no. 8). Drawings by Marta Jankalnina (1) and Vilnis Zabers (2).

Possibly also spade-like tools made of the base of an elk antler were used for digging (Abora, no. 76:654 and 1080). They could be hafted in the same way as stone spade-like tools (Fig. 4:1) [Loze 1979:Fig. 5:5].

Wooden mattocks were made of one piece of deciduous wood (Fig. 5:2). These had a pointed oval blade carefully worked from both faces (dimensions: 18 x 9 cm and 14.7 x 6.5 cm) and a slightly bent shaft [Loze 1988b:Fig. 5:5]. This type of mattock, also known from the wetland dwellings of Sarnate [Vankina 1970:Fig. XIX:1-3] and Šventoji lagoon sites 1B, 2B, 3B and 23 [Rimantiene 1979:Fig. 23], was a widespread form of hoeing tool in Neolithic Europe [Wyss 1988:45, Fig. 7].

In contrast to the wooden mattocks from Sarnate and Šventoji, the examples from Zvidze do not have a thickening of the shaft where it joins the blade.

Hoe-like stone tools, which could be hafted, are characteristic of the Late Neolithic sites in the Lake Lubana depression. Their form is not pronounced, since stone-working (apart from flint and slate) did not develop fully in the Stone Age. These thick-butted mattocks with a heavy body and narrowed in the lower part were very suitable for tilling the earth [Loze 1979:Fig. XXII:2].

Tools for loosening soil include *red deer antlers with a drilled hole in the base* (Fig. 6). Such loosening tools, consisting of a wooden shaft and attached antler, have been reconstructed by Mats Malmer, after finds in Skane (Beding etc.) and Gotland

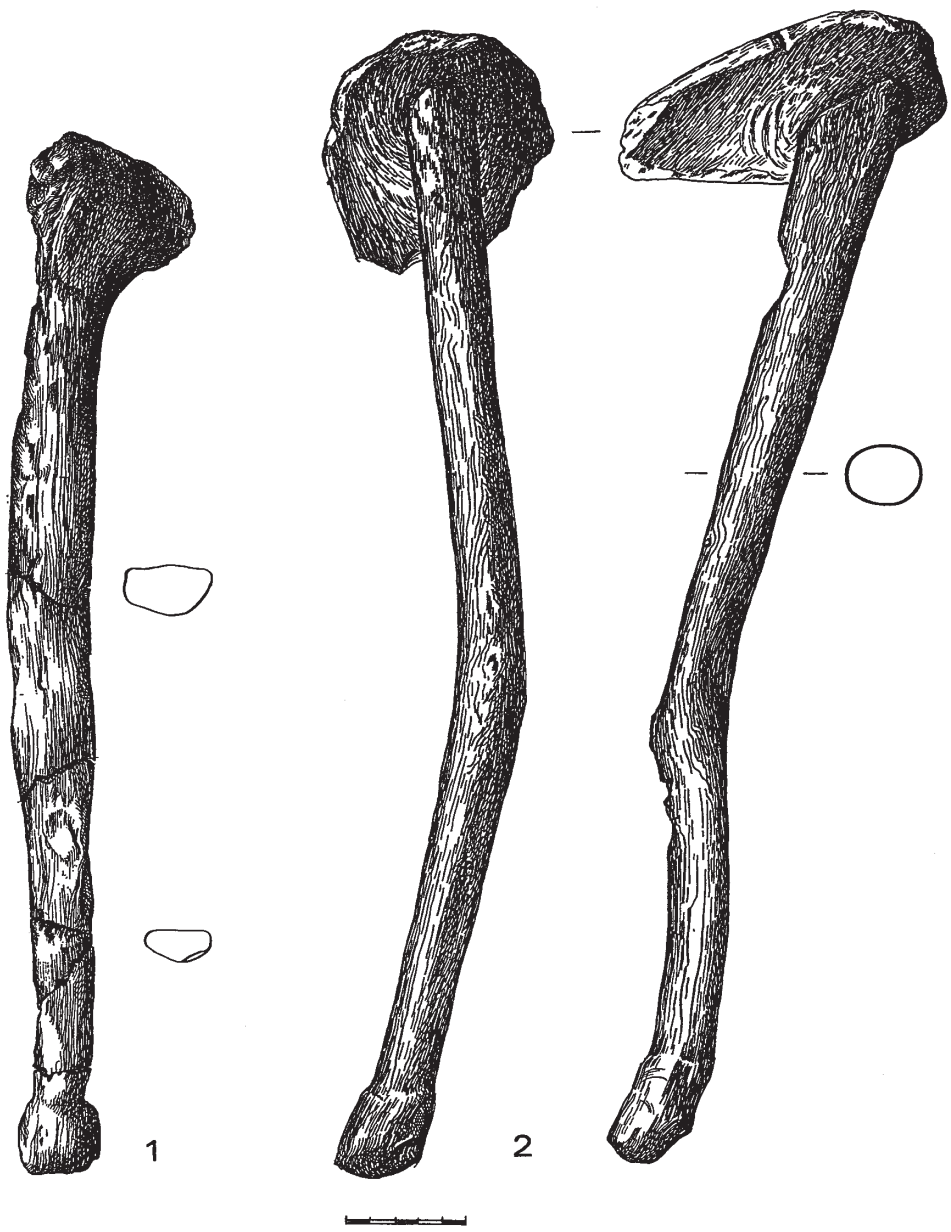

Fig. 5. Possible semi-manufactured shaft for a flint axe (1) and wooden mattock (2). Zvidze site (Collections of the Institute of History of the University of Latvia, Department of Archaeology, nos. 188:1371, 437). Drawings by Marta Jankalnina (1) and Baiba Vaska (2).

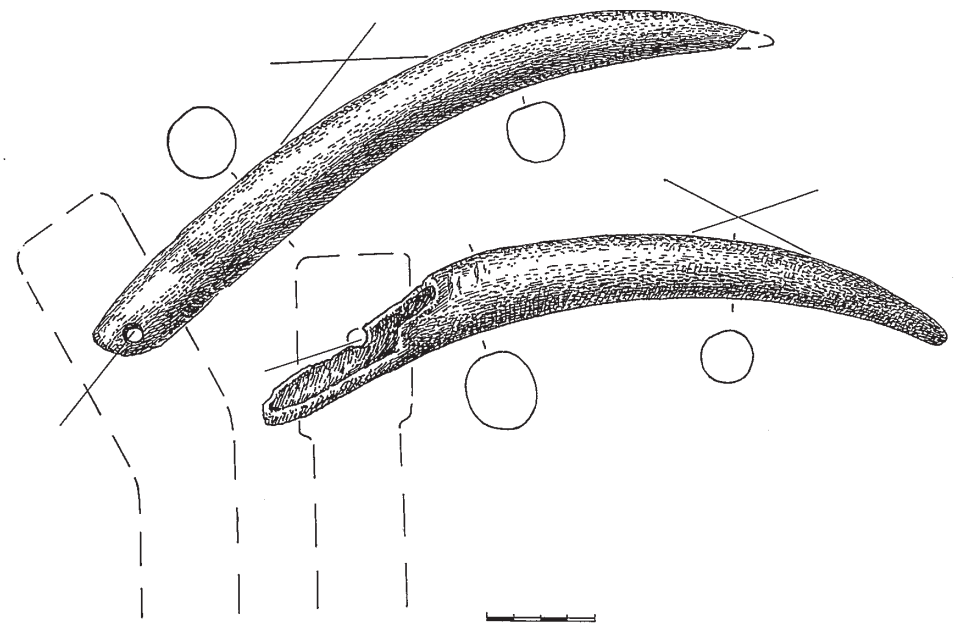

Fig. 6. Tools for loosening soil made of red deer antler. Abora site (Collections of the Institute of History of the University of Latvia, Department of Archaeology, nos. 76:3104, 3699).

(Visby etc.), where they have generally been obtained as grave goods [Malmer 1962:313-321, Figs. 66, 77; Janzon 1974:Plate 30].

Cereal harvesting tools. Knife-shaped flint sickles, one of the tool forms for harvesting cereals, were possibly known to the inhabitants of the Late Neolithic sites in the Lake Lubana depression, such as Abora I [Loze 1979:Fig. VIII:11, 12] (secure identification requires use-wear analysis). As seen from reconstructions, flint sickles were fixed in sickle-shaped or differently formed wooden handles so that they could easily be gripped [Wiślański 1979:216; Korobkova 1987:Fig. 31].

Grain processing tools. For grinding, the people of the Lake Lubana depression used grindstones and pestles.

So-called *single-handed grindstones* were used for separating the grain from the husks and for grinding the grain after it was separated from the chaff.

The earliest grindstones (round river pebbles with one working face) are 8.5-9 cm in diameter and could easily be gripped in one hand. Such grindstones are already present in the Middle Neolithic dwellings of the Zvidze site (no. 188:1639, 1787).

Among Late Neolithic grindstones from Abora I, Lagaza and Kvapani II sites, there are, in addition to round forms, also oval examples (Fig. 7:2), what possibly indicates that they were used as two-handed upper grindstones at the time when the large lower grindstone came into use.

Table 2

Dimensions of grindstones from the settlements of the Lake Lubana depression (cm)

Site	Form	Inventory no.	Diameter	Thickness	Length	Width
Abora I	oval	76:66	-	5.2	9.85	8.2
		76:3518	-	3.8	11.4	7.8
		76:3519	-	3.1	8.4	7.6
	round	76:3585	6.4	5.5	-	-
	oval	76:3663	-	4.4	14.9	9.8
Eini	oval	119:344	-	3.8	8	5
	round	119:345	6.5	3.39	-	-
Ica	oval	303:139	-	4.2	10.1	7.6
		303:156	-	0.51	8.1	6.5
Lagaza	oval	118:597	-	4.75	11	9.9
	round	118:595	7.7	5.4	-	-
		118:594	7.2	5.65	-	-

There are among the examples obtained at the Lagaza site some grindstones whose lateral edges have been used for grinding (nos. 118:596; Fig. 7:2), and traces of use are also seen on both opposite faces of the other examples (no. 118:594) (Table 2).

As established through excavation, grindstones are concentrated in large numbers around the hearths of the dwellings. Thus, for example in the dwellings uncovered in Area F (covering an area of 240 m^2) 74 grindstones were found, the majority of which came from the immediate vicinity of the hearth of one particular dwelling [Loze 1979:Fig. 12].

A large lower grindstone made of fine-grained stone, was found in excavations at the Lagaza site in the late 1960's [Loze 1979:Fig. XXV:7] (dimensions: 29.6 x 24 cm; Fig. 7:3). This was very suitable for grinding grain. Evidence of long and intensive use is a 3.5-4 cm wide groove around the slightly oval projection in the middle.

Stone pestles were present as a tool for grinding grain in the area of present-day Latvia already from the Middle Neolithic. A part of such a tool was obtained at the Zvidze site (no. 188:2454). Worthy of mention is the particular form of pestle: a 17.35 cm long pebble with a completely smoothed surface and round section

Table 3

The measurements of the pulley sheave of weawing spindle

Pottery ware	Site	Inventory no.	Diameter	Thickness	Remarks
Post-Narva	Zvidze	188:2366	6.8	0.8	
		188:708	6.5	0.95	semi-manufactured
Textile impressed	Eini	119:319	6.4	1	fragment
Post-Narva	Lagaza	118:547	6.5	0.7	semi-manufac-tured
		118:264	6	1.3	
		118:191	3.1	0.9	much used
Lubana	Late Neolithic and Early Bronze Age site at the mouth of the r.Malmuta	101:24	3	0.7	much used
	Abora	76:1342	4.7		

(3 cm in diameter) [Loze 1988a:Fig. XXIII:1]. Archaeological parallels indicate that precisely this form of tool was used together with 'saddle querns' for grinding grain in the Neolithic of Asia [Wang Xing-guang 1995:Figs. 15-17].

There is other evidence of agriculture, too: spinning and weaving tools and possible elements thereof.

Spinning implements. Among spinning utensils are the spindle whorls obtained in archaeological excavations. The earliest of these are discoidal forms made from flat sherds of pottery, with the edges rounded and a hole drilled in the centre for fixing to a spindle. Often these spindle whorls still show pottery decoration.

Spindle whorls have been made from pot-sherds with completely smooth surfaces (Lagaza, no. 118:547), with decoration of wrapped cord impressions (Lagaza, no. 118:264) and textile impressions (Eini, no. 119:319). One example has also been found of a spindle whorl with a linear design (Zvidze, no. 188:354, 2366; Table 3).

The mean diameter of spindle whorls is 6.5 cm, and 0.5 cm for the hole. The thickness of the spindle whorls is the same as for the respective pottery forms.

Weaving implements. Weaving equipment and elements of such utensils obtained in archaeological excavations can be considered indirect evidence of the presence of early farming. In this case, use can be made of archaeological evidence

of fabric making. This includes *textile impressions on pot-sherds*, as well as *wooden shuttles*. Fragmentary shuttles obtained in the Middle Neolithic layers at the site of Zvidze are rectangular in form with a hole in the middle and symmetrically or asymmetrically worked ends [Loze 1988a:Fig. XXXVI:10, 12], reminiscent of a perforated shuttle according to the classification given in ethnographic literature [Alsupe 1982:Fig. 32:5]. (Fig. 8:2, 4). It is possible that already in the Middle Neolithic the *vertical loom* was used for joining plant fibres. It is difficult to connect the many finds of wooden elements (rods, poles, thin rods etc.) with a definite type of vertical loom.

They resemble warp poles, discussed in ethnographic literature [Alsupe 1982: Fig. 23:1]. They consisted of two 1.9-2.3 m high vertical poles with pegs (of pine or birch) and two horizontal rods joining them. It is mentioned that in terms of construction they resemble a vertical loom and could be used for arranging the warp. They are classified as portable warp poles, whose function was to prevent the weaver from tangling up the warp. The pegs are more closely spaced than those of ordinary looms.

Tools for processing hemp, nettles and flax. The earliest hemp, nettle and flax processing tools in the Lake Lubana depression are represented only by *swingles*, because among the wooden artefacts from the Zvidze site there are some which closely resemble ethnographic examples in terms of form and cross-section. Ethnographers distinguish knife-like and rectangular single-sided and double-sided swingles [Istoriko-etnograficheskiy atlas, 1985:Fig. 159], often made of birch [Ligers 1952:123].

According to finds from Zvidze, *single-sided swingles* were of rounded triangular section, 18 cm long, with a 5.5 cm wide blade [Loze 1988a:Fig. XXXVI:13] (Fig. 8:5, 6). It is possible that single-sided swingles were also considerably wider. This is shown by heavily worked examples with a broad blade and a broken handle [Loze 1988a:Fig. XXXVII:1, 3]. Judging from ethnographic material, the blades of single--sided swingles may have been flat or segmental in section, the handle being round or rounded rectangular in section [Istoriko-etnograficheskiy atlas, 1985:Fig. 139].

It is possible that a *wooden comb* (Fig. 8:3) also relates to processing, i.e. combing, of hemp and flax fibres [Loze 1988a:Fig. XLI:1; 1988b:Fig. 2:1;]. Bits of wooden boards found at Zvidze, Abora and Lagaza could be evidence of so-called tablets, or smooth supports, used when processing hemp and flax fibres with a swingle.

Hemp fibres were used for making rope and fabrics. Mention should be made of a specific features of hemp processing, for hemp is a dioecious plant [Ligers 1952:127]. The male plants were plucked first (immediately after flowering) and provided finer fibres.

Hemp seeds were also used as food, being heated and then crushed in a mortar. Hemp flour mixed with fats has been used as food.

The nettle is the oldest fibre plant in Latvia. It could be used for spinning thread and weaving cloth. It is possible that tools like the ones described above were also used for processing these fibres.

7. FARMING AS REFLECTED IN POLLEN SPECTRA

The results of pollen analyses represent one of the main classes of evidence in the study of initial farming systems, as well as later ones.

In the Lake Lubana depression too, pollen of cultivated plants, together with their accompanying synanthropic plants (weeds) serves to characterise the cultivation of cereal crops during the respective periods of the Neolithic habitation.

Hemp (*Cannabis sativa*) appears sporadically in the pollen spectra of the Lake Lubana depression (at Zvidze) already in the Early Neolithic layers, and can be traced without interruption from the Middle Neolithic onwards [Yakubovskaya 1997].

Along the Lithuanian coast hemp fibres were used in everyday life, as shown by finds of seeds and a piece of string from a Middle Neolithic site in the Šventoji lagoon (no. 32) [Rimantiene 1979:75, 168], as well as hemp pollen in the Late Neolithic sites at Šventoji (nos. 1A and 9).

There is little data relating to the use of hemp fibre in the Neolithic of present-day Poland. Its possible presence is only noted in the territory of the Linear Pottery culture (around 4000-4200 BC) in north-western Poland [Wiślański 1979:179].

Barley (*Hordeum vulgare*) has been found in a different area — on the shore of the Greater Lake Ludzas, where a half of a seed was found in the vicinity of a hearth at the Kreici Neolithic settlement [Rasins, Taurina 1983:154].

In the vicinity of the Lake Lubana, barley pollen appears in the lower and upper sections of the Middle Neolithic layer of pollen spectra [Yakubovskaya 1997:157]. This is possible evidence of a hiatus in the cultivation of barley. The presence of this pollen is low in percentage terms. Previously it was the cereals, including barley, from Kivutkalns along the lower Daugava (Late Bronze Age) that served to characterise early the farming [Graudonis 1989:72]. Barley pollen has been found in the Middle Neolithic occupation layer, whose age, as indicated above, has been determined through radiocarbon dating [Loze 1988a:Table 19]. This means that the initial process of cereal cultivation, including that of barley, started two thousand years earlier.

Of cereal crops, barley and millet have been found in the Neolithic sites along the Lithuanian coast at Šventoji [Rimantiene 1979:168; 1994:129]. Also, Gaerte [Gaerte 1929:32] mentions a find of a husk of two-row barley at a site on the Couronian Spit.

Barley was known at the Linear Pottery culture and the Funnel Beaker culture sites in Poland [Wiślański 1979:Fig. XLVI], as well as the Tripolye culture, the Globular Amphorae culture and the Corded Ware culture sites in central Europe [Wiślański 1979:Fig. L]. It has also been found at the Funnel Beaker culture settlements in the south-western part of Skane [Larsson 1985:56], and it is thought that barley was much easier to cultivate than einkorn or emmer wheat [Larsson 1985:89]. There are also indications that barley is less sensitive to cold.

8. THE INITIAL DEVELOPMENT OF AGRICULTURAL SKILLS

Archaeological and palynological indications of elements of farming in the Lake Lubana depression and the vicinity lead to the conclusion that the people living in this area had possibly begun to practice shifting cultivation.

Shifting cultivation is a small-scale form of agriculture, interpreted as a land--extensive and labour-intensive subsistence system, because the cleared areas, no larger than 4 ha, provided a good return for only a short period (one to three years). At the same time, the process of forest clearance, cultivation and harvesting requires intensive human activity, with the use of tools such as axes, knives, mattocks and digging sticks [Harris 1972]. This form of small scale agriculture is usually associated with a low population density or sparsely distributed settlements with a population below 250.

Shifting cultivation is considered particularly suitable for forest ecosystems, since the vegetation of the fields cleared in forest contains a higher potential of nutrients to be used for production than fields established in scrub or grassland. A grain crop, rich in proteins, constitutes a larger reserve of food, when it is cultivated in ash and soil, than does a root crop grown under the same conditions. It is the cereals that require a change in the site of cultivation, and for this reason the fields are shifted often, with a large territory used by each community.

The development of farming skills in the Lake Lubana basin can be discussed not only on the basis of the specific body of evidence described here, but also against a much broader background.

As mentioned above, the origin of agriculture is seen as part of a broad process of domestication of the landscape by social groups [Chapman 1994:113].

One of the most important details related to this question is the modelling of the initial farming over large regions, confirming or refuting hypotheses of indigenous origin or diffusion.

Without attempting to produce a model of the first farming, which should doubtless be conducted at a larger scale, covering the eastern Baltic region, some of the basic principles will be sketched in which should be taken into account when interpreting this question as it applies to the Lake Lubana depression.

First, attention should be given to the long-term settlement of this region. This is indicated by the succession of occupation layers at the Zvidze site, showing uninterrupted settlement in the Mesolithic and Neolithic [Loze 1988a:18-23]. Archaeological excavations here show the succession from Mesolithic to the Neolithic occupation layers and the character of artefact assemblages, and provide evidence of the characteristics of the flora and fauna of particular phases of settlement.

Long-term settlement at Zvidze possibly indicates that the local community associated the choice of this settlement site with the regular utilisation of the Lake Lubana and its shore zone, as well as initial use of pasture land and fields. This is shown by seed samples from the Zvidze site. Dominant are aquatic grasses (40%) and grasses of the lakeshore (24%). Wetland and wet meadow plants (19%) and

trees and shrubs (10%) are worse represented in the ecological structure of seed floras [Loze, Yakubovskaya 1984:90, 91].

Zvidze is one of the very rare sites on the eastern shore of the Baltic Sea with an occupation layer *in situ*, recording the beginnings of the change in subsistence strategy, marked by the transition from a hunting and gathering subsistence strategy to agriculture. It is possible that long-term settlement reflects a definite world view of the inhabitants, involving the long-term use of a certain chosen settlement, to the extent that it was also adapted to a different subsistence strategy.

Second, it should be noted that there are no indications in the Lake Lubana basin of the arrival of a new culture, which could have brought with it the skills related to agriculture. However, at the Zvidze site, a small amount of the Funnel Beaker pottery has been found [Loze 1988a:Fig. LVIII:1-3] indicating contacts between the people of the Lake Lubana depression and the people of this culture.

Thus we can exclude the possibility of a culture-bearing migration, which could have induced changes in the economic structure of the local tribes prior to the Corded Ware culture.

The pointed-butt and thin-butted flint axes for tree-felling and forest clearance, which have been recovered as stray finds in the area of present-day Latvia, do not, with rare exceptions, replicate characteristic western, i.e. central European and Scandinavian, forms of flint axes of the Funnel Beaker culture.

Third, is should be borne in mind that agriculture in the Lake Lubana depression was being adopted in an area very rich in natural resources. This is indicated by the thick Neolithic occupation layers at the Zvidze site which have produced remains of a large number of species of forest fauna (wild boar, elk, roe deer, red deer and aurochs), as well as wide-ranging information about Neolithic diet, since the recorded data provides evidence of intensive everyday use of birds and fish, as well as water chestnut, hazelnut, chick-weed, reed, stinging nettle etc. [Loze, Yakubovskaya 1984:88, 89].

Fourth, it should be noted that it was precisely in the Middle Neolithic that the Lake Lubana depression, which continued to become bogged up, was densely packed with new settlement sites, which doubtless indicates a sudden change in the demographic situation. On the other hand, the Mesolithic settlements, including the Osa site, excavated by Zagorskis [Zagorskis 1978:660-662] were located only on the shore of the former bed of the Lake Lubana at a height of 94-95 m above sea level. An increase in the population and the siting of settlements in the immediate vicinity of the new, considerably lower, shoreline of the Lake Lubana (Sulka and Kvapani II in the Middle Neolithic, Asne I and Malmuta II in the Late Neolithic), as well as in the major Aiviekste system of watercourses (Dzedziekste, Nainiekste, Piestina etc.) indicates that newly bogged over areas were being settled and that people were entering a new environment which initially had not been utilised — with all of the consequences that this entails. At the same time, intensive Neolithic settlement at the Zvidze site, on the shore of the former bed of the Lake Lubana (on the edge of the undulating till) at a height of 94-95 m above sea level, was experiencing its most intensive period of activity.

It is possible that the inhabitants of these new settlements, who made their homes in a different environment from that found at Zvidze, kept to the same economic regime, but were no longer bound by the view of their predecessors that it was necessary to continue to live at the "specially chosen place".

The settlement of new areas was of great significance. It is thought that this stabilised the economic regime and broadened the sphere of activities conducted by the people of the region: they began to herd domestic animals and cultivate cereals. However, it should be noted that the bogged-over areas were subject to changes in the water conditions both during the Atlantic and the Subboreal Periods, which forced the inhabitants to move to higher ground — islands and headlands — in the wetlands on at least a few occasions at certain times in the Neolithic. It is generally agreed that hunter-gatherers used natural resources within a radius of a two hour's walk, while for farmers and stock-keepers this radius was one hour's.

It is of course difficult to judge, to what extent the uninterrupted occupation of the Zvidze site was influenced by social aspects such as the links to the past and the ancestors, but the social value of this site together with its function of providing natural protection and its economic aspects, could no doubt have served to maintain uninterrupted settlement.

Fifth, the sedentary community that inhabited the Zvidze settlement was not the last to make use of this area. Late Neolithic sites have also been excavated, and there are indications that Early and Late Bronze Age, as well as the Iron Age settlements, discovered during archaeological survey work between 1961 and 1990 were also sited here.

Also, the medieval village at Smaudi was located only a few hundred metres to the west of Zvidze Neolithic site on the shore of a relict lake — an overgrown bay of the former bed of the Lake Lubana [Loze 1974:41-44]. An Early to Late Iron Age cemetery was sited immediately adjacent [Loze 1974:42-44]. These facts indicate that settlement was uninterrupted and clearly point to productive utilisation of this area over the course of millennia.

Sixth, indications of intensive farming (with mass finds of grindstones — an average of 40 per 100 m^2) in the central part of the Late Neolithic site of Abora I indicate a concentration of settlement by another sedentary community. Intensification of agriculture is evidence of active development of this subsistence strategy, with the use of an assemblage of grindstones of the hand quern type and pestles and mortars (Fig. 7), possibly at the same time handling a small herd of livestock. Hunting, fishing and gathering still provided most subsistence needs. However, this site, unlike the site of Zvidze, was in later times, in the Middle and Late Iron Age, utilised only on a seasonal basis, because of the geographical situation: the rapid bogging-up of this area did not permit habitation after the Bronze Age.

Seventh, it is thought that the further adoption of agriculture was fostered by the infiltration of small groups from the Corded Ware culture into the Late Neolithic cultural environment [Loze 1979:40, 41]. The people at the Abora I site,

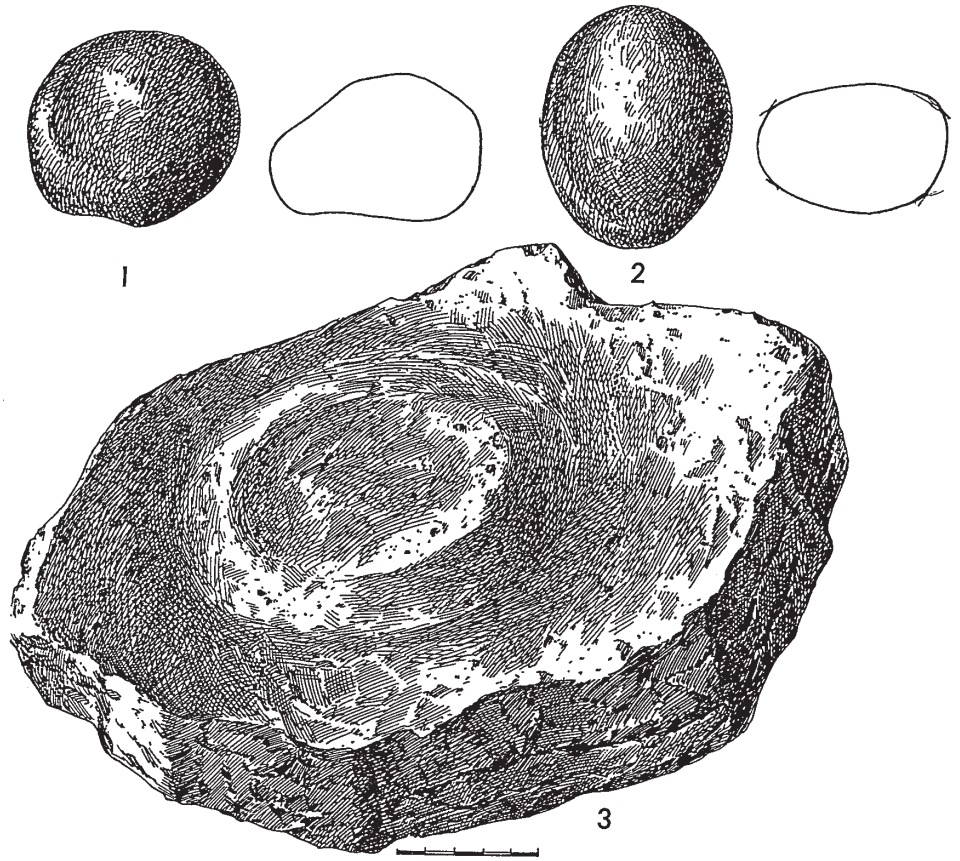

Fig. 7. Upper grindstones from the Kvapani II (1) and Lagaza (2) sites, lower grindstone from the Lagaza site (3). (Collections of the Institute of History of the University of Latvia, Department of Archaeology, nos. 194:693; 118:596, 290). Drawing by Marta Jankalnina.

who represented a new cultural environment, also started to adopt pastoralism*. They buried their dead in special chambers (?) between buildings or within an enclosed area in the settlement itself, rather than at special burial sites, providing the dead with the possibility of being permanently among the living. There might be reserved the far end of the house or the area between houses, depending on whether the hearth was in the middle or the front of the dwelling.

This fact is given particular attention in interpretations of the domestication process, and is considered a sign of the domestication of society [Hodder 1990:29].

* Palynologists have considerable evidence permitting characterisation of pasture-land in the Lake Lubana depression and the environs.

Eighth, changes in Neolithic symbolism can also be accepted, which, like social changes, could have occurred in advance of economic changes. These changes took place concomitantly and were a reflection of the world view and social structure of the respective period. With the integration of the people of the earliest Corded Ware culture into the local environment and the creation of a new cultural environment, agricultural symbols were introduced: solar and lunar signs (in the form of pendants and ornaments) [Loze 1994a; 1994b].

Also a hypothesis has been put forward linking the constellation Taurus with the ancient agricultural calendar, specifically the time of spring sowing and the advent of summer [Chmykhov 1990:276-288].

The Taurus constellation is seen in disc pendants which are widespread in Europe and which in the Lake Lubana depression were made of amber and worn by women, accompanying them to the world beyond the grave [Loze 1993b; 1993c].

Changes in world view and socio-economic developments are also reflected in the Late Neolithic art, such as a bull's head representation as a flint sculpture (from Lagaza), which surprises the viewer with the superbly executed curved horns characteristic of this particular animal and the stylised proportions of the head.

This symbol, like those of the sun and moon, are associated with the changing seasons, one of the main determinants of the agricultural cycle. Observing the calendar was one of the main pre-conditions for obtaining a successful — though as yet small — harvest, which was perhaps not insignificant, bearing in mind the possibilities of the early farming.

It is possible that the role of the bull in the adoption of the new economic regime was much greater than hitherto considered [Graudonis 1967:118; 1989:76, 77]. This is also shown by a model of a yoke for oxen found at a Late Neolithic site at Šventoji (no. 4A) on the north-west coast of Lithuania [Rimantiene 1994: Fig. 53].

It seems that the use of the horse in the Late Neolithic was linked to transport requirements, i.e. riding, as shown by part of a bridle bit found in the Lake Lubana depression (Abora; collections of the Latvian Institute of History at the University of Latvia, no. 76:3441). Establishing whether the horse was domesticated does, however, depend very much on the degree of wear of the pre-molars.

The first farming in the Lake Lubana basin indicates the beginnings of the adoption of agriculture (Zvidze), and the intensification of farming skills in the later part of the Stone Age in this same region (Abora I) shows the gradual development of this economic activity, along with changes in symbols and social structure.

That this economic system was gradually developing is shown by the siting of Bronze and Iron Age settlements and medieval villages in the vicinity of the Lake Lubana beyond the bounds of bogged-up areas, maintaining some of the previous settlement sites in the Lubana wet meadows for seasonal activities.

Finds of *Striated Pottery* show that Late Bronze and Early Iron Age farmers (1300 BC to the second or third century AD) made use of higher ground along the banks of the Rezekne (Ideni and Zoseri), Malta (Kupci and Zvejsalas) and Sulka (Sulagals) rivers, also establishing settlements on the shores of the Lake Zvidzes

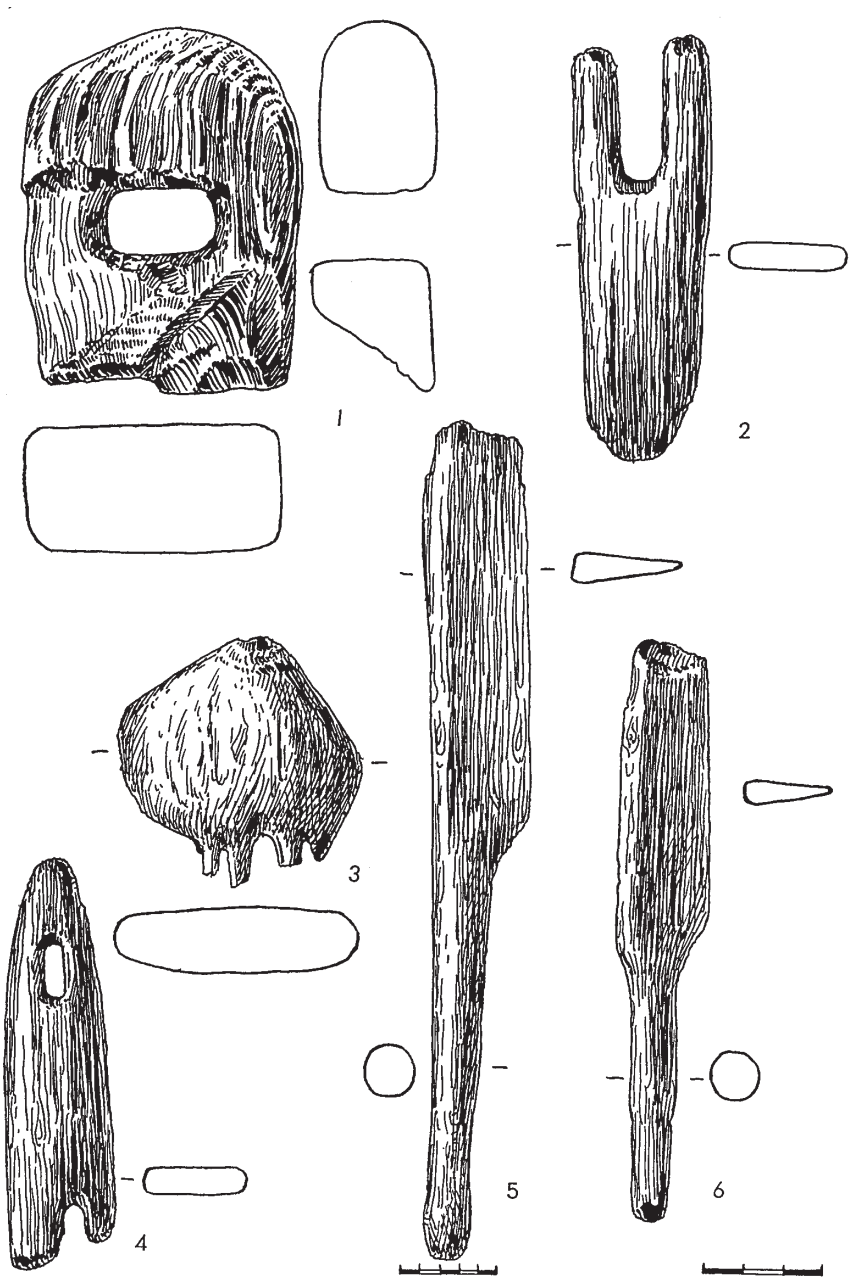

Fig. 8. Fragment of a handle of a stone mattock (1), fragments of shuttles (2,4), comb (3) and swingles (5,6) from Abora (1) and Zvidze (2-6) (Collections of the Institute of History of the University of Latvia, Department of Archaeology, nos. 76:3855, 188:477, 484, 116, 433, 476). Drawing by Marta Jankalnina.

(Smaudzi and Zvidze). This is a period when the first fortified settlement appeared at the south-east end of Ideni ridge [Loze, Vasks 1974:48-50; Vasks 1994:65-73]. This is also a time of cardinal changes in social structure, with the beginnings of the so-called period of tribal society. The system of fortifications discovered here (defensive ditches and wooden palisades) served to protect not only the people living at this site, but also those of the open settlements discovered in the immediate vicinity, also securing the products of farming labour (grain and other seeds of cultivated plants).

Evidence of farming in this period comes in the form of seasonal activities in the area of the present wet meadows, possibly involving haymaking and pasture along the banks of the Aiviekste (Abora I and Lagaza), Malta (Jasubova) and Rezekne (Kvapani II) rivers.

The people making Early Iron Age textile impressed pottery after the second or third century AD cultivated fields on higher ground along the lower course of the Rezekne River (Kvapani Laivu Baze, Mikuli, Zoseri and Lielie Idini), on the Ideni hill (Brikuli) and on higher ground along the lower course of the Malta River (Kupci and Zvejsalas), along the middle course of the Sulka (Sulagals) and on rises secure from flooding in the basin of the Malmuta River (Adumeni I and II), as well as on the present shore of the Lake Zvidzes (Smaudzi and Zvidze).

There is considerable evidence of seasonal activities of the people producing textile impressed pottery in the bogged-up depression of the Lake Lubana along the lower courses of the rivers: Aiviekste (Abora I and Lagaza), Malmuta (Malmuta I and II) and Rezekne (Kvapani I and III).

On the other hand, the farming people making plastered pottery in the Middle and Late Iron Age (fifth to tenth centuries AD) utilised areas of fertile alluvium on the banks of the rivers: Piestina (Maza Osa, Liela Osa and Galeji), Ica (Sala), Rezekne (Kvapanu Laivu Baze, Mikuli, Pasloka, Zoseri and Ideni), Malta (Kupci and Zvejsalas), Malmuta (Adumeni I and II) and Aiviekste (Naglini). They also continued to cultivate fields on the shore of the Lake Zvidzes (Smaudzi and Zvidziena).

Like many previous generations, the makers of plastered pottery made seasonal camps on the banks of the Aiviekste (Abora I), Ica (Ica and Upesgala Licis), Rezekne (Kvapani II and III) and the lower course of the Malmuta (Malmutas Grva).

That areas of higher ground with mineral soil within the present area of the Lubana wet meadows were used for growing summer cereal crops during certain periods is shown by the use of the Abora site for agriculture in the 1920's and 30 s.

Thus, the Lake Lubana depression with the Stone Age sites in the presently bogged-over areas and sixty newly discovered settlements and village sites (Bronze and Iron Age, Middle Ages) outside of this zone, constitutes a special micro-region. This is an area very well suited for large-scale interdisciplinary research not only concerning early and developed shifting cultivation, but also cultivation of permanent fields.

9. MODELLING THE PROCESS OF ADOPTION OF AGRICULTURE

Modelling of the process of the adoption of agriculture is not possible without research on a specific body of data. For this reason, an understanding of this process in the Lake Lubana basin needs to utilise the above described body of evidence gathered over the course of decades, including studies of the palaeogeographical situation and environment of the first farming settlements, requiring a considerable amount of work, which needs to be seen against the general cultural background [Eberhards 1969:59-63; 1981; 1989; Dolukhanov, Levkovskaya 1971; Loze, Eberhards 1983:116, 117; Loze, *et al.* 1984]. Modelling of the adoption of the first farming in the Lake Lubana basin could be conducted as follows:

1. A continuous line of cultural development is confirmed (Mesolithic to Middle Neolithic), envisioning a process of local, peaceful adoption of agriculture within a particular social environment (without the participation of immigrants) as a result of diffusion (the time of the Funnel Beaker culture);
2. A certain influx of socially organised people is admitted (infiltration of small groups of the earliest Corded Ware culture) in the Late Neolithic, already familiar with agriculture, furthering the process of the introduction of this activity into the local cultural environment;
3. Intensification of the process of the adoption of agriculture in the Late Neolithic and the transition to the Bronze Age, with pronounced changes in symbolism and social structure, marked the possibility of gradual stabilisation of the introduction of this farming activity, which was interrupted by catastrophic change (changes in the water regime in the Lake Lubana basin, which led to rapid paludification) and forced the people living in the region to settle outside of the area of the present-day wet meadows.

Translated by Valdis Bērziņš

ABBREVIATIONS

AR	– Archeologicke rozhledy, Praha.
AP	– Archeologia Polski, Wrocław.
AJPA	– American Journal of Physical Anthropology, New York.
CA	– Current Anthropology, Chicago.
KSIA	– Kratkiye Soobshcheniya Instituta Arkheologii Akademii Nauk USSR, Moskva.
KSIA (Ukraine)	– Kratkiye Soobshcheniya Instituta Arkheologii Akademii Nauk USSR, Kiev.
KSOGAM	– Kratkie Soobscheniya Odesskogo Gosudarstvennego Arkheologicheskogo Muzeya, Odessa.
MASP	– Materialy po Arkheologii Severnogo Prichernomorya, Kiev.
MIA	– Materialy i Issledovaniya po Arkheologii, Moskva.
SA	– Sovetskaya Arkheologiya, Moskva.
SAA	– Sovet Anthropology and Archaeology, Moskva.
SE	– Sovetskaya Etnografiya, Moskva.

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