

# ARCHAEOLOGICAL BACKGROUND OF ANCIENT LAKE PÄIJÄNNE AND GEOLOGICAL DATING OF THE MESO-NEOLITHIC BOUNDARY IN FINLAND

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## ABSTRACT

The elevation of the Ancient Lake Päijänne transgression maximum has been studied with the aid of 27 datable Stone Age shore-side dwelling places. The transition from the Mesolithic Stone Age to the Neolithic Stone Age and the change of the discharge channel of Ancient Päijänne from the Hinkua river to the Kymi river were almost simultaneous occurrences. The absolute age, expressed in  $C^{14}$ -years, is in the order of  $5\ 810 \pm 70$  years. The transgression niveau is supposed to be nearly linear.

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## Tasks

### *Archaeology*

The aim of this article is, by applying geological methods, to throw light on a question that has long occupied the minds of archaeologists, namely the age of the comb-ceramic culture, the phase limit S/Ka<sup>1</sup> or the boundary between the

<sup>1</sup>) S=Suomusjärvi group, Ka=comb-ceramic group.

Mesolithic and Neolithic periods of the Stone Age. In absolute chronology it has traditionally been placed at about the year 3 000 B.C. (*e.g.* Kivikoski 1961 p. 9). However, in 1926, on the basis of the gradient of the shore line, Ramsay placed the end of the Ka I 1-phase at around the year 3 450 B.C. (Ramsay 1926 p. 47). In 1955, Äyräpää suggested that the beginning of the

Ka-group, along with the Swedish Vrå-group should be shifted to the year 3 500 B.C. (Äyräpää 1955 p. 46), while Luho went a step further and, although only incidentally, expressed the idea that the phase in question might lie on the L I-shore of Sauramo (*cf.* also Virkkala 1953 p. 70); that would shift the beginning of the phase to the year 4 000 B.C. in the absolute chronology of Sauramo (Luho 1957 p. 159, *cf.* Sauramo 1955 p. 338). A fragment on an earthen vessel of the Ka I 1-style was found in the Niinikumpu bog in Kitee; on the basis of a pollen analysis the fragment was assigned by Luho to the vegetation historical zone boundary VI/VII (Luho 1957 p. 142); however, in the pollen diagrams, the zone boundaries VI/VII and VII/VIII cannot be determined with accuracy (Donner 1963 p. 8). Later, Luho placed the S/Ka boundary between the years 4 000 and 3 000 B.C. (Luho 1965 p. 54). The present author has suggested that the comb-ceramics appeared on the scene of material culture before 3 500 B.C. but he also is unable to define an earlier time limit (Siiriäinen 1969 p. 68).

### Geology

Since the dwelling places of the Stone Age fishing and hunting cultures were situated in the immediate proximity of the shoreline, they have proved to be suitable material for the study of shoreline displacement (*cf.* Siiriäinen 1969). Archaeologically, the dwelling places can be arranged in a relative order of age which enables the synchronous shorelines of the watercourses to be determined. In the case of Päijänne, this is of particular interest, because in the distance diagram of Risto Aario, the synchronous shoreline representing the highest position of Ancient Päijänne (= Päijänne before the breakthrough of the southern discharge channel) has been defined as a curved line the definition of which is in conflict with the findings of Tolvanen (Aario 1965 a, Tolvanen 1922). This matter can

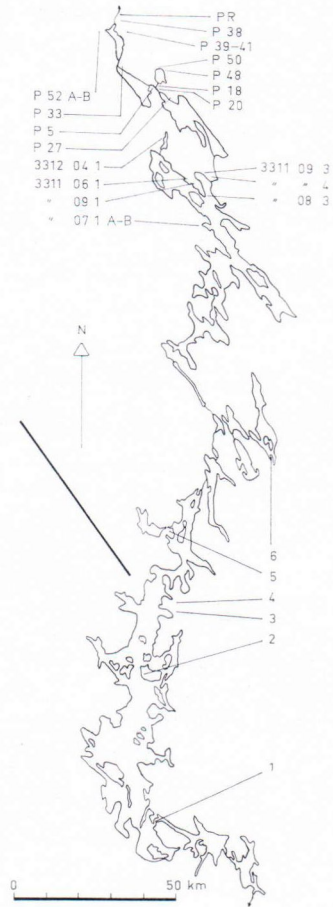


Fig. 1. Map showing the datable Stone Age dwelling places in the Ancient Päijänne basin and the direction of the base line used in the distance diagrams, Fig. 2 and 5 (according to Aario).

be tested archaeologically; in chapter III, the transgression of Ancient Päijänne is reviewed in the light of Stone Age dwelling places.

### Transgression of ancient Päijänne and Stone Age dwelling places north of the present-day Päijänne

#### Observations at Pibtipudas and Viitasaari

The distance diagram, Fig. 2, shows the following Stone Age dwelling places in the northern part of the Päijänne lake complex in which key

objects of the S-group (*cf.* Äyräpää 1950 a) or ceramics have been found. In connection with archaeological surveys at Pihtipudas (Leena Roine, 1964) and Viitasaari (Siiriäinen, 1969) it was established that these sites of discovery had been dwelling places. Excavations have been carried out at only four sites. The elevations of the others have been determined from basic maps with a scale of 1 : 20 000 on the basis of the height curves closest to the dwelling places and running below them.

Group S

- P 38 Pihtipudas Koivukangas, basic map 2343 08, coord. x = 7 052 86, y = 565 76, altitude 125 m. On a gently sloping SW-hillside; field. Datable finds: two chisels with bifacial percussion, KM 10 422 : 1 and 3.
- P 39 Pihtipudas Rimpisalo, 2343 10, x = 7 049 14, y = 570 16; 122.5 m. On a gradual western slope of a long ridge in a northsouth direction; field. A club with a funnel-shaped hole, KM 14 901 : 2.
- P 40 Pihtipudas Teini, 2343 10, x = 7 048 82, y = 569 98; 122.5 m. On the top of a low hill; field. A club with a funnel-shaped hole, KM 14 454.
- P 41 Pihtipudas Auhtola, 2343 07, x = 7 049 22, y = 569 43; 122.5 m. On the top of a low hill; field. A club with a funnel-shaped hole, KM 14 456.
- P 52 A Pihtipudas Vuohtojärvi, 2343 07, x = 7 049 77, y = 561 63; 125 m. On a southern slope south of an esker; field. Excavations by J. Ailio in 1902 (area II). Two fragments of leaf-shaped points of schist, KM 4 148 : 12. Ailio 1909 p. 144, Meinander 1964 p. 36.

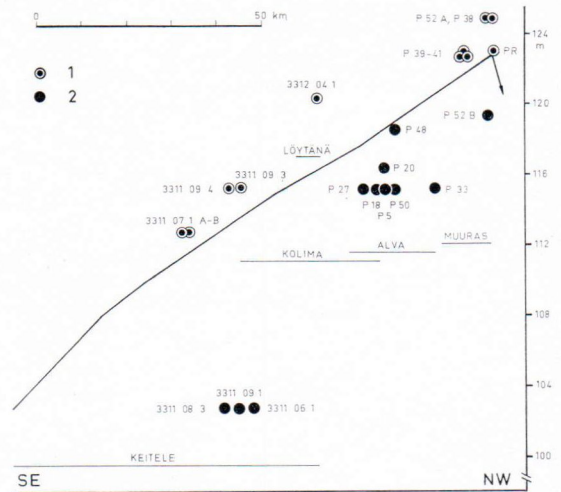


Fig. 2. Distance diagram with the transgression maximum of the northern part of Ancient Päijänne and the dwelling places of the S- and ceramic groups.

- 3311 07 1A-B Viitasaari Lamminpää, 3311 07, x = 6 987 75, y = 442 24; 112.5 m (A) 3311 07, x = 6 987 91, y = 442 32; 112.5 m. (B) A: on the top of a low till covered hill, on a gradual eastern slope; forest, B: on the NE-slope of a low morainic ridge projecting southward; field. A broken half of a club with a funnel-shaped hole, Ilmolahiti elementary school.
- 3311 09 3 Viitasaari Ruuppo, 3311 09, x = 7 003 90, y = 444 52; 115 m. On a sandy plane at the NW-foot of a steep hill, above a distinct abrasion scarp (Ancient Päijänne) that has cut into the sand; forest. An axe with bifacial percussion, KM 18 142
- 3311 09 4 Viitasaari Siirtola, 3311 09, x = 7 002 32, y = 446 59; 115 m. On a gradual sandy NW-slope of a low morainic hill, above a slightly steeper portion of the hillside; forest. A leaf-shaped point of schist, KM 13 362.

- 3312 04 1 Viitasaari Ottola,  
3312, x = 7 015 58, y = 430 90; 120—  
125 m.  
On the top and on the southern slope  
of a low esker projecting in a SE-  
direction; field.  
A hollow chisel with a curved back,  
KM 2 029 : 86.
- PR Pyhäjärvi Rajahoikka,  
2343 08, x = 7 054—55, y = 567,  
122.5 m.  
About 40 stone objects which indicate  
that the area was heavily populated  
(leaf-shaped points of schist KM  
3 354 : 66, 8 922 : 11, 12, 16, 13 846 :  
1—3; objects with bifacial percussion  
KM 5 928 : 1, 8 922 : 2, 7, 13 846 :  
6, 7; a club with a funnel-shaped hole  
KM 8 922 : 22) have been found in  
the fields of Rajahoikka farm, east  
of Lake Iso Kotajärvi, situated on a  
W-slope at the neck of ancient Hinkua  
river, 122.5—125 m above sea level.  
In 1909 Europacus (Äyräpää) dis-  
covered a dwelling place in the area.
- Ceramic group
- P 48 Pihtipudas Rönny (Rönni),  
3312 06, x = 7 037 00, y = 431 90;  
118 m.  
Finds from a large area at the mouth of  
the Kortejoki river. Excavations by  
Th. Schvindt in 1900 and J. Ailio in  
1902.  
A leaf-shaped point of schist KM  
4 146 : , an axe with bifacial per-  
cussion KM 4 146 : 4, Ka I 1- and  
Ka Sär I-ceramics KM 5 414 : 41 and  
4 146 : 3.  
Ailio 1909 p. 131, Meinander 1964 p. 30.
- P 5 Pihtipudas Madeneva,  
3312, x = 7 031, y = 426; 115 m.  
On the northern slope of the Madeharju  
esker and on the southern edge of the  
Madeneva bog, above a distinct  
abrasion scarp; forest.  
Excavations by C. F. Meinander in 1950  
and V. Luho in 1950 and 1956.
- Ka II 1- and Ka I 2-ceramics, latter  
found at an elevation of 115—120 m  
above sea level, and asbestos-ceramics,  
KM 12 520, 12 589, 13 887, 16 422.  
Meinander 1964 p. 35.
- P 18 Pihtipudas Ohtola,  
3312 03, x = 7 030 87, y = 429 14;  
115 m.  
On the SE-slope of the Putaanvirta river,  
northern shore; field.  
Excavations by V. Luho in 1968 did not  
lead to discovery of an area that had  
been inhabited.  
Ka I 2- and Ka II 1-ceramics, KM  
12 389, 12 591.
- P 20 Pihtipudas Virtala,  
3312 03, x = 7 032 07, y = 428 89;  
116.5 m.  
Excavations by Th. Schvindt in 1900 and  
J. Ailio in 1902 and 1911.  
Ka II 1- and Ka II 2-ceramics, KM  
3 938, 5 921.  
Ailio 1909 p. 141, Meinander 1964 p. 34.
- P 27 Pihtipudas Luomala,  
3312 05, x = 7 028 09, y = 432 22;  
111—115 m.  
On the gradual western slope of the Ko-  
limajärvi lake shore; yard.  
A flint flake, KM 16 659 (flint does not  
occur in Finland until the Ka II 1-  
phase).
- P 33 Pihtipudas Kokkomäki,  
2334 09, x = 7 037 63, y = 568 92; 115.  
On the SW-slope of a high esker; forest.  
Asbestos ceramics, KM 16 993 : 2, 3, 8.
- P 50 Pihtipudas Juntinniemi,  
3312 03, x = 7 037 59, y = 429 95;  
113.5—115 m.  
On a SE-hillside gently sloping to Lake  
Saani; forest.  
Ka II 1-ceramics, KM 15 459 : 1.  
Meinander 1964 p. 33.
- P 52 B Pihtipudas Vuohtojärvi,  
2343 07, x = 7 049, y = 562; 120 m.  
On the southern slope of an esker; field.  
Excavations by J. Ailio in 1902 (area III).  
Ka II 1- and Ka II 2-ceramics, KM 3 938,  
4 148.  
Ailio 1909 p. 144, Meinander 1964 p. 36.

- 3311 06 1 Viitasaari Jokela,  
3311 06, x = 7 003 34, y = 437 33;  
100—102.5 m.  
On a sloping eastern hillside at the upper  
end of the bay of Myllylahti; field.  
Ka II 1- and Ka II 2-ceramics, KM  
17 332.
- 3311 08 3 Viitasaari Mertainsaari,  
3311 08, x = 6 997 78, y = 443 50;  
100—105 m.  
On the SW-shore of a small (about 300 ×  
100 m) island; yard.  
Fragment of a Ka II 1-style earthen  
vessel, KM 11 653.
- 3311 09 1 Viitasaari Järvilinna,  
3311 09, x = 7 001 32, y = 440 27;  
100—102.5 m.  
On a sloping SW-hillside at the upper  
end of the Taimonlahti bay; field.  
Ka II 1-ceramics, KM 15 869, 17 333.

The diagram also indicates the highest position of Ancient Päijänne according to studies carried out by Tolvanen and Risto Aario, as well as the water levels of the present-day lakes Keitele, Kolima, Löytänä, Alva and Muuras. It can be seen that except for site P 48, all the dwelling places where S-group finds were made are located at the height of the transgression maximum of Ancient Päijänne whereas all the dwelling places of the ceramic group are situated below this level, 1—4 m above the present levels of the lakes.

The most ancient ceramics representative of the style phase Ka I 1 were found at dwelling place P 48; this site is the closest to the highest niveau of Ancient Päijänne which, according to Aario, is 119 m above sea level. In the small excavation area of site P 48, in addition to Ka I 1-ceramics, a fragment of an earthen vessel assignable to Ka Sär I-ceramics has been found. — It has been held that this group of ceramics belongs to the Ka II 1-phase but this conception may change (*cf.* Siiriäinen 1969 p. 57). An unpolished axe with bifacial percussion and a leaf-shaped point of schist were also found. The fact that objects such as these which, without

doubt, are of the S-group type, are represented in finds made in a dwelling place slightly below the maximum niveau of Ancient Päijänne, can be interpreted in two ways: (1) objects of the type involved were in use in central Finland as late as the early comb-ceramic period (*cf.* Äyräpää 1950 b p. 10, 12, Luho 1957 p. 153) or (2) the site was inhabited during the S-»culture» period. The latter interpretation would justify the dating of the objects at before or just after the culmination of Ancient Päijänne. The latter alternative would seem more appropriate because the objects as well as the ceramics were, according to Ailio's report, found at the same level and no evidence of the transgression could be found in the cultural stratum.

What has been stated above implies the dominance of the Stone Age S-group during the niveau representing the culmination of the transgression, *i.e.* the drying out of the northern and the breakthrough of the southern discharge channel; the Ka-phase began, however, immediately after opening of the Vuolenkoski channel. The regression that followed the opening of the discharge channel of the Vuolenkoski rapids reached the Äänekoski threshold no later than during the archaeological Ka I 2-phase (dwelling places P 5 and P 18). In other words, Lake Keitele and the lakes to the north of it had by then been formed into independent lakes.

#### *The northern outlet of Ancient Päijänne in archaeological chronology*

The geochronology of Ancient Päijänne can be correlated with archaeological chronology also in another way. The distance diagram, Fig. 3, shows those dwelling places of S- and Ka I 1-groups where investigatory excavations have been carried out. The location of the sites concerned is in the Baltic Sea basin in southern and central Ostrobothnia (as regards the construction of the diagram, reference is made to Siiriäinen 1969 p. 47). The area is the shore of continuous regression and thus even during the eustatic

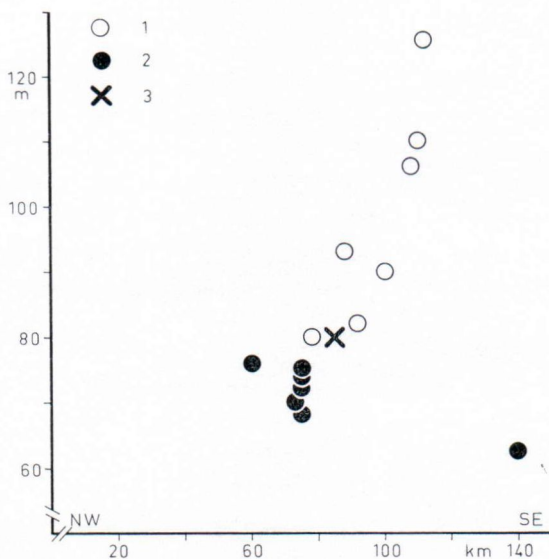


Fig. 3. Distance diagram with the dwelling places of the S- and Ka I 1-groups and the lowermost delta sediments of the Hinkua river in the Baltic Sea basin in Ostrobothnia.

transgressions, the dwelling places are in order of age from the top down. The diagram also shows the lowermost delta sediments of the Hinkua river the northern discharge channel of Ancient Päijänne, situated in the Kalajoki river valley in the commune of Haapajärvi, in Kortejärvi. These delta sediments indicate the water level of the Baltic Sea basin at the time when the Kymi river was replacing the Hinkua river as the discharge channel of Ancient Päijänne. The delta is situated at an elevation of 80–81 m above sea level (Aario 1965 a p. 78, 87) and consequently appears in the diagram in the transitional zone between groups S and Ka I 1. The gradient obtained for the tilt in the niveau of the marine stage at the period comprising the end of the Ka I 1-phase was ca. 14.5 cm/km (Siiriäinen 1969 p. 59). Being older, the gradient for the niveau corresponding to the end of the S-phase is slightly greater. If, in the diagram, dwelling place No. 7 (Kuortane Haavistonharju) is marked at a distance corresponding to the distance of the

delta formation (85 km) at the elevation concerned, its position would be 1–2 m below the delta, *i.e.* at a height of about 79 m, provided the above-mentioned gradient value is applied. Thus, the youngest dwelling place of group S is slightly younger than the last delta sediments of the Hinkua river which formed before the river bed dried out.

#### *Dating of the Meso-Neolithic boundary*

Observational data pertaining to the northern parts of the Päijänne lake complex and to Ostrobothnia respectively led to the same result: it was the S-phase of the archaeological succession that prevailed when Ancient Päijänne, after becoming independent, attained its transgressional culmination which abruptly changed into regression as masses of water in the south transgressed the Vuolenkoski threshold. The Ka I 1-phase began immediately after this geological phenomenon had occurred. It is known that, in the Baltic Sea basin the Ka I 1-phase lies at the shore of the II transgression of the Litorina Sea (*cf.* Donner 1964 p. 36, Siiriäinen 1969 p. 67); thus, in geochronology the Meso-Neolithic phase limit S/Ka can be placed between the transgression maximum of Ancient Päijänne and the II transgression of the Litorina Sea. Furthermore, it seems that in terms of time the phase limit falls very close to the transgression maximum of Ancient Päijänne. The schematic diagram, Fig. 4, shows the shoreline displacements in the Baltic Sea basin, in Keitele and Päijänne. The diagram also indicates the  $C^{14}$ -datings for the forementioned transgressions. The dating for L II was obtained in Sweden, indirectly from material pertaining to Vrå-group Stone Age dwelling places lying on the L II-shore (Florin 1963 p. 257); however, since it is indirect, the dating is not fully reliable. The dating for Ancient Päijänne, which in this connection is of greater interest because it determines the dating for the terminal phase of group S, originates from the neighbourhood of Heinola (Aario 1965

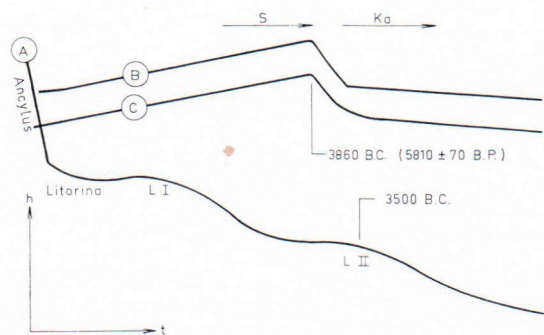


Fig. 4. Schematic diagram showing the shoreline displacements in the Baltic Sea (A), Lake Keitele (B) and Lake Päijänne (C) basins and the  $C^{14}$ -datings for the culmination stages of the Ancient Päijänne and L II-transgressions. Not to scale.

a p. 178). Since the transgression limit is synchronous in the whole of Ancient Päijänne — the lake changed its discharge channel only once — the dating (5 810 B.P.) is also valid in the north (see also Aario 1965 b p. 218). Consequently, we may conclude that the S/Ka phase-limit falls between the years 3 800 B.C. and 3 500 B.C., probably in the immediate proximity of the year 3 800 B.C. In her study on shoreline displacement along the Finnish sea coast, Okko (1967, p. 31) suggested the same approximate age of 5 800 years for the beginning of the Neolithic Stone Age.

### Ancient Päijänne and Stone Age dwelling places on the Päijänne basin

In the foregoing, it was established that in archaeological chronology the transgression maximum of Ancient Päijänne is confined within the S/Ka transition zone. On the basis of his stratigraphic investigations, Risto Aario placed the niveau concerned south of Jyväskylä, at a level considerably below the one indicated by the shore-morphological investigations carried out by Tolvanen (Tolvanen 1922). Furthermore, according to Aario, this synchronous niveau curves in such a way that its gradient becomes more gradual as the Vuolenkoski threshold is

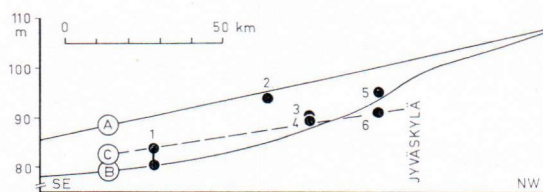


Fig. 5. Distance diagram with the transgression maximum of Ancient Päijänne in the southern part of the basin according to Tolvanen (A) and Aario (B) and the datable Stone Age dwelling places along lakes Päijänne and Kynsivesi. The broken line (C) represents the supposed tilted shoreline of Päijänne during the Ka II 2-phase.

approached (*cf.* Aario 1965 c); the curving would be caused by uneven land uplift. The niveau determined by Tolvanen is linear and, as has been mentioned, is above Aario's niveau. The differences are considerable: in Jyväskylä, 3 m, in Jämsä, 7 m, in Kuhmoinen, 9 m and at the Vuolenkoski threshold, 6.5 m. The transgression niveaus given by these investigators merge north of Jyväskylä.

In order to clarify the synchronism of the niveau given by Aario for Ancient Päijänne, the following Stone Age dwelling places located on the shores of Päijänne and Kynsivesi were marked on the diagram, Fig. 5:

#### 1. Asikkala Kotasaari,

basic map 3112 03, coord.  $x = 6\ 798\ 48$ ,  $y = 425\ 63$ ;  
altitude 81.5 m (asbestos ceramics) and 83 m (Ka II 2-ceramics)

Above a rather steep slope on the SE-shore of an island about  $400 \times 250$  m in size; field.

Excavations by A.-L. Hirviluoto and R. Holthoer in 1962 and Kauhanen in 1963.

Datable finds: Ka II 1- and Ka II 2-ceramics as well as asbestos and textile ceramics, KM 15 466, 15 789.

#### 2. Luhanka Päivärinne,

3122 02,  $x = 6\ 846\ 08$ ,  $y = 422\ 52$ ; 94 m.

On the eastern slope of a valley about 200 m wide in a north-south direction; yard.

Excavations by T. and P. Miettinen in 1966.

Ka I 1-ceramics, KM 17 130.

#### 3. Korpilahti Lähdemäki,

3211 04,  $x = 6\ 865\ 08$ ,  $y = 433\ 20$ ; 90 m.

On a gentle western slope about 100 m from the eastern shore of Virtasalmi; pasture-land.

Excavations by T. and P. Miettinen in 1965.

Ka II 1-ceramics, KM 16 358, 16 823.

4. Korpilahti Kortelahti,  
3211 04, x = 6 868 00, y = 433 66; 89.5 m.  
On a southern slope about 100 from Lake Ylisjärvi  
northern slope; forest.  
Survey by T. and P. Miettinen in 1964.  
Ka II 2-ceramics, KM 16 357.
5. Muurame Muuramenkangas,  
3212 04, x = 6 890 92, y = 430 36; 95—97 m.  
On the eastern side of the Muuramenharju esker; at the  
place of discovery the slope is very gentle; sports  
field.  
Excavations by J. Ailio in 1930.  
Ka I 1- and Ka II 1-ceramics, KM 9 318.
6. Hankasalmi Salo,  
3214 03, x = 6 950 00, y = 463 60; 90.5 m.  
On the gently sloping eastern shore of a narrow cape  
in a north-south direction, projecting into Lake  
Kynsivesi; field.  
Excavations by A. O. Heikel in 1894 and J. Ailio 1909.  
Ka II 1-, Ka II 2- and asbestos ceramics, KM 3 006,  
4 340, 5 427.  
Ailio 1909 p. 17, Luho 1966 p. 9.

It can be seen from the diagram that all the dwelling places fall below the highest stage of Tolvanen's Ancient Päijänne but, except for site 6, above the corresponding niveau given by Aario. In the terrain, the position of the dwelling places is similar to that of the waterside dwelling places. Since the cultural stratum is in sand, there is no reason for regarding them as not being confined to the shore. It would also be improbable that the dwelling places along the present-day Päijänne basin should be less strictly confined to the shore than would those farther north and along the Baltic Sea basin. The dwelling places indicate that the transgression of Päijänne extended beyond the niveau given by Aario. Dwelling place 2 which, archaeologically, is the oldest of the group (Ka I 1), falls, in its relation to Tolvanen's niveau, in the same position as dwelling place P 48 (Fig. 2), above, in its relation to the common niveau of Tolvanen and Aario.

Thus, according to archaeological observations, Aario's niveau must be regarded as metachronous. Since in the diagram, even the

dwelling places of Ka II-phase fall above the niveau, it must be at least 1300 years older north of Päijänne than in the south on the shore of the present-day Päijänne. Dwelling place 2 in the diagram, Fig. 5, indicates that the transgression of Ancient Päijänne extended to the niveau suggested by the morphological studies of Tolvanen, *i.e.* 9—10 m above the niveau given by Aario. The above-mentioned change in level will not invalidate the dating for the transgression maximum given on page 125.

The regression that followed the breakthrough of the Vuolenkoski channel was very rapid. In the northern part of Päijänne, during phase Ka I 1 the water level fell at least 4—5 m or  $\frac{1}{4}$  of its entire drainage. There are still ceramics pertaining to this phase in dwelling place 5 at Muurame, *i.e.* at an altitude of 95—97 m.

## Summary

The answer to the archaeological problem posed at the beginning of this article is that the transition from the Mesolithic Stone Age (group S) to the Neolithic Stone Age as the result of the intrusion of comb-ceramics, and the change of the discharge channel of Ancient Päijänne from the Hinkua river to the Kymi river were almost simultaneous occurrences. The absolute age, expressed in C<sup>14</sup>-years, is in the order of  $5\,810 \pm 70$  years.

The Stone Age dwelling places of the Päijänne shore appear to indicate that the transgression of Ancient Päijänne extended beyond the niveau defined by Aario; it is possible that the transgression niveau defined earlier by Tolvanen is correct. The Stone Age dwelling places in the Ancient Päijänne lake complex region are still too few to establish this matter. They are also too few in number for a final determination as to whether the transgression niveau is curved or linear. However, the material presented in this article rather suggests it is linear.



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