

ANTWERP UNIVERSITY RADIOCARBON DATES III

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The following list contains most of the measurements made during 1977, since our last list (R, 1977, v 19, p 383-388). The laboratory procedures used were those outlined in the previous date lists (R, 1976, v 18, p 151-160; R, 1977, *op cit*). Dates are calculated using ^{14}C half-life of 5568 yr and errors are reported as one-standard deviation. The collagen extraction follows Longin (1970).

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Belgium

ANTW-227. Leffinge 2 **3570 $\pm$ 60**

Peat from layer 120cm below surface (51° 8' 40" N, 2° 52' 15" E). Coll Aug 1976 by R. Paepe. *Comment* (RV): age corresponds roughly with expected age, and indicates peat growth halted at end of Sub-boreal.

Lampernisse series

ANTW-245. Lampernisse B68, 225-230 **4050 $\pm$ 180**

Wood and peat from layer 220cm thick. Sample from 225 to 230cm below surface (51° 02' 10" N, 2° 45' 10" E). Coll June 1975 by C. Baeteman. *Comment* (RV): submitter expected a date of 4200 BP, because sample was taken in lower half of layer, which began to develop at Atlanticum-Sub-Boreal transition.

ANTW-244. Lampernisse B68, 490-514 **5590 $\pm$ 80**

Clayey peat sample from 490 to 514cm below surface (51° 02' 10" N, 2° 45' 10" E). Coll June 1975 by C. Baeteman. *Comment* (RV): Atlantic age was expected, because layer was included in Calais layer, underlying Holland peat.

ANTW-248. Lampernisse B71, 84 **2040 $\pm$ 60**

Peat from layer 200cm thick at 84cm below surface (51° 01' 52" N, 2° 45' 50" E). Coll 1975 by C. Baeteman. *Comment* (RV): from sample belonging to top of Holland peat, we coll data of arrested peat development, which probably ranged from end of Sub-Boreal to 4th century AD.

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ANTW-249. Lampernisse B71, 280 4640 ± 65

Peat from layer 200cm thick at 280cm below surface (51° 01' 52" N, 2° 45' 50" E). Coll 1975 by C Baeteman. *Comment* (RV): dates beginning of peat formation in Belgian coastal plain and confirms opinion that peat development started at Atlantic-Sub-Boreal transition.

ANTW-250. Lampernisse B71, 370 5100 ± 140

Peat at 370cm below surface of layer 30cm thick (51° 01' 52" N, 2° 45' 50" E). Coll June 1975 by C Baeteman. *Comment* (RV): date of top of peat layer, included in Calais layer, reveals that peat formation stopped in last phase of Atlantic period, as expected.

ANTW-251. Lampernisse B71, 400 5310 ± 190

Peat at 400cm below surface of layer 30cm thick (51° 01' 52" N, 2° 45' 50" E). Coll June 1975 by C Baeteman. *Comment* (RV): date of base of peat layer included in Calais layer, reveals that peat formation began in Atlantic period, as expected. According to dates ANTW-250 and -251, peat growth occurred quickly, mean rate being ca 1.4mm yr⁻¹.

ANTW-214. Lampernisse 93a, Point 189 3110 ± 80

Wood from a pine trunk lying horizontally in peat layer of Belgian coastal plain 170cm below surface (51° 01' 20" N, 2° 49' 50" E). The trunk contained 89 annual rings and was divided into 3 secs for determination. Coll 1951 by R Vanhoorne.

TABLE 1

Description	Date yr BP	Recalculated date		$\bar{x} - \bar{x}$	$(\bar{x} - \bar{x})^2$
Outer 17 rings	3040 ± 50	(3040-9) ± 50	3031 ± 50	83	6889
Intermediate 27 rings	3150 ± 60	(3150-31) ± 60	3119 ± 60	5	25
Inner 45 rings	3260 ± 55	(3260-67) ± 55	3193 ± 55	79	6241

Comment (RV&MVS): assuming that each date can be related to central ring of each sec, we can recalculate the results in function of the outermost annual ring (Table 1). With recalculated dates the error of chemistry can be rechecked (R, 1976, v 18, p 151-152).

$$\text{mean value} = \bar{X} = \frac{\sum X}{n} = 3114 \text{ yr}$$

$$\text{one standard deviation: } s = \sqrt{\frac{(\bar{x} - \bar{x})^2}{n-1}} = 81 \text{ yr}$$

$$\text{error}_{\text{measured}}^2 = \text{error}_{\text{chemistry}}^2 + \text{error}_{\text{counting}}^2 \quad (\text{Wyld, 1970})$$

$$\text{error}_{\text{chemistry}} = \sqrt{\text{error}_{\text{measured}}^2 - \text{error}_{\text{counting}}^2}$$

mean error due to counting statistics alone: 55 yr

$$\text{error}_{\text{chemistry}} = \sqrt{81^2 - 55^2} = 59 \text{ yr}$$

which implies a reduction of 54%

Date fits well with peat age deducted from pollen diagram (Stockmans & Vanhoorne, 1954, p 136), in which end of Sub-Boreal is indicated between 170 to 160cm below surface. No *Fagus* was found at 1.70m, while 10cm higher, *Fagus* appears, for 1st time in pollen diagram, continuing its presence to top of peat in an uninterrupted curve, attaining 30% at top.

Zandvoorde series

ANTW-228. Zandvoorde 9 3000 ± 55

Peat from layer 150cm thick, at 450cm below surface (51° 12' 30" N, 2° 58' 30" E). Coll Aug 1976 by C Baeteman. *Comment* (RV): date reveals that peat growth halted at very end of Sub-Boreal, i.e. 500 years later than at Leffinge (ANTW-227).

ANTW-Zandvoorde 11 6750 ± 125

Peat layer 950cm below surface (51° 12' 30" N, 2° 58' 30" E). Coll Aug 1976 by C Baeteman. *Comment* (RV): date reveals that peat, embedded in Calais layer, developed in Atlantic period, which corresponds with opinion that Calais layer was deposited by Calais transgression in Atlantic period.

Paal series

ANTW-254. Paal 1-C, 60-65 9400 ± 200

Peat, 60 to 65cm below surface (51° 03' 34" N, 05° 09' 41" E). Coll Sept 1975 by L Beyens & R Vanhoorne. *Comment* (LB): date agrees with Pre-Boreal age, indicated by pollen analysis. Vegetation type was a *Betula-Pinus* forest.

ANTW-255. Paal 1-C, 85-90 10,120 ± 155

Peat, 85 to 90cm below surface (51° 03' 34" N, 05° 09' 41" E). Coll Sept 1975 by L Beyens & R Vanhoorne. *Comment* (LB): no pollen was found in sample. Palynologic analysis of sec between 80 and 70cm points to younger Dryas period.

Wortel series

Peat layer 0 to 435cm below surface (4° 47' 36" N, 51° 23' 52" E). Coll Feb 1977 by L Beyens, C Verbruggen, and M Van Strydonck.

ANTW-261. Wortel 1, 85-95 3990 ± 130

Sample from 85 to 95cm below surface.

ANTW-262. Wortel 1, 125-140 4680 ± 75

Sample from 135 to 140cm below surface.

ANTW-263. Wortel 1, 185-190 5980 ± 80

Sample from 185 to 190cm below surface.

ANTW-264. Wortel 1, 275-280 7950 ± 95

Sample from 275 to 280cm below surface.

ANTW-265. Wortel 1, 355-360 9060 ± 115

Sample from 355 to 360cm below surface.

General Comment (LB): date of ANTW-261 confirms Sub-Boreal age. At 80cm pollen diagram shows 1st appearance of *Cerealia*. No typical Atlantic sequence is present: maximum 15% mixed oak forest, probably caused by over-representation of *Alnus* and *Betula*, due to ecologic conditions. ANTW-262 date is difficult to confirm but should be early Sub-Boreal age. ANTW-263 indicates Atlantic age. ANTW-265 date fits well in pollen diagram: 70% *Pinus* and expansion of *Corylus* reveals a Boreal age. Elements of mixed oak forest appears in very small quantities.

Bergen-Bruggen series

Peat layer 100 to 330cm below surface (51° 26' 23" N, 4° 45' 47" E). Coll June 1977 by L Beyens, C Verbruggen, and M Van Strydonck.

ANTW-271. Bergen-Bruggen, 195 7060 ± 90

Wood, embedded in peat 195cm below surface.

ANTW-274. Bergen-Bruggen, 210-230 8420 ± 110

Peat, 210 to 230cm below surface.

ANTW-275. Bergen-Bruggen, 230-250 8850 ± 120

Peat, 230 to 250cm below surface.

ANTW-272. Bergen-Bruggen, 250-270 9510 ± 175

Peat, 250 to 270cm below surface.

ANTW-276. Bergen-Bruggen, 270-290 9390 ± 100

Peat, 270 to 290cm below surface.

ANTW-270. Bergen-Bruggen, 290-310 9510 ± 200

Peat, 290 to 310cm below surface.

ANTW-273. Bergen-Bruggen, 310-330 10,230 ± 320

Peat, 310 to 330cm below surface.

General Comment (LB): dates seem acceptable in light of present knowledge of Wortel-1 peat sec. ANTW-272 date is slightly too old, but can still fit in series when error is considered. Pollen analysis of sec is under study.

ANTW-204. Rijkevorsel R/2 1100 ± 240

Soil, 45 to 55cm below surface (51° 20' 39" N, 4° 45' 34" E). Coll May 1976 by J Maes. *Comment* (CV & MVS): extracted humic acid was dated, indicating beginning of formation of soil plugging.

Deinze series**ANTW-241. Deinze-market place 860 ± 50**

Sample from infilled ditch at market place of Deinze, 120cm below surface (50° 59' 18" N, 3° 3' 53" E). Coll 1976 by C Verbruggen. *Com-*

ment (CV): date agrees with pollen analysis of adjoining buried soil surface.

ANTW-256. Deinze 3 6380 ± 135

Wood, 700cm below surface (50° 59' 32" N, 3° 32' 32" E). Coll 1977 by C Verbruggen.

ANTW-257. Deinze 2 5870 ± 90

Peat, 640 to 660cm below surface (50° 59' 32" N, 3° 32' 32" E). Coll 1977 by C Verbruggen.

ANTW-258. Deinze 1 7360 ± 80

Shells, 610 to 640cm below surface (50° 59' 32" N, 3° 32' 32" E). Coll 1977 by C Verbruggen.

General Comment (CV & MVS): pollen analysis, showing Atlantic spectra, confirms dates of Deinze 2 and 3. The date of Deinze 1 is too old, as expected (Thommeret, 1976; Keith & Anderson, 1964; Broecker, 1964).

ANTW-201. Mammoth tusk, Dendermonde 29,880 ± 930

Collagen extract of a mammoth tusk 1000cm below surface in coarse sand (51° 02' 08" N, 04° 05' 18" E). Coll 1970 by H De Potter. *Comment* (RV): age is younger than expected, because sediments bearing mamalia bones were placed (De Moor, 1974) at beginning of Pleniglacial A (72,000 to 60,500 BP). However, environmental conditions of end of Denekamp interstadial, corresponding with obtained date, were favorable to proliferation of mammoth.

Ipenrooi-Hoogstraten series

ANTW-209. Ipenrooi 2', 60-70 7880 ± 85

Peat from layer 60 to 70cm below surface (51° 29' 50" N, 4° 45' 14" E). Coll Oct 1975 by J Janssens & R Vanhoorne. *Comment* (RV): date is 3500 years too young because pollen diagram reveals pine phase of Alleröd, characterized by dominance of pine over birch in a woody landscape, in which no thermophilous trees were growing. Rejuvenation is certainly due to contamination by younger plant material, observable in microscopic secs of the wood, perforated by later growing water plant roots.

ANTW-208. Ipenrooi 2', 105 9130 ± 25

Peat from layer 105cm below surface (51° 29' 50" N, 4° 45' 14" E). Coll Oct 1975 by J Janssens and R Vanhoorne. *Comment* (RV): date does not correspond with age deduced from pollen diagram. Palynoflora indicates open birch wood without thermophilous trees existing at beginning of Alleröd; date ca 11,800 yr BP was expected.

ANTW-246. Wambeek B2/25 6520 ± 100

Peat with clay and lime 450cm below surface (50° 51' 30" N, 4° 10' 00" E). Coll Feb 1977 by W Huybrechts. *Comment* (RV): scarcity of

pollen grains in sediment prevents confirmation of date of 1st half of Atlantic period. But palynoflora indicates a woody landscape, in which *Pinus*, *Alnus*, *Betula*, and *Corylus* were growing.

ANTW-247. St-Martens Bodegem B2/28 11,240 ± 90

Peat in clay and lime 460cm below surface (50° 51' 30" N, 2° 13' 00" E). Coll Feb 1977 by W Huybrechts. *Comment* (RV): palynoflora, containing 40% of arboreal pollen, points to open park landscape in which *Betula* was dominant. *Salix*, *Corylus*, and *Pinus* completed the forest vegetation. Based on the opinion that 2nd half of Alleröd was characterized by dense *Pinus-Betula* wood, date seems to be ca 200 yr too young.

ANTW-285. Ruysbroek 233 P1-μ8 4440 ± 80

Peat and wood at 247cm below surface (51° 05' 00" N, 4° 21' 16" E). Coll 1973 by J Geys. *Comment* (RV): Sub-Boreal date corresponds with expectations of submitter. Pollen spectrum shows dominance of *Quercetum mixtum* with high percentages of *Alnus* and ca 10% *Corylus*. Only few *Ericales* and *Gramineae* have been found. *Fagus* was totally absent. Therefore it is hard to conclude on basis of pollen-analysis that peat layer was deposited in Atlanticum or Sub-Boreal.

B. Scotland

Cairngorm Estate series

ANTW-220. Site 10, Sample 15 6210 ± 120

Trunk from pine stump from eroded blanket bog between Allt a' Choire Chais and Caochan Dubh a' Chadha; alt, +570m (57° 08' 09" N, 3° 40' 44" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): growth was slow in 1st 30 yr, growth rings averaging no more than 0.7mm/yr. Thereafter girth increased fairly rapidly (average growth ring: 1.85mm) and after 45 yr, trunk diam was 8cm. Age determination is based on cross-sec covering complete time span.

ANTW-221. Site 11, Sample 16 4150 ± 70

Trunk from pine stump in eroded blanket bog above Cochan Dubh a' Chadha; alt, +545m (57° 08' 13" N, 3° 40' 51" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): tree just managed to survive, for growth rings averaged 0.3mm/yr in 1st 70 yr. Between 65 to 75 yr, a number of wider growth rings of up to 2mm are present, but thereafter, width decreases again. The tree lived at least 90 yr. Age determination is based on cross-sec covering complete time span.

ANTW-222. Site 22-1, Sample 17 1190 ± 55

Root from pine stump 30cm from surface of accumulation of peat 1.5m thick overlying river gravel Caochan Dugh a' Chadha; alt, +530m (57° 08' 13" N, 3° 41' 11" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): although pine disappeared from surrounding slopes

thousands of yr previously, this sheltered valley above tree-line was able to support a number of individual trees up to the present.

ANTW-236. Site 22-2, Sample 18 5690 $\pm$ 60

Root from pine stump at base of accumulation of peat 1.5m thick overlying river gravel Caochan Dubh a' Chadha; alt, +530m (57° 08' 13" N, 3° 41' 11" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): date indicates Dubh a' Chadha stream was already in existence in Atlantic times.

ANTW-259. Site 12-1, Sample 19 3940 $\pm$ 95

Trunk from pine stump in eroded blanket bog 2.5 to 3m thick above Caochan Dubh a' Chadha, alt, +560m (57° 08' 23" N, 3° 41' 11" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): stump, 14cm in diam excluding bark, underlain by 40cm peat. While growth was slow (growth rings frequently no more than 0.3mm wide and, at most, 1.8mm wide) tree lived at least 160 yr. Age determination is based on cross-sec covering complete time span.

ANTW-269. Site 12-2, Sample 20 4450 $\pm$ 140

Root from pine stump in eroded blanket bog 2.5 to 3m thick above Caochan Dubh a' Chadha; alt, +560m (57° 08' 23" N, 3° 41' 11" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): while stump was underlain by 75cm peat, age is younger than ANTW-259. Trunk 16cm in diam excluding bark.

ANTW-277. Site 3, Sample 21 3940 $\pm$ 60

Root from pine stump overlain by 80cm blanket bog between Creagan Dubh and Allt Clais a' Mhèirlich; alt, +660m (57° 08' 38" N, 3° 38' 40" W). Coll 1975 by D K Ferguson, J and P D'hondt. *Comment* (DKF): age based on wood between 60th and 145th growth rings. Evidence for fire in form of charcoal was found 60 to 80cm below surface.

ANTW-278. Site 19, Sample 22 2670 $\pm$ 65

Root from pine stump from eroded blanket bog between Allt Ban and Allt na Ciste; alt, +485m (57° 09' 12" N, 3° 39' 15" W). Coll 1975 by L Beyens and D K Ferguson. *Comment* (DKF): relatively old age from site no more than 15m above present tree-line could indicate tree-line did not extend above 470m in recent past. More age determinations are required to confirm this supposition.

C. France

ANTW-225. Loon Plage 2440 $\pm$ 50

Wood in marine sands 1600cm below surface (51° 00' 32" N, 2° 10' 30" E). Coll Oct 1976 by R Vanhoorne. *Comment* (RV): date with opinion that marine sands containing some wood and peat were deposited during Flandrian transgression.

ANTW-243. Pont des Grenouilles 1890 ± 80

Peat from top of layer 110 to 120cm below surface (51° N, 2° 16' E). Coll 1977 by J Sommé. *Comment* (RV): peat layer from French coastal plain, covered by marine sands with shells (*Cardium edule*) overlain by a layer with Medieval pottery and a skeleton of *Bovidae*. Date, pointing to a Sub-Atlantic age, agrees with pollen diagram characterized by continuous *Fagus* curve.

*D. Malaysia***ANTW-266. Dengkil Log 11/1, Sample 1 1945 ± 110**

Wood, at 700cm below surface (2° 53' 30" N, 101° 43' E). Coll Feb 1977 by B C Batchelor.

ANTW-282. Dengkil Log 11/1, Sample 2 1700 ± 95

Wood, at 700cm below surface (2° 53' 30" N, 101° 43' E). Coll Feb 1977 by B C Batchelor.

ANTW-283. Lombong Sharikat Galian Gangganegara No. 2, Sample G G 25 8670 ± 200

Wood, from layer 100 to 500cm below surface (40° 23' 45" N, 100° 35' 55" E). Coll 1977 by B C Batchelor.

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