[RADIOCARBON, VOL. 18, NO. 3, 1976, P. 249-267]

Radiocarbon

1976

BIRMINGHAM UNIVERSITY RADIOCARBON DATES X

R E G WILLIAMS and A S JOHNSON

Department of Geological Sciences, University of Birmingham, Birmingham, England

The following list of dates contains the majority of measurements made during 1975, *ie*, since our last list (R, 1975, v 17, p 255-275).

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

$^{13}C/^{12}C$ ratios are measured on methane gas samples as previously described (R, 1973, v 15, p 451) and in most cases ages have been corrected for $\delta^{13}C$ deviations. Where no value for $\delta^{13}C$ has been quoted $-25.0‰$ has been assumed.

Sample preparation and pretreatment continue as before (R, 1969, v 11, p 263). Where sample size was insufficient for full pretreatment or where the sample required special treatment, details accompany the result. All bone samples in this list were pretreated using the collagen extraction method of Longin (1971).

ACKNOWLEDGMENTS

Sample preparation and pretreatment were carried out by Lina Salvini. We particularly wish to thank Professor F W Shotton for his keen interest in the work of the laboratory. Sample descriptions are based on information supplied by submitters and collectors.

SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. British Isles

Birm-595. Beckford, Worcestershire **27,300 ± 500 / 25,350 BC**

$\delta^{13}C = -26.6‰$

Plant material, mainly twigs with grasses and sedges, from basal organic deposit .8cm thick resting on Lias clay and overlain by .4cm clay and 4m limestone gravel at Beckford gravel pit, Worcestershire (52° 01′ 15″ N, 02° 01′ 30″ W, Grid Ref SO 98403616). Coll Sept 1974 and subm by P F Whitehead, Dept Geol Sci, Univ Birmingham. *Comment*: *cf* Birm-293: 27,650 ± 250 (R, 1973, v 15, p 5) from silt in W face of sec at N end of same pit (Briggs *et al*, 1975, Fig 3, p 6). Date equates this terrace of Carrant Brook with No. 2 Terrace of R Avon.

+2050
36,600
−1640

Birm-599. Twyning, Gloucestershire **34,650 BC**

$\delta^{13}C = -26.8‰$

Plant material, washed from silt ca .3m thick in small hollow on underlying Lower Lias clay, overlain by ca 2.7m gravel at quarry in R Avon No. 2 Terrace (Tomlinson, 1925, Pl X, Fig 1 & 2) ca 4.8km N of Tewkesbury at Twyning, Gloucestershire (52° 01′ N, 02° 09′ W, Grid Ref SO 89623570). Coll Oct 1974 and subm by PFW. *Comment*: mid-Devensian age consistent with views on origin of Avon No. 2 Terrace (Shotton, 1953, 1968; Coope, 1962, 1968).

(a) 3990 ± 120
2040 BC

$\delta^{13}C = -26.9‰$

(b) 3900 ± 120

Birm-600. Topsham, Devonshire **1950 BC**

$\delta^{13}C = -26.9‰$

Unid. wood from large log 30 × 30 × 45cm (W4) from −4.1m alt in fluvial sand and gravel on E edge of tidal R Exe at Topsham, Devonshire (50° 41′ N, 03° 28′ W, Grid Ref SX 963883). Coll May 1974 by R A Cullingford; subm by Allan Straw, Dept Geog, Univ Exeter. *Comment*: outer ca lcm used, after bark and adhering foreign matter removed. Confirms Birm-533: 3910 ± 130 (R, 1975, v 17, p 262) and dates relative sea-level stand in R Exe estuary. (a) and (b) are independent determinations of same sample gas in different counters at different filling pressures.

Pilgrim Lock series, Warwickshire

Plant fragments washed from gray silt containing shells (Shotton, 1972) overlain by 2.74m red silt at Pilgrim Lock, ca 1.5km NE of Bidford on Avon, Warwickshire (52° 09′ N, 01° 50′ W, Grid Ref SP 120516). Coll Nov 1970 by P J Osborne and F W Shotton; subm by FWS, Dept Geol Sci, Univ Birmingham.

2770 ± 250

Birm-613. **820 BC**

$\delta^{13}C = -21.3‰$

From 2.74 to 3.15m deep, immediately underlying red silt.

2890 ± 100

Birm-632. **940 BC**

$\delta^{13}C = -24.5‰$

From 3.96 to 4.07m deep, middle of gray silt.

2880 ± 100

Birm-651. **930 BC**

$\delta^{13}C = -24.8‰$

From 4.27 to 4.37m deep.

General Comment: *cf* Birm-247: 3010 ± 120 (R, 1973, v 15, p 2) from base of gray silt at 4.57 to 4.67m deep, immediately overlying gravel. Dates precede sudden change in alluvium from gray to red, which may indicate beginning of large scale field clearance and ploughing.

Birm-615. Minchin Hole, W Glamorgan **4500 ± 100**
2550 BC
$\delta^{13}C = -7.6‰$

Stalagmite from middle layer of inner talus cone of coastal cave at Minchin Hole on S coast of Gower Peninsula, W Glamorgan (51° 33′

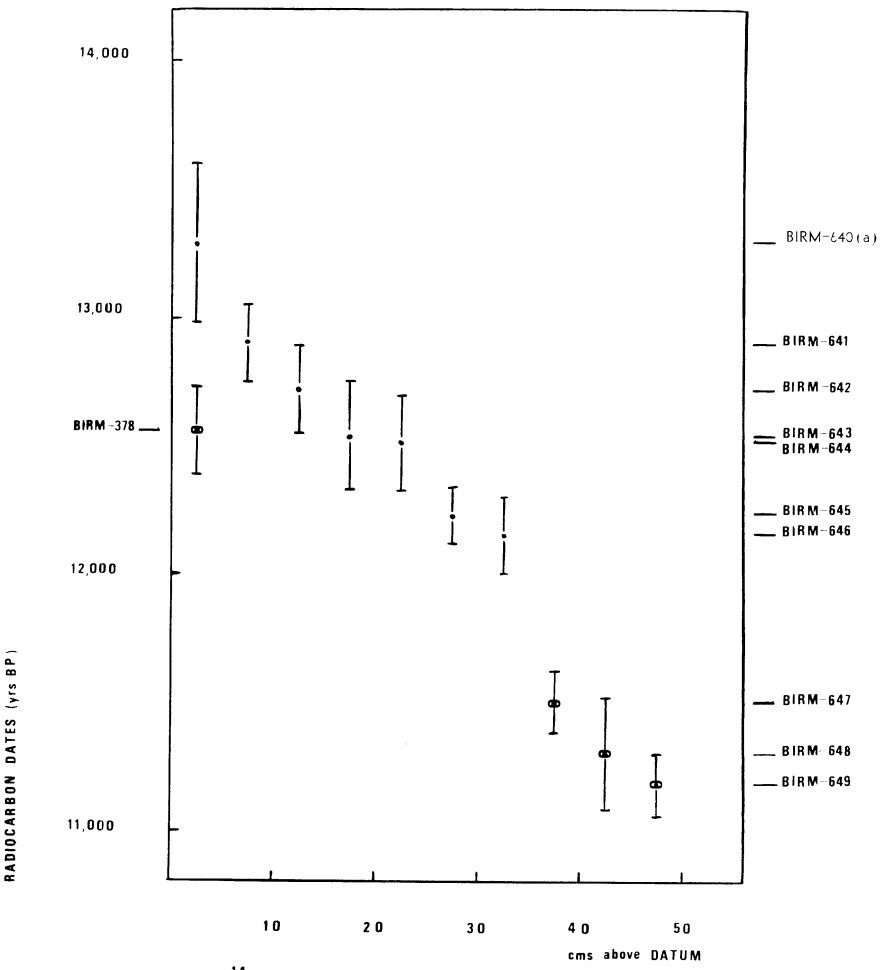

Fig. 1 ^{14}C Dates for St Bees series.

https://doi.org/10.1017/S0033822200003155 Published online by Cambridge University Press

30″ N, 04° 04′ 45″ W, Grid Ref SS 554868). Coll Dec 1974 and subm by D Q Bowen, Dept Geog, Univ Coll Wales, Aberystwyth. *Comment*: much younger than expected, probably due to dissolution and reprecipitation of $CaCO_3$ during Holocene. Date can only be taken as apparent. For details of excavation at Minchin Hole, see Sutcliffe & Bowen (1973).

Glim's Moss series, Isle of Orkney, off NE Scotland

Peat from core samples using Russian borer at Glim's Moss, Birsay, NW Mainland Orkney, off NE Scotland (59° 05′ N, 03° 13′ W, Grid Ref HY 305223). Coll July 1973 and subm by J H Dickson, Dept Botany, Univ Glasgow.

Birm-634.

(a) 2690 ± 500
740 BC
$\delta^{13}C = -21.2‰$

(b) 2960 ± 110
1010 BC
$\delta^{13}C = -24.9‰$

From 3.94 to 3.99m deep. Sample (a) after alkali pretreatment which dissolved most of sample, b) humate extract. *Comment* (JHD): sample composed mainly of fragments of *Cyperaceae* with some *Calluna* and bryophytes.

Birm-635.

4200 ± 160
2250 BC
$\delta^{13}C = -27.6‰$

From 4.54 to 4.59m deep. *Comment* (JHD): sample composed of *Cyperaceae* with some bryophytes.

General Comment (JHD): dates early agricultural phase in pollen record.

St Bees series, Cumberland

Plant material washed from detritus mud, 3.7 to 4.2m deep, from coastal cliff sec at St Bees, Cumberland (54° 29′ N, 03° 36′ W, Grid Ref NX 965114). Coll March 1975 and subm by G R Coope, Dept Geol Sci, Univ Birmingham. Birm-640 to -649 are continuous sequence of samples, 5cm thick, through detritus mud overlying red sand and gravel and underlying 3.7m sand with dark brown fibrous peat at .90 to .95m deep (Walker, 1956, p 99). Sample positions measured above base of detritus mud.

Birm-640. 0 to 5cm

(a) 13,290 ± 310
11,340 BC
$\delta^{13}C = -26.7‰$

(b) 11,940 ± 210
9990 BC
$\delta^{13}C = -27.7‰$

Sample (a) after alkali pretreatment, (b) humate extract. *Comment*: dates indicate younger humic material contained in untreated sample.

All subsequent dates in series determined on sample after alkali pretreatment.

Birm-641. 5 to 10cm	**12,900 ± 150** **10,950 BC** $\delta^{13}C = -26.0‰$
Birm-642. 10 to 15cm	**12,490 ± 250** **10,540 BC** $\delta^{13}C = -25.5‰$
Birm-643. 15 to 20cm	**12,540 ± 210** **10,590 BC** $\delta^{13}C = -24.6‰$
Birm-644. 20 to 25cm	**12,570 ± 300** **10,620 BC** $\delta^{13}C = -25.2‰$
Birm-645. 25 to 30cm	**12,230 ± 110** **10,280 BC** $\delta^{13}C = -25.1‰$
Birm-646. 30 to 35cm	**12,430 ± 250** **10,480 BC** $\delta^{13}C = -25.5‰$
Birm-647. 35 to 40cm	**11,500 ± 120** **9550 BC** $\delta^{13}C = -26.8‰$
Birm-648. 40 to 45cm	**11,300 ± 220** **9350 BC** $\delta^{13}C = -26.4‰$
Birm-649. 40 to 45cm	**11,180 ± 120** **9230 BC** $\delta^{13}C = -25.7‰$

General Comment (GRC): graph of ^{14}C age plotted against height above base of detritus mud (Fig 1) displays 2 distinct groups of dates. Group (a), Birm-640 (a), -641 to -646 and group (b), Birm-378, -647 to -649. Each group conforms to a separate linear relationship. Birm-378: 12,560 ± 170 (R, 1973, v 15, p 461) was composed of sticks washed from bottom 5cm of same detritus mud. Group (a) is pond-bottom sediments, group (b) is largely or wholely terrestrial debris. The aquatic sediments appear to be ca 400yr older than the contemporary terrestrial material at this site. Other dates from this site; Q-71: 12,810 ± 180 (R, 1959, v 1, p 67), thought to be too old due to inclusion of coal and Q-304: 10,350 ± 200

(R, 1960, v 2, p 65). Beetle fauna assoc with Cambridge dates described by Pearson (1962).

Birm-652. Kinfauns, Perthshire **5180 ± 100**
3230 BC
$\delta^{13}C = -26.6‰$

Wood fragments washed from lower .18m of peat at 1.10 to 1.63m deep, underlying gray clay and overlying .85m of sand and 1.54m+ of gravel on N bank of R Tay ca 6.4km ESE of Perth at Kinfauns, Perthshire (56° 22′ 45″ N, 03° 21′ 15″ W, Grid Ref NO 166214). Coll 1968 and subm by FWS. *Comment*: peat contains rich insect fauna, most N British Flandrian deposit yet studied.

Birm-655. Evesham, Worcestershire **8460 ± 170**
6510 BC
$\delta^{13}C = -20.8‰$

Collagen from pelvic bone of *Bos* (*cf primigenius*), ca 1m deep in bunter and flint gravel containing black organic silt overlying Lias clay and underlying floodplain alluvium of R Avon at Evesham, Worcestershire (52° 05′ 10″ N, 01° 57′ 00″ W, Grid Ref SP 037433). Coll July 1972 and subm by PFW. *Comment*: possibly only 2nd Boreal date on *Bos primigenius* in England after Starr Carr (Shawcross & Higgs, 1961).

Birm-656. Broadway, Worcestershire **26,600 $^{+700}_{-650}$**
24,650 BC
$\delta^{13}C = -19.9‰$

Collagen from sacrum of Bison in oolitic gravel of Broadway gravel pit, Worcestershire (52° 02′ N, 01° 52′ W, Grid Ref SP 091376). Coll 1915; subm by PFW. *Comment*: confirms correlation of Cotswolds subedge gravels with R Avon No. 2 Terrace (Tomlinson, 1940; Briggs, 1975).

Birm-657. Cropthorne, Worcestershire **>28,100**

Collagen from phalanx of ? Bison from R Avon terrace at Cropthorne, ca 7.2km E of Evesham, Worcestershire (52° 05′ 45″ N, 02° 00′ 05″ W, Grid Ref SP 997443). Coll ca 1900; subm by PFW. *Comment*: mammalian bones of *Hippopotamus, Bos, Cervus, Ursus,* and *Canis* from same deposit assigned to R Avon No. 3 Terrace by Tomlinson (1925, p 148) but sample too small to give limiting age (based on 4σ) old enough to exclude correlation with No. 2 Terrace.

Puggieston series, Angus, Scotland

Collagen from duck bones of diving, sea-going type from laminated silty marine clay of late-Devensian raised shoreline on N side of Montrose Basin at Puggieston, Angus, Scotland (56° 43′ N, 02° 30′ W, Grid Ref NO 69205975). Coll 1891 by D Howden; subm by D E Smith and R L Jones, Dept Geog, Lanchester Polytech, Coventry.

Birm-660. E/P1 **10,610 ± 220**
8660 BC
$\delta^{13}C = -14.0‰$

Eider duck, *Somateria mollissima,* id by D Bramwell.

Birm-661. E/P2 **11,110 ± 210**
9160 BC
$\delta^{13}C = -12.4‰$

Part of embedded skeleton, *Somateria* or Scoter, *Melanitta* sp.

General Comment (DES & RLJ): dates confirm late-Devensian age suggested by pollen from silty clay embedding skeleton. "Vina-mold" used in preparation of replicas of bones removed by handpicking after lightly crushing sample. Collagen extracted for dating.

Eshton Tarn series, N Yorkshire

Slightly humified sedge peat with woody (*Eriophorum*) remains, from N edge of drumlin field of Craven Lowlands, at Eshton Tarn basin, N Yorkshire (54° 01′ N, 02° 08′ W, Grid Ref SD 918576). Coll April 1975 and subm by I P Jones, Dept Geog, Univ Leeds.

Birm-662. **3600 ± 100**
1650 BC
$\delta^{13}C = -25.9‰$

From .86 to .91m deep. *Comment* (IPJ): dates change of agricultural activity from sporadic, low intensity nature to one of comprehensive woodland clearance.

Birm-663. **5010 ± 110**
3060 BC
$\delta^{13}C = -26.8‰$

From 2.15 to 2.21m deep. *Comment* (IPJ): dates *Ulmus* decline and start of agricultural activity in Lowland Craven. *Cf* 5100 ± 120 (unpub) for *Ulmus* decline horizon at Blea Tarn (Pennington, 1965, p 315; 1969, p 67).

Birm-664. Gordale Beck, N Yorkshire **4780 ± 120**
2830 BC
$\delta^{13}C = -25.2‰$

Peat with tree remains (? *Alnus*), 1m deep in bog ca 3m thick, overlying Silurian slate at Gordale Beck, N Yorkshire (54° 05′ 25″ N, 02° 08′ 00″ W, Grid Ref SD 911661). Coll April 1975 and subm by R T Smith, Dept Geog, Univ Leeds. *Comment* (RTS): dates final substantial woodland clearance and onset of more intensive use of land for agriculture.

White Moss series, N Yorkshire

Peat from shallow, ca 7m deep, basin at White Moss, N Yorkshire (53° 59′ 15″ N, 02° 19′ 10″ W, Grid Ref SD 792545). Coll April 1975 and subm by IPJ.

Birm-665. **5080 ± 100**
3130 BC
$\delta^{13}C = -27.3‰$

Slightly humified limnic peat with abundant woody remains from 3.88 to 3.93m deep. *Comment* (IPJ): dates *Ulmus* decline, *cf* Birm-663, *ibid,* above. Many dates on *Ulmus* decline in NW Europe within a century or two on either side of 3000 BC (Pennington, 1969, p 63).

Birm-666. **1470 ± 100**
AD 480
$\delta^{13}C = -25.9‰$

Slightly humified sedge/sphagnum peat from 1.52 to 1.56m deep. *Comment* (IPJ): dates change from sporadic, low intensity agricultural activity to comprehensive woodland clearance for more intensive use of land for agriculture.

Birm-667. Aston Mill, Worcestershire **3390 ± 100**
1440 BC
$\delta^{13}C = -21.5‰$

Collagen from rib bones of wild ox (*Bos primigenius*) from basal 20cm of peat, .76m thick, underlying .95m clay and overlying mid-Devensian terrace gravel at Aston Mill, Worcestershire (52° 01′ 00″ N, 02° 04′ 45″ W, Grid Ref SO 94493549). Peat contains pot-boilers, flint artifacts, charcoal, and wooden stake. Coll May 1975 and subm by PFW. *Comment*: bones of wild ox cut by tools. Assoc animals (*Bos longifrons,* pig, sheep) indicate domestic animal economy and hunting (wild ox, red deer).

Birm-668. Robroyston, NE Glasgow, Scotland **11,210 ± 150**
9260 BC
$\delta^{13}C = -27.0‰$

Peat composed of *Scorpidium scorpioides* and *Carex cf rostrata* from 5.60 to 5.95m deep from Borehole M47 at Robroyston, NE Glasgow, Lanarkshire, Scotland (55° 53′ N, 04° 12′ W, Grid Ref NS 633676). Coll 1975 by W Bradford; subm by J H Dickson. *Comment*: peat underlies 4.2m deposit interpreted as till, expected to be either mid-Devensian or earlier. Date indicates Pollen Zone II and "till" is either due to Loch Lomond readvance which culminated at ca 10,700 (Evans, 1971, p 236) or is solifluction.

Alcester series, Warwickshire

Wood and vegetation fragments washed from sequence of clay and peat in alluvium of R Avon at Alcester, Warwickshire (52° 12′ 25″ N, 01° 51′ 30″ W, Grid Ref SP 097576). Coll July 1975 by PJO & FWS; subm by FWS.

Birm-680. Layer 5 **7440 ± 200**
5490 BC
$\delta^{13}C = -22.0‰$

From black peaty clay, 2.13 to 2.22m deep.

Birm-694. Layer 6 — **7450 ± 500** / **5500 BC** / $\delta^{13}C = -24.6‰$

From silty peat, 2.22 to 2.29m deep.

Birm-708. Layer 7 — **6930 ± 380** / **4980 BC** / $\delta^{13}C = -22.8‰$

Coarse fraction obtained by wet sieving of silty peat, 2.29 to 2.35m deep.

Birm-709. Layer 7 — **8480 ± 140** / **6530 BC** / $\delta^{13}C = -25.1‰$

Fine fraction of same sample, *ie*, 2.29 to 2.35m deep.

Birm-696. Layer 8 — **4160 ± 290** / **2210 BC** / $\delta^{13}C = -24.5‰$

From light gray clay with occasional pebble, 2.35 to 2.43m deep.

General Comment (FWS): series dates part of study of alluvium and its fauna. Birm-708 and -696 anomalous and must be contaminated by unrecognized roots from river bank.

Birm-689. Extwistle Moor, Lancashire — **2260 ± 100** / **310 BC** / $\delta^{13}C = -27.9‰$

Moss peat with some sedge remains and abundant *Juncus* seeds from 1.18 to 1.20m deep, .26m above base of deposit at Extwistle Moor, near Burnley, Lancashire (53° 47′ 45″ N, 02° 08′ 15″ W, Grid Ref SD 908334). Coll Dec 1973 and subm by D D Bartley, Dept Plant Sci, Univ Leeds. *Comment* (DDB): dates lowest clearance phase of woodland in blanket peat on Extwistle Moor at late Bronze age/early Iron age period. Sample assoc with high percentages of *Plantago lancealota* and *Rumex acetosa* type pollen together with high *Pteridium* spore value.

Birm-690. Epping Forest, Essex — **1350 ± 100** / **AD 600** / $\delta^{13}C = -27.0‰$

Wood fragments washed from 10kg detritus clay from Borehole B5, 110 to 120cm deep, from shallow peat bog in Epping Forest, Essex (51° 41′ N, 00° 04′ E, Grid Ref TL 431999). Coll June 1975 and subm by C A Baker, Dept Geog, King's Coll, Univ London. *Comment*: dates forest clearance and *Tilia* decline. Date apparently too young but together with Birm-582: 1110 ± 160 (R, 1975, v 17, p 260) confirms clearance is Saxon phenomena.

Birm-701. Bodymoor Heath, Warwickshire **11,240 ± 260**
9290 BC
$\delta^{13}C = -28.5‰$

Compacted woody peat with silt layers from loose block not *in situ*, probably from within or beneath alluvial gravel in R Tame at Bodymoor Heath gravel pit, Warwickshire (52° 33′ 50″ N, 01° 41′ 15″ W, Grid Ref SP 21229560). Coll Sept 1975 and subm by T A Brown, Dept Geol Sci, Univ Birmingham. *Comment*: date confirms pollen and insect faunal evidence that deposit is of Zone II age.

Birm-706. Worcester **3060 ± 230**
1110 BC
$\delta^{13}C = -23.6‰$

Small fragments of wood washed from gray clay 2.3 to 3m deep, overlying coarse gravel and covered by reddish silt, on floodplain of R Severn at municipal tip site, Worcester (52° 12′ 35″ N, 02° 14′ 12″ W, Grid Ref SO 838570). Coll Oct 1975 and subm by FWS. *Comment*: limiting date to development of upper red alluvium. *Cf* dates from Pilgrim Lock, R Avon in similar gray clay beneath reddish alluvium, *ie*, Birm-613, -632, -651 (*ibid*, above) and Birm-247: 3010 ± 120 (R, 1973, v 15, p 2).

Birm-707. Messingham, Lincolnshire **10,550 ± 250**
8600 BC
$\delta^{13}C = -35.2‰$

Moss peat, largely *Drepanocladus* sp, probably *D fluitans*, id by M Dalby, from upper peat bed, ca 1.5m deep, ca 1.5m above lower peat bed, in thin bedded to laminated orange sand at Messingham sand pit, Lincolnshire (53° 30′ 30″ N, 00° 37′ 00″ W, Grid Ref SE 916047). Coll May 1975 and subm by P C Buckland, Doncaster Mus. *Comment*: sample contains arctic insect fauna. Cover sands form terminal phase of Zone III in N Lincolnshire. *Cf* Birm-349: 10,280 ± 120 (R, 1973, v 15, p 458) from lower peat deposit and N-488: 10,700 ± 190 (R, 1969, v 11, p 455) on peat from lower part of blown sand at East Moor, near Sutton on the Forest (Gaunt *et al*, 1971, p 283).

B. Other countries

Suguta Strandline series, Lake Rudolf, Kenya

Shells and algal limestone from strandlines of former large lake, ca 80km long and 30 to 50km wide, in Suguta Valley, Lake Rudolf Basin, Kenya. Outer fraction of shells discarded, inner (a) and middle (b) fraction dated.

(a) 9060 ± 380
7110 BC
$\delta^{13}C = -4.2‰$

(b) 9660 ± 210
7710 BC
$\delta^{13}C = -5.8‰$

Birm-539. 11/670

Melanoides tuberculata from lacustrine silt in shallow, offshore/beach deposit, at ca +602m alt (227m above present day Lake Rudolf) from high still strand of former Lake Rudolf near Aruba on W flank of Suguta Valley fault trough (01° 55′ N, 36° 25′ E). Coll Sept 1973 by P Truckle; subm by W W Bishop, Dept Geol, Queen Mary Coll, Univ London. *Comment* (WWB): similar ages for highest lake levels of early Holocene "pluvial"; in Omo Valley, N of Lake Rudolf (Kibish formation of Butzer & Thurber, 1969, p 1142): L-1203J, 9500 ± 150 and Y-1340, 9200 ± 160 (R, 1969, v 11, p 600) for Lake Naivasha (00° 46′ S, 36° 21′ E).

(a) 4940 ± 230
2990 BC
$\delta^{13}C = -4.6‰$

(b) 4380 ± 200
2430 BC
$\delta^{13}C = -3.7‰$

Birm-540. Ref 1

Shells of freshwater oyster (*Etheria elliptica*) from 67m strandline, *ie*, above present day lake level, ca 4.8km NE of Koobi Fora, E shore of Lake Rudolf, Kenya (03° 58′ N, 36° 12′ E). Coll Aug 1970 by R E F Leakey; subm by WWB. *Comment* (WWB): *cf* Y-1575: 4880 ± 100 (R, 1969, v 11, p 600) also on *Etheria elliptica* from an archaeol site on "67m" beach, W of Lake Rudolf at Kangatotha. Present day Lake Rudolf is saline and contains no mollusks but "67m" lake was large body of freshwater.

(a) 9320 ± 250
7370 BC
$\delta^{13}C = -1.8‰$

(b) 9470 ± 270
7520 BC
$\delta^{13}C = -3.1‰$

Birm-583. WW 900

Melanoides tuberculata from beach of pumiceous sand marking high level strandline of former lake in Suguta Valley, ca 1.6km S of camp at Kamuge waterhole (01° 40′ N, 36° 14′ E). *Comment*: dates local culmination of sedimentation on W side of Suguta Valley.

(a) 9330 ± 190
7380 BC
$\delta^{13}C = -0.5‰$

Birm-584. WW 901

(b) 10,300 ± 250
8350 BC
$\delta^{13}C = -2.2‰$

Melanoides tuberculata from beach sand largely derived from volcanic detritus and slightly ferruginous, marking high-level strandline of former large lake in Suguta Valley, .8km S of Lolilia waterhole (01° 36′ N, 36° 28′ E). *Comment*: dates local culmination of sedimentation on E side of valley.

(a) 11,250 ± 220
9300 BC
$\delta^{13}C = -3.8‰$

Birm-585. WW 903

(b) 10,570 ± 300
8620 BC
$\delta^{13}C = -3.6‰$

Etheria elliptica from coarse gravel of beach deposit with abundant remains of catfish, perch, and few mammalian fossils overlying finer-grained diatomaceous lake sediment in narrow outcrop following line of R Suguta at Naserkalia (01° 32′ N, 36° 15′ E).

(a) 29,400 $^{+1300}_{-1100}$
27,450 BC
$\delta^{13}C = -0.2‰$

Birm-586. WW 904

(b) 29,000 ± 1000
27,050 BC
$\delta^{13}C = -1.3‰$

Algal limestone encrusting basalt cobbles on former shoreline of Suguta Valley lake, 4.8km S of Kamuge river crossing (01° 38′ N, 36° 16′ E). *Comment*: an embayment in basalts encloses Suguta Beds which are diatomaceous lacustrine sediments with lenses of fossiliferous grit containing fish and bird bones and many artifacts. Algal limestone marks temporary still-stand in falling lake level. Carbonate ages >20,000 described by Butzer & Thurber (1969, p 1142) considered unreliable. Birm-586 must be taken as apparent due to possible leaching of deposit and reprecipitation.

General Comment: Birm-583-586 coll Aug 1974 and subm by WWB. Heights, where not supplied, will be computed from theodolite readings and pub elsewhere by WWB. Map refs are approx, as region is unmapped. Differing ages of inner and middle fractions indicate some isotopic replacement.

Lake Baringo strandline series, Kokwob formation

Shells, *Melanoides tuberculata, Corbicula* sp, *Unio* sp, and ? *Viviparus* sp from emerged beach deposits of several high still stands of former Lake Baringo, Kenya (00° 30′ N, 36° 00′ E). Coll Aug 1969 and Sept 1973 by P C Buckland, E Spooner, and WWB; subm by WWB.

(a) 11,870 ± 310
9920 BC
$\delta^{13}C = -4.4‰$

Birm-541. WW 505

(b) 10,860 ± 280
8910 BC
$\delta^{13}C = -5.2‰$

Melanoides tuberculata from emerged beach, +987m alt, near trig point at old trading post of Logumukum, SE of Lake Baringo (00° 27′ N, 36° 05′ E).

(a) 13,670 ± 320
11,720 BC
$\delta^{13}C = -6.4‰$

Birm-542. WW 888

(b) 13,850 ± 430
11,900 BC
$\delta^{13}C = -5.7‰$

Melanoides tuberculata from beach or near-shore deposit, 15.85m above present day Lake Baringo, ca 3.2km N of Kampi-ya-Samaki fishing village, W Bay, Lake Baringo (00° 38′ N, 36° 01′ E).

(a) 7620 ± 180
5670 BC
$\delta^{13}C = +1.6‰$

Birm-543. WW 786

(b) 8460 ± 180
6510 BC
$\delta^{13}C = +2.2‰$

Unio sp fragments and few ? *Viviparus* sp from beach or near-shore deposit, 3.66m above present day Lake Baringo, near Kampi-ya-Samaki air-strip, W of Lake Baringo (00° 36′ N, 36° 01′ E).

(a) 12,260 ± 280
10,310 BC
$\delta^{13}C = +1.1‰$

Birm-544. WW 860

(b) 12,600 ± 280
10,650 BC
$\delta^{13}C = 0.0‰$

Melanoides tuberculata, valves of *Corbicula* sp, and few ? *Viviparus* sp, from silt 15.54m above present day Lake Baringo, S of Kampi-ya-Samaki in lower valley of R Kapthurin, W of Lake Baringo (00° 35′ N, 36° 00′ E). *Comment*: *Melanoides tuberculata* dated. $\delta^{13}C$ value for fraction (b) assumed as no measurements undertaken.

(a) 9940 ± 250
7990 BC
$\delta^{13}C = -3.4‰$

(b) 10,810 ± 270
Birm-545. WW 869 **8860 BC**
$\delta^{13}C = -2.6‰$

Melanoides tuberculata from intermediate strandline 10.06m above present day Lake Baringo, S of Kampi-ya-Samaki, W of Lake Baringo (00° 35′ 30″ N, 36° 00′ 00″ E).

General Comment: outer fraction discarded, inner (a) and middle (b) fractions dated. Dates indicate isotopic replacement has occurred but series shows increasing age with increased strandline height. Study of sedimentary units in Baringo region described by Bishop *et al*, 1971.

$\delta^{14}C = +49.5 \pm 22.8‰$
Birm-612. Engabreen, N Norway **Modern**
$\delta^{13}C = -21.3‰$

Amorphous humus from buried podzol, .3m deep, overlying 2 outer moraine ridges assoc with Neoglacial advances of Engabreen glacier (Worsley & Alexander, 1975) at Hollandsfjord, N Norway (66° 50′ N, 13° 43′ E, Grid Ref 33WVP 437993). Coll Aug 1973 and subm by P Worsley, Dept Geog, Univ Reading. *Comment*: impossible to distinguish and remove large mass of ? modern roots from sample. ^{14}C age of tree stump from below horizon of soil and over-ridden by advance of Engabreen 1600 ± 100, T-263. Date erroneously reported by Liestøl (1962) as BP and AD ages read in reverse order (Worsley, 1974). $\delta^{14}C$ indicates modern roots.

$\delta^{14}C = +7.0 \pm 35.5‰$
Birm-633. Rio San Pedro, Chile **Modern**
$\delta^{13}C = -22.5‰$

Roots washed from ca 4kg soil underlying 1.3m airfall pumice at Rio San Pedro, Antofagasta prov, N Chile near frontier with Bolivia (21° 59′ S, 68° 15′ W). Coll Aug 1974 and subm by P W Francis, Dept Earth Sci, Open Univ, Buckinghamshire. *Comment*: < 1g of combustible material recovered. No alkali pretreatment. Large standard deviation does not preclude possibility that pumice is assoc with recorded eruptions of AD 1877, 1891, 1901, or 1960 (Casertano, 1962). Francis (1974, p 366) relates this pumice horizon with other events in San Pedro's volcanic history.

19,100 ± 500
Birm-679. Tyszowce, Poland **17,150 BC**
$\delta^{13}C = -21.8‰$

Fine organic material (<250μ) washed from soil, 7.5 to 8m deep, in loess on Lublin Plateau at Tyszowce, SE Poland (50° 36′ 35″ N, 23° 42′ 34″ E). Coll April 1975 and subm by J Buraczyński, Inst Geog, Univ

Curie-Skłodowska, Lublin, Poland. *Comment*: clay/humus fraction separated from ca 3kg buried soil by method used at Sed Lab, INSTAAR, Univ Colorado (Kihl, 1975). Much younger than expected Brørup interstadial age. Birm-322: 41,500 $^{+2200}_{-1750}$ (R, 1973, v 15, p 462) also on humus from similar stratigraphic position. Sample must be contaminated by younger humic material and Birm-322 should be regarded as minimum. NaOH pretreatment not possible.

II. ARCHAEOLOGIC SAMPLES

A. British Isles

Skaill series, Orkney Islands, off NE Scotland

Hearth material, mainly *Betula*, id by S Limbrey, from Iron age site at Skaill, Deerness, Orkney Is, off NE Scotland (58° 56′ 40″ N, 02° 43′ 00″ W, Grid Ref HY 587067). Coll July 1974 and subm by P S Gelling, Dept Ancient Hist & Archaeol, Univ Birmingham.

Birm-592. Site 6, No. 2 — **1500 ± 120** / **AD 450** / $\delta^{13}C = -23.4‰$

From .33 to .38m deep, underlying latest occupation level.

Birm-593. Site 6, No. 3 — **1760 ± 110** / **AD 190** / $\delta^{13}C = -23.6‰$

From .69 to .74m deep, underlying penultimate occupation level.

Birm-594. Site 6, No. 4 — **3010 ± 140** / **1060 BC** / $\delta^{13}C = -23.8‰$

From 1.12 to 1.17m deep, underlying earliest occupation level.
General Comment: dates show site occupied by wide cultural range including Saxon, Iron age, and Bronze age settlements. Previous dates from Iron age level, Birm-397: 2100 ± 100 and Birm-413: 2120 ± 120 (R, 1974, v 16, p 297-298).

Cadbury Congresbury series, Somersetshire

Charcoal and bone assoc with collapsed post-Roman rampart at Cadbury Congresbury, Somersetshire (51° 23′ N, 02° 48′ W, Grid Ref ST 442650). Coll July 1973 and subm by P A Rahtz, Hist School, Univ Birmingham.

Birm-596. G 2464/GF 164 — **1630 ± 110** / **AD 320** / $\delta^{13}C = -22.9‰$

Charcoal from ca .5m deep overlying dark ? Iron age soil and underlying stony rubble of rampart.

Birm-597. B 1410 — **1690 ± 350** / **AD 260** / $\delta^{13}C = -23.0‰$

Charcoal from ca .8m deep in similar stratigraphic position as Birm-596.

Birm-598. YF 5 — **1460 ± 110** / **AD 490** / $\delta^{13}C = -20.5‰$

Collagen from ox skull, id by PAR, from ca .7m deep, within rubble of collapsed rampart.

General Comment: dates rampart to post-Roman period rather than Iron age.

Birm-614. Fisherwick, Staffordshire — **2130 ± 100** / **180 BC** / $\delta^{13}C = -26.1‰$

Unid wood washed from peat with pebbles and sand lenses from base of Iron age ditch on W bank of R Tame at confluence with small brook, on gravel terrace ca 1.5m above present flood plain at Fisherwick, near Lichfield, Staffordshire (52° 40′ N, 01° 44′ W, Grid Ref SK 187081). Coll July 1974 and subm by Christopher Smith, Dept Archaeol, Univ Nottingham. *Comment*: sample from water-logged base of sec 2m wide and 1.75m deep, excavated across main enclosure ditches, containing "large quantities of organic materials, especially insects, seeds, wood including hewn timber, and animal bones. . . . Interstratified with these deposits is Iron age pottery. . . ." (Smith, 1975).

Skara Brae series, Orkney Islands

Collagen from bone samples (*Bos longifrons*) of Neolithic site on S edge of Bay of Skaill at Skara Brae, Orkney Is (59° 02′ 50″ N, 03° 20′ 40″ W, Grid Ref HY 231187). Coll July-Aug 1973 and subm by D V Clarke, Natl Mus Antiquaries, Edinburgh, Scotland.

Birm-636. Trench 1, Sec B, 68A — **4350 ± 130** / **2400 BC** / $\delta^{13}C = -19.2‰$

Birm-637. Trench 1, Sec B, 68B — **4430 ± 100** / **2480 BC** / $\delta^{13}C = -19.9‰$

Birm-638. Trench 1, Sec B, 68C — **4430 ± 120** / **2480 BC** / $\delta^{13}C = -24.5‰$

Birm-639. Trench 1, Sec B, 68D — **4400 ± 100** / **2450 BC** / $\delta^{13}C = -21.3‰$

General Comment: dates beginning of occupation of settlement. *Cf*

Birm-480: 4320 ± 100 (R, 1975, v 17, p 267) also assoc with earliest human activity at site. Other dates from this site: Birm-433-438 (R, 1974, v 16, p 300-301).

Birm-659. Dinas Emrys, Gwynedd **650 ± 100** **AD 1300**

$\delta^{13}C = -25.6‰$

Wood, ? conifer, from earliest post-hole, ca 1.2m deep at defended chieftain's stronghold, Dinas Emrys, ca 1.6km NE of Beddgelert, Gwynedd (53° 01′ 10″ N, 04° 04′ 20″ W, Grid Ref SH 606492). Coll July 1954 by H N Savory; subm by PAR. *Comment* (PAR): date unexpectedly late. Sample originally thought to be Iron age with site extending to 12th century (Savory, 1960). Reconsideration of pub evidence suggests post-Roman date. Both hypotheses provisionally invalidated by this Medieval date.

Birm-697. Bournville Park, Birmingham **2960 ± 140** **1010 BC**

$\delta^{13}C = -23.4‰$

Charcoal from near base of 50cm thick compact layer of severely cracked and fragmented Bunter quartzite pebbles with black clayey silt underlying 10cm loam and overlying ca 15cm clean yellow clayey alluvium, whitened at contact on N bank of Griffins Brook, near SW of yatching pool, Bournville park, Birmingham (52° 25′ 44″ N, 01° 56′ 43″ W, Grid Ref SP 03688120). Coll Aug 1975 and subm by M J Nixon, Birmingham Archaeol Soc. *Comment*: *cf* Birm-344: 2950 ± 100 and -371: 2990 ± 100 (R, 1973, v 15, p 465) from similar "potboiler" site (Ellis & Shotton, 1973).

Birm-705. Hascombe, Surrey **2180 ± 120** **230 BC**

$\delta^{13}C = -21.0‰$

Carbonized grain from Iron age hill fort 6.4km SE of Godalming at Hascombe, Surrey (51° 08′ N, 00° 34′ W, Grid Ref TQ 004386). Coll 1975 by E Collins; subm by F H Thompson, Soc Antiquaries, Burlington House, London. *Comment*: dates abandonment of fort. *Cf* dates from nearby Iron age hill fort of Anstiebury, Birm-468: 2380 ± 120 and Holmbury Hill, Birm-591: 2260 ± 100 (R, 1975, v 17, p 266).

B. Other countries

Birm-537. Chesowanja, Kenya **230 ± 110** **AD 1720**

$\delta^{13}C = -27.0‰$

Charcoal from burnt tree stump in growth position, on former course of R Mukutan at Chesowanja archaeol and hominid locality (Bishop *et al*, 1975) ca 6.4km W of old trading post of Baringo, E of Lake Baringo in Northern Rift Valley of Kenya (00° 39′ N, 36° 13′ E). Coll Sept 1973 and subm by WWB. *Comment* (WWB): date confirms tree stumps are not related to stratified archaeol material but to burning

of dead trees following diversion of R Mukutan towards N by Njemps tribesmen to irrigate washplain for agriculture. No knowledge of event from local (Njemps) oral history.

Monte Rocca series, Verona, NE Italy

Collagen from unid, animal bones in group of intersecting storage pits of Rivoli-Castelnovo at Monte Rocca, Rivoli, Verona, NE Italy (45° 50′ N, 11° 20′ E). Coll Aug 1967 and subm by L H Barfield, Dept Ancient Hist & Archaeol, Univ Birmingham.

Birm-616. Site L — **5070 ± 100** / **3120 BC** / $\delta^{13}C = -19.1‰$

Birm-617. Site L — **5370 ± 70** / **3420 BC** / $\delta^{13}C = -19.6‰$

General Comment (LHB): date latest stage of square-mouthed pottery culture (Rivoli-Castelnovo) in Veneto region. *Cf* Birm-103: 5520 ± 140 and -104: 5670 ± 130 (R, 1970, v 12, p 397) from same pit complex.

References

Bishop, W W, Chapman, G R, Hill, A, and Miller, J A, 1971, Succession of Cainozoic vertebrate assemblages from the northern Kenya Rift Valley: Nature, v 233, p 389-394.

Bishop, W W, Pickford, M, and Hill, A, 1975, New evidence regarding the Quaternary geology, archaeology, and hominids of Chesowanja, Kenya: Nature, v 258, p 204-208.

Butzer, K W and Thurber, D L, 1969, Some late Cenozoic sedimentary formations of the lower Omo Basin: Nature, v 222, p 1138-1143.

Briggs, D J, 1975, Origin, depositional environment, and age of the Cheltenham sand and gravel and related deposits: Geol Assoc Proc, v 86, p 333-348.

Briggs, D J, Coope, G R, and Gilbertson, D D, 1975, Late Pleistocene terrace deposits at Beckford, Worcestershire, England: Geol Jour, v 10, p 1-16.

Casertano, L, 1963, Catalogue of the active volcanoes of the world including solfatara fields; pt 15, Chilean continent, p 1-55: Int Volcan Assoc, Naples, 1963.

Coope, G R, 1962, A Pleistocene coleopterous fauna with arctic affinities from Fladbury, Worcestershire: Geol Soc [London] Quart Jour, v 118, p 103-123.

———— 1968, An insect fauna from Mid-Weichselian deposit at Brandon, Warwickshire: Royal Soc [London] Philos Trans, ser B, v 254, p 425-456.

Ellis, N and Shotton, F W, 1973, Radiocarbon and thermoluminescence dating of a prehistoric hearth and a pit near the Fosse Way in Harbury parish, Warwickshire: Coventry & Dist Nat Hist & Sci Soc Proc, v 4, p 204-206.

Evans, P, 1971, Towards a Pleistocene time-scale. Part 2 of The Phanerozoic Time-scale—a supplement: Geol Soc spec pub no. 5, London, p 123-356.

Francis, P W, Roobol, M J, Walker, G R L, Cobbold, P R, and Coward, M, 1974, The San Pedro and San Pablo volcanoes of northern Chile and their hot avalanche deposits: Geol Rund, v 63, p 357-388.

Gaunt, G D, Jarvis, R A, and Matthews, B, 1971, The late Weichselian sequence in the Vale of York: Yorks Geol Soc Proc, v 38, no. 13, p 281-284.

Kihl, R, 1975, Physical preparation of organic matter samples for submission to a radiocarbon dating laboratory: Quarternary Res Assoc Newsletter, no. 16, p 4-6, June 1975.

Liestøl, O, 1962, Discovery of a tree stump in front of Engabreen, Svartisen: Norsk Polarinst Årbok 1960, p 64-65.

Longin, Robert, 1971, New method of collagen extraction for radiocarbon dating: Nature, v 230, p 241-242.

Pearson, R G, 1962, The Coleoptera from a late-glacial deposit at St Bees, Cumberland: Jour Animal Ecol, v 31, p 129-150.

Pennington, Winifred, 1965, The interpretation of some post-glacial vegetation diversities at different Lake District sites: Royal Soc [London] Proc, ser B, v 161, p 310-323.

———— 1969, The history of British vegetation: London, English Univ Press, 152 p.

Savory, H N, 1960, Excavations at Dinas Emrys, Beddgelert, Caernarvonshire, 1954-56: Archaeol Cambrensis, v 109, p 13-77.

Shawcross, F W and Higgs, E S, 1961, The excavation of a *Bos primigenius* at Lowe's Farm, Littleport: Cambridge Antiquarian Soc Proc, v 54, p 3-16.

Shotton, F W, 1953, The Pleistocene deposits of the area between Coventry, Rugby, and Leamington, and their bearing upon the topographic development of the Midlands: Royal Soc [London] Philos Trans, ser B, v 237, p 209-260.

———— 1968, The Pleistocene succession around Brandon, Warwickshire: Royal Soc [London] Philos Trans, ser B, v 254, p 387-400.

———— 1972, A comparison of modern and Bronze age mollusc faunas from the Warwickshire-Worcestershire Avon: Coventry & Dist Nat Hist & Sci Soc Proc, v 4, p 173-182.

Smith, Christopher, 1975, Excavations at Fisherwick, Staffordshire, 1974, an interim note: Nottingham, Dept Classical & Archaeol Studies, Univ Nottingham, 6 p.

Sutcliffe, A J and Bowen, D Q, 1973, Preliminary report on excavations in Minchin Hole, April-May 1973: William Pengelly Cave Studies Trust Newsletter, no. 21, p 12-25.

Tomlinson, M E, 1925, River terraces of the lower valley of the Warwickshire Avon: Geol Soc [London] Quart Jour, v 81, p 137-163.

———— 1940, Pleistocene gravels of the Cotswold subedge plain from Mickleton to the Frome Valley: Geol Soc [London] Quart Jour, v 96, p 385-421.

Walker, D, 1956, A late-glacial deposit at St Bees, Cumberland: Geol Soc [London] Quart Jour, v 112, p 93-101.

Worsley, P, 1974, On the significance of the age of a buried tree stump by Engabreen, Svartisen: Norsk Polarinst Årbok 1972, p 111-117.

Worsley, P and Alexander, M, 1975, Neoglacial paleoenvironmental change at Engabrevatn, Svartisen, Holandsfjord, north Norway: Norsk Geol Unders, v 321, in press.