Proc. Estonian Acad. Sci. Geol., 1995, 44, 2, 119—132

GEOLOGY OF THE ÄNTU GROUP OF LAKES

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Received 28 June 1994, accepted 20 October 1994

Abstract. The highly alkaline basins of the lakes in the Äntu group on the Pandivere Upland, Estonia, are filled with lacustrine lime, which has accumulated since the Preboreal. Silt of the Younger Dryas age lies under the lime. Eleven local pollen assemblage zones were distinguished, with pronounced *Betula* pollen in the Preboreal, *Pinus* in the Early Boreal, *Ulmus—Alnus—Corylus* in the Late Boreal, *Ulmus* in the Early Atlantic, *Tilia* in the Late Atlantic, and *Picea* in the Late Subboreal. The role of the anthropogenic indicators during the Neolithic and Bronze Age is weak, since the Iron Age remarkable. The chronology is based on 16 radiocarbon dates from different materials. Some dates are too old due to the hard water effect, but most fit well with the pollen stratigraphy. After the recession of ice from the Pandivere Upland all three lakes belonging to the northern Äntu group formed a large lake, which in the Atlantic split into small ones. At the beginning of the Holocene the lake level was high with one considerable lowering between 4100—3200 years BP.

Key words: Litho-, bio- and chronostratigraphy; vegetation history; radiocarbon dates; lake-level changes.

INTRODUCTION

The Äntu group of lakes is located on the Pandivere Upland (59°08′ N, 26°33′ E) in a bedrock depression deepened by karst processes on the outcrop of limestones of the Porkuni regional stage. The lakes are fed by springs. This is why they have alkaline water and a high water transparency. Three lakes, Sinijärv, Vahejärv (Roheline), and Valgjärv, form the northern Äntu group of lakes near the Tartu—Rakvere road, between the Pekkeli—Ebavere esker ridge (Fig. 1). L. Sinijärv, 94.6 m a.s.l., is small, with a surface area of 2.4 ha and maximum depth of 7.3 m. It has an outlet via L. Vahejärv and L. Valgjärv to L. Linaleo and through Nõmme Brook to the Põltsamaa River. The northern, western, and southern shores are bordered by a narrow peaty rim. East of the lake there is the Kärsa mire. The area of L. Vahejärv is only 0.8 ha, its maximum water depth is 3.3 m, the shores are covered with a floating mat and the bottom with lacustrine lime. L. Valgjärv has an area of 1.4 ha and maximum water depth of 8 m. Similar to the other two lakes its shores are paludified and the bottom is covered with lacustrine lime.

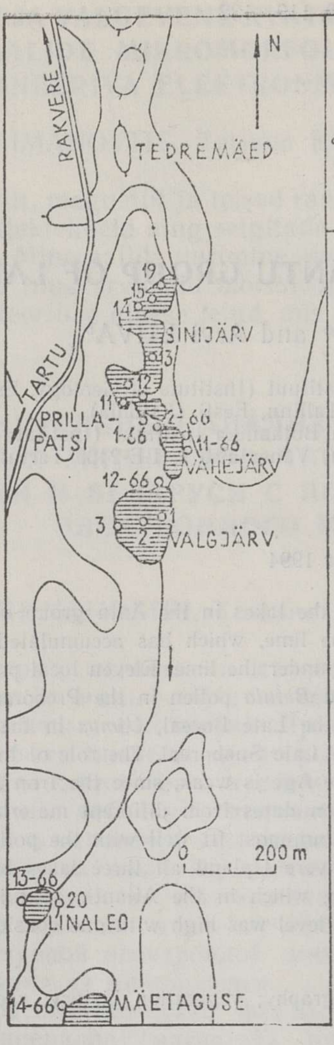

Fig. 1. Location of the Äntu group of lakes. o—cores.

The water of the lakes is calcareous, enriched with nutrients, especially with nitrogen during the last ten years (Mäemets & Saarse, 1995). The water turnover is fast, with mean residence time not exceeding 2—3 months. It is an interesting object of study due to the highly calcareous deposits, but complicated to date.

STUDIES ON THE SURROUNDINGS OF THE ÄNTU GROUP OF LAKES

The first studies in the surroundings of the Äntu group of lakes were carried out by Männil (1961). The work was continued by Reet Pirrus (unpublished data). The bottom deposits of L. Äntu Sinijärv were studied by Saarse in 1966, 1986, and 1987. In 1966 one transect along L. Sinijärv and several cores around lakes Vahejärv, Valgjärv, Linaleo, and Mäetaguse were drilled (Fig. 1, cores 1-66 and 14-66; as the scale is small the cores on L. Sinijärv are not indicated). The water transparency

Photo 1. A spring in the bottom of L. Äntu Sinijärv. Underwater photo by H. Saarse.

Photo 2. Alternation of sediments in the spring wall of L. Sinijärv. Underwater photo by H. Saarse.

measured with Secchi disc in the horizontal direction at a water depth of 1 m was 13.5 m, which means that L. Sinijärv has the highest water transparency among the Estonian lakes. In L. Sinijärv there are at least seven springs with different configurations. Their depths are up to 2 m (Photo 1). The deepest springs are located in the northern and north-eastern corners of the lake, close to the shore.

The corings enabled us to establish the maximum thickness of the lacustrine deposits. In the southern part of L. Sinijärv it is 5.1, in the central part 4.3, and in the northern part 3.3 m. Layers of lacustrine lime alternating with organic-rich layers are cropping out on the spring walls (Photo 2).

METHODS

Corings on the Äntu group of lakes were carried out from an anchored raft with a Belarus peat sampler. Cores were cut into 2 cm slices and processed for pollen analyses using standard chemical treatment. The organic fraction was estimated by loss-on-ignition at 500 and 825 °C, the carbonate fraction by measuring the content of carbon dioxide and calculating the total $CaCO_3$. Radiocarbon dates (BP, uncalibrated) were obtained on different organic and carbonate fractions.

SEDIMENT LITHOLOGY

In 1986 a transect along L. Valgjärv and L. Sinijärv was done (Figs. 2, 3) and core No. 12 (Fig. 1) was sampled for pollen and radiocarbon analyses. In 1987 peat near L. Linaleo (core 20, Fig. 1) was sampled and analysed for checking the dating.

The thickness of the lacustrine lime in L. Sinijärv based on 19 corings varies between 1.5 and 5.1 m, being on an average 3—4 m. The beige or grey-coloured lime contains subfossil molluscs and fragments of water mosses (*Scorpidium*). In the sampling point (core 12) the thin fine sand layer (7.75—7.7 m) is covered with silt containing plant macroremnants (7.7—7.5 m). The silt is overlaid by a thin gyttja layer (7.5—7.4 m), laminated lacustrine lime (7.4—7.05 m), silty lime (7.05—6.1 m), lime (6.1—5.6 m), lime with moss fragments and dispersed organic matter (5.6—4.95 m), pink lime (4.95—4.35 m), lime with moss fragments (4.35—4.1 m), and grey lime (4.1—4.0 m, Fig. 4). In L. Valgjärv the basal silt is covered with organic-rich silt, lacustrine lime, gyttja, and the topmost lacustrine lime layer (Fig. 3).

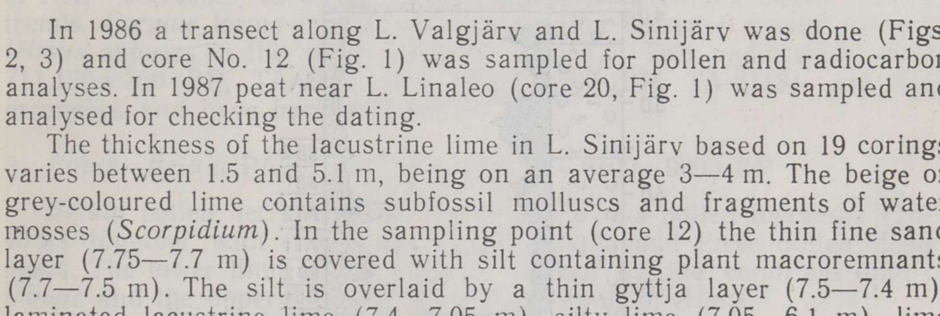

Fig. 2. Transect along L. Äntu Sinijärv.
1 peat, *2* lacustrine lime, *3* organic-rich lacustrine lime, *4* gyttja, *5* silt, *6* sand, *7* gravel, *8* limestone.

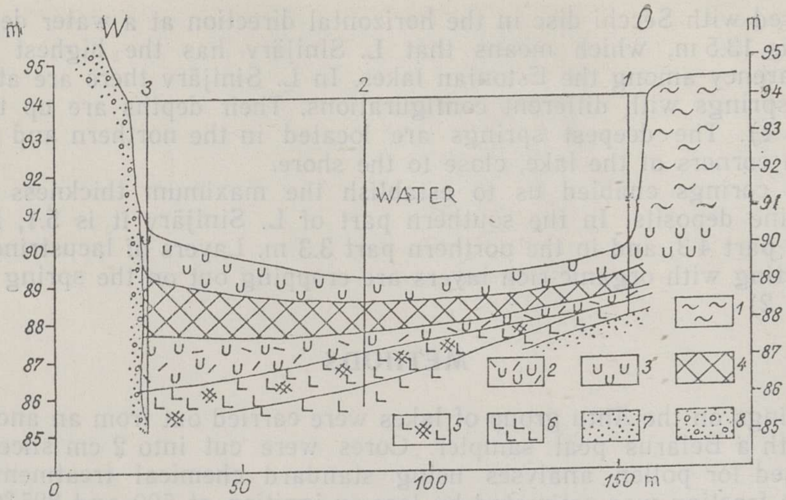

Fig. 3. Transect along L. Äntu Valgjärv.
1 peat, *2* peaty lacustrine lime, *3* lacustrine lime, *4* gyttja, *5* silt rich in mosses, *6* silt, *7* sand, *8* gravel.

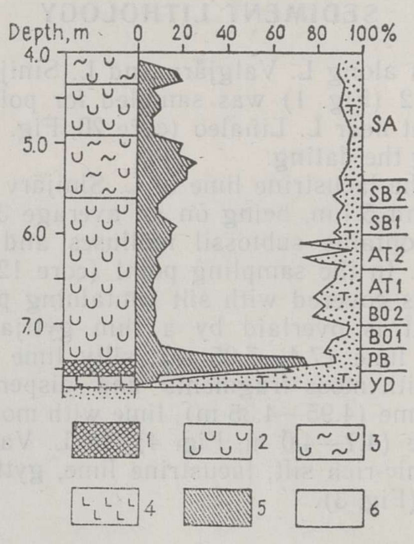

Fig. 4. Sediment composition in L. Äntu Sinijärv core No. 12.
1 gyttja, *2* lacustrine lime, *3* moss-rich lacustrine lime, *4* silt, *5* organic matter, *6* carbonaceous fraction, *7* minerogenic fraction.

The composition of the bottom deposits is variable. The content of $CaCO_3$ is high, up to 91% (Fig. 4); CaO makes up 41—47% and MgO 1.4—1.9%. These results are consistent with the X-ray data according to which the lacustrine lime consists mostly of calcite. The proportion of the organic matter varies between 7—23%, increasing in the gyttja layer up to 74%. The inorganic fraction forms 2—30% in lime and up to 98% in silts (Fig. 4).

BIOSTRATIGRAPHY

The pollen diagram from core No. 12 (Fig. 5) enabled us to subdivide the 3.75-m-long sediment core into 11 local pollen assemblage zones (PAZ). Their chronology is correlated with the ages of Linaleo mire and L. Raigastvere PAZ (Pirrus et al., 1987; Fig. 6).

1. NAP—*Betula nana*—*Salix* PAZ, Ä-1 (7.75—7.5 m), ?—10,000 BP

The percentage of tree pollen (AP) is low; it increases upwards from 40 to 80%. *Pinus* and *Betula* predominate. The frequency of *Picea* pollen is 1—4%, and it could thus be long-transported. The amount of nonarboreal pollen (NAP) is big (50—55%). Among NAP *Artemisia* is predominant (34—52%), it is followed by Chenopodiaceae (14—28%), Gramineae (12—17%), and Cyperaceae (7—14%). Such pollen composition is characteristic of the Younger Dryas. The radiocarbon dating of the plant macroremnants from silt gave the age 10,930±200 BP (TA-2119), which is consistent with the beginning of Younger Dryas. The Younger Dryas/Preboreal limit is sharp and marked by the transition of silt to jelly algal gyttja with a low calcareous content (2%).

2. *Betula* PAZ, Ä-2 (7.5—7.25 m), 10,000—9400 BP

Betula increases rapidly and dominates (up to 68%). *Pinus* is subdominant (up to 40%). The share of AP pollen increases to 95% and that of NAP decreases to 4—5%. *Pinus* and *Betula* curves show contrary trends. *Corylus* forms 1—2%. *Salix* and *Picea* decrease evenly upwards. *Ulmus* appears in the upper part of the PAZ. Two radiocarbon dates (11,150±150 BP, TA-2117, and 12,080±200 BP, TA-2118) are both erroneous and have been avoided here.

3. *Pinus*—*Betula* PAZ, Ä-3 (7.25—7.00 m), 9400—9000 BP

Betula pollen decreases (60—32%) and *Pinus* pollen increases (26—40%) together with *Ulmus* and *Corylus*. *Salix* and *Picea* pollen disappears. The lower limit of the PAZ is marked by the empirical limit of *Ulmus* and the upper limit by the rational limit of *Alnus*.

4. *Alnus*—*Ulmus*—*Corylus* PAZ, Ä-4 (7.0—6.7 m), 9000—7500 BP

Betula and *Pinus* decrease upwards. *Alnus* increases sharply at the bottom of the PAZ. *Corylus* and *Ulmus* curves are rather uniform. *Tilia*, *Quercus*, and *Picea* are sparse. The upper limit of the PAZ is marked by an increase in *Ulmus* and *Tilia* and a sharp decrease in *Pinus*. Total AP is high and stable. The radiocarbon date 8930±100 BP (TA-2116) fits with the Early Boreal age, the date 8040±120 BP (TA-2115) with the Late Boreal age of the deposits.

In the Linaleo pollen diagram (Fig. 7) the same time span (L-1) is characterized by variable but dominating *Pinus* and *Betula*. The frequency of *Alnus* pollen is around 15%, that of *Ulmus* pollen is 5%. *Tilia* has its 1%-limit. NAP is low and stable, around 5%.

5. *Ulmus*—*Alnus*—*Tilia*—*Corylus* PAZ, Ä-5 (6.7—6.35 m), 7500—6600 BP

The amount of *Pinus* pollen is small and stable, around 10%. *Betula* decreases evenly. The Quercetum mixtum (QM) frequency increases. Maxima of *Ulmus*, *Tilia*, and *Corylus* occur. *Picea* increases abruptly at the end of the PAZ. The upper limit of this PAZ is at the sharp increase in QM and *Picea*.

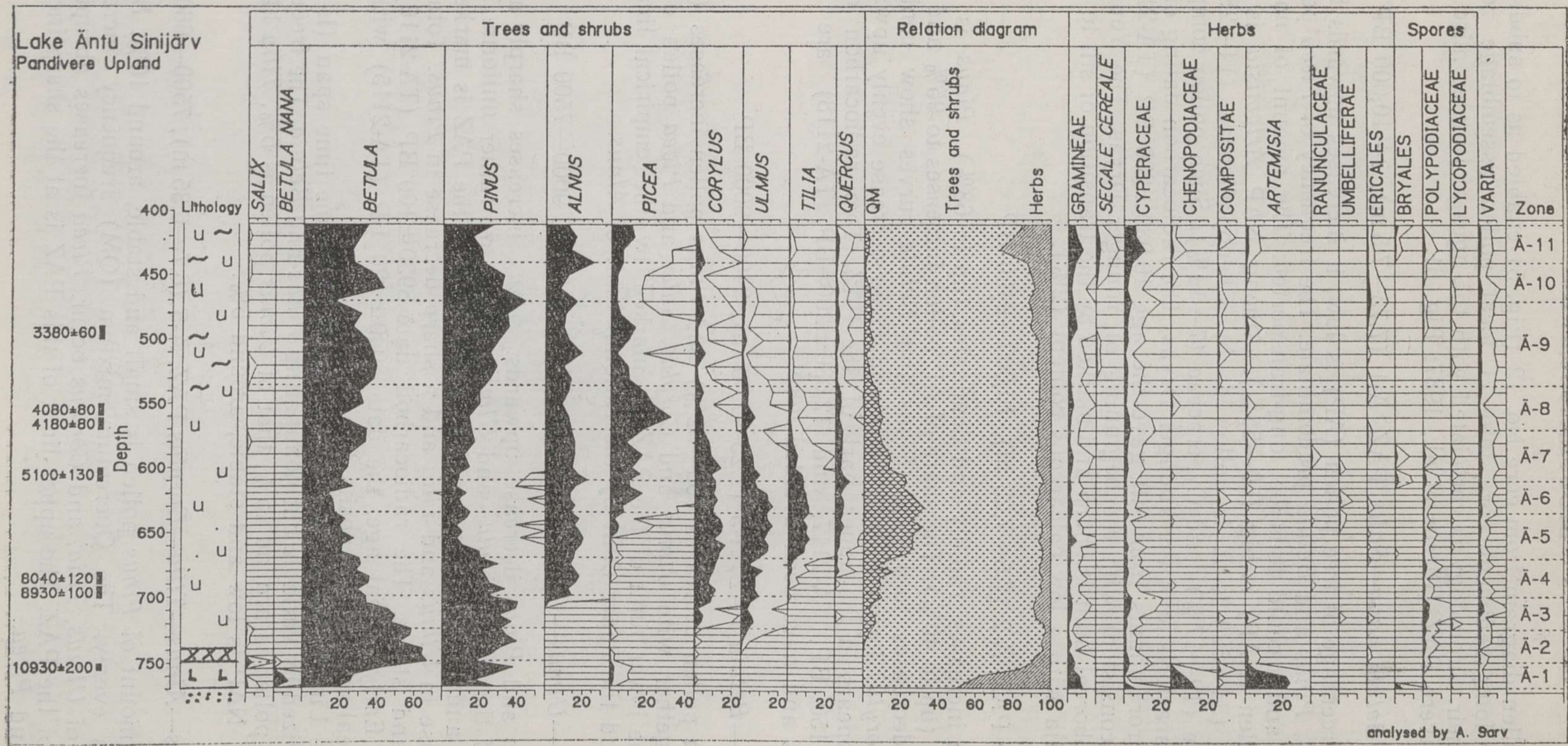

Fig. 5. Pollen diagram of L. Äntu Sinijärv.

In the Linaleo pollen diagram (Fig. 7, L-2) *Betula* and *Pinus* diminish throughout the PAZ. A reverse trend appears in the QM frequency. *Alnus* and *Ulmus* have the same values as in the previous PAZ, increasing sharply near the upper limit of the PAZ. The *Tilia* curve has a remarkable rise. *Picea* appears, dated to 7430±80 BP, but its pollen frequency is still low (2—3%).

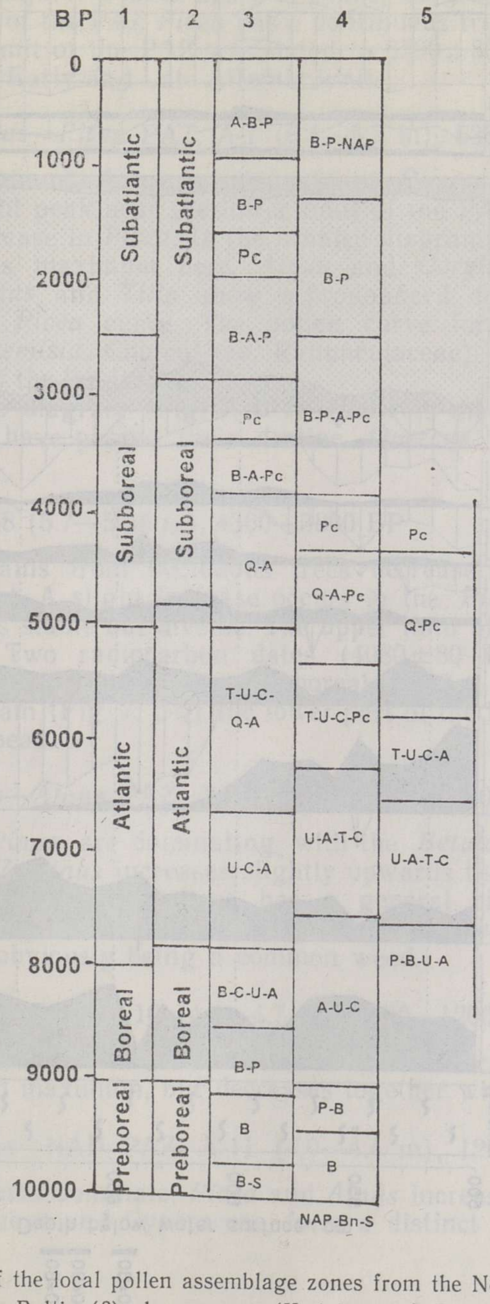

Fig. 6. Correlation of the local pollen assemblage zones from the Nordern (*1*) (Mangerud et al., 1974) and the Baltic (*2*) chronozones (Кабайлене & Раукас, 1993), L. Raigastvere (*3*), L. Äntu Sinijärv (*4*), and Linaleo mire (*5*).

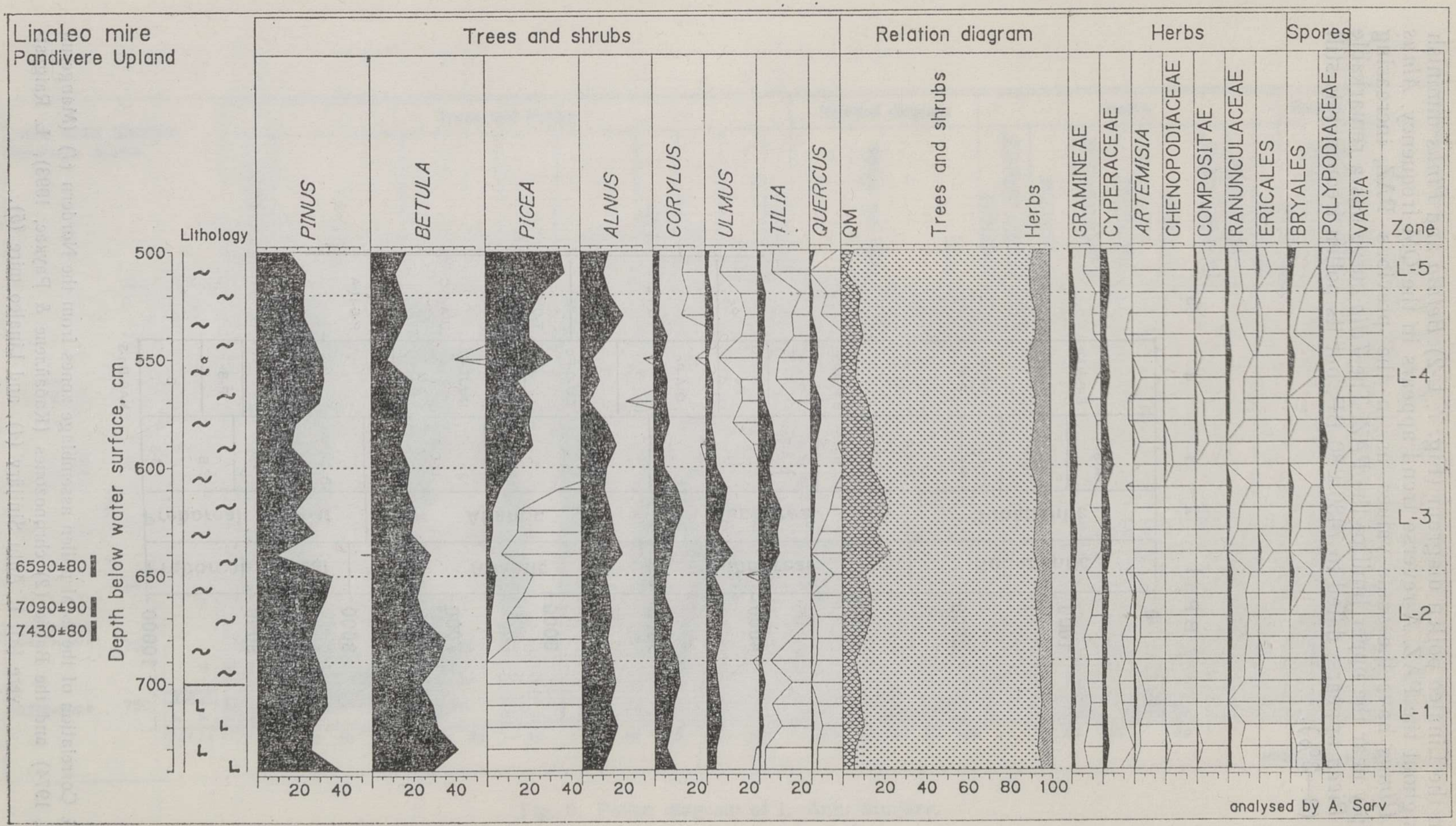

Fig. 7. Pollen diagram of Linaleo mire.

6. *Tilia—Ulmus—Corylus—Alnus—Picea* PAZ, Ä-6 (6.35—6.1 m), 6600—5300 BP

Tilia rises up to 10% accompanied by high *Ulmus* and *Corylus*. There is a culmination in the QM in the lower half of the PAZ. *Pinus* is low, *Betula* starts to increase. The upper limit of the PAZ is at the decrease in QM. The radiocarbon date 5100±130 BP (TA-2114) fits with the Late Atlantic age of the deposits.

In the Linaleo pollen diagram (Fig. 7, L-3) *Tilia* has the same values as in L. Äntu Sinijärv. *Ulmus* has two peaks, *Corylus* maximum occurs. Since the middle of the PAZ *Picea* has a continuous trend toward increasing. The lower limit of the PAZ was dated to 6590±80 BP (TA-2343). It fits well with the Early and Late Atlantic limit.

7. *Quercus—Alnus—Picea* PAZ, Ä-7 (6.1—5.7 m), 5300—4300 BP

Betula is dominant, *Alnus* is subdominant. *Quercus* is notably high and forms a slight peak near the lower limit of the PAZ. The upper limit is at a sharp increase in *Picea*. In the Linaleo diagram the *Quercus* pollen value reaches its maximum here. *Alnus* and *Corylus* are moderately represented. *Ulmus* and *Tilia* show a pronounced decrease. A reversal trend is in the *Picea* curve. The pollen curve for terrestrial plants (Cyperaceae, *Artemisia*, Compositae, Ranunculaceae) increases referring to the openness of the landscape.

In the Linaleo diagram (Fig. 7, L-4) *Picea* is the most pronounced. *Ulmus* and *Tilia* have passed their decline. *Quercus* pollen has a slight maximum.

8. *Picea* PAZ, Ä-8 (5.7—5.35 m), 4300—3800 BP

The pollen grains from deciduous trees decrease in favour of *Picea*, which is dominant. A slight increase occurs in the *Pinus* curve. *Betula* decreases. NAP is stable but diverse. The upper limit of the PAZ is at the *Picea* decrease. Two radiocarbon dates (4080±80 BP, TA-2112, and 4180±80 BP, TA-2113) fit with the Subboreal age, but could be older. On the Linaleo diagram (Fig. 7, L-5) the lower part of the PAZ is represented by a clear *Picea* peak.

9. *Betula—Pinus—Alnus* PAZ, Ä-9 (5.35—4.7 m), 3800—2400 BP

Betula and *Pinus* are dominating, with the *Betula* maximum in the middle of the PAZ. *Pinus* increases slightly upwards the PAZ limit. *Picea* forms the second peak. NAP curve has a general rise and increased diversity since the second half of the PAZ. *Secale cereale* appears at the end of the PAZ, obviously being a common weed.

10. *Betula—Pinus* PAZ, Ä-10 (4.4—4.7 m), 2400—1200 BP

Betula is dominant, *Pinus* is subdominant and decreases. *Picea* does not form a second maximum, but decreases together with *Alnus*.

11. *Betula—Pinus*—NAP PAZ, Ä-11 (4.0—4.4 m), 1200—0 BP

Betula and *Pinus* dominate, *Picea* and *Alnus* increase. Nemoral herbs, especially Gramineae and Cyperaceae, form a distinct peak.

COMPARISON OF POLLEN DIAGRAMS

A comparison of the L. Sinijärv pollen diagram with the pollen diagrams from the Linaleo mire and L. Raigastvere (Pirrus et al., 1987) reveals several similar patterns and allows a correlation of their PAZ (Fig. 6). The Early Holocene pollen assemblages are dominated by *Betula*. Unlike at Raigastvere the *Pinus* frequency is high in the Äntu area in the Boreal. *Alnus* immigrated about 9000 BP, simultaneously to Vooremaa and Pandivere. The order of the immigration of the deciduous trees (*Ulmus—Corylus—Alnus—Tilia—Quercus*) was similar at Äntu and Raigastvere. The concentration of QM pollen is quite high throughout the Atlantic period. A slight maximum of *Quercus* pollen occurs at the Atlantic/Subboreal transition. The most remarkable difference between the two diagrams is that at Äntu *Picea* forms only one pronounced peak in the Late Subboreal, whereas at Raigastvere it forms three peaks (Pirrus et al., 1987).

RADIOCARBON DATES

Radiocarbon dates from L. Sinijärv, L. Valgjärv, and the Linaleo mire are presented in the Table.

Radiocarbon dates (BP, uncalibrated)

Lab. No.	Depth, m	Date	Material
L. Sinijärv (dated by A. Liiva)			
TA-2111	4.9—5.0	3380±60	Lacustrine lime (carbon. fr.)
TA-2112	5.5—5.6	4080±80	Lacustrine lime (carbon. fr.)
TA-2113	5.6—5.7	4180±80	Lacustrine lime (carbon. fr.)
TA-2114	6.0—6.1	5100±130	Lacustrine lime (carbon. fr.)
TA-2115	6.8—6.9	8040±120	Lacustrine lime (carbon. fr.)
TA-2116	6.9—7.0	8930±100	Lacustrine lime (carbon. fr.)
TA-2117	7.3—7.4	11150±150	Lacustrine lime (carbon. fr.)
TA-2118	7.4—7.5	12080±200	Gyttja (organic fr.)
TA-2119	7.5—7.6	10930±200	Plant remnants (organic fr.)
L. Valgjärv (dated by R. Rajamäe)			
Tln-1701	6.1—6.2	3170±40	Peaty gyttja (organic fr.)
Tln-1713	6.2—6.3	4170±70	Peaty gyttja (carbon. fr.)
Tln-1714	6.2—6.3	4430±65	Peaty gyttja (organic fr.)
Linaleo mire (dated by A. Liiva)			
TA-2343	6.4—6.5	6590±80	Peat (organic fr.)
TA-2344	6.6—6.7	7090±90	Peat (organic fr.)
TA-2345	6.7—6.8	7430±80	Peat (organic fr.)
TA-2346	6.7—6.8	9060±90	Carbonate fr.

The bottom deposits of all the lakes in the Äntu group may be contaminated with old carbonate due to the calcareous tills and carbonate bedrock on the catchment and the feeding of lakes with carbonate-rich ground water. In spite of that most of the radiocarbon dates fit well with the chronozone ages and the vegetational events in the area (Fig. 6). The date 5100±130 BP (TA-2114) marks the Subboreal/Atlantic limit and fits with the traditional limit age (*c.* 5000 BP). We dated the limit of the Early and Late Atlantic periods in the Linaleo mire at 6590±80 (TA-2343); according to the Estonian stratigraphic scale it is 6600 (Кабайлене & Раукас, 1993). Only some PAZ limits are shifted towards older ages in comparison with the Raigastvere PAZ ages (Fig. 6).

We also compared several vegetational events in the Äntu region with those of L. Raigastvere. The *Betula* maximum in L. Raigastvere is dated at 9200, *Alnus* expansion at 8400, *Corylus* peak before its decline at 5000, the first peak of *Picea* at 3800, and the peak of *Alnus* at 800 BP. The radiocarbon dates of the same events from L. Sinijärv show sometimes older ages, sometimes younger ones. So, the apparent age of L. Sinijärv samples varies. This means that beside the old carbon there are obviously other factors that affect the radiocarbon dates of calcareous deposits. We should also keep in mind that the vegetational events and PAZ limits are time transgressive and are not the best instrument for measuring the validity of the radiocarbon dates.

OUTLINES ON THE VEGETATION HISTORY

There are more than 20 pollen diagrams from the Pandivere Upland (Äntu, Järvasoo, Avanduse, Savalduma, Lusiku, Tapa, Loobu, Haljala, etc.; Veber, 1961; Männil, 1961, 1964; Männil & Pirrus, 1963). They provide information on the vegetational history of different parts of the upland.

The surroundings of Äntu were densely forested during the Late Boreal and the Atlantic periods. The first deforestation caused by Neolithic clearance started on the transition of AT/SB, marked about 5000 BP by a contemporaneous *Ulmus* and *Tilia* decline, an increase in NAP, and a decrease in AP. The second deforestation phase occurred in the middle of the Early Subatlantic (Fig. 5, Ä-9), when NAP pollen, especially Gramineae, increased (Fig. 5). *Betula* and *Alnus* diminished, *Picea* increased, indicating the landscape openness. The third phase of rather clearly expressed human impact covers the last 1100 years BP. This phase saw also the beginning of *Secale cereale* cultivation. It was followed by a new forest regeneration during the last 50 years.

HYDROLOGICAL EVENTS

On the basis of the sediment lithology and deposition rate and the mollusc succession (Männil, 1961, 1964) it may be concluded that at the beginning of the Preboreal the lake level was high and algal gyttja accumulated. The lake level started to decrease in the Late Boreal. It was high in the Atlantic and low during the Subboreal, when on L. Sinijärv cape *Hypnum* peat accumulated (R. Pirrus, pers. comm.). The peat was underlaid and covered with lacustrine lime. Almost at the same time (4100—3200 BP) lacustrine lime with water mosses deposited in the deepest part of L. Sinijärv and peaty gyttja in L. Valgjärv. The lake level has been high since the mid-Subatlantic. As the lakes are fed by bottom springs, the water-level fluctuation reflects, first of all, changes in the ground-water table and, indirectly, changes in the precipitation—evaporation ratio.

ARCHAEOLOGICAL EVENTS

During the Pre-Roman Iron Age (2500—1950 BP) the climate deteriorated, becoming more continental and drier. This led to a decrease in land cultivation (Jaanits et al., 1982). On L. Sinijärv diagram the change in land use is reflected as a decrease in NAP and an increase in AP pollen (Fig. 5, first part of Ä-10 PAZ), showing that the landscape became more closed. In the Roman Iron Age, after 1800 BP, land cultivation diminished. In the Middle Iron Age (1600—1200 BP) the population density and the yields of crops increased rapidly. At that time the Äntu Punamägi stronghold was erected 5 km south from the Äntu group of lakes and it was still in use during the Late Iron Age (1200—800 BP, Jaanits et al., 1982). Agriculture made a noticeable progress. Rye, barley, wheat, oats, and flax were cultivated. This period corresponds to the uppermost herb peak, AP regression, and *Secale cereale* maximum (Fig. 5, Ä-11 PAZ). These events are also traced on the pollen diagram compiled by R. Pirrus from the cape of Äntu Sinijärv (unpublished data).

GEOLOGICAL HISTORY OF THE ÄNTU GROUP OF LAKES

After the recession of the ice from the Pandivere Upland L. Pandivere (Pa), a local ice marginal lake with levels PaI 128 m, PaIII 110 m, PaIV 90 m, was formed (Раукас et al., 1971). This large lake split up, leaving behind remnants that existed there up to the Early Holocene. The three northern Äntu lakes were also such residual lakes. They separated from one another either in the Boreal during the low water level or in the Atlantic when the area started to paludify. Since then all these three Äntu lakes have developed as isolated alkaline lakes unique in Estonia.

CONCLUSIONS

1. The Pandivere Upland was proposed as one palaeoecological type region (Saarse & Raukas, 1984). Its modern climate is continental, soils are fertile, and the degree of land cultivation is high. L. Raigastvere was selected as a reference site and therefore L. Äntu Sinijärv can serve as a secondary reference site clearing up the sedimentational peculiarities, differences in radiocarbon dates, and the vegetational and geological history of the alkalitrophic lakes of the Pandivere Upland.

2. The lakes of the Äntu group differ in the accumulation of the highly calcareous lime since the middle of the Preboreal onwards. At the beginning of the Preboreal L. Sinijärv passed the oligotrophic phase and jelly algal gyttja accumulated. The Early and Late Subatlantic deposits contain greater amounts of the organic fraction while the carbonate fraction has decreased. This can indicate to changes in the trophic stage and/or water transparency as well as lake level.

3. The L. Äntu Sinijärv pollen diagram is similar to that of L. Raigastvere, with the following differences. The *Betula* pollen frequency is high only in the Preboreal, not continuing in the Boreal as is the case in Vooremaa. *Ulmus* immigrated to the study area at the end of the Preboreal, followed by *Corylus* at the beginning of the Boreal, *Alnus* in the Late Boreal, *Tilia* and *Quercus* at the transition of the Boreal/Atlantic, and *Picea* in the Atlantic. The anthropogenic indicators are rather poor with a remarkable cultural influence traced since 1100 BP.

4. Radiocarbon dates performed from the calcareous fraction have commonly some apparent age complicate to measure. Most of the radio-

carbon dates fit well with the pollen stratigraphy and vegetational events from L. Raigastvere.

5. The lake level was considerably high at the beginning of the Preboreal, during the Atlantic, and since the middle of the Subatlantic. It was at its lowest between 4100 and 3200 BP, which coincides with the conclusions made earlier (Saarse & Harrison, 1992).

6. After the ice recession all the three northern Äntu lakes formed one large lake, whose remnants existed here up to the Atlantic (Boreal?), when the area started to paludify and the lakes separated from one another.

ACKNOWLEDGEMENTS

The authors are grateful to A. Raukas, R. Vaikmäe, and A. Miidel for critical remarks. H. Saarse and A. Rähni took part in the lake sediment corings in the field. Pollen analyses were provided by A. Sarv, radiocarbon dates from L. Valgjärv by R. Rajamäe, chemical analyses were made by L. Säga, X-ray diffractograms by K. Utsal. H. Kukk revised our English and P. Pärkma made drawings. We express our thanks to all these people.

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ÄNTU JÄRVEDE GEOLOOGIA

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On toodud andmed Äntu Sini-, Vahe- ja Valgjärve morfomeetria, põhjasetete koostise ja kujunemise kohta. On võrreldud Sinijärve ja Raigastvere järve ning Linaleo soo õietolmu tsoone ja nende vanuseid radiosüsiniku dateeringute põhjal. On järeldatud, et õietolmu tsoonid ei oma märkimisväärset «vananemise» tendentsi, nagu võiks oletada. Äntu Sinijärv on unikaalne oma erakordselt selge vee ja läbi Holotseeni kestva karbonaatsete setete kuhjumise tõttu. Äntu Sinijärv on praegu ainuke Pandivere kõrgustiku järv, mille põhjasetteid on uuritud samaaegselt lito-, bio- ja kronostratigraafiliste meetoditega, ja seda võiks kasutada Raigastvere kõrval kui sekundaarset võtmejärve.

ГЕОЛОГИЯ ГРУППЫ ОЗЕР В ЭНТУ

Лейли СААРСЕ, Арви ЛИЙВА

Приведены морфометрические показатели трех озер в Энту — Синиярв, Вахеярв и Валгъярв, а также данные об истории их развития и условиях формирования, литологии донных отложений и основных этапах развития растительности. Сравнение спорово-пыльцевых диаграмм и радиоуглеродных датировок озер Синиярв и Райгаствере, а также болота Линалео показало, что их озерные отложения не проявляют заметной тенденции к «старению». Вода в оз. Синиярв, накопителе карбонатных отложений, уникальна по своей прозрачности. Это единственное на Пандивереской возвышенности озеро, донные отложения которого изучены комплексно — лито-, био- и хроностратиграфическими методами.