

STOCKHOLM NATURAL RADIOCARBON MEASUREMENTS IV

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INTRODUCTION

This paper is a direct continuation of the third dating list (Stockholm III), and the entire technique is virtually unchanged, using one 0.5-1 and one 1.0-1 3 atm CO₂ proportional counter. Ages are calculated according to the recommendation given in the introduction of this book, and δC^{13} has been measured for unknown samples and for the different CO₂ preparations of the NBS oxalic-acid standard. Since the numerical relationship between the C¹⁴ activity of our old oak standard and that of NBS was valid for a δC^{13} value of almost exactly -19 for the NBS preparation in question, it still holds true that all dates given in Stockholm I, II and III can be converted to the new scale by subtracting 55 yr. The NBS preparation St-532 measured by Craig (1961) having a δC^{13} value of -17.2 is only one of several preparations with values between -17 and -20. Age figures are given in C¹⁴ yr before A.D. 1950; the half life for C¹⁴ is taken as 5568 ± 30 yr.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES—SWEDEN

A. Postglacial Strandlines

Limhamn series

Wood from a piece of peat, ca. 25 cm thick, found at depth of 5-6 m in the harbor of Limhamn, City of Malmö, Skåne (55° 36' N Lat, 12° 56' E Long). The piece of peat has been pollen-analytically dated to the transition between Boreal and Atlantic times, and correlated with similar peat found in the harbor at depth of 8 m. The peat there is covered by marine clay gyttja. The pollen-analytical dating of the peat gives a maximum age estimated to 7500-8000 yr for the time when the Tapes-Litorina-transgression reached the level now situated 8 m below recent sealevel at Limhamn (Persson, 1962). Coll. by G. Fredriksson, Limhamn; subm. by Tage Nilsson and Gösta Persson, Inst. of Quaternary Geol., Lund Univ.

St-720. Limhamn harbor, sample B **7895 ± 115**

Fragment of a small branch of *Salix*, lying horizontally in the upper part of the peat.

* Operated by Royal Academy of Antiquities, Geol. Survey of Sweden and, beginning 1962, Stockholm University.

St-732. Limhamn harbor, sample D 7990 ± 160

Fragment of a slightly larger branch of *Salix* (wood with bark), lying horizontally in the upper part of the peat.

Ösbysjön series

Three samples of sediments from the lake Ösbysjön (59° 24' N Lat, 18° 04' E Long), ca. 7.5 m above sealevel, Djursholm, Uppland. Samples were cut out from two 36 mm diam cores. Subm. by Magnus Fries, Dept. of Plant Ecol., Univ. of Uppsala, Sweden. To be described by the submitter (1962).

St-616. Clay gyttja 4600 ± 120

410-430 cm below the sediment surface. This sample reflects the time when signs first appeared indicating basin had started to become isolated from the Baltic.

St-642. Fibrous algal gyttja 2070 ± 80

232-246 cm below the sediment surface. Sample dates the final isolation of the lake from the Baltic. Indications of agriculture increase above this level in the pollen diagram.

St-628. Lake gyttja 1015 ± 70

118-138 cm below the sediment surface (supplement core). Sample dates a marked rise in the *Picea* pollen curve and a corresponding decrease of the *Quercus* pollen curve.

Harmånger series

Sediment samples from a number of small bogs at different alt around Harmånger (61° 50' to 62° 00' N Lat, 17° 03' to 17° 23' E Long) 24 km N of Hudiksvall, Hälsingland. Dated as a part of an investigation on crustal uplift. All samples were taken in connection with the isolation level, except for St-778 and 777 taken in recurrence surfaces. Coll. 1960 by C. Larsson; subm. by G. Lundqvist, Geol. Survey of Sweden, Stockholm. Each sample is named after the bog in question.

St-708.	Nordanmyran: 9	2535 ± 110
St-747.	Nordanmyran: 10	3270 ± 105
St-716.	Fjällmyran: 11	3970 ± 100
St-770.	Fjällmyran: 12	4315 ± 145
St-776.	At Strömsbruk: 13	945 ± 130
St-709.	At Strömsbruk: 14	1400 ± 90
St-771.	At Strömsbruk: 15	1810 ± 140
St-717.	Smälskmyran: 16	2140 ± 80
St-772.	Smälskmyran: 17	2310 ± 140

St-710.	Stormyran SW Högen: 18	6260 ± 100
St-749.	Stormyran SW Högen: 19	6750 ± 140
St-718.	Gränsmyran: 20	5495 ± 115
St-769.	Gränsmyran: 21	5810 ± 140
St-778.	Gränsmyran: 22	755 ± 100
St-777.	Gränsmyran: 23	1055 ± 130
St-753.	Stormyran N Lake Sörsjön: 24	6295 ± 185
St-754.	Stormyran N Lake Sörsjön: 25	6780 ± 155
St-711.	At Lake Idsjön: 26	4585 ± 90
St-773.	At Lake Idsjön: 28	5415 ± 180
St-781.	Rödjebergsmymren: 29	5890 ± 160
St-719.	Rödjebergsmymren: 30	6000 ± 140
St-774.	Rödjebergsmymren: 31	6530 ± 150
St-712.	Bergkärrsmymren: 32	5590 ± 90
St-750.	Bergkärrsmymren: 33	7160 ± 140
St-713.	Knåptjärn: 34	4050 ± 65
St-755.	Knåptjärn: 35	5745 ± 150
St-714.	Gammelbomyran: 36	3480 ± 80
St-775.	Gammelbomyran: 37	3670 ± 150
St-715.	Ståltjärn: 38	6375 ± 90
St-779.	Ståltjärn: 39	7070 ± 200
St-782.	Ståltjärn: 40	6940 ± 160

B. Recurrence Surfaces

Jordbärsmyren series

Peat samples from profiles in the bog Jordbärsmyren (60° 18' N Lat, 16° 56' E Long), 3 km NE of Gysinge, Gästrikland, analyzed as a part of an investigation of palynologic interest, especially the study of the recurrence surfaces. Coll. 1959 by S. Holmberg; subm. by G. Lundqvist. Bp numbers indicate drilling hole number. Depth given is below surface of the bog.

St-543.	Jordbärsmyren 1, Bp 9: 170 cm	850 ± 90
St-544.	Jordbärsmyren 2, Bp 9: 200 cm	1070 ± 80
St-545.	Jordbärsmyren 3, Bp 9: 225 cm	1950 ± 75
St-546.	Jordbärsmyren 4, Bp 9: 290 cm	1900 ± 85

St-582.	Jordbärsmyren	5, Bp 9:	330 cm	3450 ± 80
St-612.	Jordbärsmyren	7, Bp 9:	350 cm	3690 ± 120
St-611.	Jordbärsmyren	9, Bp 9:	360 cm	4140 ± 100
St-583.	Jordbärsmyren	13, Bp 9:	400 cm	4550 ± 110
St-563.	Jordbärsmyren	14, Bp 5:	170 cm	1230 ± 75
St-564.	Jordbärsmyren	15, Bp 5:	200 cm	1450 ± 75
St-565.	Jordbärsmyren	31, Bp 20:	70 cm	1250 ± 85
St-566.	Jordbärsmyren	32, Bp 20:	100 cm	1350 ± 75

Högmossen series

Peat samples from profiles in the raised bog at Högmossen (61° 00' N Lat, 17° 01' E Long), W of Axmar, Gästrikland. Coll. 1960 by S. Holmberg; subm. by G. Lundqvist. Dated as part of an investigation on recurrence surfaces and of palynologic interest. Bp indicates drilled sampling hole number, cm figures are depth below surface of the bog.

St-655.	Högmossen	1, Bp 22:	150 cm	1145 ± 60
St-656.	Högmossen	2, Bp 22:	160 cm	1280 ± 90
St-658.	Högmossen	5, Bp 22:	310 cm	2215 ± 70
St-670.	Högmossen	6, Bp 22:	330 cm	2785 ± 75
St-723.	Högmossen	7, Bp 22:	380 cm	3080 ± 105
St-725.	Högmossen	9, Bp 22:	440 cm	3705 ± 90
St-671.	Högmossen	10, Bp 22:	480 cm	3475 ± 80
St-672.	Högmossen	13, Bp 22:	575 cm	4700 ± 90
St-673.	Högmossen	14, Bp 14:	125 cm	1135 ± 80
St-674.	Högmossen	15, Bp 14:	160 cm	1485 ± 75
St-675.	Högmossen	18, Bp 14:	245 cm	2000 ± 75
St-677.	Högmossen	22, Bp 14:	400 cm	3145 ± 80
St-678.	Högmossen	23, Bp 14:	430 cm	3780 ± 100
St-679.	Högmossen	26, Bp 26:	110 cm	810 ± 90
St-680.	Högmossen	27, Bp 26:	130 cm	1090 ± 70
St-726.	Högmossen	35, Bp 26:	350 cm	3070 ± 100
St-727.	Högmossen	26, Bp 26:	370 cm	3175 ± 125
St-728.	Högmossen	38, Bp 26:	405 cm	3220 ± 80
St-729.	Högmossen	46, Bp 1:	20 cm	165 ± 90

- St-724. Högmossen 47, Bp 1: 30 cm** **766 ± 65**
- St-604. Norrtjärn** **3780 ± 90**
 Peat from the little bog at Norrtjärn (61° 24' N Lat, 16° 53' E Long), 12 km WNW of Söderhamn at depth of 265-275 cm below the surface in a presumed recurrence surface. Coll. 1959 by C. Larsson; subm. by G. Lundqvist.
- Änn series**
 Samples from the peatbog at Klocka (62° 18' N Lat, 12° 28' E Long), Änn, Jämtland. All samples, except St-600, were wood from pine stumps imbedded at various levels, and were dated for their palynologic interest, especially the development of the recurrence surfaces. Coll. 1959 and subm. by Jan Lundqvist, Geol. Survey of Sweden.
- St-571. Änn C 1** **4450 ± 80**
 Pine stump layer 100 cm below surface 700 m from eastern edge of the bog. This level probably corresponds to a recurrence surface.
- St-614. Änn C 2** **8420 ± 110**
 Pine stump from the bottom layer, 230 cm below surface, same location as St-571.
- St-600. Änn C 9** **8280 ± 110**
 Peat from the same point as St-614.
- St-601. Änn C 4** **3920 ± 80**
 Pine stump layer covered with a thin bed of alluvial sand within the peat, and situated 40 cm below surface, 2350 m from the eastern edge of the bog.
- St-570. Änn C 5** **6130 ± 100**
 Pine stump layer 100 cm below surface probably indicating a recurrence surface. Sampling point located 1500 m from eastern edge of the bog.
- St-569. Änn C 6** **8290 ± 100**
 Pine stump from bottom layer at 150 cm; same location as St-570 above.
- St-568. Änn C 10** **4700 ± 80**
 Pine-stump layer at 75 cm, close to the E edge of bog. The level probably indicates a recurrence surface.
- St-615. Änn C 11** **6120 ± 100**
 Pine stump from bottom layer at 150 cm; same location as St-568.

C. Various Geologic Problems

Hisinge Tunnel series

Samples of marine clay, containing organic material, coll. by drilling holes while surveying for the construction of the Hisinge Tunnel under the river Göta Älv (57° 43' N Lat, 10° 58' E Long), city of Göteborg. The holes reaching to a depth of 93 m revealed a stratigraphy similar to that of the Ingebäck

series (Stockholm III). Both series are described by the submitter, F. Brotzen (1961), Geol. Survey of Sweden. Depths are m below mean sealevel.

St-697. Hisinge Tunnel: 29-31 m **9185 ± 140**

Isolated plant remains from the core, obtained by washing with distilled water. Geologic dating is Late Glacial II.

St-606. Hisinge Tunnel: 36 m **14,930 ± 160**

St-607. Hisinge Tunnel: 56 m **28,700** ⁺²¹⁵⁰
-1670

St-610. Hisinge Tunnel: 78 m **27,500** ⁺¹⁰⁵⁰
-900

St-609. Hisinge Tunnel: 89 m **28,500** ⁺¹¹⁰⁰
-1000

Comment (F.B.): samples St-607, 610, 609 belong to interstadial sediments. St-606 originates from Late Glacial-I sediments.

St-524. Agnesberg **11,000 ± 120**

Sample of mollusc shells collected from Late-Glacial deposits near Agnesberg (57° 47' N Lat, 12° 00' E Long), 8 km N of Göteborg, 3 km S of Ingebäck in Göta Älv valley. Measured to check the reliability of this type of material. Subm. and described by F. Brotzen (1961). *Comment (L.E., G.Ö.):* shells were leached in acid, and after discarding the first portion (A) of gas, gas samples corresponding to intermediate (B, age 10,980 ± 130) and inner layers (C, age 11,010 ± 130) were measured.

Kyrkfjärden series

A 90 cm sediment core from the bottom of Kyrkfjärden (59° 26' N Lat, 18° 11' E Long), a land-locked arm of the Stockholm skerry system. A high, narrow threshold and a permanently stratified salinity profile have created stagnancy in the deeper levels which probably extended back a considerable length of time. The core, from depth 16 m, consists of dark gray-green gyttja. Lowest sample shows clear microvarves. Coll. 1959 and subm. by F. Manheim, Geol. Survey of Sweden.

St-572. Kyrkfjärden 2 **880 ± 85**
2-13 cm below top of core.

St-573. Kyrkfjärden 3 **2580 ± 120**
56-70 cm below top of core.

St-574. Kyrkfjärden 4 **2950 ± 110**
77-90 cm below top of core.

St-748. Älvdalsåsen **8870 ± 120**

Wood of *Pinus Silvestris* found in river deposits, covered by solifluction soil at Älvdalsåsen (61° 15' N Lat, 13° 43' E Long), 10 km SSE of Trängslet.

Dalarna. Coll. 1961 and subm. by C. G. Wenner, Dept. of Quaternary Geol., Stockholm Univ.

St-599. Näsvisken **>40,000**

Wood of *Juniperus communis*, from gravel at a depth of 8 m in a partly till-covered esker at Näsvisken (63° 51' N Lat, 15° 32' E Long), Strömsund, Ström parish, Jämtland. Till-covered sediments are common in this area. It is not known if they are interglacial, or were covered by till at a Late-Glacial occasional ice advance. Coll. 1959 and subm. by Jan Lundqvist. *Comment (L.E.)*: 3 σ confidence in the age limit figure.

St-529. Målke C 1 **3280 \pm 110**

Peat from a moor close to Mount Målke (66° 28' N Lat, 16° 08' E Long), Arjeplog parish, Lappland. Sample was collected inside a terminal moraine belonging to an abandoned cirque, at a depth of 70 cm immediately above the moraine surface. It should date the end of the melting process of the former cirque glacier. Coll. 1959 and subm. by Lennart Vilborg, Dept. of Geog., Stockholm Univ.

Dry fir series

This series was part of a study on postglacial variations of the upper limit of a *Pinus* forest, caused by climatic changes. All samples consist of well preserved *Pinus* stumps partly revealed by erosion from the coverage of present vegetation at alt above the present-day forest-line. Subm. by G. Lundqvist. Another part of this series has been dated previously (Stockholm II) and was described by G. Lundqvist (1959).

St-520. Abisko 2 **5620 \pm 100**

Location: an area S of Abisko Tourist Hotel at Lake Torneträsk (68° 20' N Lat, 18° 43' E Long) Lappland, alt 525 m above sealevel. Coll. 1959 by G. Sandberg.

St-521. Abisko 3 **6130 \pm 115**

Same data as St-520, but alt 575 m.

St-522. Abisko 4 **5175 \pm 100**

Same data as St-521.

St-523. Abisko 5 **3900 \pm 80**

Same data as St-520, but alt 530 m.

St-538. Kvikkjokk 1 **6430 \pm 100**

Location: on Mount Ruoutevare (67° 00' N Lat, 17° 43' E Long), Lappland, alt 576 m. Coll. by G. Lundqvist.

St-539. Kvikkjokk 2 **6810 \pm 110**

Same data as St-538.

- St-541. Strimasund 1** **4485 ± 80**
 Location: close to Strimasund border patrol station (66° 10' N Lat, 14° 53' E Long), Lappland, alt 550 m. Coll. by S. af Ekenstam.
- St-621. Strimasund 2** **2690 ± 80**
 Same data as St-541, but coll. by G. Lundqvist.
- St-623. Dåkkejaure 8** **6630 ± 120**
 Location: just N of Mount Ammarfjället (66° 10' N Lat, 15° 38' E Long), Lappland, alt 664 m. Coll. by G. Bexell.
- St-645. Steukajokk 3** **5315 ± 85**
 Location: the same as St-623, alt 819 m.
- St-540. Kelottijärvi** **5410 ± 100**
 Location: NW of Karesuando (68° 30' N Lat, 14° 00' E Long), Lappland, alt 369.5 m. Coll. by late Dr. G. Ekström.
- St-687. Gurkbäcken**
 Location: N of Tärnaby (65° 48' N Lat, 15° 20' E Long), Lappland, alt 620 m. Coll. by K. Nilsson.
- St-536. Dyllen** **265 ± 90**
 Recently fallen dry fir SW of Lake Grövelsjön (62° 02' N Lat, 12° 15' E Long), Dalarna, alt 820 m. Coll. by G. Lindgren.

II. GEOLOGIC SAMPLES—OTHER COUNTRIES

Hanaizumi series

Wood fragment from profiles in the Hanaizumi bed at Kanamori (38° 51' N Lat, 140° 55' E Long), Hanaizumi-machi, 70 km N of Sendai, NE Japan. This bed is interesting for its mammalian deposits. Coll., subm. and preliminary description by the Kanto Loam Research Group (1961).

- St-476. Hanaizumi 4** **21,430 ± 800**
 Uppermost part of Zone 7.
- St-531. Hanaizumi 9** **16,050 ± 170**
 Lower part of Zone 8.
- St-533. Hanaizumi 10** **28,080** + 1250
- 1100
 Zone 9.
- St-534. Hanaizumi 11** **Average 35,000** + 2000
- 1500
 Zone 13. Sample was divided into two parts. Part A was treated only with acid for carbonate removal before burning. Part B was carefully treated with an acid-alkali-acid cycle for removal of younger humus.
- St-534 A. Without pretreatment** **34,500** + 3000
- 2000

St-534 B. With pretreatment **35,500** \pm **3000**
- 2000

Comment (L.E., G.Ö.): N.B., owing to the strong asymmetry of the error of this age, there is ca. 2% probability that the sample is more than 40,000 yr old.

St-676. Valkeissuo **7610** \pm **115**

Carex peat underneath a bed of littoral sand, 170 cm thick, at Valkeissuo (62° 53' N Lat, 27° 41' E Long), Kuopio parish, Finland. Alt 94.2 m; 12.2 m above Lake Kallavesi. The Valkeissuo bog was submerged by transgression of Lake Kallavesi (Kotilainen 1953; Donner 1957). Coll. 1953 by M. Mansala and A. Rönty; subm. by Veikko Okko, Dept. of Geog., Helsinki Univ.

St-689. Heposuo **5500** \pm **100**

Limnic gyttja (mud) interbedded in terrestrial peat, Kuopio Parish (62° 54.6' N Lat, 27° 56.5' E Long), Finland. Alt 94.5 m; 12.5 m above Lake Kallavesi. The Heposuo bog was submerged by a transgression of Kallavesi during the postglacial climatic optimum (Okko, 1948, Donner, 1957). Coll. 1960 and subm. by Veikko Okko.

St-527. Tuusula **4600** \pm **115**

Roots of black alder (*Alnus glutinosa*) from the Isokorpi bog, Ruotsinkylä, Tuusula (60° 22' N Lat, 25° 02' E Long). Imbedded in beach-sand at alt 51.5 m. According to Sauramo (1954, 1958) the roots are remains of a forest submerged by the Ancylus or Echeneis transgression of the Baltic Sea. The supposed age of the roots is 8000 yr B.P. Coll., subm. and desc. by Veikko Okko (1960).

III. ARCHAEOLOGIC SAMPLES SWEDEN

A. History of Iron Manufacturing

Osmund forges series

Charcoal imbedded in slag from ancient iron manufacturing furnaces, so-called osmund forges. Subm. by G. Lundqvist, Geol. Survey of Sweden.

St-642. Tjärnåshyttan **1860** \pm **90**

Pieces of slag from osmund forge found at Tjärnåshyttan (60° 31' N Lat, 16° 24' E Long), 10 km SW of Storvik, Gästrikland. Coll. by G. Lundqvist.

St-640. Dammsjön **1415** \pm **130**

Pieces of osmund forge slag found just N of Lake Dammsjön (60° 26' N Lat, 16° 26' E Long), ca. 20 km SSW of Storvik, Gästrikland. Coll. by G. Lundqvist.

St-643. Åsmundhyttan **1980** \pm **100**

Pieces of osmund slag from a slag heap at Åsmundhyttan (60° 29' N Lat, 16° 27' E Long), 12 km S of Storvik, Gästrikland. Coll. by P. Engqvist. Note that the name of the community means "osmund forge."

St-644. Vall 1640 ± 85

A fairly large heap of slag at Vall (60° 31' N Lat, 16° 24' E Long), ca. 11 km SSW of Storvik, Gästrikland. Coll. by P. Engqvist.

St-707. Gävle 760 ± 75

Slag on an ancient grave field just NE of the city of Gävle (60° 41' N Lat, 17° 07' E Long), Gästrikland.

Falun Copper Mines series

Samples of peat and wood within lower layers of old mineral waste, and underlying material collected and investigated in order to date the beginning and earliest period of the mining activity in Falun Copper Mines, Falu Gruva (60° 36' N Lat, 15° 36' E Long), Falun, Dalarna. Coll. by G. Lundqvist and C. Larsson; subm. by Stora Kopparbergs Bergslags Ltd., Falun. A report is being prepared by C. Lundqvist. *Comment* (G.Ö.): three samples of this series have been listed previously (Stockholm I) and desc. by G. Lundqvist (1957). These age figures are now recalculated to NBS-scale and marked with an *n* before the St-number.

n St-163. Falun 1, peat	1050 ± 60
St-557. Falun 2, peat	840 ± 85
St-556. Falun 3, wood	1230 ± 80
St-558. Falun 4, wood	600 ± 70
n St-165. Falun 5, wood	635 ± 55
n St-166. Falun 7, wood	820 ± 60
St-738. Falun 9, peat	4220 ± 105
St-684. Krongården 1, wood	415 ± 100
St-663. Krongården 8, peat	4240 ± 80
St-685. Krongården 10, wood	390 ± 70
St-664. Krongården 11, peat	1605 ± 65

*B. Problems of Late Bronze Age—Early Iron Age***Fiskeby and Horn series**

Resin caulking from various grave fields in middle Sweden. Among them, the Fiskeby grave field forms a chronologic series of graves from the last phase of the Bronze Age to the second half of the Viking Age. The resin was used as tightening material in bark boxes filled with cremated bone. In addition, many of the graves contain only artifacts which cannot yet be dated archaeologically, but which are of importance for further work. In Sweden, however, there is a serious lack of archaeological material that can be connected with the first two periods of the Iron Age (500 to 100 B.C.). C¹⁴ dating of the caulking may also indicate whether the break in the series of finds indicates an intermission in

the use of the burial place, or is caused by other reasons. Samples were collected in 1951-1952 and subm. by P. Lundström, Mus. of National Antiquities, Stockholm. Descriptions have been made by Sahlström and Gejvall (1948, 1954) and the submitter (Lundström, 1952a, b). Some age figures belonging to this series have been published in previous dating lists of this Laboratory (Stockholm II and III). Because this extensive sample series is at least temporarily finished and the result is to be used by the submitter, previous dates are repeated here. These have been recalculated to be expressed in the internationally adopted NBS-scale. These samples have been marked with "n" before the St-number.

Fiskeby

A grave field including 520 inhumations, located at Fiskeby (58° 36' N Lat, 16° 06' E Long), Ö. Eneby parish, Östergötland.

n St-317.	Fiskeby 1, Grave no. 248	2455 ± 90
n St-321.	Fiskeby 2, Grave no. 217	2450 ± 85
n St-326.	Fiskeby 3, Grave no. 536	1970 ± 75
n St-327.	Fiskeby 4, Grave no. 556	2015 ± 85
n St-385.	Fiskeby 5, Grave no. 366	1925 ± 100
n St-390.	Fiskeby 7, Grave no. 317	2580 ± 90
n St-405.	Fiskeby 6, Grave no. 7	2085 ± 140
n St-481.	Fiskeby 14, Grave no. 316	2045 ± 80
n St-482.	Fiskeby 13, Grave no. 290	2065 ± 110
n St-483.	Fiskeby 15, Grave no. 198	1995 ± 80
n St-484.	Fiskeby 16, Grave no. 414	2280 ± 85
n St-505.	Fiskeby 17, Grave no. 614	1915 ± 80
n St-507.	Fiskeby 19, Grave no. 283	1875 ± 80
n St-509.	Fiskeby 21, Grave no. 542	2015 ± 70
n St-510.	Fiskeby 22, Grave no. 681	1885 ± 60
St-630.	Fiskeby 44, Grave no. 143	1945 ± 70
St-631.	Fiskeby 43, Grave no. 117	2020 ± 70
St-634.	Fiskeby 42, Grave no. 580	2060 ± 70
St-638.	Fiskeby 41, Grave no. 464	1790 ± 75
St-639.	Fiskeby 40, Grave no. 370	2040 ± 70
St-646.	Fiskeby 39, Grave no. 239	2180 ± 70

St-649.	Fiskeby 38, Grave no. 237	2085 ± 70
St-650.	Fiskeby 37, Grave no. 42	2320 ± 90

Horn

Grave field at Horn church (58° 31' N Lat, 13° 54' E Long), Västergötland.

n St-444.	Horn 9, Grave no. 109	2045 ± 70
n St-445.	Horn 10, Grave no. 119	2185 ± 90
n St-446.	Horn 11, Grave no. 211	1965 ± 80
St-590.	Horn 23, Grave no. 77	2200 ± 100
St-591.	Horn 24, Grave no. 210	1950 ± 80
St-592.	Horn 25, Grave no. 205	1970 ± 85
St-593.	Horn 26, Grave no. 216	2190 ± 90
St-594.	Horn 27, Grave no. 41	2160 ± 110
St-595.	Horn 28, Grave no. 74	2130 ± 80
St-596.	Horn 29, Grave no. 207	2020 ± 85

Bankälla

Location: Bankälla (58° 32' N Lat, 13° 56' E Long), Välla parish, Västergötland.

n St-480.	Bankälla 12, Grave no. 50	1910 ± 75
St-597.	Bankälla 30, Grave no. 57	2240 ± 90
St-598.	Bankälla 31, Grave no. 40	2190 ± 80

Rogsta Hage

Location: Rogsta Hage (58° 51' N Lat, 17° 13' E Long), Tystberga parish, Södermanland.

n St-443.	Rogsta Hage 8, Grave no. 24	2415 ± 100
St-659.	Rogsta Hage 33, Grave no. 31	2480 ± 100
St-652.	Vikingstad 36	2030 ± 90

Location: Nybble (58° 23' N Lat, 15° 28' E Long), Vikingstad parish, Östergötland.

St-653.	Klockrike 35	2405 ± 100
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Location: Berga (58° 29' N Lat, 15° 21' E Long), Klockrike parish, Östergötland.

St-657.	Östra Huseby 34	2160 ± 70
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Location: Odensberget (58° 35' N Lat, 16° 34' E Long), Östra Huseby parish, Östergötland.

St-660. Vreta Kloster 32 **2105 ± 75**

Location: Brunneby (58° 30' N Lat, 15° 30' E Long), Vreta Kloster parish, Östergötland.

Persberg series

Charcoal samples from one grave and one hearth at Persberg (58° 23' N Lat, 13° 05' E Long), Våmb parish, Västergötland. The constructions are situated on a grave field with large cairns containing burial remains from the Bronze Age to Roman Iron Age. The samples have been taken from two of the many cairns which lack archaeological datable finds. Coll. 1957 by Ulla Silvén; subm. by Else Nordahl, Mus. of National Antiquities.

St-741. Carin 2 T, hearth **2165 ± 100**

St-742. Cairn 2 D, cremation **2015 ± 80**

St-739. Igelsta 9 **3095 ± 105**

Charcoal from a cairn of brittle-burned stones at Igelsta (59° 11' N Lat, 17° 40' E Long), Östertälje parish, Södermanland. Judging from connected finds the construction should date from Late Bronze or Early Iron Age. Coll. 1958 by Birgitta von Heland; subm. by Else Nordahl. *Comment* (E.N.): date is younger than expected. This will be investigated further.

St-740. Åkerby **1580 ± 90**

Resin caulking from a grave at Åkerby (59° 40' N Lat, 17° 03' E Long), Vårfrukyrka parish, Uppland. The grave, no. 8 in a Bronze Age cemetery, apparently has been robbed and on excavation contained only the remains of a cremation burial from the Iron Age. Coll. 1959 and subm. by Else Nordahl.

Bälinge series

Resin caulking from two graves at Högsta (59° 59' N Lat, 17° 71' E Long), Bälinge parish, ca. 15 km N of Uppsala, Uppland. Of ca. 40 graves, ca. 10 could be dated by metal finds to between 1,000 and 0 B.C. Many of the undated graves seem to belong to the same time periods. Samples are taken from this group. Coll. 1955 and subm. by Margareta Biörnstad, Royal Office of Antiquities (Biörnstad, 1960).

St-503. Bälinge Grave no. 4 **2070 ± 80**

St-504. Bälinge Grave no. 11 A **2080 ± 100**

*C. Various Archaeological Samples, Sweden, except Lappland***Skedemosse series, Öland**

Wood samples from a drained fen, Skedemosse (56° 05' N Lat, 16° 45' E Long), Gårdslösa parish, Öland, coll. from different layers and constructions in the fen. The normal profile has a total depth of ca. 100 cm subdivided as follows: Cultivated layer/Peat/Algal gyttja/Lime gyttja/Sand/Layer of stumps, logs and coarse detritus/Gravel. In the Algal gyttja have been found

sacrificial finds consisting of partly destroyed jewellery, weapons and bones of animals and human beings, datable to the 4th and 5th centuries A.D. It is comparable with well-known finds in Danish bogs, even surpassing them in its richness in gold. In the same layer were found floats and fish-hooks. Fishing activity is also shown by two fish weirs. The best-preserved one, from which samples St-618 and 619 were collected, is of a type well-known from ethnographical material, but unknown in prehistoric contexts. The construction of these fish weirs precludes any dating other than by C¹⁴. Site is described by U. E. Hagberg 1961 and 1962. Coll. 1959 and 1960 and subm. by U. E. Hagberg, Royal Office of Antiquities.

St-518. Skedemosse 18 **9200 ± 160**

Stick in the stump layer, 70 cm below surface.

St-519. Skedemosse 10 **2300 ± 80**

Stick in the algal gyttja, 30-35 cm below surface.

St-618. Skedemosse 223 **3270 ± 90**

Laths from the catchholder of a "northern" fish weir.

St-619. Skedemosse 223: XIX **3410 ± 100**

Stake from "northern" fish weir.

St-620. Skedemosse 300 **3350 ± 90**

Laths from "southern" fish weir.

St-662. Skedemosse 302 **2505 ± 70**

Bark float between algal gyttja and lime gyttja ca. 35 cm below surface.

St-665. Skedemosse 317 **3475 ± 100**

Bark float in peat 25 cm below surface.

St-603. Västra Älten **< 265**

Wood from a dugout canoe found in Lake Västra Älten (56° 24' N Lat, 15° 30' E Long), Möllekulla, Tving parish, Blekinge. Canoe, made of an oak log, was found at the shore on the lake bottom partly covered by gyttja (water depth 0.5 m). Sample was taken from the outer annual rings. It was not possible to make a geologic or archaeologic dating. Dug-out canoes are known to have been used very late in lakes of southeastern Sweden. Coll. and subm. by B. E. Berglund, Dept. of Quaternary Geol., Univ. of Lund. *Comment* (G.Ö.): 2σ confidence (97%) in age figure σ = 80. (B.E.B.): C¹⁴ dating confirms the assumption that the boat was very young.

St-605. Lörby **315 ± 80**

Wood from a dug-out canoe found in the Baltic Sea, Lörby (56° 05' N Lat, 14° 44' E Long), Mjällby parish, Blekinge. The canoe, made of a beech log, was found on the sea bottom almost completely covered by sand (water depth 5-6 m) ca. 200 m from the shore. Sample was taken from the outer annual rings. It was not possible to make a geologic or archaeologic dating.

Coll. and subm. by B. E. Berglund. *Comment* (B.E.B.): C¹⁴ dating indicates that dug-out canoes occurred rather late at the sea coast of Blekinge.

St-661. Äskekärr **1120 ± 75**

Cattle hair from clinker-built ship of Viking type, found at Göta Älv River at Äskekärr (57° 56' N Lat, 12° 04' E Long), Starrkärr parish, Västergötland. The ship was excavated in 1933. Sample subm. by C.-A. Moberg, Archaeol. Mus., Göteborg.

St-577. Vallhagar **1800 ± 85**

Resin calkings from a grave in the large crematory grave field of Vallhagar (57° 20' N Lat, 18° 13' E Long), Fröjel parish, Gotland. In 1946-1949 this site, hitherto the largest migration period settlement of the North (25 house grounds), was excavated as an international team work (Stenberger et al., 1955). The grave contains an unburnt skeleton, and connected finds date it to the 1st or 2nd century A.D. Coll. 1959 and subm. by E. Nylén, Gotlands Fornsal, Visby.

Resin cakes series

Finds of a particular type of resin cake, subm. by M. P. Malmer, Mus. of National Antiquities. Approximate archaeological dating is Bronze Age, but closer date is desirable.

St-690. Vittened **2945 ± 75**

Pieces of resin cake found connected with probable Late Neolithic tools at Vittened (58° 15' N Lat, 12° 45' E Long), Högarne, N. Björke parish, Västergötland, in a layer of gyttja on sand, at depth of 1.4 m in a peat bog. Coll. 1929 by K. and S. Levin. The tools have been described by A. Oldeberg (1932).

St-514. Tågarp 7 **2800 ± 80**

Two resin cakes found A.D. 1845 together with 12 others of similar type in the Orbyngs-bog, Tågarp (55° 30' N Lat, 13° 15' E Long), V. Tommarp parish, Skåne.

St-515. Borrby **2770 ± 100**

Five resin cakes and fragments of a sixth found A.D. 1806 in a bog in Borrby parish (55° 20' N Lat, 14° 07' E Long), Skåne.

St-513. Bergstena **400 ± 85**

Wood from a cellar construction at one of the oldest farms in W Sweden, situated in Kolbäck (58° 04' N Lat, 12° 38' E Long), Bergstena parish, Västergötland. Construction material was taken from a Swedish stave church in the middle of the 19th century. The church is believed to have been built during the Medieval Period. Subm. by S. A. Hallbäck, The Vänersborg Mus., Vänersborg.

St-516. Drottningholm **1580 ± 85**

Wood from a wooden structure, found A.D. 1959 in a chieftain's grave from the Iron Age cemetery at Viken (59° 19' N Lat, 17° 53' E Long), close

to the castle of Drottningholm, 10 km W of Stockholm. The grave had been robbed in an earlier time. Collected during excavations led by Greta Arwidsson, Dept. of Northern Archaeol., Stockholm Univ. and subm. by her.

Dragby series

Resin and charcoal from a large prehistoric cemetery at Dragby (59° 59' N Lat, 17° 35' E Long), Skuttunge parish, Uppland. The field includes ca. 330 visible constructions belonging to one continuous series, or possibly two periods, from Late Neolithic to early Roman Iron Age. Coll. 1960 by S. Rydh and Ulla Silvé; subm. by M. Stenberger, Inst. of Scandinavian Archaeol., Uppsala Univ. Other samples have been dated by Olsson (Uppsala I and II). Site is described by Stenberger (1960) and others.

St-698. Dragby 162 B **2290 ± 90**

Resin from a grave on lower level.

St-699. Dragby 331 **2425 ± 80**

Charcoal from same level as St-698.

St-700. Dragby 88 P **3175 ± 80**

Charcoal on top of latest entombed bodies in a megalithic stone cist.

St-703. Dragby 88 U **3255 ± 80**

Charcoal from a hearth stratigraphically belonging to same period as megalith tomb.

St-701. Dragby 88 M **2470 ± 80**

Charcoal above peat layer (old ground surface) on top of gravel filling of the megalith tomb.

St-702. Dragby 88 Q **2780 ± 80**

Charcoal from a cremation presumably belonging to same period as 88 M, definitely younger than 88 U.

St-704. Dragby 88 S **3145 ± 130**

Charcoal underlying a grave possibly belonging to same period as 88 M.

Högom series

Birch bark and charcoal from postholes of a house, underlying a grave mound from the 6th century A.D. at Högom (62° 24' N Lat, 17° 16' E Long), N of Sundsvall, Selånger parish, Medelpad. The house, which may be one of the oldest excavated in northern Sweden, could not be dated with artifacts but must be older than the grave for stratigraphic reasons. Coll. 1956 and subm. by Margareta Biörnstad.

St-586. Högom 1 **1535 ± 90**

Birch bark from vertical posthole.

St-587. Högom 2 **1450 ± 80**

Birch bark from vertical posthole.

St-588. Högom 3 **1610 ± 85**

Charcoal from hole with vertical post.

St-589. Högom 4 **1650 ± 80**

Charcoal from horizontal beam.

Comment (M.B. and G.Ö.): the slightly older values for the charcoal samples probably reflect a reasonable growth time for the wood.

Lossnen series

Resin calkings from two graves in a grave field at Smalnäset, Lake Lossnen (62° 25' N Lat, 12° 51' E Long), Tännäs parish, Härjedalen. The place is a small peninsula containing 36 inhumations. Some of the graves contain only metal artifacts which cannot yet be dated archaeologically. There were also some stone artifacts in two graves. The resin was used as tightening material in bark boxes filled with cremated bone. Coll. and subm. by H. Hvarfner, Royal Office of Antiquities.

St-511. Lossnen 3 **2070 ± 90**

St-512. Lossnen 17 **2060 ± 75**

D. Archaeology of Lappland

Umnässjön series

Samples from a site situated on one side of a small low peninsula in the upper part of Lake Umnässjön (65° 24' N Lat, 16° 03' E Long), Stensele parish, Lappland. Among the finds of the usual stone age character were two strike-a-light stones of Iron Age type. Coll. 1958 by Elisabeth Allard; subm. by H. Hvarfner and Elisabeth Allard.

St-743. Umnässjön 1 **1660 ± 105**

Charcoal from heavy trunks or branches in a cooking pit 2 m from the shoreline.

St-744. Umnässjön 2 **1625 ± 100**

Charcoal from small twigs and bark in the sand wall around the same cooking pit. One fragmentary quartz spear head was found with the charcoal layer.

St-745. Umnässjön 3 **1040 ± 80**

Charcoal, partly mixed with sand from Hearth no. 8 at the shoreline.

St-746. Umnässjön 4 **850 ± 80**

Similar to St-745 but from Hearth no. 9.

Döudden series

Charcoal from a site at Döudden (66° 04' N Lat, 18° 09' E Long), Stensund, at Lulepotten Bay in Lake Hornavan, Arjeplog parish, Lappland. The place is a small peninsula formed by drifting sand, bound by vegetation and contains several culture levels. Lower levels contain stone artifacts only, but

the upper levels also contain pottery. Coll. 1958 by Birgitta Hallgren and G. Östlund; subm. by H. Hvarfner and B. Hallgren. Dates in this series were published (Stockholm III) under the name Hornavan series. See Hallgren, 1959. A comprehensive description is being prepared by her. Previous dates are also repeated here, recalculated to the NBS-scale, and marked with *n* before the St-number.

Profile 10

n St-454. Döudden 2 **1865 ± 80**

Thin, extensive layer of charcoal, on this point covered by 70 cm of sand up to base of present-day vegetation. Sample was located just on top of the uppermost reliable cultural layer.

St-547. Döudden 3 **3200 ± 100**

Charcoal layer ca. 20 cm below the layer with sample St-454.

St-548. Döudden 4 **5200 ± 150**

Lowest charcoal layer, here ca. 40 cm below sample St-454.

Profile 9

n St-455. Döudden 5 **1655 ± 70**

Stratigraphically the same layer as St-545 but 5 m from that point. Here covered by sand 25 cm thick.

St-549. Döudden 6 **3815 ± 85**

Thin charcoal layer ca. 30 cm below the layer with sample St-455.

St-550. Döudden 7 **5070 ± 125**

Lowest charcoal layer ca. 20 cm below St-549.

St-551. Döudden 8 **5050 ± 120**

Same layer as St-550.

Additional samples

n St-457. Döudden 13 **1755 ± 75**

Same layer as St-454 and St-455.

St-553. Döudden 15 **3560 ± 85**

Intermediate charcoal layer containing asbestos pottery.

St-552. Döudden 14 **5100 ± 85**

Charcoal connected with a quartzite scraper situated below brittle-burned stones in lowest layer.

n St-453. Döudden 1 **6105 ± 100**

Charcoal from hearth in lowest layer. Cf dates on sifted samples St-453 A, F, C in Stockholm III.

n St-456. Döudden 11 **6115 ± 100**

Charcoal from another hearth at the same stratigraphic position as St-453. At least one stone scraper was found definitely related to the hearth.

Varghalsen series

Samples from site at Varghalsen on island of Galtisguts (66° 04' N Lat, 17° 54' E Long), in SE part of Lake Hornavan, Arjeplog parish, Lappland. Site is partly covered by sand dunes on the beach, and by a small moor inside the dunes. Coll. 1960 by Birgitta Hallgren and B. O. H. Johansson; subm. by H. Hvarfner and B. Hallgren.

St-691. Varghalsen 3 **875 ± 70**

Charcoal layer, containing quartzite artifacts and imbedded in podzol. Location T 112.

St-693. Varghalsen 5 a **1675 ± 80**

Highly humified peat layer indicating old ground surface, containing asbestos pottery, now covered with sand. Location W 24.

St-695. Varghalsen 5 c **1110 ± 70**

Stratigraphically the same layer as St-693. Location X 22.

St-696. Varghalsen 33 **620 ± 65**

Peat sample from the moor, 25-27 cm below surface. Location AO 45.

St-692. Varghalsen 34 **1840 ± 75**

Peat 8 cm below St-696. Location AO 45.

St-697. Varghalsen 35 **4380 ± 85**

Peat 41-42 cm below surface and 8 cm below St-692. The layer contains Hearth no. 23. Location AO 45.

E. Younger Laponian Cultures

All samples subm. by E. Manker, Nordic Mus., Stockholm.

St-721. Vuollerim **310 ± 95**

Fragment of a wooden sledge (akja) from a grave at ca. 0.5 m depth. Find was made at Vuollerim (66° 26' N Lat, 20° 57' E Long), Jokkmokk parish in the 1930's and sent to the Museum in 1945.

St-760. Njuovvo-vierah **300 ± 80**

Fragment of a wooden coffin found at Njuovvo-vierah (66° 36' N Lat, 17° 52' E Long), near Njuorvajokk, where a small stream is crossed by the migration path between Gardeks and Palkesnjuonje Lapp camps, Arjeplog parish. Coll. 1959 by B. Sommarström.

St-722. Kallaksundet **215 ± 60**

Fragment of a child's wooden coffin, found under a block of stone at the Kallaksundet (66° 32' N Lat, 17° 41' E Long), between Lake Tjeggelvas and

Lake Skärfajaure, Arjeplog parish. Coll. 1943 and sent to the Museum the same year.

St-730. Tjatjetievva < **300**

Hair from reindeer skin found in an akja used as coffin which was placed in a grave, about 80 cm deep in a dry heap of earth, Tjatjetievva (66° 02' N Lat, 15° 31' E Long), a marshy district ca. 4 km north of Lake Tärnasjön's northern end, Tärna parish. Coll. 1953 by E. Manker during the Museum's field research. *Comment* (G.Ö.): 2 σ (97%) confidence in the age limit figure. $\sigma = 80$ yr.

St-759. Guttuberget **500 ± 90**

Fragment of birch bark, used as grave clothes. The find was made in a stone coffin-shaped grave at the slope of Guttuberget Mountain (65° 39' N Lat, 15° 31' E Long), near Forsbäck, Tärna parish. Coll. 1923 and sent to Mus. of National Antiquities.

IV. GEOCHEMICAL SAMPLES AND DEEP-SEA CORES

Havtjärnheden series

Soil humus from a profile in a very poor pine forest, ca. 130 yr old, on strongly podzolized moraine (formed from sandstone and porphyry) at Havtjärnheden (61° 21' N Lat, 13° 29' E Long), Älvdalen parish, Dalarna. Atl ca. 500 m. Coll. 1959 and subm. by C. O. Tamm, Forest Research Inst., Stockholm.

	Δ	%	Formal age
St-576. 5006	-17 ± 6		140 ± 80

Transitional horizon between mor (raw humus) layer and mineral soil (A₁ with some A₀). Ash content 81.6% of dry weight.

St-580. 5007	-28 ± 8		230 ± 85
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Leached horizon (A₂). Ash content 96.1% of dry weight.

St-575. 5008 B	-49 ± 6		400 ± 80
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Accumulation horizon (B₁ with some B₂). B₁ is a very dark-brown hardpan. Ash content 89.2% of dry weight. *Comment* (G.Ö.): error in Δ for comparison within this series only. Error in age figures is total error.

General Comment (C.O.T.): this series parallels the Garpenberg series St-472, 473, and 474 (Tamm and Östlund 1960), but is from a much poorer site. The C¹⁴-content of organic matter in the hardpan corresponds to a formal age of 400 ± 80 yr, which is approx. the same as in B-horizon humus in sample St-474. B-horizon organic matter from a humus podzol in the Netherlands has been dated to 940 ± 20 yr (sample L-251 in Lamont III). The A-horizon organic matter (St-575 and St-576) is younger and cannot be safely dated, but the figures suggest that a considerable part of the humus is older than the present forest generation at Havtjärnheden. This is in contrast to the results from Garpenberg.

Albex series

Eight samples of *Globigerina* ooze and detrital *Globigerina* mud, from deep-sea cores nos. 224 and 225 collected off W coast of Africa by the Albatross Expedition (Alb-ex), the Swedish Deep Sea Expedition 1947-1948. Subm. by Ulla Regnell, Dept. of Mineral. and Geol., Univ. of Lund. Only carbonate fraction used. Core 224 was taken at depth of 2810 m (18° 50' N Lat, 18° 24' W Long). Core 225 was taken at depth of 2978 m (18° 44' N Lat, 18° 44' W Long). Levels are given in cm below sediment surface.

St-559. Albex 1	7940 ± 140
Core 224 Level 98-99, grain size >150 μ .	
St-560. Albex 2	8200 ± 110
Core 224 Same level, grain size <150 μ .	
St-561. Albex 3	14,920 ± 300
Core 224 Level 252-264 cm.	
St-562. Albex 4	24,170 + 950 - 760
Core 224 Level 410-423 cm.	
St-666. Albex 5	6375 ± 90
Core 225 Level 42-50.5 cm.	
St-667. Albex 6	23,020 ± 450
Core 225 Level 289-301 cm.	
St-667. Albex 7	37,000 + 3000 - 2000
Core 225 Level 395-407 cm. <i>Comment</i> (L.E.): age + 2 σ is equivalent to 45,000 yr. Residual activity is (1.0 ± 0.3) % of standard NBS or $\Delta = -990 \pm 3$.	
St-669. Albex 8	>40,000
Core 225 Level 558-571 cm. <i>Comment</i> (L.E.): 3 σ confidence.	
<i>General Comment</i> (G.Ö.): dates are C ¹⁴ -time elapsed since the material was in solution at the sea surface, i.e. δC^{13} corrected age minus 400 yr. Cf. Intro. to Miami I.	

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