

Radiocarbon

1974

BIRMINGHAM UNIVERSITY RADIOCARBON DATES VIII

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The following list of dates contains all measurements made during 1973, *ie*, since our last list (R, 1973, v 15, p 451-468). We have installed this year a Nuclear Enterprises NIM system to be used with our 2.5L Oeschger-type proportional counter (Philips), in addition to our 6L and 1L proportional counters which have worked consistently with Beckman Lowbeta electronics. The Philips counter has been calibrated relative to the Beckman electronics and we are now calibrating it relative to the NIM system.

Age calculations are based on 95% activity of the NBS oxalic acid standard computed from the Libby half-life of 5570 ± 30 yr. Background samples are synthesized from Welsh anthracite. Errors quoted refer only to the standard deviation (1σ) calculated from a statistical analysis of sample, background, and standard count rates.

$^{13}\text{C}/^{12}\text{C}$ ratios are measured directly on all methane gas samples as previously described (R, 1973, v 15, p 451) and ages are corrected for $\delta^{13}\text{C}$ deviations.

Sample preparation and pretreatment continue as before (R, 1969, v 11, p 263). Where sample size was insufficient for full pretreatment, details of procedure accompany the result. For bone samples, we use the extraction method based on the solubility of collagen in slightly acidic hot water of Longin (1971).

ACKNOWLEDGMENTS

We particularly wish to thank Lina Salvini for routine sample preparation and pretreatment. Sample descriptions are based on information provided by submitters and collectors.

SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. British Isles

Ellerby series, Holderness, Yorkshire

Samples from 2 of 3 thin organic beds within gray clay filling kettle hole in till SW of New Ellerby, Holderness, Yorkshire ($53^{\circ} 50' 00''$ N, $0^{\circ} 13' 52''$ W, Grid Ref TA 16403894). Coll Oct 1970 and subm by G D Gaunt, Inst Geol Sci, Leeds.

Birm-351.**3800 ± 150****1850 BC** $\delta^{13}C = -25.0\text{‰}$

Highest organic bed from ca 0.6m deep.

Birm-390.**6240 ± 150****4290 BC** $\delta^{13}C = -26.7\text{‰}$

Middle organic bed from ca 1.0m deep.

General Comment (GDG): lowest organic bed from ca 1.2m deep dated at $10,040 \pm 210$ (Birm-304; R, 1973, v 15, p 5). Date of lowest horizon and kettle hole structure suggest hollow originated as subsidence feature due to melting, at start of Flandrian climatic amelioration, of ice buried deep enough to have survived transient late Devensian amelioration(s).

Birm-381. Sugworth Farm, Abingdon Bypass, Berkshire >47,700

Wood, unid, from tree trunk ca 4.0m deep and ca 3.0m below plateau drift gravel in road cut for bridge foundation at Sugworth Farm, Abingdon Bypass, Berkshire (51° 42' N, 1° 15' W, Grid Ref SP 512018). Coll Nov 1972 by P J Osborne; subm by F W Shotton. *Comment*: date consistent with interglacial interpretation.

Aston Mill series, Worcestershire

Wood and moss washed from current bedded sand and fine gravel with lenses of gray silty clay overlying Lower Lias at Aston Mill, SW of Bredon Hill, Worcestershire (52° 01' 00" N, 2° 04' 45" W, Grid Ref SO 944355). Coll Dec 1971 and subm by P F Whitehead, Dept Geol, Univ Birmingham.

Birm-410. Field 3, Site 25**3840 ± 130****1890 BC** $\delta^{13}C = -24.4\text{‰}$

Wood from ca 0.5m deep.

Birm-411. Field 3, Site 14**4380 ± 100****2430 BC** $\delta^{13}C = -26.5\text{‰}$

Wood (*Alnus glutinosa*) id by D F Cutler, Plant Pathol Dept, Kew Gdns, London, from ca 2.43m deep in gray blue silty marl.

Birm-382.**26,000 ± 300****24,050 BC** $\delta^{13}C = -26.8\text{‰}$

Moss washed from organic deposit with *coleoptera* and plant seeds at ca 6.20m deep at base of gravel immediately overlying Lower Lias. *Comment*: Birm-382 indicates date at end of middle Devensian, agreeing with contained fauna and flora and also with date of $27,650 \pm 250$ (R, 1973, v 15, p 5) from similar terrace gravel at Beckford, 4km E. Birm-410

and Birm-411 indicate Neolithic date and there may be a substantial break between upper and lower parts of gravel sequence.

Cletwr Pingo series, Cardiganshire

Gray clay interbedded with peat overlying 14cm gray clay at Cletwr pingo 10km SSE of New Quay, Cardiganshire (52° 07' 25" N, 4° 19' 30" W, Grid Ref SN 412499). Coll July 1972 and subm by Edward Watson, Dept Geog, Univ College Wales, Aberystwyth.

Birm-389. Pingo K, Sample W4
8260 ± 300
6310 BC
 $\delta^{13}C = -24.9\%$

"Russian" auger peat from 3.55 to 3.59m below bog surface, 10m S of foot of N rampart on profile line (Watson, 1972, written commun).

Birm-388. Pingo K, Sample W3
10,170 ± 220
8220 BC
 $\delta^{13}C = -26.5\%$

"Russian" auger peat from 3.50 to 3.56m below bog surface, 9m S of N rampart, offset 1m W of profile line. *Comment:* sample size excluded alkali pretreatment.

General Comment (EW): Birm-389 younger than expected. Probably due to contamination by younger material when auger drawn up. Birm-388 earlier than basal organic material in Cledlyn pingo (Birm-368: 9380 ± 340, R, 1973, v 15, p 461) and compatible with much shallower form of Cletwr basin in which ice lens expected to melt out more quickly and undisturbed organic sedimentation to begin earlier.

Tattershall Castle pit series, Lincolnshire

Vegetable matter washed from peat and silt lenses at large gravel pit near Tattershall Castle, Lincolnshire (53° 05' N, 0° 12' W, Grid Ref TF 210570) where Devensian gravel which overlies Ipswichian peat (Birm-260: >42,000, R, 1973, v 15, p 4) includes numerous bones of bison, reindeer and other mammals and a number of horizons of organic silt containing abundant insect assemblages. Two of these horizons referred to provisionally as the Lower Silt (Birm-398 and -408) and the (newer) *Anodonta* Bed (Birm-341 and -409) are stratigraphically assoc above Ipswichian peat. Devensian gravel is overlain by clay, peat, and gravel of Flandrian age. Coll 1973 and subm by FWS, G R Coope, R B Angus, and Maureen Girling, Dept Geol, Univ Birmingham.

Birm-409.
42,200 ± 1000
40,250 BC
 $\delta^{13}C = -26.2\%$

Plant debris washed from *Anodonta* Bed (cf Birm-341: 43,000⁺¹³⁰⁰,
 -1100
 R, 1973, v 15, p 453).

Birm-398.

+1400
42,100
 -1100
40,150 BC
 $\delta^{13}C = -25.4\text{‰}$

Finely divided organic material from Lower Silt, ca 5.0m deep, and 0.5m above Ipswichian peat.

Birm-408.

+1600
44,300
 -1300
42,350 BC
 $\delta^{13}C = -27.8\text{‰}$

Plant debris washed from Lower Silt, ca 4.0m horizontal distance from Birm-398.

General Comment: ages of these 2 beds very similar, with Lower Silt only slightly earlier than *Anodonta* Bed, despite marked alteration of climate indicated by insect assemblages.

Birm-448.

(a) **30,800 ± 360**
28,850 BC
 $\delta^{13}C = -23.2\text{‰}$
 (b) **28,000 ± 800**
26,050 BC
 $\delta^{13}C = -27.7\text{‰}$

Comminuted plant debris washed from 1.90 to 2.10m deep, from organic silt bed with *Anodonta*, extending with decreasing organic content to 1.20m below surface. Overlain by gravel and underlain by at least 1.40m sand and gravel. A marked paleosol at top of silt bed, truncated by Upper gravel (see Birm-451, below). (a) after alkali pretreatment, (b) humate extract.

Birm-451.

(a) **4120 ± 200**
2170 BC
 $\delta^{13}C = -23.9\text{‰}$
 (b) **4290 ± 130**
2340 BC
 $\delta^{13}C = -24.9\text{‰}$

Rootlets washed from large volume of silty clay, 1.20 to 1.40m deep, highest part of palaeosol referred to above. (a) and (b) are independent determinations on separate samples.

General Comment: visual evidence indicates that some rootlets at least penetrate from overlying gravel, and that date may underestimate age of palaeosol. Young date for Birm-448 (expected on faunistic grounds to be closer to 40,000, cf Birm-409) suggests penetration of these roots into Birm-448.

Birm-450.**39,400 ± 800****37,450 BC** $\delta^{13}C = -25.4\text{‰}$

Plant debris from small lens of organic silt, with *Anodonta* and rich insect assemblage, 4.55m deep in gravel underlying chalky till (no intervening Ipswichian peat here).

Birm-447.**4570 ± 150****2620 BC** $\delta^{13}C = -23.9\text{‰}$

Piece of *Pinus* wood from base of peat in Flandrian succession of 1.25m alluvial silt and clay, on ca 1m black peat with large pieces of wood, on ca 0.5m angular flinty gravel with roots, resting on Devensian gravels.

(a) 3270 ± 120**1320 BC** $\delta^{13}C = -28.7\text{‰}$ **(b) 3500 ± 130****1550 BC** $\delta^{13}C = -27.9\text{‰}$ **Birm-393. Newport Pond, Newport, Essex**

Humified and structureless fen peat from 4.50 to 4.90m deep in Borehole C19 at Newport Pond, Newport, Essex (51° 58' 30" N, 0° 13' 00" E, Grid Ref TL 52403327). Coll Nov 1972 and subm by C A Baker, Dept Geog, Kings College, Univ London. *Comment:* sample (a) after alkali pretreatment, (b) humate extract. Date confirms pollen analysis as Zone VIIb.

Birm-400. Trawling Ground, Pembrokeshire**8740 ± 110****6790 BC** $\delta^{13}C = -25.1\text{‰}$

Peat from 2.55 to 2.60m below ocean bed, -21.55 to -26.60m alt, from hydrocore Site ZZ27 at Trawling Ground 4.8km NE of Newquay, Pembrokeshire (52° 14' 12" N, 4° 18' 24" W). Coll Aug 1972 during Whitethorn project, Inst Geol Sci; subm by R A Garrad, Dept Geol, Univ College Wales, Aberystwyth. *Comment:* date is maximum for Flandrian transgression at site.

(a) 10,550 ± 340**8600 BC** $\delta^{13}C = -25.0\text{‰}$ **(b) 10,700 ± 210****8750 BC** $\delta^{13}C = -27.2\text{‰}$ **Birm-404. Brimfield, Herefordshire**

Plant material washed from stratified sand and silt at 2.50 to 2.80m deep from low terrace of R Teme ca 1km E of village of Brimfield, Herefordshire (52° 18' 32" N, 2° 40' 35" W, Grid Ref SO 53886814). Coll July 1972 and subm by Peter Cross. *Comment:* terrace postdates

R Teme's E diversion to the R Severn by Wye Glacier ice (Cross, 1971). Acid pretreatment only on (a), 1% NaOH for "humate" extraction on (b).

Roos Bog series, Yorkshire

Fine detritus coll by multiple shots with "Russian" peat sampler at the Bog, Roos, E Riding, Yorkshire (53° 44' N, 0° 05' W, Grid Ref TA 274288). Coll Jan 1973 and subm by S C Beckett, Dept Geog, Univ Hull.

Birm-405. R-192 to R-197 **10,120 ± 180**
8170 BC
 $\delta^{13}C = -31.3\%$

From 9.20 to 9.25m deep.

Birm-406. R-25 to R-29 **11,220 ± 220**
9270 BC
 $\delta^{13}C = -28.2\%$

From 10.91 to 10.95m deep.

Birm-407. R-12 to R-15 **11,450 ± 230**
9500 BC
 $\delta^{13}C = -27.6\%$

From 11.02 to 11.05m deep.

General Comment: insufficient sample for alkali pretreatment. Previous dates from this site; Birm-318: 11,500 ± 170 (11.10 to 11.15m deep) and Birm-317: 13,050 ± 270 (11.33 to 11.40m deep); R, 1973, v 15, p 454.

Birm-412. Docking Common, NW Norfolk **24,000 ± 550**
22,050 BC
 $\delta^{13}C = -27.2\%$

Upper humic layer of a paleosol profile ca 1 to 2m thick overlain by ca 3m cryoturbated flint gravel and underlain by involuted gravels on shallow dry valley floor at Docking Common, NW Norfolk (52° 53' 30" N, 0° 40' 00" E, Grid Ref TF 790357). Coll Jan 1973 and subm by Allan Straw, Dept Geog, Univ Exeter. Alkali pretreatment for contamination impossible as sample completely soluble in 1% NaOH and had to be reprecipitated. *Comment* (AS): older than previous determination on similar soil Birm-350: 19,300 ± 300 (R, 1973, v 15, p 459), suggests minimum age and soil formed well before Late Devensian advance to Holderness.

(a) 3990 ± 130
2040 BC
 $\delta^{13}C = +0.7\%$

(b) 4080 ± 120
2130 BC
 $\delta^{13}C = +0.5\%$

Birm-414. Caisteal-nan-Gilleann, Oronsay, Scotland **4110 ± 130**
2160 BC
 $\delta^{13}C = +0.4\%$

Inner (a), middle (b), and outer (c) fraction of limpet shells from

emerged beach on SE coast of I of Oronsay in Inner Hebrides, Argyllshire, Scotland (56° 00' N, 6° 14' W, Grid Ref NR 359880). Coll July 1972 and subm by W G Jardine, Dept Geol, Univ Glasgow. *Comment* (WGJ): dates are considerably younger than those for *Arctica islandica* from same horizon of emerged beach (7020 \pm 140: Birm-363, R, 1973, v 15, p 457). Hard-water effect may be greater for *Arctica islandica* than for *Patella* because of different habitat. Dates for *Patella* are younger than date for *Patella* in lower layers of adjacent Mesolithic shell midden (5850 \pm 310: Birm-348, R, 1973, v 15, p 456). This supports suggestion of excavators in 1914 that sea had not retreated far before midden areas were occupied.

Birm-415. Palnure Borehole, Scotland **6540 \pm 120**
4590 BC
 $\delta^{13}C = -25.7\text{‰}$

Sample at +6.38m alt from base of thick peat ca 4.73m deep, overlying gray clay (carse deposit) in Palnure Borehole, Newton Stewart, Kirkcudbrightshire, Scotland (54° 56' N, 4° 25' W, Grid Ref NX 4500-6367). Coll Aug 1969 and subm by WGJ. *Comment*: Birm-189: 6240 \pm 240 (R, 1971, v 13, p 144) wood assoc with peat from same junction of carse deposit.

Birm-418. Grimstock Hill, Warwickshire **>33,000**
 $\delta^{13}C = -26.9\text{‰}$

Peat between +89.9 and +91.4m alt, overlain by 0.9m silty peat and 2.7m gravelly solifluction and underlain by at least 13m gravel, sand and silty clay, in sequence predating valley of R Tame and its terraces at Grimstock Hill, Coleshill, Warwickshire (52° 30' 30" N, 1° 43' 00" W, Grid Ref SP 19259033). Coll 1973 and subm by P J Markham, Dept Geol, Univ Birmingham. *Comment*: palynology indicates an interglacial, possibly Hoxnian.

Birm-443. Craigeazle Bog, Galloway, Scotland **910 \pm 150**
AD 1040
 $\delta^{13}C = -24.6\text{‰}$

Sphagnum peat from 0.70 to 0.75m deep in auger hole at Craigeazle Bog, Silver Flowe Nature Reserve, Galloway, Scotland (55° 05' N, 4° 24' W, Grid Ref NX 476812). Coll April 1973 and subm by P D Hulme, Dept Botany, Univ Hull. *Comment*: dates start of major phase of pool system development.

Birm-444. Hornsea Old Mere, Yorkshire **10,720 \pm 480**
8770 BC
 $\delta^{13}C = -20.4\text{‰}$

Plant fragments from detritus mud with shells 12.52 to 12.73m deep at Hornsea Old Mere, E Riding, Yorkshire (53° 54' N, 0° 10' W, Grid Ref TA 210476). Coll May 1973 and subm by S C Beckett, Dept Geog, Univ Hull. *Comment*: sample dated as control on pollen zonation of late Glacial period. Large error as sample was small.

Birm-449. Stubbers Green, Staffordshire**>28,700** $\delta^{13}C = -25.6\text{‰}$

Wood (? *Pinus*) from borehole at ca 7m deep in peat, beneath 2.5m made ground and 4m coarse, medium sand and gravel, in drift filled channel at Stubbers Green, Staffordshire (52° 35' N, 2° 00' W, Grid Ref SK 045010). Coll April 1973 and subm by PJM. *Comment* (PJM): base of peat contains early interglacial type pollen (*Betula*, *Pinus*), 40cm higher in peat sequence more temperate pollen types found (*Alnus*, *Corylus*, *Picea*, *Pinus*). Date consistent with interglacial interpretation.

10,040 ± 160**Birm-452. Wicken Water, Newport, Essex****8090 BC** $\delta^{13}C = -27.0\text{‰}$

Macroflora remains (*Betula* twigs, reeds, and seeds) washed from clayey fen peat 7.20 to 7.50m deep in Hiller auger Borehole C23 at Wicken Water, Newport, Essex (51° 59' N, 0° 12' E, Grid Ref TL 51573418). Coll Aug 1973 and subm by CAB. *Comment*: dates start of sedimentation in postglacial infills in area.

12,040 ± 100**Birm-458. Howth Demesne, Co Dublin, Ireland****10,090 BC** $\delta^{13}C = -26.8\text{‰}$

Peat at 1.50 to 1.60m deep from bed at 1.30 to 1.80m deep, between 2 calcareous tills at Howth Demesne, Co Dublin, Ireland (53° 23' N, 6° 04' W, Grid Ref O 283384). Coll Aug 1973 and subm by G F Mitchell, Trinity College, Dublin. *Comment*: date younger than expected but verified by date on separate sample from same horizon by Teledyne Isotopes (I-7433: 12,020 ± 175, unpub).

3290 ± 110**Birm-461. Lochar Water, Scotland****1340 BC** $\delta^{13}C = -26.2\text{‰}$

Wood fragments at +9.20m alt from top of peat 1.97m thick underlying 1.99m silty clay (? lake deposit) and overlying 6.65m marine sand (+0.58 to +7.23m alt), directly above fluvioglacial gravels at Sandyknowe Bridge, Lochar Water, Dumfriesshire, Scotland (55° 05' N, 3° 32' W, Grid Ref NY 017776). Coll Sept 1973 and subm by WGJ. *Comment*: dates change from peat formation to overlying inorganic sediment. GU-65: 7426 ± 136; R, 1969, v 11, p 51, dates wood from base (+0.58m alt) of underlying marine sand.

34,500 ± 800**Birm-466. Little Rissington, Gloucestershire****32,550 BC** $\delta^{13}C = -21.2\text{‰}$

Collagen from elephant tusk (? *Mammuthus primigenius*) from 3.66m deep in ochreous oolite terrace gravel of R Dikler at Little Rissington near Bourton-on-the-Water, Gloucestershire (51° 53' N, 1° 44' W, Grid Ref SP 182203). Coll 1973 by H E O'Neil; subm by FWS. *Comment*: previously recorded fauna (Richardson and Sandford, 1961) sug-

gests possible correlation with No 2 Terrace of R Avon, confirmed by Middle Devensian date.

Birm-467. Cosford Pumping Station, Shropshire **500 ± 120**
AD 1450
 $\delta^{13}C = -26.5\%$

Twigs (*Betula*) washed from gray-brown clay, 0.60m thick, 3.96m deep from borehole NW of Wolverhampton at Cosford Pumping Sta, Shropshire (52° 38' 15" N, 2° 19' 20" W, Grid Ref SJ 781045). Coll 1973 and subm by P D Triccas, Westhill College Educ, Birmingham. *Comment*: recent deposition of river alluvium.

B. Miscellaneous Geologic Samples

Atlantic volcanic island series

Carbonized wood samples from volcanic rocks on Terceira I, Azores; and Tenerife, Canary Is. Coll Sept 1970 and subm by Stephen Self, Dept Geol, Imperial College, London.

Birm-394. Locality 1, S56 **2040 ± 120**
90 BC
 $\delta^{13}C = -22.3\%$

Carbonized tree branches from discrete carbon layer between 2 basaltic ashes at road cut near center of Terceira I, Azores (38° 44' N, 27° 16' W).

Birm-395. Locality 91, S228 **19,680 ± 330**
17,730 BC
 $\delta^{13}C = -20.4\%$

Carbonized tree trunk or large branch at base of nonwelded basal zone of Saõ Mateus ignimbrite on cliffs at old church of Saõ Mateus, Terceira I, Azores (38° 41' N, 27° 17' W).

Birm-396. Locality 29, S43 **18,600 ± 650**
16,650 BC
 $\delta^{13}C = -19.5\%$

Carbonized twigs from fine grained, non-welded, basal layer of Lajes ignimbrite (Self, 1971) at Caldera das Lajes, Terceira I, Azores (30° 47' N, 27° 08' W). *Comment*: Birm-306: 23,100 ± 350 (R, 1973, v 15, p 462) from 3m above base of Lajes ignimbrite significantly older.

Birm-417. S7 **28,500 +1580**
-1320
26,550 BC
 $\delta^{13}C = -21.2\%$

Carbonized wood from near base of thin ignimbrite in Orotaua Valley, ca 2km W of Puerto de la Cruz, Tenerife I, Canary Is (28° 26' N, 16° 30' W). *Comment*: Birm-180 (a): >25,200 (R, 1971, v 13, p 150) sample assoc with latest explosive eruption of Tenerife volcano.

General Comment: dates form part of tephrochronologic study of volcanic sites of N Atlantic Ocean by G P L Walker, Imperial College, London.

Birm-399. Jebel Idwa, W Sudan
3520 ± 100
1570 BC
 $\delta^{13}C = -21.5\text{‰}$

Carbonized wood buried in massive air-fall pumice deposit exposed within gully ca 1.6km N of N rim of Deriba Caldera, Jebel Marra, ca 2.0km E of Jebel Idwa, Darfur Province, W Sudan (12° 59' 30" N, 24° 16' 00" E). Coll March 1972 and subm by R S Thorpe, Dept Earth Sci, Open Univ. *Comment:* dates probable last major volcanic activity from Jebel Marra caldera (Vial, 1973).

Aavatsmokbreen series, Vestspitsbergen

Shell and whale bone from emerged beach sequence N of Aavatsmokbreen, Vestspitsbergen (78° 45' N, 11° 15' E). Coll 1973 and subm by G S Boulton, Dept Environmental Studies, Univ East Anglia.

Birm-421. S114, +3.3m alt
(a) 10,500 ± 280
8550 BC
 $\delta^{13}C = +0.5\text{‰}$
(b) 11,030 ± 310
9080 BC
 $\delta^{13}C = +0.0\text{‰}$

Inner (a) and middle (b) fraction of shells (*Hia galicena*).

Birm-422. S112, +8.8m alt
(a) 12,670 ± 250
10,720 BC
 $\delta^{13}C = -0.3\text{‰}$
(b) 11,730 ± 230
9780 BC
 $\delta^{13}C = +0.6\text{‰}$

Inner (a) and middle (b) fraction of shells (*Hia galicena*).

Birm-423. S110, +12.2m alt
11,160 ± 140
9210 BC
 $\delta^{13}C = +1.5\text{‰}$

Middle fraction of mixed shells (*Hia galicena* and *Mya truncata*).

Birm-424. S63, +15.8m alt
(a) 10,520 ± 180
8570 BC
 $\delta^{13}C = +1.0\text{‰}$
(b) 10,350 ± 170
8400 BC
 $\delta^{13}C = +1.4\text{‰}$

Inner (a) and middle (b) fraction of mixed shells (*Hia galicena* and *Mya truncata*).

(a) 13,420 \pm 460

11,470 BC

 $\delta^{13}C = +2.4\text{‰}$ (b) 14,600 \pm 240

12,650 BC

 $\delta^{13}C = +1.1\text{‰}$ **Birm-425. S108, +18.4m alt**

Inner (a) and outer (b) fraction of shell fragments (unid).

(a) 14,900 \pm 300

12,950 BC

 $\delta^{13}C = +1.7\text{‰}$ (b) 13,730 \pm 290

11,780 BC

 $\delta^{13}C = +1.4\text{‰}$ **Birm-426. S65, +24.8m alt**Inner (a) and outer (b) fraction of mixed shells (*Hia galicena*, *Mya truncata* and *Macomacarea*).1440 \pm 100**Birm-427. S64, +41.7 to +43.2m alt**

AD 510

 $\delta^{13}C = -15.0\text{‰}$

Collagen extracted from whale bone. *Comment:* where sufficient sample was available 3 fractions were evolved, the outer discarded, determinations were done on the inner and middle fractions. For the smaller samples only 2 fractions were evolved and dated as Inner and Outer. Inner fraction of Birm-423 was lost.

General Comment: dating is part of crustal uplift study of Spitsbergen area. Discorrelation between date and beach height may be due to hard water-effect or some isotopic replacement. Whale bone on highest beach obviously intrusive, and, in view of hard-water error, could be recent.

Qaleragdlit imâ series, S Greenland

Shells and cemented calcite concretions washed out from small outcrop of marine silty sand (+3.5m alt) 2km from glacier calving into head of fjord at entrance to Marrait tributary valley on SW side of Qaleragdlit imâ fjord, S Greenland (60° 58' 24" N, 46° 39' 06" W). Coll July 1973 and subm by M R Kelly, Dept Environmental Sci, Univ Lancaster.

(a) 7980 \pm 150

6030 BC

 $\delta^{13}C = -0.3\text{‰}$ (b) 7640 \pm 150

5690 BC

 $\delta^{13}C = -0.5\text{‰}$ **Birm-455.**(c) 7790 \pm 150

5840 BC

 $\delta^{13}C = +0.8\text{‰}$ Inner (a), middle (b), and outer (c) of lamellibranchs (*Mya truncata*).

Birm-454.**4690 ± 130****2740 BC** $\delta^{13}C = -15.6\text{‰}$

Calcite cemented concretions of silt containing fragments of lamellibranchs (*Mytilus edulis*). Cementation probably by solution of shells (similar to Birm-455).

General Comment (MRK): evidence from Qaleragdilit imâ and adjacent areas shows parts of margin of S Greenland ice sheet in mid postglacial times was well behind present or "little ice age" maximum positions. Shell dates agree well with indirect age of 8000 to 6000 from shoreline evidence. Calcite cement date indicates formation from different carbonate system and $\delta^{13}C$ measurements show isotopic fractionation occurred in recrystallization process.

Emuruangogolak volcano series, Kenya

Wood (? *Acacia*) from tree molds in lava of 2nd youngest basalt flow of Emuruangogolak volcano, Kenya (1° 27' N, 36° 20' E). Coll May 1973 and subm by S D Weaver, Dept Geol, Univ Birmingham.

Birm-456. S49**270 ± 100****AD 1680** $\delta^{13}C = -24.0\text{‰}$ **Birm-457. L15****230 ± 100****AD 1720** $\delta^{13}C = -23.8\text{‰}$

General Comment (SDW): older lavas of Emuruangogolak (Chapman *et al*, 1974) intercalate with Suguta valley sediments which were probably deposited in a "greater Lake Rudolf".

II. ARCHAEOLOGIC SAMPLES

*A. British Isles***Birm-377. Bidford-on-Avon, Warwickshire****1560 ± 110****AD 390** $\delta^{13}C = -25.4\text{‰}$

Wood, unid, from pile with iron tip, in bed of R Avon at Roman ford, Bidford-on-Avon, Warwickshire (52° 09' N, 1° 51' W, Grid Ref SP 101508). Coll 1970 and subm by W J Ford, Co Mus, Warwick. *Comment* (WJF): later date than expected. Site some distance downstream from previously assumed river crossing and may represent alternative or replacement ford. Dates site within Theodosian re-organization of late 4th century AD.

Stretton-on-Fosse series, Warwickshire

Collagen of human bones from Romano-British and ? Saxon cemeteries at Stretton-on-Fosse, Warwickshire (52° 25' N, 1° 41' W, Grid Ref SP 221383). Coll between 1949 and 1971, and subm by WJF.

Birm-383. Cemetery 1, ST 1949
1700 ± 180
AD 250
 $\delta^{13}C = -17.7\%$

Birm-384. Cemetery 3, F16, SF71
1800 ± 190
AD 150
 $\delta^{13}C = -18.6\%$

Tibia.

Birm-385. Cemetery 3, F11, SF71
1570 ± 150
AD 380
 $\delta^{13}C = -18.8\%$

Tibia. Comment: this date and Birm-384 represent 2 phases of same cemetery.

Birm-386. Cemetery 2, Grave 4, F88
1480 ± 170
AD 470
 $\delta^{13}C = -19.6\%$

Tibia from ca 1m deep in believed Anglo-Saxon cemetery (Grid Ref SP 220383).

Birm-439. Cemetery 2, F61, ST68
1530 ± 100
AD 420
 $\delta^{13}C = -20.2\%$

Tibia.

Birm-440. Cemetery 2, F101, ST68
1550 ± 110
AD 400
 $\delta^{13}C = -20.0\%$

Tibia.

Birm-441. Cemetery 2, F1, ST68
1630 ± 110
AD 320
 $\delta^{13}C = -19.8\%$

Rib bones from sand pit.

Birm-442. Cemetery 2, F6, ST68
1660 ± 130
AD 290
 $\delta^{13}C = -18.7\%$

Femur.

General Comment (WJF): dates from Cemetery 2 too early for Anglo-Saxon period but further archaeologic study indicates assoc shield is of late Roman army type found on the continent (particularly in the Danube frontier area) and not of normal Anglo-Saxon type. Dates useful in suggesting sequence of use of burial ground over 3 centuries.

Skaill series, Orkney Islands, off NE Scotland

Hearth charcoal under sequence of humus 0.31m, Iron age cobbling 0.15m, and mixed earth and stones with Lower Bronze age pottery 0.20m, and overlying paving of Lower Bronze age at Skaill, Deerness, on the Orkney Is, off NE Scotland (58° 56' 45" N, 2° 42' 50" W, Grid Ref HY 588064). Coll July 1972 and subm by P S Gelling, Dept Ancient Hist and Archaeol, Univ Birmingham.

Birm-397.**2100 ± 100****150 BC** $\delta^{13}C = -20.5\text{‰}$

Bulk sample given acid pretreatment only. CH₄ not as pure as normal due to ruthenium catalyst being poisoned.

Birm-413.**2120 ± 120****170 BC** $\delta^{13}C = -26.2\text{‰}$

Small pieces of charcoal washed from bulk sample. Pretreatment included mild NaOH (1%).

General Comment: sample redated due to incomplete conversion to CH₄ in Birm-397 and differences in $\delta^{13}C$ values reflect differing degrees of isotopic fractionation. Dates confirm Iron age, and overlying earth and stones must be disturbed ground.

York series

Samples from archaeologic excavations of middle Saxon to early Norman ? succession undertaken by York Archaeologic Trust on site of Lloyds Bank extension, York (53° 58' 00" N, 1° 04' 25" W, Grid Ref SE 606523). Coll Jan 1973 by P C Buckland and J R A Greig; subm by P V Addyman, York Archaeol Trust.

Birm-401. LB IV/2b top**1030 ± 100****AD 920** $\delta^{13}C = -26.0\text{‰}$

Small wooden stakes from beneath cellar floor of bank. Highest surviving wood material in 5m succession of floors and rough timber walls.

Birm-402. LB IV/F10 middle**990 ± 100****AD 960** $\delta^{13}C = -24.6\text{‰}$

Leather from 1.5m below Birm-401. *Comment:* no NaOH pretreatment.

Birm-403. LB IV/24 bottom**1070 ± 100****AD 880** $\delta^{13}C = -27.2\text{‰}$

Plant debris, mostly reeds, from 3m below Birm-401.

General Comment: dates fit chronology of Anglo-Danish cultures which precede Norman invasion of York.

Lonan series, Isle of Man

Charcoal (*Quercus*) from cooking sites at Clay Head Cairns, Lonan, I of Man (54° 12' N, 4° 23' W, Grid Ref SC 440807). Coll 1961 and subm by A M Cubbon, Manx Mus, I of Man.

Birm-416. Clay Head I, S1 **2800 ± 120**
850 BC
 $\delta^{13}C = -24.2\text{‰}$

Sample from within stone-lined trough of cooking site.

Birm-476. Clay Head I, S4 **3330 ± 120**
1380 BC
 $\delta^{13}C = -25.1\text{‰}$

Birm-429. Clay Head III, S3 **3800 ± 150**
1850 BC
 $\delta^{13}C = -23.9\text{‰}$

Mixed sample from cairn of burned stones and ash forming cooking site.

Birm-475. Clay Head III **3480 ± 100**
1530 BC
 $\delta^{13}C = -24.7\text{‰}$

General Comment: "Clay Head III finds 3 and 4 might suggest a late Neolithic or early Bronze age date. The fragment of corroded bronze from the lower layer of burnt material at Clay Head I indicates that the primary period of that site cannot be older than the Bronze age" (Cubbon, 1963, p 589). Dates, though they differ by 1000 yr, are not incompatible with evidence from elsewhere.

Birm-419. Broxbourne gravel pit, Hertfordshire **8120 ± 160**
6170 BC
 $\delta^{13}C = -26.4\text{‰}$

Wood from below Mesolithic site at Broxbourne gravel pit, Hertfordshire (51° 45' 25" N, 0° 00' 30" E, Grid Ref TL 379082). Coll 1972 and subm by Raymond Bonnet, Dept Chem, Queen Mary College, London. *Comment:* sample, together with previous determinations from this site; Birm-342: 7830 ± 520 and Birm-343; 8700 ± 170 (R, 1973, v 15, p 465), predate Mesolithic industry. Dates involved in Bonnet's study of chemical changes in wood constituents with age.

Birm-420. Shepperton, Middlesex **1520 ± 120**
AD 430
 $\delta^{13}C = -27.4\text{‰}$

Wood from group of stakes pointed at top and bound with wicker work, crossing bed of old stream at gravel pit ca 6.8km SE of Staines, at Shepperton on the Thames, Middlesex (51° 23' 30" N, 0° 26' 30" W, Grid Ref TQ 097166). Coll Feb 1973 and subm by D G Bird, Surrey Archaeol Soc. *Comment:* predates gravel as stakes below several layers of clean water-laid gravel underlying 2 soil layers.

Birm-428. Moreton-in-Marsh, Gloucestershire **1110 ± 110**
AD 840
 $\delta^{13}C = -18.1\text{‰}$

Collagen from human *femur* from skeleton ca 23cm beneath floor

of public bar at Bell Inn, Blockley, near Moreton-in-Marsh, Gloucestershire (52° 00' 40" N, 2° 45' 35" W, Grid Ref SP 164349). Coll Feb 1973 and subm by N M Marshall, Blockley Antiquarian Soc. *Comment*: date confirms Bell Inn built on part of Saxon burial ground previously undiscovered.

Quernmore Coffin Ship series, Lancaster

Wood (*Quercus*) from hull of coffin ship buried in peat bed 28cm thick and overlying gray clay with decayed gritstone at Quernmore, Lancaster (54° 00' 36" N, 2° 41' 56" W, Grid Ref SD 543574). Coll March 1973 and subm by Brian Barnes, Bolton Inst Technol.

	1340 ± 110
Birm-430. C1-B₂	AD 610
	$\delta^{13}C = -24.3\text{‰}$
	1300 ± 100
Birm-474. C1-A₂	AD 650
	$\delta^{13}C = -26.1\text{‰}$

General Comment: archaeologically, indicates Bronze age, but 2 determinations disprove this.

Beckford series, Worcestershire

Charcoal from very large earthwork that stratigraphically predates extensive habitation site of early Pre-Roman Iron age at Beckford, Worcestershire (52° 01' 30" N, 2° 01' 30" W, Grid Ref SO 983363). Coll March 1973 and subm by W J Britnell, Rescue Archaeol Group.

	3360 ± 200
Birm-431.	1410 BC
	$\delta^{13}C = -21.6\text{‰}$

Bulked sample from lower layers of large linear ditch (ca 6.0m wide and 2.5m deep). *Comment* (WJB): sherds from single vessel within same layer of fill are without precise parallel; formerly attributed to late Bronze age-early Iron age transition but date is middle Bronze age. Dates for similar type of ditch and pottery, Birm-202: 3130 ± 132; Birm-192: 3080 ± 115 (R, 1971, v 13, p 154). A *terminus ante quem* for ditch is Birm-432 (below) from succeeding Iron age settlement which partly cuts into upper layers of fill of this ditch.

	2110 ± 120
Birm-432.	160 BC
	$\delta^{13}C = -24.2\text{‰}$

Bulked sample from primary fill of L-shaped rubbish pit in ditched enclosure and containing pottery of "Duck-Stamped" type described by Peacock (1968). *Comment* (WJB): pit contemporary with enclosure which produced hoard of 10 "currency bars".

Skara Brae series, Orkney Islands, NE Scotland

Bone samples (*Bos*) from tenacious midden material composed of

large numbers of animal bone, marine shells and stone, bone and pottery artifacts of Neolithic occupation site on S edge of Bay of Skaill at Skara Brae, Orkney Is, off NE Scotland (59° 02' 50" N, 3° 20' 40" W, Grid Ref HY 231187). Coll July 1972 and subm by D V Clarke, Natl Mus Antiquities, Edinburgh, Scotland.

Birm-433. Trench 1, Sec B, S 2A
3830 ± 110
1880 BC
 $\delta^{13}C = -21.1\text{‰}$

Birm-434. Trench 1, Sec B, S 2B
4020 ± 110
2070 BC
 $\delta^{13}C = -21.2\text{‰}$

Birm-435. Trench 1, Sec B, S 10A
3870 ± 100
1920 BC
 $\delta^{13}C = -21.1\text{‰}$

Birm-436. Trench 1, Sec B, S 10B
4040 ± 110
2090 BC
 $\delta^{13}C = -22.2\text{‰}$

Birm-437. Trench 2, Sec C, S 12A
3780 ± 110
1830 BC
 $\delta^{13}C = -21.4\text{‰}$

Birm-438. Trench 2, Sec C, S 12B
4140 ± 120
2190 BC
 $\delta^{13}C = -20.6\text{‰}$

General Comment (DVC): dates midden, constituting final observable Neolithic occupation of site; for detailed description see Childe, 1931. Dates disprove Watson's hypothesis "that it is more probable that the Skara Brae cattle are post-Roman than that they are of earlier date . . ." (Childe, 1931, p 202).

Birm-445. Coombe Hay, Somerset
2650 ± 120
700 BC
 $\delta^{13}C = -23.9\text{‰}$

Charcoal from ca 1m deep at Bronze age site in Coombe Hay, ca 3.22km S of Bath, Somerset (51° 21' N, 2° 23' W, Grid Ref ST 739613). Coll April 1973 and subm by P A Rahtz, Hist School, Univ Birmingham. *Comment*: sample assoc with extensive range of younger Bronze age pottery and saddle-quern.

Birm-453. Blackstone Excavation, Worcestershire
2180 ± 100
230 BC
 $\delta^{13}C = -24.4\text{‰}$

Wood charcoal (*Quercus*) id by C A Keepax, Dept Environment Lab, London from post-hole beneath topsoil in sand and gravel of river terrace at Blackstone Edge, 200m W of Brant Farm, Bewdley, Worcestershire (52° 21' 30" N, 2° 18' 20" W, Grid Ref SO 7904273533). Coll Aug

1973 by S Hillson; subm by A M Hunt, Co Mus, Hartlebury Castle, Worcestershire. *Comment*: occupation site dated as pre-Roman Iron age, not Romano-British.

B. Miscellaneous Archaeologic Samples

Isoya series, W Nigeria

Vegetable matter from levels of midden at Isoya in Ife Div W State of Nigeria (7° 22' N, 4° 33' E). Coll 1972 and subm by Omotoso Eluyemi, Centre W African Studies, Univ Birmingham.

Birm-373. Level 5

$$\delta^{14}\text{C} = -9.2 \pm 8.2\text{‰}$$

Modern

$$\delta^{13}\text{C} = -24.7\text{‰}$$

Charcoal from 0.92m deep.

Birm-375. Level 7

$$\delta^{14}\text{C} = +8.4 \pm 8.2\text{‰}$$

Modern

$$\delta^{13}\text{C} = -22.4\text{‰}$$

Carbonized banana from 1.62m deep.

Birm-372. Level 9

$$\delta^{14}\text{C} = +4.4 \pm 17.1\text{‰}$$

Modern

$$\delta^{13}\text{C} = -22.2\text{‰}$$

Carbonized yam from 1.70m deep.

Birm-374. Level 10

$$570 \pm 240$$

AD 1380

$$\delta^{13}\text{C} = -21.4\text{‰}$$

Wood from 2.06m deep.

Birm-376. Level 12^A

$$\delta^{14}\text{C} = +16.3 \pm 17.5\text{‰}$$

Modern

$$\delta^{13}\text{C} = -23.3\text{‰}$$

Wood from 2.18m deep.

General Comment: hoped that samples would date assoc archaeological artifacts. Clearly modern except Birm-374. Evidence of recent animal disturbance observed at Level 7.

Birm-391. Lake Chad, Nigeria

$$110 \pm 80$$

AD 1840

$$\delta^{13}\text{C} = -24.8\text{‰}$$

Wood (*Acacia nilotica*) from submerged stumps near W shore of Lake Chad almost adjacent to Niger/Nigeria border (ca 13° 00' N, 14° 15' E). Coll 1972 and subm by P R Reid, Ministry of Nat Resources, Maiduguri, W Africa. *Comment*: tree grew during last recession period when lake was at very low level, was submerged ever since only to reappear in ca last 7 yr. Diam of stump ca 8cm, outer ca 0.5cm sampled for dating.

$$(a) \delta^{14}\text{C} = +1.9 \pm 11.0\%$$

Modern

$$\delta^{13}\text{C} = -23.2\%$$

$$(b) \delta^{14}\text{C} = +18.5 \pm 12.0\%$$

Modern

$$\delta^{13}\text{C} = -25.9\%$$

Birm-392. Lebena, Crete

Wood charcoal from ca 0.75m deep near center of circular stone-built tomb (diam ca 3.20m) at Yerokampos, Lenda on SE coast of Crete (34° 56' N, 24° 55' E). Coll June 1969 by S Alexiou; subm by P M Warren, Dept Ancient Hist Archaeol, Univ Birmingham. *Comment*: imported XI-XIIth Dynasty Egyptian scarab contained in upper burial level (Daux, 1960, p 845). Sample was thought to be from an early Minoan II level but 2 preparations from separate parts of sample ([a] and [b]) prove it is clearly intrusive.

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