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INTRODUCTION

Most dates in this list were obtained between 1972 and 1976. Treatment of samples has remained essentially the same as described previously (R, 1975, p 364).

Several experiments concerning shielding and counter background have been performed (Nydal *et al.*, 1975; Gulliksen & Nydal, 1976). The capacity of our iron shield has been doubled from three to six chambers, two new guard counters, GM4 and GM5, have been installed, and three new counters, nos. 7, 8 and 9, added to the three already operating. Data for the counters with present shielding are:

Counter no.	Effective vol (L)	Background (cpm)	Recent standard net count (cpm)
2	1.5	0.70	19.3
5	0.9	0.90	11.5
6	0.6	0.45	7.5
7	1.2	0.70	15.3
8	0.36	0.28	4.8
9	1.6	0.75	21.8

Counter 9 is used for both tritium and ^{14}C measurements. The backgrounds appearing in the table are not the lowest values obtained during shielding experiments. More research is needed before we decide upon a final shielding.

Ages are calculated by applying the Libby value 5570 ± 30 years for the ^{14}C half-life, and using 95% of NBS oxalic acid activity as contemporary standard referring to AD 1950. Errors quoted ($\pm 1\sigma$) include counting uncertainties for sample, standard, and background. $\delta^{13}\text{C}$ values reported are relative to PDB, and corrections for deviations from 0‰ relative PDB are applied for shell samples.

For dates that can be corrected according to the dendrochronologic calibration table given by Ralph *et al.*, 1973, the corrected range is given and denoted MASCA age. Uncertainty in half-life 5730 ± 40 yr is included in the calibrated range.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

Norway

1. Late Weichselian and Holocene samples

Mona at Mysen series

Shells of Boreo-Arctic fauna from glaciomarine clay within foreset sec of Mona ice-front delta at Mysen (59° 32' N, 11° 22' E). T-1020 coll and subm 1970 by Olaf Holtedahl and Björn G Andersen, Dept Geol, Univ Bergen; T-1382 coll and subm 1972 by B G Andersen. *Comment* (BGA): clay lies conformably with foreset beds of sand and gravel, and wedges out towards the ice-contact side. Date indicates that Mona delta is of Younger Dryas age. Thus, the Ra moraine must represent earlier phases of Younger Dryas period, not agreeing with date, 10,080 ± 160 BP on *Portlandia arctica* clay from within Ra moraine near Sarpsborg.

T-1020. Mona 1 **10,430 ± 160**
 $\delta^{13}C = -0.5\%$

T-1382. Mona 2 **10,670 ± 270**
 $\delta^{13}C = -2.0\%$

Yrkje series

From sediment core in basin at +38m in Yrkje, Tysvær, Rogaland (59° 23' N, 5° 40' E). Stratigraphy from base (7.5m): bed of silt below bed of gyttja-rich silty clay (bed 2), both .1m thick and deposited in fresh water; then .65m thick bed of silty clay (bed 3), basal part deposited in fresh water, and upper .5m in salt water. Overlain by gyttja with decreasing content of silty clay upwards. Coll and subm 1970 by Karl Anundsen, Dept Geol, Univ Trondheim. *Comment* (KA): series dates marine transgression at +38m to 10,500 BP. Basin again isolated from sea at ca 9500 BP. This is 1st demonstration of a marine transgression in Younger Dryas-Pre-Boreal in Norway (Anundsen, 1977a).

T-993. Yrkje I **11,530 ± 140**
 Gyttja-rich silty clay from base of Bed 2 at depth 7.35 to 7.40m.

T-1040. Yrkje III **10,540 ± 170**
 Organic substances in silty clay from base of Bed 3 at depth 7.27 to 7.31m.

T-994. Yrkje V **9580 ± 120**
 Organic content in silty clay from top of Bed 3 at depth 6.66 to 6.72m.

Borgöy series

From +25m at Borgöy, Tysvær, Rogaland (59° 20' N, 5° 38' E), outside terminal moraines of Younger Dryas age. Clay bed at depth ca 2m below .25 to .30m thick ground moraine and boulders, overlain by clay bed, littoral sand and gravel, and gyttja. Coll 1947 by H Olsen, Zool Mus, Univ Bergen; subm 1973 to 1975 by K Anundsen.

T-1621. Borgöy I **12,830 ± 150**
 $\delta^{13}C = -16.4\%$

Bones of Greenland right whale (*Balaena mysticetus* L) from top of clay bed at depth ca 2m. *Comment* (KA): reservoir corrected age 12,380 ± 150 BP (apparent res. age 450 yr) dates glacier advance in inner part of Boknfjord-Nedstrandsfjord area within Older Dryas Chronozone. Agrees with glacial advance during Older Dryas Stadial in Bergen dist further N (Mangerud, 1970; Anundsen, 1972, 1977a,b).

T-2005. Borgöy II **4340 ± 110**

Gyttja from depth .7m in contact zone between littoral sediment and gyttja. *Comment* (KA): if this sample dates littoral sand and gravel, sea level was at +24m ca 4300 yr ago. MASCA age: 3120 ± 200 BC.

T-1883. Nedstrand IV **12,420 ± 100**
 $\delta^{13}C = -17.0\%$

Bones of Greenland right whale (*Balaena mysticetus* L) from depth ca 2m on top of 20m marine clay at Hinderåvåg, Tysvær, Rogaland (59° 20' N, 5° 47' E). Above clay is ca .3m littoral sand and gravel. Loc at +22m outside terminal moraines of Younger Dryas age. Coll 1950 by H Olsen; subm 1974 by K Anundsen. *Comment* (KA): reservoir corrected age 11,970 ± 100 BP (apparent res. age 450 yr) indicates that Older Dryas glacial advance at Borgöy did not reach Hinderåvåg further E. Contamination from younger humic acids suspected (Anundsen, 1972; 1977b).

T-1620. Nedstrand V **11,630 ± 100**
 $\delta^{13}C = +2.0\%$

Marine shells (*Balanus balanoides*, *Mya truncata*, *Chlamys* (*Pecten*) *islandicus*) from upper part of clay overlain by .5m silt and clay and .5m ground moraine. Loc at +10m, 3 to 4km outside terminal moraines of younger Dryas in Nedstrand, Tysvær, Rogaland (59° 20' N, 5° 52' E). Coll 1968 and subm 1973 by K Anundsen. *Comment* (KA): glacier was in early phase of Younger Dryas at a more advanced position than the pronounced Younger Dryas moraines in the area (Anundsen, 1972; 1977b).

Blomvåg series

Littoral sediments rich in shells, wood, and bones, below till at ca +20m at Blomvåg cemetery, Öygarden, Hordaland (60° 32' N, 4° 93' E). Previously dated to 12,200 ± 350 and 12,700 ± 350 (T-138, -139; R, 1960, v 2, p 88). Coll 1942 by Knut Fægri and Isak Undås; subm 1974 by Jan Mangerud, Dept Geol, Univ Bergen. *Comment* (JM): Blomvåg beds

deposited during Bölling Chronozone (Mangerud, in press) as defined by Mangerud *et al* (1974). Shell-dates are corrected for apparent age of 410 yr (Mangerud, 1972b), while bone-dates are uncorrected, and entire apparent age must therefore be subtracted for latter, found to be 440 yr (Mangerud, 1972b; Mangerud *et al*, 1974; Mangerud & Gulliksen, 1975; Mangerud, in press).

T-1696. Blomvåg 3 **12,570 ± 180**
 $\delta^{13}C = -1.7\%$

Marine shells (mainly *Modiolus modiolus*) from deepest shell-bearing layer, .15m above base of sediments at depth 2.95 to 3.05m.

T-1697. Blomvåg 4 **12,570 ± 150**
 $\delta^{13}C = -1.4\%$

Marine shells (mainly *Modiolus modiolus*) from .9m below till at depth 2.45 to 2.50m.

T-1882. Blomvåg 5 **12,430 ± 90**
 $\delta^{13}C = -1.1\%$

Marine shells (*Mytilus edulis*) from plant-bearing bed in upper part of sequence.

T-1898. Blomvåg 6 **260 ± 100**

Herbs, probably grass, from same mus sample as T-1882. *Comment* (JM): sample contaminated from either field work in 1942, or alternatively in lab. MASCA age: AD 1610 ± 160.

T-1899/1. Blomvåg 7 **12,550 ± 100**
 $\delta^{13}C = -16.6\%$

From top of littoral sediments, whale bones partly penetrating into till. *Lab comment*: bone brushed and washed, treated with 40% HCl under vacuum overnight. Residue washed and dissolved in 50% HCl. Solution evaporated to dryness and burned.

T-1899/2. Blomvåg 7 **12,360 ± 80**
 $\delta^{13}C = -17.4\%$

Lab comment: collagen separated by EDTA-treatment as described by Olsson *et al* (1974).

Ågotnes series

Marine shells from sequence of marine sediments at +10m outside Younger Dryas endmoraines at Ågotnes (Sotra), Fjell, Hordaland (60° 25' N, 5° 1' E). Coll 1970; subm 1971 and 1973 by J Mangerud. *Comment* (JM): dates prove that Younger Dryas ice-advance did not reach site (Mangerud, in press; Aarseth & Mangerud, 1974).

T-1023. Ågotnes 1 **12,250 ± 150**
 $\delta^{13}C = +1.5\%$

Mya truncata, *Balanus* sp from base of brown gyttja bed, depth ca 4m.

T-1574. Ågotnes 2 **10,260 ± 180**
 $\delta^{13}C = -0.2\%$

Balanus balanus, *Hiatella arctica*, *Mya truncata*, *Astarte elliptica*
 from greenish gray silt, depth ca 2.5m.

Sandviken series

From marine clay below 2 beds of till at +8 to 10m in Sandviken, Bergen (60° 25' N, 5° 20' E). Previously dated to 12,470 ± 150 (T-750; R, 1972, v 14, p 23; Mangerud, 1970). Coll 1968 and subm 1970/74 by J Mangerud. *Comment* (JM): clay is of Alleröd age (Mangerud, in press), and not of Bölling age as previously concluded (Mangerud, 1970; 1972a; in press; R, 1972, v 14, p 418-451).

T-1024. Sandviken 2 **(a) 12,070 ± 180**
(b) 11,570 ± 160
 $\delta^{13}C = -3.1\%$

Outer (a) and inner (b) fraction of carbonate cover on pebbles, depth ca 6m.

T-1809. Sandviken 3 **12,090 ± 120**
 $\delta^{13}C = +1.3\%$

Marine shells, *Chlamys islandica*, *Mya truncata*, *Astarte elliptica*, *Balanus balanus*, depth ca 6m. *Comment* (JM): same sample as T-750.

T-1810. Sandviken 4 **11,940 ± 100**
 $\delta^{13}C = +0.8\%$

Marine shells, *Chlamys islandica*, *Mya truncata*, *Astarte elliptica*, *Hiatella arctica*, depth ca 4 to 6m.

Fensfjorden series

Marine shell fragments from area around Fensfjorden, dating glacial readvance in area, and ice-free period prior to it. Coll and subm 1971 to 1975 by Inge Aarseth, Dept Geol, Univ Bergen. *Comment* (IA): dates T-1168, T-2106 indicate approaching glacier (Aarseth & Mangerud, 1974). T-1606, -1607, and -2107 date very early (Bölling/Older Dryas) deglaciation of area. Dates are, except for T-2107, which is ca 500 yr too old, agreeing well with established stratigraphy in Bergen area (Mangerud, 1970).

T-1168. Fønnes **10,770 ± 140**

From depth 2.5m below surface in glaciomarine clay overlain by till at +7m in Fønnes, Austrheim, Hordaland (60° 48' N, 4° 58' E). Sec between 2 moraine ridges, 1km apart.

T-1606. Mongstad 1 **12,020 ± 120**
 $\delta^{13}C = -0.8\%$

From glaciomarine sediments overridden by ice. Loc at +12 to 13m at Mongstad, Lindås, Hordaland (60° 49' N, 5° 2' E), 2km proximal to Herdla Moraines. *Mya truncata*, *Balanus*, *Macoma* from small crack in bedrock below 2.5m of consolidated silty clay with dropstones.

T-1607. Mongstad 2 **11,810 ± 120**
 $\delta^{13}C = -1.1\text{‰}$

Mya truncata, *Hiatella*, *Chlamys*, *Astarte* sp from clay 1.5m above bedrock, overlain by 1m clayey till.

T-2107. Austrheim 1 **12,460 ± 100**
 $\delta^{13}C = -1.2\text{‰}$

From glaciomarine sediments in sec at +2 to 2.5m at Austrheim, Hordaland (60° 46' N, 4° 55' E), 200m distal to Herdla moraines, deposited in shallow sea (25 to 30m) during glacial readvance in Younger Dryas. *Mytilus edulis* from depth 1.3m in lowermost part of .5m thick shell layer overlain by .3m bed of glaciomarine silt and .5m soil profile. Below shell bed is .6m silts, sand and gravels.

T-2106. Austrheim 2 **10,620 ± 170**
 $\delta^{13}C = -1.4\text{‰}$

Mya truncata from depth .8m, in lowermost part of silt bed overlying shell bed.

Björnafjorden series

Marine shell fragments from area around Björnafjorden, dating glacial readvance in area, and also ice-free period prior to it. Coll 1969 and 1970; subm 1969 and 1970 by I Aarseth.

T-847. Lunde **10,570 ± 100**

From depth 3m in glaciomarine clay overlain by 2m thick till, at +42m in zone of large moraines at Lunde, Rysnes, Hordaland (60° 03' N, 5° 89' E). *Comment* (IA): date agrees with view that Herdla Moraines reached their terminal position in Late Younger Dryas (Aarseth & Mangerud, 1974).

T-983. Ölve **11,230 ± 180**
 $\delta^{13}C = -0.1\text{‰}$

From brook cutting through a clayey till, sec at +15m at Ölve, Kvinnherad, Hordaland (60° N, 5° 46' E). *Comment* (IA): dates ice-free period prior to glacial readvance (of order of min 25km) (Aarseth & Mangerud, 1974).

T-984. Nordtveit **11,320 ± 180**
 $\delta^{13}C = -1.9\text{‰}$

From depth 2m in clayey till at +35m at Nordtveit, Fusa, Hordaland (60° 06' N, 5° 44' E). *Comment* (IA): dates ice-free period prior to glacial readvance (Aarseth & Mangerud, 1974).

T-1169. Vinnesleira **2660 ± 120**

Gyttja from 27m deep core in clay at Vinnesleira, Fusa, Hordaland (60° 9' N, 5° 36' E), dating isolation contact. Lower 20m deposited as glaciomarine clay in Alleröd/Younger Dryas during Holocene uplift. Coll and subm 1971 by Inge Aarseth, Univ Bergen. *Comment* (IA): date shows

that marine sedimentation ended at Vinnes (Aarseth & Mangerud, 1974). MASCA age: 900 ± 120 BC.

T-1171. Fitjar trench, marine shells **12,860 \pm 250**
 $\delta^{13}C = -0.5\text{‰}$

Chlamys islandicus, *Macoma calcarea*, *Mytilus edulis* from depth 1.5m in dark gray fossiliferous clay till at +16 to +20m in Fitjar, Hordaland (59° 50' N, 5° 30' E). Till, exposed in 235m long trench, containing broken shells and small angular pebbles intercalated with small sandy granule deposits, overlain by outwash of gravel to cobble size with boulder inclusions. Coll and subm 1971 by A N Genes, Univ Bergen. *Comment* (ANG): date indicates Fitjar substage moraine is of older Dryas age (Genes, 1977; Mangerud, 1970).

T-1172. Fitjar trench, wood **1200 \pm 110**

Wood in same position as T-1171. *Comment* (ANG): anomolous date, solifluction or contamination negates date. MASCA age: AD 780 \pm 130.

(a) outer fraction 10,690 \pm 130
 $\delta^{13}C = -0.5\text{‰}$

T-1371. Bortveit tunnel **(b) inner fraction 10,600 \pm 140**
 $\delta^{13}C = -0.5\text{‰}$

Marine shells (*Mya truncata*, *Hiatella arctica*, *Chlamys islandicus*) from depth .5m in 1m-thick layer of bluish-gray, stoney clay directly on bedrock, at +35m in Stord, Hordaland (53° 80' N, 5° 13' E). Coll 1972 by A N Genes; subm 1972 by A N Genes and H Holtedahl, Univ Bergen. *Comment* (ANG): dessication or rapid drainage presumed to allow for seeming preconsolidation, does not suggest Younger Dryas ice movement having reached Stord I.

T-1593. Sandosen, Jondal 1 **6740 \pm 200**

Lacustrine organogenic sediments consisting of allochthonous plant remains, resting on bouldery gravel and overlain by ca 3m-thick sand deposit at +935m in S end of lake Dravdalsvatn, Sandosen, Ullensvang, Hordaland (60° 14' N, 6° 26' E). Coll 1972 and subm by Tore Torske, Norges geol undersøkelse, Trondheim. *Comment* (TT): supposedly dates period when nearby present glacier Folgefonna, or, at least, its N part, did not exist.

Omnsbreen glacier series

Plant remains and gravel with organogenic remains, uncovered during recession of the Omnsbreen glacier at +1515m, Ulvik, Hordaland (60° 39' N, 7° 29' E). Coll 1972 by Reidar Elven, subm 1973 by Rolf Y Berg, Bot Garden, Univ Oslo. *Comment* (RYB): material dates, as expected, time immediately before AD 1600 to 1700 glaciation; probably covered by perennial snowbanks at onset of this glaciation (Elven, 1974).

T-1485. Omnsbreen N3-169 **550 ± 100**
 MASCA age: AD 1345 ± 85.

T-1486. Omnsbreen N7-449 **(a) 440 ± 120**
(b) 2930 ± 160

NaOH-soluble fraction (a) and insoluble fraction (b) of gravel with abundant organic remains. *Comment* (RYB): (b)-fraction contaminated by carbon from gravel. MASCA age: (a) AD 1480 ± 120; (b) 1210 ± 270 BC.

T-1578. Omnsbreen N7-462 **430 ± 120**
Silene acaulis. MASCA age: AD 1490 ± 120.

T-1579. Omnsbreen N7-463 **430 ± 100**
Silene acaulis. MASCA age: AD 1485 ± 105.

T-793. Rebnis Li **8140 ± 310**

Sandy dy from bog at +560m between 2 lateral moraines in valley side of Mökrisdalen, Luster, Sogn og Fjordane (61° 31' N, 7° 37' E). Coll from lowermost organogenic layer, 7.15m below surface, with Livingstone samples. Coll 1968 and subm 1969 by T O Vorren. *Comment* (TOV): date is minimum of Gaupne Stadial, later dated to 9500 to 9800 BP (Vorren, 1970; 1973).

Haukelandsvatnes series, Hordaland

Peat and silty gyttja from Li at +75m, Haukedalsvatnet, Arna, Hordaland (60° 22' N, 5° 28' W). Samples from core in Holocene delta in front of alluvial fan, providing data about propagation of delta and frequency of landslides or floods on alluvial fan. Some samples also date pollen zone boundaries. Coll 1972 and subm 1973 by Kåre Skår and Jan Mangerud, Univ Bergen.

T-1490. KS-1 **4440 ± 80**

Peat from depth 1.84 to 1.73m below surface. MASCA age: 3230 ± 120 BC.

T-1491. KS-2 **8960 ± 220**

Silty gyttja from depth 11.45 to 11.50m. *Comment* (JM): dates *Corylus* rise; result agrees with other dates of this pollen-boundary in Hordaland.

T-1492. KS-3 **6560 ± 100**

Silty gyttja from depth 8.26 to 8.42m. *Comment* (JM): boundary between bottomset and foreset.

T-1749. KS-5 **7430 ± 110**

Silty gyttja from depth 10.37 to 10.45m. *Comment* (JM): dates *Alnus* rise; a few hundred yr younger than expected from dates nearer coast.

T-1750. KS-6 **6040 ± 140**

Silty gyttja from depth 3m; top of foreset beds. MASCA age: 4925 ± 215 BC.

Kroken series

Holocene organogenic sediments from regrown basin at +125m at Kroken, Luster, Sogn og Fjordane (61° 21' N, 7° 23' E), dating deglaciation events, shoreline displacement and vegetational development. Coll with piston sampler and subm 1970 by Tore O Vorren, Tromsø Univ.

T-1050. Kroken 1 **10,520 ± 450**

Silty dy from depth 6.01 to 6.05m below surface. *Comment* (TOV): date is minimum for deglaciation of Inner Lusterfjord area.

T-1107. Kroken 2 **9100 ± 200**

Fine detritus dy from depth 5.84 to 5.88m. *Comment* (TOV): dates end of unfavorable climatic period.

T-1106. Kroken 3 **8550 ± 170**

Fine detritus dy from depth 5.05 to 5.11m. *Comment* (TOV): dates 1st rise of *Pinus*.

T-1105. Kroken 4 **8550 ± 110**

Fine detritus dy from depth 4.93 to 4.98m. *Comment* (TOV): dates rational and empirical limit of *Alnus* (probably *A glutinosa*).

T-1605. Karihola 1/73 **12,090 ± 100**
 $\delta^{13}C = -0.1\text{‰}$

Shells (*Chlamys isl*) from depth 1m in roadcut with 2m sandy till overlain by ca .5m bog at +5m at Karihola, Kristiansund, Møre og Romsdal (63° 7' N, 7° 42' E). Coll 1973 and subm 1974 by Roar Kræmer, Dept Geol, Univ Bergen. *Comment* (RK): date indicates that older Dryas ice-advance passed the NW coast of Norway, leaving its terminus outside.

Flöytmyr series

Sphagnum peat from Flöytmyr at +192m, Bærum, Akershus (59° 59' N, 10° 37' E). Series provides age of various pollen-analytic horizons concerning Post-Weichselian (Flandrian) development of vegetation, climate, and agric within Oslo area. Coll 1976 by Ulf and Eva Hafsten; subm 1976 by U Hafsten, Dept Bot, Univ Trondheim. *Comment* (UH): dates agree with supposed age (Hafsten, 1956; Nydal, 1970).

T-2319. Flöytmyr 3 **2540 ± 90**

Dates initial spruce (*Picea abies*) pollen maximum occurring below beginning of continuous spruce curve. Depth 1.10 to 1.15m. MASCA age: 690 ± 180 BC.

T-2320. Flöytmyr 4 **2020 ± 110**

Dates beginning of continuous spruce (*Picea abies*) pollen curve, viz final establishment of spruce forest within area. Dept .70 to .75m. MASCA age: 155 ± 225 BC.

Våletjern series

Fine detritus gyttja, providing age of various pollen-analytic horizons concerning Post-Weichselian development of vegetation, climate, and agric within Lake Mjösa region, from Våletjern at +216m, Stange, Hedmark (60° 42' N, 11° 13' E). Coll 1974 to 1976 by Ulf and Dag Hafsten, Univ Trondheim; subm 1975 and 1976 by Ulf Hafsten. *Comment* (UH): dates agree with supposed age (Hafsten, 1956; 1958; 1975), T-2411 slightly older than expected.

T-2186. Våletjern 1 **8490 ± 130**

Dates immigration and spread of elm (*Ulmus*). Depth 5 to 5.1m.

T-2187. Våletjern 2 **6170 ± 150**

Dates immigration and spread of lime (*Tilia*). Dept 3.7 to 3.8m. MASCA age: 5105 ± 175 BC.

T-2411. Våletjern 3 **4070 ± 120**

Dates end of Megathermal lime (*Tilia*) maximum, assumed to represent start of late Post-Weichselian climatic decline. Depth 1.85 to 1.95m. MASCA age: 2745 ± 195 BC.

T-2318. Våletjern 4 **2620 ± 70**

Dates very abrupt and extensive immigration and expansion of spruce (*Picea abies*). Depth 1 to 1.1m. MASCA age: 850 ± 60 BC.

Forradal series

Peat from 2 blanket bog profiles and 1 sloping fen profile in Forradal moorland complex in Nord-Trøndelag (63° 37' N, 11° 33'-41' E). Series dates Post-Weichselian expansion and development of alder (*cf Alnus incana*) and spruce (*Picea abies*) and formation of blanket bogs. Coll and subm 1971 to 1972 by Ulf Hafsten and Thyra Solem, Univ Trondheim (Hafsten & Solem, 1976).

Blanket bog near Salthammervold, ca +485m

T-1520. Depth .075 to .125m **1230 ± 70**

Comment (UH): *Eriophorum/Calluna* peat dating spruce expansion. MASCA age: AD 750 ± 100.

T-1693. Depth .25 to .30m **4110 ± 90**

Comment (UH): *Eriophorum/Calluna* peat dating transition from optimal (Megathermal) to late warmth (Katathermal) period. MASCA age: 2780 ± 170 BC.

T-1521. Depth .30 to .35m **4840 ± 90**

Comment (UH): *Eriophorum/Calluna* peat dating decline of alder or transition to temporal period with a drier and somewhat colder type of climate during late Megathermal time. MASCA age: 3650 ± 90 BC.

T-1522. Depth .65 to .70m 7630 ± 70

Comment (UH): *Sphagnum/Eriophorum* peat dating alder expansion at transition from early to middle Megathermal period.

T-1523. Depth .975 to 1.025m 8350 ± 100

Comment (UH): birch-wood peat dating start of blanket bog formation and base of organic deposits.

Blanket bog near Roknesbustaden, ca +403m

T-1692. Depth .175 to .225m 5080 ± 90

Comment (UH): *Eriophorum* peat dating decline of alder or transition to temporal period with drier and somewhat colder climate during late Megathermal time. MASCA age: 3875 ± 125 BC.

T-1526. Depth .675 to .725m 7270 ± 120

Comment (UH): *Carex* peat dating oldest of the 2 alder maxima occurring in area.

Sloping fen near Heståa River, ca +404m

T-1691. Depth .85 to .90m 3960 ± 80

Comment (UH): *Carex/Eriophorum* peat dating youngest of the 2 alder maxima occurring in area. MASCA age: 2570 ± 230 BC.

T-1524. Depth 1.0 to 1.05m 4360 ± 90

Comment (UH): *Carex/Eriophorum* peat dating temporal period with drier and somewhat colder climate during late Megathermal time. MASCA age: 3145 ± 175 BC.

T-1525. Depth 1.30 to 1.35m 5980 ± 70

Comment (UH): unspecified peat dating oldest of the 2 alder maxima occurring in area. MASCA age: 4875 ± 145 BC.

Frosta series

Peat and gyttja from 5 different lakes and bogs on Frosta peninsula in Nord-Trøndelag (63° 33'-37' N, 10° 40'-52' E). Series dates various (pollen-analytic and stratigraphic) horizons of Post-Weichselian development of vegetation and climate, agric history and sea-level changes. Coll and subm 1970 to 1971 by Julie Lillealter and Ulf Hafsten (Lillealter, 1972; Tallantire, 1973).

Logtunmyr, ca +27m (63° 34' N, 10° 42' E)

T-1132. Depth .75m 1880 ± 70

Comment (UH): highly humified *Sphagnum/Ericales* peat dating a transient desiccation layer coinciding with 1st appearance of agric indicators in profile. MASCA age: AD 95 ± 65.

T-1131. Depth .95m 2760 ± 50

Comment (UH): minerotrophic rich-fen peat dating transient rise in

groundwater level (*viz* distinct alder peak), supposed to designate late Post-Weichselian climatic deterioration. MASCA age: 1000 ± 100 BC.

T-1130. Depth 1.57m 4030 ± 110

Comment (UH): minerotrophic rich-fen peat from base of profile indicating age of isolation of basin from sea and latest phase of Megathermal elm maximum. MASCA age: 2700 ± 210 BC.

Lianvatn, +43m (63° 36' N, 10° 46' E)

T-1133. Depth 10.45m 5950 ± 100

Comment (UH): very compressed, sandy brackish-water fine detritus gyttja, containing abundant *Hystrix*, indicating age of isolation of basin from sea. MASCA age: 4840 ± 180 BC.

Askhundvatn, +88.5m (63° 35' N, 10° 43' E)

T-1137. Depth 4.80m 1000 ± 60

Comment (UH): fine detritus dy dating youngest of 2 Iron age *Cerealea maxima* and local spruce expansion. MASCA age: AD 975 ± 65 .

T-1136. Depth 6.55m 1600 ± 80

Comment (UH): fine detritus dy dating a transient local stand of spruce prior to final spruce expansion within area. MASCA age: AD 375 ± 105 .

T-1135. Depth 8.10m 3010 ± 120

Comment (UH): fine detritus gyttja dating local decline of elm and probably 1st appearance of agric indicators on Frosta (documented also by a seed find of *Chenopodium album*). MASCA age: 1305 ± 195 BC.

T-1177. Depth 8.745 to 8.805m 6550 ± 120

Comment (UH): fine detritus gyttja dating local alder expansion and regional (?) halt in early Megathermal hazel expansion.

T-1134. Depth 9.15m 8640 ± 230

Comment (UH): fine detritus gyttja from base of profile indicating age of pine immigration and isolation of basin from sea.

Brekkmjør, ca +168m (63° 36' N, 10° 47' E)

T-1139. Depth 5.80m 7060 ± 130

Comment (UH): *Sphagnum fuscum* peat dating early Megathermal alder and local hazel expansion.

T-1138. Depth 9.10m 8770 ± 200

Comment (UH): *Sphagnum/Carex* peat from base of profile indicating age of isolation of basin from sea.

Stavsjö series

Gyttja from sediment core with 6.25m gyttja above .45m glacial sediments. Sampled in bed at deepest point of Lake Stavsjö at +246m,

Ringsaker, Hedmark (60° 49' N, 10° 50' E). Coll 1973 and subm 1974 by Per B Christiansen, Limnologisk Inst, Univ Oslo.

T-1769. Stavsjö 1 **2510 ± 210**

Depth 2.1m. *Comment* (PBC): dates rise in sedimentary chlorophyll, and parameters Fe and Mn indicates marked change in lake at this time. MASCA age: 675 ± 255 BC.

T-1770. Stavsjö 2 **6430 ± 250**

Depth 5.75m. *Comment* (PBC): dates marked fall in sedimentary chlorophyll.

Tunsbergdalen series

Plant fragments interbedded in postglacial deltaic sediments at +500m in Tunsbergdalen, Luster, Sogn og Fjordane (61° 30' N, 7° 11' E), dated to study rate and chronology of sedimentation. Coll 1974 by Jim Bogen, Geog Inst, Univ Oslo; subm 1975 by Kjell Nordseth, Geog Inst, Univ Oslo. *Comment* (KN): dates agree well with delta sedimentation model.

T-1884. Luster 1 **3380 ± 190**

Depth 6m. MASCA age: 1800 ± 290 BC.

T-1886. Luster 2 **1070 ± 130**

Depth 8m. MASCA age: AD 885 ± 155.

T-1944. Nordre Svartvatn **6110 ± 100**

Trunk of pine from mud 16m below original lake level at +390m in Nordre Svartvatn, Grane, Nordland (65° 43' N, 13° 29' E). Coll 1975 by Torbjörn Tuven, Mosjöen; subm 1975 by Nordland county forest office, Mosjöen. MASCA age: 5085 ± 155 BC.

Nordland series, Northern Norway

Shells from glaciomarine sediments in Salten and Narvik area in Nordland. Coll and subm by Björn G Andersen, Univ Bergen, 1971-72, except for T-633, which was coll by G W Holmes and subm by B G A in 1966.

T-1372. Bodö, Salten **10,930 ± 200**
 $\delta^{13}C = -1.4\text{‰}$

Portlandia arctica from Bodö clay pit (67° 17' N, 14° 24' E). *Comment* (BGA): previously dated to 10,550 ± 250 (T-246). Clay deposited when ice front was at Bodö.

T-1158. Valnesfjordvann, Salten **9870 ± 120**
 $\delta^{13}C = -1.5\text{‰}$

From clay with *Bathyarca glaciales* exposed in roadcut at Valnesfjordvann (67° 18' N, 15° 12' E). *Comment* (BGA): clay deposited when ice front had retreated at least 35km E of Bodö.

T-1154. Finneid end moraine **9570 ± 150**
 $\delta^{13}C = -0.5\text{‰}$

Mainly *Hiatella arctica* from laminated clay below bouldery till bed at the crest at S end of Fenneid end moraine (67° 14' N, 15° 27' E). *Comment* (BGA): clay deposited when ice front was at, or close to end moraine, prior to a small glacial oscillation.

T-633. Misvaer, Salten **9490 ± 220**

Mainly *Macoma calcarea* from silty foreset beds in ice-contact outwash delta at Misvær end moraine (67° 7' N, 15° E). *Comment* (BGA): shells date end moraine.

T-1157. Straumen, Salten **9380 ± 200**
 $\delta^{13}C = -1.2\text{‰}$

From clay with *Yoldiella lenticula* at Straumen (67° 20' N, 15° 32' E). *Comment* (BGA): very bouldery upper part of clay probably corresponds with end moraine at Straumen.

T-1155. Rombak end moraine, E of Narvik **9300 ± 120**
 $\delta^{13}C = -1.5\text{‰}$

From *Boreo-Arctic* fauna from laminated silt and clay below bouldery till bed at crest at S end of Rombak end moraine (68° 26' N, 17° 44' E). Marine beds exposed in road cut. *Comment* (BGA): beds deposited when ice front was located at, or close to, end moraine, prior to a small glacial oscillation.

(a) 9500 ± 130
 $\delta^{13}C = +0.7\text{‰}$

T-1373. Narvik end moraine **(b) 9450 ± 180**
 $\delta^{13}C = -0.1\text{‰}$

Outer fraction (a) and inner fraction (b) from *Boreo-Arctic* fauna in clay on proximal slope of Narvik end moraine ridge (68° 27' N, 17° 26' E). *Comment* (BGA): clay probably deposited during melting phase following Narvik glacial event.

T-1159. Håkvik, SW of Narvik **8400 ± 120**
 $\delta^{13}C = -9.7\text{‰}$

Mainly *Macoma calcarea* and *Bathyrca glacialis* in sec of stratified sand, silt and clay at Håkvik (68° 24' N, 17° 17' E). *Comment* (BGA): sec was correlated with end moraine at Håkvik, and 9500 to 10,000 yr BP was suggested. Sample must have been contaminated, also indicated by abnormal $\delta^{13}C$ value.

(a) 10,020 ± 130
 $\delta^{13}C = -0.3\text{‰}$

T-1374. Bjerkvik NE of Narvik **(b) 10,100 ± 190**
 $\delta^{13}C = -2.6\text{‰}$

Outer fraction (a) and inner fraction (b) from *Boreo-Arctic* fauna in laminated silt-clay at oldest end moraine NE of Bjerkvik church (68° 33'

N, 17° 35' E). *Comment* (BGA): marine sec overlain by bouldery till, and most likely slightly older than end moraine, which is younger than Tromsö-Lyngen moraines.

T-1881. Nedrevatn **9290 ± 200**
 $\delta^{13}C = -1.1\text{‰}$

Shell fragments (*Macoma calcarea*, *Balanus* sp) from depth 2 to 7m in silt and silty clay beneath and within an ice-front ridge of resedimented marine deposits at ca +85m at N end of Nedrevatn, Strofjord, Troms (69° 22' N, 20° 18' E). Coll 1970-1974 and subm 1974 by Geoffrey D Corner, Univ Tromsö. *Comment* (GDC): pre-dates a glacier advance in Late Pre-Boreal time; correlates probably with late Stordal event in Troms and other glacial events in Norway 9200 to 9300 yr BP (Andersen, 1968, 1975; Corner (ms in preparation).

B. Spitsbergen

Bellsund series

From Calypsostranda, Spitsbergen (77° 30' N, 14° 30' E), samples coll to date glaciation and postglacial emergence in area. Coll and subm 1974 by Otto Salvigsen, Norsk Polarinstittutt, Oslo. (Shytt *et al*, 1968).

T-1829. Calypsostranda 1 **9400 ± 120**
 $\delta^{13}C = -18.8\text{‰}$

Jawbone of whale at +10m partly buried in coarse gravel.

T-1830. Calypsostranda 2 **10,310 ± 200**
 $\delta^{13}C = +1.3\text{‰}$

Shell (*Mya truncata*) from sand and gravel at +29m in rivercutting in marine terrace at +32m. *Comment* (OS): area probably ice-free in Younger Dryas; marked rate of uplift.

T-1699. Freemansundet **8570 ± 110**

Driftwood from marine terrace at +44m at S coast of Barentsöya, Svalbard (78° 20' N, 21° 30' E). Coll 1973 and subm 1974 by T S Winsnes, Norsk Polarinstittutt, Oslo. *Comment* (TSW): agrees well with land-uplift curves from Wilhelmsöya and S-most area of Edgeöya (Shytt *et al*, 1968).

Damesmorena series

From marine moraine deposits in Damesmorena, Spitsbergen (77° 52' N, 16° 30' E), to date maximum age of great surge of glacier Paulabreen, Van Mijenfjord, and moraine deposits from it. Coll 1975 and subm 1976 by Øystein Haga, Univ Oslo, and Norsk Polarinstittutt.

T-2088. Damesmorena 1 **990 ± 60**

Driftwood at +18m from big log partly buried at inner edge of Damesmorena. MASCA age: AD 985 ± 65.

T-2089. Damesmorena 2 **4090 ± 80**
 $\delta^{13}C = -15.8\text{‰}$

Whale-bone from depth 1 m at +20m. MASCA age: 2760 ± 160 BC.

T-2090. Damesmorena 3 **3960 ± 100**
 $\delta^{13}C = +0.4\text{‰}$

Shell from depth .2m at +30m. MASCA age: 2575 ± 245 BC.

II. ARCHAEOLOGIC SAMPLES

A. Norway

1. Settlement sites

Torsröd series

Charcoal assoc with brittle-burned stones from depth 0.3 to 0.4m in ca 1m wide pits in sandy soil. Presumably late Mesolithic dwelling site at +28.5m at Rørsröd, Stavern, Vestfold (59° 0' N, 10° 2' E). Coll 1972 and subm 1973 by Einar Östmo, Univ Oslo (Östmo, 1975).

T-1493. Pit 3 **2550 ± 60**
Comment (EÖ): date too young. MASCA age: 775 ± 65 BC.

T-1425. Pit 4 **5350 ± 70**
Comment (EÖ): date supports archaeol and geol information, indicating late Mesolithic age (Östmo, 1975). MASCA age: 4220 ± 150 BC.

Mohalsen series

Charcoal from site Mohalsen IV at +84m, Mohalsen, Vega, Nordland (11° 50' N, 65° 38' E). Coll 1974 by Kristian Pettersen and Kurt Alterskjær, DKNVS Mus, Univ Trondheim; subm by Fredrik Gaustad, DKNVS, Univ Trondheim. *Comment* (FG): dates agree well with geol and archaeol data.

T-1807. Mohalsen 1 **9350 ± 270**
Salix, Quercus sp from fireplace, depth .35m.

T-1808. Mohalsen 2 **8440 ± 190**
Quercus sp from charcoal concentration, depth .32m.

T-1873. Rognlien houseground **4600 ± 130**

Charcoal coll during re-examination of trench for wall of Neolithic houseground at +21m, excavated in 1957-1958 by Anne Stine Ingstad, from Rognlien, Porsgrunn, Telemark (59° 4' N, 9° 48' E). Coll and subm 1974 by Egil Mikkelsen, Univ Mus Nat Antiquities, Oslo. *Comment* (EM): agrees well with T-133, 4700 ± 120 BP from same houseground (R, 1960, v 2, p 93), and oldest Neolithic pottery found in Rognlien may be of same age (Ingstad, 1970; Mikkelsen, 1975a). MASCA age: 3395 ± 205 BC.

Törkop series

Hazelnuts and charcoal from Mesolithic settlement site at +72m in Törkop, Voll, Halden, Ostfold (59° 6' N, 11° 26' E). Finds: flint tools, stone artifacts and animal bones. Coll and subm 1974 and 1975 by E Mikkelsen (1975b).

T-1872. Törkop 1 **8180 ± 170**

Hazelnuts from find-bearing layer, depth .90 to 1.3m. *Comment* (EM): agrees with archaeol material.

T-2134. Törkop 2 **8790 ± 100**

Charcoal from find-bearing cultural layer, depth 1.9 to 2.28m. *Comment* (EM): date slightly older than expected from artifact assemblage.

T-2135. Törkop 3 **3060 ± 60**

Charcoal assoc with flint, hazelnuts, and coarse pottery sherds, depth 1.1 to 1.3m. *Comment* (EM): date far too young, must date pottery, which may be of Bronze age type. Possibly from secondary cremation grave. MASCA age: 1385 ± 115 bc.

T-2194. Törkop 4 **8590 ± 140**

Hazelnuts from find-bearing cultural layer, depth 1.9m. *Comment* (EM): artifact assemblages do not contradict date.

Holeheia series

Charcoal from stone age site at +7m at Holeheia, Bore, Klepp, Rogaland (58° 30' N, 4° 50' E). Coll and subm 1962 to 1974 by A Skjølvold. *Comment* (AS): 6 samples were dated from this site, with average date of 2520 yr bc. One sample dates to early Bronze age, 1460 bc. Although ¹⁴C dates obtained suggest occupations in early part of middle Neolithic and in early Bronze age (R, 1964, v 6, p 288), bulk of archaeol material seems to date from late part of middle Neolithic, indicating 3 different occupations at site.

T-587. Holeheia III **4470 ± 120**

From firepit at base of cultural layer, dates oldest occupation of site. MASCA age: 3205 ± 175 bc.

T-588. Holeheia IV **4490 ± 120**

From another firepit at base of cultural layer. MASCA age: 3300 ± 150 bc.

T-1782. Holeheia V **4400 ± 130**

From Sq 4c, depth .1 to .2m, in cultural layer. MASCA age: 3170 ± 200 bc.

T-1783. Holeheia VI **3410 ± 120**

From Sq 7b, depth .2 to .3m, in cultural layer. MASCA age: 1850 ± 210 bc.

Slettabö/Stokkaland series

Charcoal from settlement site at +6m in Slettabö, Stokkaland, Oгна (58° 31' N, 4° 55' E), Rogaland. Coll and subm 1963 to 1974 by Arne Skjölsvold, Univ Oldsaksamling, Oslo. *Comment* (AS): 4 cultural layers were found in site; they reflect different settlement phases from Stone and Bronze age (R, 1972, v 14, p 440).

T-457. Slettabö 1 **2850 ± 100**

Assoc with brittleburnt stones of hearth sunken into sterile subsoil in Sq 8. MASCA age: 1095 ± 175 BC.

T-560. Slettabö 2 **4780 ± 130**

From ash and carbon underlying Layer III in Sq 1a. MASCA age: 3560 ± 170 BC.

T-561. Slettabö 3 **4650 ± 100**

From depth 0 to .15m in Sq 0d. MASCA age: 3440 ± 170 BC.

T-562. Slettabö 4 **2900 ± 100**

From depth .15 to .17m, in Layer I, Sq 1h. MASCA age: 1200 ± 190 BC.

T-1779. Slettabö 5 **4640 ± 130**

From depth 1.2m, Layer III, Sq 6q. MASCA age: 3420 ± 200 BC.

T-1780. Slettabö 6 **4470 ± 120**

From depth 1.2m, Layer III, Sq 3q. MASCA age: 3205 ± 175 BC.

T-1803. Slettabö 7 **4820 ± 180**

From depth 1.2m, Layer III, Sq 0n. MASCA age: 3585 ± 195 BC.

Oddernes church series

Charcoal from various pits in settlement-complex around Oddernes church, Kristiansand, Vest-Agder (58° 10' N, 2° 45' E). T-1498 and -1499 coll 1960 and 1961 by Elizabeth Skjelsvik, Univ Oslo; T-1410 and -1411 coll 1972 by Anne Aure, Univ Oslo; subm 1972 and 1973 by Anne Aure.

T-1410. Pit 78A, No. 6 **1840 ± 70**

From depth .9m in rectangular fireplace at +20m, 0.5m below pit with no finds. *Comment* (AA): date is within span of 3 pits containing charcoal. MASCA age: AD 130 ± 70.

T-1411. Pit 241, No. 31 **1670 ± 80**

From depth .2m in firepit at +20m with brittle stones and 2 sherds of pottery, 1 decorated. *Comment* (AA): date as expected, corresponds with other pits dated by pottery (Böe, 1931). MASCA age: AD 290 ± 110.

T-1498. Pit 4 **1750 ± 70**

From depth .7m in oven pit at +15m, with brittle stones and 70 sherds belonging to 6 to 7 pots of different types, some fingertip decorated.

Comment (AA): pottery with fingertip decoration should not predate AD 300 in Norway (Böe, 1931, p 159). MASCA age: AD 230 ± 90.

T-1499. Pit 18 1740 ± 70

From depth .28m in pit at +15m, with brittle stones, burned bones and a piece of bronze. *Comment* (AA): date as expected. MASCA age: AD 230 ± 90.

Oddernes houseground series

Charcoal from walls and a fireplace in 3 housegrounds at +20m in Oddernes prestegård, Kristiansand, Vest-Agder (58° 9' N, 8° 15' E). Coll 1972; subm 1972 and 1973 by Perry Rolfsen, Univ Mus Nat Antiquities, Oslo. *Comment* (PR): archaeol material scanty and difficult to date, dates slightly older than expected (Rolfsen, 1976).

T-1407. Oddernestuft No. 1/1 1820 ± 80

Depth .55m. MASCA age: AD 160 ± 90.

T-1548. Oddernestuft No. 1/3 1900 ± 60

From fireplace at depth .6m. MASCA age: AD 80 ± 60.

T-1549. Oddernestuft No. 2/1 2010 ± 70

Depth .5m. MASCA age: 65 ± 125 BC.

T-1550. Oddernestuft No. 4/1 1850 ± 70

Depth .6m. MASCA age: AD 130 ± 70.

Skarg houseground series

Charcoal from 4 out of 12 fireplaces in houseground at +532m in Skarg, Tveiten, Bykle, Aust-Agder (59° 9' N, 7° 43' E). Coll 1973 and 1974; subm 1974 by P Rolfsen. *Comment* (PR): dates agree with archaeol material (Rolfsen, 1977).

T-1675. Skargtuft No. 1/1 1090 ± 70

Depth .25m. MASCA age: AD 890 ± 90.

T-1758. Skargtuft No. 1/2 1300 ± 80

Depth .25m. MASCA age: AD 690 ± 100.

T-1759. Skargtuft No. 1/3 990 ± 190

Depth .4m. MASCA age: AD 980 ± 210.

T-1760. Skargtuft No. 1/4 1070 ± 80

Depth .45m. MASCA age: AD 905 ± 105.

Sandöya series, Sund

Charcoal from houseground belonging to Late Iron age settlement on Sandöya I. near Risöya, Sund, Hordaland (60° 10' N, 5° E) (R, 1975, v 17, p 379). Coll 1973 and subm 1974 by Bente Magnus, Hist Mus, Univ Bergen.

T-1591. Sandöya 1, 1x/1y, lag IV 1310 ± 80

From depth .4m in bottom layer of hearth within wall foundations. *Comment* (BM): date agrees with find material (Magnus, 1974). MASCA age: AD 665 ± 95.

T-1592. Sandöya 2, 1x/3y, lag III 1540 ± 110

From depth .3 to .35m near foundation wall. *Comment* (BM): date too old according to find material. MASCA age: AD 440 ± 150.

T-1836. Volsvika, Fjörtoft 1490 ± 110

Peat from depth 1m assoc with asbestos ceramics, dating transition from meadow to heath in Volsvika, Fjörtoft, Haram, Møre og Romsdal (62° 43' N, 6° 23' E). Coll 1968 by P E Kaland, Bot Mus, Bergen; subm 1974 by Bergljot Solberg, Hist Mus, Bergen. *Comment* (BS): date as expected. MASCA age: AD 495 ± 125.

S Kvaløy series

Charcoal from assumed Late Iron age site at +5m at Tussøy, Tromsø, Troms (69° 39' N, 17° 26' E). Site is close to burial place with clear pagan traits. Coll and subm 1972 by Kari Stören, Univ Tromsø. *Comment* (KS): dates older than expected, difference in age between them probably due to 2 building phases.

T-1402. Bö 1 1120 ± 110

Depth .52m in hearth with blackburned stones in SW end of site. MASCA age: AD 850 ± 150.

T-1403. Bö 2 1430 ± 80

From depth .64m between hearth and wall. MASCA age: AD 545 ± 95.

Hoset deserted farm series

Charcoal and 1 peat sample (T-1587) from deserted farm area at +320m to +350m at Hoset, Stjördal, Nord-Trøndelag (63° 24' N, 11° 11' E), relating to different traces of settlement and samples activities, eg, ancient fields, iron production site, houses, graves. Area also analyzed for pollen. Coll 1971 to 1974 by O Farbrege, H Salvesen and K P Buhaug; subm 1971 to 1975 by O Farbrege, DKNVS Mus, Univ Trondheim (Salvesen, 1975a,b).

T-1170. Barrow C 24 1660 ± 220

From scanty cremation layer at depth .5m below surface under cairn ca 3.5 × 2.5m wide, .3m high. *Comment* (OF): date corresponds well with this type of grave, scantily furnished. MASCA age: AD 320 ± 250.

T-1682. Phosphate concentration West 1 380 ± 100

From charcoal concentration, at depth .05m, overlying unexplained stone construction. *Comment* (OF): date is *ante quem* for construction. MASCA age: AD 1510 ± 100.

T-1583. Phosphate concentration West 2 850 ± 70

From charred piece of wood from humus layer at depth .05 to .07m in assumed old field. *Comment* (OF): field not worked after deposition of sample; proved by continuity of many separate charcoal bits. MASCA age: AD 1125 ± 95.

T-1584. Phosphate concentration West 3 1420 ± 80

From depth .5m below surface at base of charcoal (cooking ?) pit containing earth, stones, and charcoal. MASCA age: AD 555 ± 95.

T-1683. Phosphate concentration West 4 1430 ± 70

Charcoal close to T-1584, with different, twisted structure. *Comment* (OF): consistency of T-1584 and -1683 contradict hypothesis that wood of markedly different age was used for fuel in pit. MASCA age: AD 550 ± 90.

T-1585. Slag Heap 1 1840 ± 80

Charcoal (*Pinus*) from base of slag heap below ca .5m slag. *Comment* (OF): age remarkably high, corresponding well with others from same site, and also with recent research results from other iron production sites in S Norway. MASCA age: AD 135 ± 75.

T-1685. Slag Heap 2 1930 ± 80

Charcoal (*Pinus*) .2m above base of slag heap below ca .6m slag. MASCA age: AD 20 ± 120.

T-1586. Slag Heap 3 1860 ± 110

Charcoal (*Pinus*) from upper layer of slag heap below ca .3m slag. *Comment* (OF): date indicates that time span of iron production was relatively short. MASCA age: AD 120 ± 100.

T-1684. Slag Heap 4 1620 ± 70

Charcoal from outer parts of tree (*Pinus*) from bottom of slag heap below ca .6m slag. Distance 3 to 4m from Samples T-1585, -1586, and -1685. *Comment* (OF): date markedly younger than other 3 from same slag heap. Coming from bottom layer, it suggests short use of site. Since all samples are pine, most of other fuel may have been old when used for ore melting. MASCA age: AD 350 ± 90.

T-1925. Barrow C 22 1250 ± 90

From earth filling of 9m wide and .5m high barrow. *Comment* (OF): obviously brought here during building of monument. MASCA age: AD 735 ± 115.

T-1926. Cairn 1330 ± 80

From cremation layer in a cairn 4 × 2.5m wide, also containing calcinated bones, pieces of bone comb and iron fragments. MASCA age: AD 650 ± 80.

2. Bog iron industries

Mösstrand series, Telemark

Charcoal from iron extraction sites at +925 to +950m at Mösstrand, Vinje, Telemark (59° 50' N, 8° 10' E). Coll 1973 and 1974 by Univ Mus Nat Antiquities, Oslo; subm 1973 to 1975 by Irmelin Martens, Univ Mus Nat Ant, Oslo. *Comment* (IM): dates agree with archeol data. Chronology of sites and furnace types in Mösstrand are now firmly established by these and earlier dates (R, 1975, v 17, p 386).

T-1642. Nystaul 31/51 No. 4/1 **1010 ± 70**

Depth ca .2m, on original surface underlying slag heap. MASCA age: AD 965 ± 75.

T-1751. Nystaul 31/51 No. 4/2 **940 ± 80**

Depth .35m, close to furnace. *Comment* (IM): on this site was found piece of 10th century bronze brooch. MASCA age: AD 1045 ± 95.

T-1752. Nystaul 31/51 No. 5/1 **1070 ± 70**

Depth .4 to .5m on original surface underlying slag heap. MASCA age: AD 910 ± 90.

T-1643. Nystaul 31/51 No. 6/1 **910 ± 70**

Depth .4 to .5m on original surface underlying a slag heap. MASCA age: AD 1080 ± 100.

T-2042. Nystaul 31/51 No. 6/2 **1090 ± 50**

Depth .25 to .35m in slag pit close to furnace. MASCA age: AD 890 ± 70.

T-1644. Nystaul 31/51 No. 7/1 **1290 ± 110**

Depth ca .1m on original surface underlying slag heap. MASCA age: AD 695 ± 125.

T-1753. Nystaul 31/51 No. 7/2 **960 ± 80**

Depth ca .1m from charcoal layer below turf. MASCA age: AD 1015 ± 85.

T-1891. S Hovden 35/47 No. 5/1 **850 ± 90**

Depth ca .15m on original surface underlying slag heap. MASCA age: AD 1120 ± 100.

T-1892. S Hovden 35/47 No. 5/2 **1000 ± 90**

Depth .2 to .25m close to bottom of clay furnace. MASCA age: AD 965 ± 105.

T-1645. S Hovden 35/47 No. 13/1 **1430 ± 110**

Depth ca .4m on original surface underlying slag heap. MASCA age: AD 550 ± 120.

T-1646. S Hovden 35/47 No. 13/2 1190 ± 110
 Depth ca .2m in stone lined bowl furnace. MASCA age: AD 785 ± 135.

T-2041. S Hovden 35/47 No. 13/3 1300 ± 60
 Depth ca .35m in furnace. MASCA age: AD 680 ± 80.

T-1647. S Hovden 35/47 No. 14/1 1420 ± 110
 Depth ca .15m on original surface underlying slag heap. MASCA age: AD 555 ± 115.

T-1754. S Hovden 35/47 No. 14/2 1420 ± 80
 Depth .25 to .3m in stone lined bowl furnace. MASCA age: AD 555 ± 95.

T-1927. Holen, bog iron 700 ± 110
 Charcoal from depth .4m in melting furnace at +570m at Brustølhaugen, Holen, Bykle, Aust-Agder (59° 8' N, 7° 17' E). Coll and subm 1974 by P Rolfsen. *Comment* (PR): date younger than expected (Rolfsen, 1977). MASCA age: AD 1255 ± 105.

3. Hunting constructions and localities

Reindeer pitfall series

Samples from pitfalls at different localities in E Norway, to study their construction and practical use. Coll 1972 to 1975 by E K Barth and Jon Vingelen; subm 1973 to 1976 by E K Barth, Norsk Skogbruksmus, Elverum.

T-1711. Fremre Bråkdalshö 1 730 ± 70
 Wood from pointed pole in base of rectangular, stone-sided pitfall at +1480m at Fremre Bråkdalshö, Sel, Oppland (61° 55' N, 9° 36' E). Depth .2m below basal surface. *Comment* (EKB): pole perhaps for impaling animal; date agrees with pitfall at same alt, 2km SE, dated to 670 ± 60 BP, T-885 (R, 1972, v 14, p 447). MASCA age: AD 1245 ± 65.

T-1935. Fremre Bråkdalshö 2 750 ± 200
 Last remains of wood from covering frame work on top of stone sided rectangular pit, depth .2 to .55m below basal surface at +1420m in Rondane, Sel, Oppland (61° 53' N, 9° 37' E). *Comment* (EKB): agrees well with another pitfall 2km N at approx same alt (T-1711). MASCA age: AD 1205 ± 185.

T-1608. Heimare Veslefjell 140 ± 60
 Wood from .08m thick pole in bottom of rectangular stone-sided reindeer pitfall at +1130m at Heimare, Veslefjell, Brennhaug, Oppland (61° 57' N, 9° 21' E). Depth .3m below basal surface. *Comment* (EKB): pole perhaps for impaling animal; pitfall situated close to habitated area, thus expected younger than the others. MASCA age: younger than AD 1640.

T-1572. Lille Ula 2 320 ± 70

Charcoal from last remnants of burned poles from wall construction in oval-shaped pitfall at ±1020m in Lille Ula, Sel, Oppland (61° 51' N, 9° 40' E). Depth .2m below basal surface. *Comment* (EKB): date agrees with 360 ± 90 BP from same pitfall, T-1420 (R, 1975, v 17, p 391) and with charcoal from depth .3m dated by Gif-sur-Yvette Lab, France, to 370 ± 80 BP. MASCA age: AD 1535 ± 95.

T-1880. Tolga østfjell 1160 ± 70

Wood from remnants of construction in very wet boggy soil at base of oval-shaped pitfall at +780m in Trangdalen, Tolga, Hedmark (62° 19' N, 11° 24' E). Depth .6 to .7m below surface. *Comment* (EKB): one of ca 100 pitfalls within 3km distance in birch wood, *ie*, lower than other pits of same type (Barth, 1974). MASCA age: AD 805 ± 105.

T-2155. Gravskaret 990 ± 50

Last remains of wood from covering frame work on top of stone-sided rectangular pit, depth .15m below basal surface at +1482m in Gravskaret, Alvdal, Hedmark (61° 57' N, 10° 10' E). *Comment* (EKB): one of oldest known dates for pitfalls of this type (R, 1975, v 17, p 391). MASCA age: AD 985 ± 55.

T-2210. Illmandalen 720 ± 50

Humus and wood from last remains of frame work on top of stone-sided rectangular pit, depth .4m below basal surface at +1270m in Illmandalen, Sel, Oppland (61° 53'' N, 9° 49' E). *Comment* (EKB): pitfalls in Rondane seem not to have been in use after the Black Death.

T-2154. Breisjøen 640 ± 50

Humus from distinct layer in stone-sided oval pit, depth .5 to .58m below basal surface at +950m in Alvdal, Hedmark (61° 58' N, 10° 15' E). MASCA age: AD 1300 ± 60.

T-1879. Ledsageren/Hirkjölen 340 ± 60

Wood from .2 to .3m-thick logs horizontally bonded together in rectangular shape, forming elk (*Alces alces*) pit fall at +730m at Ledsageren, Stor-Elvdal, Hedmark (61° 45' N, 10° 38' E). Depth .1m below surface; pit filled with boggy soil and wake. *Comment* (EKB): 1st dating of elk pitfalls in Norway (Barth, 1974). MASCA age: AD 1520 ± 90.

T-1804. Fåset I 710 ± 90

Charcoal (pine) from depth 2.5m in 1 out of ca 500 elk (*Alces alces*) pitfalls at Fåset, Tynset, Hedmark (62° 16' N, 10° 40' E). Coll and subm 1974 by Ivar Streitlien, Tynset. MASCA age: AD 1260 ± 80.

T-715. Lesja animal trap 1230 ± 80

Wood (*Pinus*) from wooden structure in animal pit at +950m in Svartdalen, Lesja, Oppland (62° 16' N, 8° 50' E). Coll 1968 by Øystein

Mölmen, Eidsvoll; subm 1968 by Norsk Skogbruksmus, Elverum. *Comment* (NS): date as expected. MASCA age: AD 750 ± 100.

T-2136. Lomseggen 1350 ± 60

Wood (*Salix*) from drift fence directing deer toward hunter's hiding-place at +2000m in Skjåk, Oppland (61° 49' N, 8° 17' E). Coll and subm 1976 by Ö Mølmen. *Comment* (ÖM): date reasonably agrees with estimated age. MASCA age: AD 630 ± 60.

4. *Miscellaneous archaeological samples*

Small oval mounds series

Small oval mounds of earth heaped up by windfalls are widespread and commonly known, similar formations covering pits or layers may be man-made, perhaps simple graves. Charcoal from mounds in Nes, Sunndal, and Engdal, Aure, Møre og Romsdal (63° 11' N, 8° 45' E). Coll 1973 and 1974; subm 1974 by O Farbregd. *Comment* (OF): dates refer 2 such formations to period characterized by simple cremations graves and scarcity of finds. This strengthens hypothesis that some mounds may be graves (Farbregd, 1975).

T-1805. Nes 2560 ± 100

From mound at +20m, .7m below surface. MASCA age: 715 ± 185 BC.

T-1806. Engdal 1750 ± 70

From mound at +100m, ca .2m below surface. MASCA age: AD 230 ± 90.

Bog platform series

In recent years a series of similar finds were made in bogs in Trøndelag area, *viz*, round wooden platforms 1.5 to 6m wide, made of split logs. Wooden tools like spades, forks, troughs and strange cruciform objects were found in connection with the platform. Function and age of these constructions were unknown. Excavations gradually offered evidence that they were bottoms of a special kind of tar kiln. Written records and current ethnographic evidence confirm this explanation. Samples, except T-1680, are wood from outer part of platform, probably *Pinus*. Coll 1972 and 1973; subm 1972 to 1974 by O Farbregd.

T-1496. Glåmen 900 ± 110

From ca 1.6m wide platform, preserved in bottom of ca .5m deep bog at +90m in Glåmen, Halså, Møre og Romsdal (63° 07' N, 8° 20' E). *Comment* (OF): date older than others in series. May indicate that platforms, although most widely used in post-Reformation period, may be older (Farbregd, 1973, 1976; Hafsten, 1974; Dybdahl, 1976). MASCA age: AD 1085 ± 125.

T-1497. Lund 310 ± 70

From ca 1.8m wide platform at depth .6m in bog at +30m in Lund, Meldal, Sör-Trøndelag (63° 31' N, 9° 45' E). MASCA age: AD 1540 ± 100.

T-1581. Haset Platform 4 270 ± 70

From ca 1.7m wide platform at depth .5m in bog Raudmyra at ca +220m in Haset, Malvik, Sör-Trøndelag (63° 24' N, 10° 41' E). MASCA age: AD 1560 ± 90.

T-1582. Haset Platform 6 180 ± 100

From ca 2m wide platform at depth .2m in bog Raudmyra. MASCA age: younger than AD 1520.

T-1679. Litsaetertjørna 1 280 ± 70

From ca 5m wide, large platform at depth ca .6m in bog at +320m at Litsaetertjørna, Stjørdal, Nord-Trøndelag (63° 32' N, 10° 59' E). MASCA age: AD 1555 ± 95.

T-1680. Litsaetertjørna 2 200 ± 70

Wood from young tree, from handle of fork found under platform dated by T-1679. *Comment* (OF): in satisfactory agreement with T-1679. MASCA age: AD 1660 ± 140.

T-1681. Litsaetertjørna 3 410 ± 100

From ca .2m wide platform at depth ca 1m in bog at Litsaetertjørna. MASCA age: AD 1500 ± 110.

Antler mattock-heads series

Elk (*Alces alces*) and deer antlers from bogs in E Norway. Different pieces were selected for dating and compared with pollen- and typologic dating to strengthen chronologic framework on Norwegian finds of antler mattock-heads (Brögger, 1938; Mikkelsen & Höeg, 1977). Subm 1975 by Egil Mikkelsen, Univ Mus Natl Antiquities, Oslo. *Comment* (EM): dates agree very well with pollen analysis.

T-2130. Östen, Gran 7300 ± 100

Elk antler mattock-head from bog at ca +245m in Östen, Gran, Oppland (60° 29' N, 10° 29' E). Coll in 19th century and brought to Univ Mus Nat Antiquities, Oslo 1889.

T-2131. Viul 7690 ± 90

Deer antler from depth 2 to 3m in bog at +120 to 145m in Viul, Ringerike, Buskerud (60° 12' N, 10° 20' E). Coll 1891 or 1893 by unknown collector. Other finds: deer antler mattock-head, crania of deer and fish-bones.

T-2132. Lunden 2970 ± 70

Elk antler mattock-head from marsh-soil near pond found during plowing in Lunden, Ringsaker, Hedmark (60° 57' N, 10° 47' E). Coll 1957 by Freddy Løje-Jensen, Veldre. MASCA age: 1275 ± 125 BC.

T-2133. Alstad 3000 ± 80

Elk antler mattock-head probably from bog, found in 19th century and brought to Univ Mus Nat Antiquities in 1868, from Alstad, Östre Toten, Oppland (60° 41' N, 10° 50' E). MASCA age: 1315 ± 145 BC.

Hov elk antler series

Elk (*Alces alces*) antler in light silt and mud at +250m from Hov, Lötén, Hedmark (60° 49' N, 11° 21' E). T-513 coll 1965 by Gunnar Söberg, Lötén. T-1824 coll 1974 by Johan Skårholen, Lötén; subm 1965 and 1974 by Norsk Skogbruksmus, Elverum (Henningsmoen, 1975).

T-513. Hov 1 8060 ± 160

Depth 1.70m.

T-1824. Hov 2 8520 ± 140

Depth 1.85m.

Urnes series

Wood from Urnes stave church, built ca AD 1150 at Urnes, Luster, Sogn og Fjordane (61° 18' N, 7° 19' E). Coll 1974 by Hans Granum, Dept Bldg Tech, Univ Trondheim; subm 1974 by H Granum and Håkon Christie, The Central Office of Historic Monuments, Oslo. *Comment* (HC): dates older than expected.

T-1776. Urnes 1 980 ± 70

From N end of W nave raft beam. MASCA age: AD 995 ± 75.

T-1777. Urnes 6 1120 ± 110

From NE post in chancel, used in an older building. MASCA age: AD 850 ± 150.

T-1778. Urnes 9 1010 ± 70

From roof boarding, in nave. MASCA age: AD 965 ± 75.

Lom series

Wood from walls of church, recycled when present church was built ca AD 1180 at Lom, Oppland (61° 50' N, 8° 34' E). Coll 1973 and subm 1974 by H Christie. *Comment* (HC): dates older than expected.

T-1843. Lom 1 1210 ± 80

From beam on which posts of earlier church rested. MASCA age: AD 765 ± 115.

T-1845. Lom 10 1350 ± 120

From post belonging to earlier church. MASCA age: AD 625 ± 135.

T-1984. Lom 3 1130 ± 70

Same as for T-1845. MASCA age: AD 835 ± 105.

T-1985. Lom 4 1220 ± 130

Same as for T-1845. MASCA age: AD 765 ± 145.

T-1986. Lom 7 1220 ± 80

Same as for T-1845. MASCA age: AD 750 ± 100.

T-2052. Haukåsmyra 1140 ± 80

Wood from dugout canoe from depth 2m found during ditching of marsh, previously a pond, at +370m in Åsvang, Stange, Hedmark (60° 43' N, 11° 24' E). Coll 1974 by Nikolai Sjöli, Stange; subm 1975 by Norsk Skogbruksmuseum. *Comment* (NS): date considerably younger than indicated by pollen analysis. MASCA age: AD 835 ± 105.

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ERRATUM

In our previous date list, Trondheim VII (R, 1975, v 17, p 377) the date for T-1452 should be corrected from 600 ± 120 BP to 2420 ± 140 (470 BC).