

**NATIONAL PHYSICAL LABORATORY
RADIOCARBON MEASUREMENTS VI**

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The following list comprises measurements made since those reported in NPL V.

No changes have been made in measurement technique or in the method of calculating results described in NPL III.

Ages are given relative to A.D. 1950 and a half-life of 5568 yr has been assumed. Measurements, corrected for fractionation relative to the P.D.B. standard, are referred to 0.950 times the activity of the NBS oxalic acid as contemporary reference standard. The quoted uncertainty is one standard deviation and includes an additional uncertainty equivalent to a standard deviation of 80 yr for the de Vries effect, but excludes the uncertainty of the half-life. Should a net sample count rate be less than 4 times the standard error of the difference between the sample and background count rates a lower limit to the age would be reported corresponding to a net sample count rate of 4 times the standard error of this difference.

The description of each sample is based on information supplied to the laboratory by the person submitting the sample.

ARCHAEOLOGIC AND GEOLOGIC SAMPLES

A. England

Oxbow Opencast Coal site, Yorkshire

Incisor (tusk) of (*Mammuthus (Elephas) primigenius*) from silt bed within gravels at Oxbow Opencast Coal site (53° 46' 02" N Lat, 01° 28' 04" W Long), in Aire Valley near Leeds, Yorkshire. Coll. 1964 and subm. by G. D. Gaunt, Inst. of Geol. Sci. *Comment* (G.D.G.): stratigraphical position of silt bed suggests deposition during Weichselian Glaciation some time prior to phase of crysturbation diagnostic of extremely cold conditions. Included insect and floral remains, examined by G. R. Coope (Univ. of Birmingham) and J. W. Franks (Univ. of Manchester) respectively, indicate a tundra environment, insects being similar to those from Brandon Terrace, Warwickshire (NPL-87, 28,200 $\pm$ 500; NPL-IV), Tame Valley, Warwickshire and Fladbury, Worcestershire, (GrN-1269, 38,200 $\pm$ 700; GrN VI), all referable to the 'Upton Warren Interstadial.' Although tusk may have been derived and therefore older than silt bed, date still falls within range of this interstadial (Coope and Sands, 1966).

NPL-163 A. Oxbow site

Calcium carbonate from outer part of tusk. Yielded age ca. 10,000 yr.

	+1720
	38,600
	—1420
NPL-163 B. Oxbow site	36,650 B.C.
Organic carbon fraction from inner part of tusk.	$\delta C^{13} = -22.1\text{‰}$
	>30,300
NPL-163 C. Oxbow site	$\delta C^{13} = -22.1\text{‰}$
Organic carbon fraction from outer part of tusk.	

NPL-126. Middle Hope, Weston Super Mare, Somerset

Shell fragments from raised beach at N Side Middle Hope (51° 22' N Lat, 2° 59' W Long), Weston Super Mare. Coll. 1965 and subm. by Prof. A. Wood, Univ. College of Wales, Aberystwyth. *Comment* (A.W.): this unconsolidated shell-sand represents beach deposit of Swallow Cliff time, corresponding to main aggradation of Severn. Date confirms those suggested by Donovan in 'Sea Levels of the Last Glaciation' (Donovan, 1962).

	+1690
	38,990
	—1390
NPL-126 A. Middle Hope	37,040 B.C.
Inner fraction.	$\delta C^{13} = +1.0\text{‰}$
	+760
	33,240
	—700
NPL-126 B. Middle Hope	31,290 B.C.
	$\delta C^{13} = -4.1\text{‰}$

Middle fraction. *Comment* (W.J.C. and G.I.H.): 1/3 of sample was leached away and from remaining 2/3, two samples were prepared, called inner and middle. The difference in ages for these samples suggests contamination and dates must be regarded as notional only.

Devoke Water series, SW Cumberland

Samples from core of lake mud from Devoke Water (54° 21' N Lat, 3° 16' W Long), between valleys of rivers Duddon and Esk, S.W. Cumberland. Coll. 1965 and subm. by Winifred Pennington (Mrs. T. G. Tutin), Bot. Dept., Univ. of Leicester. *Comment* (W.P.): although inversion of relative age of sediments is not uncommon in this district, consistent dates have been obtained in history of Devoke Water, substantiating Late Romano-British age of major episode of clearance (Pennington, 1964); this dismisses possibility that cause of accelerated soil erosion at this horizon was general climatic deterioration, deduced from

accelerated growth of peat bogs between 800 and 500 B.C. more than 1000 yr earlier. This series of dates, together with evidence previously obtained, shows that at alt. of Devoke Water, *viz.*, 766 ft, dominant factor determining course of soil history and lake sediments was modification of vegetation type, which can only be interpreted as brought about by man (Pennington, 1964).

NPL-117. Devoke Water 1, depth **1750 ± 130**
220 to 230 cm **A.D. 200**
 $\delta C^{13} = -25.2\%$

Represents pre-erosion period of temporary forest clearance; subsequent regeneration of birch and oak, and persistence of elm, indicates this episode was not accompanied by severe soil degradation.

NPL-118. Devoke Water 2, depth **1370 ± 190**
200 to 210 cm **A.D. 580**

Represents horizon of forest regeneration after clearance of Sample 1 and immediately before main erosion episode. Date shows last time at which soil and climate at this site permitted forest regeneration. Sample diluted, and no δC^{13} measurement made.

NPL-119. Devoke Water 3, depth **1585 ± 130**
185 to 195 cm **A.D. 365**
 $\delta C^{13} = -20.3\%$

Represents horizon of inwash of mineral soil and mor humus rich in *Calluna* pollen. This coincides with episode of forest clearance of much more extensive character than any previous clearance, and with 1st appearance of continuous curve for pollen of cultivated cereals, sample represents end of continuous curve for *Ulmus* pollen at this site. For this reason alone date is of interest.

NPL-120. Devoke Water 4, depth **1620 ± 130**
167 to 177 cm **A.D. 330**
 $\delta C^{13} = -27.2\%$

Immediately above erosion horizon from within same vegetation episode as Sample 3, with non-tree pollen dominant, and continuous curves for pollen of clearance indicators, plantain, bracken, and cultivated cereals.

NPL-116. Burnmoor Tarn, SW Cumberland **1560 ± 130**
A.D. 390
 $\delta C^{13} = -28.9\%$

Lake mud from core at depth 137 to 147 cm below mud surface from Burnmoor Tarn (54° 25' N Lat, 3° 15' W Long), at alt. 832 ft between river valleys of Eskdale and Wasdale, SW Cumberland. Coll. 1965 and subm. by Winifred Pennington. *Comment* (W.P.): date obtained is consistent, as was expected, with dates from Devoke Water

NPL-117 to NPL-120 (of this list) and supports contemporaneity of these 2 sites. At both sites visible change in stratigraphy of lake sediments at this horizon indicates major change in erosion rate of drainage basin (Pennington, 1965).

3040 ± 140

1090 B.C.

$\delta C^{13} = -27.2\%$

NPL-124. Seathwaite Tarn (ii), N Lancashire

Lake mud from core at depth 252 to 277 cm below mud surface from Seathwaite Tarn (54° 22' N Lat, 3° 9' W Long), at alt. 1210 ft in valley of Tarn Beck, N Lancashire. Coll. 1965 and subm. by Winifred Pennington. *Comment* (W.P.): date refers to clearance episode in vegetation history of Seathwaite Tarn much earlier than episode dated by NPL-117 to NPL-120 and NPL-116. Accelerated erosion of mineral soils accompanied partial deforestation at this horizon. Date is consistent with distribution of this clearance episode, typical where Bronze Age burials are frequent (Pennington, 1964).

Grimthorpe series, E Riding, Yorkshire

Sample from 2 unidentified animal bones from ditch of Iron-age hillfort, assoc. with Iron-age pottery at Grimthorpe (53° 55' 36" N Lat, 0° 45' 12" W Long), Yorkshire. Coll. 1961 by I. M. Stead and subm. by L. Biek, Ministry of Public Buildings and Works.

General Comment (I.M.S.): there are few established landmarks in British Iron-age chronology, and dating of pottery without assoc. metalwork can be proposed only in very broad terms. Both dates are considerably earlier than expected from archaeological evidence, viz., between 400 B.C. and 100 B.C. (Stead and Dymond, 1959).

2640 ± 130

690 B.C.

$\delta C^{13} = -20.0\%$

NPL-136. Grimthorpe

Sample G. Br., found a few ft immediately above NPL-137.

2920 ± 130

970 B.C.

$\delta C^{13} = -22.2\%$

NPL-137. Grimthorpe

Sample G. Ca., found a few ft immediately below NPL-136.

NPL-115. Braunton Burrows, N Devon

>40,800

Barnacles (*Balanus balanoides*) from surface of rock abrasion platform at Braunton Burrows (51° 07' 06" N Lat, 04° 14' 22" W Long), Devon. Coll. 1965 by A. Heyworth and subm. by Prof. C. Kidson, Univ. College of Wales, Aberystwyth. *Comment* (C.K.): shells from beneath raised beach deposits of concreted sand overlain by head. Date suggests platform may be Eemian in age, but it could equally be older. Date throws little light on age of raised beach deposits.

B. Australia

+1270

1770

—1100

NPL-20. Northampton, Australia

A.D. 180

Rostrum of Xiphoid whale id. as *Mesoplodon densirostris* by J. C. Moore of Chicago from raised beach at Northampton (28° 21' S Lat, 114° 37' E Long; co-ordinates taken at center of town). Subm. by W. A. M. White for W. D. L. Ride. *Comment* (W.D.L.R.): catalogued in 1939 as M2362 in mammal collection of W Australia Mus., presented by Mr. R. E. Rob of Northampton, and recorded in catalogue as being "found on the beach," this may or may not refer to Horrocks Beach, most accessible beach from Northampton. Horrocks Beach is backed by coastal limestone, Pleistocene, and would fit very well with result obtained, but geologic provenance must be regarded as "uncertain." In spite of this, knowledge that *Mesoplodon densirostris* occurred here in post-glacial times is most interesting and there can be little doubt that specimen came from either coastal limestone or from one of calcareous dune system which, when indurated produce coastal limestone (Fairbridge, 1954; McArthur and Bettenay, 1960). Sample diluted, and no δC^{13} measurement made.

C. Canada

3990 $\pm$ 140

2040 B.C.

NPL-114. 'Rivière-aux-Poissons',
Sugluk Inlet, Quebec $\delta C^{13} = -25.8\text{‰}$

Brown fibrous sandy peat containing numerous graminaceous and cyperaceous remains and small woody fragments from cut-back exposure in terrace at alt. 135 ft, and depth 9 ft 8½ in., near mouth of 'Rivière-aux-Poissons', Sugluk Inlet, (62° 51' N Lat, 75° 45' W Long). Coll. 1965 and subm. by B. Matthews. *Comment* (B.M.): date older than expected, and gives maximum age for formation, during cool, dry period, of 1st layer of eolian sand; sample possibly formed during warmer and wetter period.

670 $\pm$ 120

A.D. 1280

NPL-125. 'Rivière Tourbe', Sugluk Inlet, Quebec

 $\delta C^{13} = -24.9\text{‰}$

Sphagnum peat, mainly *S. acutifolium* and occasional twigs of *Salix herbacea* and *Betula glandulosa*; some *Carex* nutlets. Sample from cut-back exposure in terrace at alt. 37 ft and depth 7 ft, near mouth of 'Rivière Tourbe', at SW end of Sugluk Inlet (62° 10' N Lat, 75° 55' W Long). Coll. 1965 and subm. by B. Matthews. *Comment* (B.M.): result gives date for cessation of *Sphagnum* peat growth and start of cool, dry period during which eolian sand buried peat. Basal (*Sphagnum*) peat

from same deposit is 1600 ± 140 yr old, (GSC-537, Radiocarbon, 1967, v. 9, p. 179). The 2 dates suggest that wet, mild period indicated in pollen diagrams (Bartley and Matthews, in preparation), coincided with climatic amelioration in Sub-Arctic Central Canada 1500 to 600 yr ago (Nichols, 1967).

D. Malaysia

Sungei Besi series, Kuala Lumpur, Malaya

Two samples of peat and one of wood in sand from location in N open-cast of Sungei Besi Tin Mines ($03^{\circ} 03' N$ Lat, $101^{\circ} 43' E$ Long), Kuala Lumpur, Selangor. Coll. 1965 by Mohammed bin Ayob and subm. by Prof. N. S. Haile, Univ. of Malaya.

+1255
36,420

NPL-143. Sungei Besi

—1085
34,470 B.C.
 $\delta C^{13} = -27.5\%$

Brown woody stems, preserved in unconsolidated black peaty sand. Some stems may have been *in situ*, since they were seen to penetrate stratification boundaries of black peaty sand. Sample taken at alt. 42 ft.

NPL-144. Sungei Besi

>41,200
 $\delta C^{13} = -29.2\%$

Dark-brown peat occurring as stratum ca. 1 ft thick in interstratified mud and sand at alt. ca. 40 ft.

NPL-145. Sungei Besi

>41,500
 $\delta C^{13} = -29.3\%$

Dark-brown peat forming deposit ca. 2 ft thick above interstratified mud and sand at alt. ca. 55 ft and 150 ft WSW of Samples NPL-143, NPL-144.

General Comment (N.S.H.): results indicate that much of deposit at Sungei Besi is pre-Holocene, most probably Pleistocene in age. NPL-143 gives age equivalent to Late Pleistocene. Results insufficient to bear any general theory of age and nature of tin-bearing alluvium in Selangor but are consistent with view that deposits formed during period of rejuvenation of river systems by lowering of sea level during glacial periods of Pleistocene. Only other direct evidence of age of alluvium comes from pollen analysis of samples from mine made by Brunei Shell Petroleum Co. Ltd., Brunei. Within rich, well-preserved pollen flora, only firm indication was trisaccate grain of *Podocarpus imbricatus* type, known in Borneo only from late Pliocene and younger rocks (Mohammed bin Ayob, unpub. thesis, Univ. of Malaya, 1965). Results show that part of deposit is young enough to be dated by radiocarbon method, and indicates that further work could be valuable.

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