

**GEOLOGICAL SURVEY OF FINLAND
RADIOCARBON MEASUREMENTS VII**

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This list of measurements includes most of the geologic samples dated in this laboratory since the publication of our last list (R, 1974, v 16, p 252-268).

The age calculations are based on 95% of the isotopically corrected activity of the NBS oxalic acid standard and on a half-life of 5568 yr. The results are reported in years before 1950. Most of the samples have been corrected for deviations from the normal ¹³C/¹²C ratios ($\delta^{13}\text{C} = -25\text{‰}$ in the PDB scale). The $\delta^{13}\text{C}$ values quoted are relative to the PDB standard.

We measured the ¹⁴C activity of the CO₂ gas in proportional counters, as described by Heikkinen *et al*, 1974. Each sample was counted at least twice for a period of not less than 2400 min. When measured activity was low, alternating counting sample/background was applied to the sample.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

Finland

Marrasjärvi series, Rovaniemi, N Finland

Four samples from lowermost part of till bed underlain by sorted sediments. Humus content 0.8%, Marrasjärvi, Raumo sand pit (66° 53' N, 25° 10' E), surface alt 125m, depth 2.5m. Coll and subm May 1973 by Aulis Heikkinen and Raimo Kujansuu. The fibrous matter, which may have been of postglacial age, was picked out of samples in the lab.

Su-236. Marrasjärvi

>42,300
 $\delta^{13}\text{C} = -28.5\text{‰}$

Sample, 1430g, boiled 1 N HCl. Organic material in till analyzed (10 2-day counts).

Su-237. Marrasjärvi

>48,000
 $\delta^{13}\text{C} = -24.7\text{‰}$

Sample weight 1300g, subjected to non-chemical processing (10 2-day counts).

Su-263. Marrasjärvi

>54,000

 $\delta^{13}C = -26.5\text{‰}$

Sample weight 3290g. Humic acids analyzed. Preparation: 1 N NaOH dissolution, filtrate + HCl = humic acids (4 2-day counts).

Su-264. Marrasjärvi

26,300 ± 250

 $\delta^{13}C = -26.5\text{‰}$

Same as Su-263. Residue boiled in 1 N HCl, residue of organic material in till analyzed (4 2-day counts).

Su-265. Marrasjärvi

>49,000

 $\delta^{13}C = -28.0\text{‰}$

Sample weight 2990g. Humic acids analyzed. Preparation: 0.5 N NaOH dissolution, filtrate + HCl = humic acids (3 2-day counts).

Su-266. Marrasjärvi

>40,700

 $\delta^{13}C = -27.7\text{‰}$

Same as Su-265. Residue of organic material in till analyzed (3 2-day counts). *Comments:* 1) because ^{14}C activity in samples may be caused by contamination, estimated age of organic substances transported by glacial ice is >55,000 yr (Heikkinen, 1975). 2) according to stratigraphy, glacial flow directions and pollen content of basal till layer, the esker at Marrasjärvi was deposited during Early-Weichselian deglaciation and covered with till during Late-Weichselian glaciation (Kujansuu, 1975).

Su-289. Savukoski, N Finland

9300 ± 160

Peat and clayey silt from lower part of postglacial peat deposit, depth 1.3 to 1.45m, surface alt 219m, Sokli (67° 49' N, 29° 24' E). Coll 1972 and subm 1973 by E Ilvonen.

Su-503. Savukoski, N Finland

>16,700

Diatomaceous earth deposited in fresh water, depth 1.1 to 1.2m, surface alt 252m, Sokli (67° 48' N, 29° 20' E). Coll 1973 and subm 1975 by E Ilvonen. *Comment:* sample derives from a diatomaceous earth deposit between 2 till beds. Microfossil composition suggests that sample is interglacial in age.

Su-290. Artjärvi, S Finland

960 ± 50

 $\delta^{13}C = -28.1\text{‰}$

Gyttja clay taken with piston corer. Sample depth 0.6 to 0.7m, water depth 65m, from lake Pyhäjärvi (60° 40' N, 26° 02' E). Coll and subm 1973 by E Kukkonen and R Tynni. *Comment:* increase in *Secale* pollen in Artjärvi area. Oldest *Secale* pollen, according to annual microvarves, AD 750, at level -1.3m (Kukkonen & Tynni, 1970).

Pieni Kankaanlampi series, Kemijärvi, N Finland

Samples from various levels of waterside bog at Lake Pieni Kankaanlampi (66° 43' N, 27° 56' E), surface alt 160.5m. Coll 1972 with piston sampler and subm 1973 by E Lappalainen.

Su-292. Pieni Kankaanlampi **8940 ± 100**
 $\delta^{13}C = -34.4\text{‰}$

Ooze taken from 5.60 to 5.68m below bog surface. *Comment:* pollen analysis shows transition from *Betula* to *Pinus maximum*.

Su-293. Pieni Kankaanlampi **10,470 ± 100**
 $\delta^{13}C = -36.5\text{‰}$

Ooze, depth 6.22 to 6.29m. *Comment:* pollen analyses, *Betula maximum*.

Su-294. Pieni Kankaanlampi **11,400 ± 200**
Ooze, depth 6.32 to 6.40m. *Comment:* *Betula maximum*.

Su-300. Laukaa, Central Finland **6630 ± 110**
 $\delta^{13}C = -27.5\text{‰}$

From peat above sand, taken with piston sampler at depth 1.66 to 1.70m, surface alt 134m, Suojärvenneva bog (62° 37' N, 25° 58' E). Coll 1973 by A Leino and subm 1973 by V E Valovirta.

Su-301. Laukaa, Central Finland **8900 ± 100**
 $\delta^{13}C = -27.7\text{‰}$

From peat above sand, taken with piston sampler, depth 2.76 to 2.80m, surface alt 148.3m, Kilpisuo bog (62° 25' N, 26° 09' E). Coll 1973 by A Leino and subm 1973 by V E Valovirta.

Su-302. Äänekoski, Central Finland **8300 ± 100**
 $\delta^{13}C = -25.9\text{‰}$

From pine wood above sand, taken with piston sampler, depth 6.77 to 6.80m, surface alt 113.8m, Kaikkarsuo bog (62° 39' N, 25° 30' E). Coll 1973 by A Leino and subm 1973 by V E Valovirta.

Su-308. Äänekoski, Central Finland **7380 ± 80**
 $\delta^{13}C = -29.2\text{‰}$

Same site as Su-302, peat, depth 6.77 to 6.80m, taken with piston sampler. Coll 1973 by A Leino and subm by V E Valovirta.

Su-303. Äänekoski, Central Finland **4390 ± 60**
 $\delta^{13}C = -29.3\text{‰}$

Shore peat above silt, taken with piston sampler, depth 3.12 to 3.16m, surface alt 89m, Orissuo bog (62° 30' N, 26° 03' E). Coll 1973 by A Leino and subm 1973 by V E Valovirta.

Su-304. Äänekoski, Central Finland **8980 ± 100**
 $\delta^{13}C = -29.0\text{‰}$

Peat above silt, taken with piston sampler, depth 4.16 to 4.20m, surface alt 178.4m, Isosuo bog (62° 34' N, 25° 31' E). Coll 1973 by A Leino and subm 1973 by V E Valovirta.

Su-305. Perniö, S Finland**5960 ± 90** $\delta^{13}C = -26.5\text{‰}$

Wood and peat above gyttja (detritus) taken with piston sampler, depth 3.97 to 4m, surface alt 43m (threshold), Melassuo bog (60° 12' N, 23° 09' E). Coll 1973 by A Leino and subm 1973 by V E Valovirta.

Su-306. Perniö, S Finland**6290 ± 80** $\delta^{13}C = -29.2\text{‰}$

Peat and wood above sand, taken with piston sampler, depth 4.61 to 4.65m, surface alt 40.5m, Träskmossan bog (60° 05' N, 23° 02' E). Coll 1973 by A Leino and subm by V E Valovirta.

Su-307. Perniö, S Finland**6290 ± 60** $\delta^{13}C = -29.2\text{‰}$

Peat taken with piston sampler, depth 3.71 to 3.75m, surface alt 43.15m, Lakiassuo bog (60° 12' N, 23° 57' E). Coll 1973 by A Leino and subm by V E Valovirta.

Su-311. Sodankylä, N Finland**>55,000** $\delta^{13}C = -26.0\text{‰}$

Peat (CB) taken with piston sampler, depth 3.6 to 3.8m, surface alt 347m, Pyssyselkä (67° 53' N, 26° 08' E). Coll and subm 1973 by H Tanskanen (5 2-day counts) (Tanskanen, 1975).

Su-312. Sodankylä, N Finland**>55,000**

Same site as Su-311. Peat (CB), depth 3.8 to 4.05m. Coll and subm 1973 by H Tanskanen (4 2-day counts) (Tanskanen, 1975).

Su-313. Inari, N Finland**6370 ± 100**

Wood from peat layer between sand in erosion bank of river Ivalojoiki Törmänen (68° 36.7' N, 27° 28.6' E), surface alt 122m, depth 1.7m. Coll and subm 1973 by A T Lahtinen. *Comment* (ATL): Analysis of Su-314 was made of peat layer mentioned below. Possibly drift wood transported by flood.

Su-314. Inari, N Finland**1270 ± 90** $\delta^{13}C = -24.2\text{‰}$

Peat between sand layers in erosion bank of Ivalojoiki at village of Törmänen. Sample was taken from peat layer mentioned in Su-313 at depth of 1.65 to 1.75m. Coll and subm 1973 by A T Lahtinen. *Comment* (ATL): peat was formed when old meander channel grew into a bog, after which river action buried peat layer under ca 1.5m alluvial sand. Thickness of peat layer varies from 10 to 30cm.

Su-315. Inari, N Finland**970 ± 60** $\delta^{13}C = -24.5\text{‰}$

Peat under sand from hand-dug section, near village of Akujärvi (68° 40.9' N, 27° 39.4' E), surface alt 122m, depth 0.55 to 0.63m. Coll and subm 1973 by A T Lahtinen. *Comment* (ATL): peat layer ca 20cm

thick was formed when delta channel grew into a bog, after which it was buried under ca 0.5m sand.

Su-316. Multia, Central Finland **5060 ± 100**
 $\delta^{13}C = -26.0\%$

Subfossil hazelnuts (*Corylus avellana*) from hand-dug sec, depth 0.8 to 1.1m, village of Isojärvi, Heposuo bog (62° 20' N, 24° 57' E). Coll 1973 by L O Ervi and subm 1973 by V E Valovirta.

Su-317. Multia, Central Finland **4985 ± 100**
 $\delta^{13}C = -22.4\%$

Subfossil hazelnuts (*Corylus avellana*) from hand-dug sec of bog earth pit, depth 0.8 to 1.1m, village of Sahrajärvi, Uusi Ilomäki (62° 28' N, 25° 05' E). Coll 1973 by L O Ervi and subm 1973 by V E Valovirta.

Jukolansuo bog series, Kytäjä, S Finland

Peat, gyttja and silt samples from hand-dug sec, surface alt 121m, Jukolansuo bog (60° 35' N, 24° 36' E). Coll 1973 by A Leino and V E Valovirta and subm 1974 by V E Valovirta (cf Heikkinen 1971, p 434).

Su-377. Jukolansuo **Modern**
 $\Delta^{14}C = +43\%$
 $\delta^{13}C = -26.4\%$

Peat, depth 0.08 to 0.1m. *Comment:* pollen analysis shows end of Sub-Atlantic period and rise of *Picea*.

Su-378. Jukolansuo **110 ± 40**
 $\delta^{13}C = -25.5\%$

Peat, depth 0.18 to 0.2m. *Comment:* pollen analysis shows Sub-Atlantic period and *Picea* minimum.

Su-379. Jukolansuo **870 ± 30**
 $\delta^{13}C = -25.8\%$

Peat, depth 0.28 to 0.3m. *Comment:* pollen analysis shows Sub-Atlantic period and *Picea* minimum.

Su-380. Jukolansuo **1330 ± 50**
 $\delta^{13}C = -26.1\%$

Peat, depth 0.38 to 0.4m. *Comment:* pollen analysis shows Sub-Atlantic period.

Su-381. Jukolansuo **2050 ± 40**
 $\delta^{13}C = -25.8\%$

Peat, depth 0.48 to 0.5m. *Comment:* pollen analysis shows Sub-Atlantic period.

Su-382. Jukolansuo **2740 ± 40**
 $\delta^{13}C = -26.7\%$

Peat, depth 0.58 to 0.6m. *Comment:* pollen analysis shows rise of *Picea* pollen and transition from Sub-Boreal to Sub-Atlantic period.

- Su-383. Jukolansuo** **5250 ± 50**
 $\delta^{13}C = -26.7\text{‰}$
Peat, depth 0.68 to 0.7m. *Comment:* pollen analysis shows end of Atlantic period.
- Su-384. Jukolansuo** **6520 ± 100**
 $\delta^{13}C = -26.7\text{‰}$
Wood peat, depth 0.78 to 0.8m. *Comment:* pollen analysis shows Atlantic period.
- Su-385. Jukolansuo** **6740 ± 40**
 $\delta^{13}C = -27.3\text{‰}$
Wood peat, depth 0.88 to 0.9m. *Comment:* pollen analysis shows Atlantic period.
- Su-386. Jukolansuo** **7090 ± 90**
 $\delta^{13}C = -27.0\text{‰}$
Wood peat, depth 0.98 to 1m. *Comment:* pollen analysis shows Atlantic period.
- Su-387. Jukolansuo** **7460 ± 80**
Peat, depth 1.08 to 1.1m. *Comment:* pollen analysis shows Atlantic period.
- Su-388. Jukolansuo** **7900 ± 100**
Peat, depth 1.18 to 1.2m. *Comment:* pollen analysis shows end of Boreal period.
- Su-389. Jukolansuo** **8410 ± 80**
Peat, depth 1.28 to 1.3m. *Comment:* pollen analysis shows transition from Pre-Boreal to Boreal period.
- Su-390. Jukolansuo** **8640 ± 90**
Gyttja (detritus), depth 1.38 to 1.4m. *Comment:* pollen analysis shows Pre-Boreal period.
- Su-391. Jukolansuo** **8890 ± 160**
Gyttja (detritus), depth 1.48 to 1.5m. *Comment:* pollen analysis shows Pre-Boreal period.
- Su-392. Jukolansuo** **9490 ± 140**
Gyttja silt, depth 1.58 to 1.6m. *Comment:* pollen analysis shows Pre-Boreal period.
- Su-393. Lammi, S Finland** **8810 ± 100**
Clay gyttja with moss remnants (mostly *Drepanocladus fluitans*), "Silmisuo" (NW part of Kaurastensuo bog) (61° 02' N, 24° 59' E), surface alt 152m, depth 5.78 to 5.82m. Coll 1973 and subm 1974 by K Tolonen. *Comment (KT):* according to pollen, diatom and cladoceran

analyses sample represents the 1st organic sedimentation after deglaciation. If result is compared with Su-394 and with the standard pollen diagrams by Tolonen & Ruuhijärvi (1976), age seems to be ca 1000 yr "too young".

Su-394. Lammi, S Finland **9040 ± 80**

Same site as Su-393. Gyttja (detritus) at depth 5.67 to 5.68m. Coll 1973 and subm 1974 by K Tolonen. *Comment*: sample represents transition *Betula/Pinus* in Lammi area. Result consistent with radiocarbon chronology of pollen zones in Lammi area (Tolonen & Ruuhijärvi, 1976).

Su-395. Vaala, N Finland **8120 ± 80**

Peat (BC) overlying gyttja (detritus), depth 3.85 to 3.9m, surface alt 122.5m, Oulujärvi (64° 27' N, 27° 10' E). Coll 1974 with piston sampler and subm 1974 by J Häikiö. *Comment*: pollen analysis shows transition from Boreal to Atlantic period.

Bastuberg series, Porvoo, S Finland

Peat and gyttja, taken with piston sampler, Bastuberg bog (60° 21' N, 25° 47' E), surface alt 28.5m. Coll 1974 by A Leino and V E Valovirta and subm 1975 by V E Valovirta.

Su-474. Bastuberg, Core A **120 ± 120**
 $\delta^{13}C = -25.0\%$

Peat (LSC), depth 0.2 to 0.24m.

Su-475. Bastuberg, Core A **1160 ± 60**
 $\delta^{13}C = -26.5\%$

Peat (LSC), depth 0.4 to 0.44m.

Su-476. Bastuberg, Core A **5180 ± 65**

Peat (LSC), depth 0.8 to 0.84m. *Comment*: pollen analysis shows Atlantic period.

Su-477. Bastuberg, Core A **5890 ± 70**

Gyttja (detritus), depth 1 to 1.04m. *Comment*: pollen analysis shows Atlantic period.

Su-478. Bastuberg, Core A **7440 ± 90**

Gyttja (detritus), depth 1.45 to 1.49m. *Comment*: pollen analysis shows beginning of Atlantic period.

Su-479. Bastuberg, Core A **7850 ± 90**

Gyttja (detritus), depth 1.96 to 2m. *Comment*: pollen analysis shows beginning of Atlantic period.

Su-480. Bastuberg, Core A **8480 ± 100**

Gyttja (detritus), depth 2.2 to 2.25m. *Comment*: pollen analysis shows Boreal period.

Su-481. Bastuberg, Core A **9150 ± 200**

Gyttja (detritus), depth 2.4 to 2.45m. *Comment:* pollen analysis shows Pre-Boreal period.

Su-482. Bastuberg, Core B **Modern**

Peat (S), depth 0.18 to 0.22m.

$$\delta^{14}\text{C} = -2 \pm 6\text{‰}$$

Su-483. Bastuberg, Core B **220 ± 30**

Peat (S), depth 0.38 to 0.42m.

$$\delta^{13}\text{C} = -26.2\text{‰}$$

Su-484. Bastuberg, Core B **3650 ± 80**

Peat (LS), depth 0.78 to 0.82m. *Comment:* pollen analysis shows Sub-Boreal period.

$$\delta^{13}\text{C} = -26.6\text{‰}$$

Su-485. Bastuberg, Core B **5350 ± 100**

Peat (LS), depth 0.98 to 1.02m. *Comment:* pollen analysis shows transition from Atlantic to Sub-Boreal period.

Kerkkolankangas series, Jämsänkoski, Central Finland

Till samples containing organic matter from gravel pit at Kerkkolankangas (61° 55' N, 25° 09' E). Till bed is in proximal part of a marginal formation, between glaciofluvial deposits, at depth ca 6 to 7m. Surface alt 140m. Coll 1974 with spade by T Ruohomäki and M Putkinen and subm 1975 by P Lahermo and H Rainio (Rainio & Lahermo, 1976).

Su-492. Kerkkolankangas B **>45,000**

Sample from middle layer of 3-layer till bed. *Comment:* analysis based on humic acids, sample 9kg, 0.5N NaOH leach, HCl precipitation (2 2-day counts).

Su-504. Kerkkolankangas B **>45,000**

Same site as Su-492. *Comment:* analysis from 3kg till without chemical treatment (2 2-day counts).

Su-493. Kerkkolankangas C **>37,000**

Sample from lowermost layer of 3-layer till bed. *Comment:* analysis based on humic acids, sample 19.2kg (2 2-day counts).

Honkalanmäki series, Kuru, Central Finland

Till samples containing organic matter from road-cut at Honkalanmäki (61° 45' N, 26° 36' E) from basal till on lee side of rock hummock overlain by sand, silt and till 4m thick. Surface alt 120m. Coll 1974 with spade by T Ruohomäki and M Putkinen and subm 1975 by P Lahermo and H Rainio (Rainio & Lahermo, 1976).

Su-494. Honkalanmäki B >**37,000**

Sample from topmost layer of 3-layer till bed. *Comment:* analysis from humic acids, sample 18.6kg, 0.5N NaOH leach, HCl precipitation (2 2-day counts).

Su-495. Honkalanmäki C >**45,000**

Sample from middle layer of 3-layer till bed. *Comment:* analysis from humic acids, sample 18kg (2 2-day counts).

Osuuspankki series, Kuopio, Central Finland

Samples from ancient bog covered by sand deposits, from foundation pit excavated for Osuuspankki bldg (62° 53.5' N, 27° 41' E). Coll 1975 by L. Timgren and subm 1975 by V E Valovirta (Kotilainen, 1953).

Su-496. Osuuspankki, Sample 1 **7760 ± 100**

Peat from lowermost part of peat, 0.4m thick, between 2 sand beds, depth 3.1m, surface alt 95.6m.

Su-497. Osuuspankki, Sample 3 **8170 ± 100**

Wood, same site as Su-496.

Su-498. Osuuspankki, Sample 4 **700 ± 100**

Mud and peat, depth 1m, surface alt 97.7m.

Kurujoki series, Sodankylä, N Finland

Samples from various levels of till deposit covered by postglacial peat bog near Kurujoki brook (67° 58' N, 27° 18' E), surface alt 244m. Coll with piston sampler (and jackhammer piston sampler) 1975 by E Magga and subm 1975 by R Kujansuu and S Leskelä.

Su-507. Kurujoki **9060 ± 100**

Peat from bottom of postglacial peat layer at depth of 1.45 to 1.52m.

Su-508. Kurujoki >**50,000**

Peat layer sandwiched in flood-plain sediments overlain by till and postglacial peat, depth 4.3 to 4.5m (Hirvas *et al*, 1976) (5 2-day counts).

Su-509. Kurujoki >**50,000**

Peat layer sandwiched in flood-plain sediments overlain by till and postglacial peat, depth 6.86 to 7.78m (Hirvas *et al*, 1976) (3 2-day counts).

Su-510. Kittilä, N Finland >**50,000**

Peat overlain by till, depth 5.93 to 6.50m, surface alt ca 200m, Naakenavaara (67° 42' N, 24° 7.1' E). Coll 1975 with jackhammer piston sampler by E Magga and subm 1975 by R Kujansuu and S Leskelä (4 2-day counts).

Su-511. Sodankylä, N Finland **7140 ± 120**

Peat from bottom of postglacial peat layer, depth 2.7 to 2.9m, surface alt ca 208m, Ilmakkiselkä (67° 43' N, 26° 38' E). Coll 1975 with jack-

hammer piston sampler by E Magga and subm 1975 by R Kujansuu and S Leskelä.

Su-512. Sodankylä, N Finland **9130 ± 150**

Peat from bottom of postglacial peat layer, depth 3.8 to 4.02m, surface alt ca 207m, Postoaapa (67° 38.5' N, 26° 36.4 E). Coll 1975 with piston sampler by E Magga and subm 1975 by R Kujansuu and S Leskelä.

Su-513. Sodankylä, N Finland **>50,000**

Same site as Su-512. Gyttja overlain by till deposits, depth 6 to 6.5m. Coll with jackhammer piston sampler by E Magga and subm 1975 by R Kujansuu and S Leskelä (4 2-day counts).

Su-514. Kristiinankaupunki, W Finland **520 ± 50**

Till-covered silty sand with root remnants in gravel pit, depth 1.5m, surface alt 57m, Risåsen (62° 12.5' N, 21° 38' E). Coll and subm 1975 by J Niemelä and R Tynni.

Mieslahti series, Paltamo, E Finland

Samples from various levels in bog near Mieslahti (64° 22' N, 28° 00' E), surface alt 122.5m. Coll 1975 with piston sampler and subm 1975 by J Häikiö.

Su-515. Mieslahti **3750 ± 100**

Peat (EqC) from immediately below silty gyttja, depth 4.05 to 4.1m. Bog was flooded by water of Lake Oulujärvi.

Su-516. Mieslahti **6430 ± 60**

Peat (EqSC) overlying silty gyttja, depth 5.4 to 5.5m. *Comment:* end of flood or transgression that caused silt layer.

Su-517. Mieslahti **8000 ± 100**

Peat (EqC) mixed with detritus underlying gyttja and silt, depth 6 to 6.1m. *Comment:* pollen analysis shows transition from Boreal to Atlantic period.

Su-541. Kristiinankaupunki, W Finland **>37,000**

Sand containing charcoal in gravel pit, depth 1.5m, surface alt 57m, Risåsen (62° 12.5' N, 21° 38' E). Coll 1975 by R Tynni and K Hokkanen and subm 1975 by J Niemelä and R Tynni (1975). *Comment:* stratigraphic and microfossil determinations indicate that carboniferous layer was deposited during previous interstadial or interglacial period. Cf Su-573 (2 2-day counts).

Su-573. Kristiinankaupunki, W Finland **>50,000**

Till-covered esker, charcoal in sand in gravel pit, depth 3m, surface alt 45m, Risåsen (62° 13' N, 21° 37.8' E), 600m N from site of Su-541. Coll by R Tynni and K Hokkanen and subm 1975 by J Niemelä and R Tynni (4 2-day counts).

Su-542. Vaala, N Finland **300 ± 30**

Stump, exposed from below a beach ridge, surface alt 122.5m, Kuostonsaari (64° 27' N, 27° 10' E). Coll and subm 1975 by J Häikiö.

Sammaljoensuu bog series, Ylitornio, N Finland

Samples from various sites and levels in Sammaljoensuu bog (66° 26' N, 23° 51' E), surface alt 105m. Coll 1975 with piston sampler by P Lahermo and V E Valovirta (Lahermo *et al*, 1977).

Su-543. Sammaljoensuu, C-D, 105m **6230 ± 60**

Wood, depth 3.72 to 3.83m. *Comment*: dates beginning of paludification.

Su-544. Sammaljoensuu, C-D, 205m **6830 ± 120**

Peat (LSB), depth 4.2 to 4.24 m. *Comment*: dates beginning of paludification.

Su-545. Sammaljoensuu, A-B, 105m **7150 ± 50**

Peat (LSB), depth 4.35 to 4.41m. *Comment*: pollen analysis shows beginning of Atlantic period.

Su-546. Sammaljoensuu, A-B, 105m **7900 ± 150**

Peat (LSB), depth 4.58 to 4.64m. *Comment*: pollen analysis shows Boreal period.

Värhtiövaara series, Kittilä, N Finland

Samples from various sites and levels in Värhtiövaara bog (67° 33' N, 25° 45' E), surface alt 214m. Coll 1975 with piston sampler by P Lahermo, A Leino and M Putkinen and subm 1975 by P Lahermo and V E Valovirta (Lahermo *et al*, 1977).

Su-547. Värhtiövaara, A-B, 0m **4660 ± 40**

Peat (BSC), depth 0.95 to 1m. *Comment*: pollen analysis shows Sub-Boreal period.

Su-548. Värhtiövaara, A-B, 7m **8810 ± 50**

Peat (BSC), depth 1.9 to 1.95m. *Comment*: pollen analysis shows Pre-Boreal period.

Säynäjärvi series, Kittilä, N Finland

Samples from various sites and levels in Säynäjärvi bog (67° 21' N, 25° 24' E), surface alt 215m. Coll 1975 with piston sampler by P Lahermo, A Leino and M Putkinen and subm 1975 by P Lahermo and V E Valovirta (Lahermo *et al*, 1977).

Su-549. Säynäjärvi, A-B, 20m **4530 ± 40**

Peat (BS), depth 1.95 to 2m. *Comment*: pollen analysis shows Atlantic period.

Su-550. Säynäjärvi, A, 32m 7920 ± 70

Peat (BS), depth 2.76 to 2.8m. *Comment:* pollen analysis shows beginning of Atlantic period.

Tuorenaakiselkä series, Sodankylä, N Finland

Samples from various levels and sites in Tuorenaakiselkä bog (67° 46' N, 25° 58' E), surface alt 296m. Coll 1975 with piston sampler by P Lahermo, A Leino and M Putkinen and subm 1975 by P Lahermo and V E Valovirta (Lahermo *et al*, 1977).

Su-551. Tuorenaakiselkä, A-B, 10m 8640 ± 120

Peat (LSB), depth 2.06 to 2.11m. *Comment:* pollen analysis shows Pre-Boreal period.

Su-552. Tuorenaakiselkä, C-D, 14m 7910 ± 60

Peat (LSB), depth 1.95 to 2m. *Comment:* pollen analysis shows beginning of Atlantic period.

Su-553. Tuorenaakiselkä, C-D, 29m 8790 ± 70

Peat (CB), depth 2.76 to 2.8m. *Comment:* pollen analysis shows Pre-Boreal period.

Hattuvaara series, Suomussalmi, E Finland

Samples from various levels of Hattuvaara bog (65° 06' N, 28° 39' E), surface alt 262m. Coll 1975 with piston sampler by A Leino and subm 1975 by V E Valovirta.

Su-556. Hattuvaara 160 ± 50

Peat (S), depth 0.2 to 0.23m. *Comment:* pollen analysis shows Sub-Atlantic period.

Su-557. Hattuvaara 1990 ± 90

Peat (ErS), depth 0.4 to 0.43m. *Comment:* pollen analysis shows Sub-Boreal period.

Su-558. Hattuvaara 3640 ± 60

Peat (ErS), depth 0.6 to 0.63m. *Comment:* pollen analysis shows Sub-Boreal period.

Su-559. Hattuvaara 4710 ± 30

Peat (CS), depth 0.8 to 0.83m. *Comment:* rise of *Picea* pollen curve starts at this level.

Su-560. Hattuvaara 5950 ± 50

Peat (CS), depth 1 to 1.03m. *Comment:* pollen analysis shows transition from Atlantic to Sub-Boreal period.

Su-561. Hattuvaara 6830 ± 70

Peat (SC), depth 1.2 to 1.23m. *Comment:* pollen analysis shows Atlantic period.

- Su-562. Hattuvaara** **6920 ± 90**
Peat (SC), depth 1.4 to 1.43m. *Comment:* pollen analysis shows Atlantic period.
- Su-563. Hattuvaara** **7010 ± 110**
Peat (SC), depth 1.6 to 1.63m. *Comment:* pollen analysis shows Atlantic period.
- Su-564. Hattuvaara** **7210 ± 80**
Peat (SC), depth 1.7 to 1.72m. *Comment:* pollen analysis shows Atlantic period.
- Su-565. Hattuvaara** **7590 ± 90**
Peat (SC), depth 1.8 to 1.82m. *Comment:* pollen analysis shows transition from Boreal to Atlantic period.
- Su-566. Hattuvaara** **7900 ± 50**
Peat (BC), depth 1.89 to 1.92m. *Comment:* pollen analysis shows end of Boreal period.
- Su-567. Hattuvaara** **8040 ± 80**
Peat (EqC), depth 1.94 to 1.97m. *Comment:* pollen analysis shows Boreal period.
- Su-568. Hattuvaara** **8380 ± 90**
Gyttja, depth 2.02 to 2.05m. *Comment:* pollen analysis shows Boreal period.
- Su-569. Hattuvaara** **8790 ± 90**
Gyttja, depth 2.1 to 2.13m. *Comment:* pollen analysis shows beginning of Boreal period.
- Su-570. Hattuvaara** **8810 ± 150**
Gyttja, depth 2.18 to 2.21m. *Comment:* pollen analysis shows transition from Pre-Boreal to Boreal period.
- Su-571. Hattuvaara** **8830 ± 140**
Gyttja, depth 2.26 to 2.27m. *Comment:* pollen analysis shows end of Pre-Boreal period.
- Su-572. Kuopio, Central Finland** **6250 ± 100**
Wood and peat sample from peat layer in sand, Savilahti (62° 54.5' N, 27° 37.8' E), surface alt 90m, depth 3m. Coll 1975 by H Rainio and T Ruohomäki and subm 1975 by H Rainio.
- Su-574. Bothnian Sea** **6600 ± 180**
Gyttja-banded clay, Bothnian Sea (61° 40' N, 20° 50' E), depth ca 3m, water depth ca 85m, sample taken 0 to 5cm above Litorina/Ancylus boundary. Coll 1974 with piston corer by E Kukkonen and subm 1975 by H Ignatius. *Comment:* sample subjected to non-chemical processing.

Su-575. Bothnian Sea 8470 ± 100

Homogeneous clay containing some organic matter, same site as Su-574, sample taken 0 to 10cm below Litorina/Ancylus boundary. Coll 1974 with piston corer by E Kukkonen and subm 1975 by H Ignatius. *Comment*: sample subjected to non-chemical processing.

II. ARCHAEOLOGIC SAMPLES

*Finland**Early agricultural history in SW Finland***Su-428. Tenhola, SW Finland 1240 ± 50**

Dark humus-rich gyttja clay, Bonästräsket (60° 03' N, 23° 22' E), surface alt 1m, depth 1 to 1.05m, water depth ca 10m. Coll 1974 by K Tolonen and A Siiriäinen and subm 1974 by K Tolonen. *Comment*: according to land-uplift chronology from diatoms, horizon would date to ca AD 1400, *ie*, radiocarbon age is ca 700 yr "too old". Old fossil organic carbon in sediment obviously originates from "field erosion" in catchment area of basin owing to beginning of intensive rye cultivation (Tolonen & Ruuhijärvi, 1976; Tolonen, Siiriäinen & Hirviluoto, 1977).

Läppträsket series, Karjaa, SW Finland

Samples from various sites and levels, Lake Läppträsket (60° 03' N, 23° 44' E), surface alt 5.2m. Coll 1974 by A Siiriäinen and K Tolonen and subm 1974 by K Tolonen.

General Comment: results from Läppträsket cores agree with each other and with land-uplift chronology as well as with corresponding dates obtained from Espoo area (Tolonen *et al*, 1975a;b).

Su-429. Läppträsket, Core A 2240 ± 90

Fine detritus gyttja, depth 2.55 to 2.65m. *Comment*: horizon represents 1st occurrence of rye in pollen diagram (Tolonen & Ruuhijärvi, 1976; Tolonen, Siiriäinen & Hirviluoto, 1977).

Su-430. Läppträsket, Core A 940 ± 100

Dark coarse detritus gyttja from 1.8 to 1.85m. *Comment*: start of "upper occurrence" of wheat and rye (*op cit*, above).

Su-432. Läppträsket, Core D 2380 ± 70

Dark organic gyttja clay from 2.45 to 2.55m. *Comment*: 1st occurrence of rye in pollen diagram at end of brackish water stage (*op cit*, above).

Su-433. Läppträsket, Core D 1030 ± 50

Dark coarse detritus gyttja from 1.85 to 1.95m. *Comment*: upper occurrence of cereals after gap ca AD 600 to 900. Result agrees with history of settlement (*op cit*, above).

Su-434. Vöyri, SW Finland 990 ± 90

Sphagnum fuscum peat from hand-dug sec from raised bog Lintunemossen (63° 07' 30" N, 22° 10' E), surface alt 17.5m, depth 0.8 to 0.82m. Coll 1973 by A Siiriäinen and K Tolonen and subm 1974 by K Tolonen. *Comment*: "upper occurrence" of cultural pollen grains and cereals. Age agrees with growth-rate curve of bog obtained by means of isolation niveau at depth 1.6m, ca 1800 BP, dating Hel-705: 750 ± 100 BP, at depth 0.6 to 0.63m, and natural bog surface (*op cit, above*).

Su-435. Laitila "II", SW Finland 1210 ± 50

Forest peat from hand-dug sec from raised bog Isorahka (60° 54' N, 21° 38' E), surface alt 15m, depth from 1.61 to 1.71m. Coll 1973 and subm 1974 by K Tolonen. *Comment*: date agrees with other dates from same profile as well as those from beginning of rye pollen curve in latter half of Iron age in Laitila area (*op cit, above*).

Su-436. Laitila "II", SW Finland 1780 ± 70

Forest peat from same place as Su-435, depth from 2.4 to 2.49m. *Comment*: date agrees with land uplift chronology as well as with other dates from beginning of cerealia curve in Early Roman Iron age in Laitila area (*op cit, above*).

Su-437. Laitila "IX", SW Finland 2310 ± 50

Gyttja from isolation niveau in basin of raised bog Pärkönsuo (60° 51' N, 21° 40' E), surface alt 12.5m, depth from 1.9 to 2m. Coll 1973 with large peat sampler made in USSR and subm 1974 by K Tolonen. *Comment*: 1st cerealia pollen grains occur in dated horizon, age is ca 400 to 500 yr "too old" when compared with land-uplift chronology based on diatoms (*op cit, above*).

Turkey

Su-295. Kozlu, Erbaa 4750 ± 30
 $\delta^{13}C = -23.6\text{‰}$

Wood, Kozlu (40° 36' N, 36° 25' E), from depth 6m in hand-dug pit; coll May 1973 by E P Kuijpers and subm 1973 by J Huhta (Giles & Kuijpers, 1974).

III. PALEOZOOLOGIC SAMPLES

Su-554. Isojoki, SW Finland 5720 ± 50

Wood with clear marks of gnawing by beaver (*Castor fiber* L), from bog Todiston neva (62° 02' N, 21° 52' E), surface alt 79m, depth 1.5m. Museum sample. Subm 1975 by E Lappalainen (Lappalainen & Lahti, 1972; 1973).

Su-555. Kirkkonummi, S Finland 2510 ± 30

Wood, sent to Zool Mus of Helsinki. Sample bears possible gnawing marks by beaver. Subm 1975 by E Lappalainen.

IV. GEOCHEMICAL SAMPLES

Leaves from birch trees and annual plants from Pitkälampi bog (60° 43' N, 24° 12' E), Loppi, S Finland, alt +110m. Samples grew on paludifying shore of oligotrophic pond. They were cleaned and washed with distilled water; coll July 1973, Aug 1974, and June 1975 by Aulis Heikkinen (Heikkinen *et al.*, 1974).

Su-296. Loppi, 1-1973	$\delta^{14}\text{C} = +472 \pm 9\text{‰}$ $\Delta^{14}\text{C} = +463 \pm 9\text{‰}$ $\delta^{13}\text{C} = -21.8\text{‰}$
Leaves (<i>Carex lasiocarpa</i>), coll July 5, 1973.	
Su-297. Loppi, 2-1973	$\delta^{14}\text{C} = +464 \pm 5\text{‰}$ $\Delta^{14}\text{C} = +453 \pm 5\text{‰}$ $\delta^{13}\text{C} = -21.3\text{‰}$
Leaves (<i>Carex vesicaria</i>), coll July 5, 1973.	
Su-298. Loppi, 3-1973	$\delta^{14}\text{C} = +472 \pm 5\text{‰}$ $\Delta^{14}\text{C} = +460 \pm 5\text{‰}$ $\delta^{13}\text{C} = -20.9\text{‰}$
Leaves (<i>Phragmites communis</i>), coll July 4, 1973.	
Su-299. Loppi, 4-1973	$\delta^{14}\text{C} = +455 \pm 4\text{‰}$ $\Delta^{14}\text{C} = +454 \pm 4\text{‰}$ $\delta^{13}\text{C} = -24.4\text{‰}$
Leaves (<i>Betula odorata</i>), coll July 4, 1973.	
Su-438. Loppi, 1-1974	$\delta^{14}\text{C} = +417 \pm 5\text{‰}$ $\Delta^{14}\text{C} = +419 \pm 5\text{‰}$ $\delta^{13}\text{C} = -27.2\text{‰}$
Leaves (<i>Carex lasiocarpa</i>), coll Aug 10, 1974.	
Su-439. Loppi, 2-1974	$\delta^{14}\text{C} = +423 \pm 5\text{‰}$ $\Delta^{14}\text{C} = +426 \pm 5\text{‰}$ $\delta^{13}\text{C} = -28.4\text{‰}$
Leaves (<i>Carex vesicaria</i>), coll Aug 10, 1974.	
Su-440. Loppi, 3-1974	$\delta^{14}\text{C} = +429 \pm 3\text{‰}$ $\Delta^{14}\text{C} = +429 \pm 3\text{‰}$ $\delta^{13}\text{C} = -25.0\text{‰}$
Leaves (<i>Phragmites communis</i>), coll Aug 10, 1974.	
Su-441. Loppi, 4-1974	$\delta^{14}\text{C} = +422 \pm 2\text{‰}$ $\Delta^{14}\text{C} = +426 \pm 2\text{‰}$ $\delta^{13}\text{C} = -28.8\text{‰}$
Leaves (<i>Betula odorata</i>), coll Aug 10, 1974.	
Su-518. Loppi, 1-1975	$\delta^{14}\text{C} = +403 \pm 12\text{‰}$ $\Delta^{14}\text{C} = +404 \pm 12\text{‰}$ $\delta^{15}\text{C} = -26.7\text{‰}$
Leaves (<i>Carex lasiocarpa</i>), coll July 10, 1975.	
Su-519. Loppi, 2-1975	$\delta^{14}\text{C} = +422 \pm 10\text{‰}$ $\Delta^{14}\text{C} = +425 \pm 10\text{‰}$ $\delta^{13}\text{C} = -28.2\text{‰}$
Leaves (<i>Carex vesicaria</i>), coll July 10, 1975.	

Su-520. Loppi, 3-1975

$$\delta^{14}\text{C} = +417 \pm 8\%$$

$$\Delta^{14}\text{C} = +417 \pm 8\%$$

$$\delta^{13}\text{C} = -25.3\%$$

Leaves (*Phragmites communis*), coll July 10, 1975.

Su-521. Loppi, 4-1975

$$\delta^{14}\text{C} = +398 \pm 5\%$$

$$\Delta^{14}\text{C} = +400 \pm 5\%$$

$$\delta^{13}\text{C} = -27.4\%$$

Leaves (*Betula odorata*), coll July 10, 1975.

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