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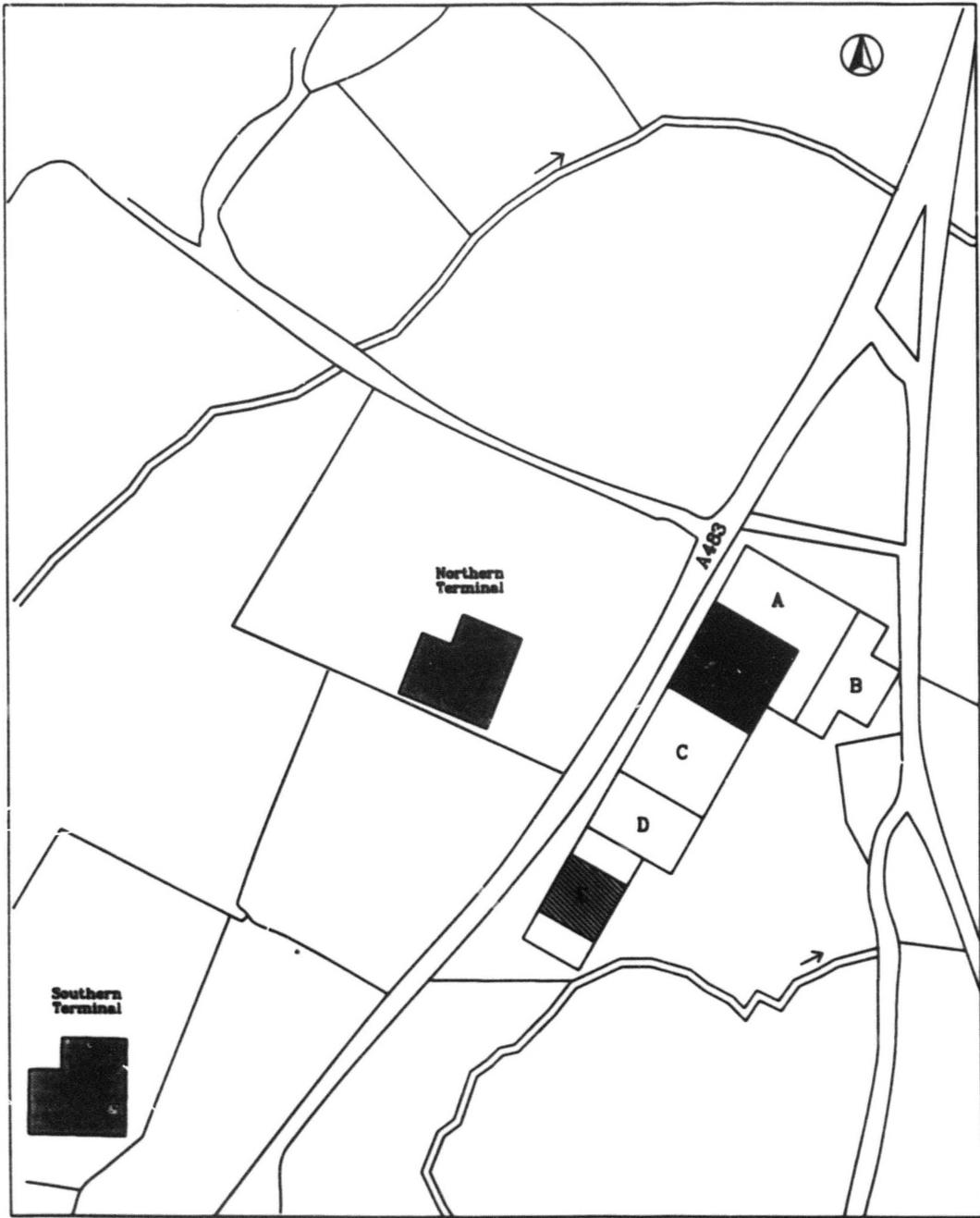
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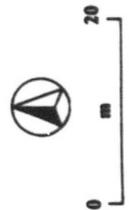
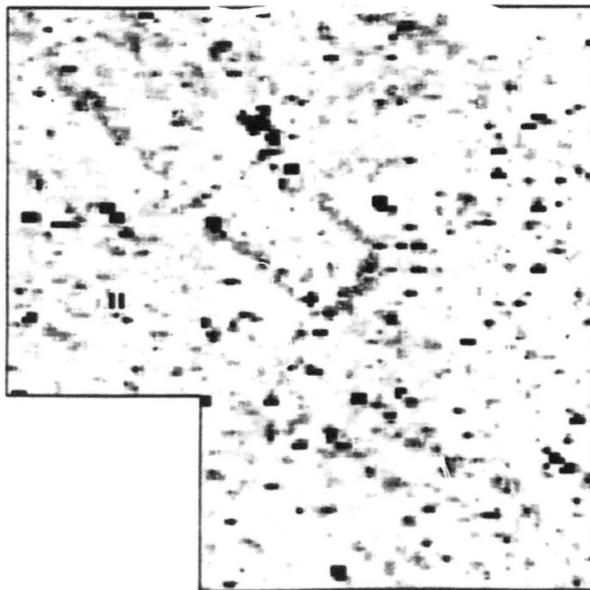
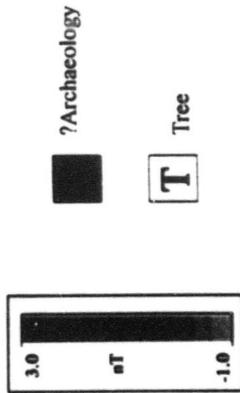
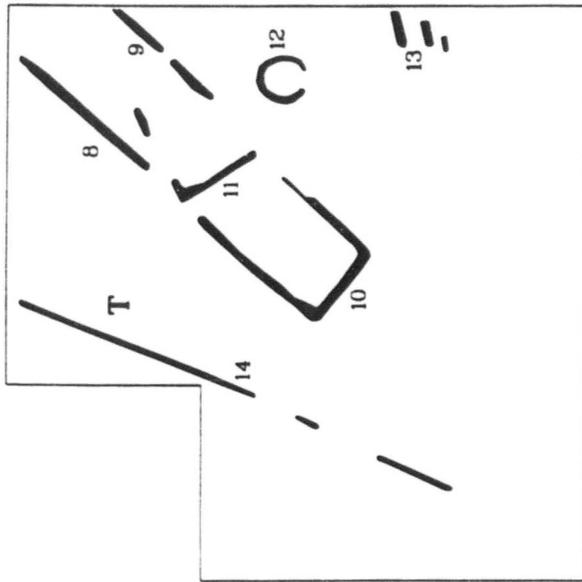


-  Cursus Survey
-  E Modified
-  A-E Bypass Survey
-  A Modified

GEOPHYSICAL SURVEYS OF BRADFORD
PROJECT: WELSHPOOL BYPASS & CURSUS
TITLE: Location of Survey Areas

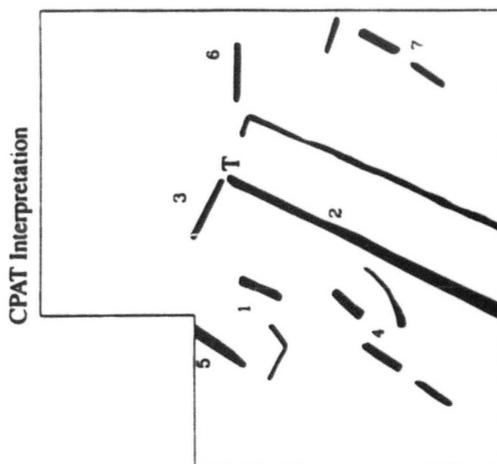
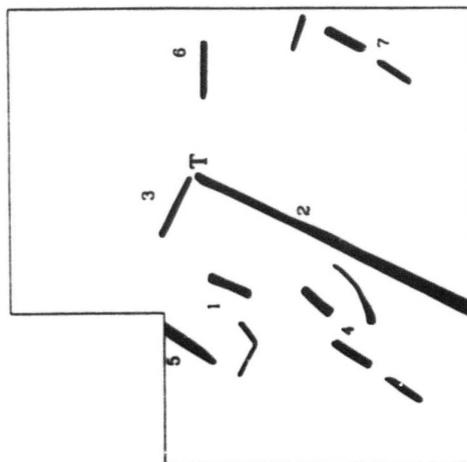
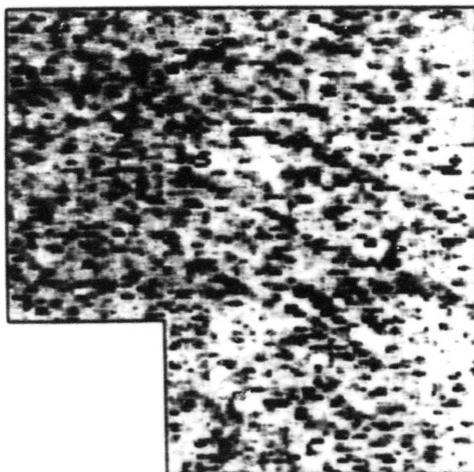
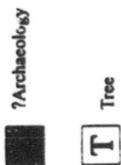
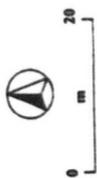
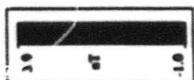
Areas of geophysical survey carried out prior to the 1990 excavations (courtesy Geophysical Surveys of Bradford).

WELSHPOOL
Cursus Southern Terminal



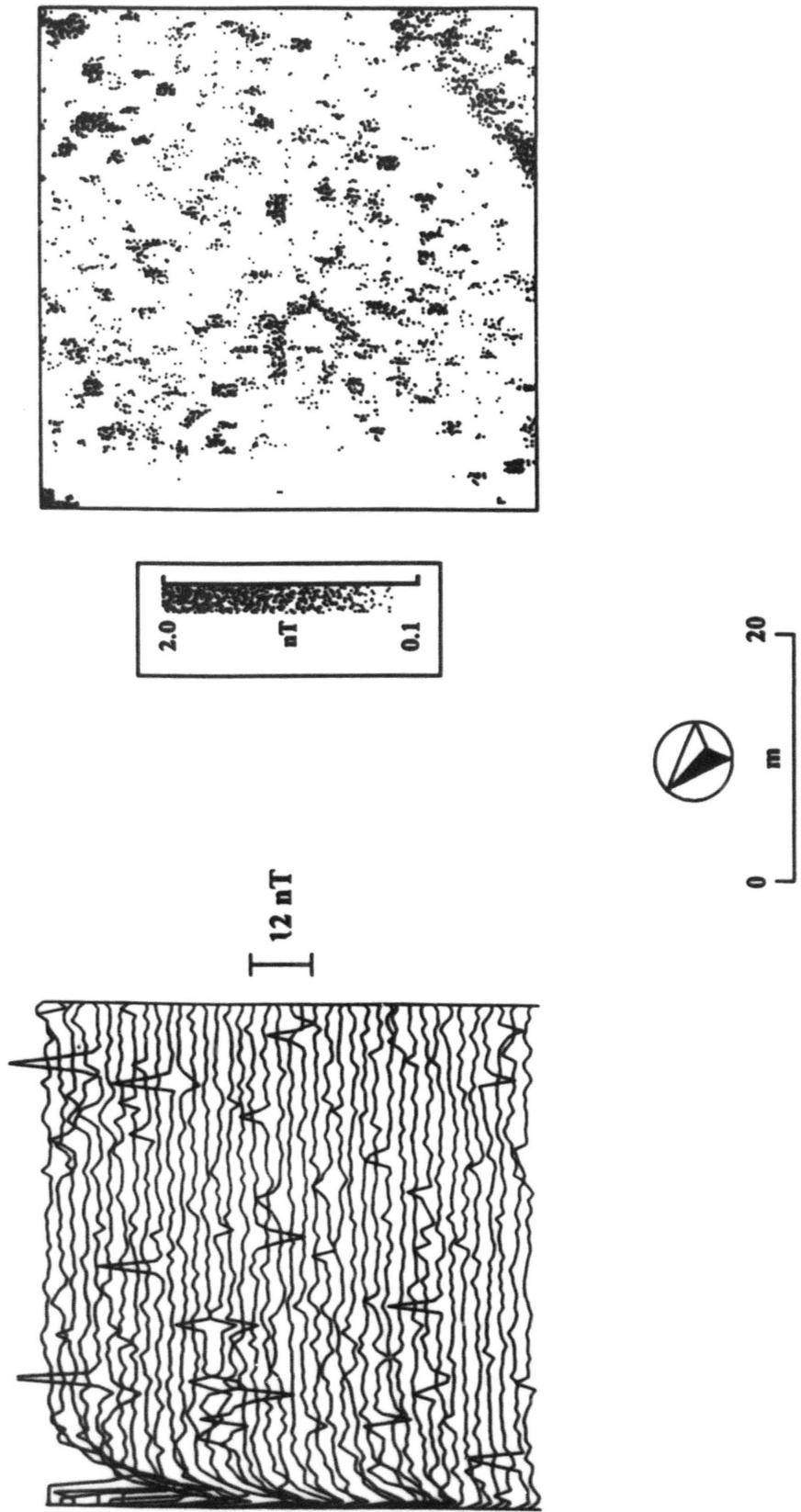
Results of the geophysical survey at the southern terminal of the cursus monument (courtesy Geophysical Surveys of Bradford).

WELSHPOOL
Cursus Northern Terminal



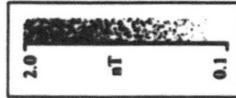
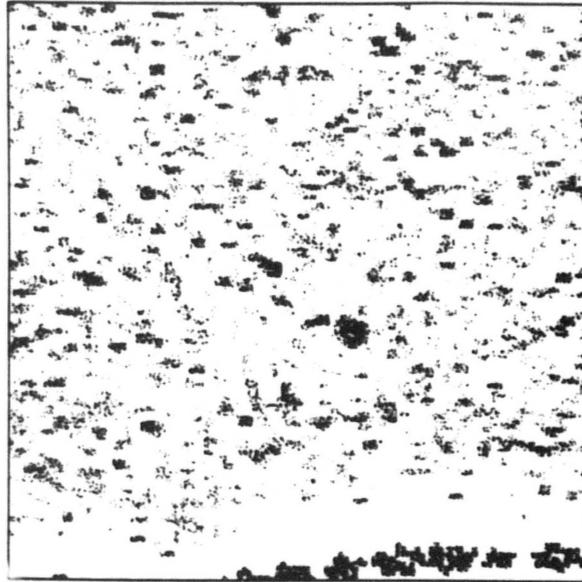
Results of the geophysical survey at the northern terminal of the cursus monument (courtesy Geophysical Surveys of Bradford).

WELSHPOOL BYPASS Area E Modified

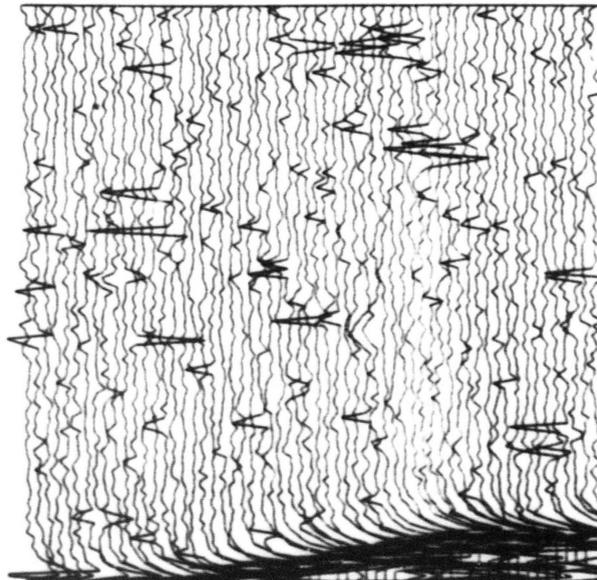


Results of the geophysical survey at Site 2, the Sarn-y-bryn-caled penannular ring-ditch (courtesy Geophysical Surveys of Bradford).

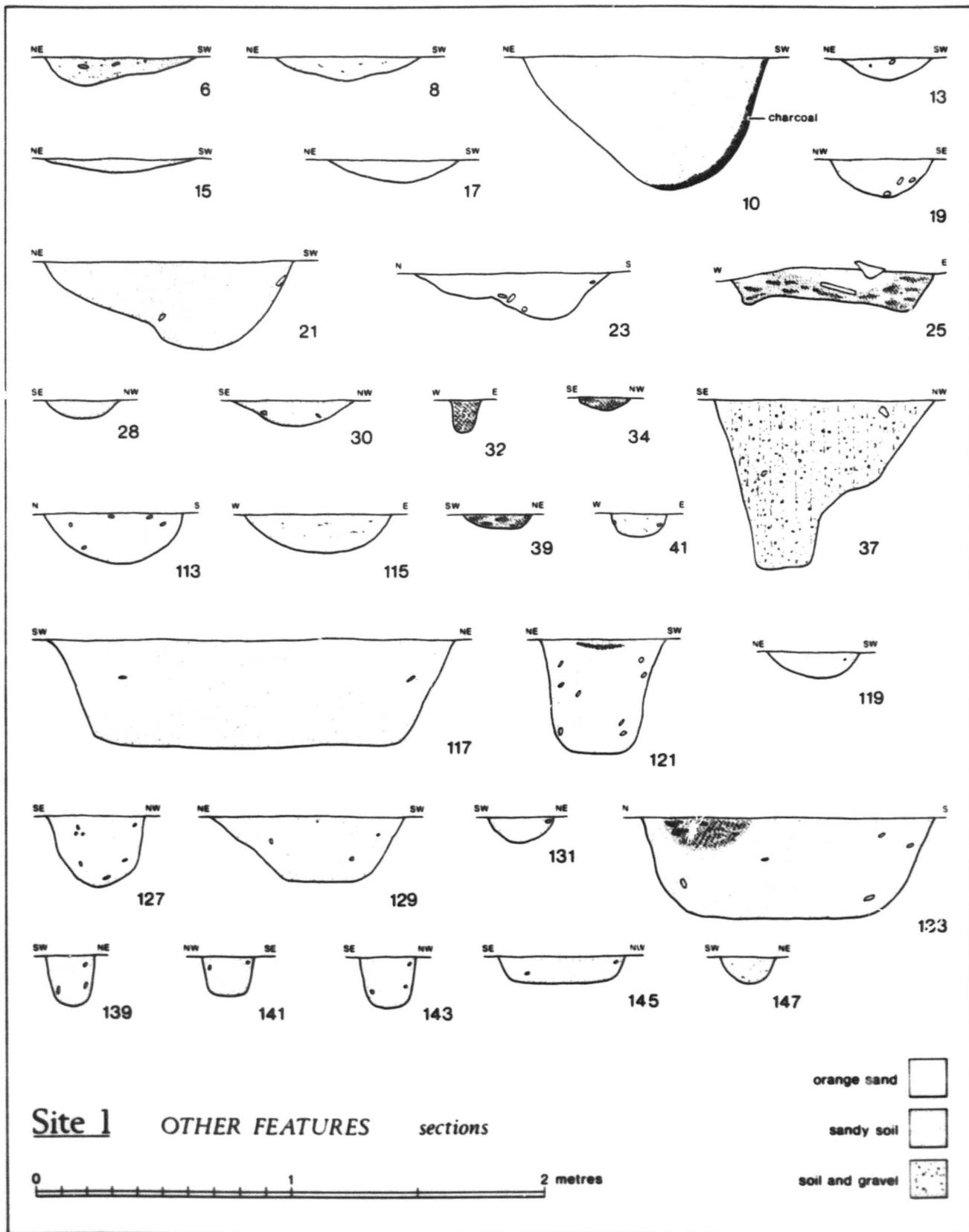
**WELSHPOOL BYPASS
Area A Modified**



12 nT

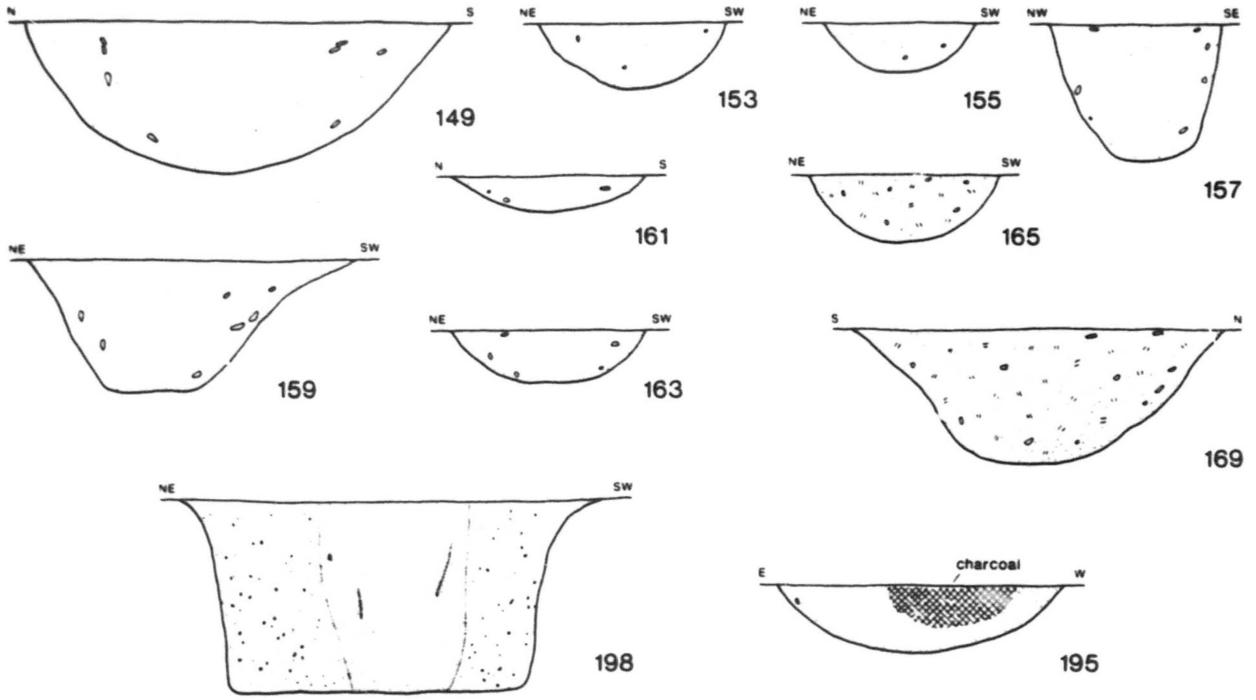


Results of the geophysical survey at Site 1, the Sarn-y-bryn-caled timber circle. The central pit and linear field boundaries were located but the outer pits could not be convincingly identified (courtesy Geophysical Surveys of Bradford).

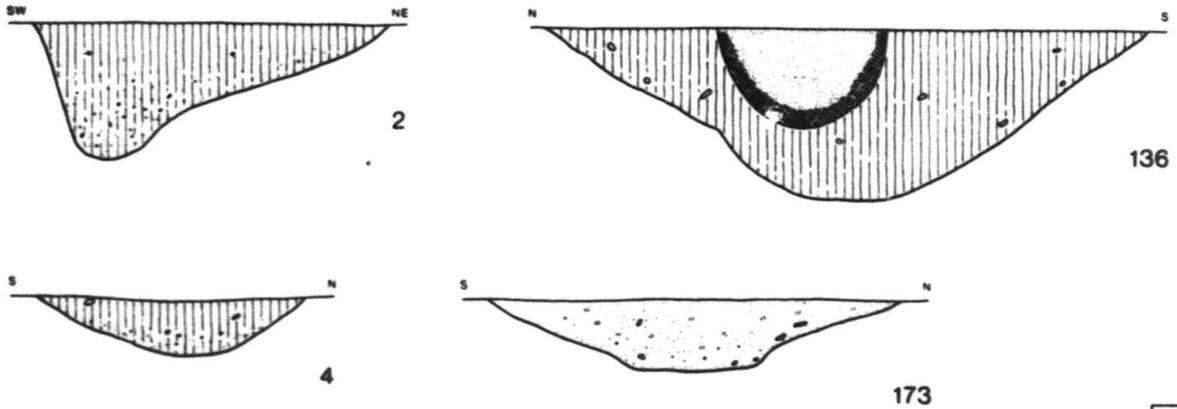


Site 1 OTHER FEATURES sections

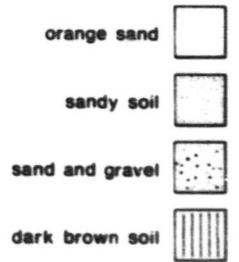
Sarn-y-bryn-caled Site 1: sections through other features.



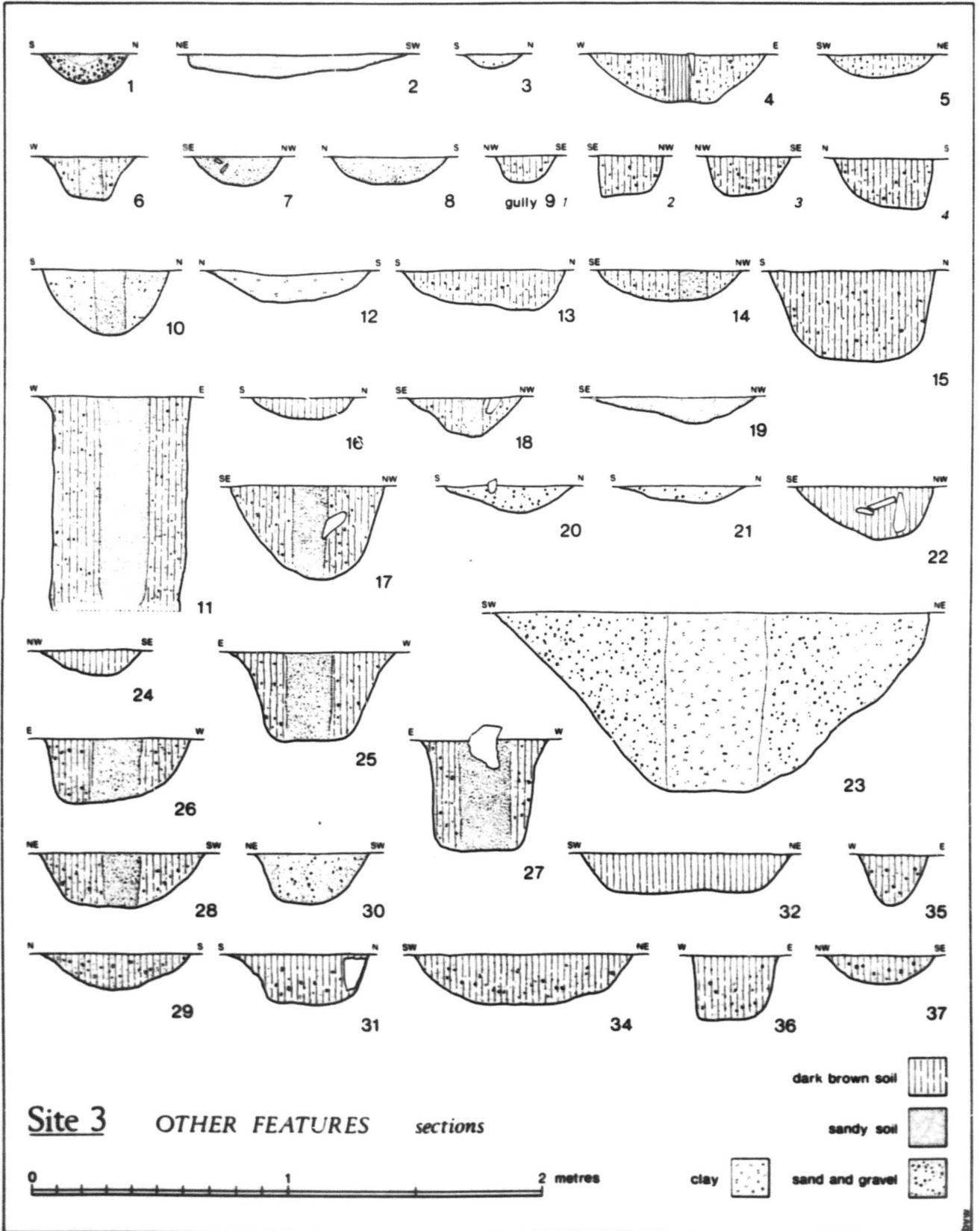
field boundary ditches



Site 1 OTHER FEATURES sections



Sarn-y-bryn-caled Site 1: sections through other features.



Coed-y-Dinas, Site 3: sections of other features

Sarn-y-bryn-caled Site 1, the Timber Circle: Dimensions of Postholes
(all measurements in metres below present gravel surface)

Pit No	Depth	Diam top	Diam base	Post diam
1	1.19	1.50	0.90	0.35
2	1.28	1.95	0.90	0.33
3	1.36	1.60	0.80	0.32
4	1.23	1.35	0.85	0.32
5	1.22	1.40	0.90	0.34
6	1.19	1.60	0.95	0.32
7	1.10	1.33	0.95	0.32
8	1.07	1.45	1.00	0.38
9	1.02	1.25	0.90	0.30
10	1.11	1.20	0.85	0.33
11	1.15	1.45	0.95	0.36
12	1.23	1.15	0.85	0.30
13*	1.40	1.45	1.05	0.65
14*	1.42	1.46	1.05	0.73
15	1.32	1.75	0.65	0.30
16	1.36	1.37	1.00	0.35
17	1.15	1.37	1.15	0.35
18	1.30	1.65	0.85	0.30
19	1.24	1.45	0.70	0.30
20	1.19	1.45	1.05	0.30
A	1.25	1.40	1.00	0.66
B	1.35	1.50	1.35	0.66
C	1.29	1.70	1.30	0.66
D	1.34	1.60	1.00	0.66
E	1.38	1.90	1.50	0.65
F	1.28	1.70	1.25	0.64

* = Probable entrance posts

Dimensions of Other Features from Site 1

Context No	Fill No	Site grid reference	Overall Dimensions			Description
			L	W	Diam Dp (m)	
2	3				.40	Field ditch containing Medieval and post-Medieval pottery and finds.
4	5				.15	Field ditch containing Medieval and post-Medieval pottery and finds.
6	7	B49901260	.96	.62	.12	Shallow, kidney-shaped pit filled with charcoal-stained brown sand and gravel.
8	9	B56201300			.50 .10	Shallow bowl-shaped pit filled with orange sand and occasional charcoal flecks.
10	11,12	B52200550	2.04	1.04	.54	Deep, steep-sided kidney-shaped pit filled with orange sand (11) but with thin charcoal lens (12). Tree throw-hole ?
13?	14	B55400520			.38 .09	Small, shallow, bowl-shaped pit filled with clean orange sand.
15?	16	B50200260			.52 .06	Small, shallow, bowl-shaped pit filled with clean orange sand.
17?	18	B57400460			.54 .09	Small, shallow, bowl-shaped pit filled with clean orange sand.
19?	20	B59400410			.52 .15	Small, shallow, bowl-shaped pit filled with clean orange sand.
21?	22	B60600440	2.22	1.10	.35	Elongated, steep-sided pit with rounded but irregular base. Filled with orange sandy soil.
23?	24	B50801600			.65 .19	Small, shallow, bowl-shaped pit filled with clean orange sand. Possible post depression on base.
25?	26,27	B67501790	1.00	.60	.14	Pit with irregular profile, filled with orange sand in the centre (26) and dense charcoal and <i>in situ</i> burning on the edges (27). Probable tree-hole. Frags of blue and white glazed pot from fill.
28	29	B56102120			.40 .07	Oval round-bottomed pit with mixed sand and soil fill.
30	31	B62802120			.46 .10	Small, shallow, bowl-shaped pit filled with soil and orange sand.
32	33	B63800640			.16 .13	Small posthole with carbonaceous central fill.
34	35	B61903340	.80	.22	.05	Irregular depression with charcoal-rich fill.
37	38	B64205060	1.72	.90	.67	Deep irregular pit with orange-brown soil and gravel fill. Possible posthole.
39	40	B63005050	.40	.20	.06	Shallow depression with charcoal-stained soil fill.
41?	42	B68005300	.50	.20	.09	Small oval pit with sand fill and occasional charcoal flecks.
113?	114	B78802290			.54 .18	Small, shallow, bowl-shaped pit filled with clean orange sand.
117?	118	B74383375			1.5 .43	Circular shallow pit filled with orange sand.
119?	120	B83400780			.40 .18	Oval round-based pit with orange sandy fill.
121?	122	B83701120			.50 .45	Small pit filled with clean orange sand.
127	128	B84803360			.40 .27	Small pit filled with clean orange sand.
129?	130	B82103900	1.20	.75	.25	Small bowl-shaped pit filled with clean orange sand.
131?	132	B95600260			.40 .10	Small circular round-based pit filled with orange sand.
133	134/5	B96200600	1.85	1.15	.40	Oval, steep-sided, flat-based pit filled with sand (134) and patch of charcoal-stained soil (135).
136	137			1.80	.50	Field boundary ditch filled with dark brown soil. Small circular charcoal and sand-filled pit in upper fill.
139?	140	B97004030			.20 .20	Circular pit or possible posthole filled with clean orange sand.
141	142	B95604050			.20 .15	Small pit or posthole with clean orange sandy fill.
143	144	B96404100			.25 .20	Small pit or posthole with clean orange sandy fill.
145	146	B96404160			.20 .10	Small shallow pit with clean orange sandy fill with occasional charcoal flecks.
147	148	B96904310			.20 .10	Small pit or posthole with clean orange sandy fill with occasional charcoal flecks.
149	150	B94404560	1.56	1.25	.45	Oval round-bottomed pit filled with clean orange sand.
153?	154	B95005400	.50	.60	.20	Oval round-bottomed pit filled with clean orange sand.
155?	156	B94005400			.40 .15	Circular round-bottomed pit filled with clean orange sand.

Context No	Fill No	Site grid reference	Overall Dimensions			Description
			L	W	Diam Dp (m)	
157?	158	B08003720			.60 .40	Small oval round-bottomed pit filled with clean orange sand.
159?	160	B71004400	2.30	1.30-70	.38	Irregular pit filled with clean orange sand.
161?	162	B71705460			.60 .10	Small, circular round-bottomed pit filled with clean orange sand.
163?	164	B87405240			.55 .15	Small, circular round-bottomed pit filled with clean orange sand.
165?	166	B86905340			.60 .20	Roughly circular round-bottomed pit filled with clean orange sandy clay.
169?	170	C16700550	1.30	1.00	.40	Oval round-bottomed pit filled with orange-brown sandy clay.
173	174				.75 .18	Field ditch filled with dark brown sandy soil.
195	196/7	A51000380			.83 .20	Circular shallow pit with dense circular charcoal patch (196) within orange sand fill (197). Posthole ?

L = long. W = wide. Dp = deep. Diam = diameter. ? = possibly natural.

Catalogue of Unillustrated Beaker from Site 3, Coed-y-Dinas.

P21 Beaker concentration, 1 sherd (4 g). Three comb lines visible. Fabric up to 8 mm thick. Not illustrated.

P22 Ditch sector 1, 1 sherd (2 g). Three comb lines made by a comb with small rounded teeth. Fabric up to 6 mm thick. Not illustrated.

P23 Ditch, NE arc, 2 sherds (7 g). Very abraded sherds displaying up to 3 comb lines. Fabric up to 8 mm thick. Not illustrated.

P24 Beaker concentration, 1 sherd (4 g). Very abraded base angle with 2 possible comb lines. Fabric 6 mm thick at wall. Not illustrated.

P30 Beaker concentration, 4 sherds (13 g). Undecorated rim similar to P29 but burnished. One shoulder/cordon sherd. Similar in fabric to P26. Not illustrated.

P31 Beaker concentration, 1 sherd (16 g). Undecorated base angle in slightly "gritty" fabric 8 mm thick at top of wall. Not illustrated. P34 Beaker concentration, 2 sherds (5 g). Wall sherds with crazed surfaces. Fabric up to 9 mm thick. One sherd has faint ?horizontal comb impression. Not illustrated.

P35 Ditch, southeast arc, 1 sherd (20 g). Base sherd up to 14 mm thick. Not illustrated.

P36 Beaker concentration, 1 sherd (9 g). Abraded wall sherd with two ?FN impressions/ short incisions. Not illustrated.

P37 Beaker concentration, 1 sherd (2 g). Everted rim sherd with traces of diagonal and deeply impressed comb impression. Up to 9 mm thick. Not illustrated.

P38 Posthole 23, 1 sherd (2 g). Undecorated wall sherd with crazed outer surface up to 5 mm thick. Similar to P34. Not illustrated.

P39 Ditch, southeast arc, 1 sherd (2 g). Thin wall sherd (up to 6 mm), perhaps from near base with single small oval impression. Not illustrated.

P40 Ditch, NE arc, 1 sherd (6 g). Undecorated base sherd up to 9 mm thick. Not illustrated.

P41 Beaker concentration, 1 sherd (3 g). Undecorated wall-herd with traces of a cordon. Up to 6 mm thick (avoiding cordon). Not illustrated.

P42 Ditch, S arc, 1 sherd (2 g). Body sherd with 2 converging incisions. Up to 8 mm thick. Not illustrated.

P43 Ditch, E arc, 1 sherd (3 g). Wall sherd with single incised line. Up to 7 mm thick. Not illustrated.

P44 Beaker concentration, 1 sherd (4 g). Wall sherd with ?raised knob/broad grooving/fingertip rustication. Not illustrated.

Catalogue of Flint Finds from Sarn-y-bryn-caled sites 1 and 2

Site 1

F1 (fig. 27) Calcined barbed and tanged arrowhead of Conygar type. Concave serrated edges, barbs missing. Primary cremation in the timber circle.

F2 (fig. 27) Calcined barbed and tanged arrowhead of Conygar type. Convex edges, tip missing, impact fracture. Primary cremation in the timber circle.

F3 (fig. 27) Calcined barbed and tanged arrowhead of Conygar type. Straight edges, tip missing, impact fracture. Primary cremation in the timber circle.

F4 (fig. 27) Calcined barbed and tanged arrowhead of Conygar type. Convex edges. Primary cremation in the timber circle

F5 (fig. 27) Plano-convex knife in black pebble flint. From above the weathering cone of the central pit, site Grid B35201990.

F6-7 Calcined flint flakes from the primary cremation. Not illustrated

F8 Calcined flake fragment with marked spalling. 0.27 m deep in the packing of inner posthole F. Not illustrated.

F9 Possible Mesolithic blade from the gravel surface at site grid B61452522. Unworked or utilised with striking platform missing. Not illustrated

F10 Calcined utilised blade from the fill of pit 195 in site grid A51500440. Not illustrated

F11 Retouched flake fragment from 0.53 m deep in the packing of inner posthole A. Not illustrated.

Site 2

F13 Calcined flint flake from primary cremation. Not illustrated

F14 Flake fragment with possible utilisation from upper fills of secondary recut. Not illustrated.

F15 Calcined flake fragment from upper fills of the secondary recut. Not illustrated.

APPENDIX I

REPORT ON THE CREMATIONS FROM SARN-Y-BRYN-CALED, WELSHPOOL, POWYS.

S. Stead

All the findings are summarised in table I.1

The adults appear to be healthy and relatively young. None has vertebral degeneration nor any trace of osteoarthritis. There is no dental pathology. As for age deduced from dental attrition, only the primary cremation from the timber circle (site 1) and cremation 3 from site 2 have useful molar crown fragments (either first or second). Both show some flattening of the occlusal surface but with wear limited to level 3. This would give an age of 17-25 if first molars and 25-35 if second - in any case an upper limit of 35. The secondary cremation in the timber circle (site 1) and cremation 1 in the floor of the southern ditch terminal of site 2 are young adults between 17 and 25.

The sexing of cremations in general has to be prefaced with a 'probable' because of the absence of the relevant pelvic remains, i.e. the complete girdle with sub-pubic angle, etc.

Considering the large amount of bone in the primary and secondary burials from site 1, the failure to achieve a positive attribution of sex is disappointing. The secondary cremation is probably female but the sex of the primary burial is unknown. Comparisons between the two show the difficulties of interpretation. The measurements demonstrate a relative difference but cannot be compared to uncremated bone because of the shrinkage. The mandibular condyle of the primary cremation measures 18.8 mm whereas that of the secondary burial is 15.5 mm. The occipital bone of the primary burial has a slight external occipital protuberance and extending nuchal lines, which are male indicators, but at the central point it is only 7.5 mm thick whereas the secondary cremation, with a completely smooth occipital (a female indicator) has a thickness of 10 mm. The secondary burial has thicker vault fragments, but the primary has the more substantial malar. The limbs appear similar and fairly robust, though the secondary cremation has the larger patella. There is no sub adult evidence in the primary burial to explain the thin occipital bone; the remains are those of an adult and its sex is still obscure.

All the cremated bone has been well-burnt. The colour of all the cortical bone is white while the spongy cancellous bone of the long bone extremities varies from white in the case of the children to cream and pale brown in the case of the adults. Horizontal splitting of the cranial vault was noted in all the cremations (least in the secondary cremation in the timber circle (site 1)). Cracking and fissuring and curving of thin vault fragments exists throughout. The uniformity of the remains seems to imply a consistency of method and care in the tending of the funeral pyre. Only one cremation has a colour variation. Several bones in the primary cremation from site 2 have an external grey staining: humerus, lunate and two metacarpals are patchily stained, but of two joining skull bones (the right malar and right upper orbital limit) only the malar is affected. The staining must have occurred after their separation during or later than the cremation process and not beforehand.

In the larger and adult burials all parts of the body are represented (list of identified bones is attached to the description of the individual burials) with the exception of feet in cremations 1 and 3 from site 2. Possibly the feet are included in the unidentified material or perhaps they were regarded as less important than the skull, at the opposite extremity, when the cremated bones

were collected. The hands are more often present and may have been placed across the centre of the body or near the head before cremation where they may have stood a better chance of recovery.

SITE 1 - THE TIMBER CIRCLE

The primary burial, cremation 1

Two adults (1A and 1B) are represented here but there is only one piece of indisputable evidence for the second individual, a duplicate left petrous temporal. All the rest of the cremated bone points to a single burial, an adult. It was not possible to assign sex.

The left petrous temporal that is a better, but not the perfect, match for the right came from the middle of the excavated material while the second left petrous temporal was found in the top of the deposit. It is larger than the probable pair. This is a large cremation with all parts of the body represented showing that most of the cremated bone had been carefully collected together for placement in the central pit. It therefore seems very probable that 1B (the individual with the duplicate left petrous temporal) had been burnt on the same cremation site but on a different occasion. It was at the top of 1A's cremation heap and may, therefore, have been one of the last bones to be deposited tying in with the theory that it may have come from lower in 1A's cremation pyre. However, there is no proof as to which is in truth the odd man (temporal) out.

The cranial fragments have been divided into two groups as possibly being further evidence of two individuals. The larger quantity are mostly crazed and split horizontally and have a worn appearance, the smaller quantity are mostly uncrazed and thinner with neater serrated sutures. But the coronal suture has neat serrations in any skull and there is no proven duplication. There is an unusually large number of phalange fragments, but this is not incompatible with one individual.

Anatomical parts identified:

Cranial	Vault and vault with serrated edges Frontal at crest including nasion Upper orbital at junction with malar, R and L Temporal squamous Temporal petrous R and 2 L Springing of zygomatic arch R and L Malar R and L Occipital. Three fragments including occipital protuberance Wormian. One, small Maxilla at inferior orbital limit R Maxilla palate with alveolar, left arc to first molar.
Mandible	Condyles R and L Coronoid R Horizontal ramus meeting the vertical R and L at third molar Alveolar arc from R canine to L third molar
Teeth	Healthy dentition. All roots with complete apices, 2 crowns and roots from upper molars (see above). 27 roots: Lower - 4 incisor, 1 canine, molars (4 with double roots and 5 single roots). Upper - 2 central incisors, 1 canine, 2 pre-molar (bifid) 1 other premolar, 2 molar and crowns, 4 single.
Post-cranial	Upper Clavicle R and L

Scapula
Coracoid ?L
Humerus, dist R and L
Ulna, dist R and prox L
Radius, R prox shaft
Humerus, radius and ulna shaft
Hand - Carpals, lunate ?L, scaphoid, trapezium, capitate L, metacarpals 6 and 2
probable, phalanges proximal and middle 26 fragments (2 proximal and 1 middle
complete) distal 8 (2 first).

Lower Femur R top shaft and L
Tibia shaft and proximal
Patella R
Feet - Calcaneum, navicular (2), talus, sesamoid, cuneiform (second) and others,
metatarsals first (L and R) and 9 fragments, distal phalanges.
Pelvis - Ilium at acetabulum (and blade), sacrum (SV 1)

Vertebra: Dens of axis
CV 5 body fragments
TV 3 upper
LV 1 ? and 1 lower TV/LV

Ribs

Animal bones (identified by A.J. Legge)

Pig: Humerus head unfused epiphyses
two other unfused fragments, shafts
Ulna prox epiphysis (non articulating) above olecranon (as context 185 below).
ulnar carpal
?pig rib
Rib articulation, too large for pig ?animal.

Secondary burial, cremation 2

A large amount of cremated bone though less than in the primary burial. This is the remains of one individual, a young adult, probably a female. All parts of the body are represented in the cremation.

Anatomical parts identified

Cranial Vault, and vault with serrated edges
Frontal crest upper orbital R and L (with foramen above)
Temporal: squamous/petrous L
Springing of zygomatic arch L and sphenoid
Malar L
Vomer
Parietal at lambda with parietal foramen L
Maxilla palate. Alveolar at 3rd molar R
Mandible Condyle R and L

- Coronoid R and L
- Junction of horizontal and ascending ramus R
- Ascending ramus at foramen
- Alveolar, arc from 2nd incisor R to 3 molar L.
- Teeth Crowns: premolar, 1 ? molar
- Roots: approximately 40 fragments including 3 upper molars, Premolars 5, incisors 5, lower molars 6 (single roots) canines 3.

There is evidence of a minor abnormality in the mandible alveolar at the level of the first molar where there is a single root socket at the lingual side. This would be too far back for a residual deciduous second molar, so may be either the root of a supernumerary tooth or an abnormal permanent first molar.

Post-cranial

- Upper Scapula at glenoid fossa
- Humerus capitum/shaft prox R dist ext R and L
- Ulna dist ext R
- Radius prox ext R and L / dist ext L, shaft
- Hand carpals, lunate
- metacarpal full length and a first phalanges distal and middle, 15 fragments.
- Lower Femur dist ext R and L shaft
- Tibia prox ext at nutrient foramen shaft R
- Fibula dist ext L
- Patella L
- Feet, first metatarsal ?
- Pelvis Sacrum at artic with 5th LV
- Pubic symphysis
- Ilium incl R? at articulation with sacrum

- Vertebra CV Dens and fitting axis/atlas
- TV and LV

Animal bone (identified by A.J. Legge)

- | | | |
|------|---------------------------------------|-----------------------------|
| Pig: | Ulna prox R | possibly from same forelimb |
| | Radius shaft dist artic unfused R | |
| | Carpal | |
| | ?pig rib | |

Context 73: fill of the central pit, site 1

Small amount of cremated bone with tiny fragments. No identification possible, not even to determine whether the bone is human or animal.

Context 94: fill of the central pit, site 1

A small amount of cremated bone, probably of a young adult. All the identifiable bone is cranial though there are also some long bone fragments.

- Cranial Parietal at lambda with parietal foramen L
- Temporal petrous L
- Occipital L at asterion, squamous at parietal/temporal border

(the first two cranial fragments listed are also present in the secondary cremation from the timber circle).

Context 185: fill of central pit, site 1

A small amount of cremated bone, probably of an adult. All the identifiable bone is cranial though long bone fragments are present.

Cranial	Temporal petrous R
	Springing of mastoid L
	Occipital near centre

Animal bone (identified by A. J. Legge)

Fig: Ulna prox epiphysis (non articulating) above olecranon. As primary cremation (above).

Because of the proximity of the bone from contexts 94 and 185 to the secondary cremation it is possible that either or both might be from this cremation. There is duplication of two parts between context 94 and the secondary burial, namely the parietal at lambda with parietal foramen and the left petrous temporal.

Context 185 provides one duplicated bone, the central occipital. The right petrous temporal is, however, a good match for the left in the secondary cremation. It might have been a match for the left one in context 94, but the 94 specimen is too small a fragment for such a judgement.

It is possible, therefore, that the bone from contexts 94 and 185 may come from the same body, but neither came from the cremated body in the secondary burial.

SITE 2 - THE PENANNULAR RING-DITCH**Cremation 1, the primary cremation**

This is the cremation of a young adult, probably female, with slender bones though there is a substantial linear aspera on a femur fragment. All parts of the body are represented but not all are included in the burial.

Anatomical parts identified

Cranial	Frontal crest and upper orbital limit R
	Temporal petrous R and L
	Malar R
	Basi occipital.
	Zygomatic arch L
	Maxilla alveolar arc (4 frags)
Mandible	Condyle R
	Alveolar almost complete (7 frags)
Teeth	Roots - incisor upper central and lower, premolars, upper and lower molars
	The apex of a third molar upper root is not quite closed though all lower molar roots are.
Post-cranial	
Upper	Scapula, clavicle

	Humerus R (3 joining frags), ulna
	Carpal (lunate), metacarpal
	Phalanges (distal 4)
Lower	Femur R and L
	Tibia
	Pelvis
Vertebra	(CV, TV) and ribs

Cremation 2, the secondary cremation

This is the cremation of a child aged about three years. There is one incompatible long bone fragment which has some muscle development, probably the tuberosity of an adult ulna, and which is whiter and more calcified than the rest of the cremated bone. As with cremation 3, perhaps the suggestion holds good that this might be an accidental survivor from a previous pyre on the same site. The long bone shafts are small enough in section to query whether perhaps only the upper half of the body has been included in the burial.

Anatomical parts identified

Cranial	Vault thin fragments Temporal petrous L
Mandible	Alveolar and lingual vertical section through horizontal ramus with socket for first adult molar.
Teeth	Unerupted crowns of permanent dentition. Canine, premolars upper 2, lower 1. Roots, one deciduous ?incisor.
Post-cranial	Unfused long bone shafts (4) No epiphyses
Vertebra (2)	

Cremation 3, from the recut in the southern ditch terminal

The cremated bone from this burial is remarkably clean, free of earth and ash smearing considering that it was not contained in an urn. It represents an adult, probably a female. The whole body has been burnt though no feet bone have been identified. Not all the body is included in the burial though it was plough-truncated.

Anatomical parts identified

Cranial	Vault and serrated vault Frontal at crest Temporal L mastoid Zygomatic arch R Occipital
Mandible	Condyle L and R Coronoid L Alveolar
Teeth	Crown - upper premolar, molar ?second upper and an other. Roots - incisor, canine, premolar, molar (upper and lower).

Post-cranial

Upper: Scapula, radius (prox ext.), carpal (lunate), phalange
Lower: Tibia

Vertebra CV4, LV

Ribs

Cremation 4, from the recut in the northern ditch terminal

This cremation deposit had been severely plough-damaged and only ten small and a few tiny fragments of bone survived. The edges are very worn. They are human and probably adult.

Anatomical parts identified
Cranial Vault (5), one with serrated edge
Post-cranial Long bone (2)

List of abbreviations

dist = distal; prox = proximal; L = left; R = right; ext = extremity; artic = articulation; CV, TV, LV, SV = cervical thoracic, lumbar and sacral vertebrae; numbers refer to the number of separate vertebrae present, hence CV3 = three cervical vertebrae present, not the third cervical vertebra.

Table 1.1: Summary of cremation deposits from Sarn-y-bryn-caled, sites 1 and 2.

Sample	Sex	Age	Wt. (g)	Unident. Frags †	Animal Bones	Size of Fragments	
						Largest	Longest (mm)
Site 1							
Primary			1603	54	+	50x32	69
burial A	?	AD					
burial B	?	AD					
Secondary	F	YAD	1179	46	+	51x28	115
Other Cremated Remains							
ctxt.73	?	?H	1	NA	?	NA	NA
ctxt.94	?	AD P	21	29	-	39x29	28
ctxt.185	?	AD P	46	45	-	32x16	37
Site 2							
crem.1	F	YAD	746	54	-	37x34	74
crem.2	C	3	95	62	-	24x12	28
crem.3	F	AD	715	68	-	25x21	53
crem.4	?	AD P	5	NA	-	13x10	16

KEY

F = female, C = child, AD = adult, Y = young, P = probable, H = human,
+ = present, - = absent, NA = not applicable.

"unidentified fragments" does not include unidentified long bones.

Animal bone, where present, is included in the total weight but is a small proportion of the whole (5-50 g)

APPENDIX II

REPORT ON THE CHARCOALS.

Graham Morgan

Sizes (mm) and ages are estimated minima. Only floated material over 1mm was analysed.

Table II.1: Charcoals from the timber circle (Site 1)

Sample	(Weight)	Species	Rings	Diam	Age	Growth	Comments
Outer Circle							
Posthole 1	(1g)	hazel	15	5	6		one fragment only
		oak	30+	15	15+	slow	
Posthole 2	(60g)	oak	100+	6	40+	fast	
	(36g)	oak	60+	10	15+	fast	
Posthole 3	(50g)	oak	80+	6	15+	fast	
	(10g)	oak	50+	3	10+	fast	
Posthole 4	(2g)	oak	25+				fragments
Posthole 5	(15g)	oak	60+	6	15+	fast	
Posthole 7	(1g)	Unidentified fragments					
Posthole 8	(4g)	oak	60+	8	15+	fast	
		hazel	10				one fragment only
Posthole 9	(27g)	oak	90+	15	30	fast	
			50+	15	30+	slow	
Posthole 10	(80g)	oak	70+	10	30		
			100+	30	50+	slow	
Posthole 11*	(40g)	oak	50+	5	15+	fast	
Posthole 12*	(320g)	oak	100+	16	30+		
Posthole 13	(4g)	oak					fragments
Posthole 14	(4g)	oak					fragments, charred & modern(?) plants and seeds
	(9g)	hazel	15	5	5		
		oak	50	5	10	fast	
Posthole 15	(3g)	oak	50+	8	15+	fast	
Posthole 16	(19g)	oak	50+	5	15+	fast	
Posthole 17	(8g)	oak	50+	9	20+	fast	
Posthole 18	(1g)	Unidentified fragments					
Posthole 19	(18g)	hazel	25	9	12		This sample is nearly all hazel.
			45+	8	25+		
		oak	25+	6	12+		
		elder	10	2	2		
	(1g)	oak	15				fragment
		elder	5				fragment
Posthole 20	(4g)	oak	50+	10	20+	fast	
Inner Circle							
Posthole A	(84g)	oak	60+				fragments
Posthole B	(18g)	oak	70+	10	25+	fast	
Posthole C	(15g)	oak	50+				fragments
Posthole D*	(475g)	oak	100+	12	30+	fast	
centre of Posthole D	(20g)	oak	80+	8	20+	fast	
Posthole E*	(122g)	oak	80+	20	40+	slow	
		oak	60+	6	20+	fast	
Posthole F	(70g)	oak	50+				fragments

Table II.2: Samples from other contexts (Site 1)

Sample	(Weight)	Species	Diam	Rings	Age	Growth	Comments
Central pit lining	(422g)	oak	80+	12	25+	fast	
top of central pit*	(72g)	oak	50+				fragments
two-poster	(40g)	oak	50+			fast & slow	
2ndry crem*	(100g)						
sub-sample 1		oak	60+			fast	fragments
2		oak	80+	8	20+	fast	
3		oak	60+			fast	fragments
4		oak	60+			fast	fragments
5		oak	60+			fast	fragments
6		oak	80+	6	15+	fast	
			80+	20	40+	slow/sapwood	(one piece)
7		oak	60+				fragments
8		oak	60+				fragments
9		oak	60+				fragments
10		oak	60+				fragments
		hazel	15	3	3		(one piece)
11		oak	60+			fast	fragments
12		oak	60+	10	20+	fast	
13		oak	60+				fragments
14		oak				slow/sapwood	(one piece) fragment
15		oak					fragments
Primary crem* (50g)							
sub-sample 1		oak	60+			fast	fragments
2		oak	60+			fast	fragments
3		oak	60+			fast	fragments
4		oak	60+			fast	fragments
5		oak	60+			fast	fragments
6		oak	80+	12	25+	fast	
7		oak	60+			fast	fragments
8		oak	80+			fast	fragments
9		oak	60+			fast	fragments
Context 7	(34g)	hazel	20	12	15		This sample is mainly hazel
		oak	20+				fragment
Context 9	(12g)						hazel nut shell
		hazel	25+				fragment
		poplar	25+				fragment
Context 12	(69g)	hazel	15	10	10		
		oak	10	2	2		
Context 27	(460g)	oak	100+	6	20+	fast	
Context 33	(14g)	oak	100+	30	60+	slow	Possibly sapwood from old tree
Context 35	(7g)	rowan	5	5	5		
		hazel	30	3	10		
		ash	25+				fragment
			10	10	10		
		poplar	25+				fragment
Context 40	(2g)	oak					fragment of mature bark
Context 42	(6g)	oak	25+				fragment
Context 135	(10g)	hazel	25	12	15		
Context 138	(64g)						hazel nut shell
		hazel	35	15	18		This sample is mainly hazel
		ash	15	15	15		
Context 154	(16g)	oak	80+	30	60+	slow	?sapwood
Context 156	(6g)	oak	80+	20	40+	slow	?sapwood
Context 158	(162g)	oak	100+	10	30+	fast	
Context 170	(4g)	hazel	15	15	25		
Context 174	(33g)	hazel	20	10	20		
			30	20	25		worm eaten
Context 196	(8g)	hazel	30	5	10		
			40+	3	10		
		oak	15	5	10		
		hawthorn	25+	3	10+		
Context 199	(520g)	oak	65+	12	20+	fast	This sample is mainly oak
			100+	22	80+	slow/sapwood	
			100+	20	30	fast	
		hazel	20	10	10		

Observations

Oak is by far the most common species represented. The presence of some very narrow-ringed samples suggests either very slow-grown wood or possibly sapwood on mature timber. The size of the samples does, however, make this only a suggestion. The bulk of the oak is very fast grown, pointing to good growing conditions, and appears to be large or mature timber. The other species generally represent open woodland or scrub.

Table II.3: The Penannular Ring-ditch (Site 2)

Sample	Species	Diam	Rings	Age	Growth	Comments
cremation 2	oak		30+			fragments
	poplar type		30+			fragments
cremation 3	oak		35+			fragments, some carbonised plant buds.
context 2	hawthorn type					fragments
context 3*	oak	40+	3	8-	fast	
	oak	45	5	10-	fast	
context 5*	oak	50+	3	10+	fast	
	oak	45+	6	10-	fast	
	oak	50+	8	12-	fast	
	oak	35+	6	10-		
	hazel type	45+	12	20+		
context 6	oak		25+			fragments
context 8	oak		25+			fragments
context 10	oak		50+	3	10-	fast

Table II.4: Coed-y-Dinas Ring-ditch (Site 3)

Sample	Species	Diam	Rings	Age	Comments
RD1	blackthorn	10	5	5	
	field maple	15	5	5	
	blackthorn	10	6	6	
	oak frag.	30+			
	oak	50+	12	25+	
		25	5	10	
	hazel	45	15	20	
	field maple	10	5	5	
	poplar type	40+			fragment
	rowan type	10	10	12	
F23	blackthorn	10	5	5	
	oak frag.	50+			
F25*	oak	50+	5	20+	
	hazel	30	10	10	worm eaten
	hawthorn	30+			fragment
F26	poplar type	30+			fragment
	gorse type	15	5	6	
F27	hazel frag	20+			
	hazel	20	5	6	
	oak	15	3	4	
		30	5	10	
F28	rowan type	10	5	5	
	oak frag	10+			
	hazel frag	10+			
F32	rowan type	10	15	15	
	field maple	10	5	5	
F32 (ctd)	hazel	10	5	5	
	poplar type	15	6	6	
	gorse type	10	5	5	

Table II.5: The Cursus (Site 5)

Sample	Species	Diam	Rings	Age	Comments
F1	oak	30-60		10-20	Fast grown reflecting open, damp conditions.

Species Represented

oak	<i>Quercus spec.</i>
hazel	<i>Corylus avellana</i>
rowan type	<i>Sorbus spec.</i>
elder	<i>Sambucus nigra</i>
poplar type	<i>Populus spec.</i> or willow <i>Salix spec.</i>
ash	<i>Fraxinus excelsior</i>
hawthorn type	<i>Crataegus spec.</i>
blackthorn type	<i>Prunus spinosa</i>
field maple	<i>Acer campestre</i>
gorse type	<i>Ulex spec.</i>

Hazel should be read as Alder/Hazel, Poplar as Willow/Poplar and Hawthorn type could be *Roaceae* as well.

* denotes samples sent for radiocarbon dating.

APPENDIX III

RADIOCARBON DATES USED IN THE TEXT.

Introduction

The Radiocarbon dates were calibrated using the University of Washington Quaternary Research Centres computer programme CALIB, rev 3.0.1 (Stuiver & Reimer 1993). Dr J Ambers, British Museum Dept. of Scientific Research helped arrange and interpret the dates for Sarn-y-bryn-caled (sites 1 and 2) and Coed-y-Dinas (Site 3).

Table III.1: SARN-Y-BRYN-CALED AND THE CURSUS COMPLEX

Context	material	Date BP	Date BC (68%)	Date BC (95%)	Lab No.
Site 5: The Cursus					
Basal silts of E ditch	Charcoal	4960±70	3891-3889 or 3796-3662	3946-3636	OxA-3997
Site 2: The Penannular Ring-ditch					
Lower Recut	Charcoal	4400±45	3090-3057 or 3045-2920	3294-3273 or 3269-3239 or 3105-2910	BM-2820
Upper Recut	Charcoal	4200±40	2886-2868 or 2805-2768 or 2719-2703	2908-2855 or 2819-2663 or 2633-2628	BM-2819
Site 1: The Timber Circle					
Inner Post F	Charcoal	3730±40	2190-2159 or 2145-2109 or 2089-2038	2274-2252 or 2204-2016 or 2005-1979	BM-2805
Inner Post E	Charcoal	3670±40	2129-2079 or 2045-1972	2171-2169 or 2140-1919	BM-2806
Outer Post 12	Charcoal	3660±40	2121-2083 or 2042-1950	2138-1903	BM-2807
Outer Post 11	Charcoal	3720±40	2180-2165 or 2143-2034	2270-2268 or 2201-1975	BM-2808
2ndry Crem	Charcoal	3660±40	2121-2083 or 2042-1950	2138-1903	BM-2809
Primary Crem	Charcoal	3900±50	2461-2288	2490-2199	BM-2810
Top cent pit	Charcoal	2160±60	353- 302 or 207- 101	377- 35	BM-2830
Site 1: Context 198/9, The Outlying Posthole					
Posthole 199	Charcoal	4740±35	3624-3571 or 3538-3504 or 3414-3383	3635-3495 or 3464-3375	BM-2829
Site 3: Coed-Y-Dinas Ring-Ditches					
Basal silts ring-ditch 1	Charcoal	3630±45	2033-1915	2133-2074 or 2049-1880	BM-2837
Posthole F25 in RD 2	Charcoal	2110±40	182- 49	199- 31 or 24- 7	BM-2838

Table III.2: CURSUS MONUMENTS

Site	Date BP	Date BC (68%)	Date BC (95%)	Lab No	Material	Context	Relationship
Dorchester	4510±100	3360-3032	3506-3406or 3385-2911	BM-2443	antler	ditch	primary
Dorset	4770±120	3663-3491or 3484-3372	3787-3332or 3215-3198or 3154-3137	OxA-626	bone	ditch	primary
	4570±120	3500-3424or 3381-3091or 3055-2915	3634-2915	OxA-624	bone	ditch	primary
	4490±60	3339-3074or 3067-3039	3361-2923	BM-2438	antler	ditch	primary
	4440±100	3335-2917	3370-2881	OxA-626	bone	ditch	primary
Drayton	4990±100	3942-3844or 3824-3662	3981-3628or 3562-3543	HAR-6477	bone	ditch	primary
	4940±80	3792-3647	3946-3624	OxA-2075	charcoal	OLS	TAQ
	4810±70	3656-3613or 3501-3518	3709-3495or 3462-3376	OxA-2071	wood	ditch	primary
	4800±100	3691-3503or 3417-3383	3782-3356	OxA-2073	charcoal	OLS	TAQ
	4780±100	3656-3498	3773-3349	HAR-6478	bone	ditch	primary
	4620±80	3503-3415or 3383-3335	3625-3568or 3540-3094	OxA-2074	charcoal	OLS	TAQ
Inchtuthil	5160±70	4033-4024or 3998-3942or 3846-3823	4216-4200or 4144-4119or 4087-3791	GU-2760	charcoal	fence	primary
	5070±50	3954-3791	3974-3761or 3734-3726	GU-2761	charcoal	fence	primary
North Stoke	4672±50	3509-3397or 3388-3363	3623-3573or 3537-3346	BM-1405	antler	ditch	primary
Stonehenge Greater	4100±90	2871-2801or 2775-2714or 2706-2553or 2543-2493	2890-2454or 2413-2409	OxA-1403	antler	ditch	primary
Stonehenge Lesser	4640±100	3613-3600or 3519-3335	3642-3083or 3061-3043	OxA-1405	antler	ditch	primary
	4550±120	3495-3460or 3376-3075or 3066-3039	3628-3560or 3544-2911	OxA-1404	antler	ditch	primary
	4000±120	2850-2825or 2654-2644or 2621-2392or 2386-2337	2881-2177or 2166-2142	OxA-1406	antler	ditch	primary

Table III.3: 14C Dates from Timber Circles

Table III.3.i- Direct Association

Site	Date BP	Date BC (68%)	Date BC (95%)	Lab No	Material	Context	Relationship
Dorchester 3	4060±110	2865-2802or 2756-2722or 2700-2461	2890-2284	BM-2161R	charcoal	Posthole	primary
	4100±120	2877-2791or 2789-2468	2917-2313	BM-2162R	charcoal	posthole	primary
	4120±120	2881-2486	2921-2392or 2386-2337	BM-2164R	charcoal	posthole	primary
Durrington Walls S. I	3760±170	2457-1925	2614-1734or 1721-1689	NPL-239	antler	posthole	primary
Durrington Walls S. II	3900±90	2473-2272or 2259-2203	2586-2131or 2076-2048	BM-395	charcoal	posthole	primary
	3950±90	2567-2519or 2504-2314	2853-2821or 2660-2638or 2625-2189or 2161-2145	BM-396	charcoal	posthole	primary
	3850±90	2459-2177or 2166-2142	2563-2524or 2500-2031or 1991-1989	BM-397	charcoal	posthole	primary
Durrington Walls N.II	3905±140	2570-2516or 2506-2184or 2163-2144	2870-2803or 2773-2716or 2704-1969	NPL-240	antler	posthole	primary
Machrie Moor I	4470±50	3310-3225or 3187-3158or 3128-3036	3347-2923	GU-2316	charcoal	posthole	primary
	3980±50	2862-2812or 2742-2726or 2697-2200	2917-1953	GU-2325	charcoal	posthole	primary
	4080±90	2866-2808or 2756-2722or 2700-2472	2886-2400or 2373-2362	GU-2324	charcoal	posthole	primary
Moel-y-Gaer	3570±100	2031-1991or 1989-1748	2190-2160or 2145-1673	HAR-1195	charcoal	posthole	primary
Newgrange	3930±35	2465-2398or 2376-2351	2490-2304	GrN12829	charcoal	posthole	primary
North Mains	4040±70	2836-2828or 2618-2466	2869-2804or 2771-2718or 2703-2400or 2373-2361	GU-1354	charcoal	posthole	primary
	4105±60	2864-2810or 2748-2724or 2698-2570or 2516-2506	2878-2469	GU-1353	charcoal	posthole	primary
Oddendale	4075±35	2837-2828or 2618-2567or 2519-2503	2858-2816or 2692-2674or 2668-2489	UB-3400	charcoal	posthole	primary
	4010±35	2570-2515or 2506-2467	2587-2458	UB-3399	charcoal	posthole	primary
Pont-ar-Daf	3510±50	1887-1745	1946-1730or 1729-1685	UB-3216	charcoal	posthole	primary
Poole	3210±15	1511-1437	1515-1425	GrN-1684	charcoal	posthole	primary
Temple Wood	5025±190	3992-3640	4313-4302or 4252-3371	GU-1296	charcoal	posthole	primary

Table III.3.ii: Indirect Association

Site	Date BP	Date BC (68%)	Date BC (95%)	Lab No.	Material Context	Relationship
Balfarg	4180±50	2879-2853or 2822-2659or 2639-2625	2891-2585	GU-1160	charcoal backfill	?
	4035±50	2589-2469	2855-2819or 2663-2634or 2627-2457	GU-1161	charcoal backfill	?
	4270±60	2915-2875or 2794-2784	3023-2982or 2928-2859or 2815-2693or 2675-2668	GU-1162	charcoal backfill	?
	4315±60	3012-3003or 2924-2884	3082-3063or 3042-2872or 2800-2776or 2713-2707	GU-1163	charcoal backfill	?
Marden	3936±48	2469-2395or 2381-2344	2564-2522or 2502-2283	BM-557	charcoal henge	?
	3526±99	1970-1736or 1716-1695	2133-2073or 2050-1610	BM-558	bone henge	?
	3626±81	2126-2081or 2044-1883	2196-1746	BM-559	antler henge	?
Mount Pleasant	3911±89	2488-2277or 2222-2207	2611-2135or 2070-2066	BM-663	charcoal henge	?
	3988±84	2582-2451or 2431-2402	2861-2813or 2737-2728or 2695-2276or 2227-2206	BM-667	charcoal henge	?
Whitton Hill	3980±130	2836-2829or 2618-2289	2881-2131or 2076-2048	BM-2265R	charcoal ditch	primary ?
	3970±110	2586-2314	2871-2801or 2775-2714or 2706-2139	BM-2206R	charcoal ditch	primary ?
	3360±130	1859-1847or 1771-1511	1961-1391or 1332-1328	BM-2266R	charcoal burial	?
Woodhenge	3815±75	2397-2378or 2349-2137	2465-2028or 1995-1986	BM-677	charcoal henge	primary ?
	3755±55	2273-2255or 2203-2118or 2085-2041	2324-2013or 2007-1977	BM-678	bone henge	primary ?

Table III.3.iii: Terminus Ante Quem Dates

Site	Date BP	Date BC (68%)	Date BC (95%)	Lab No.	Material	Context
Brenig 44	3630±100	2134-2071or 2064-1878or 1832-1824or 1791-1789	2281-1736or 1715-1698	HAR-501	charcoal	central feature
	3470±70	1881-1683	1945-1611	HAR-502	charcoal	bank over postholes
Dorchester 3	4070±130	2873-2797or 2780-2711or 2709-2459	2915-2272or 2260-2203	BM-2163R	charcoal	cremation in top of posthole
	4030±130	2862-2812or 2741-2726or 2696-2450or 2448-2401or 2372-2364	2898-2189or 2160-2145	BM-2166R	charcoal	cremation in top of posthole
	3550±130	2034-1734or 1721-1689	2273-2256or 2203-1524	BM-2165R	charcoal	cremation in top of posthole
Milfield North	3775±40	2275-2232or 2205-2135	2314-2112or 2088-2039	BM-1149	charcoal	henge ditch
	3800±60	2316-2137	2455-2034	BM-1150	charcoal	henge ditch
Newgrange	3750±80	2281-2031or 1991-1989	2452-2422or 2405-1923	HAR-1199	charcoal	central cremation in henge
	4000±30	2563-2524or 2501-2465	2578-2458	GrN12828	charcoal	phase 1 of pit circle

Table III.3.iv: Problem Dates

Site	Date BP	Date BC (68%)	Date BC (95%)	Lab No	Comment
Arminghall	4440±150	3353-2897	3613-3600or 3519-2856or 2818-2690or 2689-2664or 2632-2628	BM-129	Charcoal from outer rings of post Inconsistent with Beaker sherds from primary ditch silts. Hence secondary ?
Bleasdale	3760±90	2289-2031or 1991-1989	2459-1907	NPL-69	Wooden post. Uncertain whether from inner or outer circle.
Coneybury	3370±90	1746-1522	1885-1435	OxA-1409	Animal bone from central pit. Too young for Grooved Ware associations.
	3200±110	1598-1566or 1529-1386or 1337-1324	1734-1729or 1689-1250or 1249-1204	OxA-1408	As above

Table III.3.v: Rejected Dates

Site	Date BP	Date (68%)	Date (95%)	Lab No.	Comment
Maxey IIIA	1730±90	AD229-420	AD86-101or AD113-542	GAK-657	Too young for apparent context of circles within late Neo ritual landscape
Maxey IIIB	1640±90	AD267-275or AD333-541	AD228-621	GAK-658	As above

Reference

Stuiver, M. & Reimer, P.J. 1993. Extended 14C database and revised CALIB 3:0 14C age calibration program, *Radiocarbon* 35, 215-230.

APPENDIX IV

THERMOLUMINESCENCE DATING OF DAUB FROM
SITE 1: THE TIMBER CIRCLE.

N Debenham

A sample of burnt clay (SBC 1), recovered from context 80, c. 0.5 m deep in the central pit of the timber circle, was examined by thermoluminescence (TL). The clay was expected to be either Bronze Age or Iron Age in date, being associated either with the timber circle or with the Iron Age metalworking in the top of the central pit.

The TL dating method measures the time that has elapsed since the heating of the material (which zeroes the TL signal). The measurement consists of firstly a determination of the radiation dose received by the sample since its heating (through the examination of its TL) and secondly an assessment of the rate at which the radiation dose was received (carried out by radioactivity measurements). Further descriptions of the method are given by Aitken (1985) and Zimmerman (1971).

The outer 2 mm or more of the sample were cut away to remove those parts that had been exposed to light and to the alpha and beta activity of the surrounding sediment. The interior piece was crushed, and fine grains of 2-10 μ m were separated by suspension in dilute hydrochloric acid. The grains were then washed in water, methanol and acetone before deposition onto aluminium discs.

The TL measurements are summarised on table IV.1. The archaeological dose measurements consisted of comparing the TL emissions of the natural (unirradiated) discs with those from discs which had received additional alpha and beta irradiations; these are referred to as the first glow measurements. The natural discs were subsequently irradiated with varying doses and remeasured (on second glow) to yield information on the non-linearity of the TL growth curves.

The first and second glow data were normalised to fourth glows following equalisation of the total dose given to each disc. The growth curve of second dose TL against beta dose was non-linear, while that for alpha irradiation was linear. Archaeological doses were evaluated by extrapolation of the first glow growth curve with an appropriate curve form pre-fitted to the second glow growth curve.

Tests were carried out on the short-term stability of the beta induced TL signals. These showed no measurable loss of TL intensity after storage at 50°C for 22 days.

The rate of internal dose, i.e. that due to alpha and beta radiations originating within the daub, was assessed by alpha counting and potassium analyses of the sample. The external dose is mainly contributed by gamma radiation from the burial soil. Its rate was assessed by alpha counting and potassium analyses of the surrounding sediments. Alpha counts, potassium and water contents of the fired clay and the surrounding sediments are given in table IV.2. The dose rate assessments for the sample are summarised in table IV.1.

The TL date for the burning of the fired clay sample is shown in table IV.1. The quoted error combines random and systematic uncertainties and refers to the 68% confidence level. The date implies that an early Bronze Age assignment is considerably more probable than one to the Iron Age.

Table IV.1: TL Measurements and Dose Rates

	Beta	Alpha	Dose Rates:			
	A.D.	A.D.	Alpha	Beta	External	TL Age
	Grays	μm^{-2}	μm^{-2} /ka	Gy/ka	Gy/ka	ka B.P.
SBC 1	14.5±0.5	7.3±0.5	0.671	1.577	1.158	3.77±0.35

Note: The uncertainty in the alpha dose rate is ±13%; for the beta dose rates, ±8%; and the external dose rate uncertainty is ±9%.

Table IV.2

	Alpha Count ($\text{Ms}^{-1} \text{mm}^{-2}$)	K20 Content (%)	Measured Water Content (%)	Assumed Past Water Content (%)
Daub	5.50	1.95	16	16±6
Soil	5.55	2.70	11	11±6

References

Aitken, M.J., 1985. *Thermoluminescence Dating*. London: Academic Press.

Zimmerman, D.W., 1971. Thermoluminescent dating using fine grains from pottery. *Archaeometry*, 13, 1, 29-52.

APPENDIX V**REPORT ON THE THIN-SECTIONS OF POTTERY AND CLAY FROM SARN-Y-BRYN-CALED AND COED-Y-DINAS.**

A. Vince

Samples of fired clay (L595), Peterborough Ware (L596, L597, L598) and Beaker pottery (L599-602) were submitted for examination. They were studied using a x20 binocular microscope and in thin-section. The thin-sections were prepared using Dickson's Method of staining, which distinguishes various types of carbonate, although in this case none of the samples contained calcareous inclusions.

The thin sections were examined using a standardised procedure and the abundance, maximum size and any relevant comments were recorded for the following inclusion types:

Rounded Quartz Grains (fields 7-9)
Angular Quartz Grains (fields 10-12)
Limestone (fields 13-15)
Shell (fields 16-18)
Sedimentary Rock Fragments (fields 19-21)
Metamorphic Rock Fragments (fields 22-24)
Basic Igneous Rock Fragments (fields 25-27)
Acid Igneous Rock Fragments (fields 28-30)
Clay Pellets (fields 31-33)
Quartz in matrix (field 34)
Mica in matrix (field 35)
Limestone in matrix (field 36)
Firing (field 37)
General Comments (field 38)

Description

All of the samples were soft and friable so that the sections were typically variable in thickness. Nevertheless, by combining the information visible in thin-section with that seen under the binocular microscope and adequate indication of the petrological composition of the vessel could be made.

Sparse quartz grains were present in all but two of the samples (exceptions being L595 and L597) and these varied in size and roundness. Only one sample (L600) produced rounded quartz grains, up to 0.3mm across. The angular quartz grains in the other samples ranged from 0.3mm to 0.2mm across

Sedimentary rock fragments were present in three samples. Sparse fragments of siltstone, 0.3mm across, were present in L595. L597 contained angular fragments of sandstone up to 2mm across, varying in texture and grain size from fragment to fragment. Sandstone fragments up to 1mm across were present in L601.

Fragments of acid igneous rock were present in two samples, L600 and L602, and fragments of basic igneous rock were present in two other samples, L597 and L601.

Clay samples were present in four samples. In L595 they were moderate in frequency, reddish in colour and dense whilst in the other three samples, L599, L601, L602, they were abundant, of variable colour and texture and up to 2mm across.

Silt-sized quartz grains were observed in the matrix of five of the samples, in three cases alongside flecks of white mica. In all cases where the clay matrix was thin enough to check, the matrix was anisotropic indicative of a fairly low temperature or short duration firing.

Conclusion

The sample of fired clay, L595, was dissimilar to those of the Peterborough Ware and Beaker pottery. It strongly resembled in petrology the Devonian Marl of the Welsh Marches and glacial till derived from this marl. The presence of siltstone, however, is a feature observed in the clays and pottery fabrics of northern Herefordshire and the Montgomery area, although in these areas the siltstones were abundant.

There is no clear petrology between the Peterborough Ware and Beaker samples. Both contain sparse detrital rock fragments which include igneous and sedimentary rocks as well as angular quartz of unknown derivation. Three of the four Beaker samples, however, have a similar texture in thin section, characterised by the presence of abundant clay pellets which vary in colour and texture. Whether this is indicative of the nature of the parent clay or is a feature of the clay preparation is uncertain. Perhaps, for example, the Peterborough Ware clays were more thoroughly worked before use or the Beaker pottery clays were stiffer. In either case, there is no evidence from ceramic petrology to suggest a difference in geological source for the two groups.

Sherd Concordance

Lincoln No.	Report No.	Pot Type	Site	Context
L595		Fired Clay	Site 1	Central pit
L596	P2	Peterborough Ware	Site 1	Pit 115
L597	P1	Peterborough Ware	Site 1	Gravel surface
L598	P5	Peterborough Ware	Site 2	Ditch recut
L599	P9	Beaker	Site 3	Base of ditch
L600	P10	Beaker	Site 3	Base of ditch
L601	P11	Beaker	Site 3	Base of ditch
L602	P12	Beaker	Site 3	Base of ditch

APPENDIX VI

REPORT ON THE EXAMINATION AND ANALYSIS OF A GROUP OF COPPER ALLOY FRAGMENTS AND OTHER MATERIAL FROM SARN-Y-BRYN-CALED, POWYS.

Duncan Hook

Introduction

Ten amorphous copper alloy fragments from Sarn-y-bryn-caled, Powys, were submitted to the Department of Scientific Research for analysis. They were analysed qualitatively using X-ray fluorescence (XRF) to identify the major and trace elements. Three of the larger fragments were also analysed quantitatively using inductively-coupled plasma spectrometry (ICP), allowing their compositions to be compared with other analyses of bronze age metalwork (e.g. Northover, 1980).

In addition, a number of clay/daub fragments and a possible piece of slag from the upper levels of the central pit were analysed to try and determine whether they were connected with metalworking.

Qualitative analysis of copper alloy fragments using XRF

All the copper-alloy fragments submitted (small finds Nos 9, 12-18, 20, 22: Conservation Nos 5388/1-10: BM lab Nos 41772P-41781Y) were found to be tin bronzes, with traces of arsenic and silver. Traces of iron were also found on each piece, but this probably results from contamination from the soil during burial. Lead, nickel and antimony were not found to be present above their detection limit (c. 0.1%). The fragments were found to be very consistent in composition.

Qualitative analysis of copper alloy fragments using ICP

Ident.	LabNo	Ag%	As%	Cu%	Fe%	Ni%	P%	Pb%	S%	Sb%	Sr%	Total
5388/01	41772P	.231	.19	83.5	.014	.007	<.01	.016	.13	.12	13.0	97.2
5388/02	41773Y	.218	.23	78.0	.014	<.006	.02	.016	.05	.12	13.5	92.1
5388/09	41780P	.231	.17	80.3	.009	<.006	.03	.016	.06	.12	12.8	93.8

In addition to the elements listed in the table, the following elements were also sought but were not found to be present at levels greater than their respective detection limits: Au <0.004%, Bi <0.02%, Cd <0.004%, Co <0.004%, Mn <0.002% and Zn <0.01%. The ICP results have precisions of approximately $\pm 2\%$ for copper, $\pm 10\%$ for tin and between 20% and 50% for the remaining elements quoted, the precision for each element deteriorating as the respective detection limit is approached. The low analytical totals reflect the corroded state of the metalwork.

The ICP results again show that the fragments analysed were bronzes with very similar compositions. The trace element pattern (high silver, moderate arsenic and antimony, and low nickel and cobalt) does not match closely any of the published analyses of Welsh Bronze Age metalwork (e.g. Northover, 1980). It is, however, similar in composition to some fragments of Iron Age casting waste from Merthyr Mawr (Northover pers. comm.). The recently measured

radiocarbon date (BM-2830: Appendix III) of charcoal associated with the Sarn-y-bryn-caled casting waste confirms a likely Iron Age date for the material.

Identification of other material

A small black fragment of suspected slag 5387/08 (41771R), was analysed using XRF and was found to contain silicon, potassium, calcium, iron and manganese. It appears to be vitrified and clearly has been subjected to a high temperature. Whilst the analysis is consistent with the composition of some slags, a positive identification was not possible.

All the clay/daub fragments were examined visually and five were analysed using XRF. No evidence was found to connect them with metalworking.

Reference

Northover, J.P. 1980. The analysis of Welsh Bronze Age metalwork. Appendix in Savory, H.N. 1980 *Guide Catalogue of the Bronze Age Collections*. Cardiff: National Museum of Wales, 229-243.

APPENDIX VII

THE GEOTECHNICAL DATA FROM SITE 3: THE DITCH SILTS AT COED-Y-DINAS, WELSHPOOL.

M Brownsett

Introduction

The purpose of these analyses is to assist in determining possible configurations of the original earthworks at Coed-y-dinas ring-ditch 1. This report contains a discussion of what are considered to be relevant geotechnical issues with some conclusions as to the range of configurations which might have existed. A summary of some of the calculations which have been carried out are given below.

Discussion

Because the descriptive terms used to identify the material found in-filling the ditch are different from those used in geotechnical engineering, it is difficult to make a direct comparison between the archaeological data and other available engineering information. However, there seems no reason to doubt that the ditch infill would have been derived from the local material and that at least the majority of it would have been transported into the ditch from the area contained within the ditch, probably by a combination of natural erosion and human activity.

The prediction of stable slope angles presents a number of problems. The factors which affect stability include soil characteristics, groundwater level and time. For instance, a clay face might stand vertically in the short term, but for long term stability would need to be cut back to 25° to 30°, or even flatter if the groundwater table is high. Granular materials are much less affected by time except in so far as erosional forces are concerned. Stable slope angles in granular materials above the water table lie typically in the range 30° to 40° depending on the grading and state of compaction.

From the ditch cross-sections, it would appear that side slopes of about 45° were used. This is in line with recent agricultural practice for ditches, but would probably have required some occasional maintenance to repair localised slippage and spalling of the ditch sides. Similarly, a slope angle of about 45° might have been used for the upcast material if maintenance in the medium to long term was envisaged. Alternatively, a flatter angle, say 30° to 35°, could have been employed with a reduced risk of remedial measures being required.

A number of calculations have been made using both 35° and 45° slopes and they are summarised below. In general it has been found that the answers are not particularly sensitive to the choice of slope angle within the range examined, but are affected significantly by assumptions about the width of the crest of any bank that might have been constructed. Obviously further calculations could be made, using different values for the assumed parameters; it is believed, however, that those presented give a reasonable representation of the likely configurations.

There is no clear indication from the cross-sections as to whether the upcast was used to form a mound or a bank. The absence both of any relict topsoil or vegetation layers marking the old ditch sides and of evidence of recutting of the ditch sides suggests that the ditch was refilled not long after it had been excavated.

If a mound had been formed, it is difficult to imagine natural processes moving sufficient material quickly enough to infill the ditch in the way that appears to have taken place. It would almost certainly have required human assistance. On the other hand, the bank option would have provided the maximum volume of soil immediately adjacent to the ditch to facilitate its refilling, whether by natural or human agencies, or by a combination of the two.

Conclusions

As stated previously, a summary of the calculations are given below. If the up-cast was used to raise the level of the whole area within the ditch, there would have been sufficient material to produce a mound about 0.44-0.45m high for slope angles of 45° and 35° respectively. The calculations of the possible height of the bank which could have been formed are sensitive to the assumed crest width. For a 1m wide crest, the height could have been in the range of 1.15-1.03m for 45° and 35° degree slopes respectively. For a crest width reduced to zero, the possible range of heights becomes 1.56-1.34m.

The bank, as opposed to the mound, option is the configuration which would have contributed more easily to the apparently quick infilling of the ditch. However, the evidence is far from conclusive.

Summary of Calculations**1: Volume of material excavated**

a based on Section 1 with the assumed 30cm loss replaced

Total volume = 122m³ approx.

b based on all sections as they now exist with lost soil replaced - c.30cm from northern arc and 1m from southern.

Total volume = 135m³ approx.

The difference in calculated volumes is probably not significant given the likely accuracy of the base data. Use volume 125m³ for further calculations.

2: Stability of sides of ditch and mound/bank

Depends on nature of soil, level of groundwater table, amount of maintenance considered acceptable by original occupiers and, for the mound/bank, the amount of compaction given to the fill material.

Assume slope angle in the range 35° to 45° to the horizontal.

3: Height of mound

Radius of area within the ditch = 9.7m approx.

Assume side slopes of 45°, flat top

Height of mound = 0.44m

If side slopes assumed to be 35°

Height of mound = 0.45m

Therefore calculation of height is insensitive to assumptions about slope angle.

4: Height of bank

Assume slope angle 45°, crest 1m wide
height = 1.15m approx.

Assume slope angle 35°, crest 1m wide
height = 1.03m approx.

Assume slope angle 45°, crest 0m wide
height = 1.56m approx

Assume slope angle 35°, crest 0m wide
height = 1.34m approx.