

**BRITISH MUSEUM NATURAL RADIOCARBON  
MEASUREMENTS XVIII**

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The following list consists of dates for archaeological and geologic samples mostly measured from June 1983 to June 1984. The dates were obtained by liquid scintillation counting of benzene using the laboratory procedures outlined in previous lists (see, eg, BM-VIII, R, 1976, v 18, p 16). Dates are expressed in radiocarbon years relative to AD 1950 based on the Libby half-life for  $^{14}\text{C}$  of 5570 yr, and are corrected for isotopic fractionation ( $\delta^{13}\text{C}$  values are relative to PDB). Some dates are corrected, using the calibration tables of Klein *et al* (1982), and are reported in the *Comment* with an asterisk (\*). The modern reference standard is NBS oxalic acid (SRM 4990). Errors quoted with dates are based on counting statistics alone and are equivalent to  $\pm 1$  standard deviation ( $\pm 1\sigma$ ). Descriptions, comments, and references to publications are based on information supplied by submitters.

ARCHAEOLOGIC SAMPLES

*British Isles*

*England*

**BM-2157. Stonea** **1950  $\pm$  50**  
 $\delta^{13}\text{C} = -28.0\text{‰}$   
Waterlogged wood, ref ADZ/AEQ W38, from large bundle of prepared rods embedded in thick peat deposit within very large feature at Stonea Grange, near March, Cambridgeshire (52° 30' N, 0° 10' E, Natl Grid Ref TL 449937). Coll 1982 and subm by R Jackson, Dept Prehist and Romano-British Antiquities, British Mus. *Comment* (RJ): subsequent excavation in 1983 and 1984 suggests that feature was filled in ca AD 130-140, thus according well with  $^{14}\text{C}$  determination.

**BM-2158. Ozengell** **Modern**  
 $\delta^{13}\text{C} = -22.6\text{‰}$   
Collagen from shaft of right femur from burial of complete skeleton of ox in rectangular pit (ref F1/LOM 5/82) cut into chalk within circular ditched enclosure at Ozengell (Lord of the Manor), Ramsgate, Kent (51° 20' N, 1° 25' E, Natl Grid Ref TR 356653). Coll 1982 and subm by D R J Perkins, Is. Thanet Archaeol Unit, to provide date for later modification of group of Neolithic/Bronze age enclosures/barrows, and for presumed remains of *Bos primigenius*, ca 1000 bc. *Comment* (DRJP): enclosure is one of group presumed to be small henges, interspersed with ploughed-off round barrows and Ozengell Anglo-Saxon cemetery. Excavations 1976 to 1977 revealed re-use of enclosures assoc with Beaker pottery and crouched

burial (Perkins & MacPherson-Grant, ms in preparation). Pit (F2) at center of enclosure LOM 5, close to ox burial, contained selected human bones from 4 individuals. Possibly these bones were found and re-interred when pit F1 was dug for relatively modern burial of ox. Result shows remains belong to domestic ox, not *Bos primigenius*.

### Dorchester Cursus series

Samples from cursus and assoc earthworks at Dorchester-on-Thames, Oxfordshire (51° 40' N, 1° 10' W, Natl Grid Ref SU 582948). Coll 1981 by R Chambers, Oxfordshire Archaeol Unit and subm by R Bradley, Univ Reading.

**BM-2161. Dorchester Cursus** **3840 ± 40**  
 $\delta^{13}C = -24.6\text{‰}$

Charcoal, ref Site III 2009/8, (outer rings of *Quercus* sp, >15 yr old) id by M Robinson, Univ Mus, Oxford, from burned post *in situ* within post pit of timber circle, loc at center of cursus monument. Measured to establish *terminus post quem* for bldg of timber circle.

**BM-2162. Dorchester Cursus** **3870 ± 60**  
 $\delta^{13}C = -24.2\text{‰}$

Charcoal, ref Site III 2013/9, (*Quercus* sp, possibly sapwood) id by M Robinson, from outer rings of different burned post from same timber circle as BM-2161, above.

**BM-2163. Dorchester Cursus** **3780 ± 50**  
 $\delta^{13}C = -24.7\text{‰}$

Charcoal, ref Site III 2009/1, (*Quercus* sp) id by M Robinson, from upper fill of post pipe of upright belonging to same timber circle as BM-2161, -2162, above, assoc with deposit of cremated bone. Measured to establish interval between use of circle and deposition of cremation.

**BM-2164. Dorchester Cursus** **3890 ± 60**  
 $\delta^{13}C = -24.4\text{‰}$

Charcoal, ref Site III 2014/11, (*Quercus* sp, possibly heartwood) id by M Robinson, from outer rings of different burned post from same timber circle as BM-2161, -2162, -2163, above.

**BM-2165. Dorchester Cursus** **3330 ± 80**  
 $\delta^{13}C = -25.1\text{‰}$

Charcoal, ref Site III 2013/1, (*Quercus* sp, *Fagus* sp) id by M Robinson, from upper fill of post pipe of timber circle postdating burning of post and assoc with cremated bone.

**BM-2166. Dorchester Cursus** **3730 ± 45**  
 $\delta^{13}C = -24.6\text{‰}$

Charcoal, ref Site III 2014/7, (*Quercus* sp) id by M Robinson from upper fill of post pipe of upright belonging to same timber circle as BM-

2161 to -2165, above. Measured to date re-use of site after removal of timber circle.

**BM-2167. Dorchester Cursus** **3390 ± 70**  
 $\delta^{13}C = -24.8\text{‰}$

Charcoal, ref Site IV F1006, (*Quercus* sp) id by M Robinson, from pit at center of ring ditch inside cursus, assoc with Collared Urn and cremated bone.

**BM-2268. Dorchester Cursus** **3950 ± 70**  
 $\delta^{13}C = -21.3\text{‰}$

Collagen from antler pick, ref Site I F81, id as probably red deer by R Wilson, Univ Mus, Oxford, from top of primary fill of ditch of hengiform single-entranced enclosure within E terminal of Dorchester Cursus. Measured to establish *terminus ante quem* for cremation burials cut into uppermost filling of ditch.

*General Comment* (RB): samples suggest date of secondary activity inside cursus complex, involving construction of substantial post circle and hengiform enclosure. BM-2163 and -2166 suggest date of secondary use of timber circle for deposition of human cremations. BM-2165 should date same activity but seems anomalously late. BM-2167 indicates continuing significance of cursus in Early Bronze age. Earlier use of cursus is suggested by OxA-119, 4800 ± 130 bp (Gillespie *et al*, 1984).

**BM-2168. Kent's Cavern** **11,570 ± 410**  
 $\delta^{13}C = -19.8\text{‰}$

Collagen from fragmentary atlas vertebra of bovid (ref no. 1951), id by A Carrant, Dept Palaeontol, British Mus (Nat Hist), from 'Black Band' above cave earth sealed by stalagmite in Kent's Cavern, Lincombe Hill, Torquay, Devon (50° 25' N, 3° 30' W, Natl Grid Ref SX 935642). Coll 1867 by W Pengelly and subm by R M Jacobi, Dept Classics and Archaeol, Univ Lancaster, from Pengelly colln in British Mus (Nat Hist) (ref no.M559), to help estimate range of time over which faunal remains and artifacts attributed by Pengelly to 'Black Band' could have accumulated. *Comment* (RMJ): this new determination opens possibility of incorporation of Late Glacial backed blade assemblage (see dates for Gough's Cave, BM-2183 to -2188, this list, below) into this part of Pengelly's excavations at date later than inferred previously (ca 14,000 bp; Campbell & Sampson, 1971). Both dates need to be taken into consideration when estimating age of possible human return after last glacial max (Jacobi *et al*, ms in preparation).

### Down Farm series

Samples from Neolithic ring ditch re-used as Deverel-Rimbury cremation cemetery near Down Farm, Woodcutts, Dorset (50° 55' N, 2° 0' W, Natl Grid Ref SU 002137). Coll 1980 and subm by R Bradley. Ring ditch is 130m from Deverel-Rimbury enclosed settlement site previously dated (*cf* BM-1850, 2680 ± 130; BM-1851, 2730 ± 50; BM-1852, 2740 ± 40; BM-1853, 2790 ± 45; BM-1854, 2800 ± 45; R, 1982, v 24, p 271).

**BM-2177. Down Farm Ring Ditch****3050 ± 70** $\delta^{13}C = -25.0\text{‰}$ 

Charcoal, ref L4, (*Quercus* sp) id by M Robinson, from upper filling of ring ditch, directly sealed by flint layer, L3, measured to give *terminus post quem* for flint layer, dated directly by BM-2178, below.

**BM-2178. Down Farm Ring Ditch****3010 ± 60** $\delta^{13}C = -24.9\text{‰}$ 

Charcoal, ref L3, (*Quercus* sp, heartwood) id by M Robinson, from flint packing containing cremated bone and Deverel-Rimbury pottery in top filling of ring ditch. Dated to check if contemporary with nearby Deverel-Rimbury settlement.

**BM-2179. Down Farm Ring Ditch****2740 ± 30** $\delta^{13}C = -24.7\text{‰}$ 

Charcoal, ref crem 12, (*Fraxinus* sp) id by M Robinson, from pit outside ring ditch, assoc with human cremation and Deverel-Rimbury sherds. Dated to check if deposit is contemporary with nearby settlement.

**BM-2180. Down Farm Ring Ditch****2810 ± 50** $\delta^{13}C = -24.7\text{‰}$ 

Charcoal, ref crem 6, (*Fraxinus* sp) id by M Robinson, from pit outside ring ditch, assoc with human cremation and Globular Urn fragments. Dated to check if deposit is contemporary with nearby settlement.

*General Comment (RB):* BM-2177 and -2178, both on heartwood, indicate period of re-use of Neolithic ring ditch, whilst BM-2179 and -2180 suggest that secondary cremation cemetery may have belonged to nearby settlement dated by BM-1850 to -1854; R, 1982, v 24, p 271.

**BM-2181. Pitstone****5520 ± 60** $\delta^{13}C = -23.2\text{‰}$ 

Collagen from basal part of fragmentary left horn core of *Bos primigenius*, id by Barbara Noddle, Univ Coll, Cardiff, from Postglacial (Flandrian) buried soil beneath hillwash in Pitstone no.3 Quarry, N E side of Tring Gap, Pitstone, Buckinghamshire (51° 50' N, 0° 40' W, Natl Grid Ref SP 933140). Coll 1970 and subm by J G Evans, Dept Archaeol, Univ Coll, Cardiff, from Bucks Co Mus colln (ref 378.1972) to provide max age for onset of hillwash and date for *Bos primigenius* (late Pleistocene/early Holocene mammalian extinctions program; R, 1983, v 25, p 39–41). *Comment (JGE):* horn core was found in buried soil overlying coombe rock and under several m of colluvium in bottom of dry valley. Charcoal from buried soil in adjacent valley assoc with molluscan evidence for woodland clearance was dated 3910 ± 220 (HAR-327; Evans & Valentine, 1974). Molluscan assemblages from hollows below buried soils in two other closely adjacent valleys were of closed woodland type indicative of an Atlantic age (Evans, 1966). Although correlation is indirect assemblages are probably approx same age as horn core.

**Gough's Cave series**

Collagen from bones of horse (*Equus ferus*) id by Dorothea Bate, from levels (spits) in Gough's (New) Cave, S side of Cheddar Gorge, Mendip, Somerset (51° 15' N, 2° 45' W, Natl Grid Ref ST 467539). Coll 1927 to 1928 by R F Parry (1929) and subm 1982 by R M Jacobi, Dept Classics and Archaeol, Univ Lancaster from British Mus (Nat Hist) colln, to provide dates for assoc Cheddarian artifacts and occurrence of horse in late Devonian fauna of British Is.

**BM-2183. Gough's Cave** **12,120 ± 120**  
 $\delta^{13}C = -20.6\text{‰}$   
Atlas vertebra, humanly modified, from Parry's Level 10.

**BM-2184. Gough's Cave** **12,020 ± 120**  
 $\delta^{13}C = -20.3\text{‰}$   
Calcaneum from Parry's Level 12.

**BM-2185. Gough's Cave** **11,970 ± 230**  
 $\delta^{13}C = -20.2\text{‰}$   
Metapodial from Parry's Level 13.

**BM-2186. Gough's Cave** **12,240 ± 220**  
 $\delta^{13}C = -20.2\text{‰}$   
Metapodial from Parry's Level 14.

**BM-2187. Gough's Cave** **12,070 ± 170**  
 $\delta^{13}C = -19.9\text{‰}$   
Metapodial from Parry's Level 16.

**BM-2188. Gough's Cave** **12,160 ± 210**  
 $\delta^{13}C = -19.9\text{‰}$   
Metapodial from Parry's Level 18.

*General Comment* (RMJ): believed to be 1st reliable dates for important Late Glacial backed blade assemblage, so-called "Cheddarian" industry. Stylistically, assemblage seems very similar to that recovered from Black Band at Kent's Cavern (BM-2168, above). Results imply contemporaneity of this type of assemblage with later Hamburgian style stone tool kits from further E in European mainland. Dates confirm Cheddar Man (9080 ± 150; R, 1971, v 13, p 180) was later, intrusive, inhumation, and are substantially earlier than ages of just before 11,000 bp, apparently assoc with lithic assemblage with many Tjonger points from in front of Mother Grundy's Parlour, Creswell Crags, Derbyshire (Jacobi, 1981, p 62; Burleigh, Jacobi, & Jacobi, 1985).

**Whitton Hill series**

Charcoal from prehistoric earthworks at Whitton Hill, Northumberland (55° 40' N, 2° 0' W, Natl Grid Ref NT 930355). Coll 1982 and subm by R Miket, Tyne and Wear Co Council, to establish chronol for site.

- BM-2203. Whitton Hill**  $4820 \pm 80$   
 $\delta^{13}C = -26.0\text{‰}$   
Charcoal, ref T2/1, from patch of burning cut by W arc of ring ditch (Site 2). Measured to date earliest evidence of activity found at site.
- BM-2204. Whitton Hill**  $2860 \pm 90$   
 $\delta^{13}C = -24.9\text{‰}$   
Charcoal, ref T2/3, from Pit 1 at entrance to monument (Site 2), assoc with cremation deposit.
- BM-2205. Whitton Hill**  $3610 \pm 45$   
 $\delta^{13}C = -26.5\text{‰}$   
Charcoal, ref T2/4, from mid-point of ditch of Site 2.
- BM-2206. Whitton Hill**  $3740 \pm 50$   
 $\delta^{13}C = -25.3\text{‰}$   
Charcoal, ref T1/2, from timber structure within ditch (Site 1).
- BM-2264. Whitton Hill**  $2880 \pm 310$   
 $\delta^{13}C = -24.2\text{‰}$   
Charcoal, ref T2/2 from beneath stone covering central cremation on Site 2.
- BM-2265. Whitton Hill**  $3680 \pm 80$   
 $\delta^{13}C = -26.2\text{‰}$   
Charcoal, ref T1/1, from timber structure within ditch (Site 1), from similar context to BM-2206, above.
- BM-2266. Whitton Hill**  $3660 \pm 50$   
 $\delta^{13}C = -25.9\text{‰}$   
Charcoal, ref T1/3, from central burial in Site 1.
- BM-2267. Whitton Hill**  $2770 \pm 170$   
 $\delta^{13}C = -25.2\text{‰}$   
Charcoal, ref T2/5, from ditch on Site 2.

*General Comment (RM):* from structure and assoc finds, both monuments were considered to fit within later 3rd/early 2nd millennium BC context. Corrected dates for Site 1 are consistent with this. Two of 5 dates for Site 2, however, present anomalies. Ditch, central deposit, and entrance pits all appear to be part of same process. Date for ditch fill (BM-2205) would also link this monument to adjacent Site 1, but consistently younger dates from other elements of monument (BM-2264, from central deposit, and BM-2204, from 1 of entrance pits) do not match expected earlier date. Date,  $820 \pm 170$  bc (BM-2267), from upper silting of ditch fill was assoc with vessel of 1st millennium BC. This was seen as evidence of much later discard activity, but conflicting dates referred to above now throw this open to question.

**Rangoon Street series**

Bone from two articulated female human skeletons buried together in one grave orientated N-S in 'Dark Earth' layer from Rangoon St, Aldgate Ward, City of London (51° 30' N, 0° 05' W, Natl Grid Ref TQ 335815). Coll 1982 and subm by Barbara West and David Butler, Dept Urban Archaeol, Mus London, to date 'Dark Earth' in London.

**BM-2214. Rangoon St** **1050 ± 45**  
 $\delta^{13}C = -16.0\text{‰}$   
Collagen from human ribs, ref 1090.

**BM-2215. Rangoon St** **980 ± 50**  
 $\delta^{13}C = -20.4\text{‰}$   
Collagen from human ribs, ref 1157.

*General Comment* (BW): skeletons are one of few examples of non-residual datable objects within 'Dark Earth' but burial itself is enigmatic. N-S orientation suggests pagan burial but there are no grave goods and date is too late for pagan Saxon burial. Dates might fit Viking activity but lack of grave goods is surprising.

**Asham Quarry series**

Samples of charcoal and shells of *Pomatias elegans* from biostrat sec in Asham Quarry, near Lewes, Sussex (50° 50' N, 0° 0' W, Natl Grid Ref TQ 440060). Coll 1982 to 1983 and subm by Caroline Ellis, Dept Geol, Imperial Coll, Univ London, from buried soil assoc with open-country and mixed open-country and woodland molluscan faunal assemblages representing clearance (molluscan biozones d and e). Samples measured to provide dates for molluscan zones (Kerney, 1977) and for comparison of dates for charcoal and snail shells from related strat level.

**BM-2216. Asham** **2760 ± 120**  
 $\delta^{13}C = -25.6\text{‰}$

Charcoal from N Sec, from hearth in middle of molluscan column. Open-country assemblage (biozone e, clearance horizon, but prior to appearance of *Monacha cartusiana*). Carbonized seeds from sample include *Arrhenatherum elatius*, *Atriplex* spp, *Potentilla anselina*, *Veronica hederifolia*, and *Plantago lanceolata*, id by D T Holyoak, Geog Dept, Univ Nottingham.

**BM-2217. Asham** **3460 ± 190**  
 $\delta^{13}C = -25.6\text{‰}$

Charcoal from N Sec, from hearth ca 3m to right of molluscan column and strat below BM-2216. Mixed open-country and woodland assemblage (biozones d and e).

**BM-2277. Asham** **3580 ± 280**  
 $\delta^{13}C = -24.7\text{‰}$

Charcoal from S Sec, from same strat layer as BM-2217, above. Open-country assemblage with small element of woodland sp (boundary between biozones d and e).

**BM-2296. Asham** **4590 ± 110**  
 $\delta^{13}C = -6.5\text{‰}$

Carbonate, aragonite form, id by Susan La Niece, Research Lab, British Mus, from shells of *Pomatias elegans* from N Sec for comparison with charcoal from same sec, BM-2217, above.

*General Comment* (CE): charcoal results indicate Bronze age date for forest clearance at this site. Date for shell carbonate is older than corresponding charcoal despite careful selection of shells without calcite encrustations (forms part of continuing comparative study of dates for charcoal and shells of selected sp of land snails).

**BM-2219. South Heighton** **3450 ± 150**  
 $\delta^{13}C = -24.6\text{‰}$

Charcoal from biostrat sec at South Heighton, near Newhaven, Sussex (50° 45' N, 0° 0' W, Natl Grid Ref TQ 450034). Coll 1982 to 1983 and subm by Caroline Ellis, from clearance horizon (base of biozone) in buried soil with open-country molluscan faunal assemblage with *Monacha cartusiana* present. *Comment* (CE): charcoal result obtained from South Heighton indicates Bronze age date for forest clearance. Several Bronze age artifacts were found close to site.

### Cow Gap series

Charcoal and shells of *Pomatias elegans* from slope deposits at Cow Gap, near Eastbourne, Sussex (51° 40' N, 0° 10' E; Natl Grid Ref TV 595957). Coll 1982 to 1983 and subm by Caroline Ellis, from biostrat sec assoc with mixed open-country and woodland molluscan faunal assemblage representing clearance (boundary between molluscan biozones d and e). Samples measured to provide dates for molluscan zones (Kerney, 1977) and for comparison of dates for charcoal and snail shells (*cf* Asham Quarry, above).

**BM-2220. Cow Gap** **4820 ± 350**  
 $\delta^{13}C = -24.6\text{‰}$

Charcoal from base of postglacial colluvium directly overlying late glacial deposits of chalk rubble and silts, assoc with mixed molluscan fauna of open-country and woodland sp including *Monacha cartusiana*.

**BM-2295. Cow Gap** **5860 ± 130**  
 $\delta^{13}C = -6.1\text{‰}$

Carbonate, aragonite form, id by S La Niece, from shells of *Pomatias elegans* from basal colluvium directly overlying late glacial deposits, dated for comparison with charcoal from same level, BM-2220, above.

*General Comment* (CE): charcoal date is considerably earlier than those for Asham and South Heighton, above. Date falls within Neolithic period and agrees with sherd of finger-impressed Beaker pottery from same strat layer (Bell, 1981). Carbonate date from *Pomatias elegans* shells from same layer is considerably older than charcoal date, as is shell carbonate date from

Asham. Possible sources of error in shell dating are discussed by Burleigh and Kerney (1982) and Goodfriend and Hood (1983).

### Gallibury Down series

Charcoal samples from Bronze age round barrow at Gallibury Down, Calbourne, Isle of Wight (50° 40' N, 1° 20' W, Natl Grid Ref SZ 442855). Coll 1978 and subm by D J Tomalin, Co Archaeol Unit, Newport, Isle of Wight, to establish chronol for site.

**BM-2230. Gallibury Down** **3560 ± 50**  
 $\delta^{13}C = -27.0\text{‰}$

Charcoal, ref NBD 78 Context 20 (sample 1), from scattered deposit on old ground surface sealed by clay upcast from primary Beaker burial pit containing Dorset-type bowl. Sample dates use of ground surface just before primary burial.

**BM-2231. Gallibury Down** **5150 ± 60**  
 $\delta^{13}C = -26.9\text{‰}$

Charcoal, ref NBD 78 Context 18/22, from in and around posthole 100u.

**BM-2232. Gallibury Down** **3380 ± 80**  
 $\delta^{13}C = -26.6\text{‰}$

Charcoal, ref NBD 78 Context 14/5 (sample 3), from scatter at base of turf stack. Sample dates opening of phase II contemporary with barrow construction. *Terminus post quem* for graves G and H.

**BM-2233. Gallibury Down** **3440 ± 150**  
 $\delta^{13}C = -25.4\text{‰}$

Charcoal, ref NBD 78 Context 15 (sample 5), from scatter on paleosol beneath turf stack. Dates later part of phase I of barrow construction.

**BM-2234. Gallibury Down** **3520 ± 90**  
 $\delta^{13}C = -26.0\text{‰}$

Charcoal, ref NBD 78 Context 15 (sample 6), from scatter on paleosol beneath turf stack. Dates later part of phase I of barrow construction.

*General Comment* (DJT): BM-2230 provides *terminus post quem* for deposition of handled Beaker bowl and Clarke's Dorset type. Date is also assoc with palynol horizon indicative of pastoral/grassland environment on surrounding chalk hilltop. BM-2233 and -2234 give *terminus post quem* for close of phase I of barrow and are approx coincident with graves B, C, D, and E (graves D and E assoc with Food Vessels with lugs and feet), BM-2232 provides *terminus post quem* for construction of outer post corduroy and turf enlargement of barrow at opening of phase II. Date also gives *terminus post quem* for insertion of secondary food vessel urn cremation graves G and H. On grounds of Armorican ceramic assoc, grave H can be generally equated with Gerloff's Armorican-British C dagger grave series. BM-2231 is equated with charcoal evidence for archaic anthropogenic activity pre-

served in B horizon and pre-barrow paleosol. Series provides concise dating for sustained use of barrow and accords with proposed development of Tomalin's Form 3 Food Vessel/Urn series after ca 1500 bc.

**9930 ± 210**

**BM-2249. Soldier's Hole**

$\delta^{13}C = -19.3\text{‰}$

Collagen from juvenile reindeer metacarpal (*Rangifer tarandus*) id by A Curren, Dept Palaeontol, British Mus (Nat Hist), from Spit 8 of Unit 3 in Soldier's Hole, Cheddar Gorge, Mendip, Somerset (51° 15' N, 2° 45' W, Natl Grid Ref ST 469540). Coll 1928 to 1929 by R F Parry (1931) and subm 1983 by R M Jacobi, Dept Classics and Archaeol, Univ Lancaster, from colln of Manchester Mus, as addition to series of dates for remains of reindeer from later contexts in British Is. (late Pleistocene/early Holocene mammalian extinctions program; see, eg, R, 1983, v 25, p 39–41). *Comment* (RB & RMJ): result compares with few other available dates for reindeer from late glacial/early postglacial contexts in British Is. (Clutton-Brock & Burleigh, 1983), and agrees closely with date of 9920 ± 130 bp (Q-1581) for reindeer antler from neighboring site, Gough's Cave. Bone shows no evidence of human modification and need not be assoc with Cheddarian-type late Magdalenian technol from this unit (*cf* BM-2183 to -2188, dates for Gough's Cave, Cheddar, above). With determinations from Gough's (New) Cave (Q-1581; Hawkins & Tratman, 1977) and Sun Hole (Birm-819; Colcutt, Curren & Hawkes, 1981) confirms terminal ice-age presence of reindeer in Mendip area.

*Ireland*

**Ferriters Cove series**

Samples from series of shell middens resting on wave-cut platform overlain by sand dunes at Ferriters Cove, Ballyoughteragh South, Co Kerry, Eire (52° 10' N, 10° 30' W). Coll 1983 and subm by P C Woodman, Univ Coll, Cork.

**5230 ± 200**

**BM-2227. Ferriters Cove**

$\delta^{13}C = -29.3\text{‰}$

Charcoal, ref Sample 1, Site 1, loosely assoc with plano-convex stone knife and stone-working industries.

**5190 ± 110**

**BM-2227A. Ferriters Cove**

$\delta^{13}C = -29.3\text{‰}$

Repeat measurement of BM-2227, above.

**5580 ± 110**

**BM-2228. Ferriters Cove**

$\delta^{13}C = -29.1\text{‰}$

Charcoal, ref Sample 7, Site 2, assoc with stone-working industry.

**5620 ± 80**

**BM-2228A. Ferriters Cove**

$\delta^{13}C = -29.1\text{‰}$

Repeat measurement of BM-2228, above.

**BM-2229. Ferriters Cove** **5310 ± 130**  
 $\delta^{13}C = -28.5\text{‰}$   
Charcoal, ref Sample 1, from Site 3, assoc with stone industry.

**BM-2229A. Ferriters Cove** **5270 ± 90**  
 $\delta^{13}C = -28.5\text{‰}$   
Repeat measurement of BM-2229, above.

*General Comment* (PCW): dates from Site 1 are slightly later than those from other sites which could be in keeping with slightly different industrial tradition and loose assoc with plano-convex knife. Industry from Sites 2 and 3 was, despite absence of "type fossils," reminiscent of later Mesolithic of N E Ireland. Dates would be in keeping with assumption that this material is later Mesolithic.

#### *Ecuador*

#### **Hacienda Guarumal series**

Samples from Jambeli site at Hacienda Guarumal, near Machala, Eloro (3° 20' S, 80° 0' W). Coll 1976 and subm by Elizabeth J Currie (Carter), Inst Archaeol, Univ London.

**BM-1682. Hacienda Guarumal** **1820 ± 70**  
 $\delta^{13}C = -24.9\text{‰}$   
Charcoal, ref HG 76 A13 S41, from thick layer of charcoal in probable fossil 'A' horizon of original land surface beneath Shell Mound 1 (1.6m asl) just before 1st dumping of as yet unid. sp of *Crassostrea*. Dated for early phase of site occupation, as represented by exploitation of sp as primary food source.

**BM-1684. Hacienda Guarumal** **1760 ± 70**  
 $\delta^{13}C = -24.8\text{‰}$   
Charcoal, ref HG 76 A11 S37, from within *Crassostrea* deposits.  
*General Comment* (EC): BM-1684 dates span for *Crassostrea* phase and provides ref between early date, BM-1682, for surface prior to shell dumping, and late date from final dumping layer in Mound 1, BM-1688 (R, 1983, v 25, p 46). BM-1684 fits with expectations for level well into *Crassostrea* deposits and is consistent with interpretation of regular exploitation of this shellfish for many seasons. These dates, with previous series (BM-1688, -1689; R, 1983, v 25, p 46) contribute to dating of main phases of site occupation, and, with pottery analysis, confirm this to be within later half of Ecuadorian Regional Development period.

#### *India*

#### **Zawar series**

Samples from early zinc-smelting site covering wide area at Zawar, Udaipur Dist, Rajasthan (center ca 24° N, 74° E). Coll 1983 and subm by P T Craddock, Research Lab, British Mus.

**BM-2222. Zawar****10 ± 40** $\delta^{13}C = -27.0\text{‰}$ 

Charcoal from Tr 1, Layer 3. *Comment*: AD 1680 to 1705, 1810 to 1850, or 1880 to 1920\*.

**BM-2223. Zawar****230 ± 60** $\delta^{13}C = -29.0\text{‰}$ 

Charcoal from Site 30 near N side of excavated furnace of form so far unique to Zawar. *Comment*: AD 1505 to 1675, 1710 to 1805, or 1925 to 1950\*.

**BM-2243. Zawar****80 ± 60** $\delta^{13}C = -26.1\text{‰}$ 

Charcoal sample, ref 33, from Site 34 at W end of Old Zawar. Sample taken from below many layers of floor levels where sec cut through occupation layers by modern road. *Comment*: AD 1665 to 1940\*.

*General Comment* (PTC): zinc distillation is described in detail in Indian spargyral works from 13th century onwards. Presence of concentration of 14th and 15th century temples within smelting area and documentary evidence from same period suggest extensive early zinc smelting at this time. Tod's reliable history (1829, p 399) records that mines were working in 1760 but were completely extinct by 19th century. Two samples from inside mine (BM-2184, -2149; R, 1984, v 26, p 67–68) gave dates of ca 2000 bp, but mines produced mixed silver/lead/zinc ore and these early dates probably relate to exploitation of silver/lead, with zinc production commencing at some time in medieval period. Zinc production on massive scale resulting in heaps of debris that cover site seems to have occurred in final 3 centuries of early process, possibly connected with rise and fall of East India trade to Europe.

*Israel***BM-2242. Timna****1210 ± 100** $\delta^{13}C = -25.1\text{‰}$ 

Charcoal, ref 1393, from bottom of smelting furnace cut into bedrock at Timna Site 30, in Timna Valley (Rothenberg, 1972; Rothenberg, Tylecote, & Boydell, 1978), Wadi Arabah, ca 30km N of Elat, Gulf of Aqaba (34° 55' N, 29° 45' E) assoc with Egyptian pottery. Coll 1982 and subm by B Rothenberg, Inst Archaeo-Metallurg Studies, London. *Comment* supplied by P T Craddock, Research Lab, British Mus. *Comment* (PTC): sample came from Layer-1-type furnace, which was previously placed in Late Bronze age. However, this date and presence of some early Arabic pottery in vicinity suggests type was used much later. Other samples are currently being studied to establish if all Layer 1 furnaces are so late, or whether this furnace type had long use. For other dates from site, see BM-1115, -1117, -1162, -1163; R, 1979, v 21, p 349–350; BM-1368, -1598; R, 1982, v 24, p 165.

## Nigeria

**Igbo-Ukwu series**

Samples from sites at Igbo-Ukwu (6° 30' N, 7° 0' E). Area has produced cast bronzes, evidence of iron smelting, and copper (Shaw, 1975). Coll 1964 and subm by T Shaw, Cambridge.

**BM-2142. Igbo-Ukwu** **720 ± 360**  
 $\delta^{13}C = -25.0\%$

Wood, ref IR 420, from stool in burial chamber at Igbo Richard. Fractionation correction estimated.

**BM-2143A. Igbo-Ukwu** **1030 ± 300**  
 $\delta^{13}C = -26.1\%$

Combined charcoal samples, ref IJ 248, IJ 441, IJ 381, and IJ 325 from Pit IV, Igbo Jonah.

**BM-2143B. Igbo-Ukwu** **880 ± 240**  
 $\delta^{13}C = -26.1\%$

Repeat measurement of BM-2143A, above.

*General Comment* (TS): controversy existed over 5 previous  $^{14}C$  dates from Igbo-Ukwu, of which 4 (I-2008, -1784; R, 1968, v 10, p 289 and Hv-1514, -1515; unpub) fall in 9th century ad and 1 (Hv-1516; unpub) in 15th (Shaw, 1975). These 3 additional dates, together with 5 previous ones, would appear to place Igbo-Ukwu finds firmly in 9th to 11th centuries ad.

## Pakistan

Charcoal samples measured to supplement series from Punjab and North West Frontier Prov already pub (R, 1983, v 25, p 50–54). All samples coll 1983 and subm by K D Thomas, British Archaeol Mission to Pakistan and Inst Archaeol, Univ London.

**BM-2195. Bhir Mound** **2140 ± 130**  
 $\delta^{13}C = -25.0\%$

Charcoal, ref BM1, from earliest occupation, 4 to 4.1m below present surface, NE side of Bhir Mound, Taxila Valley, Punjab Prov (30° 45' N, 72° 50' E). Coordinates correct those previously given. Sample comes from distant part of site and was measured to check if surprisingly late dates from earlier series (BM-1951 to -1965; R, 1983, v 25, p 51–54) can be applied to whole site. *Comment* (KDT): date compares well with previous dates for earliest occupation at Bhir Mound.

**Hathial West series**

Samples from mound of Hathial West, now thought to be 1st major settlement at Taxila (Allchin, 1982), near Taxila Mus, Punjab Prov (33° 45' N, 72° 50' E). Coordinates correct those given previously. BM-2196, -2197, -2198 from floors apparently assoc with previously undated Red Burnished

Ware levels. BM-2199 from intrusive pit, probably contemporary with early Bhir Mound occupation, measured to check link between 2 sites.

**BM-2196. Hathial West**  $1890 \pm 60$   
 $\delta^{13}C = -23.9\text{‰}$   
 Charcoal, ref H1.

**BM-2197. Hathial West**  $1890 \pm 50$   
 $\delta^{13}C = -23.5\text{‰}$   
 Charcoal, ref H2.

**BM-2198. Hathial West**  $2610 \pm 120$   
 $\delta^{13}C = -25.6\text{‰}$   
 Charcoal, ref H3.

**BM-2199. Hathial West**  $2210 \pm 70$   
 $\delta^{13}C = -24.9\text{‰}$   
 Charcoal, ref HS1.

*General Comment* (KDT): BM-2196 and -2197 agree but are much later than expected and also much later than BM-2198, which seemed to come from same series of deposits. Both compare well with some dates for later occupation at Bhir Mound (BM-1952, -1955, -1957 to -1959, -1961; R, 1983, v 25, p 50–54). BM-2198 is, as expected, earlier than dates for Bhir Mound series (BM-1961, -1963 to -1965; R, 1983, v 25, p 50–54). BM-2199 is not consistent with BM-2196, -2197 but is strat consistent with BM-2198 and is earlier than those for earliest occupation of Bhir Mound. Series of dates is enigmatic; despite their agreement, BM-2196 and -2197 are at variance with archaeol interpretation of cultural sequence at site. BM-2198 is acceptable date in that Red Burnished Ware period was expected to be earlier than earliest occupation at Bhir Mound, although by how much was unknown; thus, date is provisional for Red Burnished Ware occupation at site. Clearly, complex strat and chronol relationships between various phases of occupation at Hathial will not be solved without further excavation.

### Jhang series

Samples from mound at Jhang, Taxila Valley, Taxila, Punjab Prov (33° 40' N, 72° 40' E), measured as addition to previous series of dates for northern extension of Kot Dijian culture. Site was severely damaged by recent excavations for foundation trenches of hospital.

**BM-2200. Jhang**  $3780 \pm 220$   
 $\delta^{13}C = -24.2\text{‰}$   
 Charcoal, ref J1, from Kot Dijian occupation floor.

**BM-2201. Jhang**  $4030 \pm 50$   
 $\delta^{13}C = -24.0\text{‰}$   
 Charcoal, ref J2, from Kot Dijian occupation floor.

**BM-2202. Jhang****940 ± 30**  
 $\delta^{13}C = -25.0\text{‰}$ 

Charcoal, ref J3, from pit.

*General Comment* (KDT): BM-2200 compares well with later Kot Dijian dates from Serai Khola and Hathial, in Taxila Valley, and Tarakai Quila and Islam Chauki in Bannu Basin (R, 1983, v 25, p 50–54; R, 1982, v 24, p 281). BM-2201 compares well with earlier Kot Dijian occupation dates from Serai Khola. BM-2202 is far too late for Early Historic period occupation; either limited colln of potsherds has been inadequate to classify period of occupation of site or there is even later occupation in addition to one of Early Historic period. Date compares well with BM-1947 from upper levels at Serai Khola, assigned to late Hindu Shahi period.

*Spain***BM-2002. Olive wood****Modern**  
 $\delta^{13}C = -23.8\text{‰}$ 

Olive wood (*Olea europea*) from exposed central zone of massive tree, ca 2m diam, at Ferrandell Oleza, Valldemosa, Mallorca, Balears (39° 40' N, 2° 30' E). Coll 1981 and subm by R Burleigh to check against age of >1000 yr often claimed for some large or ancient-looking olive trees. *Comment* (RB): result presumably reflects difficulty of resolving <sup>14</sup>C ages for last 200 to 300 yr due to natural <sup>14</sup>C variations, as tree of this size cannot be completely modern; also shows that size and ancient appearance of these trees are not reliable indicators of great age (*cf* BM-2001; R, 1984, v 26, p 71). So-called “*Olivos milenarios*” trees may be only ca 200 yr old.

**Moncín series**

Collagen from fragmentary domestic horse mandibles, id by A J Legge, Dept Extra-Mural studies, Univ London, from multi-period occupation site at Moncín, Borja, Zaragoza prov (41° 50' N, 2° 10' W). Coll 1980 and 1982 and subm by R J Harrison, Dept Classics and Archaeol, Univ Bristol, and A J Legge.

**BM-2193. Moncín****2860 ± 60**  
 $\delta^{13}C = -20.4\text{‰}$ 

From Quad 1, Level 3A (1980).

**BM-2194. Moncín****2840 ± 70**  
 $\delta^{13}C = -27.0\text{‰}$ 

From Quad 1B/1D, Level 4, yellowish soil (1982).

*General Comment* (RB & RJH): samples dated to check possibility of domestic horses at Moncín in Beaker period, ca 2000 bc, but results show that context of these bones is clearly late Bronze age and dates correspond clearly with BM-1926, 2880 ± 35 (R, 1983, v 25, p 54) from same cultural horizon in which finds include open platters and bowls, some decorated in “Boquique” style of stab-and-drag incision. Dates show that faunal remains

within deep middens at Moncín are in correct strat positions and that intermixing did not occur.

## GEOLOGIC SAMPLES

**Copal series**

Copal (resin) from E Africa (ca 7° S, 38° E) and Miches, Dominican Republic (ca 19° N, 69° W); E African specimen from British Mus (Nat Hist) colln, Dominican specimen from Helen Fragnet. Subm by P E S Whalley, Dept Entomol, British Mus (Nat Hist) to verify age of material in relation to insect inclusions (R, 1982, v 24, p 256; Burleigh & Whalley, 1983).

**BM-2211. E African copal** **140 ± 50**  
 $\delta^{13}\text{C} = -25.2\text{‰}$   
Sample (ref BM-60864) coll by Sir Joseph Banks ca AD 1750.

**BM-2235. Dominican copal** **>36,000**  
 $\delta^{13}\text{C} = -26.1\text{‰}$   
Sample ref D 001.

*General Comment* (RB): result for E African specimen, BM-2211, is consistent with date of colln when allowance is made for natural  $^{14}\text{C}$  variations and adds to series of recent dates for copal for which Pleistocene age was expected (Burleigh & Whalley, 1983). Dominican specimen had IR spectrum similar to copal and was expected to be either Recent (modern) or Miocene (infinite  $^{14}\text{C}$  age). Age is significant in relation to insect inclusions in this material, 1st Pleistocene specimen dated.

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