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# TRONDHEIM NATURAL RADIOCARBON MEASUREMENTS IX

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## INTRODUCTION

Most dates in this list were measured from 1976 to 1981. The counting technique is based on gas counting of $CO_2$ in proportional counters at 2 atmospheres pressure. In addition to the 6 previous counters, with effective volumes ranging between 0.6L and 1.6L (R, 1978, v 20, p 105–133), two very small counters have been put into operation. These counters, effectively based on 0.2L and 0.1L $CO_2$, have backgrounds of 0.10 and 0.12 c/min and standard net count of 1.29 c/min and 0.69 c/min, respectively.

Chemical treatment of samples largely follows our earlier procedure. For gyttja samples, we tend to date the soluble and insoluble fractions separately. The date is only regarded satisfactory when agreement in age occurs between the two fractions. Dating of very old shells (>30,000 yr) has generally been performed on outer and inner fractions of the sample. Even if these fractions normally yield equal $^{14}C$ ages, their reliability is often still doubted. Independent methods of amino acid and thorium/uranium dating have not yet completely excluded the possibility of contamination with younger carbon.

Ages are calculated according to the Libby half-life of 5570 ± 30 years. The recent standard is 95% of the $^{14}C$ activity of oxalic acid, referring to AD 1950. All ages are given in years before present (AD 1950) and correction for isotopic fractionation is generally performed. In addition to these dates, MASCA-calibrated dates are provided for samples up to 7000 yr, and are cited, AD/BC*. The shell samples in our present and previous date lists are also corrected for reservoir effect (440 yr) and thus represent a fairly true historical age.

## ACKNOWLEDGMENTS

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## GEOLOGIC SAMPLES

### *Svalbard*

*Raised Beaches*

**Forlandet series**

Shells, shell fragments, and whale bone from Prins Karls Forland, Svalbard were coll 1975 to date sediments and raised beaches; subm 1975 to

1976 by Otto Salvigsen, Norwegian Polar Inst, Oslo. *Comment* (OS): samples designated SA are Th/U dated. Th/U ages of this series agree with $^{14}C$ results (Salvigsen & Nydal, 1981). If dates are reliable, series shows that highest beaches and great amounts of sediment are 30,000 to 40,000 yr BP. Late Weichselian ice sheet did not reach Prins Karls Forland, and area has been free of glacial ice for at least 40,000 yr (Salvigsen, 1977; Mangerud & Gulliksen, 1975).

**32,750 $^{+\ 450}_{-\ 430}$**

**T-2095. Aberdeenflya 1/SA-10** $\delta^{13}C = +1.4‰$

Shell fragments from surface at +30m (78° 52′ N, 10° 42′ E).

**12,590 ± 70**

**T-2096. Aberdeenflya 2** $\delta^{13}C = +0.9‰$

*Hiatella arctica* from river cut in marine sediments at +9m, depth 0.5m (78° 51′ N, 10° 50′ E). *Comment* (OS): shells lived at unknown water depth.

**35,230 $^{+\ 470}_{-\ 440}$**

**T-2097. Aberdeenflya 3/SA-12** $\delta^{13}C = +1.0‰$

*Hiatella arctica* from river cut in clay-rich sediments at +12m, depth 0 to 0.5m (78° 52′ N, 10° 50′ E).

**9300 ± 120**

**T-2232. Austflyodden 1** $\delta^{13}C = +0.2‰$

*Mya truncata* from beach sediments at +10m (78° 15′ N, 12° 05′ E). Shells probably lived near tidal zone.

**9370 ± 150**

**T-2235. Austflyodden 2** $\delta^{13}C = -19.2‰$

Whale bone, well-preserved rib, on surface at +10m. *Comment* (OS): with T-2232 dates give same age for 10m level.

**9490 ± 140**

**T-2233. Persisvatna** $\delta^{13}C = -16.1‰$

Remnants of whale bone on surface, covered by moss vegetation at +28m (78° 18′ N, 11° 59′ E). *Comment* (OS): age seems too old compared to Austflyodden dates.

**10,880 ± 100**

**T-2391. Vestflya** $\delta^{13}C = +1.0‰$

*Hiatella arctica* in frost-sorted material at +21m, depth 0.25m (78° 15′ N, 11° 55′ E). *Comment* (OS): date is max for 21m level.

**34,250 $^{+\ 440}_{-\ 420}$**

**T-2098. Aberdeenflya 4/SA-15** $\delta^{13}C = +0.9‰$

*Mya truncata* and *Hiatella arctica* on surface, frost-sorted material with stone circles at +36m (78° 51′ N, 10° 49′ E).

**37,340 $^{+\ 910}_{-\ 820}$**

**T-2392. Aberdeenflya 5** $\delta^{13}C = +1.2‰$

*Mya truncata* found in river cut at +10m on surface (78° 51′ N, 10° 56′ E).

**37,050 $^{+\ 910}_{-\ 830}$**

**T-2099II. Sildresletta/SA-16** $\delta^{13}C = +1.2‰$

*Mya truncata* from river cut near underlying bedrock slate at +20m, depth 5 to 7m (78° 46′ N, 10° 52′ E).

**41,400 $^{+\ 1600}_{-\ 1300}$**

**T-2100. Mc Vitiepynten 1/SA-13** $\delta^{13}C = +0.3‰$

*Mya truncata* from thin shell-rich layer in sediments meeting sea in steep, wave-cut cliff at +5.5m, depth 11m (78° 52′ N, 10° 52′ E).

**43,870 $^{+\ 4310}_{-\ 2790}$**

**T-2101. Mc Vitiepynten 2** $\delta^{13}C = +0.3‰$

*Mya truncata* at +6m, depth 10.5m (see T-2100).

**Dansköya series**

Shells and shell fragments from Dansköya and Amsterdamöya, Svalbard (T-2091). Coll and subm 1975 to 1978 by O Salvigsen. *Comment* (OS): dates are max for glacial advance in NW corner of Svalbard. Th/U ages are highly variable and often younger than $^{14}C$ ages.

**28,530 $^{+\ 430}_{-\ 310}$**

**T-2091. Hakluytodden/SA-1** $\delta^{13}C = +0.5‰$

*Mya Truncata* and *Hiatella arctica* deposited on land at +6 to +8m by glacier stream (79° 47′ N, 10° 48′ E).

**38,400 $^{+\ 1400}_{-\ 1200}$**

**T-2092. Kapp de Geer/SA-3** $\delta^{13}C = +0.7‰$

*Mya truncata,* probably pushed up from sea bottom by glacial advance at +6 to +7m, depth 0 to 0.5m (79° 43′ N, 10° 44′ E).

**38,800 $^{+\ 900}_{-\ 800}$**

**T-2093. Kobbefjorden/SA-5** $\delta^{13}C = +0.6‰$

*Mya truncata* from seaward front of moraine ridge of N shore of Kobbefjorden at +3 to +4m, depth 0 to 0.5m (79° 42′ N, 10° 49′ E).

**41,100 $^{+\ 2700}_{-\ 2000}$**

**T-2094. Luftskipsodden 1/SA-8** $\delta^{13}C = +1.1‰$

*Hiatella arctica* from seaward front of moraine ridge at +3 to +4m, depth 0 to 0.5m (79° 41′ N, 20° 43′ E).

**T-2390. Luftskipsodden 2/SA-6** **40,700 $^{+\ 1800}_{-\ 1500}$**

*Hiatella arctica* from sediments probably *in situ* at +4m, depth 0 to 0.5m (79° 41′ N, 10° 46′ E). *Comment* (OS): underwater moraines and moraine ridges on land represent max extension of Late Weichselian ice sheet. Parts of this area have been ice-free for at least 40,000 yr (Salvigsen, 1979; Liestöl, 1972).

**T-3095. Luftskipsodden/SA-8** **38,500 $^{+\ 550}_{-\ 540}$**

*Mya truncata* from seaward front of moraine ridge at +3 to +4m, depth 0 to 0.5m at Luftskipsodden, Dansköya (79° 41′ N, 10° 43′ E). Various fractions (towards inside) $^{14}C$ dated: A(24%): 37,700 $^{+1000}_{-900}$ BP; B(33%): 39,300 $^{+1700}_{-1400}$ BP; C(33%): 38,900 $^{+900}_{-800}$ BP.

**T-3096. Amsterdamöya** **39,700 $^{+\ 1300}_{-\ 1000}$**

*Hiatella arctica* from sand cliff facing sea on W coast at +6m, depth 0.5m at Amsterdamöya (79° 46′ N, 10° 41′ E). Coll 1977; subm 1978 by O Salvigsen.

**Phippsöya series**

Shells and whale bone from Phippsöya, Sjuöyane, Svalbard. Coll and subm 1978 by O Salvigsen.

**T-3100. Phippsöya I/SA78-51** **9950 ± 60**

*Mya truncata* from bottom of 18m high cliff sec facing sea of marine and glacial sediments at +8m, depth 0.5m (80° 42′ N, 21° 00′ E). *Comment* (OS): discrepancy between assumed (30,000 to 40,000 yr) and real age is probably due to misinterpretation of sediments. They may have slid from top to bottom of sec.

**T-3103. Phippsöya II/SA-71** **39,800 $^{+\ 1500}_{-\ 1300}$**

*Hiatella arctica* from till overlain by marine deposits from cliff sec facing sea at +8m, depth 0.5m (80° 43′ N, 20° 48′ E). *Comment* (OS): various

fractions $^{14}C$ dated; A(21%): 41,200 $^{+\ 3100}_{-\ 2200}$ BP; B(21%): 38,000 $^{+\ 3300}_{-\ 2300}$ BP; C(37%): 39,800 $^{+\ 1500}_{-\ 1300}$ BP. Amino acid date: >70,000 yr (Salvigsen & Nydal, 1981).

**T-3102. Phippsöya III/SA-46** **39,400 $^{+\ 1000}_{-\ 900}$**

*Mya truncata* found on and near surface in frost-sorted till above marine limit at +37m to +38m, depth 0 to 0.2m (80° 42′ N, 21° 60′ E). *Comment:* $^{14}C$ dated; A(31%): 38,400 $^{+\ 1960}_{-\ 1500}$ BP; B(31%): 37,600 $^{+\ 1400}_{-\ 1200}$ BP; C(32%): 41,400 $^{+\ 1900}_{-\ 1500}$ BP. Amino acid date: ca 40,000 BP, and Th/U age below ca 50,000 BP.

**T-3104. Phippsöya IV** **1330 ± 70**
$\delta^{13}C = -17.2‰$

Remnants of old-looking whale bone, 0.5m long, on surface of old beach ridge near marine limit at +22.5m (80° 42′ N, 21° 00′ E). *Comment* (OS): sample was thought to date marine limit on Sjuöyane. Age shows that this bone must have been brought up to its level by polar bear or man.

**Damesmorena series**

Samples from marine morainal deposits in Damesmorena, Svalbard (77° 52′ N, 16° 30′ E). Coll 1975 and subm 1978 by Ö Haga and O Salvigsen, Norsk Polarinstitutt, Oslo. *Comment:* dated sample T-2236 supplements previous dates in series (R, 1978, v 20, p 107–108).

**T-2236. Damesmorena 4** **340 ± 80**

Driftwood (*Salix* sp) from oldest part of beach area of Damesmorena at +2m, partly buried in solifluction material from moraine. *Comment* (ÖH): dated for min of great surge of Paulabreen glacier, Van Mijenfjorden (Haga, 1978).

**Svartknausflya series**

Driftwood and whale bones from different levels of raised beaches at Svartknausflya, Nordaustlandet, Svalbard (79° 25′ N, 22° 00′ E). Coll 1976; subm 1976–1977 by O Salvigsen. *Comment* (OS): dated to establish reliable emergence curve for this area (fig 1; Salvigsen, 1978).

**T-2393. Svartknausflya 1** **>46,600 (2σ)**

Log (*Picea* sp) from littoral sand and gravel at +89.9m in permafrost layer 1.5m below surface before its recent exposure by temporary meltwater stream. Diam is ca 0.2m with 120 annual rings. *Comment* (OS): log possibly survived greater extension of ice in Nordaustlandet.

**T-2394. Svartknausflya 2** **9630 ± 120**
$\delta^{13}C = -17.0‰$

Whale bone (*vertebra*) on surface at +70m.

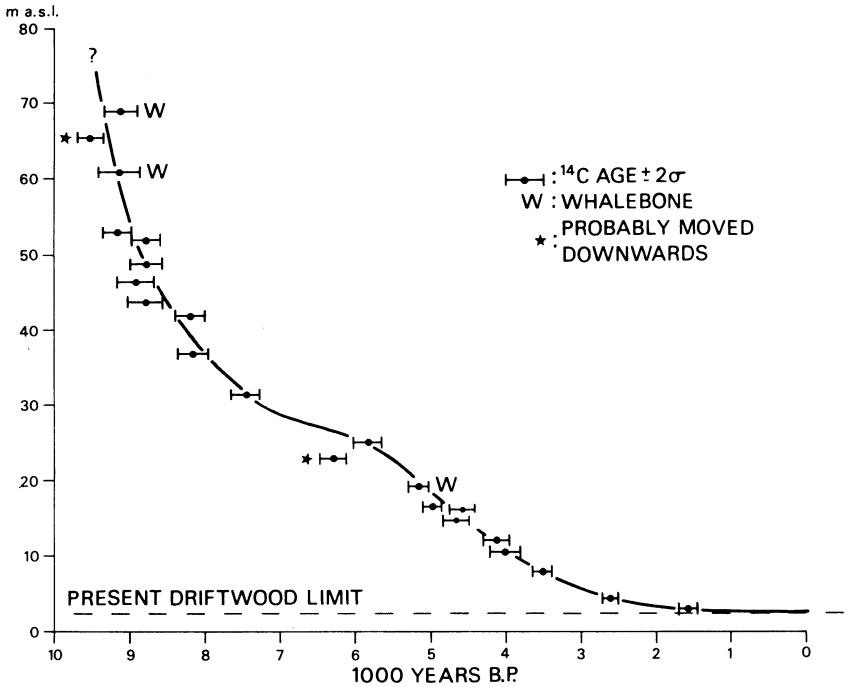


Fig 1. Emergence curve for the southern part of Nordaustlandet based on driftwood dates in the Svartknausflya series

**T-2503. Svartknausflya 3** **9550 ± 80**

Driftwood (*Salix* sp) at +65.5m, probably moved a few meters downwards by temporary meltwater stream.

**9640 ± 140**

**T-2502. Svartknausflya 4** $\delta^{13}C = -18.5‰$

Whale bone, well-preserved jaw, covered by snow field at +68.7m.

**T-2697. Svartknausflya 5** **9130 ± 80**

Driftwood, (*Salix* sp) covered by snow field at +52.8m.

**T-2504. Svartknausflya 6** **8800 ± 100**

Driftwood (*Larix* sp) diam ca 0.25m at +51.8m.

**T-2505. Svartknausflya 7** **8780 ± 110**

Driftwood (*Larix* sp) diam ca 0.3m at +48.7m.

**8890 ± 130**

**T-2696. Svartknausflya 8** $\delta^{13}C = -26.7‰$

Driftwood (*Picea* sp) diam ca 0.2m at +46.3m.

**T-2695. Svartknausflya 9** **8770 ± 120**
$\delta^{13}C = -26.0‰$
Driftwood (*Larix* sp) diam ca 0.35m at +43.7m.

**T-2506. Svartknausflya 10** **8200 ± 110**
Driftwood (*Larix* sp) diam ca 0.4m at +41.8m.

**T-2507. Svartknausflya 11** **8150 ± 100**
Driftwood (*Salix* sp) diam ca 0.15m at +36.8m.

**T-2508. Svartknausflya 12** **7440 ± 110**
Driftwood (*Larix* sp) diam ca 0.3m at +31.4m.

**T-2509. Svartknausflya 13** **5850 ± 90**
Driftwood (*Larix* sp) diam ca 0.45m at +25.1m.

**T-2698. Svartknausflya 14** **6270 ± 90**
$\delta^{13}C = -24.6‰$
Driftwood, conifer, at +23.1m; probably moved downwards.

**T-2510. Svartknausflya 15** **5670 ± 90**
$\delta^{13}C = -17.6‰$
Whale bone covered by beach sediment exposed in river cut 1m below surface at +19.2m.

**T-2699. Svartknausflya 16** **4970 ± 60**
$\delta^{13}C = -25.9‰$
Driftwood (*Larix* sp) diam ca 0.3m at +16.4m.

**T-2396. Svartknausflya 17** **4560 ± 80**
Driftwood (*Larix* sp) diam ca 0.3m at +16m.

**T-2395. Svartknausflya 18** **4650 ± 90**
Driftwood (*Picea* sp) diam ca 0.3m at +14.7m.

**T-2694. Svartknausflya 19** **4100 ± 90**
$\delta^{13}C = -27.1‰$
Driftwood (*Salix* sp), diam ca 0.15m at +12.2m.

**T-2693. Svartknausflya 20** **4020 ± 100**
$\delta^{13}C = -24.4‰$
Driftwood (*Larix* sp), diam ca 0.3m at +10.5m.

**T-2511. Svartknausflya 21** **3520 ± 70**
Driftwood (*Larix* sp), diam ca 0.15m at +7.7m.

**T-2692. Svartknausflya 22** **2600 ± 50**
$\delta^{13}C = -24.4‰$

Driftwood (*Pinus* sp), diam ca 0.25m at +4.5m.

**T-2512. Svartknausflya 23** **1570 ± 70**

Driftwood (*Larix* sp), diam ca 0.5m at +2.7m. *Comment* (OS): limit of new driftwood is ca 2.5m above mean tide level.

**Northern Spitsbergen series**

Dates in this series are part of study of glacial history and old sea levels along Northern Spitsbergen coast. Coll and subm 1977 to 1978 by O Salvigsen.

**T-2700. Liefdefjorden** **9380 ± 110**

*Mya truncata* and *Hiatella arctica* at +6m, depth 0 to 0.3m from Liefdefjorden, Spitsbergen, Svalbard (79° 35′ N, 12° 45′ E). Marine limit is ca 10m.

**T-2701. Reinsdyrflya I** **>35,000**

Shell fragments from surface of frost-sorted material in SE part of Reinsdyrflya, Spitsbergen, at +65m, depth 0 to 0.2m (79° 43′ N, 13° 40′ E).

**T-2702 II. Reinsdyrflya II** **43,300 $^{+1800}_{-1400}$**

*Hiatella arctica* found on and near surface of marine terrace at +80m at Reinsdyrflya (79° 45′ N, 13° 40′ E).

**T-2703. Reinsdyrflya III** **9260 ± 90**
$\delta^{13}C = -17.7‰$

Part of whale rib found on surface at +19m at Reinsdyrflya (79° 45′ N, 13° 50′ E). *Comment* (OS): compared with other whalebone dates in area, this age seems too low.

**T-2838. Reinsdyrflya IV** **9090 ± 70**
$\delta^{13}C = -18.0‰$

Whale cranium, partly covered with beach sediments at +5m at Reinsdyrflya.

**T-2819. Reinsdyrflya V** **9480 ± 140**

Very big *Mya truncata* valves from marine sec, 8m thick, at +4m, depth 0.4m on Stasjonsöyane (79° 41′ N, 13° 40′ E).

**T-2837. Bockfjorden I** **9540 ± 110**
$\delta^{13}C = -17.9‰$

Skeleton of big whale in beach sediments, uncovered by small river at +21.5m at Bockfjorden (79° 28′ N, 13° 25′ E).

**T-2918. Bockfjorden II** **10,050 ± 120**

Shells of *Mya truncata* and *Hiatella arctica* from surface of frost-sorted material at 35m, depth 0 to 0.2m at Bockfjorden (79° 25′ N, 13° 20′ E).

**T-2917. Roosneset** **9580 ± 150**

*Mya truncata,* single valves of >30g from bottom of marine terrace sec at +2m, depth 0.5m at Woodfjorden (79° 39′ N, 13° 20′ E), surface level, 7m asl.

**T-3097. Gråhuken I** **8760 ± 70**
$\delta^{13}C = -17.9‰$

Cranium of big whale on ground surface at +6m at Gråhuken (79° 48′ N, 14° 34′ E).

**T-3098. Gråhuken II** **9360 ± 110**

*Mytilus edulis* shells from marine sec, 11m thick, at +8m, depth 1m at Andrée Land (79° 49′ N, 14° 58′ E). *Comment* (OS): *Mytilus edulis* is now extinct in Spitsbergen waters; date indicates rather warm Early Holocene climate in Spitsbergen.

**T-3099. Gråhuken III** **10,920 ± 120**

*Hiatella arctica* from beach ridge terrace at +40m, depth 0 to 0.2m at Andrée Land (79° 47′ N, 14° 31′ E). *Comment* (OS): date probably represents age of lower marine limit in area. Higher levels seem to be >40,000 yr (T-2702 II).

**Rundisen series**

Driftwood and whale bones from different levels of raised beaches near Rundisen, Kongsöy, Kong Karls Land, Svalbard (78° 50′ N, 29° 20′ E). Coll 1979; subm 1979–1980 by O Salvigsen. *Comment* (OS): dated to establish reliable emergence curve for this area (fig 2; Salvigsen, 1981).

**T-3397. Rundisen 1** **9790 ± 120**

Driftwood (*Larix*) at +100m, recently exposed by temporary meltwater stream, diam ca 0.25m. *Comment* (OS): also dated as interlab check sample, GSC-3039: 9850 ± 80 ($2\sigma$).

**T-3906. Rundisen 2** **33,600 ± 970**
$\delta^{13}C = -20.6‰$

Whale bone at +96m, exposed by meltwater stream. *Comment* (OS): survived last glaciation in Svalbard, age seems too young compared with Rundisen 4 and 5. Coll by Björn Holmgren, Univ Uppsala.

**T-3907. Rundisen 3** **8740 ± 130**
$\delta^{13}C = -17.0‰$

Whale bone on surface at +88m. *Comment* (OS): seems too young compared with driftwood dates. Coll by B Holmgren.

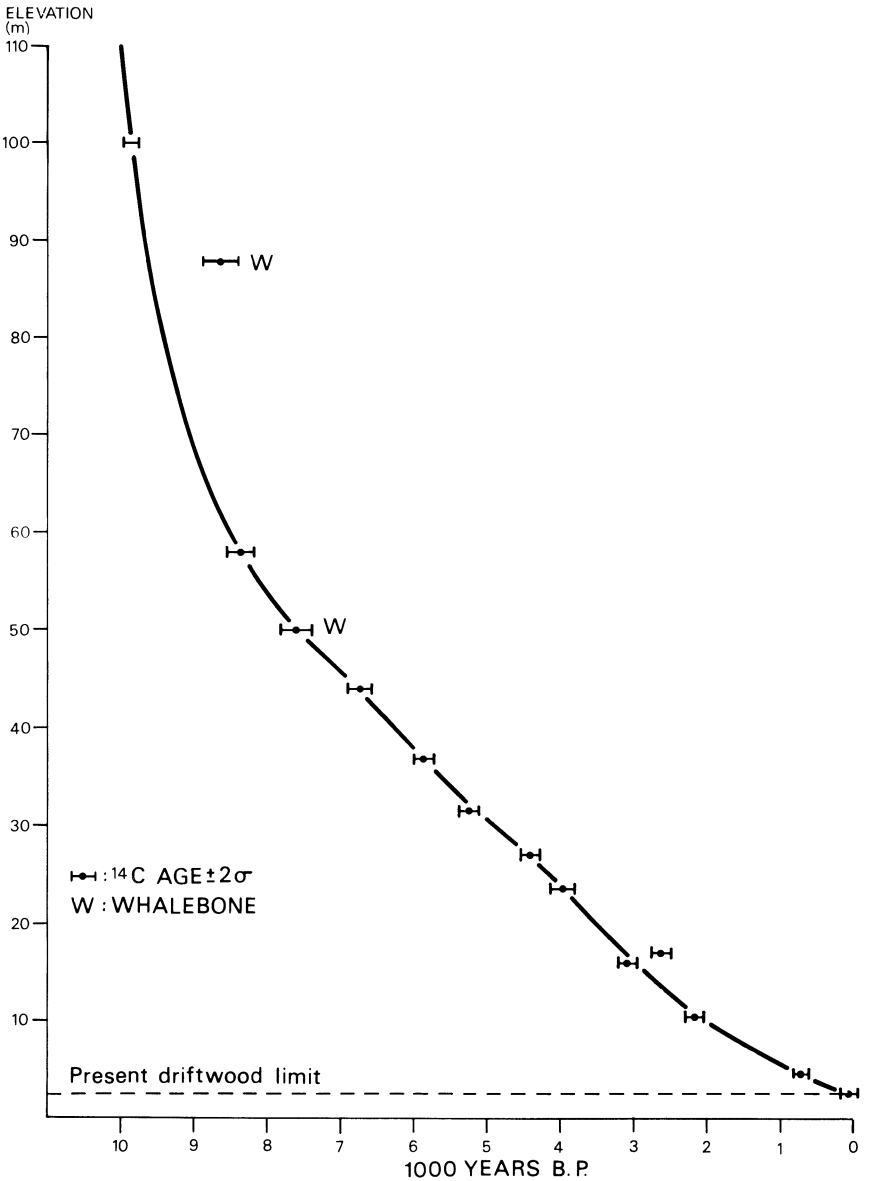


Fig 2. Emergence curve for the eastern part of Kongsøya based on driftwood dates in the Rundisen series

**T-3355. Rundisen 4** **>46,000 ($2\sigma$)**

Driftwood (*Picea*) at +80m, recently exposed by meltwater stream, diam ca 0.05m. *Comment* (OS): survived Last glaciation in Svalbard.

**T-3732II. Rundisen 5** **>52,000 ($2\sigma$)**

Driftwood (*Picea*) at +72m, recently exposed by meltwater stream, diam ca 0.15m. *Comment* (OS): survived Last glaciation in Svalbard.

**T-3456. Rundisen 6** **8370 ± 100**

Driftwood (*Picea*) at +58m, diam ca 0.25m.

**T-3731. Rundisen 7** **7640 ± 110**
$\delta^{13}C = -17.4‰$

Whale bone (jaw) at +50m.

**T-3457. Rundisen 8** **6760 ± 90**

Driftwood (*Picea*) at +44m, diam ca 0.1m.

**T-3733. Rundisen 9** **5850 ± 70**

Driftwood (*Larix*) at +36.6m, diam ca 0.3m.

**T-3458. Rundisen 10** **5240 ± 70**

Driftwood (*Larix*) at +31.5m, diam ca 0.15m.

**T-3726. Rundisen 11** **4440 ± 80**

Driftwood (*Larix*) at +27m, diam ca 0.4m.

**T-3730. Rundisen 12** **3970 ± 80**

Driftwood (*Pinus*) at +23.5m, diam ca 0.5m.

**T-3459. Rundisen 13** **2620 ± 70**

Driftwood (*Larix*) at +17.2m, diam ca 0.5m.

**T-3729. Rundisen 14** **3110 ± 80**

Driftwood (*Larix*) at +16m, diam ca 0.5m.

**T-3728. Rundisen 15** **2150 ± 70**

Driftwood (*Pinus*) at +10.3m, diam ca 0.5m.

**T-3460. Rundisen 16** **750 ± 60**

Driftwood (*Populus*) at +4.7m, diam ca 0.5m.

**T-3727. Rundisen 17** **110 ± 60**

Driftwood (*Larix*) at +2.5m, diam ca 0.25m. *Comment* (OS): limit of new driftwood is ca 2.5m above mean tide level.

*Norway*

*Continental Shelf Mapping*

**Continental Shelf series, N Norway**

Marine shells and shell fragments were dated as part of regional mapping program of Continental Shelf Inst (IKU). Samples coll 1975 from 50 loci; Grab (0.5m$^3$ vol), gravity corer (110mm diam), and vibrocorer (84mm) were used with Decca Main Chain as positioning system (Rokoengen, 1979; Rokoengen *et al,* 1977, 1979a; Rokoengen, Bugge, & Löfaldi, 1979b).

**T-2876. C76-126/1** **430 ± 60**

*Arctica islandica,* grab sample from top layer at Malangsgrunnen (69° 53′ N, 17° 38′ E), at 90m water depth.

**T-2878. C76-139/1** **1590 ± 70**

Shell fragments, grab sample from gravelly top layer at Sveinsgrunnen (69° 34′ N, 16° 56′ E), at 45m water depth.

**T-2926. C76-136/1, 0.15m** **1760 ± 70**

Grab sample 0.15m below sea bed in top sand with *Cibicides lobatulus* fauna at Sveinsgrunnen (69° 43′ N, 16° 47′ E), at 105m water depth.

**T-2877. C-127/1, 0.1m** **5150 ± 60**

Grab sample 0.1m below sea bed in top sand with *Cibicides lobatulus* fauna at Malangsgrunnen (69° 54′ N, 17° 33′ E), at 75m water depth.

**T-2530. B76-12/1, 0.2 to 0.3m** **5590 ± 80**

Shell, grab sample, mainly *Chlamys islandica* and *Macoma calcarea* in silty, gravelly sand below 0.2m of silty, clayey sand in Vestfjorden (67° 23′ N, 13° 05′ E), at 230m water depth.

**T-2546. C76-108/3, 0.1 to 0.2m** **7030 ± 70**

Small shell and shell fragments in top sand, 0.22m thick, at Nordvestbanken (70° 21′ N, 17° 24′ E). Coll with vibrocorer at 200m water depth.

**T-2879. C76-113/3, 0.3 to 0.4m** **9630 ± 120**

*Pomatoceros triqueter* from layer, 0.4m thick, below 0.05m top sand at Fuglöybanken (70° 51′ N, 17° 56′ E). Coll with gravity corer at 198m water depth.

**T-2648. B76-10/1, 0.15 to 0.4m** **11,050 ± 140**

*Mya truncata,* grab sample from 0.25m layer of silty, sandy, gravelly clay with shells below 0.15m sandy, gravelly top layer (67° 39′ N, 12° 09′ E), at 128m water depth.

**T-2529. C76-115/1, 0.6 to 0.7m** **11,090 ± 80**

*Mya truncata* and *Macoma calcarea* partly in life position at 0.6 to 0.7m below sea bed in silty, clayey sand at Tromsöflaket (71° 16′ N, 19° 44′ E).

Sample contained microfauna dominated by *Cibicides lobatulus, Cassidulina crassa,* and *Elphidium excavatum.* Coll with gravity corer at 220m water depth.

**T-2327. C76-114/1, 0.15 to 0.30m 11,130 ± 180**

*Chlamys islandica* from shell layer below 0.15m silty top sand at Fuglöybanken (70° 54′ N, 18° 00′ E), was dominated by *Cibicides lobatulus, Trifarina angulosa,* and *Cassidulina crassa.* Grab sample at 207m water depth.

**T-2649. C76-142/1, 0.05 to 0.2m 11,240 ± 150**

Grab sample, mainly *Mya truncata,* from silty, gravelly sand layer below thin layer of stone, gravel, and sand (69° 21′ N, 15° 32′ E), at 170m water depth.

**T-2528. C76-113/3, 0.65 to 0.8m 11,770 ± 170**

Shell fragments from silty, sandy, gravelly clay below 0.05m sand and 0.4m shell layer (see C76-113/3, 0.3 to 0.4m). Coll with gravity corer at 198m water depth (70° 51′ N, 17° 56′ E).

**T-2345. C76-148/1, 0.1 to 0.4m 11,970 ± 170**

Shell fragments (*Hiatella arctica, Mya truncata,* and *Balanus* sp) in silty, sandy, gravelly clay below top layer of gravel and sand (68° 39′ N, 12° 59′ E). Grab sample at 130m water depth.

**T-2531. C76-108/3, 0.22 to 0.27m 12,200 ± 110**

Shell fragments (*Chlamys islandica, Macoma calcarea,* and *Balanus* sp) in silty, sandy clay between top sand (see C76-108/3, 0.1 to 0.2m) and basal till. Coll with vibrocorer at 200m water depth (70° 21′ N, 17° 24′ E). *Comment* (KR): till below (Mulegga drift) must be older than date.

**T-2344. C76-118/2, 0.3 to 0.4m 12,220 ± 200**

*Hiatella arctica* from glacial marine clay below 0.2m silty sand and gravel and 0.1m top sand (70° 47′ N, 20° 00′ E). Grab sample at 180m water depth. *Comment* (KR): this date also is min for underlying till (Mulegga Drift).

**T-2326. C76-109/1, 0.1 to 0.3m 13,310 ± 110**

Shell fragments (mainly *Chlamys islandica, Balanus* sp, *Mya truncata,* and *Hiatella arctica*) from supposed till below 0.1m gravelly top sand (70° 27′ N, 17° 41′ E). Grab sample at 160m water depth. *Comment* (KR): date is max for Nordvestsnaget Drift off Troms.

*Interstadial Events*

**Sandnes Interstadial series**

Marine sediments underlying Late Weichselian drift sheet at Jæren (Sandnes Interstadial). Coll and subm 1965 to 1978 by B G Andersen, Dept Geol, Univ Oslo. *Comment:* after removing outer shell surface (10–20%),

various fractions (% of total) towards inside are both $^{14}C$ and Th/U dated. $^{14}C$ dates suggest age ca 40,000 BP for interstadial. Amino acid and some Th/U dates agree generally with this conclusion (Feyling Hanssen, 1971; Andersen *et al,* 1981).

| | | |
|---|---|---|
| | **A (43%)** | **39,200** $^{+1800}_{-1600}$ |
| **T-3422. Oppstad, Jæren** | **B (45%)** | **38,600** $^{+1600}_{-1300}$ |

Shell fragments from Skagerak moraine and underlying tectonized marine clay at +180m, depth 0 to 3m, at old Oppstad clay pit (58° 39′ N, 5° 42′ E).

| | | |
|---|---|---|
| | **A (30%)** | **27,900** $^{+850}_{-760}$ |
| **T-3423. Foss, Eigeland** | **B (60%)** | **31,330** $^{+700}_{-640}$ |

Shell fragments from partly tectonized marine clay below Late Weichselian till at +60m, depth 0 to 6m, near Foss, Eigeland (58° 46′ N, 5° 45′ E).

**T-641. Graveren, Sandnes** **>27,300 ($2\sigma$)**

Whale bone from marine clay with *Portlandia arctica,* foraminiferal zone I at +20m from Sandnes (58° 50′ N, 5° 45′ E).

**Skagerak Moraine**

Shell and shell fragments from very clayey till (glacially tectonized marine clay) "Skagerak Moraine," at Jæren and Karmöy. Previously thought to be of Saalean age. Coll and subm 1968 to 1978 by B G Andersen. *Comment:* dates suggest that Skagerak Moraine is of Late Weichselian age. Th/U dates and amino acid dates support this conclusion (Andersen *et al,* 1981).

**T-640. Lerbrekk, Jæren** **41,500 ± 2000**

**T-3631. Lerbrekk, Jæren** **46,700** $^{+3000}_{-2600}$

**T-3011. Lerbrekk, Jæren** **43,100** $^{+2300}_{-1800}$

*Arctica islandica* from Skagerak Moraine exposed in river bluff at +20m, depth 0 to 8m, at Lerbrekk, Jæren (58° 35′ N, 5° 38′ E).

**T-1784. Bö, Karmöy** **35,900** $^{+1900}_{-1500}$

Shell fragments at +8m, depth 0 to 6m.

**T-2006. Bö, Karmöy** **37,500 $^{+2200}_{-1700}$**

*Portlandia arctica* at +10m, depth 2 to 4m.

**T-2007. Bö II, Karmöy** **38,300 $^{+2400}_{-1700}$**

*Mya truncata* at +10m, depth 2 to 4m. Various shell and shell fragments exposed in clay pit at Bö, Karmöy (59° 22′ N, 5° 13′ E).

**Nygaard interstadial series, Karmöy**

Marine sediments below Late Weichselian drift sheet at Karmöy were correlated with marine sediments below Sandnes interstadial deposits at Jæren. They represent low shore level phase, called Nygaard Interstadial, separated from Sandnes Interstadial by Jæren Stadial (Andersen *et al*, 1981). Coll and subm 1966 to 1978 (except for T-567) by B G Andersen. *Comment* (BGA): $^{14}C$ dates suggest age between 40,000 and 50,000 BP. Amino acid and Th/U dates generally support this conclusion.

**A+B (53.5%) 38,000 $^{+1700}_{-1400}$**

**T-2953. Bö, Karmöy** **C+D (46.5%) 42,700 $^{+2600}_{-1800}$**

*Mya truncata* from marine clay and sand beds below tectonized clay and Skagerak Moraine at +6m, depth 5m, at Bö, Karmöy.

**T-2954. Bö, Karmöy** **>46,500 (2$\sigma$)**

Well-preserved *Chlamys islandicus* from low-lying beds within marine unit at +1m, depth 10m.

**T-567. Reve, Jæren** **>37,500 (2$\sigma$)**

*Hiatella arctica* from bed in marine unit, lying below Late Weichselian till and overlying older till at +8m, depth 6m. Coll by S R Östmo, Dept Geol, Univ Bergen.

**T-2380. Asheim** **35,850 $^{+1180}_{-1040}$**

Decomposed sand- and silt-rich organic matter at +720m in Asheim, Bykle (59° 27′ N, 7° 22′ E). Coll and subm 1976 by Per Blystad, Univ Bergen. Sediment was found in ridge at top of brown, cobble- and boulder-rich till overlying tectonized glaciofluvial sediment. Brown till was covered by compact basal till and loose melt-out till. *Comment* (PB): strat position, pollen content, and high age, indicate interstadial origin. Due to possible contamination by younger carbon, date should be regarded as min, indicating Early or Middle Weichselian age (Blystad, 1981).

*Glacial Events*

**Tjötta Glacial Event series, Nordland**

Shells from end moraines of Tjötta Glacial Event indicate early Younger Dryas age, 10,500 to 11,000 BP.

**T-3081. Sövik** **10,800 ± 180**

*Portlandia arctica* from zone with dropstones, 1m thick, within min 4m thick glaciomarine clay sec at +10m on distal side of Breimo end moraine at Sövik (65° 55′ N, 12° 28′ E). Coll and subm 1978 by B G Andersen.

**T-3083. Angersnes I** **10,460 ± 190**

*Mya truncata* from 0.5m thick bed of glaciomarine blue clay with dropstones within Angersnes end moraine at +25m at Angersnes (66° 04′ N, 12° 42′ E). Coll and subm 1978 by BGA.

**T-3272. Angersnes II** **10,540 ± 90**

Shell fragments (*Mya truncata, Hiatella arctica, Yoldiella lenticula*) from bouldery and gravelly till-like bed at +25m within Angersnes moraine.

**T-3276. Laukbakken** **10,510 ± 190**

*Mya truncata, Macoma calcarea,* and *Astarte elliptica* from silty sand with dropstones at +10m at Laukbakken (66° 28′ N, 13° 04′ E). Coll and subm 1978 by BGA.

**T-3271. Sövikskar** **10,940 ± 120**

*Mya truncata* and *Hiatella arctica* from glaciomarine clay below Sövikskar end moraine (65° 54′ N, 12° 28′ E). Coll and subm 1978 by BGA.

**T-3082. Breimo** **11,400 ± 100**

Crushed shells from strongly folded silt beds within Breimo end moraine at +60m at Breimo (65° 57′ N, 12° 32′ E). Beds are pushed up by glacier and are older than glacial advance. Coll and subm 1978 by BGA.

**T-3084. Fagervik** **11,210 ± 200**

*Portlandia arctica* from 4m silty clay unit, with no dropstones but overlain by 4m clayey silt without fossils and 2m outwash gravel. Sample was 1km from Brunes end moraine at +50m at Fagervik (66° 07′ N, 12° 52′ E). Coll and subm 1978 by BGA.

**T-2374. Sætvik** **10,860 ± 150**
$\delta^{13}C = +1.1‰$

*Chlamys islandica, Mya truncata,* and *Hiatella arctica* from glaciomarine silty clay underlying Holocene marine sand ca 2km outside end-moraines deposited during Glomfjord event at ca +4m in Melöy (66° 50′ N, 13° 55′ E). Coll and subm 1976 by Arne Rasmussen, Geol Inst, Univ Bergen. *Comment* (AR): glaciomarine silt is correlated with Glomfjord moraines. Thus, sample dates Glomfjord event (Andersen *et al,* 1979).

**11,050 ± 120**

**T-2372. Sandå** $\delta^{13}C = +1.3‰$

*Astarte elliptica, Mya truncata,* and *Macoma calcarea* from glaciomarine, silty clay at ca +10m at Melöy (66° 50′ N, 13° 45′ E). Coll and subm 1976 by A Rasmussen. *Comment* (AR): also dates Glomfjord event.

**T-3520. Gravvik** **11,080 ± 140**

Shell fragments from till-sec, 11.5 to 14m high, in end-moraine deposited during Tjötta event at ca +30m at Næröy (65° 00′ N, 11° 47′ E). Coll and subm 1979 by Frede Böen, Geol Inst, Univ Bergen. *Comment* (FB): date is max for Tjötta event in area.

**T-3519. Bogen** **10,330 ± 200**

*Portlandia arctica, Macoma calcarea, Hiatella arctica* and *Nuculana pernula* from 2 to 3m glaciomarine clay at ca +20m at Næröy, N Tröndelag (65° 04′ N, 11° 57′ E). Coll and subm 1979 by F Böen. *Comment* (FB): probably dates late phase of Tjötta event.

**Tjötta—Nordli events series, Nordland**

Shells from glaciomarine clays deposited during glacial retreat from Tjötta Event to Nordli Event moraines. Coll and subm 1977 by B G Andersen.

**T-2767. Mjönes** **10,380 ± 270**

Shells (*Yoldiella lenticula*) and fauna from glaciomarine clay +15m at Mjönes (67° 16′ N, 14° 59′ E). *Comment* (BGA): date agrees very well with our knowledge of Tjötta and Nordli Events.

**T-2769. Nesna** **16,360 ± 480**

Foraminifera and *Yoldiella lenticula* from glaciomarine clay with dropstones +15m at Nesna (66° 12′ N, 13° 02′ E). *Comment* (BGA): date is much too old; sample must have been contaminated.

**T-2768. Holstad-Venset** **26,470 ± 3790**

Foraminifera, *Yoldiella lenticula,* etc from glaciomarine clay +30m at Holstad-Venset (67° 16′ N, 15° 01′ E). *Comment* (BGA): see T-2769.

**T-2641. Nygårdsjöen** **10,540 ± 190**

*Yoldiella lenticula* and *Macoma calcarea* at ca +60m from lower parts of 3 to 5m glaciomarine clay, lying directly on bedrock and superimposed by 1 to 1.5m shore gravel at Gildeskål (67° 08′ N, 14° 19′ E). Coll and subm 1977 by Pål N Vallevik, Geol Inst, Univ Bergen. *Comment* (PNV): date is min for Strömöy event (Andersen *et al,* 1979).

**Nordli Glacial Event series, Nordland**

Coll and subm 1978 by BGA.

**T-3085. Nordli** **10,140 ± 180**

*Bathyarca glacialis, Yoldiella lenticula,* and *Macoma calcarea* from gravelly and bouldery blue clay at +60m, overlain by 0.5m gray clay with dropstones, 1 to 3m strat silt and clay and 1m beach gravel with large boulders at Nordli (66° 05′ N, 13° 06′ E).

**T-3273. Forsland** **10,100 ± 250**

*Macoma calcarea, Yoldiella lenticula,* and *Nuculana pernula* at +50m from glaciomarine clay with dropstones on distal side of supposed loc of ice front during Nordli Event at Forsland (66° 03′ N, 13° 01′ E).

**T-3275. Grönliakselen** **9620 ± 110**

*Mya truncata,* etc at +15m from strat silt and clay on proximal side of Grönliakselen end moraine, which is older than silt and clay at Grönliakselen (66° 00′ N, 12° 57′ E).

**T-3274. Ranelv** **9480 ± 70**

*Mya truncata* and *Arctica islandica* at +75 to 80m from bed of fossiliferous clay, 0.5m thick, on top of broad, low end moraine at Ranelv (66° 05′ N, 13° 07′ E). Clay rests on glaciomarine clay with dropstones and *Yoldia lenticula* fauna.

**Vassdal Event series, Nordland**

Shells from glaciomarine clays deposited shortly after Vassdal Event. Coll and subm 1977 and 1978 by Arne Rasmussen, Dept Geol, Univ Bergen.

**T-2669. Bratsberg** **11,740 ± 100**

*Macoma calcarea* from glaciomarine silty clay, 1m thick, underlying ca 1m shore gravel, also containing *Astarte elliptica* and *Mya truncata* at ca +20m, depth ca 3m, at Bratsberg, Gildeskål (66° 58′ N, 14° 04′ E). *Comment* (AR): date is min for deglaciation at Sörfjorden.

**T-2672. Næverdal** **11,610 ± 140**

*Mya truncata* from lower part of 0 to 2m thick shell-rich glaciomarine clay overlying till at ca +40m in Næverdal, Melöy (66° 50′ N, 13° 46′ E). *Comment* (AR): dates early Alleröd deglaciation of Glomfjorden.

**T-3080. Engavågen** **11,720 ± 200**

*Macoma calcarea* from glaciomarine clayey silt underlying 1 to 2m shore gravel at ca +5m at Engavågen, Melöy (66° 46′ N, 13° 32′ E). *Comment* (AR): date is min for Vassdal Event and early Alleröd deglaciation of outer parts of Glomfjorden (Andersen *et al,* 1979).

**Pre-boreal Glacial events series, Nordland**

Shells from glaciomarine clays deposited in front of glaciers during several Pre-boreal glacial events. Coll 1979 by B G Andersen, F Böen, and N Vallevik; subm 1979 by F Böen.

**T-3521. Elsfjord** **9780 ± 130**

*Mya truncata* and *Chlamys islandica* from glaciomarine clay with numerous dropstones underlying 2 to 3m silty clay with few dropstones at Elsfjord, Vefsn (66° 05′ N, 13° 30′ E). *Comment* (BGA): date is believed contemporaneous with ice-front delta deposited from N at Elsfjord.

**T-3522. Terråk** **9890 ± 230**
$\delta^{13}C = +1.0‰$

*Yoldiella lenticula* and *Nuculana pernula* from ca 3m glaciomarine clay with numerous dropstones underlying ca 1.5m layered, sandy clay with few dropstones, 200 to 300m outside end moraine at +20m at Terråk, Bindal (65° 06′ N, 12° 20′ E). *Comment* (BGA): glaciomarine clay is believed contemporaneous with end moraine at Terråk.

**T-2870. Reisadalen, Troms** **8940 ± 210**

Gyttja from basal layer of bog at +80 to +85m in Reisa Valley, Nordreisa (69° 37′ N, 21° 16′ E). Bog is only few meters above highest marine level. Coll 1976 and subm 1978 by Björn Bergström, Dept Geol, Univ Bergen. *Comment* (BB): date is min for deglaciation and *Betula* rise and culmination in this part of valley.

**T-2765. Oksfjord, Finnmark** **A 11,040 ± 140**
**B 10,930 ± 130**

*Mya truncata* and *Hiatella arctica* at +15m from silt bed within foreset beds of delta, ca +25m, at Oksfjord (69° 57′ N, 27° 30′ E). Coll and subm 1977 by B G Andersen.

**T-2467. Forsand, Rogaland** **12,250 ± 150**

*Mytilus edulis* from clay bed at +35m, overlain by 2m strat silt and clay and 8m outwash gravels at Forsand (58° 53′ N, 5° 9′ E). Coll and subm 1976 by B G Andersen. *Comment* (BGA): date is min for end moraine (corresponds with Lysefjord end moraine) and shows that glacier had retreated to position of moraine in late Bölling time.

**T-3202. Turhusvatnet 6-78, Möre og Romsdal** **9170 ± 160**

Gyttja from bog at +350m, depth 5.4 to 5.5m at Turhusvatn, Eresfjord (62° 40′ N, 8° 04′ E). Coll 1978 by A B Carlson and B Torp, Dept Geog, Univ Oslo; subm 1978 by J L Sollid, Dept Geog, Univ Oslo. *Comment* (JLS): dated to test hypothesis that morphologic marginal moraines from Younger Dryas chronozone are synchronous. Date is younger than expected. Sample from lower part of core may not be from basal sediment (Sollid & Sörbel, 1979).

*Sea Level Changes*

**Frosta series, Nord-Trøndelag**

Gyttja and clay-gyttja from eight lakes on Frosta peninsula in Nord-Trøndelag (63° 33′ to 63° 37′ N, 10° 40′ to 10° 52′ E). Series dates marine-

lacustrine boundaries from Late Weichselian and Flandrian time. Soluble (a) and insoluble (b) fractions were dated separately after treatment with 0.1M $Na_4P_2O_7$ and 0.1M NaOH (Goh & Molloy, 1972). Coll and subm 1976 to 1977 by Alfred Kjemperud and Ulf Hafsten, Bot Inst, Univ Trondheim (fig 3; Kjemperud 1978, 1981; Hafsten, 1983).

**T-2624. Skalitjern**

**(a) 10,480 ± 200**
$\delta^{13}C = -25.9‰$

**(b) 10,610 ± 190**
$\delta^{13}C = -24.1‰$

Coll at +170m, depth 8.37 to 8.41m, above marine/lacustrine boundary. *Comment* (AK): dates describe hyerbola-shaped shoreline displacement curve with continual regression from middle Younger Dryas up to now, and agree well with pollen strat established in all basins.

**T-2484. Småtjern**

**(a) 10,330 ± 270**
$\delta^{13}C = -25.2‰$

**(b) 10,920 ± 150**
$\delta^{13}C = -24.0‰$

**Total organic (c) 10,590 ± 210**
$\delta^{13}C = -24.6‰$

Coll at +170m, depth 7.74 to 7.78m, above marine/lacustrine boundary.

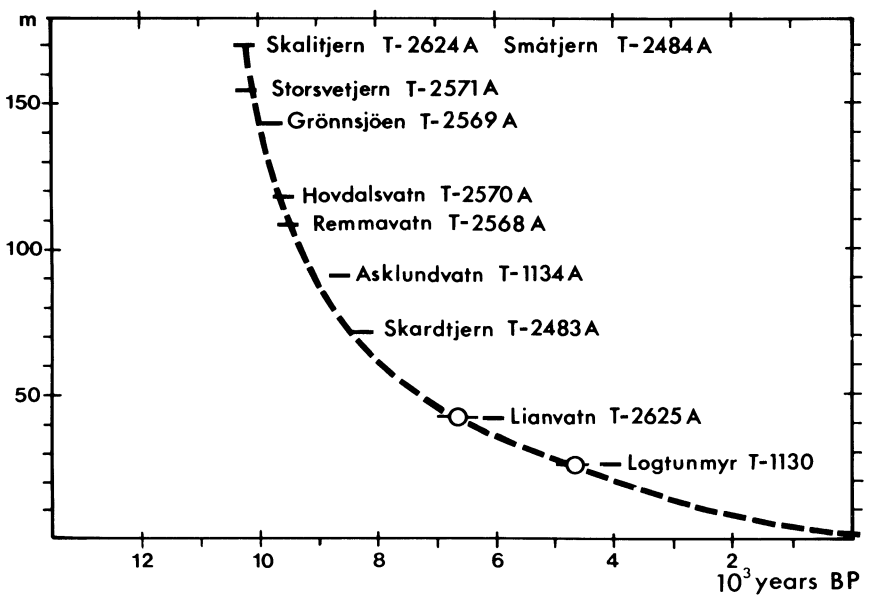


Fig 3. Shore displacement curve for Frosta, Nord-Trøndelag. -O- = MASCA age. After Kjemperund (1981)

**T-2571. Storsvetjern**

**(a) 10,200 ± 200**
$\delta^{13}C = -25.3‰$

**(b) 10,380 ± 130**
$\delta^{13}C = -24.0‰$

Coll at +154m, depth 3.69 to 3.73m, above marine/lacustrine boundary.

**T-2569. Grønnsjøen**

**(a) 9730 ± 200**
$\delta^{13}C = -31.5‰$

**(b) 9880 ± 130**
$\delta^{13}C = -30.0‰$

Coll at +143m, depth 5.31 to 5.35m, above marine/lacustrine boundary.

**T-2570. Hovdalsvatn**

**(a) 9560 ± 160**
$\delta^{13}C = -25.5‰$

**(b) 9520 ± 120**
$\delta^{13}C = -23.9‰$

Coll at +118.5m, depth 3.60 to 3.64m, above marine/lacustrine boundary.

**T-2568. Remmavatn**

**(a) 9530 ± 150**
$\delta^{13}C = -35.8‰$

**(b) 9700 ± 160**
$\delta^{13}C = -35.4‰$

Coll at +108.5 m, depth 6.64 to 6.68m, above marine/lacustrine boundary.

**T-2482. Skardtjern I**

**(a) 8300 ± 190**
$\delta^{13}C = -32.7‰$

**(b) 8320 ± 130**
$\delta^{13}C = -31.4‰$

**Total organic (c) 8490 ± 150**
$\delta^{13}C = -32.8‰$

Coll at +72m, depth 6.65 to 6.69m, beneath marine/lacustrine boundary.

**T-2483. Skardtjern II**

**(a) 8180 ± 190**
$\delta^{13}C = -32.0‰$

**(b) 8370 ± 200**
$\delta^{13}C = -31.7‰$

Coarse gyttja at +72m, depth 6.61 to 6.65m, above marine/lacustrine boundary.

**T-2625. Lianvatn**

**(a) 5880 ± 130**
$\delta^{13}C = -32.1‰$

**(b) 6000 ± 100**
$\delta^{13}C = -31.6‰$

Clay gyttja at +42.5m, depth 5.41 to 5.45m, above marine/lacustrine boundary. *Comment* (AK): dates agree well with previous dates from same basin (Gulliksen, Nydal, & Skogseth, 1978).

**Saug series, Hedmark**

Peat from shallow bog at +250m in small depression at Saug, Ringsaker (60° 52′ N, 10° 48′ E). Coll 1972 and subm 1973 to 1974 by R Sørensen, Dept Geol, Agric Univ Norway (NLH), Ås.

**T-1531. Saug myr, 1.02m** **9260 ± 150**

Basal telmatic peat at 1.02m depth. *Comment* (RS): dates approx deglaciation of area (Henningsmoen, 1975; Hafsten, 1975).

**T-1746. Saug myr, 6.50m**

**8930 ± 140**
$\delta^{13}C = -32.0‰$

Terrestrial peat at 0.65m depth. *Comment* (RS): dates *Alnus* expansion, also immigration of *Ulmus*. Age is too old compared to data from Stange (Henningsmoen, 1975), but similar to Vålertjern (Hafsten, 1975; R, 1978, v 20, p 114).

**T-1842. Limosen** **9460 ± 170**

Gyttja with fine sand at +208m, depth 8.65m, from Limosen, on Hauerseter glacial delta in Ullensaker (60° 10′ N, 11° 13′ E). Coll and subm 1974 by S R Östmo and R Sörensen. Coll from deepest part of bog just above marine limit on large glacio-fluvial glacial delta. *Comment* (SRÖ, RS): date provides inf on establishment of pioneer vegetation (Holtedahl, 1924, 1974).

**Ås—Ski series, SE Norway**

Samples date Holocene sea-level changes and age of Ski Moraine from Akershus and Buskerud. Coll and subm 1973 to 1977 by R Sörensen and J M Östby, Dept Geol, NLH, Ås (R, 1975, v 17, p 367; Sörensen, 1979).

**T-1529. Båtstö peat**

**3440 ± 110**
$\delta^{13}C = -31.7‰$

Peat and gyttja at +24m, depth 3.4m near present Oslofjord (59° 42′ N, 10° 38′ E). *Comment* (RS): dates abrupt transition from marine to terrestrial facies; 1885 ± 195 BC*.

**T-1624I. Båtstö gyttja** **6490 ± 360**

**T-1624II. Båtstö wood** **6190 ± 240**

Wood and gyttja from +50m, depth 2.3m at Verpen Lake (59° 42′ N, 10° 38′ E). *Comment* (RS): dates transition from marine to limnic facies. Mean age: 6280 ± 200; 5185 ± 165 BC*.

**T-1838. Verpen Lake** **5580 ± 140**

Clay gyttja from +42m, depth 5.20 to 5.25m at Verpen Lake (59° 40′ N, 10° 33′ E). *Comment* (RS): similar to T-1624; 4470 ± 110 BC*.

**T-604. Gultvedt I** **8100 ± 120**

*Pinus* cones from +70m, depth ca 1.2m at Gultvedt, Ås (59° 39′ N, 10° 43′ E). Coll 1965 and subm 1966 by S Skjeseth and G Semb, NLH. *Comment* (SS): dates approx fm of lower *Alnus* carr peat.

**T-1837. Gultvedt II** **8760 ± 290**

Clay gyttja from +70m, depth 1.4m. *Comment* (SS): dates transition from marine to limnic/brackish facies.

**T-1528. Kirkerudtjernet**

**(a) 9170 ± 310**
$\delta^{13}C = -35.0‰$

**(b) 10,520 ± 270**
$\delta^{13}C = -37.5‰$

Soluble (a) and insoluble (b) fractions of clay gyttja from +120m, depth 7.45m (59° 43′ N, 10° 46′ E). *Comment* (RS): dates transition from marine to limnic facies. Older insoluble fraction may be due to contamination.

**T-2749. Hääya, Frogn** **9590 ± 70**

*Mya truncata* from +1.25m, depth ca 2m at Frogn (59° 41′ N, 10° 36′ E). *Comment* (RS): approx age of 135m shore level.

**T-1527. Grytland grustak**

**(a) 9290 ± 130**
$\delta^{13}C = -0.8‰$

**(b) 9290 ± 120**
$\delta^{13}C = -0.5‰$

*Arctica islandica* from +140m, depth ca 1.5m at Grytland, Kråkstad (Ski) (59° 41′ N, 10° 51′ E). *Comment* (RS): approx age of 140m shore level.

**T-607. Nordbyhögda** **9530 ± 180**

*Balanus* sp from +150m, depth ca 4m at Nordbyhögda (59° 43′ N, 10° 46′ E). Coll and subm 1966 by S Skjeseth and G Semb. *Comment* (SS): approx age of 150m shore level.

**T-1747. Haugland** **9440 ± 140**
$\delta^{13}C = -1.5‰$

*Arctica islandica* from +162m, depth 0.2m at Haugland, Ski (59° 44′ N, 10° 49′ E). Coll and subm 1974 by R Sörensen. *Comment* (RS): approx age of 162m shore level.

**T-1727. Myren** **10,570 ± 250**

Clay gyttja from bog of glaciomarine sediments at +167m, depth 4m at Enebakk (59° 45′ N, 11° 00′ E). Coll 1973 by J M Östby, Dept Geol, Univ

Oslo; subm 1973 by J M Östby and R Sörensen. *Comment* (RS): date is ca 1000 yr too old compared to others in series, possibly due to contamination.

**T-1623. Langskaugtjern** **10,490 ± 190**

Clay gyttja from small tarn with rock and moraine threshold at +192m, depth 14.5m at Langskaugtjern, Enebakk (59° 46′ N, 10° 59′ E). Coll 1973 by J M Östby; subm 1973 by J M Östby and R Sörensen. *Comment* (RS): date is ca 700 yr too old compared to others in series, possibly due to contamination.

**T-1726. Östre Kollåsen** **9520 ± 150**

Clay gyttja from bog with rock threshold on NE side of hill at +195m, depth 4.75m in Kollåsen, Ski (59° 45′ N, 10° 57′ E). Coll 1973 by J M Östby and E Sörensen; subm 1973 by J M Östby. *Comment* (JMÖ): dates approx transition from marine to limnic facies.

**Kilebu—Kolbjörnvik series, Östfold**

Shells from upper part of small valley below crags in Kolbjörnviken, Marker (59° 19′ N, 11° 36′ E) and S Kilebu, Rakkestad (59° 20′ N, 11° 33′ E). Coll 1973 and subm 1974 by R Sörensen (Breien, 1932; Öyen, 1912; Sörensen, 1973).

**T-1839. Kolbjörnvik, skogen** **10,110 ± 190**
$\delta^{13}C = -0.5‰$

*Balanus* sp and *Mya truncata* from +180m, depth 1 to 1.5m. *Comment* (RS): dates approx upper marine limit at Kolbjörnviken.

**T-1841. Kolbjörnviken** **10,050 ± 190**
$\delta^{13}C = -1.2‰$

*Mytilus edulis* from +116m, depth 1.5m at Kolbjörnviken. *Comment* (RS): unexpectedly high age of dominant littoral fauna. *Mytilus* shell beds may develop in deep water (>40m?).

**T-1840. Kilebu "*littorina* level"** **9520 ± 140**
$\delta^{13}C = -0.9‰$

*Littorina* sp from +142m, depth ca 1m at Kilebu. *Comment* (RS): dates local Middle Pre-boreal.

**Telemark I series**

Sediments from isolation contacts in cores from basins at +7.4 to +99.0m, dating Holocene sea level changes in Telemark. Transition from marine to lacustrine sediments determined by diatom analysis. Coll and subm 1972 to 1977 by Björg Stabell and Helge Irgens Höeg, Dept Geol, Univ Oslo. *Comment* (HIH, BS): dates are generally in fair agreement with palynol (Stabell, 1976, 1980). Pollen analysis suggests that isolation coincides with *Corylus* rise (9500 BP).

**T-1732. Depth 5.90 to 5.96m** **8000 ± 270**

Clay gyttja at +47m from Stamland, Eidanger (59° 05′ N, 9° 45′ E).

**T-1740. Depth 3.70 to 3.75m** **3750 ± 150**

Clay gyttja at +19.5m from Storemyr, Skien (59° 11′ N, 9° 40′ E); 2315 ± 225 BC*.

**T-1849. Depth 3.93m** **5900 ± 240**

Clay gyttja at +31.9m from Halvarp, Porsgrunn (59° 04′ N, 9° 48′ E); 4800 ± 290 BC*.

**T-1850. Depth 3.64 to 3.66m** **2630 ± 180**

Clay gyttja at +8.43m from Lona (Svartkjenn), Kragerö (58° 50′ N, 9° 17′ E); 870 ± 340 BC*.

**T-1851. Depth 3.38m** **3070 ± 170**

Clay gyttja at +14.95m from Bærö, Kragerö (59° 52′ N, 9° 27′ E); 1395 ± 245 BC*.

**T-1852. Depth 2.73m** **4340 ± 180**

Clay gyttja at +18.5m from Bog N of Oisang, Risör, Aust-Agder (58° 46′ N, 9° 16′ E); 3105 ± 245 BC*.

**T-1853. Depth 4.30 to 4.33m** **5860 ± 290**

Clay gyttja at +27.5m from Dyvikvann, Kragerö (58° 55′ N, 9° 27′ E); 4770 ± 330 BC*.

**T-1962. Depth 3.30 to 3.40m** **3260 ± 240**

Clay gyttja at +7.4m from Vallemyr, Porsgrunn (59° 07′ N, 9° 41′ E). Change from *Hystrix* and *Discorbina* to *Pediastrum. Comment* (BS): sediment dates change to more saline water, not isolation from sea; 1665 ± 355 BC*.

**T-1963. Depth 4.70 to 4.73m** **2750 ± 240**

Gyttja at +10.5m from Karlstadkjenna, Kragerö (58° 52′ N, 9° 23′ E); 975 ± 215 BC*.

**T-1964. Depth 4.00 to 4.03m** **6270 ± 130**

Clay gyttja at +28.6m from Tyvatn, Kragerö (58° 54′ N, 9° 19′ E); 5180 ± 130 BC*.

**T-1965. Depth 6.20 to 6.23m** **7720 ± 200**

Clay gyttja at +38m from Lillie Neslandskjenn, Kragerö (58° 57′ N, 9° 17′ E)

**T-1966. Depth 5.58 to 5.60m** **8500 ± 180**

Clay gyttja at +43m from Storekjenn, Kragerö (58° 50′ N, 9° 26′ E).

**T-1967. Depth 6.62 to 6.64m** **8820 ± 300**

Clay gyttja at +50.5m from Pöddetjönn, Kragerö (58° 49′ N, 9° 14′ E).

**T-1968. Depth 9.16 to 9.18m** **9040 ± 210**

Clay gyttja at +99m from Langvann bog, Kragerö (58° 51′ N, 9° 16′ E). *Comment* (BS): palynol suggests isolation occurred prior to *Corylus* rise (9500 BP).

**T-2120. Depth 2.58 to 2.60m** **2360 ± 110**

Clay gyttja at +7.4m from Vallermyr, Porsgrunn (59° 7′ N, 9° 41′ E); 580 ± 170 BC*.

**T-2414. Depth 2.23m** **3830 ± 280**

Clay gyttja at +15m from Nygaardstjenna, Kragerö (58° 47′ N, 9° 21′ E); 2460 ± 410 BC*.

**T-2415. Depth 6.95m** **9180 ± 340**

Clay gyttja at +82m from Storemyr (Kolbjörnsmyr), Kragerö (58° 48′ N, 9° 17′ E). Transition from marine to lacustrine sediments determined by diatom analysis.

**T-2564. Övre Grefsen Gård** **9620 ± 80**

Erratic plates of *Balanus balanus* on large boulder, at +198m, depth ca 5m, at Övre Grefsen Gård, Oslo (59° 57′ N, 10° 47′ E). Coll 1977 by Iver Grefsen; subm 1977 by Just Gjessing, Dept Geog, Univ Oslo and Nils Spjeldnaes, Dept Palaeoecol, Aarhus Univ, Denmark. *Comment* (JG): dated in accordance with current views on ice recession and uplift of land in region, but in contrast with earlier dates for Skådalen (at +221m) judged to be too young (Gjessing & Spjeldnaes, 1979).

**Svinesund Project series, Östfold**

Svinesund Project is pilot proj using methods of modern marine ecology to improve precision of graphic methods used for late Pleistocene. Loc 2km NNE of Svinesund Bridge, Östfold (UTM grid, 32, Pl 307554). Coll 1974 and subm 1976 by Nild Spjeldnaes. *Comment* (NS): previous methods do not reflect time-strat but rather small ecol changes in basal condition. Complex at Svinesund was deposited during comparatively short time, as expected from geog position and fauna (Spjeldnaes, 1978).

**T-2430. SV-IA, upper bed** **11,160 ± 100**

*Macoma calcarea* in life position in fresh road cut at +70.5m.

**T-2431. SV-IF, *Mytilus* clump** **11,140 ± 140**

*Mytilus edulis* from fresh road cut in clay at +67m. Shells are supposed to represent ice-rafted clump of animals with articulated valves, originally living in littoral environment.

*Vegetation History and Shore Displacement*

**Endletvann series, Nordland**

Clay and gyttja coll with 0.054m diam sampler (Geonor) at +35m at Endletvann, Andöya (69° 44′ N, 16° 05′ E). Coll and subm 1972 to 1976 by K D Vorren, Univ Tromsö. *Comment* (KDV): 4m sample core gives continuous inf of vegetational development during long period of late Weichselian. Site is unique in being only one in Scandinavia covering time span from 18,000 to 19,000 BP until present. Dating either of total sample (HCl-treated) or NaOH soluble (a) and insoluble fraction (b) (Vorren, 1978). Core extension is 5.3m for Late Weichselian layers and 5.5m for Holocene, totally 10.8m. Samples were in overlapping 0.8m segments.

**T-1888. Endletvann 10** **(a) 10,510 ± 510**

Depth 5.45 to 5.55m. *Comment* (KDV): dated for regional Holocene *Betula* expansion; expected age ca 9500 BP.

**T-1889. Endletvann 11** **10,850 ± 280**

Depth 5.75 to 5.85m. *Comment* (KDV): dated for rise of *Empetrum* curve during later part of Younger Dryas, but is estimated to be too old.

**T-1510. Endletvann 2** **10,940 ± 270**

Depth 6.25 to 6.35m. *Rumex* decline, *Artemisia* rise.

**T-1511. Endletvann 3** **12,610 ± 220**

Depth 6.65 to 6.67m. *Comment* (KDV): age concerns rise of *Salix* curve in late glacial period.

**T-1887. Endeltvann 9** **12,920 ± 110**

Depth 7.30 to 7.45m. *Comment* (KDV): oldest Dryas/Bölling transition. Marked increase in loss on ignition. Temperate mosses occurring.

**T-1576. Endletvann 7** **(a) 11,800 ± 2000**

Depth 7.42 to 7.52m. *Comment* (KDV): expected age ca 13,000 yr BP (see T-1887).

**T-1573. Endletvann 5** **(a) 9900 ± 1600**

Depth 8.2 to 8.4m; expected age ca 15,000 BP.

**T-2152. Endletvann 12** **(a) 14,990 ± 130**
**(b) 15,300 ± 290**

Depth 9.05 to 9.15m. Dating of soluble (a) and insoluble fractions (b). *Comment* (KDV): expected to date climatic amelioration. Date is satisfactory.

**T-1512. Endletvann 4** **18,710 ± 400**

Depth 9.75 to 9.95m. Expected to date near-bottom sediments (laminated clayey silt or gyttja). Date is satisfactory.

**T-1575. Endletvann 6** **(a)[1] 14,800 ± 1800**

Depth 9.75 to 9.95m. *Comment* (KDV): expected age ca 18,000 to 19,000 BP.

**T-1775. Endletvann 8** **(a)[1] 18,100 ± 800**
**(b) 19,100 ± 270**

Depth 9.98 to 10.28m. *Comment* (KDV): dates bottom lacustrine sediments; age is satisfactory.

**T-1509. Palsa II, Troms** **110 ± 70**

Dated for sporadic permafrost (palsa) fm in area. *Salix*-Ericales peat was sampled at +630m with iron tube, 0.1m diam, and sampled for study of "pollen horizons" from Råggastatjægge, Målselv (68° 37′ N, 20° 01′ E). Coll and subm 1973 by K D Vorren; <AD 1650*.

**T-1220. Palsa, N Finland** **1010 ± 80**

*Sphagnum lindbergii* peat from palsa (5m high) at Ropinsalmi, 50km E of Kilpisjärvi (68° 50′ N, 21° 20′ E). Coll and subm 1973 by K D Vorren. *Comment* (KDV): date is older than expected, probably because of erosion; AD 970 ± 80*.

**Bøverdalen series, Oppland**

Peat coll with plastic pipes, 0.10m wide and 2m long, and gyttja coll with Russian type of chamber sampler, from Bøverdalen Valley in W Jotunheimen mt area. Series dates start of peat fm and organic sedimentation, as well as various pollenstrat horizons. Samples coll and subm 1981 by Marie Aukrust and Ulf Hafsten. *Comment* (UH, MA): series indicates that oldest bog or lake deposits in area date to Boreal/Atlantic transition (T-4091, -4096A, -4090A). Alder (*Alnus* cf *incana*) was probably in area at that time. Dates show tendency of two-peaked pollen max during post-glacial optimum period. Agric activity may be traced back to late Bronze/early Iron age (T-4093) and cultivation to Viking age or a little later (T-4092) (Aukrust, 1983).

**T-4091. Blåmyrhø** **7890 ± 110**
$\delta^{13}C = -29.2‰$

Peat from bog area NE of Blåhø, Lom at +1226m, depth 0.77 to 0.82m (61° 41′ N, 08° 07′ E). Dated sample at base of peat column.

**T-4096A. Bøverkinntjern II** **8120 ± 120**
$\delta^{13}C = -30.6‰$

Fine detritus gyttja from small lake E of Jotunheimen fjellstue, Lom at +1000m, depth 5.80 to 5.85m (61° 40′ N, 0.8° 09′ E). Dated sample at base of organic deposits.

[1] Humic acids extracted with 0.1M NaOH and 0.1M $Na_4P_2O_7 \times 10\ H_2O$.

**5300 ± 120**

**T-4095A. Bøverkinntjern I** $\delta^{13}C = -31.1‰$

Fine detritus gyttja from 5.05 to 5.10m at base of marked decrease in *Pinus* and non-arboreal pollen and start of continuous occurrence of *Rumex* pollen; 4170 ± 190 BC*.

**7890 ± 160**

**T-4090A. Raubergstultjern** $\delta^{13}C = -31.8‰$

Fine detritus gyttja from margin of small lake at Raubergstulen in Bøverdalen, Lom at +999m, depth 4.58 to 4.63m (61° 43′ N, 08° 24′ E). Dated sample at base of organic gyttja.

**5510 ± 190**

**T-4094. Dalsvatnmyr II** $\delta^{13}C = -28.1‰$

Peat from log at Dalsvatn in Bøverdalen, Lom at +736m, depth 1.12 to 1.17m (61° 41′ N, 08° 10′ E). Dated sample at base of peat column and steep fall in *Alnus* cf *incana* pollen curve; 4375 ± 185 BC*.

**2480 ± 80**

**T-4093. Dalsvatnmyr I** $\delta^{13}C = -25.5‰$

Peat from 0.53 to 0.57m at steep fall in *Pinus, Alnus* and non-arboreal pollen and start of continuous occurrence of *Rumex* and *Artemisia;* 645 ± 155 BC*.

**950 ± 80**

**T-4092. Vassmyr** $\delta^{13}C = -24.8‰$

Peat from Vassmyra in Bøverdalen, Lom at +660m, depth 0.35 to 0.40m (61° 43′ N, 08° 25′ E). Dated sample at temporary min in *Betula* and non-arboreal pollen and at start of continuous occurrence of weed pollen (*Artemisia, Rumex, Chenopodium,* and *Plantago lanceolata*); AD 1030 ± 90*.

**Dovre series, Oppland**

Peat coll with plastic pipes, 0.10m wide and 2m long, and wood of subfossil pine trunk, from subalpine region of Dovre, S Norway, including Fokstumyra Nature Reserve and Dovrefjell Natl Park. Series dates start of bog and mire fm in area and various pollenstrat horizons. Peat samples coll and subm 1981 to 1982 by Grete Berge Owren and Ulf Hafsten; pine trunk coll 1979 by Johs Domaas, Dombås, and subm 1980 by Ulf Hafsten. *Comment* (UH, GBO): series indicates bog and mire fm in area dates to Boreal time (Fokstrumyrin I, Nysetra I). *Pinus sylvestris* probably had greatest extension in Boreal (Nysetra IV), whereas *Alnus* cf *incana* immigrated and culminated during Atlantic time, when concentration of *Corylus* and *Ulmus* pollen (long-distance transport?) is also highest.

**8560 ± 70**

**T-4563. Nysetra I** $\delta^{13}C = -28.6‰$

From bog NW of Nysætri, at +1010m, depth 1.26 to 1.30m (62° 09′ N, 09° 18′ E). Dated sample at base of peat column, well below first appearance of *Alnus* pollen.

**6130 ± 110**

**T-4434. Nysetra II** $\delta^{13}C = -27.0‰$

Peat from 0.73 to 0.77m depth, just below substantial *Alnus* cf *incana* pollen max and highest values recorded of *Corylus* and *Ulmus;* 5090 ± 150 BC*.

**4910 ± 90**

**T-4435. Nysetra III** $\delta^{13}C = -25.9‰$

Peat from 0.43 to 0.47m depth, just above max of alder, hazel, and elm, (see T-4434); 3705 ± 65 BC*.

**8240 ± 100**

**T-3650. Nysetra IV** $\delta^{13}C = -26.1‰$

Outer wood layer of protruding end of subfossil pine trunk, 3 to 4m long and 0.3m thick, sticking out of bog. Coll 1979 by Johs Domaas; subm 1980 by U Hafsten. *Comment* (UH): date agrees with results from Hardangervidda plateau and Sylene-Ovik mts in Jämtland, Sweden, that pine had greatest extension during early post-glacial warming period (Hafsten, 1981).

**9010 ± 120**

**T-4565. Fokstumyrin I** $\delta^{13}C = -23.5‰$

Peat from central part of Fokstumyrin at +950m, depth 1.61 to 1.65m (62° 07′ N, 09° 18′ E). Dated sample at base of peat column, well below first appearance of alder pollen.

**6200 ± 40**

**T-4566. Fokstumyrin II** $\delta^{13}C = -24.9‰$

Peat from 0.98 to 1.02m, at steep rise in birch pollen curve from 25 to 40% level, which might reflect establishment of subalpine birch forest belt in Dovre area; 5160 ± 80 BC*.

**5720 ± 40**

**T-4437. Vålåsjø** $\delta^{13}C = -27.5‰$

Peat from bog SW of Vålåsjøen at +940m, depth 1.03 to 1.07m (62° 10′ N, 09° 22′ E). Dated sample at upper boundary of alder pollen max and contemporaneous shift from pine to birch pollen dominance, 4555 ± 45 BC*.

**3970 ± 80**

**T-4436. Gåvåli** $\delta^{13}C = -27.8‰$

Peat from bog S of Gåvålivatnet, Oppdal, Sør-Trøndelag at +940m, depth 0.93 to 0.97m (62° 16′ N, 09° 38′ E). Dated sample at marked fall in alder pollen and contemporaneous increase in non-arboreal pollen; 2600 ± 180 BC*.

**6940 ± 110**

**T-4564. Bekkelægret** $\delta^{13}C = -26.7‰$

Peat from bog 1km SW of Bekkelægret, Oppdal, Sør-Trøndelag at +1110m, depth 1.38 to 1.41m (62° 20′ N, 09° 46′ E). Dated sample at base of peat column, at base of steep increase in alder and at end of pine dominance.

**Nord-Østerdal series, Hedmark**

Pine wood and peat coll from drainage ditches in extensive Gotlandsfloen peat bog, +482m (62° 17′ 30″ N, 10° 52′ E), just E of Glomma R, in Tynset, Hedmark.

**T-1678. Gotlandsfloen I** **6180 ± 100**

Sample dates pine wood from stump layer resting on silty underground, beneath ca 2m thick peat layer. Coll 1973 by Ivar A Streitlien, from bottom of drainage ditch; subm 1974 by U Hafsten.

**T-3193. Gotlandsfloen II** **7810 ± 60**

Sample dates peat from 1.43 to 1.45m depth, at depth where local alder establishment is reflected. Coll 1975 and subm 1978 by U Hafsten. *Comment* (UH): date indicates that post-Weichselian alder establishment occurred at practically same time in continental Nord-Østerdal dist as in most other parts of S Norway.

**T-794. Ullahornet, Møre and Romsdal** **2730 ± 90**

Peat from base of extensive blanket bogs covering central mt plateau at +300 to 325m, 0.8m below surface at Haramsøy, Nordøyane archipelago, Haram (62° 40′ N, 06° 11′ E). Sample coll SE of Ullahornet, at transition from mineral soil to overlying dark peat, where traces of organic matter of glacial survivals might be found. Coll and subm 1968 by U Hafsten, for Rolf Nordhagen, Univ Oslo. *Comment* (UH): date indicates that peat sample does not help trace plant survivals in ice-free refuges during last glaciation, but does trace local start of blanket bog fm (Hafsten & Tallantire, 1978).

**Ytre Trondheimsfjord series, S Trøndelag**

Gyttja and peat coll with 75mm chamber samples and 110mm piston sampler from four lakes and bogs at mouth of Trondheimsfjord, in Agdenes and Bjugn, Sør-Trøndelag: Eidemstjern, Agdenes, +22m (63° 26′ N, 9° 35′ E), Langmyran, Bjugn, +65m (63° 43′ N, 9° 48′ E), Lomtjønn, Bjugn, +134m (63° 44′ N, 9° 48′ E), and Damtjønn, Bjugn, +134m (63° 47′ N, 9° 59′ E). Series dates various palynol and strat horizons of post-Weichselian vegetational development and shore displacement. Coll and subm 1977–1979 by Bjørn Petter Hansen and Ulf Hafsten, Trondheim Univ. *Comments* (BPH, UH).

*Vegetational History*

**T-2831. Lomtjønn I** **8020 ± 110**

Peat, 3.05 to 3.15m depth, dates start of continuous alder pollen curve, reflecting local alder establishment.

**T-3152A. Damtjønn** **7940 ± 130**

Gyttja 9.20 to 9.23m depth, dates start of continuous alder pollen curve, reflecting local alder establishment.

**T-3153A. Lomtjønn IV** **7830 ± 120**

Peat, 4.00 to 4.05m depth, dates isolated (30% high) alder and (5% high) hazel pollen max, ca 1m below start of continuous (Megathermal) pollen curves for alder and hazel. *Comment* (BPH): date uncovers mix-up during sampling, later proved by resampling. Date agrees well with T-2831 and -3152A.

**T-2832. Lomtjønn II** **4230 ± 90**
$\delta^{13}C = -28.5‰$

Peat, 2.20 to 2.30m depth, dates end of coinciding alder and elm pollen max; 2840 ± 150 BC*.

**T-3282A. Eidemstjern II** **4100 ± 60**

Gyttja, 6.70 to 6.73m depth, dates end of elm pollen max; 2770 ± 150 BC*.

**T-3283A. Eidemstjern III** **3750 ± 90**

Gyttja, 6.43 to 6.46m depth, dates end of hazel pollen max; 2280 ± 160 BC*.

**T-2833. Lomtjønn III** **3010 ± 100**
$\delta^{13}C = -28.5‰$

Peat, from 1.85 to 1.95m depth, dates end of hazel pollen max; 1215 ± 185 BC*.

**T-2834. Langmyran** **650 ± 70**
$\delta^{13}C = -28.5‰$

Peat, 0.17 to 0.21m depth, dates start of continuous spruce pollen curve, reflecting local spruce establishment; AD 1330 ± 70* (Hafsten, 1985).

*Shore Displacement*

**T-3151A. Eidemstjern I** **4710 ± 50**

Gyttja from 6.80 to 6.83m, overlying marine/lacustrine boundary; 3510 ± 100 BC*.

**T-3257. Eidemstjern IV** **5000 ± 70**

Thick-walled valve of *Ostrea edulis* shell, exposed on very shallow lake bottom near outlet of lake. Coll 1978 and subm 1979 by Ulf Hafsten; 3805 ± 85 BC*. *Comment* (UH): date supports that of T-3151A; basin was inundated by sea prior to 4710 ± 50 BP.

**Steinkjer series, N Trøndelag**

Gyttja/dy, coll with Russian version of Hiller sampler, and peat, coll with 0.10m wide plastic pipe, from four lakes and bogs in Steinkjer, Nord-Trøndelag: Lomtjern, +165 to 170m (64° 03′ N, 11° 21′ E), Vassaunvatnet, +117m (64° 03′ N, 11° 28′ E), "Hammersumpen," +49m (64° 02′ N, 11° 16′ E), and Kirknesmyr, +36.5m (64° 02′ N, 11° 15′ E). Series dates various palynol and strat horizons of post-Weichselian vegetational development and agric hist. Coll and subm 1979–1981 by Ole Erik Jevne and U Hafsten. *Comments* (Jevne, 1982).

**T-3689A. Lomtjern I** **6050 ± 130**
$\delta^{13}C = -31.7‰$

Gyttja, 4.45 to 4.50m depth, dates steep rise in *Corylus* curve just below distinct increase in *Ulmus* pollen. Dates local establishment of hazel and elm; 4960 ± 170 BC*.

**T-4103A. Lomtjern III** **8030 ± 130**
$\delta^{13}C = -32.2‰$

Gyttja, 5.15 to 5.20m depth, dates start of steep rise in *Alnus* curve reflecting local alder establishment.

**T-3690A. Lomtjern II** **9430 ± 110**
$\delta^{13}C = -30.3‰$

**T-4178A. Lomtjern II** **9640 ± 140**
$\delta^{13}C = -29.5‰$

Gyttja, 5.40 to 5.45m depth, dates steep rise in *Pinus* curve reflecting local pine forest establishment. *Comment:* date seems somewhat high compared with pine forest establishment in S Scandinavia.

**T-4104A. Lomtjern IV** **10,590 ± 190**
$\delta^{13}C = -29.1‰$

Clay gyttja/gyttja, 5.63 to 5.68m depth, dates basis of organic deposits overlying basal clay. *Comment:* date seemingly too old compared with deglaciation hist of area, *cf* possible influence of inactive carbon from Cambro-Ordovician limestone ridges to E.

**T-3465A. Vassaunvatnet IV** **1350 ± 130**
$\delta^{13}C = -31.7‰$

Gyttja, 3.85 to 3.90m depth, dating start of steep rise in *Picea* curve reflecting local forest establishment of Norwegian spruce; AD 640 ± 150* (Hafsten, 1985).

**4550 ± 80**

**T-4105A. Vassaunvatnet III** $\delta^{13}C = -31.8‰$

Dy/gyttja, 4.65 to 4.70m depth, dates end of steep decline in *Alnus, Corylus,* and *Ulmus* curves and first appearance of cultivation (weeds only); 3330 ± 140 BC*.

**7940 ± 130**

**T-3464A. Vassaunvatnet II** $\delta^{13}C = -37.6‰$

Gyttja, 5.25 to 5.30m depth, dates start of steep rise in *Alnus* curve reflecting local alder establishment.

**9210 ± 130**

**T-3463A. Vassaunvatnet I** $\delta^{13}C = -32.7‰$

**8760 ± 160**

**T-3463B. Vassaunvatnet I** $\delta^{13}C = -31.3‰$

Gyttja 5.70 to 5.73m depth, dates marine/lacustrine boundary (isolation contact) of basin. *Comment:* result is surprising, because 1) soluble fraction indicates higher age than insoluble, and 2) both dates seem too young compared with shore displacement curve for Frosta, at same isobase (Kjemperud, 1981).

**1990 ± 80**

**T-3688. Hammersumpen** $\delta^{13}C = -30.7‰$

Minerogenous peat with charcoal particles, 0.62 to 0.66m depth, dates start of local cultivation reflecting late clearance phase; 45 ± 115 BC*.

**1860 ± 40**

**T-4102. Kirknesmyr II** $\delta^{13}C = -29.4‰$

Peat from 1.10 to 1.15m depth, dates first appearance of cultivation including Cereale pollen; AD 115 ± 45*.

**3910 ± 90**

**T-2185. Kirknesmyr I** $\delta^{13}C = -27.7‰$

Lacustrine gyttja/peat, 1.5m depth, dates base of organic deposits resting on (beach)? gravel; 2400 ± 210 BC*. *Comment* (UH): date is min for Arctic rock carvings at Hammer, 0.5km to E, at same alt, which had been covered by old beach deposits and thus had been made just above ancient, littoral zone (Bakka, 1975, p 17).

**Nærøy series, N Trøndelag**

Gyttja coll with Russian version of Hiller sampler, and peat, coll with 0.10km wide plastic pipes from 11 lakes and bogs in Nærøy, N Trøndelag. Series dates various palynol and strat horizons of post-Weichselian vegetational development and shore displacement. Coll and subm 1977 to 1980 by H Ramfjord and U Hafsten. *Comments* (HR, UH): (Ramfjord, 1982).

*Vegetational History*

**T-3043A. Gorrtjønn II** **8280 ± 150**

Gyttja from Gorrtjønn at +66m, depth 4.47 to 4.52m (64° 55′ N, 11° 38′ E). Dates start of continuous alder curve, presumably reflecting local alder establishment.

**T-2845. Blåvasstjønn II** **8000 ± 160**

Gyttja from Blåvasstjønn at +92m, depth 3.90 to 3.95m (64° 54′ N, 11° 38′ E). Dates start of continuous alder curve, presumably reflecting local alder establishment.

**T-3045A. Blåvasstjønn III** **6110 ± 200**

Gyttja, 3.37 to 3.42m depth, dates "megathermal" min in QM curve, at same depth as decline of *Alnus;* 5090 ± 190 BC*.

**T-3044A. Gorrtjønn III** **2630 ± 120**

Gyttja, 2.20 to 2.25m depth, dates start of continuous spruce curve, presumably reflecting local spruce establishment; 905 ± 115 BC*.

**T-2846. Blåvasstjønn IV** **2600 ± 120**

Gyttja, 2.65 to 2.70m depth, dates start of continuous spruce curve, presumably reflecting local spruce establishment; 895 ± 115 BC*.

**T-3373A. Gorrtjønnmyr** **2400 ± 100**

600 ± 180 BC*.

**T-3373B. Gorrtjønnmyr** **2060 ± 200**

Peat, 0.26 to 0.30m depth, dates start of continuous spruce curve, presumably reflecting local spruce establishment; 145 ± 275 BC*.

**T-3247. Løypmomyr** **1510 ± 110**

Peat from Løypmomyr at +25m, depth 0.67 to 0.72m depth (64° 49′ N, 11° 22′ E). Dates rise in spruce curve, presumably related to climatic change at end of Roman Iron age; AD 420 ± 130* (Hafsten, 1985).

*Shore Displacement*

Gyttja overlying marine/lacustrine boundary.

**T-3844A. Nedre Lisetjønn** **10,340 ± 250**
$\delta^{13}C = -27.7‰$

Gyttja 4.79 to 4.84m depth at Nedre Lisetjønn +12m (64° 25′N, 11° 49′ E).

**T-3844B. Nedre Lisetjønn** **9230 ± 130**
$\delta^{13}C = -27.7‰$

**9230 ± 130**

**T-3843A. Kvennhusvatn** $\delta^{13}C = -30.7‰$

Gyttja, 3.53 to 3.58m depth at Kvennhusvatn +117m (64° 57′ N, 11° 36′ E).

**8630 ± 150**

**T-3843B. Kvennhusvatn** $\delta^{13}C = -28.7‰$

**8450 ± 80**

**T-3807A. Lomstjønn** $\delta^{13}C = -32.1‰$

Gyttja, 3.35 to 3.40m depth at Lomstjern +103m (64° 55′ N, 11° 36′ E).

**8360 ± 240**

**T-3807B. Lomstjønn** $\delta^{13}C = -31.6‰$

Date seems too young, compared with dates from lower level sites (T-2844A, -2847A).

**8950 ± 260**

**T-2844A. Blåvasstjønn I** $\delta^{13}C = -27.7‰$

Gyttja, 4.35 to 4.39m depth at Blåvasstjønn +92m (64° 54′ N, 11° 38′ E).

**8680 ± 150**

**T-2847A. Gorrtjønn I** $\delta^{13}C = -27.7‰$

Gyttja, 4.58 to 4.63m depth at Gorrtjønn +66m (64° 55′ N, 11° 38′ E).

**6180 ± 90**

**T-3738A. Lomtjønn** $\delta^{13}C = -32.5‰$

Gyttja, 5.48 to 5.53m depth at Lomtjønn +52m (64° 53′ N, 11° 39′ E); 5135 ± 115 BC*.

**6380 ± 90**

**T-3738B. Lomtjønn** $\delta^{13}C = -31.6‰$

5280 ± 70 BC*.

**7080 ± 110**

**T-3805 IIA. Strandavatn** $\delta^{13}C = -31.8‰$

Gyttja, 10.90 to 10.95m depth at Strandavatn +48m (64° 56′ N, 11° 31′ E).

**3750 ± 110**

**T-3806A. Løypmotjønn** $\delta^{13}C = -27.7‰$

Gyttja, 3.15 to 3.20m depth at Løypmotjønn +18m (64° 50′ N, 11° 22′ E); 2295 ± 185 BC*.

**T-3806B. Løypmotjønn** **3440 ± 140**
$\delta^{13}C = -32.2‰$

1885 ± 225 BC*.

**T-3845. Osavatn** **1570 ± 190**
$\delta^{13}C = -31.0‰$

Gyttja, 2.97 to 3m at Osavatn +7m (64° 57′ N, 11° 41′ E); AD 405 ± 185*.

**Spruce Forest Establishment, SE Norway I**

Peat coll with plastic pipes, 0.10m wide and 2m long, from 18 peat bogs in E part of SE Norwegian spruce (*Picea abies* (L) Karst) forest prov, mainly within lower Glomma and Trysilelven catchments. Series dates peat at depths revealing local spruce forest establishment (fig 4). Coll and subm 1978 to 1983 by U Hafsten. *Comment* (UH): series shows that immigration and initial forest establishment of spruce in SE Norway took place within rather restricted period over its total N-S range, from Femund region in N to Iddefjord region in S (ca 300km), *viz* centuries just preceding and succeeding birth of Christ (late Celtic Iron age in N and Roman Iron age in S). Dates are arranged geog from N to S (Hafsten, 1985).

**T-4850. Kvislflået** **2170 ± 70**
$\delta^{13}C = -25.0‰$

From W part of extensive Kvislflået bog area, Engerdal, Hedmark at +760m, depth 0.40 to 0.45m (61° 48′ N, 12° 03′ E). Date at base of steep rise in *Picea* pollen curve; 275 ± 135 BC*.

**T-4856. Sørmyra** **2100 ± 80**
$\delta^{13}C = -26.4‰$

From Sørmyra at Sennsjøen, Trysil, Hedmark at +520m, depth 0.80 to 0.85m (61° 36′ N, 11° 55′ E). Date at base of distinct rise in *Picea* pollen curve; 190 ± 200 BC*.

**T-4086. Storkjølen Profile A, I** **2990 ± 100**
$\delta^{13}C = -27.7‰$

From rim of big ditch dug in bog at Storkjølen, Trysil, Hedmark at +735m, depth 0.53 to 0.57m (61° 20′ N, 12° 38′ E). Date at base of steep rise in *Picea* pollen curve; 1305 ± 155 BC*. *Comment* (UH): reported date millennium older than other dates reported for spruce establishment in this area; due possibly to contamination at wall of ditch dug by excavator.

**T-4609. Storkjølen Profile A, II** **2210 ± 50**
$\delta^{13}C = -24.7‰$

Depth 0.50 to 0.53m. Date at beginning of steep rise in *Picea* pollen curve; 315 ± 105 BC*.

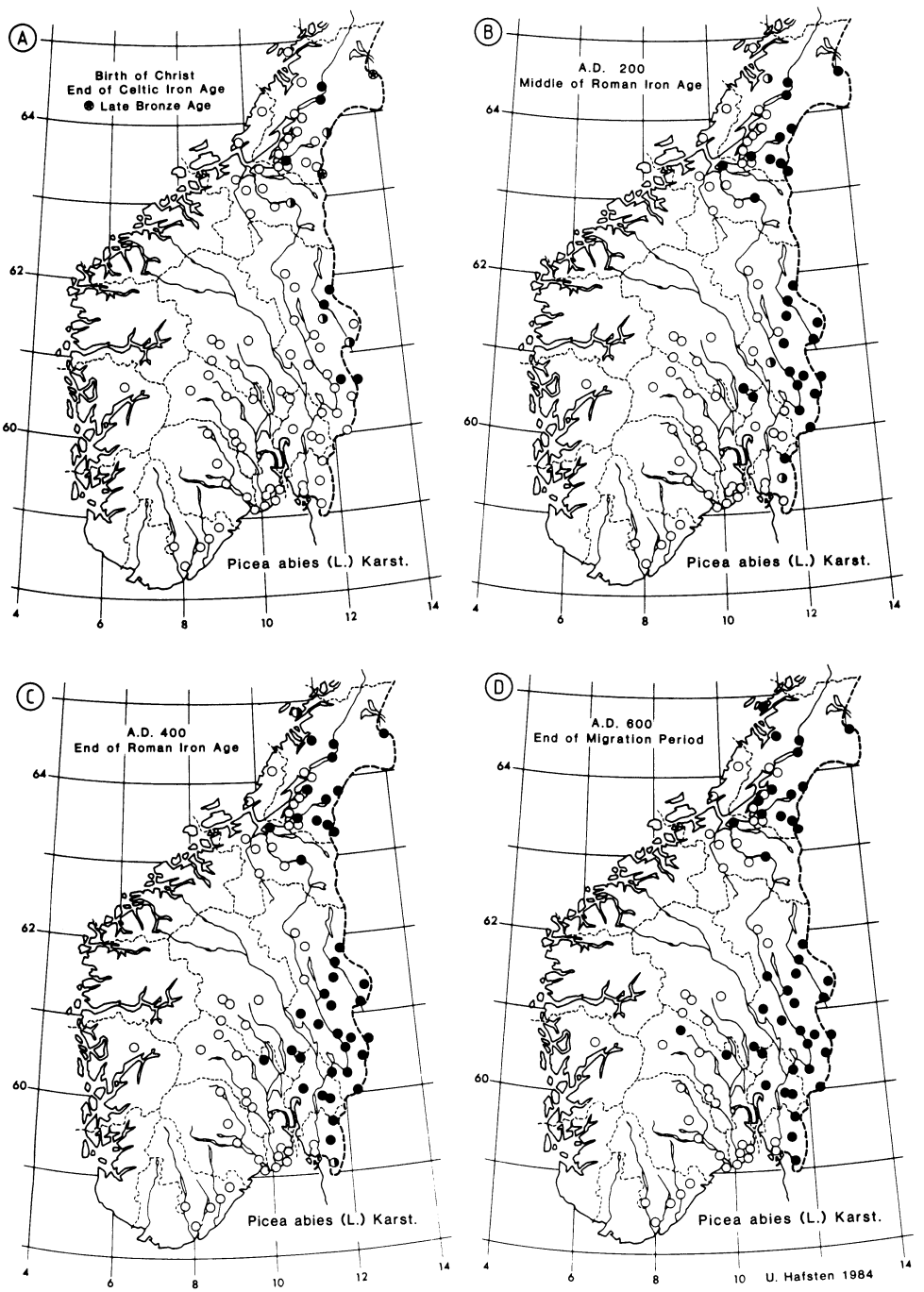


Fig 4. Map series illustrating immigration and spread of spruce in S Norway. A–D: end of various Early Iron age stages; E–G: end of Late Iron age stages and Medieval time; H: early part of 20th century; small dots indicate scattered stands outside continuous (hatched) area.

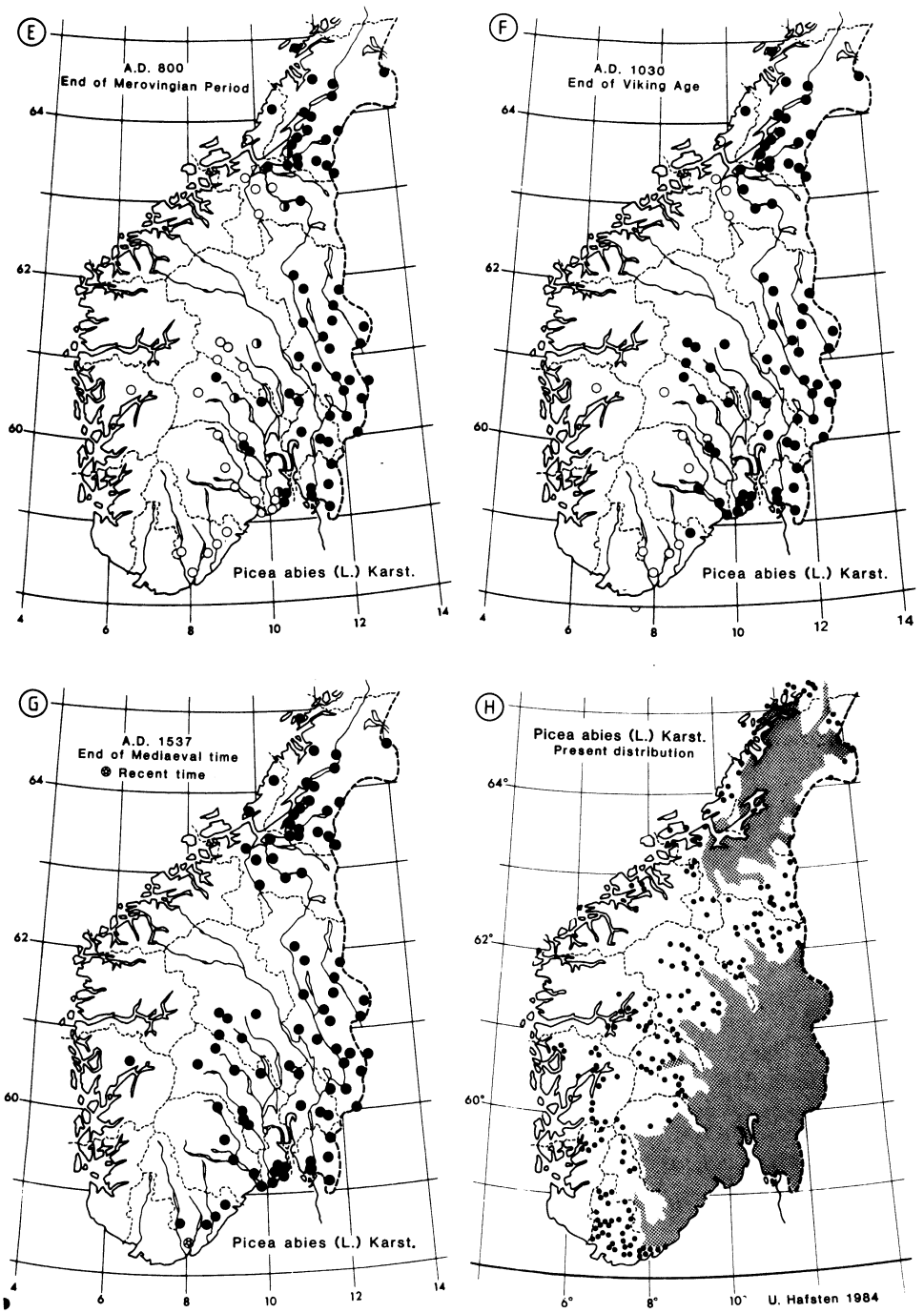


Fig 4 (cont'd). ●: sites where local spruce forest establishment has already taken place. ◑: establishment at transition to next period, O: establishment not yet reflected for period (Hafsten, 1985).

**1900 ± 70**

**T-5328. Storkjølen Profile B** $\delta^{13}C = -21.3‰$

From same bog as Profile A, but coll ca 40m away from ditch where Profile A was secured, depth 0.68 to 0.70m. Date as base of marked rise in *Picea* pollen curve; AD 85 ± 65*.

**1950 ± 50**

**T-3425. Rundfloen** $\delta^{13}C = -26.1‰$

From bog at Rundfloen, Trysil, Hedmark at +330m, depth 0.55 to 0.60m (61° 05′ N, 12° 34′ E). Date at base of steep rise in *Picea* pollen curve; AD 5 ± 65*.

**1960 ± 40**

**T-3649. Fliskjølen** $\delta^{13}C = -26.9‰$

From Fliskjølen, Trysil, Hedmark at +500m, depth 0.35 to 0.40m (61° 04′ N, 11° 57′ E). Date of base of steep rise in *Picea* pollen curve; AD 5 ± 45*.

**1990 ± 70**

**T-3867. Kindsjøen** $\delta^{13}C = -26.4‰$

From Kindsjøen, Värmland, Sweden at +350m, depth 0.55 to 0.60m (60° 38′ N, 12° 41′ E). Date at base of steep rise in *Picea* pollen curve; 35 ± 105 BC*.

**2140 ± 70**

**T-3253. Langmyra** $\delta^{13}C = -28.3‰$

From Langmyra, Åsnes, Hedmark at +200m, depth 0.85 to 0.90m (60° 39′ N, 12° 13′ E). Date at base of steep rise in *Picea* pollen curve; 235 ± 165 BC*.

**1890 ± 70**

**T-4085. Røgden I** $\delta^{13}C = -27.2‰$

From bog at Røgden, Grue, Hedmark at +285m, depth 1.05 to 1.10m (60° 25′ N, 12° 28′ E). Date at base of steep rise in *Picea* pollen curve; AD 90 ± 70*.

**390 ± 40**

**T-4451. Røgden II** $\delta^{13}C = -24.0‰$

Depth 0.35 to 0.40m. Date at base of temporary, pronounced min in *Picea* pollen curve; AD 1465 ± 45*.

**1920 ± 70**

**T-3256. Rennmyra** $\delta^{13}C = -28.0‰$

From Rennmyra, Åsnes, Hedmark at +168m, depth 1.45 to 1.50m (60° 31′ N, 12° 02′ E). Date at start of distinct rise in *Picea* pollen curve; AD 75 ± 65*.

**T-3254. Glesmyr** **1830 ± 70** $\delta^{13}C = -26.8‰$

From Glesmyr, Våler, Hedmark at +187m, depth 0.80 to 0.85m (60° 41′ N, 11° 50′ E). Date at base of steep rise in *Picea* pollen curve; AD 140 ± 70*.

**T-3252. Raudstadmosen** **1830 ± 60** $\delta^{13}C = -26.5‰$

From Raudstadmosen, Kongsvinger, Hedmark at +160m, depth 0.75 to 0.80m (60° 13′ N, 12° 02′ E). Date at base of steep rise in *Picea* pollen curve; AD 140 ± 70*.

**T-3251. Ullernmosen** **1710 ± 70** $\delta^{13}C = -27.7‰$

From Ullernmosen (Stormyra), Sør-Odal, Hedmark at +138m, depth 0.95 to 1.00m (60° 13′ N, 11° 39′ E). Date at base of slow rise in *Picea* pollen curve, 0.10m below final steep rise in pollen curve; AD 260 ± 100*.

**T-3250. Magnormosen** **1850 ± 80** $\delta^{13}C = -27.7‰$

From bog N of Magnor, Eidskog, Hedmark at +128m, depth 1.12 to 1.15m (59° 58′ N, 12° 13′ E). Date at start of steep rise in *Picea* pollen curve; AD 130 ± 80*.

**T-3042. Liermosen** **1720 ± 70**

From Liermosen, Aurskog-Høland, Akershus at +128m, depth 1.55 to 1.60m (59° 54′ N, 11° 34′ E). Date at start of distinct rise in *Picea* pollen curve; AD 260 ± 100*.

**T-3255. Vesle Jarsmoen** **1730 ± 80** $\delta^{13}C = -27.7‰$

From Vesle Jarsmoen, Aurskog-Høland, Akershus at +161m, depth 1.40 to 1.45m (59° 57′ N, 11° 23′ E). Date at start of slow rise in *Picea* pollen curve, 0.30m below final, steep rise in pollen curve; AD 245 ± 105*.

**T-4299. Lintjern I** **1830 ± 40** $\delta^{13}C = -26.7‰$

From bog SE of Lintjern, Marker, Østfold at +166m, depth 1.20 to 1.25m (59° 36′ N, 11° 37′ E). Date at first slow rise in *Picea* pollen curve; AD 135 ± 45.

**T-4300. Lintjern II** **1650 ± 50** $\delta^{13}C = -25.9‰$

Depth 0.98 to 1.02m. Date at steep rise in *Picea* pollen curve; AD 325 ± 65*.

**T-4452. Breidmosen** **1730 ± 40** $\delta^{13}C = -25.3‰$

From Breidmosen, Rakkestad, Østfold at +110m, depth 1.05 to 1.10m (59° 22′ N, 11° 32′ E). Date at base of slow rise in *Picea* pollen curve; AD 230 ± 50*.

**1580 ± 70**

**T-4652. Gullundmosen** $\delta^{13}C = -26.1‰$

From Gullundmosen, Halden, Østfold at +170m, depth 0.45 to 0.50m (50° 04′ N, 11° 31′ E). Date at base of slow rise in *Picea* pollen curve; AD 410 ± 120*.

**Spruce Forest Establishment, SE Norway II**

Peat, coll with plastic pipes, 0.10m wide and 2m long, from 24 peat bogs in central and W part of SE Norwegian spruce (*Picea abies* (L) Karst) forest prov, arranged from SE to NW along main river valleys or catchments (Østerdalen/Gudbrandsdalen, Valdres, Hallingdal-Hemsedal, Numedal). Series dates peat from depths where local spruce forest was established (fig 4). Coll and subm 1978 to 1983 by U Hafsten. *Comment* (UH): series shows distinct migration and spread of spruce forest in W or NW direction from earlier inhabited areas in E-most SE Norway (see SE Norway I). Areas at E foothills of Langfjellene mt range, which represents W boundary of continuous SE Norwegian spruce forest, were reached ca 800 to 1100 BP (see T-5329, -4553, -5060, -5059). Early outposts of spruce forest may have existed in areas W of Mjøsa and Gudbrandsdalen Valleys (see T-4853 and probably -4088) (Hafsten, 1985).

**1920 ± 40**

**T-3648. Svarstadmyr** $\delta^{13}C = -27.6‰$

From bog S of Svarstadbua, Åmot, Hedmark at +370m, depth 0.35 to 0.38m (61° 12′ N, 11° 35′ E). Date at base of steep rise in *Picea* pollen curve; AD 65 ± 45*.

**1630 ± 80**

**T-4087. Stenersætra** $\delta^{13}C = -27.2‰$

From bog at Stenersætra, Trysil, Hedmark at +615m, depth 0.55 to 0.60m (61° 24′ N, 11° 52′ E). Date at base of steep rise in *Picea* pollen curve; AD 335 ± 105*.

**2020 ± 70**

**T-3426. Evenstad I** $\delta^{13}C = -26.3‰$

From bog S of Evenstad RR sta, Stor-Elvdal, Hedmark at +260m, depth 0.50 to 0.55m (61° 25′ N, 11° 06′ E). Date at start of low *Picea* pollen curve; 70 ± 130 BC*.

**1460 ± 80**

**T-4301. Evenstad II** $\delta^{13}C = -24.0‰$

Depth 0.28 to 0.32m. Date at final, steep rise in *Picea* pollen curve, 0.20m, above T-3426; AD 520 ± 90*.

**1680 ± 80**

**T-3647. Østmyra I** $\delta^{13}C = -29.9‰$

From S part of Østmyra, Rendalen, Hedmark at +257m, depth 0.65 to 0.70m (61° 49′ N, 11° 08′ E). Date at initial, slow rise in *Picea* pollen curve; AD 285 ± 105*.

**T-5061. Østmyra II** **1290 ± 70**
$\delta^{13}C = -24.1‰$

Depth 0.40 to 0.45m. Date 0.20m above T-3647, at distinct rise in *Picea* pollen curve; AD 700 ± 90*.

**T-3646. Langmyra I** **1630 ± 60**
$\delta^{13}C = -28.6‰$

From Langmyra, Rendalen, Hedmark at +395m, depth 0.95 to 1.00m (62° 02′ N, 10° 55′ E). Date at start of slow rise in *Picea* pollen curve; AD 345 ± 85*.

**T-4302. Langmyra II** **1230 ± 70**
$\delta^{13}C = -26.7‰$

Depth 0.75 to 0.80m. Date 0.20m above T-3646, at start of final rise in *Picea* pollen curve; AD 750 ± 100*.

**T-3424. Løten almenning** **1760 ± 80**
$\delta^{13}C = -27.5‰$

From boggy area at Løten almenning, Løten, Hedmark at +265m, depth 0.45 to 0.50m (60° 51′ N, 11° 25′ E). Date at base of steep rise in *Picea* pollen curve; AD 200 ± 90*.

**T-4851. Danseråsmyr** **1620 ± 40**
$\delta^{13}C = -26.8‰$

From Danseråsmyr, Ringsaker, Hedmark at +615m, depth 1.10 to 1.15m (60° 54′ N, 10° 53′ E). Date at start of steep rise in *Picea* pollen curve; AD 360 ± 70*.

**T-5329. Holsbru** **1190 ± 40**
$\delta^{13}C = -24.7‰$

From peat bog surrounding small tarn ca 400m N of Holsbru, Gausdal, Oppland at +735m, depth 0.28 to 0.30m (61° 10′ N, 09° 53′ E). Date at base of steep rise in *Picea* pollen curve; AD 790 ± 60*.

**T-4088. Ormtjern** **1820 ± 80**
$\delta^{13}C = -27.9‰$

From soligenous mire E of Ormtjern, Gausdal, Oppland at +835m, depth 0.28 to 0.32m (61° 11′ N, 09° 51′ E). Date at base of steep rise in *Picea* pollen curve; AD 160 ± 90*. *Comment:* because peat column was taken from sloping vaginatum mire, underlain by mica schist and alum slate, possibly that date is too old cannot be ignored.

**T-3041. Gaustadmosan** **1770 ± 50**

From Gaustadmosan, Nittedal, Akershus at +109m, depth 1.10 to 1.13m (60° 02′ N, 10° 53′ E). Date at initial, slow rise in *Picea* pollen curve; AD 205 ± 55*.

**1840 ± 80**

**T-4857. Skrukkelisjøen** $\delta^{13}C = -25.2‰$

From bog at E shore of Skrukkelisjøen, Hurdal, Akershus at +330m, depth 1.15 to 1.20m (60° 25′ N, 10° 54′ E). Date at start of initial, slow rise in *Picea* pollen curve; AD 140 ± 80*.

**1920 ± 30**

**T-4554. Stormyra** $\delta^{13}C = -25.7‰$

From Stormyra, Vestre Toten, Oppland at +400m, depth 0.68 to 0.72m (60° 31′ N, 10° 39′ E). Date at steep rise in *Picea* pollen curve; AD 65 ± 35*.

**3040 ± 80**

**T-4853. Vardal I** $\delta^{13}C = -28.0‰$

From S part of bog complex N of Vardal church, Gjøvik, Oppland at +500m, depth 0.35 to 0.40m (60° 50′ N, 10° 31′ E). Date at abrupt start and rise in *Picea* pollen curve; 1360 ± 140 BC*. *Comment* (UH): reported age millennium or more older than all other dates reported for spruce establishment in central SE Norway.

**1580 ± 80**

**T-4089. Lykkrosmyr** $\delta^{13}C = -28.3‰$

From Lykkrosmyr, 1km W of Vikersætra, Ringerike, Buskerud at +700m, depth 0.25 to 0.30m (60° 27′ N, 09° 56′ E). Date at base of steep rise in *Picea* pollen curve; AD 400 ± 110*.

**1140 ± 40**

**T-4552. Røymyri** $\delta^{13}C = -25.0‰$

From Røymyri, Nord-Aurdal, Oppland at +436m, depth 0.63 to 0.67m (60° 53′ N, 09° 28′ E). Date at start of marked rise in *Picea* pollen curve; AD 840 ± 70*.

**1140 ± 30**

**T-4553. Heggebø** $\delta^{13}C = -25.0‰$

From bog at Heggebø, Øystre Slidre, Oppland at +650m, depth 0.13 to 0.17m (61° 10′ N, 09° 03′ E). Date of start of steep rise in *Picea* pollen curve; AD 835 ± 55*.

**960 ± 80**

**T-5060. Beitostøl** $\delta^{13}C = -26.3‰$

From complex bog E of Vesleåni, 2km SE of Beitostølen, Øystre Slidre, Oppland at +790m, depth 0.30 to 0.35m (61° 13′ N, 08° 56′ E). Date at start of steep rise in *Picea* pollen curve; AD 1020 ± 80*.

**1140 ± 80**

**T-4303. Stormyri I** $\delta^{13}C = -26.3‰$

From Stormyri, 8km SE of Nesbyen, Nes, Buskerud at +251m, depth 0.88 to 0.92m (60° 31′ N, 09° 11′ E). Date at initial, slow rise in *Picea* pollen curve; AD 835 ± 165*.

**T-4304. Stormyri II** **810 ± 40**
$\delta^{13}C = -27.7‰$

Depth 0.48 to 0.52m. Date at base of steep rise in *Picea* pollen curve; AD 1155 ± 65*.

**T-4852. Granheim** **1450 ± 60**
$\delta^{13}C = -27.1‰$

From bog at rifle range, 1.5km SE of Granheim, Hemsedal, Buskerud at +540m, depth 0.15 to 0.20m (60° 46′ N, 08° 47′ E). Date at start of steep rise in *Picea* pollen curve; AD 530 ± 80*.

**T-5673. Fystro seter** **1040 ± 80**
$\delta^{13}C = -28.0‰$

From small boggy spot within fenced-in meadow of Fystro seter, V Slidre, Oppland at +940m, depth 0.29 to 0.31m (60° 57′ N, 08° 52′ E). Date at start of rise in *Picea* pollen curve; AD 935 ± 85*.

**T-5059. Vetremyrene** **810 ± 60**
$\delta^{13}C = -25.3‰$

From bog at old rifle range in Vetremyrene, Hol, Buskerud at +550m, depth 0.30 to 0.35m (60° 36′ N, 08° 20′ E). Date at base of steep rise in *Picea* pollen curve; AD 1155 ± 75*.

**T-5670. Lampeland** **1190 ± 60**
$\delta^{13}C = -26.1‰$

From bog 600m SSW of Ranvik, Flesberg, Buskerud at +170m, depth 0.60 to 0.63m (59° 50′ N, 09° 34′ E). Date at start of rise in *Picea* pollen curve; AD 785 ± 95*.

**T-4551. Aslefetmyr** **1360 ± 40**
$\delta^{13}C = -26.1‰$

From Aslefetmyr, Flesberg, Buskerud at +190m, depth 0.23 to 0.27m (59° 52′ N, 09° 24′ E). Date at start of steep rise in *Picea* pollen curve; AD 620 ± 50*.

**T-5671. Stormyri** **910 ± 60**
$\delta^{13}C = -25.5‰$

From bog 2km E of Rollag, Rollag, Buskerud at +350m, depth 0.34 to 0.37m (59° 59′ N, 09° 20′ E). Date at base of steep rise in *Picea* pollen curve; AD 1075 ± 95*.

**Spruce Forest Establishment, SE Norway III**

Peat coll with plastic pipes, 0.10m wide and 2m long, from four peat bogs in SW part of SE Norwegian spruce (*Picea abies* (L) Karst) forest prov, across Aust-Agder Co from E to W or SW. Series dates peat from depths of local spruce forest establishment (fig 4). Coll and subm 1982 to 1983 by U Hafsten. *Comment* (UH): series shows inland spread to W, towards Setesdalen Valley (*viz*, T-5332 at Evje), during Viking and Medieval ages and

probably followed by S migration down Setesdalen towards coast (see T-5331), during Medieval and Recent times (Hafsten, 1985).

**T-4855. Kvisli** — **1130 ± 70**, $\delta^{13}C = -23.9‰$

From bog ca 1km S of Kvisli, Vegårdshei, Aust-Agder at +220m, depth 0.30 to 0.35m (58° 54′ N, 08° 56′ E). Date at start of slow rise in *Picea* pollen curve; AD 855 ± 85*.

**T-5672. Myrli** — **680 ± 70**, $\delta^{13}C = -26.9‰$

From bog NE of Myrli farm, Åmli, Aust-Agder at +270m, depth 0.13 to 0.16m (58° 40′ N, 08° 43′ E). Date at slow rise in *Picea* pollen curve; AD 1275 ± 75*.

**T-5330. Hinnebu** — **400 ± 70**, $\delta^{13}C = -23.9‰$

From narrow bog 1km S of Hinnebu, Froland, Aust-Agder at +240m, depth 0.25 to 0.27m (58° 34′ N, 08° 29′ E). Date at start of marked rise in *Picea* pollen curve; AD 1465 ± 55*.

**T-5332. Bjorvassmyr** — **530 ± 40**, $\delta^{13}C = -24.8‰$

From Bjorvassmyr, Evje & Hornnes, Aust-Agder at +401m, depth 0.13 to 0.15m (58° 35′ N, 07° 53′ E). Sample at start of marked rise in *Picea* pollen curve; AD 1385 ± 25*.

**T-5331. Fredsmyr** — **170 ± 70**, $\delta^{13}C = -27.7‰$

From narrow bog S of Fredsmyr, Birkenes, Aust-Agder at +200m, depth 0.33 to 0.35m (58° 20′ N, 08° 07′ E). Date at marked rise in *Picea* pollen curve. Younger than AD 1530*.

**Spruce Forest Establishment, W Norway**

**T-4306. Istadmyrene** — **1720 ± 80**, $\delta^{13}C = -26.2‰$

From bog at Istad, Voss, Hordaland at +250m, depth 0.25 to 0.30m (60° 36′ N, 06° 34′ E). Date at start of low 'tail' of *Picea* pollen curve, 0.2m below final rise; AD 270 ± 110*.

**T-4305. Istadmyrene** — **490 ± 70**, $\delta^{13}C = -26.5‰$

Depth 0.08 to 0.12m. Date at final rise in *Picea* pollen curve; AD 1400 ± 40* (Hafsten, 1985).

**Spruce Forest Establishment, Sør-Trøndelag**

Peat, coll with plastic pipes, 0.10m wide and 2m long, from seven ombrotrophic bogs in various parts of spruce (*Picea abies* (L) Karst) forest

in Sør-Trøndelag Co. Series dates peat from depths of local spruce forest establishment. Coll and subm 1978 to 1982 by P O Trillerud and U Hafsten. *Comment:* series shows slow spread of spruce from two early centers or outposts in Trondheim (*cf* Sjetnemyr) and upper part of Gauldalen (*cf* Kjølen) to central (*cf* Lundadalen and Gåsbakken), S (*cf* Berkåk) and W (*cf* Siken) spruce area (Trillerud, 1983; Hafsten, 1985).

**T-3864. Sjetnemyr** **1850 ± 70**
$\delta^{13}C = -23.1‰$

From Sjetnemyr, Trondheim, Sør-Trøndelag at +155m, depth 0.60 to 0.65m (63° 22′ N, 10° 23′ E). Date at base of rise in *Picea* pollen curve; AD 130 ± 70*.

**T-4150. Kjølen** **1950 ± 70**
$\delta^{13}C = -26.1‰$

From Kjølen bog complex, Haltdalen, Sør-Trøndelag at +570m, depth 0.22 to 0.25m (62° 56′ N, 11° 12′ E). Date at base of steep rise in *Picea* pollen curve; AD 15 ± 115*.

**T-4151. Fordalen** **1170 ± 70**
$\delta^{13}C = -26.2‰$

From Fordalen, Midtre Gauldal, Sør-Trøndelag at +570m, depth 0.20 to 0.23m (62° 53′ N, 10° 44′ E). Date at slow rise in *Picea* pollen curve; AD 865 ± 105*.

**T-3865. Lundadalen** **1070 ± 80**
$\delta^{13}C = -26.3‰$

From Lundadalen, Melhus, Sør-Trøndelag at +240m, depth 0.30 to 0.35m (63° 08′ N, 10° 26′ E). Date at base of steep rise in *Picea* pollen curve; AD 910 ± 90*.

**T-4154. Gåsbakken I** **850 ± 70**
$\delta^{13}C = -26.0‰$

From bog W of Gåsbakken, Melhus, Sør-Trøndelag at +260m, depth 0.30 to 0.35m (63° 07′ N, 09° 57′ E). Date at slow rise in *Picea* pollen curve; AD 1125 ± 95*.

**T-4153. Gåsbakken II** **1730 ± 70**
$\delta^{13}C = -25.8‰$

From 0.65 to 0.70m. Date at base of protracted 'tail' in *Picea* pollen curve; AD 250 ± 100*.

**T-4152. Siken** **390 ± 70**
$\delta^{13}C = -27.4‰$

From bog at Siken, Orkdal, Sør-Trøndelag at +175m, depth 0.35 to 0.40m (63° 15′ N, 09° 42′ E). Date at base of marked rise in *Picea* pollen curve; AD 1500 ± 90*.

**410 ± 70**

**T-3866. Berkåk** $\delta^{13}C = -25.8‰$

From bog S of Berkåk, Rennebu, Sør-Trøndelag at +430m, depth 0.12 to 0.15m (62° 48′ N, 10° 02′ E). Date at base of steep rise in *Picea* pollen curve; AD 1465 ± 55*.

**Spruce Forest Establishment, N Trøndelag I**

Peat coll with plastic pipes, 0.10m wide and 2m long, from eight ombrotrophic bogs in spruce (*Picea abies* (L) Karst) forest in S part of Nord-Trøndelag Co, from Storvallen in Jämtland, Sweden, down Stjørdalen Valley to Trondheimsfjorden and N-ward E of fiord to Levanger. Series dates peat from depths of local spruce forest establishment. Coll and subm 1979 to 1981 by P U Sandvik and U Hafsten. *Comment:* series shows spread of Norwegian Spruce from E towards W part of study area (Hafsten, 1985).

**4820 ± 100**

**T-3967. Storvallen Profile A** $\delta^{13}C = -26.3‰$

From bog complex E of Storvallen at +570m, depth 0.25 to 0.30m (63° 17′ N, 12° 10′ E). Date at base of slow rise in *Picea* pollen curve; 3635 ± 96 BC*.

**2830 ± 80**

**T-4431. Storvallen Profile B** $\delta^{13}C = -25.5‰$

From same bog as T-3967, but coll 2m away from Profile A, depth 0.18 to 0.20m. Date at base of slow rise in *Picea* pollen curve; 1075 ± 135 BC*. *Comment:* dated out to be control of T-3967, which seems surprisingly old.

**1880 ± 40**

**T-3708. Skurdalsvollen** $\delta^{13}C = -29.1‰$

From bog at Skurdalsvollen, Meråker at +442m, depth 1.03 to 1.07m (63° 23′ N, 12° 00′ E). Date at base of slow rise in *Picea* pollen curve; AD 100 ± 40*.

**1910 ± 70**

**T-3709. Klokkhaugen** $\delta^{13}C = -27.8‰$

From bog at Klokkhaugen, Meråker at +100m, depth 0.43 to 0.47m (60° 26′ N, 11° 42′ E). Date at base of steep rise in *Picea* pollen curve; AD 75 ± 65*.

**2010 ± 80**

**T-3966. Hegra festning** $\delta^{13}C = -28.8‰$

From bog at Hegra festning, Stjørdal at +215m, depth 0.55 to 0.60m (63° 27′ N, 11° 10′ E). Date at base of steep rise in *Picea* pollen curve; 65 ± 125 BC*.

**1340 ± 60**

**T-3707. Aunet** $\delta^{13}C = -28.7‰$

From Aunet in Lånke, Stjørdal at +160m, depth 0.90 to 0.95m (63° 24′ N, 10° 55′ E). Date at base of slow rise in *Picea* pollen curve; AD 630 ± 60*.

**1170 ± 40**

**T-4122. Nordsveet I** $\delta^{13}C = -25.6‰$

From bog at Nordsveet, Stjørdal at +160m, depth 1.15 to 1.20m (63° 33′ N, 10° 57′ E). Date at base of steep rise in *Picea* pollen curve; AD 805 ± 75*.

**1450 ± 90**

**T-4123. Nordsveet II** $\delta^{13}C = -27.7‰$

From 1.95 to 2.00m. Date at base of protracted 'tail' in *Picea* pollen curve; AD 535 ± 105*.

**1030 ± 70**

**T-3963. Ronglan I** $\delta^{13}C = -27.2‰$

From bog at Tuv N of Ronglan, Levanger at +60m, depth 1.05 to 1.10m (63° 40′ N, 11° 07′ E). Dates lower of two steps in *Picea* pollen curve; AD 35 ± 95*.

**1470 ± 70**

**T-3964. Ronglan II** $\delta^{13}C = -26.7‰$

From 0.75 to 0.80m depth. Dates upper of two steps in *Picea* pollen curve; AD 515 ± 85*.

**1320 ± 70**

**T-4124. Alstadhaug I** $\delta^{13}C = -27.3‰$

From bog SE of Alstadhaug church, Levanger at +60m, depth 1.05 to 1.10m (63° 43′ N, 11° 14′ E). Data at base of slow rise in *Picea* pollen curve; AD 650 ± 80*.

**3140 ± 80**

**T-4125. Alstadhaug II** $\delta^{13}C = -26.8‰$

From 1.55 to 1.60m depth. Date at base of protracted 'tail' in *Picea* pollen curve; 1470 ± 130 BC*.

**Spruce Forest Establishment, N Trøndelag II**

Peat coll with plastic pipes, 0.10m wide and 2m long, from seven bogs in various parts of spruce (*Picea abies* (L) Karst) forest in central part of Nord-Trøndelag Co, E of Trondheimsfjorden and Snåsavatn. Series dates peat from depths of local spruce forest establishment. Coll and subm 1979 to 1982 by S F Selvik and U Hafsten. *Comment:* series shows spread of spruce from E towards W part of study area (Hafsten, 1985).

**2360 ± 70**

**T-3898. Kalvikmyra** $\delta^{13}C = -28.4‰$

From bog S of Kvesjøen, Lierne at +430m, depth 0.49 to 0.51m (64° 27′ N, 13° 52′ E). Date at base of steep rise in *Picea* pollen curve; 565 ± 145 BC*.

**2030 ± 80**

**T-4119. Formofoss** $\delta^{13}C = 27.4‰$

From bog S of Formofoss, Grong at +175m, depth 1.03 to 1.06m (64° 23′ N, 12° 31′ E). Date at base of slow rise in *Picea* pollen curve; 95 ± 155 BC*.

**2290 ± 80**

**T-4118. Brennmyra** $\delta^{13}C = -26.4‰$

From bog E of Snåsavatnet, Snåsa at +75m, depth 1.20 to 1.22m (64° 14′ N, 12° 19′ E). Date at rise in *Picea* pollen curve; 430 ± 40 BC*.

**1240 ± 70**

**T-3897. Bjørnamyra** $\delta^{13}C = -26.1‰$

From bog at Såsegg, Steinkjer at 80m, depth 1.04 to 1.07m (63° 56′ N, 11° 40′ E). Date at rise in *Picea* pollen curve; AD 750 ± 100*.

**2770 ± 80**

**T-3899. Leinsmyra I** $\delta^{13}C = -27.5‰$

From bog near Stiklestad, Verdal at +35m, depth 2.90 to 2.93m (63° 48′ N, 11° 32′ E). Date at base of *Picea* pollen curve; 1005 ± 105 BC*.

**1640 ± 70**

**T-3896. Leinsmyra II** $\delta^{13}C = -28.3‰$

From 1.50 to 1.53m. Date at slow rise in *Picea* pollen curve, at end of protracted 'tail' in same curve; AD 330 ± 100*.

**720 ± 80**

**T-3711. Leinsmyra III** $\delta^{13}C = -28.4‰$

From 0.78 to 0.81m. Date at marked rise in *Picea* pollen curve; AD 1245 ± 65*.

**1960 ± 60**

**T-3548. Sveet** $\delta^{13}C = -28.8‰$

From bog E of Veravatnet, Verdal at +380m, depth 0.48 to 0.52m (63° 48′ N, 12° 23′ E). Date at base of steep rise in *Picea* pollen curve; 5 ± 95 BC*.

**1780 ± 70**

**T-3710. Litlmomyra** $\delta^{13}C = 27.9‰$

From bog at Sul, Verdal at +250m, depth 0.72 to 0.76m (63° 40′ N, 12° 00′ E). Date at base of steep rise in *Picea* pollen curve; AD 190 ± 80*.

**Hardangervidda series, SW Norway**

These studies have been part of "The Hardangervidda project for interdisiplinary cultural research" (HTK), to document vegetational and environmental hist during Holocene. Peat, gyttja, and wood were dated from this mountainous area, ca 8000km$^2$ (60° 15′ N, 07° 30′ E). Coll and subm 1970–1974 by Dagfinn Moe, Bot Inst, Univ Bergen (Johansen, 1973;

Moe, 1978a; Moe, Indrelid, & Kjos-Hansen, 1978; Moe, 1979; R, 1975, v 17, p 371–372; Indrelid & Moe, 1982).

**T-1079. DM 2302** **5090 ± 180**

*Salix* at +1310m (UTM MM 272865); 3940 ± 240 BC*.

**T-1193. DM 1916** **6760 ± 100**

*Betula pubescens* at +1005m (MM 048959).

**T-1194. DM 1917** **5240 ± 140**

*Pinus sylvestris* at +1005m (MM 048959); 4120 ± 230 BC*.

**T-1197. DM 1287** **7170 ± 100**

*Salix* at +1205 (MN 517017).

**T-1254. DM 1288** **6580 ± 170**

*Salix* at +1205m (MN 517017).

**T-1309. DM 1782** **1930 ± 120**

*Pinus sylvestris* at +670m (MN 037003); AD 10 ± 150*.

**T-1310. DM 1784** **4900 ± 130**

*Pinus sylvestris* at +670 (MN 037003); 3690 ± 110 BC*.

**T-1431. DM 1810** **5280 ± 100**

Peat at +670m (MN 037003); 4165 ± 185 BC*.

**T-1432. DM 2595** **2710 ± 80**

Peat at +1135m (MN 540032); 915 ± 105 BC*.

**T-1432B. DM 2595B** **1610 ± 110**

Peat at +1135m (MN 540032); AD 375 ± 155*.

**T-1433. DM 2596** **4640 ± 130**

Peat at +1135m (MN 540032); 3420 ± 200 BC*.

**T-1435. DM 2597** **4450 ± 90**

*Betula pubescens* at +890m (MN 121986); 3240 ± 130 BC*.

**T-1436. DM 3057A** **7010 ± 100**

*Betula pubescens* at +1122m (MN 603625).

**T-1437. DM 3060** **7740 ± 160**

*Pinus sylvestris* at +1180m (MN 5172).

**T-1438. DM 3061.** **6510 ± 190**

*Pinus sylvestris* at +1100m (MN 417917).

**T-1447. DM 3062A** **16,350 ± 620**

Clay/gyttja at +1190m (MM 44976).

**T-1447BI. DM 3062B (KOH)** **8460 ± 190**

Clay/gyttja at +1190m (MM 442976).

**T-1447BII. DM 3062A** **9400 ± 260**

Clay/gyttja at +1190m (MM 442976). *Comment* (DM): T-1447 is too old; sediment contains fyllit. New dates T-1447BI (8460 ± 260 BP) and II are based on fractioned material. T-1447BI is close to estimate.

**T-1554. DM 2472** **1400 ± 80**

Peat at +1310m (MN 512038); AD 575 ± 85*.

**T-1555. DM 2591 (2588)** **7570 ± 100**

Peat at +670m (MN 037003).

**T-1651. DM 2577** **2590 ± 80**

Peat at +1005m (MN 048959); 830 ± 70 BC*.

**T-1652. DM 3280** **7910 ± 230**

Gyttja at +1245m (MM 148721).

**T-1653. DM 3281** **2570 ± 80**

Peat at +670m (MN 037003); 815 ± 75 BC*.

**T-1654. DM 3278** **4760 ± 90**

*Pinus sylvestris* at +985m (MN 374083); 3540 ± 140 BC*.

**T-1655. DM 3279** **8180 ± 110**

*Pinus sylvestris* at +1100m (MN 2814).

**T-1656. DM 3239** **2890 ± 100**

*Pinus sylvestris* at +760m (MM 059987); 1155 ± 145 BC*.

**T-1657. DM 3240** **2840 ± 80**

*Pinus sylvestris* at +760m (MM 059987); 1090 ± 150 BC*.

**T-1658. DM 3244** **5040 ± 90**

*Pinus sylvestris* at +800m (MN 052987); 3845 ± 115 BC*.

**T-1659. DM 3246** **4080 ± 80**

*Betula pubescens* at +990m (MM 114958); 2750 ± 160 BC*.

**T-1660. DM 3264** **5910 ± 140**

*Pinus sylvestris* at +1100m (LM 982800); 4805 ± 205 BC*.

**T-1741. DM 3242** **740 ± 90**

*Pinus sylvestris* at +675m (MN 036001); AD 1210 ± 100*.

**T-1742. DM 3258** **7160 ± 130**

*Pinus sylvestris* at +920m (MM 008933).

**T-1743. DM 3274** **5360 ± 110**

*Betula pubescens* at +990m (MN 3709); 4220 ± 180 BC*.

**T-1744. DM 3276** **6340 ± 100**

*Pinus sylvestris* at +990m (MN 3709); 5230 ± 90 BC*.

**T-1745. DM 3263** **8310 ± 110**

*Pinus sylvestris* at +1100m (LM 987812).

**T-1762. DM LOC 35, 108-112** **4580 ± 90**

Peat at +1245m (MM 148721); 3380 ± 140 BC*.

## ARCHAEOLOGIC SAMPLES

### *Norway*

*Settlement Sites*

**Iversfjord series, Finnmark**

Charcoal and marine shell from coastal site dating from younger Stone age. Fifteen of 50 houses were excavated 1974 to 1977 at +8 to +12m in Iversfjord, Gamvik (70° 48′ N, 27° 50′ E). Coll and subm 1975 to 1977 by Ericka Helskog, Tromsö Mus, Univ Tromsö.

*General Comment* (EH): most extensively excavated late Stone age site between Varangerfjord and Söröya. Dates indicate greater variation in length of occupation, activity, and population size than previously believed (Helskog, 1983).

**T-2048. House 18** **3100 ± 70**

Charcoal (birch) from S side of entrance passage, depth 0.25m. *Comment* (EH): possibly secondary use of house; 1430 ± 120 BC*.

**T-2049. House 19** **2600 ± 70**

Charcoal (birch) from middle of entrance passage, depth 0.15 to 0.20m; 840 ± 60 BC*.

**T-2050. House 19** **2490 ± 100**

Charcoal (birch) from middle of entrance passage, depth 0.15 to 0.20m; 645 ± 165 BC*.

**T-2347. House 15 midden** **3910 ± 70**
$\delta^{13}C = +1.1‰$

Marine shell from layer 5 of midden, depth 0.4 to 0.5m. *Comment* (EH): osteol material indicates possible year-round occupation; 2405 ± 195 BC*.

**T-2348. House 17** **3490 ± 100**

Charcoal (birch) from underlying stone platform in house interior, depth 0.2m; 1910 ± 200 BC*.

**T-2349. House 20** **3560 ± 100**

Charcoal (birch) from entrance passage, depth 0.2m; 1975 ± 175 BC*.

**T-2350. House 22** **2800 ± 110**

Charcoal (birch) from charcoal concentration in middle of house interior, depth 0.1 to 0.2m; 1055 ± 155 BC*.

**T-2351. House 32** **3050 ± 90**

Charcoal (pine, juniper) from charcoal concentration at N end of stone-lined hearth in house interior, depth 0.12m; 1360 ± 140 BC*.

**T-2771. House 17** **3640 ± 120**

Charcoal (birch) in assoc with ornamented asbestos ceramics in layer 3 of refuse area in front of house entrance, depth 0.25m. *Comment* (EH): only $^{14}C$ date on this material from coast of Finnmark; 2100 ± 80 BC*.

**T-2772. House 18** **3730 ± 90**

Charcoal (birch) from stone-lined hearth in house interior, depth 0.1m; 2210 ± 100 BC*.

**T-2773. House 24** **3410 ± 80**

Charcoal (birch) from middle of stone-lined hearth in house interior, depth 0.1m; 1860 ± 180 BC*.

**T-2881. House 15 midden** **4240 ± 100**

Charcoal (birch) from midden layer 4, depth 0.4m; 3000 ± 150 BC*.

**T-2485. House 15 midden** **4120 ± 50**

Marine shell from layer 4 of midden, depth 0.3 to 0.4m; 2785 ± 135 BC*.

**T-2486. House 17** **3480 ± 130**

Charcoal from charcoal concentration on border between floor and wall in NW quad of house interior, depth 0.13 to 0.15m; 1900 ± 210 BC*.

**T-2487. House 20** **3590 ± 70**

Charcoal (birch) from charcoal concentration in middle of house interior, depth 0.2m; 2080 ± 65 BC*.

**Iesjav'ri series, Finnmark**

Charcoal concentration assoc with textile-ornamented asbestos ceramics from two-component Stone-age site at ca +400m, depth 0.2m at Karasjok (69° 42′ N, 24° 18′ E). Coll 1974 by Knut Helskog, Tromsö Mus, Univ Tromsö; subm 1975 to 1978 by E Helskog. *Comment* (EH): only $^{14}C$ dated finds of asbestos ceramics from interior of Finnmark.

**T-1814. Gasadaknjar'ga no. 1** **3280 ± 120**

1685 ± 185 BC*

**T-2880. Gasadaknjar'ga no. 5** **3100 ± 80**

1425 ± 125 BC*

**T-1815. Gasadaknjar'ga no. 6** **4130 ± 230**

2815 ± 335 BC*

**T-3312. Skrolsvik** **1980 ± 70**

Charcoal (*Betula, Pinus*) from hearth of Stone-age-type house C at +15m in Skrolsvik, Tranö, Troms (69° 04′ N, 16° 49′ E). Coll 1956 by Per Sörensen, Tromsö Mus; subm 1979 by Olav S Johansen, Univ Tromsö, 35 ± 105 BC*.

**Tussöy series, Troms**

Charcoal from house site in Tussöy (69° 40′ N, 18° 10′ E). Samples (except T-1847) coll and subm 1972 to 1975 by Kari Stören Binns, Tromsö Mus, Univ Tromsö. *Comment* (KSB): dates show that site was used, with possible intervals, from AD 300 to 900 (Johansen, 1979; Stören, 1976; Stören Binns, 1978).

**T-1402. Tussöy I/Dk** **1120 ± 110**

From fireplace in SW end of site; AD 850 ± 150*.

**T-1403. Tussöy I/Ek** **1430 ± 80**

From SW end of house, from earliest settlement layer of site; AD 545 ± 95*.

**T-1628. Tussöy III/Vk** **1660 ± 110**

From under wall of most recent house; AD 305 ± 135*.

**T-1629. Tussöy VII/Ak** **1220 ± 70**

From inside E corner of wall, may be remnants from post hole; AD 750 ± 100*.

**T-1630. Tussöy RI/Ak** **480 ± 60**

From burial cairn. *Comment* (KSB): date is 400 to 500 yr later than end of this type of burial; AD 1410 ± 30*.

**T-1847. Tussöy I/23 (1)** **1400 ± 270**

From corner of oldest house site; AD 580 ± 300*.

**T-2051. Tussöy I/27 (1)** **990 ± 60**

From fireplace in corner of house; AD 985 ± 65*.

**T-2218. Tussöy I/28** **1410 ± 70**

From oldest settlement layer, outside walls of most recent house site; AD 570 ± 80*.

**T-1900. Greipstad I** **1620 ± 90**

Charcoal from fireplace in house site which is part of Iron age farm consisting of 5 houses, 3 burial graves, and gate at Greipstad, Troms (69° 33′ N, 18° 27′ E). Coll 1961 by Jens Storm Munch, Tromsö Mus; subm 1973 by K Stören Binns; AD 350 ± 130*.

**1980 ± 70**

**T-3064. Austein I** $\delta^{13}C = -14.8‰$

Human bones of female skeleton buried in shelly sand with no visible grave structure on surface at +3m, depth 0.5m at Austein, Kvalöy, Troms (69° 35′ N, 18° 2′ E). Coll and subm 1978 by K Stören Binns. *Comment* (KSB): oldest known date of Iron age burials in N Norway. Finds suggest Merovingian period (Stören Binns, 1978); 25 ± 95 BC*.

**Helgöy series I, Troms**

Charcoal from Iron-age house sites in Helgöy parish were dated as part of multidisciplinary Helgöy Proj at Karlsöy (70° 07′ N, 19° 21′ E). Coll 1975 to 1979 by Kari Stören Binns, Astrid Utne, and I M Holm-Olsen, Tromsö Mus; subm 1975 to 1980 by I M Holm-Olsen. *Comment* (IMHO): these Iron-age houses are of type traditionally attributed to Norwegian population (as opposed to Sami), and represent N-most permanent settlement of this kind in Norway (Holm-Olsen, 1980).

**T-2044. Finnby 1975/2** **1220 ± 50**

From junction of wall and floor area; AD 750 ± 70*.

**T–2281. Finnby 1975/1** **1250 ± 60**

From floor area; AD 735 ± 85*.

**T-2742. Grunnfjord, Naust 1977/7** **1220 ± 50**

From floor area in boat house; AD 750 ± 70*.

**T-2914. Grunnfjord, Naust 1977/25** **1350 ± 70**

Charcoal concentration underlying floor level of boat house; AD 630 ± 60*.

**T-3664. Nordskar 79/JA** **350 ± 50**

From interior wall of house; AD 1520 ± 90*.

**Tjötta series, Nordland**

Charcoal from courtyard site at +10m at Laekkenga, Alstahaug (65° 00′ N, 01° 30′ E). T-2156, -2157, and -2746 coll 1950 by H E Lund, DKNVS Mus, Univ Trondheim; subm 1976 (except T-2746) by Tom Söbstad, Tromsö Mus. Other samples coll and subm 1977 by Birgitta Wik, DKNVS Mus. *Comment* (BW): courtyard site consists of min 10 houses around an open square. Tjötta is known from Saga to be governmental center at end of Viking age. Evidence suggests center of religious, economic, administra-

tive, and military activities. Similar sites also found on SW and N coast of Norway.

**T-2743. Laekkenga, Tuft A** **1030 ± 50**

Coll 0.73m below surface in center of hearth, 0.58m thick at S end of house; AD 960 ± 50*.

**T-2744. Laekkenga, Tuft B** **1190 ± 50**

Coll 0.36m below surface from hearth, 0.2 to 0.3m thick, at S end of house; AD 775 ± 75*.

**T-2745. Laekkenga, Tuft C** **1410 ± 60**

Coll 0.38 to 0.58m below surface from hearth, 0.2m thick, at S end of house; AD 575 ± 65*.

**T-2746. Laekkenga, Haug 2** **1390 ± 70**

Coll 0.5m below surface at base of mound under two stone layers; AD 585 ± 75*.

**T-2819. Laekkenga 5** **1290 ± 70**

Coll 0.46m below surface from lower part of construction loc between outer turf walls of houses A and B, 0.38m thick, with burned stones, black earth, and burned animal bones; AD 685 ± 75*.

**T-2156. Laekkenga, Tuft I** **1640 ± 80**

Coll from cooking pit, 0.8 to 0.9m deep, with burned stones and black earth. Top of pit was at floor level; AD 330 ± 110*.

**T-2157. Laekkenga, Tuft IIB** **1320 ± 70**

Coll in hearths and along walls inside house; AD 650 ± 80*.

**Vestvågöy series, Nordland**

Charcoal from several Iron-age farms, Vestvågöy I. Coll 1973 to 1977 and subm 1974–1978 by O S Johansen, Tromsö (Johansen, 1979).

**T-3030. Malnes I, 1978/4** **900 ± 50**

*Betula* and *Pinus* from small deserted farm E of Malnes Hill at +15m (68° 12′ N, 14° 07′ E). Coll from bottom of cultural layer on house floor; AD 1095 ± 75*.

**T-3031. Malnes II, 1978/1** **900 ± 80**

*Corylus* at +20m; AD 1080 ± 100*.

**T-1671. Liland 1973/2** **1270 ± 110**

Coll at +25m, depth 0.15m in stone fireplace at Liland (68° 13′ N, 13° 44′ E). *Comment* (OSJ): only known example of stone fireplace in Iron-age house site on Vestvågöy. Date corresponds well with T-1672; AD 725 ± 125*.

**T-1672. Liland 1973/3** **1330 ± 110**

Coll at +25m, depth 0.3m below stone fireplace; AD 670 ± 120*.

**T-1673. Böstad 1973/1** **2150 ± 80**

Coll at +25m, depth 0.4m from hearth below E outer sod wall at Böstad (68° 15′ N, 13° 45′ E). *Comment* (OSJ): date represents human activities before bldg of house. Pollen analysis confirms farming activities at Böstad almost continuously from ca 3800 BP; 285 ± 145 BC*.

**T-1674. Böstad 1973/6** **1060 ± 150**

Coll at depth 0.15m in charcoal layer in house site. *Comment* (OSJ): with datable artifacts, date confirms that house belongs to late Iron age; AD 895 ± 165*.

**T-1831. Böstad 1973/2** **1790 ± 150**

From cultural layer, 0.5m thick, below W outer wall of house site. *Comment* (OSJ): represents activities that antedate house; AD 205 ± 155*.

**T-1832. Böstad 1973/7** **1260 ± 90**

Coll 0.3 to 0.4m above T-1831; AD 720 ± 100*.

**T-1833. Böstad 1973/8** **1470 ± 180**

From earth fill of depression in house floor. *Comment* (OSJ): range is too wide to determine if depression in floor antedates house or is part of structure; AD 485 ± 195*.

**T-1834. Böstad 1973/4** **1650 ± 130**

From post hole in floor. *Comment* (OSJ): position does not fit well into house structure. Date supports suggestion that it belongs to older house; AD 325 ± 155*.

**T-1969. Böstad 1973/3** **1290 ± 80**

From W outer sod wall. *Comment* (OSJ): *post quem* date for house; AD 695 ± 95*.

**T-2112. Moland, Tuft 1, 1975/5** **1680 ± 110**

*Betula* at +20m from charcoal layer below outer sod wall at Moland (68° 13′ N, 14° 07′ E). *Comment* (OSJ): *post quem* date for construction of house; AD 295 ± 135*.

**T-2113. Moland, Tuft 1, 1975/8** **1610 ± 80**

*Betula* from charcoal layer along inside of outer sod wall; probably remains of inner wooden wall. *Comment* (OSJ): agrees with datable artifacts found in house; AD 370 ± 110*.

**T-2628. Moland, Tuft 1, 1976/7** **1540 ± 50**
$\delta^{13}C = -28.7‰$

*Betula* from fireplace on house floor. *Comment* (OSJ): date generally agrees with T-2113; AD 460 ± 70*.

**T-2807. Moland, Tuft 1, 1975/2** **1680 ± 120**

*Betula* from charcoal layer in earth fill on house floor. *Comment* (OSJ): dated for evidence of oldest period of farm; AD 295 ± 135*.

**T-1835. Moland, Tuft 2, 1974/2** **1070 ± 70**

Probably remains of inner wooden wall. *Comment* (OSJ): late Iron age; agrees with artifactual remains; AD 910 ± 90*.

**T-1970. Moland, Tuft 2, 1974/1** **1670 ± 160**

*Betula* from concentration of charcoal on floor. *Comment* (OSJ): too old compared with artifacts and other $^{14}C$ dates; may represent older activities, as it fits dates from houses 1, 3, and 4 in vicinity; AD 325 ± 185*.

**T-1971. Moland, Tuft 2, 1974/11** **1120 ± 70**

*Betula* from charcoal layer in outer sod wall. *Comment* (OSJ): *post quem* date for construction of house. Fits with late Iron-age Viking-period date for house; AD 855 ± 85*.

**T-2114. Moland, Tuft 2, 1975/2** **1190 ± 100**

Probably remains of inner wooden wall. *Comment* (OSJ): date seems to be from barn and agrees with $^{14}C$ dates of T-1835 and -1971; AD 780 ± 130*.

**T-2116. Moland, Tuft 3, 1975/XXXVI** **1530 ± 70**

Concentration of charcoal on floor. *Comment* (OSJ): agrees with datable artifacts in house: AD 460 ± 90*.

**T-2117. Moland Tuft 4, 1975/7** **1300 ± 90**

From charcoal layers in outer wall. *Comment* (OSJ): date slightly too young compared with T-2118 and sherds from floor; AD 690 ± 100*.

**T-2118. Moland, Tuft 4, 1975/20** **1600 ± 60**

From concentration of charcoal on floor. *Comment* (OSJ): agrees with date of potsherds from floor; AD 370 ± 80*.

**T-2629. Moland, Tuft 5, 1976/40** **1960 ± 100** $\delta^{13}C = -28.9‰$

From bottom of hearth dug into sterile soil in floor of house. *Comment* (OSJ): date is unacceptable compared to artifacts on floor, indicating that house belongs to Viking/early Medieval period; 5 ± 135 BC*.

**T-2630. Moland, Tuft 6, 1976/am** **1320 ± 60** $\delta^{13}C = -29.1‰$

From bottom of cultural layer (below slab) on floor in N part of house. *Comment* (OSJ): date is acceptable but slightly older than T-2809; AD 665 ± 65*.

**T-2809. Moland, Tuft 6, 1976/as** **1050 ± 80**

Charcoal layer on floor in S part of house; AD 925 ± 95*.

**T-2333. Moland, Struktur Z, 1976/3** **1410 ± 60**

From test pit of round shallow depression in meadow. Charcoal taken from central area where concentration of charcoal indicated fireplace. *Comment* (OSJ): no datable evidence; site may be ruins of round house.

**T-2119. Moland, åkerrein, 1975/5** **2010 ± 150**

Charcoal in layer of sand underlying lynchet with traces of ploughing with ard. *Comment* (OSJ): *post quem* date for fm of lynchet; 125 ± 255 BC*.

**T-2808. Moland, åkerrein 1975/4** **1230 ± 110**

From charcoal layer ca 0.10m above sample T-2119. *Comment* (OSJ): date indicates considerable interval between farming activities below lynchet (T-2119) and fm of lynchet; AD 750 ± 130*.

**T-1972. Moland, Röys 1, 1974/12** **1660 ± 170**

Charcoal from earth layer below stones in burial cairn. *Comment* (OSJ): it is uncertain if date is of construction period of cairn or is *post quem* date; AD 335 ± 195*.

**T-1995. Moland, Röys 1, 1974/13** **1470 ± 190**

Charcoal from sand layer 0.05m below T-1972. *Comment* (OSJ): *post quem* date for construction of cairn; AD 490 ± 200*.

**T-1973. Moland, Röys 2, 1974/16** **960 ± 160**

Charcoal from sand layer below stones in burial cairn. *Comment* (OSJ): it is uncertain if date is of construction period of cairn, or is *post quem* date; AD 1020 ± 170*.

**790 ± 70**

**T-2631. Moland, naust, 1977/7** $\delta^{13}C = -28.0‰$

From charcoal layer along inside of outer wall built of sod and stone; probably remains of inner wooden wall. *Comment* (OSJ): date younger than expected; may represent secondary activity on site; AD 1170 ± 80*.

**T-3029. Moland, naust, 1978/7** **1230 ± 70**

*Betula* and *Pinus* from charcoal layer at ca 3m on floor of boat house at Moland (68° 13′ N, 14° 07′ E). *Comment* (OSJ): date is more acceptable than T-2631; AD 750 ± 100*.

**Gjerland series, Sogn og Fjordane**

Charcoal from two houses and cooking pits at +300m, depth 0.3m at Gjerland, Förde, (61° 20′ N, 6° 20′ E). Coll 1971 to 1972 and subm 1972 to 1973 by B Myhre. *Comment* (BM): dates were somewhat older than expected, but are now convincing (Myhre, 1973).

**T-1334. No. 1** **1790 ± 110**

From fireplace in House I; AD 180 ± 110*.

**T-1335. No. 2** **1580 ± 150**

From cooking pit outside houses; AD 405 ± 185*.

**T-1404. No. 3** **1650 ± 70**

From fireplace in House I; AD 315 ± 95*.

**T-1459. No. 4** **1670 ± 80**

From fireplace in House II; AD 300 ± 100*.

**Boat house series, Hordaland**

Charcoal from several types of boat houses above sea level. All samples (except T-2950) coll 1970–1978 and subm 1973–1978 by Björn Myhre, Hist Mus, Univ Bergen. *Commet* (BM): dates fit well with expected period, based on type of boat and elevation. Boat house was probably used in "Skipreide" organization of Medieval period (Bull, 1917).

**T-2948. Hamn, Kvam** **520 ± 50**

From fireplace at entrance of boat house at +1m, depth 0.3m at Hamn, Kvam (60° 05′ N, 5° 50′ E); AD 1385 ± 35*.

**T-2949. Kårevik, Stord** **980 ± 70**

From oldest part of boat house at +5m, depth 0.5m at Kårevik (59° 45′ N, 5° 30′ E); AD 1000 ± 70*.

**T-2950. Bjelland, Stord** **1780 ± 50**

From entrance of boat house at +5m, at Bjelland (59° 45′ N, 5° 30′ E). Coll 1959 by Erik Hinsch, Hist Mus, Bergen; AD 180 ± 70*.

**T-3032. Skåtun, Fusa** **1580 ± 60**

From fireplace close to wall of boat house at +10m, depth 0.5m at Skåtun (60° 10′ N, 5° 30′ E); AD 385 ± 95*.

**T-3033. Lekven, Os** **1860 ± 70**

From wall of boat house at +5m, depth 0.2m at Lekven (60° 10′ N, 5° 20′ E); AD 115 ± 65*.

**T-1067. Stend, Fana 1** **1730 ± 160**

Wooden plank of inner end wall of boat house at +3m, depth 1m at Stend, Bergen (60° 15′ N, 5° 20′ E); AD 240 ± 170*. *Comment* (BM): dates T-1241, -1336 are a few hundred yr older than expected, but fully acceptable.

**T-1241. Stend, Fana 2** **1810 ± 60**

Wooden plank of inner end wall of boat house; AD 155 ± 65*.

**T-1242. Stend, Fana 3** **1680 ± 60**

From fireplace close to inner end wall; AD 300 ± 90*.

**T-1336. Stend, Fana 4** **1790 ± 110**

Wooden plank in W wall; AD 180 ± 110*.

**T-1337. Stend, Fana 5** **1520 ± 70**

Fireplace at entrance; AD 475 ± 85*.

**T-2331. Stend, Fana 6** **1740 ± 70**

Charcoal layer under earth wall outside wooden wall; AD 230 ± 90*.

### Ullandhaug series, Rogaland

Charcoal from house sites at +85m at Ullandhaug, Stavanger, Rogaland (59° 55′ N, 5° 40′ E). Coll 1968 and subm 1976 by B Myhre. *Comment* (BM): dates fit well with expected date, to Roman and Migration periods, though some of them are a few hundred yr older than expected (Myhre, 1980).

**T-2249. Ullandhaug 1/6** **1580 ± 60**

From House 1, Fireplace 6, depth 0.3m; AD 385 ± 95*.

**T-2250. Ullandhaug 2/1** **1480 ± 70**

From House 2, Fireplace 1, depth 0.3m; AD 500 ± 90*.

**T-2251. Ullandhaug 3/3** **1570 ± 70**

From House 3, Fireplace 3, depth 0.3m; AD 410 ± 120*.

**T-2252. Ullandhaug 3/4** **2020 ± 80**

From House 3, Fireplace 4, depth 0.5m; 70 ± 130 BC*.

**T-2253. Ullandhaug 3/9** **1800 ± 70**

From House 3, Fireplace 9, depth 0.2m; AD 170 ± 80*.

### Håheller series, Rogaland

**T-3544. Loc 135/SBA-79** **3920 ± 90**

From Håheller E at +12m, depth 0.90 to 0.95m below ground surface in cave containing finds from various archaeol periods at Forsand (59° 03′ N, 6° 31′ E). Coll 1979 by Ö Kristiansen, P Ethelberg, and S Bang-Andersen; subm 1979 by S Bang-Andersen, Archaeol Mus, Stavanger. *Comment* (SBA): dates agree well with site strat and indicate occupation period ca 1000 yr, late Middle Neolithic to late Bronze age. Youngest period (T-3545) is not represented in archaeol finds; 2405 ± 215 BC*.

**T-3545. Loc 130/SBA-79** **2870 ± 60**

Animal bones from Håheller E at +12m, depth 0.4 to 0.5m in center of cultural layer; 1135 ± 125 BC*.

**T-3546. Loc 216/SBA-79** **4190 ± 90**

Charcoal from Håheller W at +12.5m, depth 0.78 to 0.82m, 0.1m under cultural layer; 2880 ± 180 BC*.

**T-3547. Loc 170/SBA-79** **3540 ± 90**

Charcoal from Håheller W at +12.5m, depth 0.42 to 0.45m in charcoal pit in lower part of cultural layer; 2035 ± 75 BC*.

*Mountain Settlements*

**S Norway series**

Charcoal from dwelling sites with finds from Mesolithic, Neolithic, and Iron ages in mt area between Ryfylke and Setesdal, S Norway. Coll and subm 1974 to 1979 by S Bang-Andersen. *Comment* (SBA): dated to study use of this mt area in prehistory (Bang-Andersen, 1974; 1976).

**Mosvatnet series, Rogaland**

**T-1811. Loc 7/UF4** **1320 ± 70**

From depth 0.12 to 0.15m below ground surface in cultural layer of distinct hearth, +520m at Mosvatnet, Suldal (59° 25′ N, 6° 26′ E); AD 660 ± 70*.

**T-2071. Loc 7/SBA2** **1120 ± 90**

From depth 0.01 to 0.15m of indistinct hearth in upper part of cultural layer; AD 845 ± 115*.

**T-3304. Storemos, Loc 1** **5040 ± 100**

Burned nutshells from large concentration of carbonized nutshells (*Corylus*), charcoal, and fire-cracked flint artifacts at +245m, depth 0.08 to 0.12m at Store Mosvatnet, Hå (58° 38′ N, 5° 47′ E). Coll 1978 and subm 1979 by S Bang-Andersen (1979); 3855 ± 125 BC*.

**Övre Storvatnet series, Aust-Agder**

**T-2072. Loc 7/SBA3** **5960 ± 80**

From depth 0.12 to 0.13m in thin unstrat cultural layer of indistinct hearth at +978m at Övre Storvatnet, Bykle (59° 20′ N, 6° 56′ E); 4845 ± 155 BC*.

**T-2073. Loc 17/SBA4** **6100 ± 130**

From depth 0.12 to 0.16m of indistinct part of thick cultural layer. *Comment* (SBA): date, older than expected, belongs to Mesolithic settlement; 5075 ± 165 BC*.

**T-2650. Loc 17/SBA3-77** **6870 ± 110**

Depth 0.28 to 0.30m from deepest part of cultural layer.

**T-3075. Loc 17/SBA2-78** **4040 ± 50**

From depth 0.12 to 0.15m at +978m in charcoal-filled spot of thin, unstrat cultural layer. *Comment* (SBA): small fragment of projectile point indicates Neolithic occupation; 2710 ± 130 BC*.

**T-2074. Loc 12/SBA5** **6800 ± 210**

From depth 0.12 to 0.14m of indistinct hearth middle of cultural layer with Stone-age finds at +987m (59° 18′ N, 6° 56′ E).

**T-3542. Loc 12/F no 10** **6740 ± 110**

From depth 0.06 to 0.09m of hearth in upper part of cultural layer at +520m.

**T-3076. Loc 147/SBA 6-77** **6050 ± 60**

From depth 0.05 to 0.07m in charcoal layer with flint artifacts at +978m (59° 20′ N, 6° 57′ E); 4980 ± 70 BC*.

**T-2360. Loc 147/F-10-III** **7020 ± 170**

Depth 0.35 to 0.40m in charcoal-filled pit in bottom of cultural layer.

**T-2652. Loc 183/SBA/16-77** **6950 ± 120**

Depth 0.12 to 0.13m in middle of cultural layer in indistinct hearth.

**T-3077. Loc 13/SBA- 1-77** **4000 ± 70**

From depth 0.14 to 0.17m of indistinct hearth with fire-cracked stones. *Comment* (SBA): T-3077 and -3075 date human activities in Neolithic period; 2710 ± 130 BC*.

**Hovassåna series, Aust-Agder**

**T-3072. Loc 148/SBA 9-77** **5870 ± 70**

From depth 0.14 to 0.16m of distinct hearth in lower part of cultural layer at +980m in Hovassåna, Bykle (59° 21′ N, 6° 58′ E); 4760 ± 150 BC*.

**T-3073. Loc 150/SBA 12-77** **5720 ± 90**

From depth 0.08 to 0.10m of indistinct hearth in upper part of cultural layer; 4570 ± 90 BC*.

**Vestre Gyvatnet series, Aust-Agder**

**T-3074. Loc 145/SBA I-78** **5670 ± 90**

From depth 0.05 to 0.08m of charcoal concentration in lower part of cultural layer +920m at Vestre Gyvatnet, Bykle (59° 17′ N, 6° 58′ E); 4530 ± 70 BC*.

**T-3078. Loc 146/H-21-I/II** **2550 ± 70**

From depth 0.15 to 0.17m of distinct charcoal layer without artifacts superimposing layer at +913m (59° 57′ N, 6° 57′ E); 750 ± 90 BC*.

**T-2359. Loc 146/H-23-II/III** **6680 ± 80**

From depth 0.22 to 0.25m in partly stratified dwelling site with Stone-age finds. *Comment* (SBA): date proves that oldest settlement on site is clearly Mesolithic.

**T-2200. Loc 68/SBA 6** **1620 ± 120**

From open unstratified dwelling site void of archaeol artifacts, depth 0.14 to 0.16m at +995m at Undeknutvatnet, Suldal, Rogaland (59° 23′ N,

6° 49′ E). *Comment* (SBA): date proves that this loc has no connection with Stone-age sites in area; AD 370 ± 160*.

**Stegaros series, Telemark**

Charcoal from cultural layers at +1125m assoc with rock shelters in Stegaros at Lake Mår in Tinn (60° 05′ N, 8° 17′ E). Coll and subm 1973 to 1974 by Lil Gustafson, Univ Oldsaksamling, Oslo (R, 1975, v 17, p 364–395; R, 1978, v 20, p 105–133).

**T-1452. Stegaros 1058/2** **2420 ± 140**

From depth 0.3m in fireplace in rock shelter. *Comment* (RN): misprint in earlier age for this sample (R, 1975, v 17, p 377); 610 ± 190 BC*.

**T-1609. Stegaros 1058/3** **1730 ± 110**

From pit in cultural layer (L4, 99x 99y) ca 0.5m below surface in rock shelter with lithic artifacts. *Comment* (LG): Loc 1058 was not used between ca 2420–1730 BP. Main habitation period was ca 3810–2420 BP (Gustafson, 1978); AD 250 ± 140*.

**T-1610. Stegaros 1056** **8030 ± 110**

From base of charcoal pit (P1, 104x 108y), close to rock shelters, Loc 1006 and 1058, 0.4m below surface. *Comment* (LG): human occupation not expected at this date. Sample (*Pinus*) probably represents fossil firewood (Moe, 1978b).

**T-1709. Stegaros 1061** **1910 ± 80**

From base of cultural layer, 0.4 to 0.5m thick, (L3b, 94x 106y) of open site ca 0.5m below surface, behind rock shelters, Loc 1006 and 1058. *Comment* (LG): assoc between lithic artifacts and date is uncertain (Gustafson, 1978); AD 45 ± 105*.

**T-1710. Stegaros 1062** **1690 ± 110**

From base of cultural layer (L2, 105x 41y) in house site with lithic and iron artifacts, ca 0.5m W of rock shelters, Loc 1058 and 1006 at shore of Lake Mår; depth 0.15m. *Comment* (LG): assoc between lithic artifacts and date is uncertain; AD 285 ± 125*.

**T-1648. Stegaros 1063** **1510 ± 110**

Bone sample from base of cultural layer (111x 47y) outside house, Loc 1063; depth 0.20m. Find of iron arrow in bone heap. Coll and subm 1973 by Rolf W Lie, Zool Mus, Univ Bergen. *Comment* (RWL): connection between house and bone heap is verified, and sample also dates house; AD 460 ± 140*.

**Charcoal pit series, W Norway**

Charcoal from pits from mt loci in W Norway, interpreted as traces of seasonal occupation. Samples coll from base of pit with heated stones. Coll 1978–1980 by L Gustafson and P K Jensen, Hist Mus, Bergen; subm 1978–

1980 by L Gustafson. *Comment* (LG): dates correspond well with dates of similar pits in lowland areas (Gustafson, 1981; Myhre, 1980; Farbregd, 1979a).

**T-3066. Nedre Grøndalsvatn IA** **1940 ± 70**

From Ulvik, Hardanger (60° 40′ N, 7° 10′ E) at +976m, depth 0.15m; AD 15 ± 115*.

**T-3284. Nedre Grøndalsvatn IIB** **1600 ± 90**

AD 385 ± 125*

**T-3882. Upsete 1C** **1690 ± 80**

From Aurland, Sogn & Fjordane (60° 43′ N, 7° 01′ E) at +850m, depth 0.15 to 0.30m; AD 285 ± 105*.

**T-3067. Hallingskeid 1, Hordaland** **6850 ± 120**

Charcoal from cultural layer with Stone-age artifacts at +980m, depth 0.18 to 0.2m at Hallingskeid, Ulvik (60° 40′ N, 7° 10′ E). Coll and subm 1978 by L Gustafson. *Comment* (LG): date corresponds well with assoc microblades (Gustafson 1978, 1981).

**Hardangervidda and Ryfylke/Setesdal series**

This dating program was conducted 1970 to 1980 and is part of two interdisciplinary research projects in cultural history. Samples mainly coll and subm by A B Johansen, 1972–1980, Archaeol Mus, Stavanger. *Comment* (ABJ): present program consists of settlement history of some mt valleys in S Norway: Ryfylke/Setesdal (58° 15′ to 58° 45′ N, 6° 30′ to 7° 30′ E) and Hardangervidda (60° 0′ to 60° 30′ N, 6° 30′ to 8° 30′ E). Basic activities in this area were pasturing, animal husbandry, iron production, hunting, and fishing. Samples are from rock shelters, house sites, and bogs. *Comment* (ABJ): $^{14}C$ results place start of pasturing at ca 2000 yr ago in best grazing areas in Ryfylke Mts. This early date is due partly to archaeol evidence of human activity, such as wooden chips and other remains of forest clearance preserved in bog. Open settlement nearby is dated to 1330 ± 150 and 1210 ± 150 (T-1189, -1190, this list). In less suitable parts of grassland, summer farming seems to start ca 700–800 yr ago (T-3670, -3408, -3671, -2216).

**Pasturing series**

Charcoal from hunting cabins in Hordaland and Buskerud coll and subm 1972–1974 by A B Johansen. *Comment* (ABJ): dates suggest that inhabitants (farmers from mt valleys?) started to hunt from permanent cabins in treeless mt area ca 800 to 900 yr ago. Main problem is connection between this form of hunting and those of numerous well-known Stone-age hunting settlements in same area, which are open sites, normally with stone artifacts and no organic material left. Sites usually found close to reindeer tracks.

**T-1414. Leirvatnet, 22** **970 ± 70**

From cultural layer in hunting cabin at +1000m at Leirvatnet, Eidfjord, Hordaland (UTM 1415I/161023), depth 0.05 to 0.20m; AD 1010 ± 70*.

**T-1700. Leirvatnet** **830 ± 110**

From 0.05 to 0.15m depth (UTM 1415I/161022); AD 1130 ± 110*.

**T-1415. Maurset, 24** **780 ± 110**

From basal layer of rock shelter in farming area at +800m at Maurset (UTM 1415I/093987), depth 0.25 to 0.28m. *Comment* (ABJ): stone was main artifactual material from this period (*cf* T-1704); assoc finds: arrowheads and quartzite flakes; AD 1175 ± 115*.

**T-1704. Maurset, 50** **800 ± 70**

Depth 0.22 to 0.25m; AD 1160 ± 80*.

**T-1639. Langavatn, 48** **510 ± 80**

From cultural layer at +1225m at Langavatn (UTM 1415I/187804), depth 0.04 to 0.09m; AD 1385 ± 45*.

**T-1500. Lengjedalsvatnet, 23** **870 ± 100**

From cultural layer in hunting cabin at +1310m at Lengjedalsvatnet, Hol, Buskerud (UTM 1416II/276182), depth 0.10 to 0.13m; AD 1110 ± 110*.

**T-1703. Digernes, 49** **640 ± 90**

From cultural layer in deserted hunting cabin at +990m at Digernes (UTM 1515IV/437063), depth 0.03 to 0.11m; AD 1310 ± 80*.

**Suldal/Rogaland series**

**T-1902. Sandsa** **1340 ± 190**

Charcoal from fireplace on open living floor at +620m, depth 0.10m (UTM 1313IV/632912). Coll 1975 by Synnöve Vinsrygg, Stavanger Mus; subm 1975 by ABJ; AD 645 ± 205*.

**T-2410. Håvistöl, S51/3** **540 ± 80**

Charcoal from cultural layer in house site on summer farm at +600m, depth 0.15m (UTM 1314II/783062). Coll and subm 1976 by Lars Steinvik, Stavanger Mus; AD 1375 ± 35*.

**T-3406. Buarehelleren, 110/79** **930 ± 80**

**T-3670. Buarehelleren, 112/79** **820 ± 90**

Charcoal and twigs from basal layer in rock shelter in summer farm area, depth 0.45m at +900m (UTM 1313I/677888). Coll and subm 1979; AD 1065 ± 105* (T-3406); AD 1140 ± 100* (T-3670).

**T-3408. Svultanuthelleren, 26/76** **810 ± 50**

Charcoal from thin cultural layer in rock shelter, depth 0.08m at +800m (UTM 1313I/657878). Coll 1976 by A M Knudsen, Stavanger Mus; subm 1979 by ABJ; AD 1155 ± 65*.

**T-3671. Svultanuthelleren, 42/76** **790 ± 60**

Charcoal at 0.02m depth coll and subm 1979; AD 1165 ± 75*.

**T-3190. Stölsmyra, 1978/S12** **920 ± 50**

Wood, birch root, depth 0.73m, Sandsa (UTM 1313IV/631912). Coll and subm 1978. *Comment* (ABJ): birch root was from next to last forest cover of bog; AD 1060 ± 60*.

**T-3191. Stölsmyra, 1978/S24** **1910 ± 80**

Part of birch root cut by metal axe, depth 1.20m. Coll and subm 1978; AD 45 ± 105*.

**T-3674. Stölsmyra, 23/79** **2310 ± 90**

Birch bark at 1.57m depth. Coll and subm 1980. *Comment* (ABJ): dates last forest cover unexploited by man; 520 ± 120 BC*.

**T-3407. Stölsmyra, 62/79** **2280 ± 70**

Twigs, depth 1.60m, coll 1979 by Kari Grösfjeld, Stavanger Mus; subm 1979. *Comment* (ABJ): dates first archaeol detectable traces of man in bog. Assoc finds: twigs and chips from woodworking; 430 ± 40 BC*.

**T-3410. Stölsmyra, 17/79** **2500 ± 70**

Pieces of wood from basal layer of bog, depth 2.02m at +620m. Coll and subm 1979; 655 ± 145 BC*.

*Iron Production*

Charcoal from slag heaps and charcoal kilns. *Comment* (ABJ): iron production started ca 2000 yr ago (T-1188, -1676) in mt area of Hardanger, and lasted only short time (T-1507, -1640, -1819). Next production period is characterized by sharp change in technol, hundreds of furnace sites all over mt valleys, and far more extensive production. This second period started ca 1000–1200 yr ago (T-3184, -1416), and peaked at 800–900 yr BP. Most iron smelting ended 600 yr ago.

**Vinje/Telemark series**

**T-2733. Kvervesjå, 1/77** **960 ± 70**

From basal layer of charcoal kiln, depth 0.2m at +890m, Vinje (UTM 1414II/182184). Coll and subm 1977; AD 1015 ± 75*.

**T-2734. Kvervesjå, 2/77** **900 ± 70**

From top layer of charcoal kiln, depth 0.1m at +890m, coll and subm 1977; AD 1090 ± 90*.

**T-2735. Sigurdsbu, 6/77** **960 ± 70**

From charcoal kiln, depth 0.10m at +890m, Sigurdsbu (UTM 1414II/183163), coll and subm 1977; AD 1015 ± 75*.

**T-2868. Kyrkjemoen, 10/77** **650 ± 60**

From top layer in charcoal kiln, depth 0.10m at +910m, Kyrkjemoen (UTM 1414II/131135), coll 1977 and subm 1978; AD 1300 ± 60*.

**T-3187. Nystöl, 1978/3** **880 ± 60**

From top layer in charcoal kiln, depth 0.10m at +920m, Nystöl (UTM 1414II/183134), coll and subm 1978 by T E Aanestad, Stavanger Mus; AD 1100 ± 80*.

**T-3285. Sæsvatn, 1978/31** **830 ± 70**

From top layer of charcoal kiln, depth 0.10m at +910m, Sæsvatn (UTM 1414II/147146), coll 1978 by T E Aanestad and subm 1979 by ABJ; AD 1135 ± 85*.

**Bykle/Aust-Agder series**

**T-3286. Vikvollen, 1978/11** **970 ± 60**

From top layer in charcoal kiln, depth 0.10m at +915m, at Vikvollen, Bykle (UTM 1414II/115123). Coll 1978 by T E Aanestad and subm 1979 by ABJ; AD 1005 ± 65*.

**T-2737. Lislefjödd, 13/77** **720 ± 50**

From top layer in charcoal kiln, depth 0.09m at +910m, Lislefjödd (UTM 1414II/097094), coll and subm 1977; AD 1240 ± 50*.

**T-3184. Finnastöllia, 1978/20** **1380 ± 50**

From top layer of slag heap in iron production site, depth 0.05m to 0.10m at +830m, Finnastöllia (UTM 1414II/075052). Coll 1978 by TEA and subm 1979 by ABJ; AD 600 ± 50*.

**T-3188. Finnastöllia, 1978/23** **860 ± 70**

From top layer of slag heap in iron production site, depth 0.03 to 0.10m at +850m (UTM 1414II/072053). Coll by TEA and subm 1978; AD 1120 ± 90*.

**T-3287. Finnastöllia, 1978/24** **730 ± 60**

Depth 0.02 to 0.10m (UTM 1414II/073053), coll by TEA and subm 1978; AD 1235 ± 55*.

**T-3288. Finnastöllia, 1978/24** **690 ± 50**

Depth 0.05 to 0.10m (UTM 1414II/074051). Coll 1978 by TEA and subm 1979 by ABJ; AD 1255 ± 55*.

**T-3289. Finnastöllia, 1978/33** **870 ± 60**

From cultural layer in iron production site, depth 0.05 to 0.10m at +870m (UTM 1414III/060040). Coll 1978 by TEA and subm 1979 by ABJ; AD 1110 ± 80*.

**T-3183. Brakamo, 1978/36** **970 ± 50**

From top layer in charcoal kiln, depth 0.02 to 0.12m at +720m, Brakamo, Valle, Aust-Agder (UTM 1413I/138745). Coll by TEA and subm 1978 by ABJ; AD 1005 ± 55*.

**T-3290. Brakamo, 1978/33** **910 ± 50**

From 0.05 to 0.15m depth; AD 1075 ± 65*.

**T-3185. Berdalen, 1978/39** **3050 ± 70**

From top layer in coal pit, depth 0.10 to 0.15m at +870m, Berdalen (UTM 1413I/145905). Coll by TEA and subm 1978 by ABJ. *Comment:* evidently not related to iron production; 1380 ± 110 BC*.

**T-3186. Botsvatn, 1978/32** **570 ± 60**

From top layer in charcoal kiln, depth 0.05 to 0.15m at +620m, Botsvatn (UTM 1413IV/130807). Coll by TEA and subm 1978 by ABJ; AD 1360 ± 50*.

**T-3189. Stavenes, 1978/38** **690 ± 70**

From top layer in charcoal kiln, depth 0.20 to 0.25m at +710m, Stavenes (UTM 1413I/080809). Coll by TEA and subm 1979 by ABJ; AD 1265 ± 65*.

**Eidfjord/Ulvik series**

**T-1189. Fljodal, 5** **1330 ± 150**

Charcoal from fireplace in house site on summer farm, depth 0.10m at +1000m in Fljodal, Eidfjord, Hordaland (UTM 1415IV/990905). Coll and subm 1971; AD 655 ± 165*.

**T-1190. Instestølen, 6** **1210 ± 150**

Charcoal from cultural layer in summer farm house, depth 0.10m at +930m, Eidfjord (UTM 1415I/140015). Coll and subm 1971; AD 775 ± 165*.

**T-1412. Skissete, 20** **300 ± 70**

Charcoal from cultural layer assoc with summer farm house, depth 0.05 to 0.07m at +940m, Eidfjord (UTM 1415IV/035973). Coll and subm 1972; AD 1545 ± 95*.

**T-1413. Hadletseter, 21** **260 ± 70**

Charcoal from cultural layer in house site on summer farm, depth 0.08 to 0.12m at +1010m, Eidfjord (UTM 1415IV/034945). Coll and subm 1972; AD 1565 ± 95*.

**T-2869. Viveli, 1973/102** **700 ± 80**

From top layer in charcoal kiln, depth 0.05 to 0.07m at +870m in Viveli, Eidfjord, (UTM 1415IV/981917). Coll 1973 and subm 1978; AD 1260 ± 70*.

**T-2864. Viveli, 1973/101** **680 ± 60**

From top layer in charcoal kiln, depth 0.05 to 0.07m at +865m (UTM 1415IV/979918). Coll 1973 and subm 1974; AD 1280 ± 60*.

**T-1820. Storlii, 62** **640 ± 70**

From top layer of slag heap in iron production site, depth 0.05 to 0.10m at +940m, Storlii (UTM 1415I/112963). Coll and subm 1974; AD 1310 ± 70*.

**T-1299. Maurset, 14** **200 ± 80**

From basal layer in charcoal kiln close to existing farm, depth 0.15m at +800m at Maurset (UTM 1415I/092987). Coll 1971 and subm 1972; AD 1660 ± 140*.

**T-1503. Fetalii, 29** **830 ± 70**

From basal layer of slag heap in iron production site (see T-2865), depth 0.50m at +795m, Fetalii (UTM 1415IV/056975). Coll and subm 1973; AD 1135 ± 85*.

**T-2865. Fetalii, 1972/104** **860 ± 60**

From 0.00 to 0.05m depth, coll and subm 1978; AD 1110 ± 80*.

**T-1507. Fet, 35** **1840 ± 80**

From top layer of slag heap in iron production site, depth 0.05m at +730m (UTM 1415IV/053984); AD 135 ± 75*.

**T-1640. Fet, 43** **1840 ± 70**

From top layer, 0.05m depth; AD 130 ± 70*.

**T-1819. Fet, 60** **1810 ± 110**

From top layer, 0.00 to 0.10m depth; AD 165 ± 105*.

**T-1188. Fet, 4** **2070 ± 110**

From basal layer, 0.40m depth at +730m (UTM 1415IV/053984). Coll and subm 1971; 170 ± 220 BC*.

**T-1676. Fet, 40** **1990 ± 100**

From basal layer, 0.77m depth; 45 ± 145 BC*.

**T-1636. Fet, 41** **1240 ± 110**

From basal layer, 0.79m depth; AD 750 ± 130*.

**T-1637. Fet, 44** **1800 ± 150**

From charcoal layer underlying basal slab of reduction furnace, 0.30m depth; AD 190 ± 160*.

**T-1508. Fet, 37** **470 ± 70**

From cultural layer of house in iron production site, 0.10 to 0.15m depth; AD 1415 ± 35*.

**T-1298. Fet, 12** **360 ± 60**

From charcoal kiln, depth 0.45m; AD 1520 ± 90*.

**T-1300. Fet, 15** **880 ± 70**

From charcoal kiln, depth 0.13 to 0.22m (UTM 1415IV/056982); AD 1105 ± 85*.

**T-1301. Fet, 16** **740 ± 120**

From charcoal kiln, depth 0.05 to 0.10m (UTM 1415IV/057983). Coll 1971 and subm 1972; AD 1210 ± 120*.

**T-1702. Liset, 47** **840 ± 70**

From top layer of slag heap, depth 0.00 to 0.05m at +735m, Liset (UTM 1415IV/047002). Coll 1973 and subm 1974; AD 1130 ± 90*.

**T-1504. Tveit, 30** **270 ± 90**

From charcoal kiln, depth 0.20m at +95m, Tveit (UTM 1415IV/968987). Coll 1972 and subm 1973; AD 1610 ± 150*.

**T-2215. Olastölen, Ulvik 2** **160 ± 60**

Charcoal from fireplace in house site of summer farm, depth 0.08 to 0.10m at +800m, Ulvik, Hordaland (UTM 1416III/909200). Coll 1975 and subm 1976; younger than AD 1630*.

**T-2216. Klovsteinen, Ulvik 4** **760 ± 60**

Charcoal from fireplace in cultural layer in house site on summer farm, depth 0.10m at +800m, Ulvik (UTM 1416III/918205); AD 1185 ± 75*.

**Hol/Buskerud series**

**T-1416. Lauvvikstölen, 27** **1010 ± 80**

From top layer of slag heap, depth 0.05m at +995m, Lauvvikstölen, Hol, Buskerud (UTM 1515IV/422067). Coll and subm 1972; AD 970 ± 80*.

**T-1417. Lauvvikstölen, 28** **990 ± 90**

From basal layer, depth 0.55 to 0.60m; AD 985 + 95*.

**T-2866. Ustevatn, 1973/100** **830 ± 50**

From top layer of slag heap, depth 0.05m at +990m, S of Ustevatn (UTM 1515IV/435060). Coll 1973 and subm 1978; AD 1145 ± 75*.

**T-1506. Ustevatn, 34** **880 ± 110**

From basal layer, depth 0.60m Coll 1972 and subm 1973; AD 1100 ± 120*.

**T-3672. Fekjo, 115/79** **190 ± 40**

From charcoal kiln, depth 0.04 to 0.08m at +770m, Fekjö (UTM 1516II/539105). Coll 1979 and subm 1980; younger than AD 1470*.

**T-3673. Fekjo, 116/79** **340 ± 70**

From 0.05 to 0.15m depth; AD 1530 ± 100*.

**T-3409. Fekjo, 117/79** **290 ± 60**

From 0.15 to 0.21m depth; AD 1550 ± 90*.

**T-1501. Borgastölen** **740 ± 60**

From top layer of slag heap, depth 0.03 to 0.05m at +1010m, Borgarstölen (UTM 1515I/606027). Coll 1972 and subm 1973; AD 1235 ± 55*.

**T-1502. Borgastölen** **750 ± 90**

From basal layer of slag heap, depth 0.50 to 0.55m; AD 1195 ± 105*.

**T-1505. Tuftestölen, 33** **300 ± 70**

From charcoal kiln, depth 0.05 to 0.10m at +860m, Tuftestölen (UTM 1515I/560048). Coll 1972 and subm 1973; AD 1545 ± 95*.

**T-2867. Aslegarden, 1972/105** **540 ± 50**

From charcoal kiln, depth 0.10m at +1060m, Aslegarden (UTM 1515I/560048). Coll 1972 and subm 1973; AD 1375 ± 35*.

**T-1701. Ossjöen, 46** **700 ± 70**

From top layer of slag heap, depth 0.05m at +955m, Ossjöen (UTM 1515I/585942). Coll 1973 and subm 1974; AD 1255 ± 65*.

**T-1418. Halne, 31** **1610 ± 110**

From coal pit, depth 0.15 to 0.20m at +1140m, Halne (UTM 1415I/287986), coll and subm 1972. *Comment:* sample unrelated to iron production; AD 364 ± 155*.

**T-1641. Halne, 51** **1710 ± 110**

From charcoal pit assoc with house site, depth 0.11 to 0.13m at +1140m (UTM 1415I/287987). *Comment:* sample unrelated to iron production; AD 270 ± 130*.

**T-1638. Kruksetra** **880 ± 70**

From top layer of slag heap, depth 0.05 to 0.10m at +980m, Kruksetra, Nore og Uvdal, Buskerud (UTM 1515I/639847). Coll and subm 1973 by Tore Björgo, Stavanger Mus; AD 1105 ± 85*.

**Mösstrand series, Telemark**

This series of charcoal samples (R, 1978, v 20, p 126–127) covers time span of ca 700 yr (AD 550–1250) with large-scale iron production from Vinje (59° 50′ N, 8° 10′ E). Coll and subm 1978 by Irmelin Martens, Univ Mus Natl Antiquities, Oslo. *Comment* (IM): chronology is mainly based on 48 $^{14}C$ dates from 31 sites, comprising four types: 1) slag heaps with bowl furnaces, 2) slag heaps with shaft furnaces, 3) single-room house sites with slag heap and shaft furnaces, 4) larger house sites with slag heaps and shaft furnaces. This is also chronologic series, confirmed by slag composition, several other elements on sites, relations to excavated farm houses, and a few artifacts. Dates agree very well with archaeol dates (Martens, 1977, 1979).

**T-3091. Kulingsli** **930 ± 50**

From slag heap outside house site at +980m, depth 0.10 to 0.20m; AD 1045 ± 45*.

**T-3092. Björnefjell** **880 ± 50**

From slag heap at +1030m, depth 0.10 to 0.20m; AD 1100 ± 80*.

**T-3093. Sandhaug** **840 ± 50**

From area right outside house site with slag heap at +930m, depth 0.10 to 0.20m; AD 1140 ± 70*.

**T-3094. Varlistöl** **1040 ± 60**

From slag heap at +960m, depth 0.10 to 0.25m; AD 940 ± 80*.

**T-3557. Halvtekkja 40/52 No. 2** **810 ± 50**

From slag heap outside house site at +925m, depth 0.10 to 0.25m; AD 1155 ± 65*.

**T-3558. Hove 53/34 No. 1** **850 ± 50**

From layer right outside house, probably charcoal storage area at +920m, depth 0.10 to 0.15m; AD 1125 ± 65*.

**T-3559. Liset 40/53 No. 1** **880 ± 60**

From slag heap outside house at +917m, depth 0.10 to 0.20m; AD 1100 ± 80*.

**Bloomery series**

During last 20 yr, furnaces were excavated as part of other investigations. They are of great interest as parallels to Mösstrond furnaces. This charcoal series is from different sites in S Norway. Subm 1978 by I Martens.

**T-2993. Tangvassosen** **900 ± 60**

From stone-lined bowl furnace in house site at +960m in Vinje (59° 50′ N, 7° 30′ E). Coll 1959 by Jo Bleken-Nilssen, Telemark. *Comment* (IM): dates are 300 yr later than same furnace type at Mösstrond, only ca 35km away (see T-2997); AD 1090 ± 90*.

**T-2994. Rolleivstad** **1700 ± 70**

From bloomery furnace, probably with low shaft, depth ca 3m, at +650m in Fyresdal (59° 15′ N, 8° 15′ E). Coll 1968 by I Martens. *Comment* (IM): even if date is far earlier than expected, result cannot be rejected; corresponds well with T-2995; AD 285 ± 105*.

**T-2995. Homstölvatn** **1830 ± 60**

From bloomery furnace with outer stone lining at +350m, Froland, Aust-Agder (58° 45′ N, 8° 0′ E), depth 0.4 to 0.5m; AD 140 ± 70*.

**T-2996. Valldalseter** **840 ± 50**

From between two layers of slag in furnace hearth at +700m, Odda, Hordaland (59° 55′ N, 6° 55′ E). Coll 1964 by J-R Næss and I Martens. *Comment* (IM): furnace underlay house site dated to 12th century AD; date is fully acceptable (Martens, 1973); AD 1135 ± 55*.

**T-2997. Tangvassosen** **910 ± 70**

From same loc at T-2993; coll 1959 by J Bleken-Nilssen; AD 1080 ± 100*.

**T-1666. Kvitfeten, Oppland** **1020 ± 80**

Charcoal (Sample 1) in coarse ground moraine ca 35km from nearest settlement in area with large bogs and scattering patches of mt birch at +980m, depth 0.15m, Kvitfeten cheese farm, Östre Slidre, Oppland (61° 14′ N, 9° 20′ E). Coll and subm 1973 to 1974 by Björn Axelsen, Dept Geog, Univ Trondheim. *Comment* (BA): charcoal production for bog iron smelting probably removed much of original forest before intensive agric began in Viking period (Axelsen, 1975); AD 950 ± 90*.

**Ropptjern series, Oppland**

Charcoal (birch) from base of charcoal kiln at Lake Ropptjern at +825m, Gausdal (61° 12′ N′ 9° 59′ E). Coll 1974 and subm 1975 by Jarle Bye, Univ Mus Natl Antiquities, Oslo. *Comment* (JB): samples date period of iron production in area (Bye, 1978).

**T-2537. Ropptjern no. 3** **790 ± 70**

Depth 0.10m; D 1165 ± 75*.

**T-2538. Ropptjern no. 4** **710 ± 50**

Depth 0.55m; AD 1250 ± 50.

**T-2539. Ropptjern no. 5** **570 ± 40**

Depth 0.25m; AD 1355 ± 35.

*Agricultural Development*

**Karlsöy series, Troms**

Peat (*Cyperaceae-Campylium-Depanocladus intermedium*) (rich fen) and charcoal from agric development in Karlsöy. Peat samples were separated into two fractions according to particle size: <1mm (a, b) and >1mm (c). Smaller fraction (<1mm) was divided into soluble fraction (a) in NaOH and insoluble fraction (b). Coll 1976 and subm 1977 by K D Vorren (1979).

**T-2549. Dåfjord II:1**

**(a) 1510 ± 80**
$\delta^{13}C = -29.7‰$

**(b) 1550 ± 70**
$\delta^{13}C = -30.1‰$

**T-2605. Dåfjord II:1** **(c) 1420 ± 80**

From peat layer (H7), 0.8m thick, at +10m, depth 0.26 to 0.29m, Dåfjord (60° 59′ N, 19° 25′ E). *Comment* (KDV): dates beginning of *Hordeum* growing in Dåfjord. Coarse remains of fraction of *Carex* peat (c) shows slight contamination by younger rootlets; (a) AD 490 ± 100*; (b) AD 430 ± 110*; (c) AD 550 ± 90*.

**T-2550. Dåfjord I:2**

**(a) 4820 ± 80**
$\delta^{13}C = -31.0‰$

**(b) 4760 ± 120**
$\delta^{13}C = -31.2‰$

**T-2604. Dåfjord I: 2** **(c) 4410 ± 100**

Peat (H5) from depth 0.59 to 0.64m at +20m (69° 58′ N, 19° 25′ E). *Comment* (KDV): probably dates pasturing in area. Coarse remains (c) show possible contamination by younger rootlets; (a) 3635 ± 75 BC*; (b) 3545 ± 155 BC*; (c) 3165 ± 185 BC*.

**T-2547. Vannareid 1**

**(b) 3450 ± 40**
$\delta^{13}C = -30.0‰$

**T-2606. Vannareid 1** **(c) 3190 ± 70**

Peat (H5) from peat layer, 0.8m thick, at +20m, depth 0.27 to 0.32m, Vannareid, Karlsöy (70° 12′ N, 19° 05′ E). *Comment* (KDV): younger roots and stolons in *Carex-Scirpus caespitosus* peat (c) may have influenced result. Dates fit well with general agric expansion during later part of Neolithic period; (b) 1875 ± 165 BC*; (c) 1550 ± 90 BC*.

**T-2548. Vannareid 2** **6450 ± 70**

Depth 0.70 to 0.77m. *Comment* (KDV): dates local stage rich in *Chenopodium* and *Rumex*, and decline in *Pinus*.

**T-2560. Stornes** **810 ± 60**

Charcoal (*Calluna* stems and roots) at +10m from Helgöy, Karlsöy (70° 12′ N, 19° 25′ E), depth 0.33 to 0.36m. *Comment* (KDV): dates late stage in maritime heath burning culture of W and N Norway; AD 1155 ± 75*.

**T-2221. Helgöy 2** **1120 ± 100**

Peat cut out for dating of "pollen horizons" from +15m, depth 0.43 to 0.46m, at Helgöy, Karlsöy (70° 07′ N, 19° 20′ E). Dates agric development on Helgöy farm. *Comment* (KDV): expected age, 1300–1400 BP on archaeol evidence (Vorren, 1980); AD 850 ± 120*.

**T-3669. Helgöy 6** **1960 ± 80**

Twigs/roots of *Salix* from depth 0.76 to 0.81m in same core as T-2221, concerns rise of *Piaceae* curve, interpreted as result of fm of early pastures. *Comment* (KDV): expected age ca 2500 BP due to similar agric development elsewhere (Vorren, 1980); 5 ± 115 BC*.

**Hofsöy series, Troms**

Peat at +7m from Deggemyra near Hofsöy, Tranöy, Troms (69° 04′ N, 17° 05′ E). Sample dated in study of agric development as part of archaeol investigations of Iron age and Neolithic settlements. Excavated by O S Johansen, Univ Tromsö, coll 1977 and subm 1978 by K D Vorren.

**T-2861. Hofsöy 1 (1977)** **1140 ± 70**

Depth 1.00 to 1.03m. *Comment* (KDV): dates end of intensive agric assoc with Iron age settlement; AD 830 ± 100*.

**T-2862. Hofsöy 2 (1977)** **1770 ± 50**

Depth 1.39 to 1.42m. *Comment* (KDV): expected age based on archaeol evidence. Dates start of intensive agric; AD 200 ± 60*.

**T-2863. Hofsöy 3 (1977)** **2240 ± 80**

Depth 1.93 to 1.95m. *Comment* (KDV): date seems too young based on expected Bronze age agric; 320 ± 110 BC*.

**Bakkemyra series, Troms**

Peat, sampled with Hiller sampler, ca 7 cores for each $^{14}C$ sample, from Torsli at +140m, Tranöy (69° 12′ N, 17° 33′ E). Samples dated for forest and agric history of area. Coll and subm 1975 by K D Vorren.

**T-1987. Bakkemyra I** **2060 ± 120**

Depth 0.20 to 0.23m. *Comment* (KDV): marked agric expansion, according to alleged hist data. Date was based on agric event. Mire surface is slightly eroded, hence, small distance from surface to sample; 165 ± 225 BC*.

**T-1988. Bakkemyra II** **3420 ± 70**

Depth 0.8 to 0.9m. *Comment* (KDV): unexpectedly high age due to current assumption that agric was introduced to N Norway during Roman Iron age, Migration period. More recent palynol results from N Norway support this date (Vorren, 1979); 1855 ± 165 BC*.

**T-1989. Bakkemyra III** **5170 ± 110**

Depth 1.9 to 2.0m. *Comment* (KDV): date indicates that *Alnus* decline is identical with Atlantic/Sub-boreal boundary; 3995 ± 195 BC*.

**T-1990. Bakkemyra IV** **7790 ± 160**

Depth 3.5 to 3.6m. *Comment* (KDV): later dates from Troms show *Pinus* and *Alnus* rise fairly simultaneously ca 7700 BP.

**T-1991. Bakkemyra V** **8760 ± 170**

Depth 3.9 to 4.0m. *Comment* (KDV): basal sediments of mire showing *Betula* dominated stage, end of *Ericales* peak.

**Bakkan series, Nordland**

Peat (*Sphagnum fuscum-Ericales vaginatum*) coll with iron tube, 1m diam, at +30m from Bakkan, Andöya (69° 01′ N, 15° 31′ E). Coll 1972 and subm 1973 to 1975 by K D Vorren. *Comment* (KDV): part of study of "pollen horizons" to date oldest agric in N Norway (Vorren, 1975).

| | | | |
|---|---|---|---|
| **T-1912.** | **Bakken II, <.5mm** | **(a)** | **2530 ± 190** |
| | **Bakken II, <.5mm** | **(b)** | **2360 ± 110** |
| **T-1913.** | **Bakken II, <1mm** | **(c)** | **2050 ± 120** |

Depth 0.70 to 0.72m. Samples were soluble (a) and insoluble (b, c) fractions of respective particle sizes. *Comment* (KDV): T-1913 (c) indicates influence of younger roots and stolons; (a) 685 ± 245 BC*; (b) 575 ± 165 BC*; (c) 160 ± 230 BC*.

**T-1635. Bakkan IV** **3070 ± 80**

Depth 1.10 to 1.12m. *Comment* (KDV): date indicates first marked agric expansion in area; 1390 ± 120 BC*.

**Böstad series, Nordland**

Peat coll with iron tube, 0.10m diam, at +30m, Böstad, Vestvågöy (68° 15′ N, 13° 45′ E). Coll 1973 to 1975 and subm 1973 to 1976 by K D Vorren (1979).

**T-2222. Böstad I** **610 ± 90**

Depth 0.30 to 0.33m. Sample size, 1mm after washing and sieving. *Comment:* dates marked decline, possible temporary end of agric; AD 1320 ± 80*.

**T-2223. Böstad II** **3740 ± 50**

Depth 1.09 to 1.11m. *Comment* (KDV): introd of cereal growth; 2220 ± 70 BC*.

**T-2224. Böstad III** **5510 ± 80**

Depth 1.27 to 1.30m. *Comment* (KDV): probably introd of sheep/cattle and/or transition to permanent settlement; 4420 ± 60 BC*.

**T-2607. Böstad IV** **950 ± 70**

Depth 0.43 to 0.45m. *Comment* (KDV): decline in agric; AD 1025 ± 75*.

**T-2608. Böstad V** **1500 ± 70**

Depth 0.64 to 0.66m. *Comment* (KDV): most intensive agric phase; AD 495 ± 95*.

**T-2609. Böstad VI** **2430 ± 130**

Depth 0.97 to 0.99m. *Comment* (KDV): grassland expansion; 610 ± 190 BC*.

**T-2610. Böstad VII** **7140 ± 130**

Depth 1.38 to 1.4m. *Comment* (KDV): probable start of settlement.

**Ard share series, W Norway**

Wood samples were coll from two sites to date Norwegian wooden ard shares of Döstrup type. Coll 1953 to 1955 by local farmer; subm 1974 by Björn Myhre, Hist Mus, Univ Bergen. *Comment* (BM): dates fit well with earlier dates of similar wooden shares from Denmark and Germany (Myhre, unpub).

**T-1771. Taksdal, S-8749** **2360 ± 100**

From bog, 1.5m deep, at +150m, Taksdal, Time, Rogaland (58° 45′ N, 5° 30′ E); 570 ± 160 BC*.

**T-1772. Os, B-10069** **1910 ± 110**

From bog at +25m, Os, Eid, Sogn and Fjordane (61° 55′ N, 6° 00′ E); AD 35 ± 135*.

*Hunting Constructions*

**Ledsageren/Hirkjölen series, Hedmark**

Charcoal and wood coll to study construction and period when pitfalls for elk (*Alces alces*) were used. From +730m, Ledsageren/Hirkjölen, Stor-Elvdal (61° 45′ N, 10° 38′ E). Coll and subm 1976–1979 by K Barth, Zool Mus, Oslo (Barth, 1981).

**T-2513. P 3c-76** **800 ± 40**

Charcoal from layer, 0.02m thick, 0.40m below surface in surrounding bank, 1.2m from old wall of pit. *Comment* (EKB): represents burned vegetation when pit was restored. Same pit as T-1879 (R, 1978, v 20, p 128) and T-2514; AD 1155 ± 65*.

**T-2514. P 3d-76** **730 ± 60**

Wood from vegetation 0.30m below surface in bank 3.5m from old wall of pit. *Comment* (EKB): corresponds with charcoal layer of T-2513; AD 1240 ± 60*.

**T-2655. P 10-77** **300 ± 60**

Wood 0.30m below surface in surrounding bank. *Comment* (EKB): represents burned vegetation when pit was restored; AD 1550 ± 90*.

**T-2366. P 4-76** **90 ± 40**

From stick of spruce wood, 0.85m long, that originally had iron pike on top, used for impaling animals. Depth 1.6m below basal surface; same pitfall as T-2655. *Comment* (EKB): date shows that this kind of elk hunting was practiced up to recent times; younger than AD 1670*.

**T-2812. P 18-77** **380 ± 90**

Wood from logs, 0.2 to 0.3m thick, horizontally bound together in rectangular pitfall. Depth 2m below surface; pit filled with soil and water. Same pit at T-2366; AD 1510 ± 100*.

**T-2820. P 2a-77** **300 ± 50**

Wood from remains of vertical logs 0.3m below surface; in dry pit, 2m deep; AD 1545 ± 85*.

**T-2656. P 17-77** **70 ± 50**

Wood set into iron pike, as T-2366, at depth 1.6m below basal surface; younger than AD 1780*.

**T-3471. P 5-79** **3040 ± 50**

Upper 0.03m of humus deposit, ca. 0.09m thick, 0.7m below surface in surrounding bank, 1.2m from the old wall. *Comment* (EKB): upper layer of this humus represents organic material of old earth surface when pit was dug out first time. Same pit as T-1879, -2513 and -2514; 1365 ± 95 BC*.

**T-3470. Görrtjönn P 1-79** **580 ± 70**

Wood from walls in rectangular/oval pitfall, partly filled with boggy soil and water at +320m, Storfalldalen, Eidskog (60° 05′ N, 12° 13′ E). *Comment* (EKB): date corresponds with occupation period of Ledsageren/Hirkjölen series; AD 1335 ± 75*.

**T-3543A. Loc 67/SBA-79** **1390 ± 50**

Humified peat at +993m, depth 0.35 to 0.36m in subfossil humus horizon in dike encircling reindeer pitfall at Undeknutvatnet, Suldal, Rogaland (59° 23′ N, 6° 48′ E). Coll and subm 1979 by S Bang-Andersen (ms in preparation); AD 600 ± 40*.

**Pitfall series, Hedmark**

Bark and charcoal from system of 53 trapping pits at +700m, Röa, Engerdal (62° 28′ N, 12° E). Coll 1978 and subm 1979 by G Bolstad, Hist Mus, Bergen. *Comment* (GB): dates agree and confirm successive use of area.

**T-3087. Pit no. 27** **1620 ± 80**

Bark from top cover (branches, etc) from center of base underlying 0.75m of sand; AD 355 ± 95*.

**T-3088. Pit no. 1** **2120 ± 230**

Charcoal from plant material beneath podsol profile in mound, ca 0.2m depth; 190 ± 280 BC*.

*Iron Age Cemeteries*

**Navlus series, N Tröndelag**

Charcoal pits and iron foundry were also found in Iron age cemetery of Navlus. Chronologic relationships of different activities at site seemed to be of special importance. Charcoal (*Alnus, Betula, Pinus*) found at ca +100m at Navlus, Snåsa (64° 15′ N, 12° 28′ E). Coll and subm 1976 by O Farbregd (1983).

**T-2341. Pit A** **1740 ± 100**

From base of pit near grave monuments and slag heap, depth ca 0.5m. *Comment* (OF): charcoal pits are evidently older than barrows, possibly later than iron production (Farbregd, 1979c, 1983); AD 235 ± 125*.

**T-2342. Furnace pit** **1900 ± 90**

From iron slag layer in and around furnace pit below grave monument from 4th to 5th century, depth ca 0.15m; AD 50 ± 110*.

**T-2343. Pit Ia** **1800 ± 80**

From bottom of pit older than grave, but probably related to iron production, depth ca 0.5m. *Comment* (OF): similarity of T-2342 and -2343 supports assumption that Pit Ia is related to iron production; AD 165 ± 95*.

**Veiem grave series, N Tröndelag**

Partly leveled round barrow with well-furnished stone cist grave from ca AD 500. In subsoil below was distinct pattern of plow marks, and various pits were found around edge of barrow. Charcoal, wood and bark from +20m at Veiem, Grong (12° 07′ N, 64° 28′ E). Coll 1976 and subm 1976–1977 by Oddmunn Farbregd, DKNVS Mus, Univ Trondheim.

**T-2340. Veiem R9, plow marks** **2340 ± 90**

Charcoal (*Pinus, Betula, Alnus*) from bits scattered in grooves made by ard, depth ca 0.8m; 560 ± 160 BC*.

**T-2490. Veiem R9, Pit 7** **2180 ± 50**

Charcoal (*Betula*) from base of charcoal pit dug into subsoil ca 5m outside barrow, depth ca 0.4m; 305 ± 105 BC*.

**T-2491. Veiem R9, Pit 9** **150 ± 60**

Decomposed wood (*Picea*) from previous cover layer in filled rectangular pit ca 3m by 4.5m. Assoc with numerous iron rivets. Depth ca 0.4m. *Comment* (OF): pit was disturbed boat grave, and date refers to plundering (Farbregd, 1979a, b); younger than AD 1640*.

**T-2492. Veiem R9, charcoal** **1460 ± 70**

Charcoal from layer 8, ca 2.5m wide and 0.05m thick, overlying subsoil ca 4m outside barrow, partly covering charcoal Pit 7, depth ca 0.3m. *Comment* (OF): layer may be site of funeral pyre; AD 520 ± 80*.

**T-2493. Veiem R9, birch bark** **1500 ± 70**

Birch bark (*Betula*) placed on planks in stone cist, 4m long, depth ca 1.1m. *Comment* (OF): date is presumably quite reliable and suggests that traditional weapon chronology is somewhat too young; AD 495 ± 95*.

**T-2494. Veiem R9, Pit 2** **2210 ± 70**

Charcoal (*Pinus*) from base of pit ca 1.6m wide, depth ca 0.6m; 315 ± 105 BC*.

**T-2495. Veiem R9, charcoal** **1700 ± 60**

Charcoal (*Pinus*) from concentration in soil fill of mound near cist, depth 0.7m. *Comment* (OF): on basis of stratigraphy, charcoal feature should not be older than cist burial (*cf* T-2493); AD 280 ± 100*.

**T-2639. Veiem R9, Pit 3** **2170 ± 50**

Charcoal (*Betula*) from base of pit ca 1.5m wide, depth ca 0.4m; 290 ± 120 BC*.

**T-2640. Veiem R9, Pit 4** **2080 ± 50**

Charcoal (*Betula*) from base of pit ca 1m wide, depth ca 0.6m; 195 ± 185 BC*.

**T-2883. Human bones, Hordaland** **3690 ± 80**

Human bones from late Neolithic hunting place, depth 0.80 to 0.90m in sand, at Ruskenesset, Strömme, Bergen (60° 20′ N, 5° 15′ E). Assoc find: flint dagger of type IX (B6914). Coll 1915 by Haakon Schetlig, Univ Mus Natl Antiquities, Oslo; subm 1978 by Anders Hagen and Rolf Lie, Univ Bergen; 2150 ± 40 BC*.

**T-2990. Human bones, Buskerud** **3600 ± 50**

Human bones from late Neolithic grave (hellekiste) at Verket, Hurum (59° 40′ N, 10° 25′ W). Assoc were five flint daggers of Ebbe Lombergs Type IA and IB. Coll 1880 by Univ Mus Natl Antiquities, Oslo; subm 1978 by Rolf Scheen, Univ Mus Natl Antiquities. *Comment* (RS): until now only these two discoveries of human bones (T-2883, -2990) with assoc flint daggers of type I from late Neolithic have been made; 2090 ± 45 BC*.

*Other Archaeologic Samples*

**T-2043. Ts 6746** **1600 ± 60**

Rib of oak, probably part of complete boat from bog at ca +3m at Böröya, Stokmarknes, Hadsel, Nordland (68° 34′ N, 14° 57′ E). Coll 1974 by A/S Ivar Bergsmo, Stokmarknes; subm 1975 by Reidar Bertelsen, Univ Tromsö. *Comment* (RB): construction is similar to boat from Bårset, Karlsöy, Troms (Gjessing, 1941; Bertelsen, 1976); AD 370 ± 80*.

**T-2303. Log boat** **590 ± 60**

Wood (pine) from log boat from little shallow lake Skrövlingen at +209m, Hokåsen, Brandval/Kongsvinger, Hedmark (60° 15′ N, 12° E). Coll 1950 by Georg Flyginn, Hokåsen; subm 1975 by Martin Skaare Botner, Hokåsen (Nakkerud, 1976); AD 1325 ± 65*.

**T-2339. Selnes I, S Tröndelag** **1160 ± 100**

Wood (*Pinus*) from Selnes, Snillfjord, Sör-Tröndelag at ca +20m, depth ca 0.5m (63° 22′ N, 9° 19′ E). Wooden upright post ends of uncertain function scattered over area ca 50 × 30m wide, found when pond/bog was drained and cultivated (Farbregd, 1978); AD 815 ± 125*.

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