

**UPPSALA  
NATURAL RADIOCARBON MEASUREMENTS VII**

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The following list covers some old measurements not included in previous lists and most of the samples measured at the Uppsala C<sup>14</sup> laboratory since the last list (Uppsala V) except for all of the samples utilized for determining the increase of the C<sup>14</sup>/C<sup>12</sup> ratio due to explosion of nuclear devices, and except for more than twenty samples measured for testing, storing, and pretreatment of Foraminifera.

The technique used is mainly the same as previously described by Olsson (1958) and the pretreatment is mainly that which has been used earlier (Uppsala IV). In spring 1966 a washing bottle with chromic acid (saturated CrO<sub>3</sub> in conc. H<sub>2</sub>SO<sub>4</sub>) was included in the combustion line. Due to the high C<sup>14</sup> activity of the troposphere during the summer 1965 in part of Sweden extra precautions are taken to avoid contamination. The pH of the samples is less than 3 when they are put in the oven to be dried. The combustion is done shortly after the pretreatment is completed. The fraction used for shell samples is given in percent as a mean value. Since the shell fragments usually are different in size the fraction used of individual shells might vary within one sample.

The reference sample is 95% of the activity of the NBS oxalic-acid standard. Any corrections for apparent water ages are thus not included here, but will be discussed in the later papers dealing with the samples. Corrections for deviations from the normal C<sup>13</sup>/C<sup>12</sup> ratio (−25.0‰ in the PDB scale) are applied for the unknown samples. Our five oxalic-acid samples have not shown any significant difference in their C<sup>13</sup> content. The value for oxalic-acid 1, −18.97‰, agrees with the value to which the activity of oxalic-acid should be standardized.

The value 5570 yr has been used for the half-life of C<sup>14</sup>. Results are expressed before 1950 (B.P.). Errors include the standard deviation ( $\sigma$ ) of the counted particles and errors in the corrections due to the C<sup>13</sup> content, filling pressure, temperature, working voltage, barometric pressure etc. as described by Olsson (1965, 1966). When the measured activity is lower than zero, 2 $\sigma$  has been used for calculation of the minimum age. When it is between zero and 2 $\sigma$ , the net activity + 2 $\sigma$  has been used for calculation of the minimum age.

Several samples had to be diluted with CO<sub>2</sub> from an old source to bring them to normal working pressure of the counters. This pressure has been about 3 atm for samples with numbers lower than U-1000, and about 2 atm for samples with numbers from U-2000. Two counters have

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been used for these samples. A third counter has been used at varying pressure and the corresponding measurements have numbers between U-1000 and U-1400.

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#### SAMPLE DESCRIPTIONS

##### I. GEOLOGIC SAMPLES

##### A. South hemisphere

##### Sealevel changes, S hemisphere series

Sapropelitic mud from Core 122 (07° 30' S Lat, 113° 38' E Long), Java Sea, depth in sea 68 m. Sample dating last transgression from salt to brackish water. Coll. 1948 by Swedish *Albatross* Expedition (Pettersson); subm. by Eric Olausson, Oceanografiska Inst., Göteborg, Sweden.

	<b>12,900 ± 300</b>
<b>U-556. Core 122, 694 to 700 cm</b>	<b>10,900 B.C.</b>
Core 122, 694 to 700 cm. <i>Comment:</i> diluted. $\delta C^{13} = -9.6\%$ .	

	<b>13,550 ± 330</b>
<b>U-557. Core 122, 701.5 to 710 cm</b>	<b>11,600 B.C.</b>
Core 122, depth 701.5 to 710 cm. <i>Comment:</i> diluted. $\delta C^{13} = -11.1\%$ .	

##### B. Mediterranean and Red Sea Area

	<b>8980 ± 360</b>
<b>U-256. Core 21003, 107 to 117 cm, &gt;44<math>\mu</math></b>	<b>7030 B.C.</b>

Core 21003 (37° 26' N Lat, 01° 05' E Long), depth 107 to 117 cm, depth in sea 2782 m. Previous samples in Western Mediterranean Sea series are given in Uppsala I, II, III, IV, and V and discussed in Eriksson (1965) and Eriksson and Olsson (1963). *Comment:* treated with dist. water, fraction >44 $\mu$  used. Diluted.  $\delta C^{13} = -5.5\%$ .

**Red Sea series**

Foraminifera tests from deep-sea cores. Coll. 1948 by Swedish *Albatross* Expedition (Pettersson); subm. by Eric Olausson.

**U-555. Core 162, 641.5 to 649.5 cm, >65 $\mu$  7960  $\pm$  130  
6010 B.C.**

Core 162 (11° 57' N Lat, 44° 18' E Long), depth 641.5 to 649.5 cm, depth in sea 883 m. Sample dates time when outflow from Red Sea had been constant. *Comment*: sample ultrasonically washed in boiled dist. water, sieved and washed (immediately before being decomposed) in ca. 80 cm<sup>3</sup> dil. HCl, pH about 2.5. Fraction >65 $\mu$  was used.  $\delta C^{13} = -3.4\%$ .

**U-554. Core 162, 881.5 to 889.5 cm, >65 $\mu$  9310  $\pm$  100  
7360 B.C.**

Core 162 (11° 57' N Lat, 44° 18' E Long), depth 881.5 to 889.5 cm, depth in sea 883 m. Sample dates time when outflowing, subsurface Red Sea water began influencing oxidation processes in Gulf of Aden. *Comment*: sample ultrasonically washed in boiled dist. water, sieved and washed (immediately before being decomposed) in ca. 80 cm<sup>3</sup> dil. HCl, pH about 3. Fraction >65 $\mu$  was used.  $\delta C^{13} = -3.3\%$ .

**U-562. Core 166, 52.5 to 58.5 cm, >65 $\mu$ , b 8690  $\pm$  130  
6740 B.C.**

Core 166 (17° 56' N Lat, 39° 57' E Long), depth 52.5 to 58.5 cm, length of core 1091 cm, depth in sea 1283 m. Sample dates decrease of carbon content in Postglacial stage of core. Descr. by Olausson (1960). *Comment*: sample was washed ultrasonically in boiled dist. acidified water and sieved, pH about 3. Inner 72% was used.  $\delta C^{13} = +3.8\%$ .

**U-2020. Core 166, 52.5 to 58.5 cm, >65 $\mu$ , a 7800  $\pm$  340  
5850 B.C.**

The same sample as U-562, but outer 28% was used.  $\delta C^{13} = -0.6\%$ .

*C. Spitsbergen***Vestspitsbergen series**

Shells and bones measured as continuation of Vestspitsbergen series (Uppsala II, III, IV, and V; Feyling-Hanssen and Olsson, 1959-1960) to determine shoreline displacements. All altitudes are above mean sea-level. *Comment*: a treatment of bones suggested by de Waard (priv. commun., 1962) was used. 200 g bone is treated several times at 50°C with EDTA dissolved in dist. water and NaOH, repeatedly washed with water at 50°C, treated with 0.1-N HCl at 70°C, dried, dissolved in water and centrifuged. The liquid is dried and used for age determinations (R). The undissolved material was, for test purposes, also used for age determinations (W).

**U-573. Kapp Linné 6006 b 9270  $\pm$  130  
7320 B.C.**

Shell fragments of different species from Kapp Linné (78° 04' N

Lat, 13° 38' E Long), Isfjorden, Spitsbergen, alt 7 to 8 m. Coll. 1960 by Feyling-Hanssen and Olsson. Fragments were frozen to surface in patterned ground area of a terrace. They may thus originate from layers lower and older than terrace surface. Sample coll. in attempt to search for possible systematic errors in areas with permafrost. Sample is older than shells from this altitude normally are. *Comment:* inner 39% was used.  $\delta C^{13} = -0.1\%$ .

**U-572. Kapp Linné 6006 a** **9640 ± 200**  
**7690 B.C.**

Shell layer surrounding the part used for U-573. *Comment:* layer corresponds to 27% of the shells; 34% was removed by washing.  $\delta C^{13} = +0.0\%$ .

**U-506. Gipshuken 6013 b R (5)** **3080 ± 90**  
**1130 B.C.**

Collagen fraction of whalebone from Gipshuken (78° 27' N Lat, 16° 24' E Long), Isfjorden, Spitsbergen, alt ca. 5.5 m (Feyling-Hanssen and Jørstad, 1950, p. 55-58).  $\frac{2}{3}$  of sample buried. Coll. 1960 by Feyling-Hanssen and Olsson.  $\delta C^{13}$  assumed  $-20.2\%$ .

**U-506. Gipshuken 6013 b W (2)** **1800 = 330**  
**A.D. 150**

Wrong fraction of same whalebone as used for sample U-506 but from another portion of the crushed bone. *Comment:* diluted.  $\delta C^{13} = -22.5\%$ .

**U-570. Ekholmrika 6022 b R (3)** **9090 ± 190**  
**7140 B.C.**

Collagen fraction of whalebone from Ekholmrika (78° 35' N Lat, 16° 38' E Long), Billefjorden, Spitsbergen; alt ca. 50 m. Deeply buried in fine gravel. Location mapped by Balchin (1941). Coll. 1960 by D. H. Maling. *Comment:* diluted.  $\delta C^{13} = -20.2\%$ .

**U-569. Ekholmrika 6022 b W (2)** **8120 ± 190**  
**6170 B.C.**

Wrong fraction of same whalebone as used for U-570 but from another portion of crushed bone.  $\delta C^{13} = -20.1\%$ .

#### *D. Iceland*

##### **Iceland series**

Shell, peat, wood and charcoal from Iceland.  $C^{14}$  determinations on Iceland are often used to date lava-flows, tephra layers and shore-lines. Pollen diagrams are usually dated by tephra layers. Earlier  $C^{14}$  datings of Quaternary deposits in Iceland are listed by Kjartansson *et al.* (1964). Present samples subm. by Gudmundur Kjartansson, Náttúrugripasafnid (Mus. of Nat. History) Reykjavik, Iceland.

- 11,450 ± 330**  
**9500 B.C.**
- U-2019. Ekruhorn**  
One valve of *Mya truncata* from Ekruhorn in Saurbaer (65° 24' N Lat, 21° 56' W Long), Dalasýsla, Iceland. Sample, found together with *Yoldia arctica* close to the sea, from upper half of thick marine clay layer, upper boundary at 15 m alt, overlain by gravel. Coll. 1964 by Kjartansson. *Comment*: inner 65% was used. Diluted.  $\delta C^{13} = -1.7\%$ .
- 5310 ± 170**  
**3360 B.C.**
- U-519. Gardsendi 1 p (2)**  
Peat from Gardsendi (63° 25' N Lat, 20° 17' W Long), Heimaey, Vestmannaeyjar, Iceland, overlain by thick volcanic formations that bear no signs of glaciation. Below sample, ca. 0.1 m thick, is layer of aeolian soil on lava of Stórhöfði. Coll. 1964 by Kjartansson.  $\delta C^{13} = -25.8\%$ .
- 5760 ± 120**  
**3810 B.C.**
- U-539. Gardsendi 1 p (3)**  
Same peat as U-519 but new pre-treatment.  $\delta C^{13} = -26.1\%$ .
- 4120 ± 90**  
**2170 B.C.**
- U-517. Gardsendi 1 p (1)**  
Same peat as U-519 but bad pre-treatment; sample was not stirred when made acid before drying. *Comment*: result should not be used for an age discussion.  $\delta C^{13} = -29.7\%$ .
- 5110 ± 200**  
**3160 B.C.**
- U-521. Gardsendi 1 w**  
Small pieces of *Salix* wood picked from peat used for U-519. Diluted.  $\delta C^{13} = -27.0\%$ .
- 8190 ± 190**  
**6240 B.C.**
- U-525. Thjórsárbrú p 0 to 2**  
Peat from Thjórsárbrú (63° 56' N Lat, 20° 39' W Long), Árnessýsla, Iceland, from 2 lowest cm of peat layer 30 cm thick, resting on river gravel and overlain by 3 m lava. Dated to determine final regression of sea from lowlands. This lava, called Thjórsárhraun, is largest known postglacial lava flow on Earth. Coll. 1959 by Kjartansson. Descr. by Kjartansson (1958) and Kjartansson *et al.* (1964). *Comment*: top layer of same peat has been dated previously: W-482 and W-913, 8065 ± 400 and 8170 ± 300 B.P. (USGS IV and VI).  $\delta C^{13} = -24.4\%$ .
- 8210 ± 310**  
**6260 B.C.**
- U-524. Thjórsárbrú p 2 to 3**  
Peat from same layer as U-525 but selected 2 to 3 cm from bottom. *Comment*: diluted.  $\delta C^{13} = -28.0\%$ .
- 4530 ± 100**  
**2580 B.C.**
- U-523. Hlírdalsskóli**  
Charcoal from Hlírdalsskóli (63° 56' N Lat, 21° 24' W Long), Árnessýsla, Iceland. From top layer of aeolian soil where plant remains

have been carbonized by heat of overlying lava. Coll. 1956 by Sigurdur Thorarinsson. *Comment*: peat underlying Ellidaárhraun lava, which might be identical with Hlíðardalsskóli lava, was dated previously: C-749,  $5300 \pm 340$  (Libby, 1955).  $\delta C^{13} = -22.1\text{‰}$ .

#### E. Arctic Ocean

##### Arctic Ocean series

*Globigerina pachyderma* from flank of Alpha Rise ( $82^{\circ} 56.2'$  N Lat,  $155^{\circ} 54'$  W Long), Arctic Ocean, depth in sea 3548 m. Coll. 1963 by K. Hunkins; subm. by W. Donn and T. Saito, Lamont Geol. Observatory, Palisades, New York. Piston corer penetrated only 24 cm. Samples from several cores close to each other. Similar cores are descr. by Ericson *et al.* (1964). *Comment*: before being submitted, samples washed with tap water. In two cases a leaching procedure to eliminate outer contamination was tried. Large discrepancy between fractions indicates contamination. All samples diluted.

**8070  $\pm$  180**

**U-548. T3-63-1/S 1 to 2 cm, b** **6120 B.C.**  
Core T3-63-1/S, depth 1 to 2 cm. *Comment*: inner 85% was used.  
 $\delta C^{13} = +2.5\text{‰}$ .

**6200  $\pm$  500**

**U-547. T3-63-1/S 1 to 2 cm, a** **4300 B.C.**  
Shell layer surrounding the part used for U-548. *Comment*: outer 15% was used.  $\delta C^{13} = -14.7\text{‰}$ .

**13,400  $\pm$  400**

**U-550. T3-63-1/S 3 to 4 cm, b** **11,400 B.C.**  
Core T3-63-1/S depth 3 to 4 cm. *Comment*: inner 55% was used.  
 $\delta C^{13} = -5.8\text{‰}$ .

**10,200  $\pm$  300**

**U-549. T3-63-1/S 3 to 4 cm, a** **8300 B.C.**  
Shell layer surrounding the part used for U-550. *Comment*: outer 45% was used.  $\delta C^{13} = -3.4\text{‰}$ .

**12,000 + 1200**  
**- 1000**

**U-551. T3-63-1/S 5.5 to 6.5 cm** **10,100 B.C.**  
Core T3-63-1/S, depth 5.5 to 6.5 cm. *Comment*: whole sample was used.  $\delta C^{13} = +3.7\text{‰}$ .

#### F. Poland

**280  $\pm$  90**

**U-542. Korne near Kościerzyna (1)** **A.D. 1670**  
Peat from Korne ( $54^{\circ} 08'$  N Lat,  $17^{\circ} 52'$  E Long), Poland. From upper part, 1.3 to 1.4 m below surface, of 0.8-m-thick peat layer overlain by sand of alluvial cone. Below peat is fluvio-glacial sand and

gravel. Coll. 1964 and subm. by Jan Szupryczyński, Instytut Geografii Polska Akademia Nauk Toruń, Poland.  $\delta C^{13} = -29.3\text{‰}$ .

**U-575. Korne near Kościerzyna (3) A.D. 1740**  
**210 ± 60**

Another portion of sample used for U-542. New pretreatment.  $\delta C^{13} = -28.5\text{‰}$ .

#### *G. Shetland*

##### **Shetland series**

Lake sediments and peat from Shetland to study sealevel changes and glacial and vegetational history. Coll. 1964 by Gunnar Hoppe and Anders Häggblom (Naturgeografiska Institutionen, Stockholms Univ., Stockholm, Sweden) together with Magnus Fries (Skoghögskolan, Stockholm, Sweden). Descr. by Hoppe (1965). *Comment:* samples contain old coal as determined chemically by A. M. Asklund and H. Berger, Stockholm. Several samples were dated previously (Stockholm VII). Some gave higher ages than expected. Since Uppsala lab. was engaged in this project only one dating completed. Different separation methods are being tried. As a first step humus was dated, since pretreatment with NaOH, to extract humus, would not dissolve the old coal, which most probably caused some of Stockholm dates to be too high.

**U-2007. Lower Loch of Brouster, 7700 ± 600**  
**core 20, 343 to 348, h, 1 5800 B.C.**

**U-576. 7600 ± 600**  
**5700 B.C.**

Two measurements of humus extracted from gyttja from tidal lake Lower Loch of Brouster (60° 15' N Lat, 01° 36' W Long), Shetland. Sample 343 to 348 cm below top of sediment. Sample supposed to be of same age as one sample collected nearby, dated 15,080 ± 850 (St-1757). *Comment:* diluted.  $\delta C^{13} = -20.5\text{‰}$ .

#### *H. Sweden*

##### **Shell banks series**

Shells from Lindalsskogen, Väjern (58° 22' N Lat, 06° 47' E Long), alt 25 m and Hult, Svarteborg (58° 36' N Lat, 06° 26' E Long), alt 103 m, Bohuslän, Sweden. Collected in shell banks. *Balanus* shells were broken. An attempt to date the shells was done in order to study time interval for deposit. At Väjern all samples were coll. within 100 m from each other. Shell bank at Svarteborg is descr. by Hessland (1943). Coll. 1966 and subm. by K. Gösta Eriksson, Göteborgs Univ., Göteborg, Sweden.

**U-584. Väjern 3275 b 10,200 ± 120**  
**8250 B.C.**

*Balanus* shells from Väjern, coll. 2 to 3 m below surface of bank,

1 to 2 m below erosion surface. *Comment:* inner 20% was used.  $\delta C^{13} = -2.1\text{‰}$ .

**U-583. Väjern 3275 a**

**9990 ± 130  
8040 B.C.**

Shell layer surrounding the part used for U-584. *Comment:* layer corresponds to 15% of the shells; 65% was removed by washing. Diluted.  $\delta C^{13} = +3.0\text{‰}$ .

**U-590. Väjern 3276 b**

**10,430 ± 200  
8480 B.C.**

*Balanus* shells from Väjern, coll. in a layer with much *Mytilus edulis*, 0.8 to 1 m below erosion surface. *Comment:* inner 40% was used. Diluted.  $\delta C^{13} = +3.0\text{‰}$ .

**U-2017. Väjern 3276 a**

**10,330 ± 160  
8380 B.C.**

Shell layer surrounding the part used for U-590. *Comment:* layer corresponds to 25% of shells; 35% was removed by washing.  $\delta C^{13} = -1.1\text{‰}$ .

**U-586. Väjern 3248 b<sub>1</sub>**

**10,930 ± 150  
8980 B.C.**

*Balanus* shells from Väjern, coll. 0 to 1 m below erosion surface. *Comment:* inner 42% was used.  $\delta C^{13} = +0.2\text{‰}$ .

**U-585. Väjern 3248 a<sub>1</sub>**

**10,260 ± 140  
8310 B.C.**

Shell layer surrounding the part used for U-586. *Comment:* layer corresponds to 35% of the shells; 23% was removed by washing.  $\delta C^{13} = -0.4\text{‰}$ .

**U-588. Väjern 3248 b<sub>2</sub>**

**9680 ± 150  
7730 B.C.**

*Balanus* shells from same sample as U-586. *Comment:* new treatment due to difference between U-585 and U-586. Inner 40% was used.  $\delta C^{13}$  assumed  $-1.0\text{‰}$ .

**U-587. Väjern 3248 a<sub>2</sub>**

**9520 ± 120  
7570 B.C.**

Shell layer surrounding the part used for U-588. *Comment:* layer corresponds to ca. 50% of the shells; 10% was removed by washing.  $\delta C^{13} = -0.8\text{‰}$ .

**U-2016. Väjern 3273 b**

**9540 ± 230  
7590 B.C.**

*Balanus* shells from Väjern, coll. 0 to 0.5 m above erosion surface. *Comment:* inner 20% was used. Diluted.  $\delta C^{13} = -0.7\text{‰}$ .

**U-568. Väjern 3273 a**

**9650 ± 130  
7700 B.C.**

Shell layer surrounding the part used for U-2016. *Comment:* layer corresponds to 45% of the shells; 35% was removed by washing.  $\delta C^{13} = -2.4\text{‰}$ .



**U-566. Väjern 3247 b** **7830 ± 120**  
**5880 B.C.**

*Ostrea* shell from Väjern, coll. close above boundary of Tapes transgression. *Comment:* inner 28% was used. Diluted.  $\delta C^{13} = -0.0\text{‰}$ .

**U-565. Väjern 3247 a** **7810 ± 120**  
**5860 B.C.**

Shell layer surrounding the part used for U-566. *Comment:* layer corresponds to 22% of the shell; 50% was removed by washing.  $\delta C^{13} = -0.2\text{‰}$ .

**U-582. Väjern 3274 b<sub>1</sub>** **9750 ± 140**  
**7800 B.C.**

*Balanus* shells from Väjern, coll. from upper Postglacial layer 0 to 1 m below surface of bank, 0.5 to 1.5 m above erosion surface. *Comment:* inner half was used.  $\delta C^{13} = +0.3\text{‰}$ .

**U-589. Väjern 3274 b<sub>2</sub>** **9750 ± 240**  
**7800 B.C.**

Shells from same layer as U-582. *Comment:* inner 60% was used.  $\delta C^{13} = -1.4\text{‰}$ .

**U-2013. Hult 3271 b** **10,840 + 420**  
**– 390**  
**8890 B.C.**

*Balanus hameri* from Hult, coll. in clay 0.5 to 1 m below surface of bank. Sample is Late Glacial. *Comment:* inner quarter was used. Diluted.  $\delta C^{13} = -1.4\text{‰}$ .

**U-567. Hult 3271 a** **11,320 ± 180**  
**9370 B.C.**

Shell layer surrounding the part used for U-2013. *Comment:* layer corresponds to a quarter of the shells; outer half of the shells was removed by washing.  $\delta C^{13} = -1.2\text{‰}$ .

### Östra Landborgen series

Peat and gyttja sequences to date the *Ancylus* transgression. Pollen analyses by Lars-König Königsson, Kvartärgeologiska Inst., Uppsala Univ., Uppsala, Sweden. Coll. 1963 and subm. by Königsson. *Comment:* the first samples in this series were published in Uppsala V.

**U-485. Mellösa 483 (1)** **6570 ± 180**  
**4620 B.C.**

Peat from Mellösa (56° 53' N Lat, 16° 50' E Long), Bredsättra parish, Öland, Sweden. From upper part of peat layer, dating period between *Ancylus* and *Littorina* transgressions. *Comment:* lower part of same layer was used for U-489 and U-1016.  $\delta C^{13} = -26.6\text{‰}$ .

**U-571. Mellösa 483 (2)** **6410 ± 110**  
**4460 B.C.**

Peat of same sample as U-485, but new pretreatment.  $\delta C^{13} = -27.5\text{‰}$ .

**U-495. Övra Sandby 497 (1)** **6510 ± 110**  
**4560 B.C.**

Peat from Övra Sandby (56° 52' N Lat, 16° 49' E Long), Bredsättra parish, Öland, Sweden. From peat below shore deposit.  $\delta C^{13} = -27.7\text{‰}$ .

**U-514. Övra Sandby 497 (2)** **6910 ± 120**  
**4960 B.C.**

Peat of same sample as U-495, but new pretreatment.  $\delta C^{13} = -27.8\text{‰}$ .

**U-494. Bettorp 557** **9670 ± 140**  
**7720 B.C.**

Gyttja from Bettorp (56° 40' N Lat, 16° 42' E Long), Norra Möckleby parish, Öland, Sweden. From gyttja layer below shore deposits estimated to be of Ancyclus age.  $\delta C^{13} = -29.4\text{‰}$ .

#### Late Pleistocene Vegetational series, Eastern Central Sweden

Sediments from Lillsjön (59° 14' N Lat, 14° 43' E Long), Kilsbergen, Närke, Sweden, alt 171 m. Coll. 1964 by Maj-Britt Florin and assistants, Kvartärgeologiska Inst., Uppsala Univ., Uppsala, Sweden; subm. by M.-B. Florin. Diatom (1944) and pollen analyses by M.-B. Florin.

**U-468. Lillsjön I, 70 to 74** **9160 ± 520**  
**7210 B.C.**

Silt with some gyttja, 70 to 74 cm below sediment surface. Pollen analyses imply late Pre-Boreal Pollen-Zone IV b and early Pollen-Zone V (Jessen). *Comment:* diluted.  $\delta C^{13} = -30.4\text{‰}$ .

**U-470. Lillsjön III, 82 to 86** **9200 ± 200**  
**7250 B.C.**

Silt with some organic material, 82 to 86 cm below sediment surface. Pollen analyses imply Pre-Boreal Pollen-Zone IV b (Jessen). *Comment:* diluted.  $\delta C^{13} = -18.1\text{‰}$ .

**U-469. Lillsjön II, 98 to 102** **9420 ± 210**  
**7470 B.C.**

Silt and sand with some organic material, 98 to 102 cm below sediment surface. Pollen analyses imply early Pre-Boreal Pollen-Zone IV b (Jessen). *Comment:* diluted.  $\delta C^{13} = -19.5\text{‰}$ .

#### Land Uplift series, Central Sweden

Sediments from Central Sweden, coll. from ancient lakes developed by isolation from the sea (S. Florin 1944; 1948; 1963). Subm. by S. Florin, Kvartärgeologiska Inst., Uppsala Univ., Uppsala, Sweden. Pollen analyses by M.-B. Florin and Gunnel Linnman.

**U-513. Elgsjö mossen I, II and IV, p** **4550 ± 140**  
**2600 B.C.**

Partly humified *Sphagnum* peat with *Eriophorum vaginatum* from Elgsjö mossen (59° 13' N Lat, 14° 26.5' E Long), Nysund parish, Närke,

Sweden, 98.8 m alt. Sample 375 to 385 cm below surface. Coll. 1959 by S. Florin. *Comment*: diluted.  $\delta C^{13} = -13.7\text{‰}$ .

**U-606. Elgsjömossen I, II and IV, h** **5610 ± 100**  
**3660 B.C.**

Humus from sample used for U-513.  $\delta C^{13} = -29.1\text{‰}$ .

**U-2021. Elgsjömossen III and V, p** **3800 ± 600**  
**1900 B.C.**

Partly humified *Sphagnum* peat with *Eriophorum vaginatum* from Elgsjömossen (59° 13' N Lat, 14° 26.5' E Long), Nysund parish, Närke, Sweden, 98.8 m alt. Sample 400 to 407 cm below surface. This sample and U-513 are from Littorina Time L II and date an early local *Picea* occurrence which has been seen at other localities in Central Sweden. Coll. 1959 by S. Florin. *Comment*: diluted.  $\delta C^{13} = -25.1\text{‰}$ .

**U-2012. Elgsjömossen III and V, h** **5680 ± 130**  
**3730 B.C.**

Humus from sample used for U-2021.  $\delta C^{13} = -21.1\text{‰}$ .

**U-522. Nedre Mogetorp I, p** **5790 ± 820**  
**3840 B.C.**

Clay with gyttja from Nedre Mogetorp (59° 00' N Lat, 16° 09' E Long), Södermanland, Sweden, alt 44 to 45 m. Sample 370 to 375 cm below surface, Littorina Time, before L II maximum. Layer corresponds to 400 cm level below surface in diagram given by Florin (1948). Coll. 1959 by S. Florin.  $\delta C^{13} = -22.1\text{‰}$ .

**U-2022. Nedre Mogetory I, h** **7370 ± 140**  
**5420 B.C.**

Humus from the sample used for U-522.  $\delta C^{13} = -24.5\text{‰}$ .

### Fluvial processes series

Peat from Bjurholm (63° 53' N Lat, 19° 15' E Long), Västerbotten, Sweden. Samples sedimented in rather thin layers separated by heavy sand layers in river bed of Öre älv. Samples are first in series to try to date the processes. Coll. 1965 and subm. by Sten Martvall and Gunnar Nilsson, Geografiska Inst., Uppsala Univ., Uppsala, Sweden.

**U-552. Bjurholm 1:1 + 1:2** **900 ± 400**  
**A.D. 1100**

Peat coll. 72 and 67.5 to 66 cm above sand bottom used as reference level.  $\delta C^{13} = -26.8\text{‰}$ .

**U-553. Bjurholm 1:3 + 1:4** **1290 ± 190**  
**A.D. 660**

Peat coll. in same core as U-552, 38 to 36.5 and 29 to 27.5 cm above sand bottom used as reference level.  $\delta C^{13} = -22.8\text{‰}$ .

**Ejurselet series**

Carr peat from Bjurselet (65° 10' N Lat, 21° 10' E Long), Byske parish, Västerbotten, Sweden. Samples were taken to date vegetational development as seen in pollen diagrams made in connection with archaeological investigation (see p. 467) in same area. Pollen analyses by Königsson and Candolin. Coll. 1964 and subm. by Königsson.

*General Comment:* all samples were highly humified and roots were removed by sieving. These samples are first in one extensive series.

	<b>3180 ± 80</b>
<b>U-515. Bjurselet 5 G</b>	<b>1230 B.C.</b>
Peat, 34 to 36 cm below surface. Dates beginning of the <i>Picea</i> . $\delta C^{13} = -27.8\%$ .	
	<b>4120 ± 90</b>
<b>U-579. Bjurselet 11 G</b>	<b>2170 B.C.</b>
Peat, 46 to 48.5 cm below surface. $\delta C^{13} = -28.9\%$ .	
	<b>3470 ± 80</b>
<b>U-499. Bjurselet 12 G</b>	<b>1520 B.C.</b>
Peat, 48.5 to 51 cm below surface. $\delta C^{13} = -30.5\%$ .	
	<b>3630 ± 140</b>
<b>U-498. Bjurselet 12 G, h</b>	<b>1680 B.C.</b>
Humus extracted from sample used for U-499. $\delta C^{13} = -26.2\%$ .	
	<b>3320 ± 400</b>
<b>U-497. Bjurselet 14 G</b>	<b>1370 B.C.</b>
Peat, 53.5 to 56 cm below surface. <i>Comment:</i> diluted. $\delta C^{13} = -26.7\%$ .	
	<b>3710 ± 90</b>
<b>U-496. Bjurselet 14 G, h</b>	<b>1760 B.C.</b>
Humus extracted from sample used for U-497. $\delta C^{13} = -28.5\%$ .	

## II. ARCHAEOLOGIC SAMPLES

*A. Sweden***Gårdlösa series**

Charcoal from Gårdlösa No. 3 (55° 34' N Lat, 14° 08' E Long), Smedstorp parish, Skåne, Sweden. Coll. 1964 and subm. by Berta Stjernquist, Lunds Historiska Mus., Lund, Sweden. Investigation of prehistoric cult places in province of Skåne (Scania) is treated by Stjernquist (1964). Several samples in this series have been dated previously (Uppsala V). Gårdlösa springs are situated on a slight incline and are surrounded by several hearths. Potsherds, sherds of glass, some metal artifacts and some bones are found indicating Migration or Vendel periods.

- 1760 ± 80**
- U-534. Gårdlösa 3, Hearth 40** **A.D. 190**  
Charcoal from Gårdlösa 3, Hearth 40. Sample found in pit in a layer 0.7 to 0.8 m below surface well below cultivated layer.  $\delta C^{13} = -26.1\text{‰}$ .
- 1940 ± 70**
- U-532. Gårdlösa 3, Layer under Hearth 40** **A.D. 10**  
Charcoal from Gårdlösa 3, Hearth 40. Found in layer 0.9 to 1.0 m below surface.  $\delta C^{13} = -24.1\text{‰}$ .
- 1670 ± 70**
- U-536. Gårdlösa 3, Hearth 102** **A.D. 280**  
Charcoal from Gårdlösa 3 in small pit below limestone setting, 0.2 m below surface. Ground is cultivated down to stone setting.  $\delta C^{13} = -26.5\text{‰}$ .
- 1850 ± 70**
- U-531. Gårdlösa 3, Hearth 106** **A.D. 100**  
Charcoal from Gårdlösa 3. From a layer 0.40 to 0.45 m below surface, underlying cultivated ground.  $\delta C^{13} = -25.6\text{‰}$ .
- 1660 ± 90**
- U-535. Gårdlösa 3, L/M-P/Q, upper** **A.D. 290**  
Charcoal from Gårdlösa 3, L/M-P/Q, the upper layer, 0.4 to 0.5 m below surface. Found together with potsherds. Layer with charcoal is separated from cultivated layer by a thin layer of soil.  $\delta C^{13} = -25.8\text{‰}$ .
- 1940 ± 60**
- U-580. Gårdlösa 3, L/M-P/Q, lower** **A.D. 10**  
Charcoal from Gårdlösa 3, L/M-P/Q, the lower layer, 0.6 to 0.8 m below surface. Found together with potsherds.  $\delta C^{13} = -27.5\text{‰}$ .
- 1490 ± 80**
- U-533. Gårdlösa 3, Trench L, Setting 1** **A.D. 460**  
Charcoal from Gårdlösa 3, Excavation Trench L, Stone-setting 1, 0.25 to 0.3 m below surface. Sample coll. on and between stones.  $\delta C^{13} = -25.5\text{‰}$ .
- 1380 ± 80**
- U-528. Gårdlösa 3, House X** **A.D. 570**  
Charcoal from Gårdlösa 3, House X, found in a hearth, 0.75 to 0.8 m below surface. Found together with weaver's weights, potsherds, iron artifacts, slag, pearls and others items.  $\delta C^{13} = -24.8\text{‰}$ .
- 1450 ± 60**
- U-529. Gårdlösa 3, House XII** **A.D. 500**  
Charcoal from Gårdlösa 3, House XII, 0.75 to 0.8 m below surface, well below cultivated ground. Found together with pearls, iron items, iron pieces, potsherds, slag and other items.  $\delta C^{13} = -24.1\text{‰}$ .

**1450 ± 80****U-530. Gårdlösa 3, House XIX****A.D. 500**

Charcoal from Gårdlösa 3, House XIX, found in a hearth, 0.6 m below surface, together with a pearl, potsherds, iron pieces and slag. The cultivated ground is 0.25 m deep.  $\delta C^{13} = -26.1\%$ .

**3070 ± 150****U-527. Gudahagen test pit: 60****1120 B.C.**

Charcoal from Gudahagen (56° 10' N Lat, 14° 29' E Long), Näsrum parish, Skåne, Sweden. From charcoal horizon in bog at depth of 0.6 m in a test pit. Another sample from Gudahagen has been dated previously (Uppsala V). Coll. 1962 and subm. by Stjernquist. *Comment:* diluted.  $\delta C^{13} = -22.5\%$ .

**3970 ± 150****U-526. Gudahagen test pit: 180****2020 B.C.**

Charcoal from Gudahagen (56° 10' N Lat, 14° 29' E Long), Näsrum parish, Skåne, Sweden. From charcoal horizon in bog at depth of 1.8 m in a test pit. Coll. 1962 and subm. by Stjernquist. *Comment:* diluted.  $\delta C^{13} = -26.7\%$ .

**1490 ± 80****U-541. Eketorp ring-fort, House 1, sample 1****A.D. 460**

Charcoal from Eketorp (56° 02' N Lat, 16° 03' E Long), Gräsgård parish, Öland, Sweden. From hearth in lower layer. Coll. 1964 and subm. by Mårten Stenberger, Inst. för Nordisk och Jämförande Fornkenskap, Uppsala Univ., Uppsala, Sweden. There are 16 known ancient forts on Öland and a few uncertain. The forts are descr. by Stenberger (1966a). The Eketorp ringfortress is descr. by Stenberger (1966b and c). It has inner diam of 80 m, an almost circular wall, originally 5 m thick and probably ca. 4 m high, now destroyed and nowhere higher than 2 m; it is surrounded by another lower wall which probably was used as foundation for a palisade. An upper habitation level from ruined settlement within fort consists mainly of large stones, probably from houses, and numerous artifacts indicate Late Viking Period and Early Medieval time. A lower level has system of trapezoidal building foundations stretching their walls from ring wall 11.5 m towards center of fort. Each house, 5 m wide at ring wall and with radial walls common with nearest houses, had probably two rooms. Several artifacts in lower level indicate Late Migration and Early Vendel Period. Excavation started 1964 and is not completed. Several samples are dated in Stockholm (Stockholm VII).  $\delta C^{13} = -24.8\%$ .

**Bjurselet series**

Charcoal from Bjurselet (65° 00' N Lat, 21° 04' E Long), Byske parish, Västerbotten, Sweden. From a Stone Age dwelling-site, alt 53 m, with imported flint axes, scrapers and potsherds. Subm. by Hans Christiansson, Inst. för Nordisk och Jämförande Fornkenskap, Uppsala

Univ., Uppsala, Sweden. An upper layer consisted of cultivated soil, Layer I, underlain by sand, Layer II and Layer III. Excavation started 1962, preliminary descr. by Christiansson (1965a, b). Flint artifacts are descr. by Becker (1952). A pollen profile from same area is dated p. 465. *Comment:* some samples are found in such a place that their origin is very uncertain.

**U-545. Bjurselet 115/265, Hearth 5 (1)** **580 ± 80**  
**A.D. 1370**

Charcoal, 0.3 m below surface, from "the hearth area", (Härdplatsen). Coll. from boundary between cultivated ground and underlying sand. Coll. 1963 by Christiansson.  $\delta C^{13} = -23.8\%$ .

**U-544. Bjurselet 115/265, Hearth 5 (2)** **360 ± 80**  
**A.D. 1590**

Charcoal from the same sample as U-545, but new pretreatment.  $\delta C^{13} = -25.4\%$ .

**U-560. Bjurselet 120/265** **590 ± 90**  
**A.D. 1360**

Charcoal, 0.3 m below surface, from hearth area (Härdplatsen). Coll. from boundary between cultivated ground and pure sand. Coll. 1964 by Christiansson.  $\delta C^{13}$  assumed  $-25.3\%$ .

**U-2005. Bjurselet 194/227 Åkern** **1050 ± 130**  
**A.D. 900**

Charcoal, 0.3 m below surface, from the field. From boundary between cultivated ground and pure sand. Coll. 1964 by Christiansson. *Comment:* diluted.  $\delta C^{13}$  assumed  $-25.0\%$ .

**U-561. Bjurselet 190/228 Åkern** **1130 ± 70**  
**A.D. 820**

Charcoal, 0.3 m below surface, from "Åkern." From the sand below cultivated ground (Layer II). Coll. 1964 by Christiansson.  $\delta C^{13} = -26.5\%$ .

**U-546. Bjurselet 202/228 Åkern** **310 ± 60**  
**A.D. 1640**

Charcoal, 0.3 m below surface, from "Åkern." From boundary between cultivated ground and pure sand. Coll. 1964 by Christiansson.  $\delta C^{13} = -26.1\%$ .

**U-2010. Bjurselet 334/204 Staketet** **3020 ± 230**  
**1070 B.C.**

Charcoal from Layer III possibly in connection with a hut. From layer with burned brittle stones below upper layer of sand. Coll. 1966 by Christiansson. *Comment:* diluted.  $\delta C^{13} = -26.2\%$ .

**U-2003. Bjurselet 722/265 Udden A** **3440 ± 450**  
**1490 B.C.**

Charcoal from hearth, Layer III, the ground probably never cultivated. Found together with flint artifacts and bones of seal and white-

fish. Coll. 1964 by Christiansson. *Comment:* diluted.  $\delta C^{13}$  assumed  $-25.0\%$ .

**U-559. Bjurselet 722/265 Udden B** **3970  $\pm$  340**  
**2020 B.C.**

Charcoal from same sample as U-2003 but somewhat different pre-treatment. *Comment:* diluted.  $\delta C^{13} = -27.4\%$ .

**U-558. Kusmark 219/120 K I** **1380  $\pm$  70**  
**A.D. 570**

Charcoal, from "Skackerforsen," Kusmark I<sup>6</sup> (64° 53' N Lat, 20° 43' E Long), Skellefteå parish, Västerbotten, Sweden. 0.2 m below the grass, in layer with soot at Stone Age dwelling site, probably connected with ca. 100 flint axes found 100 m from site with bones of seal. Ground is cultivated. Coll. 1965 by H. C. Vorting, Inst. för Nordisk och Jämförande Fornkunskap, Uppsala Univ., Uppsala, Sweden; subm. by Christiansson.  $\delta C^{13} = -26.0\%$ .

**U-540. Hednäs, Hunting pit 4** **3980  $\pm$  90**  
**2030 B.C.**

Charcoal from Hednäs (64° 15' N Lat, 19° 30' E Long), Degerfors parish, Västerbotten, Sweden. From bottom of hunting pit for reindeer, ca. 190 cm below mean level of surrounding ground. Charcoal probably from a forest fire. Some similar pits are dated at 1150  $\pm$  65 B.P. (St-152), 450  $\pm$  55 B.P. (St-170), 1110  $\pm$  60 B.P. (St-110 and St-131) (all calculated with old Stockholm standard, Stockholm I); 1240  $\pm$  70 (Manker, 1960, p. 88). Coll. 1964 and subm. by Göran Rosander, Inst. för Nordisk och Jämförande Fornkunskap, Uppsala Univ., Uppsala, Sweden.  $\delta C^{13} = -19.4\%$ .

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