# Proceedings of the Cambridge Antiquarian Society

(incorporating the Cambs and Hunts Archaeological Society)

Volume LXXXV

for 1996

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# Contents

## Editorial

This is the last *PCAS* I shall edit (having decided that I should concentrate on my own research until senility overtakes me). The new Editor will be Alison Taylor, Cambridgeshire County Archaeologist for more than twenty years, and probably the first local archaeologist I met on my return to the 'old country' after many years in Australia. Alison's kindness and friendship, and her organisational abilities, I value highly, and I am delighted to edit this volume in her honour, at a time when she is beginning a new career as a consultant.

Many of the articles in this volume have been written by Alison's colleagues at the County Council, others by friends who have been associated with her and Cambridgeshire archaeology over many years, and this volume therefore concentrates on areas which I hope she will find of interest: around the massive piece of work on the Cambridgeshire Dykes are several shorter (but not small or insignificant) papers, all concerned with sites investigated in Cambridgeshire since 1974, and since Alison's appointment as County Archaeologist.

With our good wishes for future blossoming.

Audrey Meaney

# New Evidence on the Cambridgeshire Dykes and Worsted Street Roman Road

Tim Malim
with Ken Penn, Ben Robinson, Gerald Wait & Ken Welsh

and contributions by Debby Banham, Alex Bayliss, G.W. Dimbleby, C.A.I. French, Peter Murphy, Paul Pettitt & Ken Thomas

> Devil's Dyke ... has a kind of menacing, palpably ancient air, but also a feeling of monumental folly. It required an immense commitment of labour to construct, but it didn't take a whole lot of milltary genius to realize that all an invading army had to do was go around it ... and within no time Devil's Dyke had ceased to have any use except to show people in the fen country what it felt like to be 60 feet high.
>
> Bill Bryson, *Notes from a Small Island.*

### Contents



### Summary

*A sequence of well stratified carbon dates has established that the first phase of Fleam Dyke was most probably constructed in the fifth century* AD. *Ensuing phases, which produced the typical profile of the monument as it survives today, were sixth century or later in date, and, by analogy, the other three Cambridgeshire Dykes (Bran Ditch, Brent Ditch, Devils Dyke) are assumed to be of similar date. Comparison of their size and design supports an interpretation as defensive barriers, but their possible use as routeways and their association with earlier sacred places suggest that secondary functions may also have existed. Evidence from pagan Saxon burials, place-names and contemporary settlement suggests the existence of a definite cultural boundary in this zone between west and east, and between Anglian Cambridgeshire and British Hertfordshire and Essex. The Icknield Way zone into which the Dykes were built appears to have been grazed grassland, a tract of moorland between the Chiltern scarp and the spring-line beside Ashwell Street, and it was this zone that the Dykes controlled. However, the origins of the Dykes may lie further back in time, as boundaries in a prehistoric division of the landscape, as suggested for the Mile Ditches, together with many of the Hertfordshire dykes, which also cross the Icknield Way zone.*

### Introduction

Since the time of the earliest antiquarians, the Dykes of southern Cambridgeshire (Fig. 1) have aroused great interest and debate, because they form a distinct group within the region; in the consistency of their overall concept and parallel courses, and in the execution of their design, they appear to share a common purpose. Information and theories regarding them have been published and re-worked many times, and their date of construction has ranged from Iron Age to Anglo-Saxon, but the basic premise that these structures were defensive earthworks preventing access to East Anglia and giving control of the Icknield Way has remained uncontested. They have been regarded as military

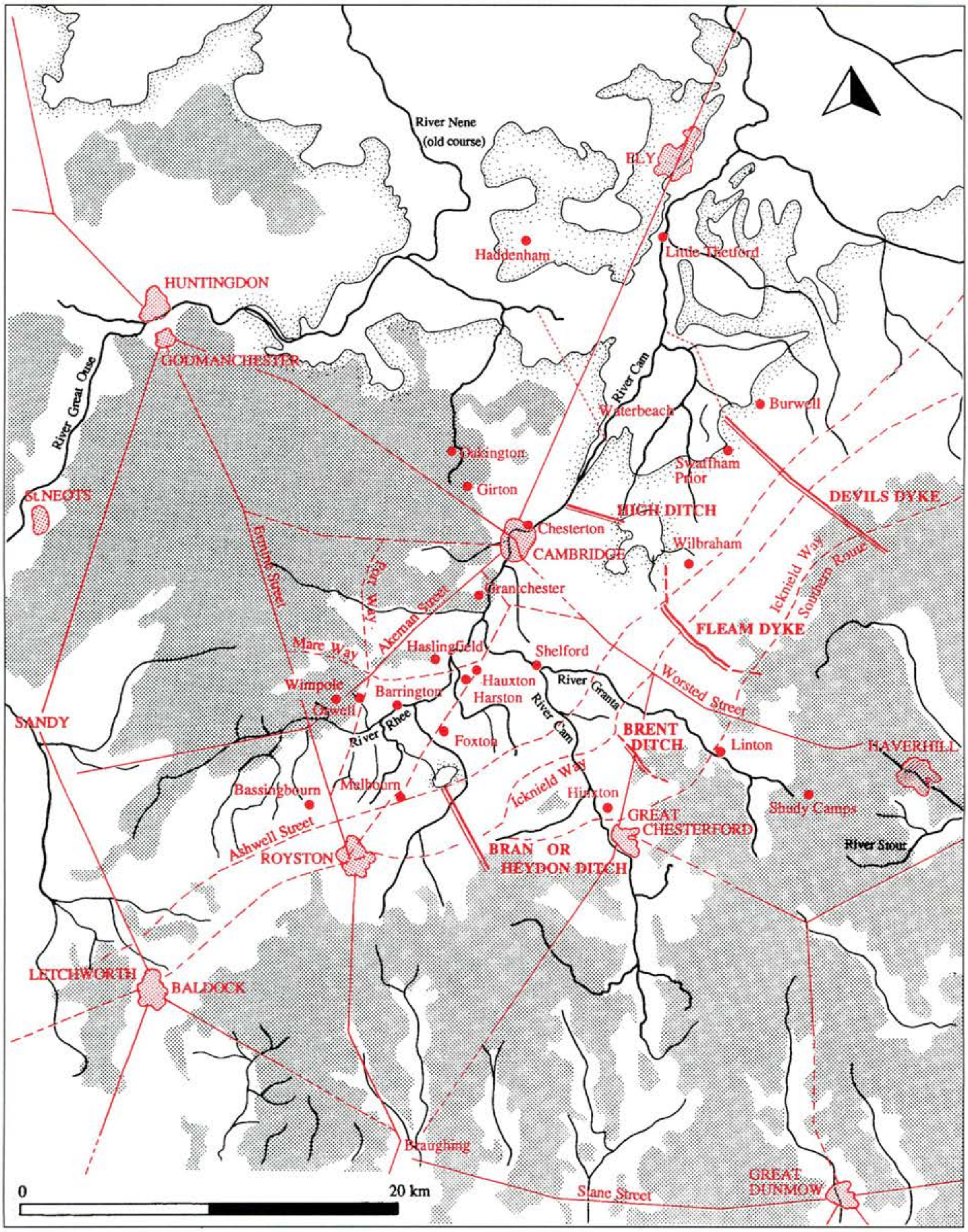


**Figure 1.** *Map of the Cambridge region, showing dykes, ditches and Roman roads.*

barriers running north west to south east between wooded hills to the south and fens to the north, both of which formed terrain that antiquarians have considered would have been impassable for an army (Fig. 2). From west to east, these Dykes are: Bran (Heydon) Ditch, Brent (Pampisford) Ditch, Fleam (Balsham) Dyke and Devils Dyke.


*Key to Fig. 1.*

Nineteenth-century archaeologists, including Beldam, Babington, Ridgeway and McKenny Hughes, who investigated these monuments (see Table 11), all agreed on their common defensive function for East Anglia and proposed that they were built, together with another 'dyke' along Worsted Street, by the Iceni. Ridgeway (1893) suggested they were used during the Roman attack by Ostorius. However, during the 1920s and 1930s, extensive excavations were undertaken by Fox and Palmer, and later by Lethbridge, which established a definite post-Roman date for their main construction, and ascribed the most likely historical context for them to the seventh-century wars between the expanding kingdoms of Middle Anglia (Mercia) and East Anglia. Worsted Street, however, was demonstrated to be a work of purely Roman engineering (Fox 1923b). Lethbridge (1958) later revised his ideas on the origins of the Dykes and suggested that they were works of the fourth-century Romano-British, designed to entrap marauding Anglo-Saxon raiding parties. Hope-Taylor (1976) reported that the bank of Devils Dyke sealed a fourth-century Roman coin, and that the primary fills of the ditch already existed by the time a twelfth to thirteenth-century human burial was inserted (see Table 11).

Subsequent work was piecemeal and conducted in response to particular threats, rather than as pure research, but nonetheless contributed significantly to the available data. In spite of this, definitive dating for the construction and use of these monuments continued to be elusive, until, in the early 1990s, a series of development threats, including water pipelines and the dualling of the A11, presented the chance for a new cohesive programme of research into the origins of three of the Dykes and Worsted Street, and an opportunity to

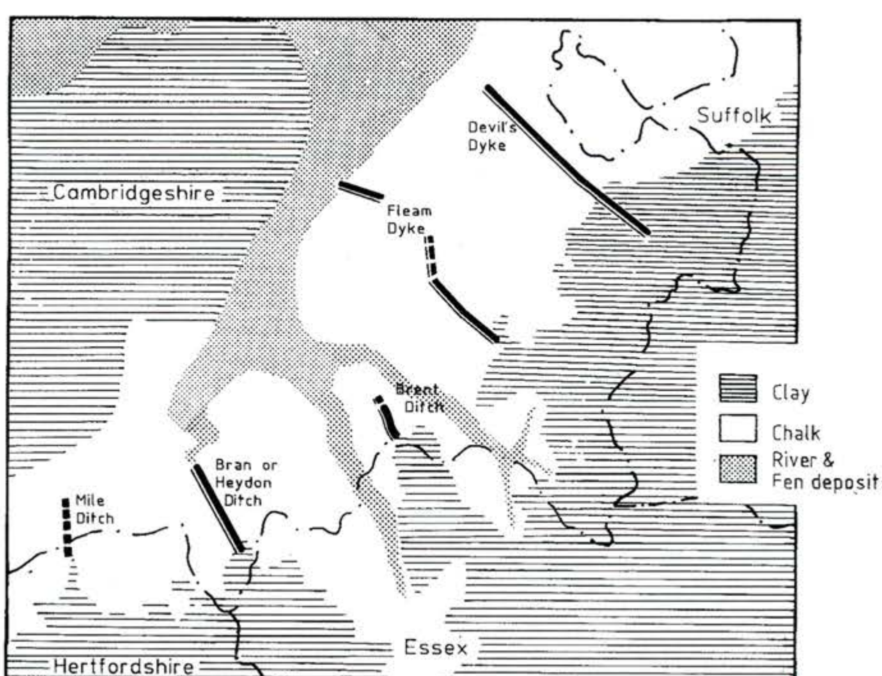


**Figure 2.** *Geology of the Cambridgeshire Dykes.*

**Figure 3.** *View of the southern end of Bran Ditch, surviving as a hollow way from Heydon village and continuing as a footpath to the north west (photo: Tim Malim, March 1993).*

**Figure 4.** *Aerial view of Bran Ditch, visible as a straight field boundary heading south-east across centre of picture from the northern end at Fowlmere RSPB reserve (left) (photo: Tim Malim, July 1993).*

reappraise the information and theories accepted as standard for so long. The following reports outline the main results from each project, the research aims of which were linked by a single organisation, the Archaeological Field Unit of Cambridgeshire County Council, which fortunately managed to undertake all the investigations in spite of the recently introduced tendering procedures for archaeology. Without such a circumstance, allowing continuity of key staff, the cohesiveness and value of the work would have been seriously undermined. To complete the programme of investigation as originally envisaged by the main author, English Heritage accepted the argument that, having excavated the other three Dykes, it was also important to examine Bran Ditch in order to provide valid comparative information and to investigate the monuments as a group. The main research aims, beyond recording the physical characteristics of the surviving monuments, were to obtain well sealed samples, firstly for absolute dating purposes and secondly to allow reconstruction of the contemporary environment, and also to untangle, as far as possible, the phases of development of each monument and their possible prehistoric origins.

The investigations of the individual Dykes are set out below as discrete site reports, arranged in geographical order from west to east, and the summarised data from every recorded excavation of the Dykes are presented in tabular form for easy comparison (see Table 11). The excavation results are followed by various specialist analyses, and the final contribution is a synthetic overview which examines the conundrum of the Dykes in their regional setting and contemporary context. However, it is not the intention at this stage of research to provide a detailed comparative discussion of the Cambridgeshire Dykes in relation to similar features in neighbouring counties; such broader analysis awaits further study.

## Bran Ditch

Ken Welsh

### *Background*

#### *Geology and topography*

Bran Ditch (Heydon Ditch) has its southern terminus at Heydon, at a height of about 120 m OD, on the edge of the Boulder Clay plateau which extends southwards into Essex and Hertfordshire. From here, Bran runs north-west for 5 km (Fig. 3), dropping down to a height of 25 m OD into the chalk plain of south Cambridgeshire to meet an area of wetland where springs rise out of the chalk (Fig. 4), an area curiously named Black Peak. In the field immediately to the north east of the terminus there are several large hollows, probably the result of quarrying; to the west there is a knoll (Black Peak itself) with an enclosure of Iron Age date, and to the east an extensive Roman site, both of which were probably located along Ashwell Street, an ancient west–east routeway.

The present wetland area, now the RSPB nature reserve, Fowlmere, at Black Peak, was more extensive in the past, and then known as Fowlmere Moor. After enclosure, the area was partially drained and watercress beds constructed in some of the remaining portion.

#### *Previous work*

Bran Ditch now survives only as an undulation in the ground and a field boundary along much of its length, although near the village of Heydon it is more substantial. Much of the bank was levelled (or removed) and the ditch filled in during the period after the enclosure of Melbourn and Fowlmere in 1845. However, it was still reported to be 7 foot (2.1 m) high and 80 foot (24.4 m) wide (total width of ditch and bank) in 1868 (Fox 1923a: 127).

Excavations on Bran Ditch by Fox and Palmer (1926) established a post-third-century date for its construction, and after a further excavation (Lethbridge and Palmer 1929; Palmer *et al.* 1932) they concluded that the bank and ditch deviated to respect a burial ground dated by pottery sherds and one or two iron objects to the Anglo-Saxon period. They also recorded two other ditches running roughly parallel to Bran Ditch which they thought were of an earlier date; it seemed therefore that Bran Ditch followed the line of an earlier boundary. The eight sections cut across Bran Ditch by Fox in the 1920s (Fig. 5, A–H) show a profile that varies along its length: in most places flat-bottomed and very similar to the other three Dykes, but at the northern end much less regular with a slightly rounded base. No trace of the bank was found near Black Peak, although to the south east it was recorded as a concentration of chalk fragments in the soil after ploughing.

### *Strategy and methods*

During August 1993 two trenches were opened at the north end of Bran Ditch. Trench A (Fig. 6, 1993a) was situated on land rising to the south west towards Black Peak, and Trench B (Fig. 6, 1993b) was situated about 10 m from the present edge of the wetland area.

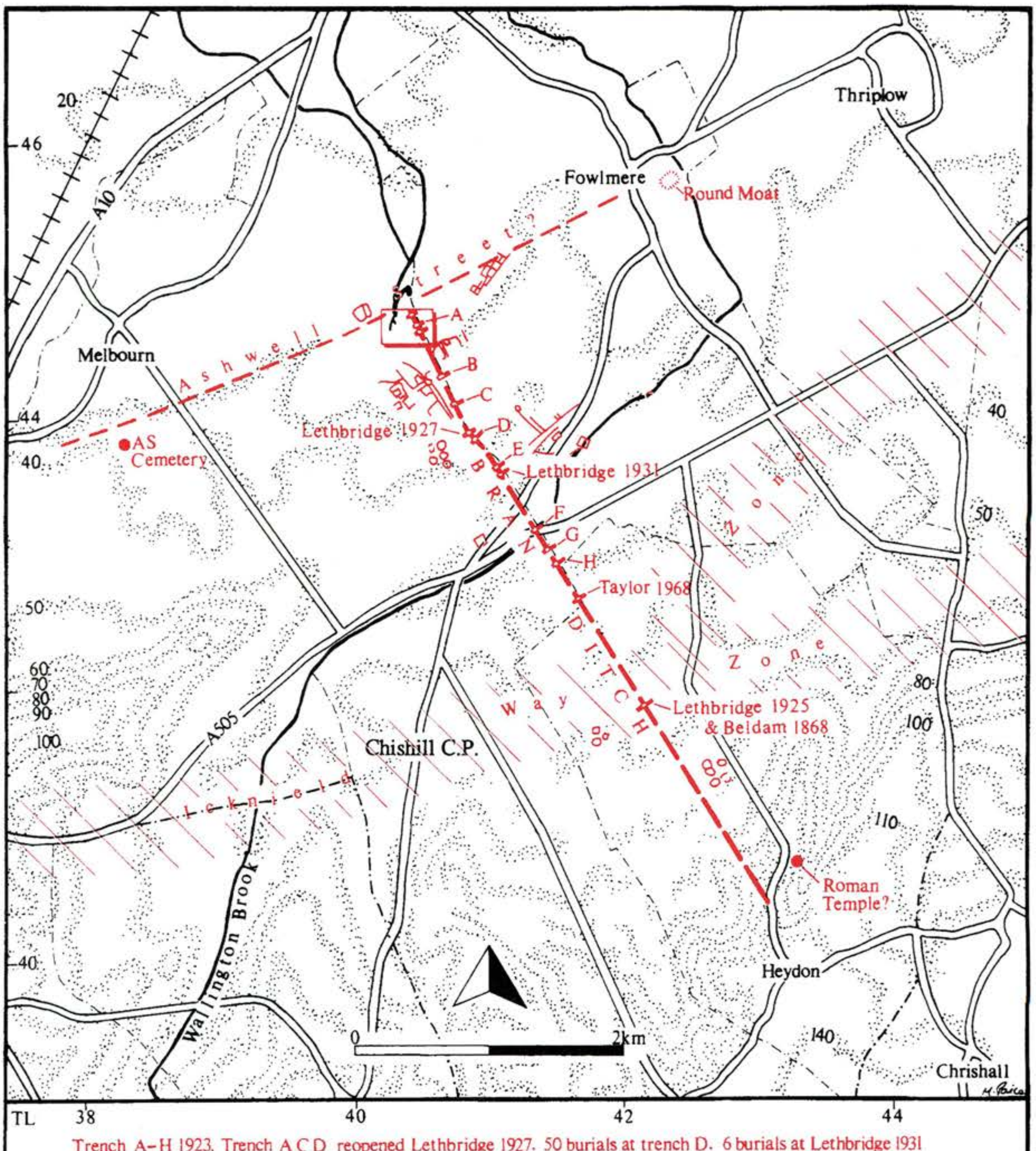


**Figure 5.** *Bran Ditch: location map showing previous work and associated archaeological sites.*

Key of Archaeological Features for Detailed Location Maps of Each Dyke.

Probable ancient route: with reference e.g. (FOX III)

Selected earthworks

Selected cropmarks

Dykes:

Surviving bank & ditch

Surviving bank only

Surviving ditch only

Original line of dyke

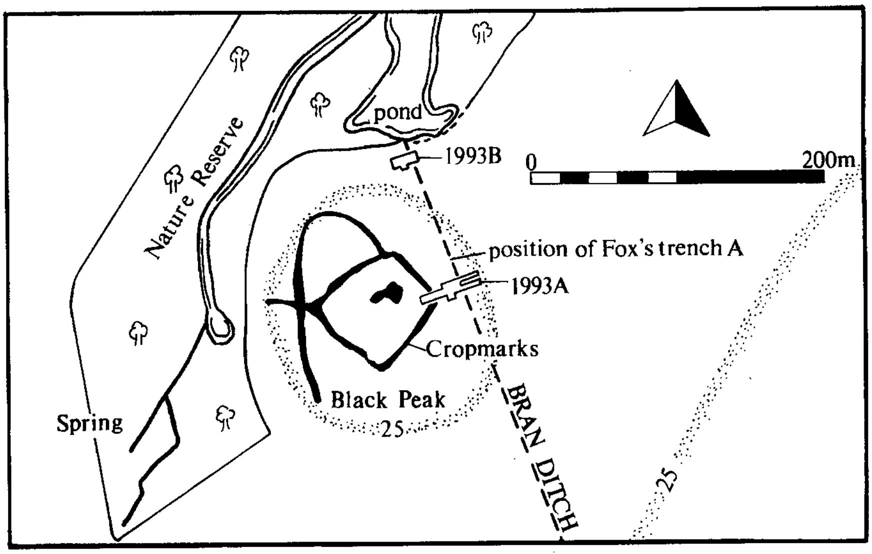


**Figure 6.** *Bran Ditch: location of 1993 trenches and cropmark features.*

The topsoil was stripped by mechanical excavator and the upper fill of Bran Ditch removed. The sides of the trenches were stepped for safety reasons, as well as to increase the light levels in the base of the ditch for photographic purposes, and the trenches were extended to either side of the Ditch in order to investigate any associated features. Trench A was positioned to coincide with the enclosure ditch seen as a cropmark in aerial photographs (Fig. 6). The positioning of Trench B was designed to examine the northern terminal of Bran Ditch and the most likely area for survival of organic deposits immediately adjacent to the wetland. However, a small water tank, used to top up water levels in the nature reserve during dry periods, had been installed here, and so it was necessary to place Trench B a few metres to the south.

The remaining Ditch fills and any other features revealed were then excavated by hand, and where appropriate the spoil was dry-sieved, using a 5 mm mesh, as it was removed. Samples from the ditch and buried soil were taken for molluscan analysis (Murphy, below), but the degree of oxidation of the deposits meant that ancient pollen was unlikely to survive. A column sample through the bank was taken for micromorphological analysis (French, below).

### *Results*

#### *The Ditch*

In Trench A (Fig. 7) the original Ditch (**13**) was shown to survive to a maximum depth of 1.80 m. (Cut numbers are given in **bold** in this and the following reports; fills and layers in normal type.) The width at the top is 5.75 m and at the base 2.45 m (Figs 8 and 9). The natural chalk into which it was cut was strongly bedded and fractured. The surface of the chalk was 0.65 m lower on the north-east side than on the south-west because the upper part of the north-eastern edge had been cut away by a modern pipe-trench, laid in 1982 to supply water to the nature reserve.

The corners of the Ditch were filled by a series of primary weathering fills. The majority of these (Fills 38, 55, 56, 57, 60, 61, 62, 63, 64 and 65: Figs 8 and 9) were composed of very compact, angular or platy chalk fragments with a varying, but small, proportion of grey silty clay. Fills 39 and 59, thin layers within this mass of weathered chalk, were dark grey silty clay with only very occasional chalk fragments. In general, there was a tendency for the later of these weathering fills to contain a higher percentage of silt, and for the chalk fragments to be smaller. Cut into these primary fills was a possible recut (**54**) which contained a compact grey silty clay (40) but no artefacts. Overlying this, Fill 53, a brown silty clay containing moderately frequent chalk fragments, was cut by a pit **67**, which contained (66) a mixture of chalk fragments and grey chalky clay, presumably derived from the earlier weathering fills. Feature **52** contained a mid brown silty clay with occasional chalk fragments. Although no dating evidence was found, it seems probable that this was a drainage ditch cut into the base of the partially silted-up Bran Ditch. The upper fills of the Ditch (12, 50, and 58) were similar greyish brown silty clays, although 50 and 58 contained a much higher proportion of chalk fragments. A few post-medieval tile fragments were retrieved from Fill 12. All of these fills seem

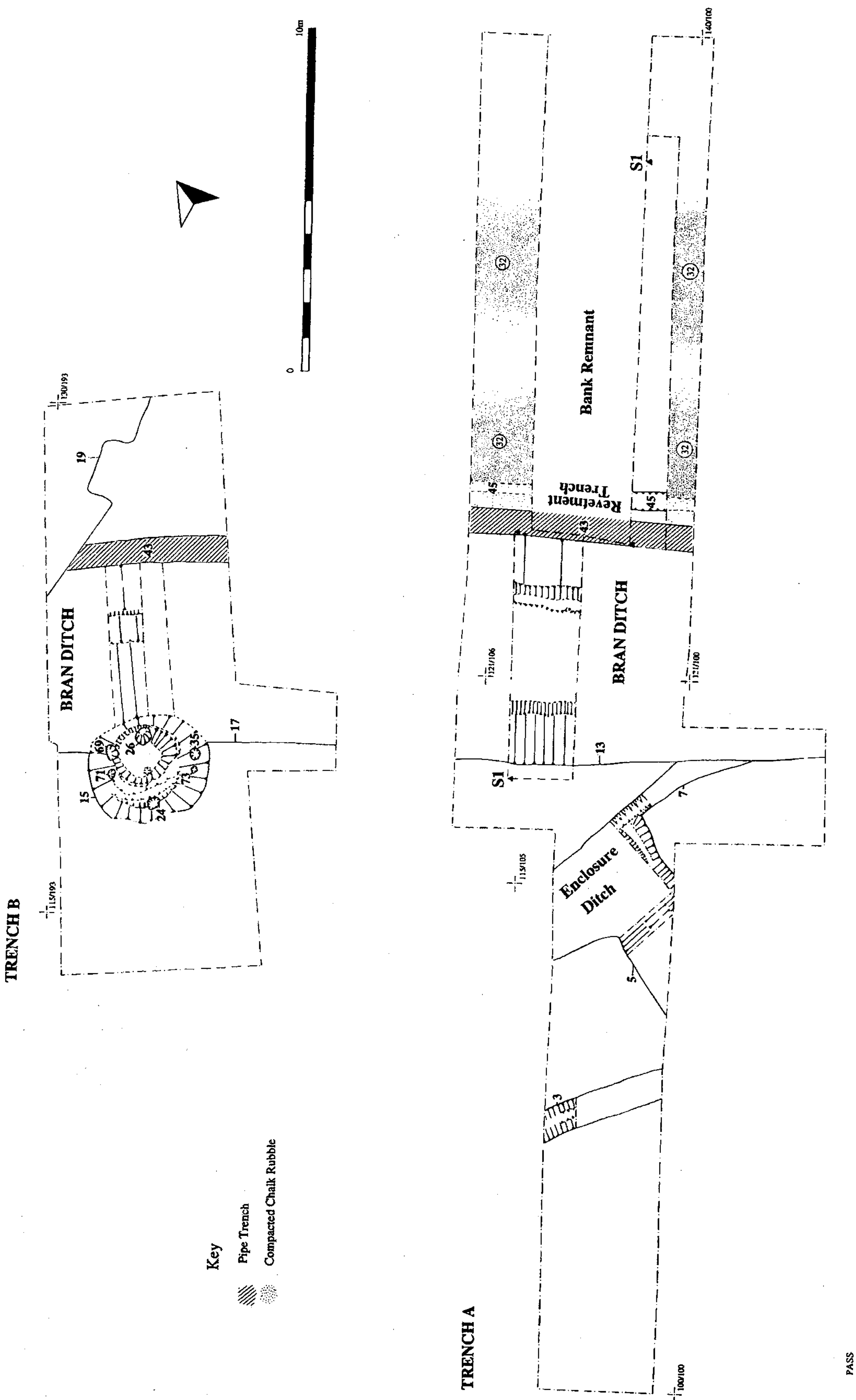


**Figure 7.** *Bran Ditch: trench plans (A and B).*

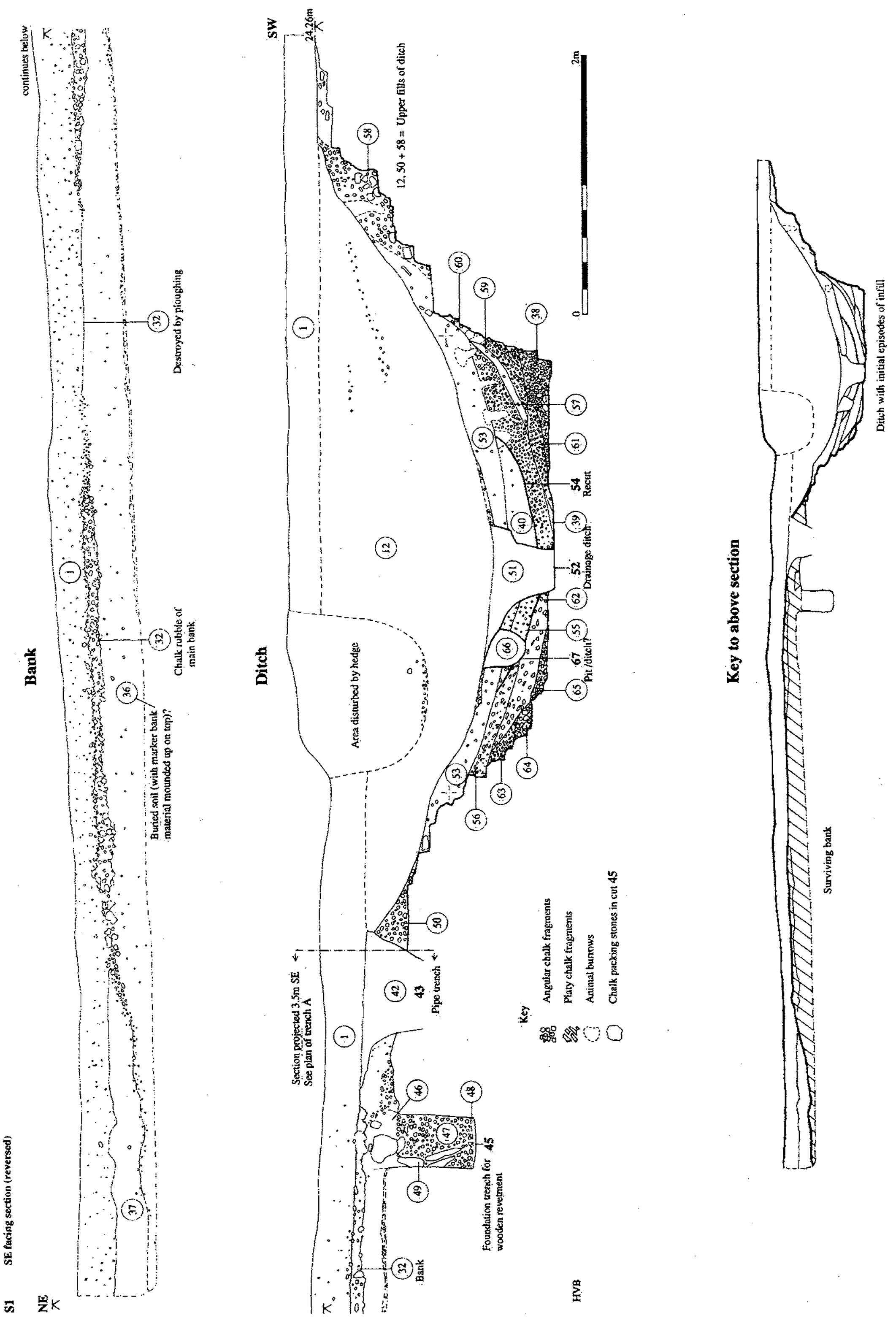


**Figure 8.** *Bran Ditch: south-east facing section through the ditch and bank (Trench A).*

**Figure 9.** *Bran Ditch: photograph of the south-east facing stepped section through fully excavated ditch (Trench A) (scale in 0.5 m divisions).*

**Figure 10.** *Bran Ditch: photograph of Trench B from the west, partly excavated, showing the northern end of Bran Ditch with the oval pit or structure in the foreground (scale in 0.5 m divisions).*

to be a result of deliberate 'ploughing-in', presumably at enclosure or in more recent times.

In Trench B, the original Ditch (**17**) was at least 5.3 m wide and had a maximum depth of 1.49 m (Figs 7 and 10). The north-eastern edge had been cut away by the modern pipe-trench (**43**), which itself was cut into redeposited chalk probably associated with the quarry pit to the north east. The fills of Bran Ditch were much simpler in Trench B, with none of the chalky weathering fills seen in Trench A. At the base of the ditch was a layer of chalk (44), badly disturbed by roots but otherwise indistinguishable from the natural chalk. Above this was a brownish grey clayey silt with occasional chalk fragments (29). The upper fill (16) was a greyish brown silty clay, very similar to the upper fill seen in Trench A and presumably having the same origin.

The natural chalk in Trench B was very different from that found in Trench A. Instead of showing clear bedding planes and fractures it had a smooth, structureless appearance, as if it had been dissolved, and was full of root holes filled with brown chalky clay.

### *The Bank*

On the north-eastern side of Bran Ditch, a layer of chalk was at first taken to be chalk bedrock, cut by two ditches. It subsequently proved to be a layer, 0.13 m thick, of redeposited chalk rubble (32) destroyed by ploughing in its central part, and about 8.5 m wide in total (Fig. 8). It partially overlay Feature **45**, 0.48 m wide and 0.59 m deep, which contained large chalk blocks down its north-eastern edge. This feature ran parallel to Bran Ditch and about 1.2 m away from it. It is clear that Layer 32 is the remains of the original bank of Bran Ditch. Feature **45** would, therefore, appear to be a foundation trench, containing packing stones, for a wooden revetment. Stratigraphically, it is contemporary with the construction of the bank. A possible marker bank might have been used, represented by dumping of topsoil to give a mounded-up appearance to the buried soil (see below).

### *The Buried soil*

Beneath the bank in Trench A was a layer of dark brown silty clay (36) containing abraded Iron Age and Roman pottery. It had a maximum thickness of 0.30 m. Although very homogeneous, the upper surface was not level; rather, it had a high point where Layer 32, above, had been ploughed away, and dropped away on either side. In part this layer is the ancient soil, buried when Bran Ditch was constructed, but the way in which it 'mounds up' suggests that the upper part is the upcast topsoil from the ditch, perhaps used as a marker bank (Fig. 8). The lowest 20–30 mm of the buried soil and the top of the weathered chalk below it contained many struck flint flakes of Mesolithic or Neolithic date, but no pottery.

### *Stratigraphically related features*

Aerial photographs revealed a rectilinear ditch running round Black Peak and enclosing an area of roughly 0.4 ha (Fig. 6) with internal features. Trench A was positioned to coincide with the eastern corner of the enclosure ditch to the south east of Bran Ditch (Figs 7 and 11). This ditch (**5**), 2.5 m wide and 0.92 m deep, had fairly steep sides with a narrow, slightly concave base. The upper fills (4, 27, 30, 31, and 33), brown silty clays with a small proportion of chalk fragments, were the result of gradual silting. Feature **7**, cut by both enclosure ditch **5** and by Bran Ditch, 0.48 m wide and 0.44 m deep where excavated, contained greyish brown silty clay (6) over dark greyish brown silty clay (28). Below this was a very dark brown organic silty clay (34) containing a large fragment of soft, decorated late Iron Age pottery. The lowest fill (35) consisted of chalk fragments, probably weathered from the sides of the ditch.

Feature **3**, 1.05 m wide and 0.34 m deep, contained three fills. Fill 2, a greyish brown silty clay, may represent a post-pipe, where a post has rotted away or been removed. Fill 8, compact greyish brown silty clay and chalk fragments, appears to be packing material. Underlying this was a layer of compacted redeposited chalk.

A circular feature (**15**) (Figs 7 and 10) in Trench B was about 3.5 m in diameter and 0.9 m deep, and had steep sides which were stepped on the south-west side. The upper fill (14), 0.69 m thick, was a friable greyish brown silty clay very similar to the ploughsoil above. Below this, Fill 20, 0.21 m thick, was a greyish brown silty clay. Cut into the sides of Feature **15** were six post-holes: two (**69** and **71**) on the north west, two (**35** and **73**) on the south east; one (**24**) on the south west and one (**26**) on the north east. The fill in each case was mid or dark grey silty clay with occasional chalk flecks. All six post-holes were inclined towards the centre of Feature **15**. The stratigraphic relationship with Bran Ditch was unclear since the upper fills of both were exactly similar. Within Feature **15** there was an abundance of avian eggshell fragments which may relate to egg collection from wildfowl nests around the mere.

### *Molluscan and soil micromorphological analyses*

A total of 15 samples were taken from the Iron Age enclosure ditch, the fills of Bran Ditch, the buried soil, and the circular pit and an associ-

**Figure 11.** *Bran Ditch: photograph of the Iron Age enclosure ditch from the north east (Trench A) (scale in 0.5 m divisions).*

ated post-hole. They were processed and analysed for molluscs and other macrofossils by P. Murphy (see below).

Seeds from a range of taxa from the *base* of the buried soil under the bank indicate the presence of established woodland, whilst the *top* of the buried soil contained molluscs which suggest that Bran Ditch was constructed in conditions of tall, damp grassland, and a sample from the ditch itself also indicates damp conditions, with periodic flooding. The buried soil was also sampled as an intact block and micromorphological analysis carried out by C. A. I. French (see below). It did not show any evidence of horizonation, and was probably a poorly developed rendzina-type soil with an A horizon which had developed directly on the chalk subsoil; this type of soil is usually associated with open, downland types of environment. From the base of the Iron Age enclosure ditch, the molluscan assemblage suggests that there was at least some open ground – perhaps the area within the enclosure – during the Iron Age. In short it appears that evidence from the *base* of the buried soil and from the ditch around the Black Peak enclosure represent an environment earlier than that in which the bank and ditch were constructed.

*Discussion*

Excavation in Trench A has shown that in this area Bran Ditch was 1.8 m deep from the surface of the natural chalk, and 5.75 m across. On the north-east side there was a berm of about 1.5 m between the ditch and the bank. The bank was 8.5 m wide at the base and during construction was revetted along its south-western side. The revetment was presumably intended to prevent the freshly excavated chalk rubble from slumping back into the ditch. That it fulfilled this function is clear from the roughly equal quantity of chalk rubble fill in either side of the ditch, suggesting that it derived from erosion of the ditch edge and not of the bank. Macrofossil analysis of these deposits suggests that open conditions prevailed. After a period of rapid erosion of the edges, the ditch may have been cleaned out once, after which it seems to have attained a stable profile. At some later date, two further recuts were made in the bottom fills of the ditch, which appear to be drainage ditches and must therefore date from a period when the original function of the ditch was obsolete. The final phase of infilling resulted in an homogeneous fill, clearly derived from the topsoil. It seems very probable that its cause was deliberate 'ploughing-in' after enclosure. Either at this time or earlier, the bulk of the chalk rubble making up the bank must have been removed from the immediate area, as there is no evidence that it was used to backfill the ditch or that it was spread across the adjoining field.

In contrast, excavation in Trench B revealed a very different profile. Although only slightly smaller, the south-west side had a much shallower gradient and there was no sign of the steeply sloping weathering fills seen in Trench A. The combination of horizontally bedded fills and the nature of the natural chalk strongly suggest that this extreme portion of Bran Ditch was originally waterlogged. Indeed, the macrofossil assemblage shows that damp conditions prevailed, with occasional flooding from the wetland area. It seems likely, then, that the base of the ditch when constructed was close to the contemporary spring-line, with the result that the wetland area would have been contiguous with the end of the ditch. Baker's Map of Cambridgeshire (1825) shows that the springs in this area gave rise to a fairly substantial stream which flowed north-west. If this was the case in the Anglo-Saxon period, then it would have continued the line of Bran Ditch to the River Cam and obviated the need to construct an artificial barrier to impede access in this area.

The buried soil beneath the surviving remnant of bank contained many sherds of abraded Iron Age and Roman pottery, indicating a *terminus post quem* for the construction of Bran Ditch. At least some of this layer seems to derive from topsoil upcast from the ditch. Macrofossil analysis reveals that open conditions existed, and charred cereal in the soil suggests cultivation or grain processing in the area. The base of the soil and the surface of weathered chalk beneath contained many flint flakes, and may represent a Mesolithic or early Neolithic tool production surface; seeds in this portion of the buried soil have been interpreted as characteristic of wooded conditions with open areas, in some contrast to the environmental evidence derived from higher in the soil profile. The presence of a buried soil beneath the bank, along with a slight dip in the natural chalk, which afforded it protection from the ravages of modern ploughing, has resulted in the survival of useful information on the contemporary and earlier environment for Bran Ditch, and of a possible Mesolithic or Neolithic surface.

The adjacent rectilinear enclosure ditch contained an Iron Age sherd. Of the two other ditches revealed, Ditch **7**, outside the enclosure, was earlier than both Bran Ditch and the enclosure ditch but could not be dated otherwise. Ditch **3** may have had a slight curve but the length revealed was not sufficient for this to be certain. Its fills and profile suggest that it was used as a post foundation trench, perhaps for a palisade. Its date is uncertain, although it did contain a few sherds of abraded late Iron Age pottery. These features and cropmarks may well represent an enclosed Iron Age farmstead but, since they are so close to an area of springs, a ritual function is quite possible.

The excavations indicate that, at least at this northern end, Bran Ditch was constructed in a single phase when the ditch was excavated and the bank raised. There was no indication that it followed an earlier boundary, but this cannot be positively ruled out, since any evidence may have been entirely obliterated when Bran Ditch was constructed. The chance that traces of an earlier boundary may still exist at other points along the monument should not be ignored.

## Brent Ditch

Ben Robinson

### *Background*

#### *Geology and topography*

Brent Ditch (Pampisford Ditch) survives as a ditch running north west to south east for 2.3 km. The northern end has been cut through the glacial sands and gravels, which cap the Middle Chalk, on a slight rise of up to 30 m OD near Pampisford Hall (Fig. 12). It crosses a band of Middle Chalk before rising up to 80 m OD at its southern terminal, where it abuts a spur of Boulder Clay.

The northern portion is covered by the mature trees of a ninteenth-century arboretum, while the portion south of the A11 is similarly tree-covered, though with much smaller tree species. The non-scheduled section, the focus of the present investigations, was under cultivation at the time of excavation and runs from the A11 north west towards the arboretum (Fig. 13). Here the ditch is apparent as a slight linear depression (0.5 m deep), flanked by two low undulating ridges. Where the monument is tree-covered, the ditch survives to a greater depth, although there is little visible trace of a bank in these better preserved locations.

**Figure 12.** *Brent Ditch from the air, showing the northern end at Dickmans Grove and Pampisford Hall (bottom left), and a continuation as a curving line of trees towards the south east (top right). The recent excavations took place where Brent Ditch appears as a crop-mark joining the line of trees (centre) (Cambridge University Collection of Air Photographs RC8-BS-34, April 1977; copyright reserved).*

*Previous work*

Fox's investigation of Brent Ditch was limited to the examination of a small trial hole, and was never followed up by further excavation (Fox 1923a: 130). Fox noted that there was no definite bank along the length of the monument, but instead slight ridges bordering both sides of the ditch. He also mentioned that a 450 yard (400 m) portion of the ditch, which formerly continued to a spring at Dickman's Grove, north west of Pampisford Hall, had been destroyed (*ibid.*: 126).

A section of the ditch 400 yards (350 m) to the south east of the hall was exposed by excavations for a gas pipeline in 1968 (Taylor 1969; see Fig. 13). The section revealed that the ditch was 2 m deep and flat-bottomed, and had gently sloping sides with well marked ledges near the top. Its fill mostly comprised a dark brown loam with chalky lumps, although a lens of sand and gravel was apparent near to the surface. A small remnant of the bank had survived on the north-east side (less than 1 m in height), and this sealed a buried soil. A small undated ditch had been cut through the buried soil and was also sealed by the bank material. No artefacts were noted either in the buried soil or in the ditch deposit (Taylor 1969: 30) and consequently no secure dates for the construction of the ditch were obtained.

Brent Ditch is now cut by the A11, which is presumed here to follow the line of a Roman road (Margary 21B) emanating from Great Chesterford (Margary 1967: 24; but see Penn and Wait on Worsted Street, below). A slight cutting and embankment for the very short-lived Great Chesterford to Newmarket Railway (Joby 1977) bisected the monument a few hundred metres to the north of the A11.

The north-west portion of Brent Ditch (to the west of the A11) is within Pampisford parish; the remaining portion is in Great Abington. That part of Pampisford parish bounded by the A11 and A505 was agricultural land farmed in open fields until parliamentary enclosure in the early nineteenth century when Pampisford Hall and surrounding park was constructed (VCH VI:

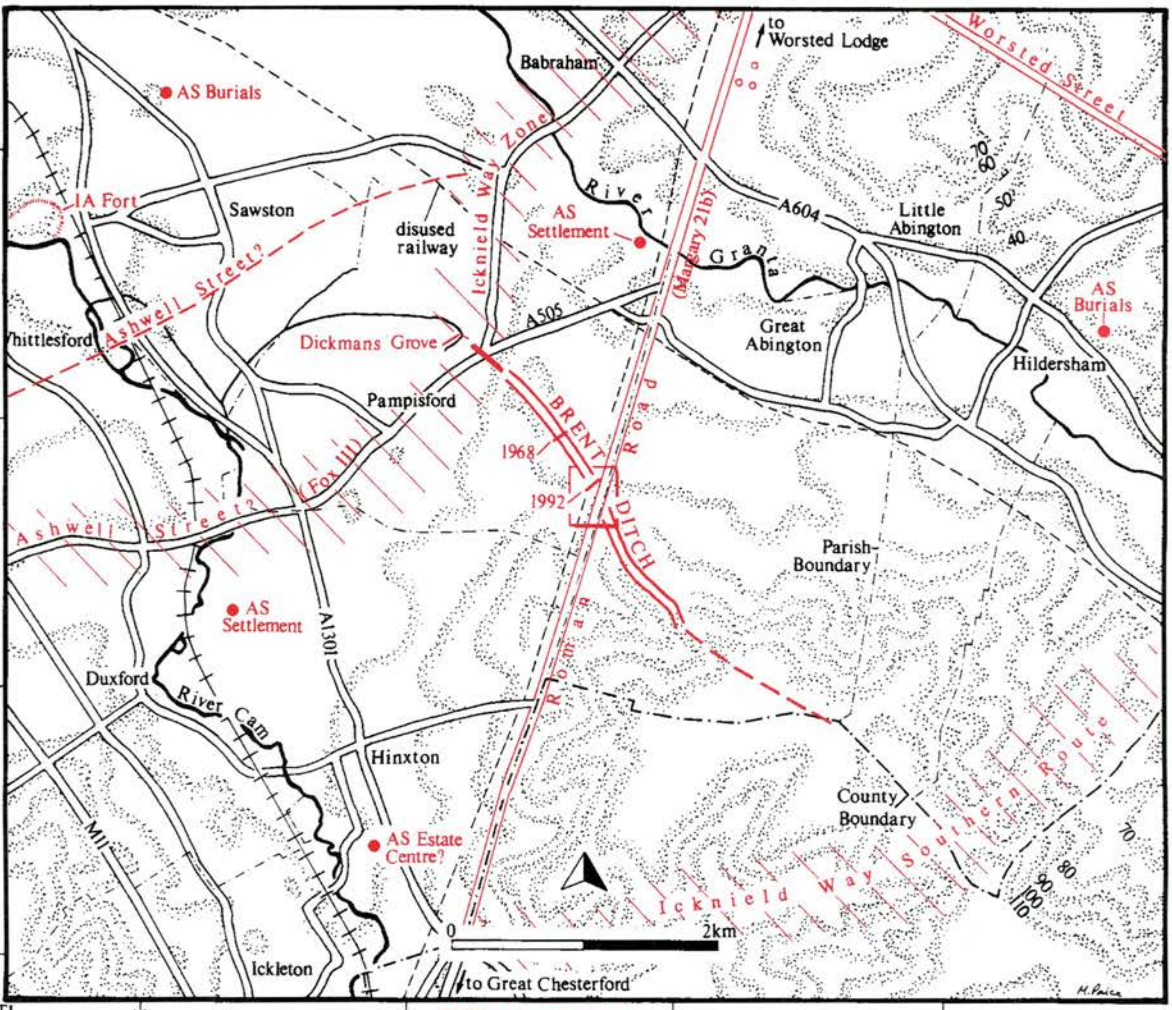


**Figure 13.** *Brent Ditch: location map, showing previous work and associated archaeological sites.*

105–107). Brent Ditch, known as the 'Green Ditch' just prior to enclosure, probably formed the boundary between Branditch Field and Middle Field (Mayo 1985: 21), which together with Mill Field and the less important Down or Dean Field, comprised the open field pattern established by the fifteenth century (VCH VI: 108). Further medieval references to the earthwork include mention of tenants 'Thomas in Dich' and 'Maud in Dich' in the Chilford Hundred Court Rolls (VCH II: 37). Ditch Field, one of Great Abington's three open fields in 1600 (VCH VI: 10), was presumably also named after Brent Ditch.

At the time of enclosure, Brent Ditch extended to the Royston to Newmarket turnpike road (A505) and a large clunch pit had been excavated close to the monument within 200 m of the road. The clunch pit, as depicted by the 1880s Ordnance Survey map of the area (LIV.12), appears to have encroached on the monument. The approach drive to Pampisford Hall was apparently constructed on the line of the ditch. On the 1880s OS map, the ditch is not marked to the west of the turnpike road, at 'Brent Ditch End'. Its former presence here, however, is suggested not only by the name but also perhaps by a boundary ditch leading across Dickman's Grove, which might preserve its line.

### *Site specific aims*

Although the other Cambridgeshire Dykes have all been subject to some systematic excavations over the last seventy years, Brent Ditch, with the exception of a single recorded section and trial hole, has remained largely undisturbed. Consequently, little was known, although a great deal about its nature and origin was assumed by association with the other Dykes. The campaign described below was designed to fol-

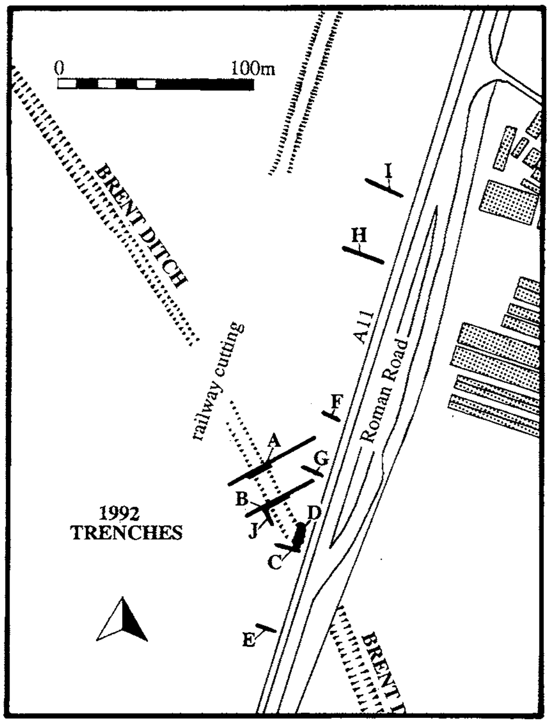


**Figure 14.** *Brent Ditch: location of the 1992 trenches.*

low the main research aims of the overall Dykes project and specifically to establish whether a bank existed in this area and on which side it was constructed. It was also hoped that a section could be excavated close enough to the A11 to be able to locate the Roman road and to establish the relationship between ditch, bank, and road surface.

### *Strategy and methods*

The segment of Brent Ditch examined was adjacent to, and to the north of, the old A11 (Figs 13 and 14), on the Pampisford Hall estate (TL 5145 4753). Road widening created the opportunity to conduct a controlled excavation during August 1992, backed up by observation as roadworks progressed during summer and autumn 1994.

Two complete sections were investigated to lessen the possibility of obtaining unrepresentative information. Topsoil was removed by mechanical excavator over the ditch and in open areas to either side, and then archaeological deposits were excavated by hand. As in Trench A at Bran Ditch, wide steps were dug in the upper ditch deposits in order to ensure safety and facilitate working at depth lower down the profile. The hand-dug slots (1 m wide) were excavated in plan by mattock and trowel from just below the modern ploughsoil to the base of the ditch in two sections, and fills were dry sieved with 5 mm meshes to recover small artefacts.

Soil samples for molluscan analysis (2 kg dry weight) were taken in Trench B in a column from the ploughsoil to the base of the ditch, avoiding fill interfaces (Fig. 22), but macrobotanical samples were not taken, as concentrations of suitable charred material were not encountered. The oxidised nature of the ditch fill ensured that there was no chance of encountering preserved ancient organic material or pollen. The absence of a remnant of bank or buried soil meant that there was no opportunity for soil micromorphological analysis.

### *Results*

#### *Trench A*

The location of Trench A was chosen in order to investigate the position at which the slight ridge on the north-east side of the ditch (possible bank remnant) was at its most pronounced (Figs 15 and 16). The trench ran south-west to north-east, perpendicular to the line of Brent Ditch. Over the width of the ditch, and a little to each side, the trench was expanded to allow for a wide-stepped section. This also allowed a good length of the ditch edge to be examined for post-holes, palisade trenches or any other associated features which might form part of the monument.

The composite section was made up of two sections offset by a 1 m step (Figs 17 and 18). A trial trench across the slight ridge at the north-east edge of the ditch proved that it was a natural chalk undulation, and not a remnant of bank.

The earliest layer (27) was solely composed of large, loose, tabular lumps of chalk which rested on the flat base of the ditch (Fig. 18). No 'trample' deposits were recognised below the chalk rubble. Consecutive layers of fine and coarse chalk flecks and lumps were visible, within the general trend of decreasing size of chalk inclusions as the ditch fills accumulated. Observation at Overton Down experimental earthwork, also dug into chalk, has established that such a pattern results from the differential, seasonally influenced weathering of the ditch sides (Jewell and Dimbleby 1966). Over time, these deposits become progressively more mixed in a greyish brown silt matrix; discrete layers were much less easily identified towards the top of the basal deposits of Brent Ditch, where they become progressively thinner and more compact.

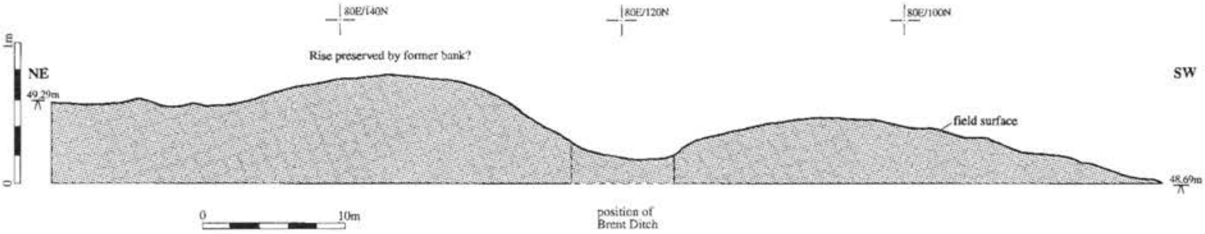


**Figure 15.** *Brent Ditch: pre-excavation profile of Trench A with exaggerated vertical scale, showing possible position of bank as a natural ridge to the north east.*

**Figure 16.** *Brent Ditch: photograph of Trench A from the south west, showing the natural ridge in the chalk to the north east (background).*

Contexts 16 and 13 define the profiles of the natural stabilisation of the ditch and seal the initial accumulation of chalk rubble deposits. The upper interface of these deposits formed a gently rounded and symmetrical profile in the centre of the ditch. This suggests that the weathering was equal on both sides of the ditch and, further, that the chalk rubble had derived from the ditch sides and edge, rather than from a bank on one side or the other. If a single bank was indeed all that was present (and the evidence from Taylor's section and Trench B suggests this is the case), a wide berm must have existed between it and the ditch in order to have prevented weathered material from the bank skewing the symmetry of the lower fills.

Deposits 8, 10 and 12, and the layers above, seem to have resulted from ploughing in. The presence of clay pipe-stem fragments in these fills indicates a post-medieval date, although intrusion due to burrowing animals cannot be ruled out entirely. Deposits 4 and 14 were very distinct, being much less chalk-flecked than the overlying fills, and Deposits 11 and 15 were fine chalk rubble tip lines. A clay pipe-stem and small fragment of willow-pattern pottery indicate that the above fills had not accumulated before the post-medieval period. Deposit 5 was much less compact than surrounding deposits

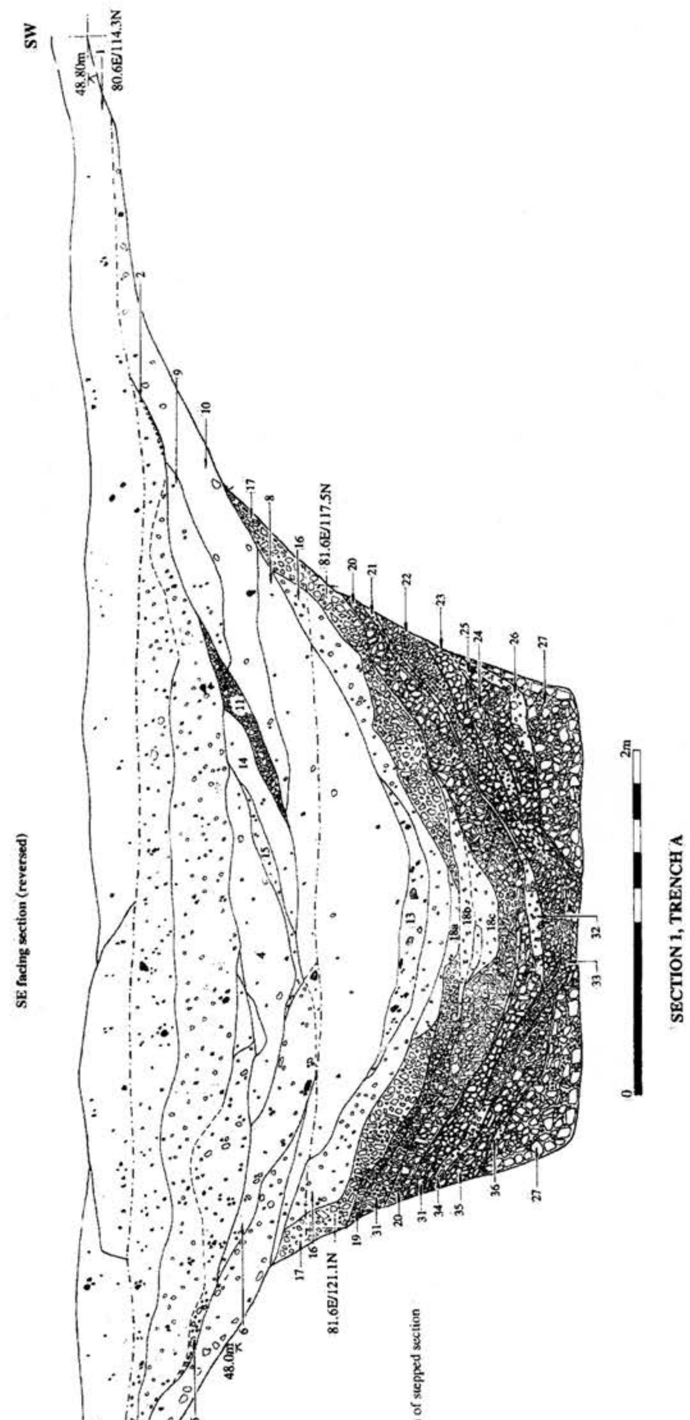


**Figure 17.** *Brent Ditch: south-east facing section through the ditch (Trench A).*

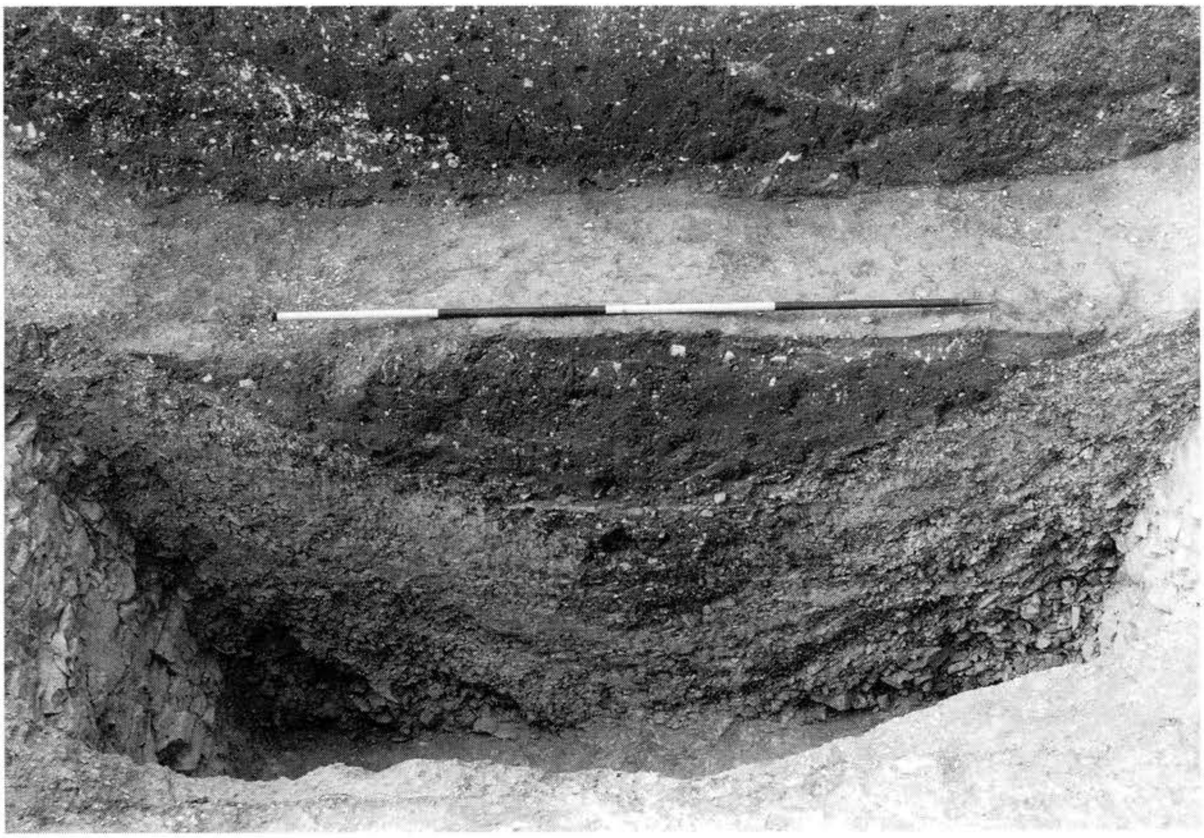

**Figure 18.** *Brent Ditch: photograph of the south-east facing section through the lower fills of the ditch (Trench A) (scale in 0.5 m divisions).*

and probably represents an area disturbed by animal burrows. Discrete burrow holes were evident in both sections down to the level of the basal weathered chalk deposits.

The modern plough-soil (1) directly overlay natural chalk. Regular deep-ploughing score lines (up to 50 mm deep) were visible on the surface of the chalk. Plough-soil had accumulated in the top of the depression over the ditch and had become compacted as Deposit 2. This layer contained clay pipe-stems, modern glass, and a very abraded Romano-British potsherd. Deposit 3 seemed to be similarly derived and contained similar modern inclusions. Deep plough score lines were apparent at its surface.

The section showed that the ditch was over 2.8 m deep, and had steep, convex sides which met the flat base (2.6 m wide) with a sharp break of slope. The convex sides, I would suggest, are a result of erosion rather than a true indication of the original profile of the ditch. A steep straight-sided ditch cut through the weathered upper interface of thinly bedded Middle Chalk would be prone to severe weathering. The transformation of an original sharp break of slope at the top of its profile into a more gentle or rounded break of slope would be a natural consequence of such weathering.

*Trench B*

A single section, 1.5 m wide, was dug from the base of the plough-soil to the bottom of the ditch. Both of the resulting composite sections were recorded. Overall, the fills encountered were generally analogous to those observed in Trench A; however, some differences were noted.

Deposit 110 corresponded to Deposit 16 observed in Trench A and seals the chalky initial weathering fills (Figs 19 and 20). The angle of repose of the basal rubble deposits followed a natural gradual decrease as they accumulated. There was no sign of recutting or ditch cleaning in any of the recorded sections. Deposit 129 was very loose amongst quite compact deposits and may have resulted from tree root or animal disturbance. The upper deposits of the ditch in this area (Fig. 21) corresponded to those revealed in Trench A, and were similarly dated, by small potsherds, brick or ceramic drain fragments, clay pipe-stems and glass, to the post-medieval and modern periods. Deposits 106

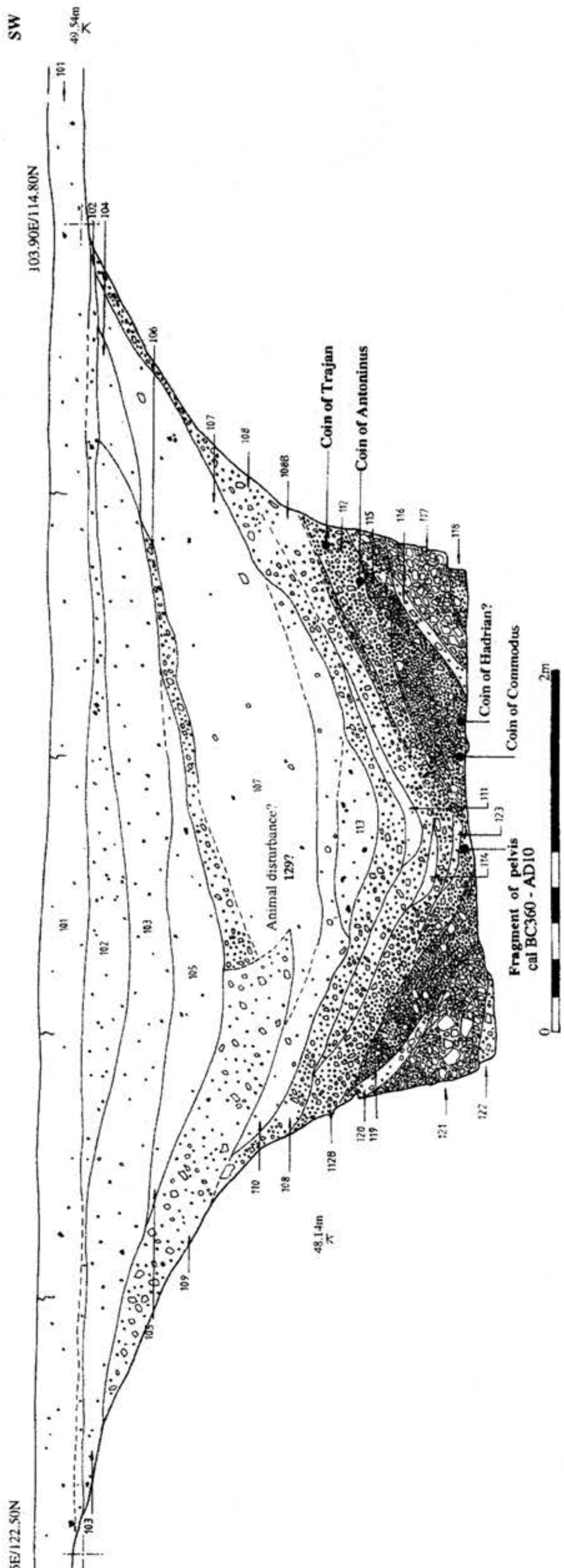


**Figure 19.** *Brent Ditch: north-west facing section through the ditch (Trench B).*

**Figure 20.** *Brent Ditch: photograph of the north-west facing section through the lower fills of the ditch (Trench B) (scale in 0.2 m divisions).*

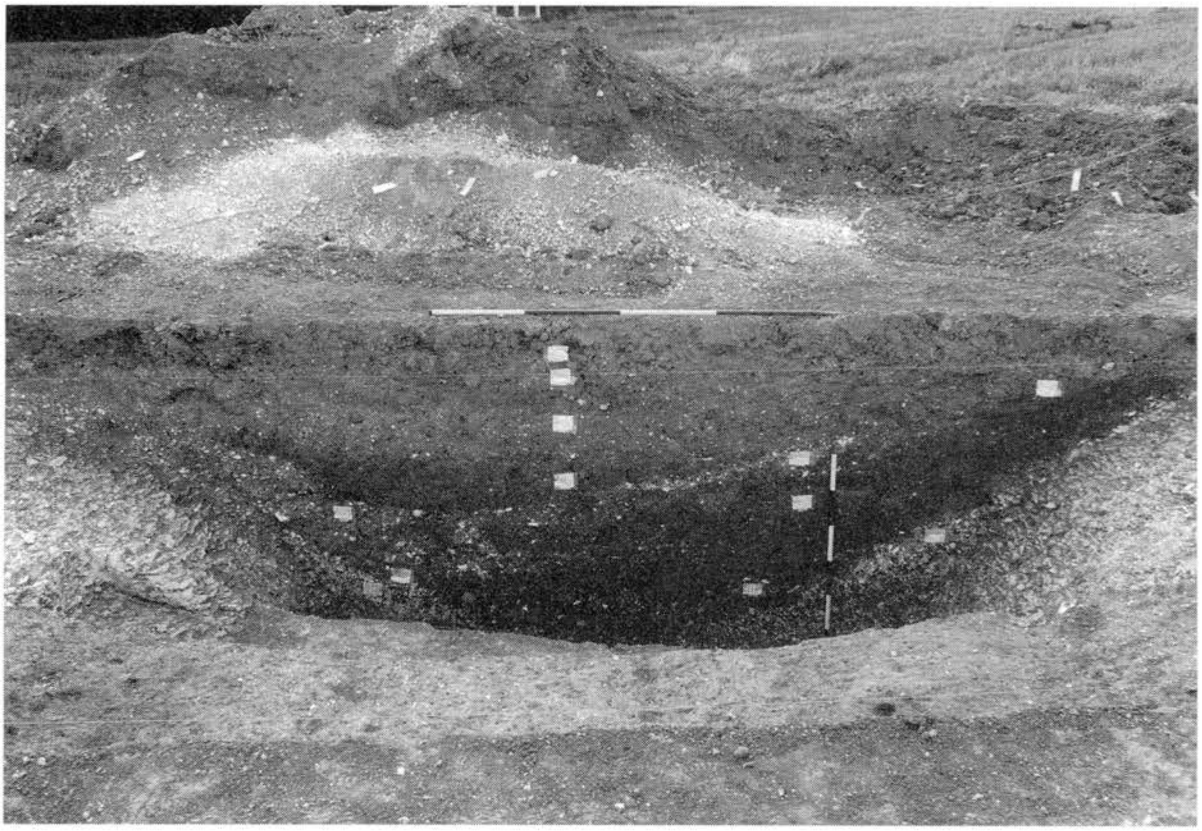

**Figure 21.** *Brent Ditch: photograph of the south-east facing section through the upper fills of the ditch (Trench B) (horizontal scale in 0.5 m divisions; vertical scale in 0.2 m divisions).*

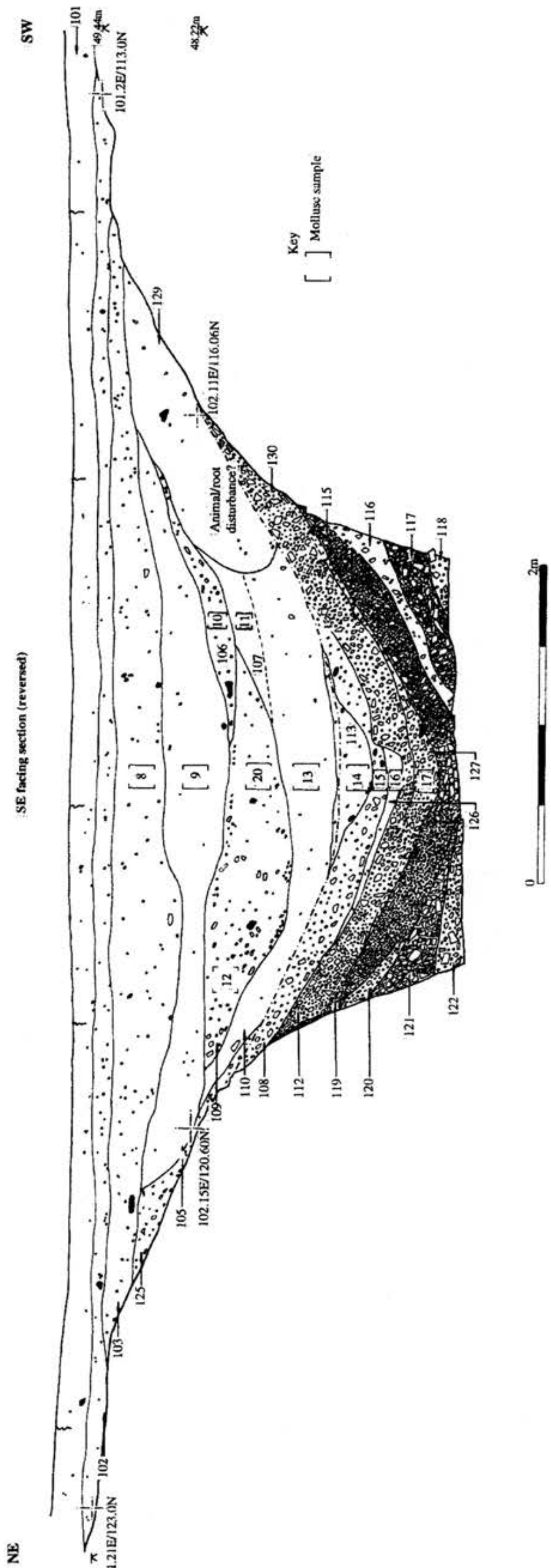


**Figure 22.** *Brent Ditch: south-east facing section through the ditch, showing location of soil samples (Trench B).*

and 109 were not, however, paralleled in the Trench A sections. Both contained larger and more frequent chalk lump inclusions than all other deposits, with the exception of the basal rubble layers. These deposits probably resulted from deliberate dumping, rather than the natural erosion and gradual accumulation exhibited by the other deposits. It is possible that they derive from the slighting of a bank, though there is not sufficient redeposited chalk material to suggest that anything but a part or remnant of a chalk bank was deposited in the ditch.

The section revealed that the ditch retained the shape noted in Trench A but was approximately 0.4 m shallower. The possibility that the decreasing depth of the ditch as it approached the presumed Roman road indicated the presence of an original causeway was tested as far as was possible by the rapid excavation of a third trench (Trench D, see below).

*Dating*

Five coins were recovered from Fills 112 and 115, near the north-west facing section of Trench B (Fig. 19): a *dupondius* possibly of Hadrian (AD 117–138), a *sestertius* of Commodus (AD 180–192), a *sestertius* of Marcus Aurelius (AD 161–180) and two *sestertii* of Trajan (AD 98–117). Such second-century coins may have been in circulation up to the mid-third century, although the minimal wear on the later coins suggests that these examples were taken out of circulation around the beginning of the third century (K. Butcher, personal communication). It is conceivable that, despite their recovery from different (though adjacent) deposits, the coins originated from a single source, for example a grave or hoard, and were separated only by post-depositional influences such as animal burrowing or during the settling of the rubble deposits.

If we accept that, based on experimental work at Overton Down, these substantial basal rubble deposits had accumulated within a very few years of the construction of the ditch, then the coins suggest a somewhat surprising late second or third-century AD origin for the monument. However, a fragment of human pelvis, radiocarbon dated at 95% confidence to 360 cal. BC–cal. AD 10 (OxA-4065: 2105±55 BP), was also recovered from the basal chalk rubble deposits (Fig. 19). The Iron Age date for this find suggests there is residual material present. The coins may therefore also have been displaced during the construction of the ditch from a much earlier feature or deposit, such as the Roman road, and gone unnoticed by its builders. Trench J (Fig. 14) was opened to further investigate the lip of Brent Ditch in this area, and to establish whether there were any nearby features from which the finds might have derived. No features were found in close proximity to the ditch edge in this location, which does suggest that the coins are indeed a relatively secure indication of the monument's date. On the other hand, the presence of the earlier human bone indicates a possibility that all the dating evidence derived from features or horizons which were subsequently destroyed.

*Stratigraphically related features*

Trench C was opened in order to test for the presence of road ditches or field boundaries connected with the presumed adjacent Roman road (Fig. 14). A narrow linear ditch (**150**) which ran parallel to the A11 was encountered and excavated, and proved to contain two very small and abraded Romano-British(?) potsherds, but no other datable material. Further trenches were opened to test the continuity and alignment of the ditch, and to allow the excavation of further sections from which to extract datable material. The ditch was encountered in Trench D (Fig. 14), the section demonstrating that it pre-dates Brent Ditch. Unfortunately, the only feature apparent on the other side of Brent Ditch was an undated gully of differing alignment. Trench G gave similarly negative results. An undated ovoid feature (post-pit?) was sectioned in Trench F, and a modern(?) gully in Trench H. Trench I also failed to pick up ditch **150**.

*Mollusc samples* (see Murphy, below)

A discontinous column of samples was taken from the ditch fills in Section 4 (Fig. 22) with additional topsoil samples from Section 5 (Fig. 19). From the possible road ditch in Trench C two samples were examined. The samples consistently produced assemblages of low species diversity and it appears from the mollusca present that open conditions persisted throughout the period of ditch infilling with no evidence for any phase of stable vegetational cover or scrub growth. Some scraps of mussel shell in the samples may be related to nearby domestic activities.

## Discussion

The ditch was originally around 3 m deep, 2.6 m basal width and over 4.5 m wide at the top (projected original width), with a very regular, steep-sided, flat-bottomed profile. No structures suggestive of an earlier constructional phase or a palisade were observed. There is no evidence that the ditch was ever cleaned out or recut, and consequently it lost its sharp profile, and presumably much of its efficacy as a physical barrier, a few years after construction. A sufficiently wide berm must have existed between any single bank and the ditch in order to have prevented eroded material from skewing the accumulation of basal deposits. Although no bank was found to have survived on either side of the ditch, the profile of the ground surface recorded in Trench A, before excavation (Fig. 15), shows that the ditch was dug into a natural chalk undulation creating the effect of the flanking ridges observed by Fox. The higher part of the undulation is to the north-east side of the ditch and logically this should have been exploited for the foundation of the bank. This would be consistent with the evidence for the slighting of a bank remnant, seen in Trench B, and conforms with the evidence for a bank from Taylor's (1969) section; it is therefore reasonable to infer that a bank had once existed in this position. Indeed, where else would the material removed to construct the ditch have been put, except in a bank?

Ditch silting processes were seen to be essentially similar in each of the exposed sections, with the exception of the evidence of slighting in one trench. On the other hand, Taylor's (1969) section was free of chalk rubble and clearly demonstrated a different sequence of deposition. The sequence excavated in 1992 began with natural erosion from the exposed chalk edges of the ditch and culminated with the accumulation of washed-in and ploughed-in silts. The molluscan evidence suggests that the ditch sides and edges were never successfully stabilised by vegetation, and a large amount of chalk rubble accumulated in the base of the ditch early in its existence. Whilst it is clear that much of this derived from natural weathering processes, it is possible that human activity such as cultivation, movement along the nearby road, or even intensive grazing, served to increase erosion during its pre-medieval life.

If we accept that there was indeed a single bank only, and it was on the north-east side of the ditch, most of it must have been deliberately removed before many of the ploughed-in silts had accumulated. Some of the bank may have been quarried away as ballast for the nearby road, as happened to Devils Dyke at Swaffham Prior where it is crossed by the Burwell road (Robinson 1992). Alternatively, the navvies constructing the nearby railway embankment during the 1840s (Joby 1977) might have found it a tempting source of material.

It is possible that the fragment of pelvis and Roman coins are residual and do not reflect the date of the monument's construction (other than providing a reasonably secure *terminus post quem* of the late second century for the excavation of the ditch). The small ditch observed in Trenches C, D and E was discontinuous and is therefore unlikely to have been a roadside ditch, but it appears to run parallel to the A11 (and thus the presumed Roman road) and may represent a boundary connected with it.

## Worsted Street Roman Road

Tim Malim, Ken Penn and Gerald Wait

### *Background*

*Geology and topography*

Worsted Street, as represented by Wort's Causeway, runs nearly west to east towards Wandlebury and the War Ditches, before turning south east as the main line of Worsted Street to run along the top of a chalk ridge in the direction of Haverhill (Fig. 1). Southwards from its junction with the A11, Worsted Street becomes gradually less straight, though still very regular (Fig. 23). For most of its course it lies over a natural chalk subsoil, until Boulder Clay is reached near Horseheath. In the past, this earthwork was considered to be one of the Cambridgeshire Dykes (e.g. by Hughes 1904), with which it has many similarities in alignment and topographic location, and it therefore became the focus of one of the first campaigns of Dyke excavation in 1921 (Fox 1923b: 21–27).

Worsted or Wool Street (perhaps named after a medieval landowner as suggested by Dewhurst 1964: 56, but see also Reaney 1943: 31–33) is a Roman road (Margary 24) which survives today as a green way about 10 m wide overall, occasionally with a raised bank (*agger*) up to 2 m above the level of adjacent fields (Fig. 24). It is clearly of Roman character in the north-west stretch; in the nineteenth century it was suggested that it was part of a major route from Colchester to Chester (*Deva*), and the name *Via Devana* was coined for it. The system of Roman roads in Cambridgeshire is discussed by Fox (1923a), and later by Wilkes and Elrington (VCH VII: 15–29), who include the results of excavations and dating evidence for Worsted Street, but nonetheless the pattern of Roman roads around Cambridge is still imperfectly understood. It is clear that Akeman Street ran in from Sandy to the south west *via* Arrington (Margary 23a) and continued to Ely and Denver to the north east (Margary 23b), while the modern Huntingdon Road follows the line of '*Via Devana*' north-westwards (Margary 24), meeting Ermine Street at Godmanchester.

**Figure 23.** *Worsted Street from the air, looking south-east from the Worsted Lodge area (note the increasingly irregular line taken by the road to the south east) (photo: Ben Robinson, 1991).*

**Figure 24.** *Worsted Street: looking north-west from Trench 1 with the top of the* agger *visible in the cut section (1991).*

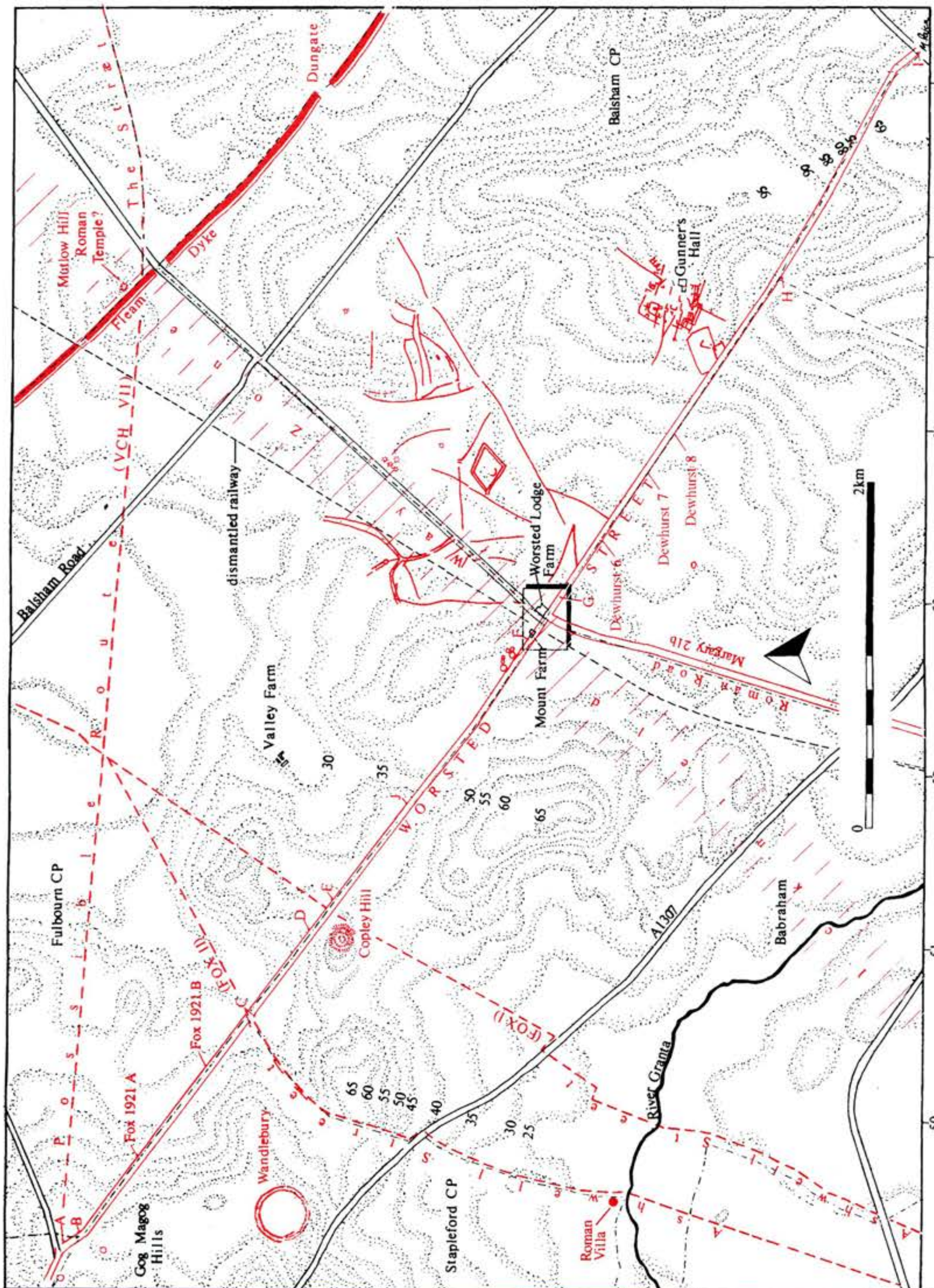


**Figure 25.** *Worsted Street: location map, showing the position of watching briefs (A–J) and associated archaeological sites and routeways.*

Worsted Street would therefore make a sensible continuation of this latter route to the south east, with the Roman town at Cambridge acting as a crossroads for these major roads, and Roman burials have been found in the vicinity of Cambridge alongside each of these roads (except Worsted Street) (Taylor 1993). However, a continuation of Worsted Street (Wort's Causeway) directly into the Roman town has not yet been proved; instead most authorities include in the road system a deviation along Wort's Causeway, itself probably the western end of a route that came in from the east via Mutlow Hill (Fox 1923b: 33; Lethbridge 1958: 2; VCH VII: 28), which would connect with a crossing of the Cam at Grantchester (Fox 1923a, map IV; VCH VII, 18). A Roman road along this alignment was not identifed by excavation in 1993, when the hypothesis was investigated archaeologically (Kemp 1993: 21–23; Site 4 Trench A), although soilmarks which appear to be a road have been seen from Addenbrooke's Hospital (personal communication). Excavations by Walker (1910) in the grounds of the Perse School revealed remains of a possible Roman road made of chalk with a gravel and chalk metalling; this road was once visible 'as a ridge' on its route to Red Cross to connect with Wort's Causeway and may therefore form the continuation of Worsted Street towards the Roman town. Further work at the Perse School in 1952 failed to confirm the earlier observations (VCH VII: 18) although it appears that this investigation was not actually on the line of the Roman road (Leith 1996: 1, 5).

### *Previous work*

Previous archaeological work includes a section across Worsted Street near Horseheath, dug in 1910, which revealed a road (about '12 feet wide') composed of layers of chalk, clay and gravel, with flint and stone metalling. Although the date of this was not certainly Roman, it had at least one side ditch, one of which (the west) contained objects of Roman date (Walker 1910: 162, n.1). In 1921, Fox excavated two sections across Worsted Street, one near Gog Magog Hills, and the other 675 m to the south east, which revealed an *agger* with several layers, including chalk foundations over the old ground surface, with a final gravel metalling, but found no flanking ditches (Fox 1923a: 129; 1923b). Fox also noted that the line of the Icknield Way passed just to the north of the A11 junction at Worsted Lodge (Fig. 25).

Further work was carried out in 1959 by Dewhurst, who observed the construction of a gas main which was laid along Worsted Street from Gog Magog Hills to Haverhill, and recorded the character of the road at 24 places (1–24) along its length, a distance of 16 km (Dewhurst 1964). The gas main lay mostly within the road, but not at its centre. In the north-west stretch, 140 m north-west of Worsted Lodge (his Section 4) and close to 1991 Trench 1, the road comprised a foundation of chalk (0.3–0.5 m) over the old ground surface, capped with gravel, about 0.6–0.9 m in total thickness, and was flanked by ditches about 13–14 m apart. The metalled surface was some 2.5 m in width. Dewhurst recorded sections of the road south-east of Worsted Lodge at 5 (see Fig. 26), where he saw that the chalk continued (his Fig. 4), and at his Point 6, where he saw chalk foundation over turf with a gravel metalling (his Fig. 5). At Worsted Lodge he saw no trace of a 'Roman A11', but suggested that a thinning of the chalk foundation just to the north west marked the passage of the Icknield Way across Worsted Street, apparently confirming Fox's conclusions about their junction.

Further to the south, beyond Worsted Lodge, the *agger* and the present track did not always coincide precisely. Although the *agger* continued south-east of the Lodge, it became intermittent and irregular, appearing last in his Section 15 at TL 584 488, 6.5 km from Worsted Lodge (his Fig. 7). At 660 m south-east of Worsted Lodge (Dewhurst's Point 7) he again recorded a chalk foundation over a buried soil with a gravel metalling (Plate IVb). At 800 m south-east of the Lodge, he found coal sealed beneath the gravel metalling at Point 8, which suggested a date after the first century for construction, after the foundation of the fort at Cambridge. The road changed character in his 'Transitional Half-Mile', with the *agger* and side ditches intermittent there, and the course thereafter erratic.

Dewhurst suggested that Worsted Street was a local road, possibly pre-Roman in origin, intended to continue to Horseheath, but only completed in full Roman fashion to Worsted Lodge, and thereafter reduced in character, perhaps even during construction. He noted that the chalk overlay the buried soil throughout (Dewhurst 1964: 45).

## **Strategy and methods**

During August 1991, excavations were conducted in order to record Worsted Street before damage from road widening and associated

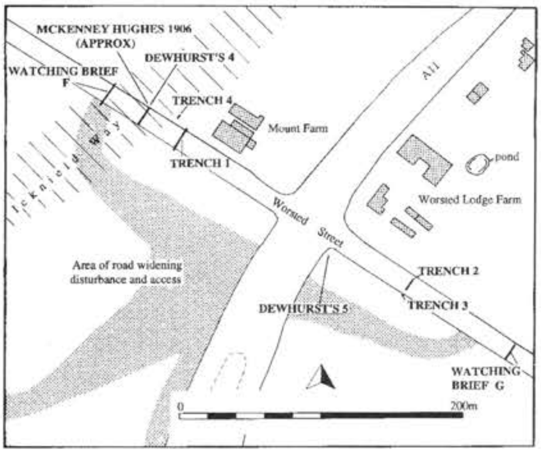


**Figure 26.** *Worsted Street: location of 1991 trenches.*

works for the present A11. The actual junction of Worsted Street and the A11 (presumed Roman road 333) could not be investigated, and four trenches were therefore laid out to either side of the junction, Trenches 1 and 4 to the north west, and Trenches 2 and 3 to the south east (Fig. 26). Access to farm entrances made a single full section impractical, and a complete section across Worsted Street north-west of Worsted Lodge was achieved by laying out two staggered trenches (1 and 4), so that the Roman metalled surface and both side ditches would be encountered. After initial machine excavation of the upper layers, excavation proceeded by hand. Samples for environmental analysis were taken from buried soils.

Trenches 2 and 3 were located on the south-east side of the A11 junction, to allow the examination of Worsted Street in its south-eastern stretch. Dewhurst had noted that the present track lay to one side of the Roman road, so that the south-western ditch lay 8 m into the field, and the north-east ditch lay under the centre of the track (Dewhurst 1964: Fig. 3). Trench 2 lay across the centre of the track, and Trench 3 over the likely location of any south-western ditch. This trench was necessarily restricted in size, and field observations were therefore ambiguous at some points.

A field walking and auger survey was undertaken along the line of Worsted Street to the south east of the A11 junction, and a record made during a watching brief on the digging of holes for gates and barriers at several places along Worsted Street, on behalf of South Cambridgeshire District Council (Fig. 25: A–I).

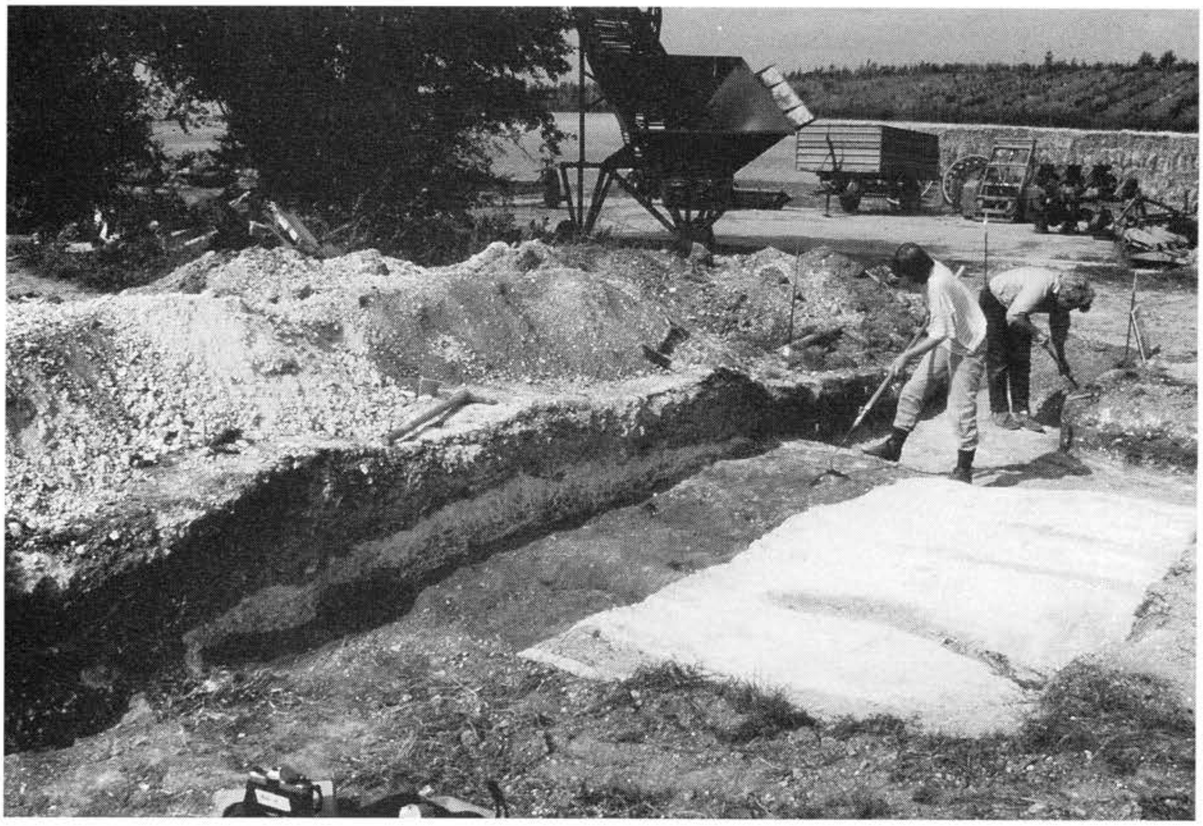

**Figure 27.** *Worsted Street: photograph of the south-east facing section through the Roman road (Trench 1).*

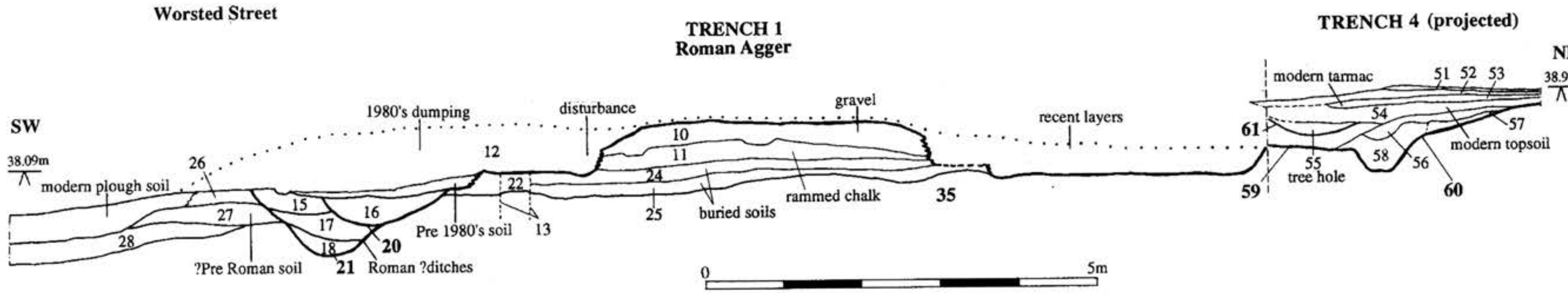


**Figure 28.** *Worsted Street: south-east facing section through the Roman road (Trenches 1 and 4).*

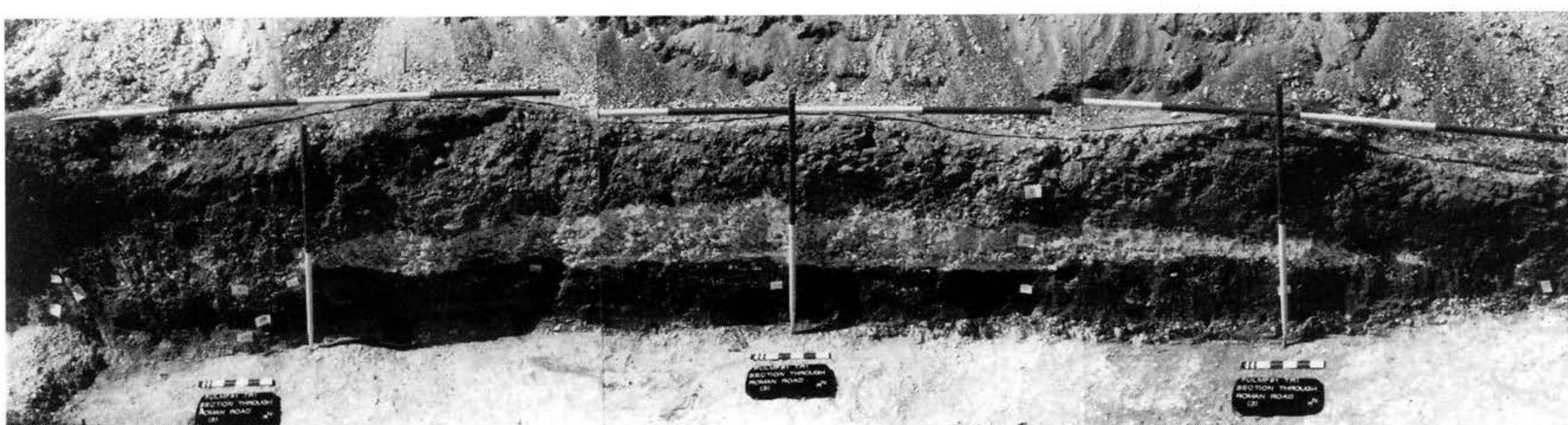

**Figure 29.** *Worsted Street: composite photograph of the south-east facing section through the Roman road (Trench 1), showing gravel metalling on top of rammed chalk above the buried soil (scale in 0.5 m divisions).*

### *Results*

*Trenches 1 and 4*

In Trench 1 the Roman road was overlain by recent (1980s) massive dumping on the south-west side (contexts 2, 5, 12 and 23) and by modern build-up (7, 8 and 9) on the north-east side. Below this, the road and its flanking ditches were very clear in plan and section (Figs 27–29).

The *agger* survived to 3 m in width and to about 1 m above the surface of the natural chalk, with a gravel metalling (10) on top about 0.20 m thick, but this had been encroached upon by ploughing and other disturbances. This metalling was a yellow to yellow-orange slightly clayey rammed gravel, worn to a hard surface, with several episodes of repair and deposition evident in section. The gravel lay directly on a rammed chalk foundation (11), up to 0.25 m in thickness, whose surface bore wheel-ruts, seen in plan and section, possibly from construction traffic or even a period of use before the metalling was laid. The foundation chalk (11) had been dumped directly on the old ground surface; within this buried soil, both the A horizon (24) and the B horizon (25) could be clearly distinguished.

The flanking ditches could also be seen, **21** on the south-west and **60** on the north-eastern side in Trench 4. The south-western ditch **21** (approximately 1.5 m wide and 0.5 m deep) was found to contain fills of silty loam (17–18; see Fig. 28). The north-eastern ditch **60** (seen in Trench 4), was about 0.7 m wide and 1.00 m deep (from modern ground level), contained a primary fill of silty loam (58), and was sealed by Layers 50–56, including 53, a tarmac road of 1940s date. Layer 54 was a pre-war topsoil, 55 a tree-hole, and 56 a late fill of the ditch. Both roadside ditches seemed to be cut by later features (**20** and **59**), probably recuts of these ditches. The 1959 gas trench was also seen, overlain by recent dumping, and truncated by a modern disturbance which also cut into the side of the Roman road. A possible tree-hole (30) was found to cut the natural chalk sealed below the buried soil, and to the north east the surface of the natural chalk bore possible plough-marks.

*The Buried soil*

The buried soil sealed beneath the road material in Trench 1 comprised two distinct layers, 24 and 25 (Figs 28 and 29). Samples were taken for analysis, and the results are summarised here. Soil micromorphology analysis by C. A. I. French (see below) showed that the two horizons represent an upper, brown organic silt loam (24) and a lower greyish brown, less organic silt–loam (25), each about 0.20 m thick, and developed on a natural chalk subsoil.

Layer 24 represents a lower A horizon and 25 a weathered lower B horizon, with leaching of lime-rich water down the soil profile from the overlying chalk road foundation (11). Together these two layers comprise a poor to moderately well developed brown earth, only slightly truncated by turf removal.

Preservation of molluscs from the buried soil was good, and analysis by P. Murphy (see below) indicates an open habitat locally, superseding more shaded conditions. It seems likely that the road was built in an open landscape, possibly cultivated, and that woodland had been cleared from this area not long before. The snails from the upper layer (24) were characteristic of open soils, and probably indicate that the road was built across an open landscape, possibly treeless, at least locally. Other indicators suggest either very intensive grazing, or that the site was under cultivation when the road was laid out. The snails from the upper part of 25 were open-country species with some woodland snails, whilst in the lower part of the buried soil shelter-loving snails predominated, pointing to an earlier (probably Iron Age) phase of scrub or woodland. The main shade snail in the assemblage (*Pomatias elegans*) is indicative of soil disturbance.

Pollen was examined by E. Guttmann but had not survived in a condition suitable for evaluation as part of this project.

*Trenches 2 and 3*

In Trench 2, immediately below the topsoil (101) and subsoil (102) lay a bank of chalk (105), interpreted by the excavator as the natural chalk subsoil (Fig. 30). On the north-eastern side, pockets of convoluted sand (107, 109) lay over a brown soil (111) thought possibly to be the fill of a side ditch, or merely a soil butting the chalk bank 105 (although this could not be certainly established). The surface of the chalk bank (105) was very worn and eroded, and this may indicate much use and wear as an unmetalled track.

The rammed chalk of the road foundation in Trench 1 and the natural chalk in this area are very similar in their appearance, and therefore another interpretation for 105 is possibly to be preferred, which accords better with Dewhurst's observations of an *agger*

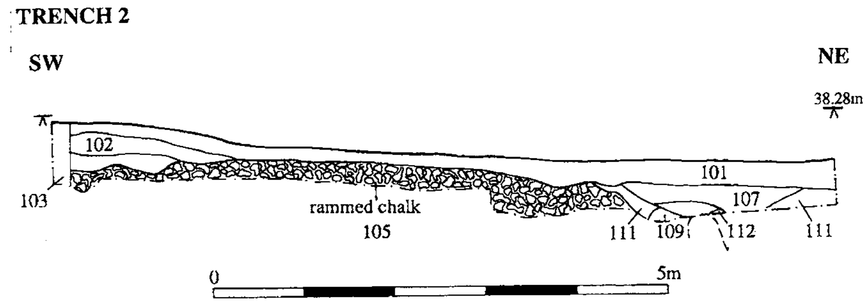


**Figure 30.** *Worsted Street: south-east facing section through the Roman road (Trench 2).*

in his section. This has 105 as the chalk foundation, whose slight surface curve corresponds to the curve of the foundation surface in Trench 1; the height of this surface relative to the adjacent fields is then explained, and the layers to the north east might then be interpreted as either remnants of a side ditch, or more likely, perhaps, later plough-soils lapping up to the *agger*.

Trench 3 to the south west was excavated to a depth of 0.50 m below the surface of the ploughsoil, at which depth the trench cut a sandy subsoil, with no sign of a side ditch or any other archaeological features.

*Field survey*

Field survey (with auger transects across the road at several points) was carried out along the length of Worsted Street, south-east of the A11 junction, to the Essex border, and 10 m each side of the track (where conditions allowed). A full *agger* could be observed for about 500 m south-east of Worsted Lodge before it dwindled, and was thereafter seen intermittently, the last sighting of the full *agger* being at TL 584 488, where a small test-pit was dug, and where Dewhurst in 1959 (Section 15) had recorded traces of the chalk foundation over a layer of loam (the buried soil). Further stretches of upstanding *agger* were seen at TL 555 503–561 498, 568 495–578 490, and north of Horseheath at 605 480–615 478. Work during the watching brief indicated that, south-east of the junction with the Balsham to Linton road, the apparent *agger* occasionally visible may be the product of erosion or lynchets.

The present track makes a short diversion immediately south-east of Marks Grave (TL 595 484), but air photographs indicate that Worsted Street continued here on its true course (Dewhurst 1964, 52n; VCH VII, 19n).

The field walking survey resulted in a background scatter of post-medieval pottery, but nothing clearly related to the road or its construction.

*The watching brief*

Gates and fencing were erected at nine places (A–I; Figs 25 and 26) along Worsted Street, involving posts set into concrete blocks set some 0.4–0.5 m into the ground. Of these nine places, only B, F, G and I lay within the track and were therefore likely to disturb surviving road fabric. Results were as follows:

*B*: topsoil lay over flint pebbles and then chalk, with no clear trace of the road, although the flints could be late repairs.

*F* (two holes, close to the 1991 Trench 1): yellow gravel metalling overlay a compacted soil, with no trace of a chalk foundation.

*G*: topsoil overlay a sandy soil, mixed chalk and then clean chalk, probably representing road foundation.

*I*: topsoil and chalk overlay sand and gravel, chalk, and then flint over chalk, probably the road foundation.

### *Discussion*

The present work has confirmed Fox's and Dewhurst's previous conclusions that Worsted Street was typical of Roman road construction along its section from Wort's Causeway to Worsted Lodge with a 3 m wide gravel-capped *agger* and 5 m wide rammed chalk foundation, which survived in total to 0.6 m in height, and outlying ditches giving an overall width of 14 m; but the recent investigation was unable to demonstrate unequivocally the survival of a metalled road fabric south-east of the A11 junction. In spite of the lack of excavated evidence to show that Worsted Street was completed to full Roman standards over the whole of its length, it nonetheless maintains a very regular course in this south eastern part, and the chalk seen by Dewhurst and detected by the recent auger survey in stretches along this part of the road are indeed likely to be remnants of the chalk foundation seen north of the A11. This may suggest that in its south-east stretch Worsted Street was left as a minor road once its course from Cambridge had joined with the Roman road (Margary 21b) to Great Chesterford, and with the Icknield Way (Margary 333) just north west of Worsted Lodge. However, Walker's results in 1910 hint at a formal road construction in Worsted Street's furthest south-east part.

Worsted Street and its place in the Roman road system have been much discussed (Charge 1986; Dewhurst 1964; Fox 1923a and b; VCH VII). There is no archaeological evidence that a Roman road (333) underlies the A11 itself, and this road was probably first set out by the Newmarket Heath Turnpike Trust *c.* 1764 in the most direct way to connect with existing roads to Great Chesterford (CRO: Minutes of the Newmarket Heath Turnpike Trust 1763–77). However, the line of the Icknield Way undoubtedly crossed Worsted Street and ran parallel to the present A11 on its north side *via* Mutlow Hill and Fleam Dyke, and thus the general impression of Margary's route 333 is valid. The failure to find specific evidence for this Roman road at Worsted Lodge is therefore not surprising, and perhaps clarifies the role of Worsted Street itself: Worsted Lodge was a major crossroads for the local Roman communication network where the road from Great Chesterford met the Icknield Way and also the southern access to Cambridge. From this point, travellers from Cambridge could take the route due south to Great Chesterford, or south-east towards the Stour valley, thus making the stretch of Worsted Street north of the A11 the important link road to Cambridge from the south east. This would account for the apparent discrepancy between the full Roman construction in this section and the more basic appearance of Worsted Street south-east of the A11. At face value, such a triangular arrangement seems illogical for access between Cambridge and Great Chesterford, but neither Fox nor Margary, or Wilkes and Elrington, refer to any direct road connecting these two Roman towns, and indeed the arrangement at the north end of Worsted Street with its sudden deviation to the west along Wort's Causeway is equally illogical. It would seem likely that a route must have existed along the Cam valley which would have given a more straightforward connection between the two towns, but it appears that the more complex arrangement involving Worsted Street was employed by the Romans. Such an arrangement might well have been due to the importance of a pre-existing ridgeway, which might have run along the line of Worsted Street past the Iron Age forts of War Ditches and Wandlebury to the Stour valley, as originally suggested by Dewhurst. This would also partly account for the Iron Age date given to Worsted Street when it was considered a 'dyke' by earlier scholars.

## Fleam Dyke

Tim Malim, Ken Penn and Gerald Wait

### *Background*

#### *Geology and topography*

The name Fleam Dyke has been attributed to three distinct monuments, which may together constitute a single original scheme. These three parts are firstly the High Ditch at Fen Ditton; secondly the 'northern extension' to the main part of the Dyke, from Great Wilbraham Fen to Shardelow's Well (Figs 1 and 35; see below); and thirdly the main section (also called Balsham Ditch) which runs north-west to south-east for 5 km from the fen-edge at Shardelow's Well, Fulbourn (Fig. 31), to beyond Dungate Farm, Balsham (Fig. 32), from where it runs a further 2 km as a hedge to Oxcroft Farm, after which its line is taken up by a minor stream (Fig. 33). It is a parish boundary for the whole of its length, and for virtually all this distance rests on a natural chalk subsoil. From 15 m OD at the fen-edge, the earthwork climbs to 50 m at Mutlow Hill (Fig. 32), and ascends a steep slope at The Ambush, reaching 100 m or more at Oxcroft Farm.

#### *Previous work*

The first recorded excavations on Fleam Dyke were the two campaigns by Fox and Palmer in 1921 and 1922 (Fox and Palmer 1923 and 1924). In 1921 Fox dug seven cuttings across the ditch and two across the bank (Fig. 33), revealing in each place two ditches, a V-shaped one near the bank, and a deep, flat-bottomed one further away. After first regarding them as successive features (Fox and Palmer 1923: 45–51), Fox came to argue that both belonged to a single phase of the monument (Fox and Palmer 1924: 31–3). His section across the bank at the railway cutting revealed a 'marker bank' or core, with two 'reconstructions', and Fox (at first) argued that the V-shaped ditch went with the bank 'core', and was part of the original dyke. He also excavated in the vicinity of Mutlow Hill, finding Roman pottery under and within the bank at two places, and adduced an early Saxon date for Fleam Dyke.

Further work was undertaken by Fox and Palmer in 1922 (Fig. 33) to answer outstanding questions, and this was reported in 1924. They cut a section across the bank 70 m south-east of the railway cutting, and found the buried soil, again containing Roman pottery, and the two ditches, but no trace of the 'marker bank'

**Figure 31.** *Fleam Dyke from the air, showing hollow ways leading to Mutlow Hill in the foreground, and the Dyke running north west to Shardelow's Well (photo: Geoffrey Robinson, 1990).*

**Figure 32.** *Fleam Dyke from the air, with Mutlow Hill in the foreground and the Dyke running off towards the hills to the south east (photo: Ben Robinson, 1991).*

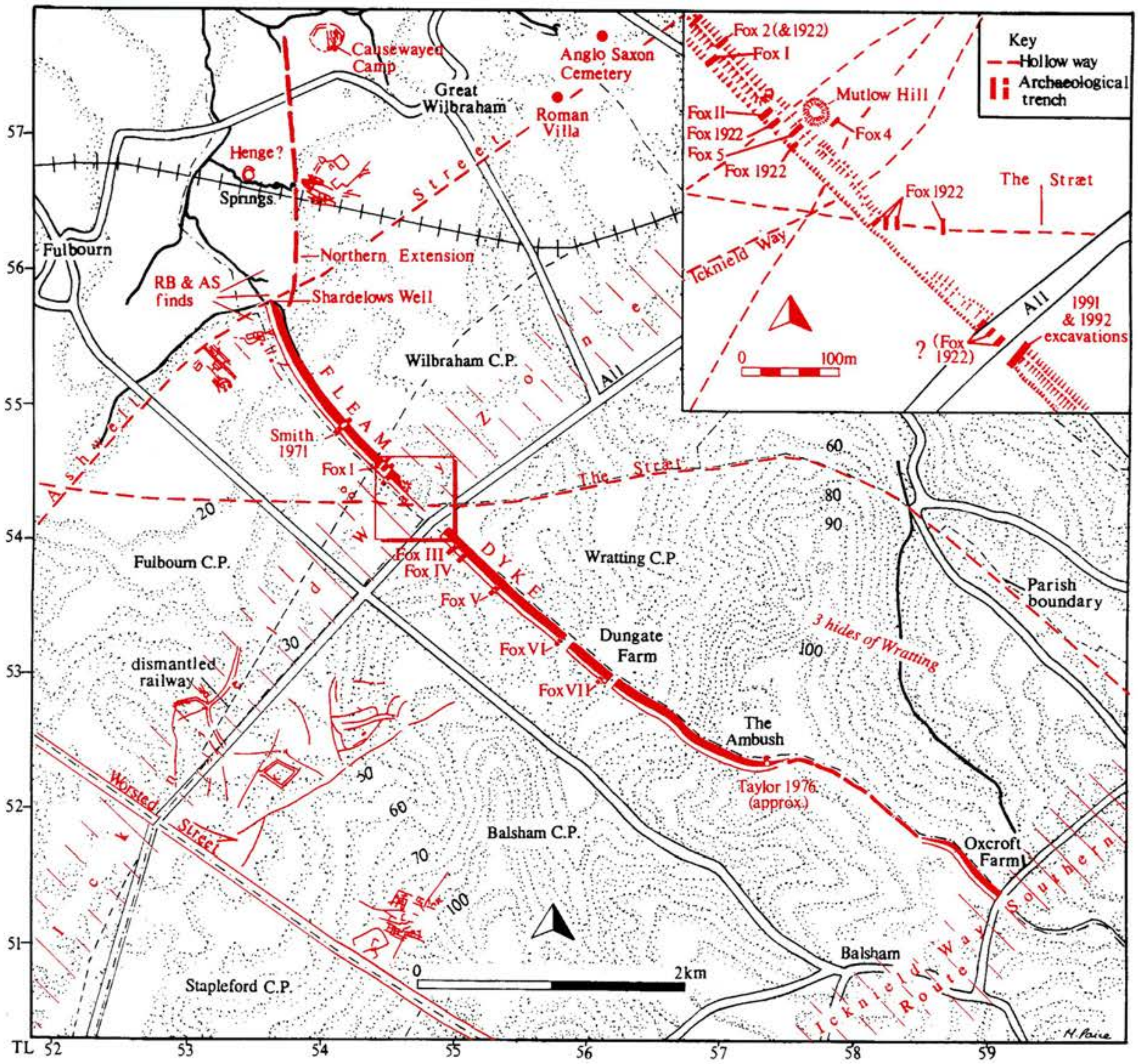


**Figure 33.** *Fleam Dyke: location map, showing previous work, 1991–2 trenches and associated archaeological sites and routeways.*

or original core. Although Fox altered his view of the V-shaped ditch, now regarding it as an integral part of a single-phase ditch, against his earlier conclusions, he still regarded the bank as the product of several reconstructions with intervening standstill phases (Fox and Palmer 1924: 31–3).

Fox also saw that the relationship of the Dyke to the contemporary road system was critical to its understanding, and therefore dug holes on either side of the A11 (close to the present work), where 'the sloping wall of the filled-in fosse was disclosed'. Trial holes along the line of the ditch at Mutlow Hill produced a similar result, showing a continuous ditch, and thus revealed that the two hollow ways he noted heading for this spot, the probable line of the Icknield Way passing immediately to the north of Mutlow Hill, and any other road across the Dyke, must post-date it and have had to cross the line of bank and ditch. Therefore, any idea that the A11 itself lies over a Roman road (Margary 333) must be doubtful, unless its exact line was re-established after a long period of disuse.

A partial section across the earthwork in 1971, just east of the Fleam Dyke Pumping Station (TL 542 548; Fig. 33), revealed the buried soil, a possible marker bank of chalk rubble, and the upper part of the large flat-bottomed ditch; the V-shaped ditch was apparently absent from the section exposed (Smith 1973). A further section by The Ambush was recorded in 1976 by Alison Taylor (Cambridgeshire County Council Sites and Monuments Record; Figs 33–36). There is a full discussion of Fleam Dyke, its character and date, in RCHME (1972: appendix).

**Figure 34.** *Fleam Dyke: photograph of the bank section from the northwest (1976 excavation: scale in 0.5 m divisions).*

**Figure 35.** *Air photograph of the north end of Fleam Dyke at Shardelow's Well, with crop-mark of additional extension to the bank and ditch running off northwards to Great Wilbraham River (photo: Ben Robinson 1990; from the south).*

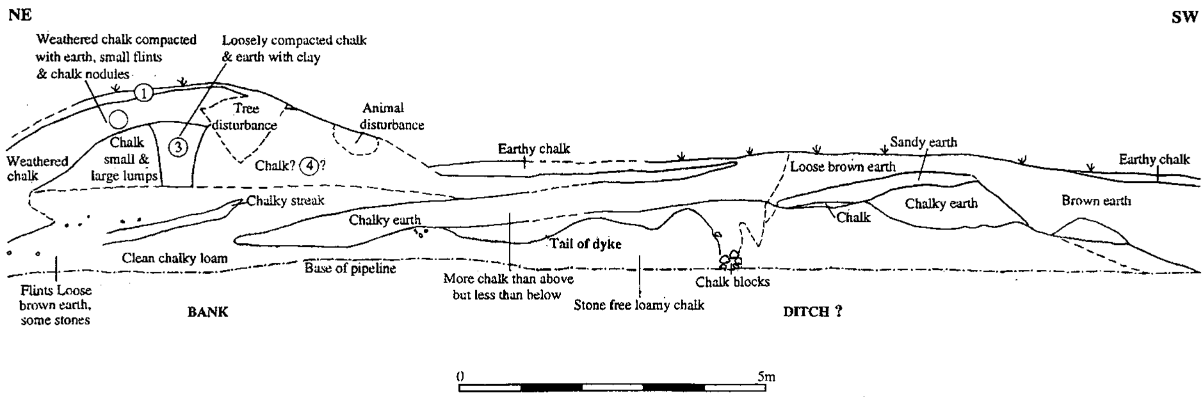


**Figure 36.** *Fleam Dyke: interpreted north-west facing section (1976 excavation: after Alison Taylor).*

### *Strategy and methods*

In October 1991, excavations were carried out by Gerald Wait at the point where Fleam Dyke is crossed by the A11 trunk road (TL 548 541) (Fig. 33). This work was necessitated by the widening of the A11, and a full excavation was undertaken on both bank and ditch, making use of the false terminus to the bank left by previous roadworks to provide a 'stepped' section and therefore avoid any initial need for substantial shoring; the trench across the ditch was placed in line with the bank section. Before excavation, scrub and small trees were removed by hand.

Constraints on time and resources meant that initial excavation was by mechanical excavator, which was used to dig a stepped section across the bank and across the ditch, removing the most recent ditch silts (much disturbed by animals). This was followed by hand excavation and the recording of sections and surface features. The trench was 3 m wide overall, and the ditch was dug in plan in 1 m wide stepped 'slices', with shoring for safety. Samples for soil and environmental analysis were taken as necessary, in consultation with P. Murphy, both as spot tests and monoliths, with a buried soil (Layer 4) being cleaned as a target for the spot samples. Although both north-west and south-east facing sections were recorded, the south-east facing section of the ditch was the more complete and less disturbed, and has been used (reversed) with the north facing bank section for the published section (Fig. 37).

In 1992, roadworks cut 2–3 m further into the monument than had been proposed, revealing a less disturbed section than was recorded in 1991. This important section was recorded by Ruth Pelling at short notice without additional funding from English Heritage. The opportunity was also taken to retrieve further environmental samples from the buried soil and other critical layers identified during post-excavation work on the 1991 material, but when processed, these samples added little to the previous year's findings.

To distinguish between these two investigations, duplication of context numbers was avoided, so that all contexts from 1991 range between 1 and 499, and those from 1992 range from 500 to 599. Similarly, discussion of phases has been kept distinct, so that phases interpreted from the 1991 excavation have Roman numerals (Bank Phases I to III and Ditches Phases I to III) whereas the phases from the 1992 investigation have been given arabic numerals (Phases 1A, 1B, 1C, and 2–4).

### ***Results of the 1991 excavation*** (Fig. 37)

A red–brown nearly stoneless soil (4) was seen to underlie almost all the bank material, and this was overlain by a small (marker) bank (53) of a similar material, with some bands of soil and chalk, and of a dark grey–black colour on its upper surface (Fig. 38). Over 200 sherds of pottery came from the buried soil (4), and these were mostly, as far as could be told, from coarse-ware vessels of the first to second centuries AD, but were highly pulverised. These represent either surface trample, or pottery thoroughly broken by subsequent agricultural activity. This pottery included three sherds of early to middle Bronze Age date. There was nothing in this buried soil clearly dateable to the later Roman period, and no material of post-Roman date (C. Going, personal communication). The bank appeared to have been built in two or three phases, a conclusion consistent with the evidence from the ditches.

Two ditches cut into the solid chalk were found, the earlier being a V-shaped ditch **(76)**, at least partially silted by the time the second **(77)** was dug (Fig. 39). This second ditch had

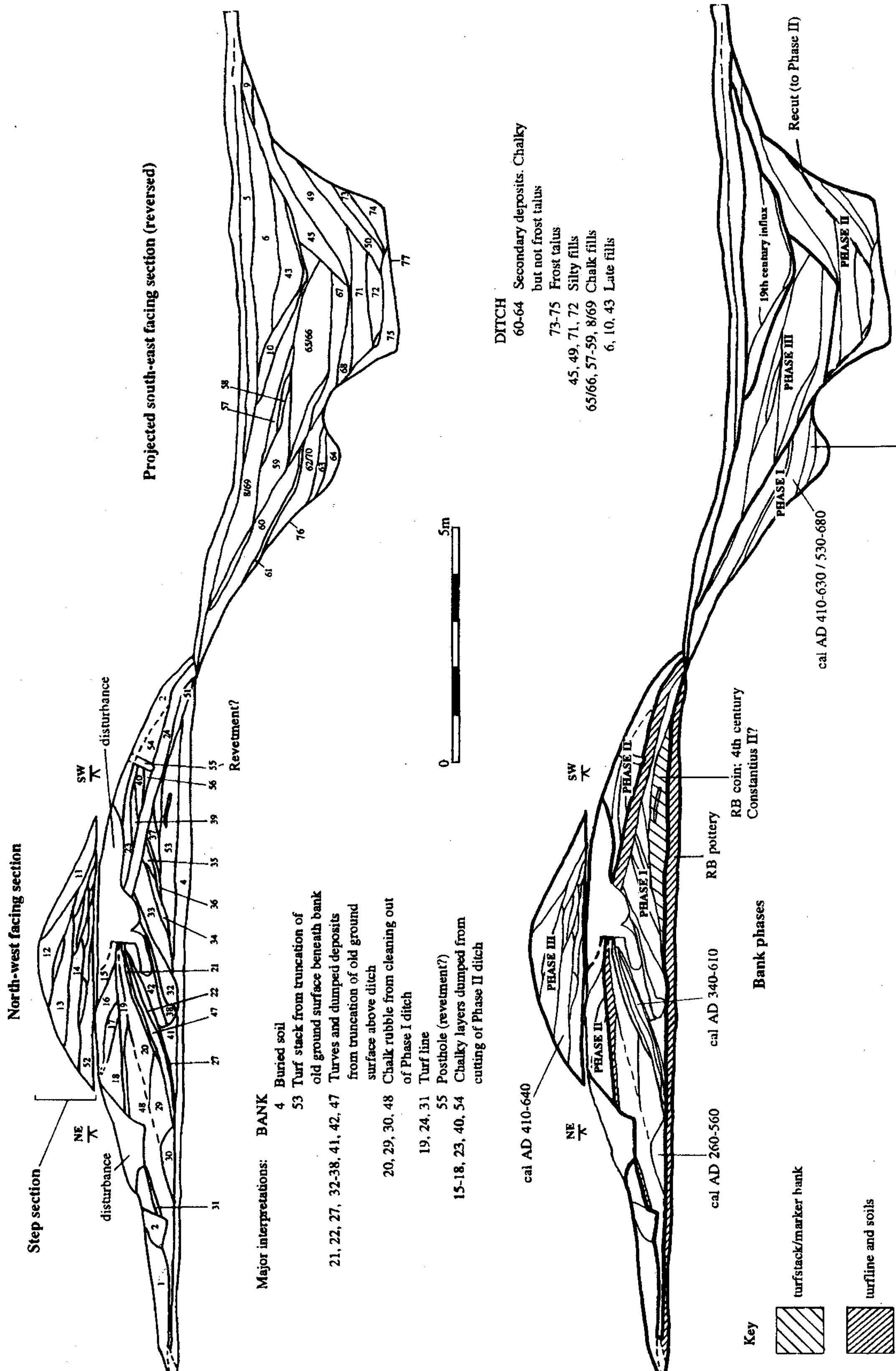


**Figure 37.** *Fleam Dyke: composite section through the bank and ditch (1991 trench).*


**Figure 38.** *Fleam Dyke: photograph of the buried soil beneath the Phase I bank (1991 trench: horizontal scale in 0.5 m divisions; vertical scale in 50 mm divisions).*

**Figure 39.** *Fleam Dyke: photograph of the south-east facing section through the fully excavated ditches (1991 trench: scale in 0.5 m divisions).*

very chalky lower fills which lay below fawn to mid-brown loamy upper fills and a dark topsoil. This ditch was flat-bottomed, and cut the silted remains of the earlier ditch.

From the excavated evidence it is possible to identify the major events of ditch digging and bank construction with reasonable certainty. However, the finer interpretation of episodes such as erosion, infill, cleaning out and dumping, and therefore of direct relationships between individual layers or groups of layers in the ditch and bank, is extremely complex and has to remain much more tentative. The layers seen in the two sections, of bank and ditch, cannot be reconciled with certainty, and the bank and ditch sequences are therefore described separately below.

*Phasing of the bank*

The excavated sections across the bank and ditch confirm the general sequence recorded by Fox of two or three successive reconstructions, although the need to utilise stepped and machine-dug sections introduced a little uncertainty into this section. Some less certain aspects of the 1991 excavations are elucidated by reference to the 1992 results, in particular, the probable existence of two turf layers running across the width of the contemporary bank. The low profiles of the first one or two phases of the bank probably indicate the loss of the original profile by erosion.

Phase I began with a low bank of turves (?) (53) (equivalent to layer 546 in 1992) over the buried soil (4); this may have been the result of turf-stripping from above the buried soil to provide a guide bank for further dumping, for the creation of the Phase I bank that survives to 1.50 m above the buried soil (Fig. 40; the excavator noted that this buried soil corresponded closely with the modern ground surface in adjacent fields). The Phase I bank comprised a number of layers, dipping down from south west to north east, whose angles could indicate some truncation or loss of material at the front (south) side, perhaps by slumping into the ditch. This cannot be proved, but the final surviving chalky silting (60) of the V-shaped ditch (ditch Phase I) may reflect a substantial erosion from the Phase I bank whose eventual low profile was capped with Layers 19 and 24. These layers were identified by the excavator as a single turf-line, which could have formed during an extended break in the construction of the bank, although the low shape of the bank might also indicate that this soil developed over a slightly eroded bank (this would also fit the evidence of the 1992 excavation, where two turfy layers (532 and 524/526) were observed, corresponding to the top of Phase I and Phase II respectively). Layer 24 was 0.25 m thick, layer 19 (and 31) was 0.2 m thick; the top few centimetres of each were a fine chalk rubble, compressed or worn to a hard surface, and markedly more silty than most of the other layers in the bank (attempts to take soil samples to confirm turf growth were not successful). However, within the Phase I bank, a complex pattern of deposition can be seen (Fig. 37), showing that several episodes or stages in construction occurred, before a major interlude allowed formation of the turf line represented by layers 19, 24 and 31. Another layer of fine chalky rubble, which appeared to have been compressed or worn to a hard surface 80 mm thick, was layer 21 which, together with two possible incipient turf lines (22 and 47), is interpreted as a stabilization episode within the main body of the Phase I bank. Indeed, within the Phase I bank, the tip-lines (33–7: layers often described as 'turf like' by the excavator) may point to a second stage in its construction (seen more clearly in 1992 as Phase 1B; see Fig. 42), and may be evidence of the truncation of the old ground surface over the area of the ditch by turf stripping and dumping of this material as 21, 22, 27, 32–38, 41, 42 and 46–7. This was followed by a third stage (1992 Phase 1C) at the rear of the bank, consisting of initial excavation of the V-shaped ditch, and possibly cleaning out and dumping of the accumulation of frost talus (layers 20, 29,30, and 48). This would suggest that the second stage (1992 Phase 1B) happened very soon after the creation of the marker bank, and may in fact be a continuation of the first episode of construction, whereas the third stage was, at the latest, a maintenance episode within the first few years of the life of the Dyke, when the primary fills (chalk talus) were cleaned out of the V-shaped ditch, but more probably represents part of the first phase of overall construction and digging of the V-shaped ditch.

The buried soil (4) produced 200 sherds of well abraded Romano-British pottery, mostly of first to second-century date. The possible marker bank (53) produced a probable fourth-century Roman coin, and an animal bone from Layer 22 (an early temporary stabilization layer, sealed by chalk layers dumped from initial ditch construction and cleaning out) was sent for radiocarbon analysis and produced a date range of cal. AD 340–610 (OxA 4066: 1580±55 BP). A second sample was submitted from the base of the final stage of construction of the Phase I bank (from layer 30, a dumped deposit, perhaps from initial cleaning out of the first phase ditch) which produced a date range of cal. AD 260–560 (OxA 5350: 1615 ± 50). Together these radiocarbon determinations can be analysed and refined to suggest a date range of *cal. AD 330–510* (at 92% confidence; see Bayliss *et al.* below), which would place the construction of the Phase I bank in the late Roman or early

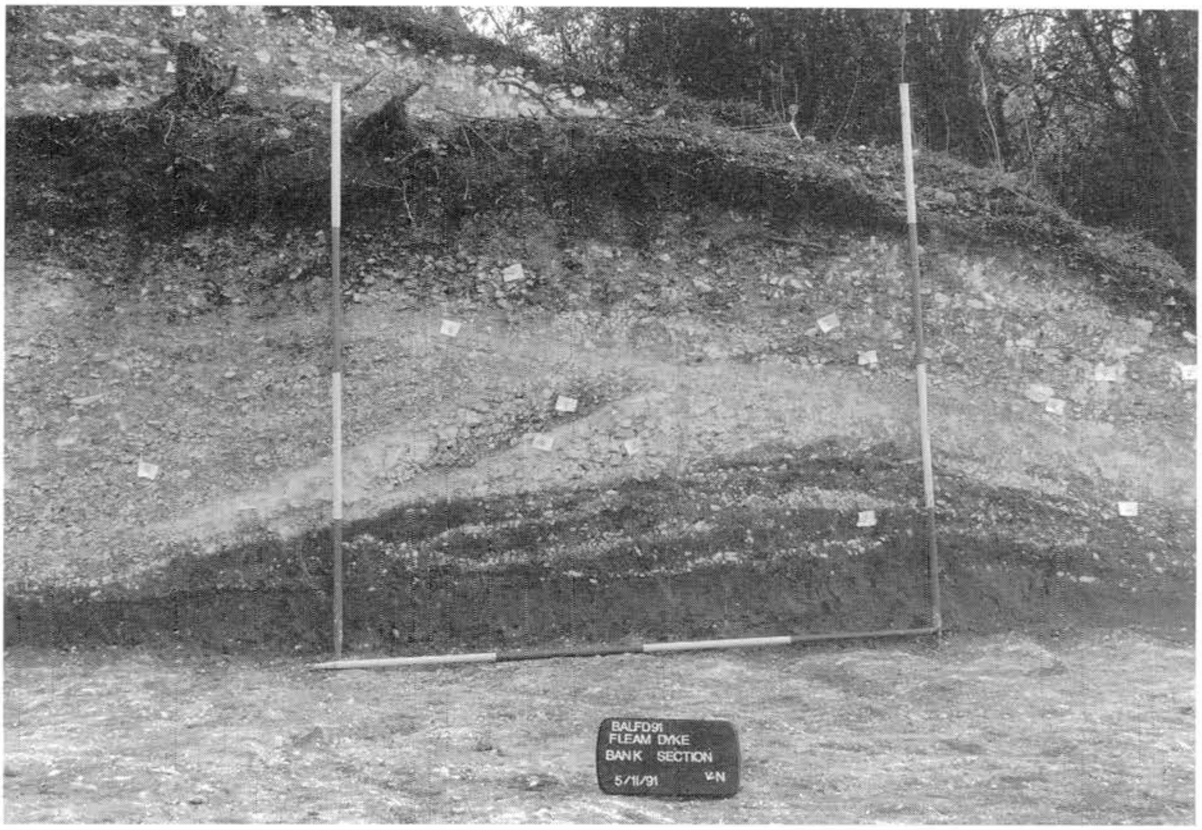


**Figure 40.** *Fleam Dyke: photograph of the north-west facing section through the Phase I bank (1991 trench: scale in 0.5 m divisions).*

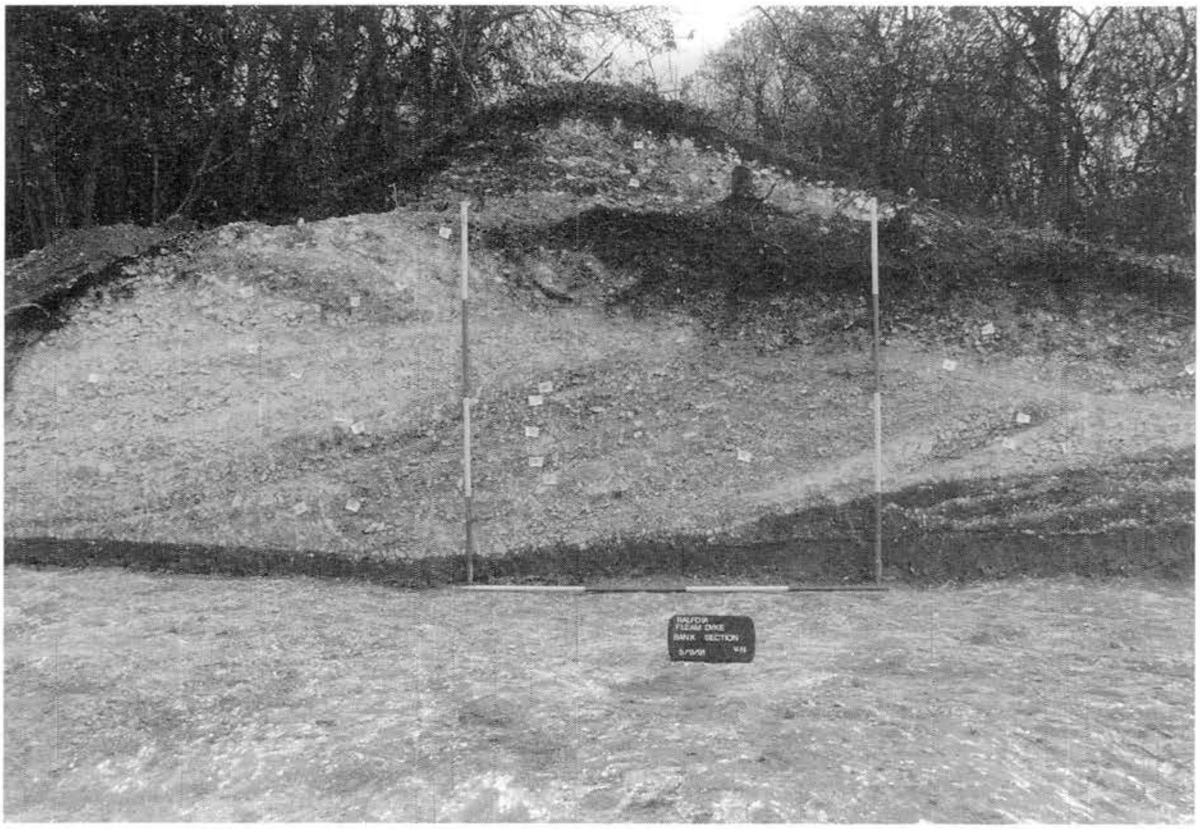

**Figure 41.** *Fleam Dyke: photograph of the north-west facing section through the Phase II/III banks (1991 trench: scale in 0.5 m divisions.*

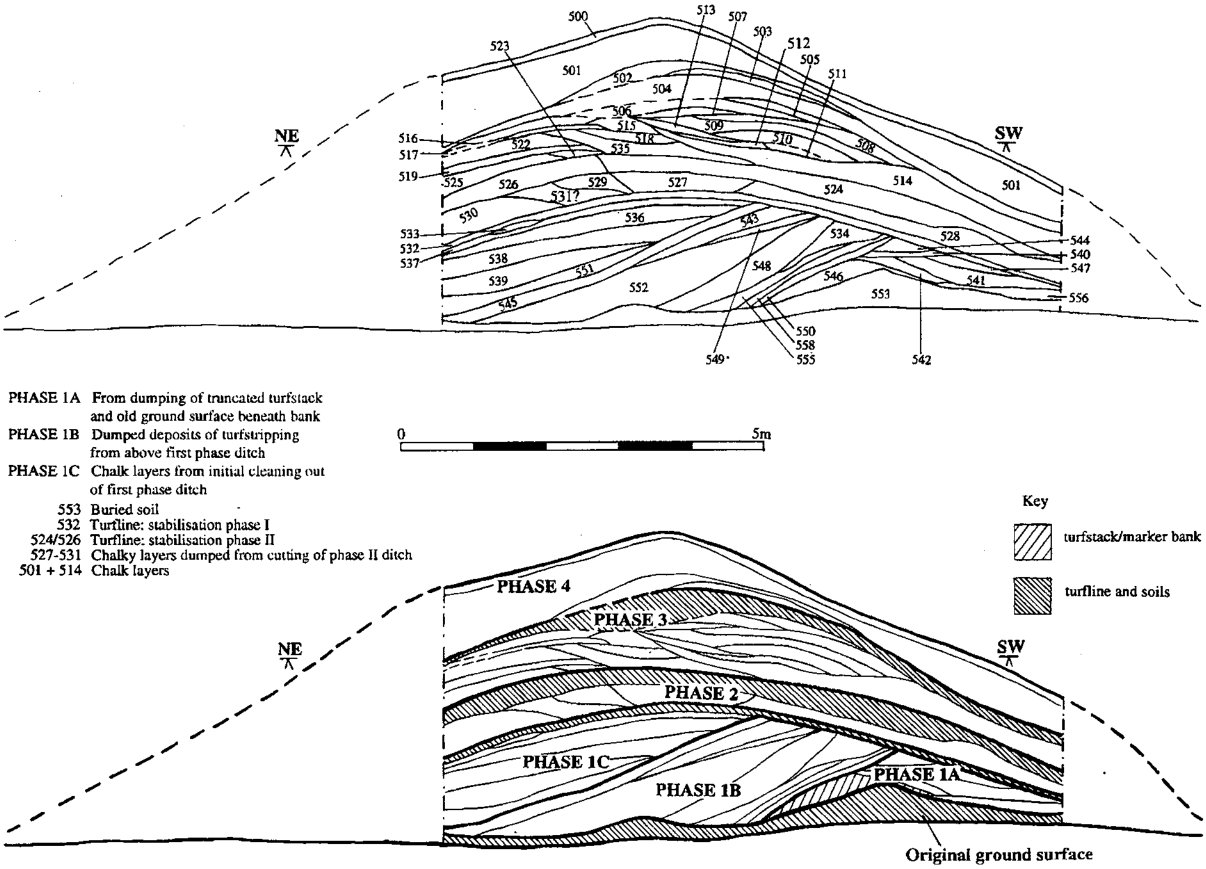


**Figure 42.** *Fleam Dyke: north-west facing section through the bank (1992 trench).*

Saxon period. The existence of the soil layer and turf line (19/24/31 = 532 from 1992) suggests that the Phase I bank existed for some time before Phase II was raised.

Phase II, the next raising of the bank, was represented by chalky Layers 15–18, lying over 19, and 23, 39, 40, 54 and 56, lying over 24 (Figs 37 and 41). Interpretation of this section is hampered by the stepped section, and rests partly on comparison with the 1992 section, which shows the Phase 2 bank as of little surviving thickness and surmounted by a turf-line layer (524/526). The Phase II bank may derive from material excavated as a major recutting of the ditch on a larger scale, shown as **77** on the ditch section (Fig. 37).

Phase III, the final raising of the now eroded bank, was represented by a number of layers, the topmost of which were 11, 12, 13 and 14, all of which contained fine layers of silt and chalk rubble, and could derive from later periodic cleanings of the large ditch, with the spoil added to the top of the bank (represented by Phases 3 and 4 in 1992; see Fig. 42). The filling of both ditches, and the need for a recut, could indicate that substantial erosion had taken place on the bank in both main phases.

On the front (south) side of the bank, Context 55 appears to have been a post-hole about 0.20 m in diameter, and survived to a depth of 0.60 m below the modern ground surface. The 'post-hole' was angled 'down-slope' to the west, and would be consistent with a rampart upright which has been forced out of the vertical by the collapse of the rampart. If this was part of a wooden rampart or internal frame, the slightness of the surviving post-hole points to considerable erosion of the bank in which it was set.

An animal bone from Layer 14 within the Phase III bank produced a date range of cal. AD 410–640 (OxA-5349: 1530±50 BP). This date, more recent than the previous two radiocarbon dates from the bank, is consistent with its stratigraphic position and points to the sixth century, a date certainly still within the early Saxon period, for the raising of the Phase III bank.

### *Phasing of the ditches*

The sections recorded by Fox make it clear that more than one phase was represented, notwithstanding his later arguments to the contrary. The general sequence of layers here is consistent with Fox's stylised drawings and suggests that the V-shaped notch **(76)** nearest the bank is the remains of a first-phase ditch.

The Phase I ditch **(76)** was represented by five fills (60–64) on the east side of the present

**Figure 43.** *Fleam Dyke: photograph of the south-east facing section through the Phase I ditch (right) (1991 trench: scale in 0.5 m divisions; note: main ditch only partly excavated).*

ditch (Fig. 43), truncated by the digging of the second ditch (**77**). From the evidence of its lowest part, the original ditch profile would appear to have been a deep V-shape, originally about 6 m in width at the old ground surface, and 3 m deep. Layers 63 and 64 were the initial fills, and contained a considerable amount of small chalk fragments; the excavator noted that they were not entirely typical of the frost talus found in initial weathering, and suggested that the first fills had been cleaned out (possibly producing some of the chalky layers of the Phase 1C stage (Fig. 42) of the first phase bank construction) before the ditch was refilled with a mixture of silts and fine chalk fragments. The upper fills, 60 and 61, were similarly silty and might derive from the weathering of silt running off the bank. This cannot be established for certain, but any cleaning out could have been connected with initial erosion of ditch sides and slumping of the Phase I bank, and hence its reconstruction by dumping the initial infill of the ditch at the rear of the eroded bank (see above). It is possible that the V-shaped ditch was well filled when the large Phase II ditch was dug, and that the Phase II ditch profile which truncates the Phase I ditch-fills at a shallow angle represents an erosion of an original steep Phase II ditch profile.

Animal bones from the Phase I ditch fills produced two sets of date ranges from each of Layers 63 and 62. From Layer 63 came date ranges cal. AD 420–640 (OxA-5454: 1510±45 BP) and cal. AD 590–680 (OxA-5353: 1390±45 BP); from Layer 62 came date ranges cal. AD 410–630 (OxA-5352: 1535±50 BP) and cal. AD 530–680 (OxA-5351: 1430±55 BP). Overall, this suggests accumulation within the sixth century (Table 10: but see also, below, the section on Radiocarbon determinations by Bayliss *et al.*, and the discussion in Overview).

The Phase II ditch (**77**) was dug to the west of the partially silted Phase I ditch and on a much larger scale, between 7 and 8 m wide and over 4 m deep (from the old ground surface) (Fig. 44). The initial fills (73, 74 and 75) were mostly chalk rubble, typical of initial frost talus, as was 72, a silty layer. As the excavator noted, the survival of the initial frost talus, derived from the side of the ditch, indicates that any cleaning of the ditch never reached this lower level, and was restricted to upper layers of the ditch fill. As can be seen from the section drawing, this section is comparable to that of the

**Figure 44.** *Fleam Dyke: photograph of the south-east facing section through the main ditch (1991 trench), showing dark 19th century infill and the chalk fill of phase III, with phase II fills beneath (scale in 0.5 m divisions).*

experimental earthwork on Overton Down, Wiltshire, which had developed within four years (Jewell and Dimbleby 1966). The chalk material excavated for this ditch may have been used to construct the Phase II bank.

The character and angles of the fills in the Phase II ditch strongly suggest that this ditch was cleaned out, and therefore that fresh material was placed on the bank as Phase III (Phases 3 and 4 from 1992). Above initial Fills 73–5 and 50, Fills 68, 71 and 72 lie at the horizontal and may be the result of slow silting, although the steep angle of Fills 50 and 75 could hint at a further cleaning out. However, it seems more likely that 45 represents the top fill of the Phase II ditch, which was then recut, providing material for a corresponding raising of the bank (equivalent to Phase III?).

Fills 65/66, 57–9, and 68/69 were markedly more chalky, and were thought by the excavator to reflect an increased rate of silting from the side of the ditch and the bank. Fills 57–9 were almost entirely chalk rubble with a little silt, and may indicate substantial erosion or slumping of fresh bank material into the shallow recut(?) ditch then existing, and also the extent to which the bank profile had changed. However, these fills were thicker on the north-west side of the excavated trench, but were almost absent on the south-east side, which might indicate some local, even deliberate, erosion or slighting of the bank, although the suggestion that this was to provide a causeway remains speculative.

Although animal bone from Phase I fills has been used for radiocarbon dating, no pottery was found in the earlier ditch fills of Phase II to help with dating these layers. The uppermost fills (6, 10 and 43) contained nineteenth-century pottery, and this may reflect a sudden influx of silts accompanying the establishment of intensive arable agriculture, in place of traditional heathland pasture, in the early nineteenth century.

*Correlation between ditch and bank phases* (Figs 36 and 42)

Whilst there are uncertainties in the exact relationships of the bank and ditch phases, it is possible to postulate a sequence of events, as follows:

i) Ditch **76** (ditch Phase I) cut and the spoil raised as bank Phase I and Phase 1 (stages 1A–1C).
ii) Frost talus erodes from the bank and ditch sides into the ditch.
iii) Ditch cleaned out and the spoil placed on the bank as part of Phase 1C.
iv) Further erosion of the bank into the ditch as 60–62 and 70.
v) Standstill episode; formation of a turf-line and stabilization layer on top of the Phase I/1 bank (19, 24, 31 and 532).
vi) Ditch **77** (ditch Phase II) cut, and bank Phase II/2 raised from the excavated material.
vii) Erosion of the bank into the ditch: fills surviving as 50, 73-75.
viii) Standstill episode; formation of turf-line and stabilization layer on top of Phase II/2 bank (524/526).
ix) The partly infilled Phase II ditch is recut and the spoil placed on the bank as Phase III/3.
x) Further erosion into the ditch (45, 49 and 71–2).
xi) Standstill episode and formation of turf-line and stabilization layer on top of Phase III/3 (504).
xii) Ditch recut as Phase III and the spoil placed on the bank as Phase 4.
xiii) Slow erosion into the ditch of 57–9, 65 and 67.
xiv) Infilled Phase III ditch recut, probably in nineteenth century.
xv) Final erosion into the ditch or deliberate infilling of 5, 6 and 43, containing ninteenth–century and later finds.

*Molluscan and soil micromorphological analyses*

The recent excavations have revealed the character of the environment when the dyke was built, when it appears to have been surrounded by an open landscape and one that was heavily cultivated or grazed. Analysis by C. A. I. French (see below) shows that the buried soil (4) under the bank (Fig. 38) seems to have been a thin and poorly developed soil (more of a rendzina than a brown earth), which had suffered considerable truncation. This type of thin rendzina soil is generally associated with deforested and intensively cultivated soils in prehistoric Wessex. It is suspected that most of the turf and upper half of the soil was reincorporated into the bank. This fits well with the macrofossil evidence noted by P. Murphy (see below), who concluded that the assemblage from the top of the buried soil (4) was an extreme open-country assemblage, indicating a high proportion of bare ground and disturbed soils in the vicinity, as a result of cultivation or heavy grazing pressure. The evidence from the macrofossils may suggest that little time passed between the three stages of Phase I bank construction (as seen e.g. in layer 22), with few shells being incorporated into the earlier bank surface, although there was time for the formation of a stabilization layer or topsoil (19/24 and 532), and that Phase I and II ditches were clearly separated by sufficient time for the silting of the V-shaped ditch. Pollen was found to be too poorly preserved for further analysis (E. Guttmann personal communication).

***Results of the 1992 investigation*** (Fig. 42)

During road construction in summer 1992, machining at the site of the 1991 excavation cut further back (southwards) into the bank than had been anticipated, exposing a fresh section of the bank. This was cut in one almost vertical plane and afforded a section less disturbed by trees and 'stepping' than the 1991 section. However, because of the manner in which machining had been carried out, only the central, high part of the bank could be properly examined (Fig. 42). Fortunately, the machining had exposed the buried soil (553) seen in 1991 (as 4), and this allowed good comparison with the previous work.

The bank was composed of many discrete layers of chalk rubble, some more or less soily, and several old soil surfaces (or topsoil dumps), thought to mark successive stages in the construction of the monument. Above the buried soil (553) of the old ground surface (equivalent to Layer 4 from 1991), four main phases of construction were identified (Phases 1–4, of which 3 and 4 equate with Phase III from 1991), and three distinct stages could be seen within the development of the first phase bank (Phases 1A–1C).

The end of Phase 1 was defined by an old soil surface (532), which may mark the end of the first major construction phase. This soil surface was a thin band of silt and chalk, rather than a true topsoil, but overlay all the material identified as the Phase 1 bank (and was equivalent to 1991 Layer 19/24). This Phase 1 bank had three apparent construction episodes (A–C) over a small 'bank' of soil or turf (546) identical to the 1991 'marker bank' (53), with 1C being equivalent to the 1991 Layers 20, 29, 30 and 48.

The Phase 2 bank was defined by Layer 524/526 running across the entire exposed section. This was thought to define another 'buried soil' marking the top of a bank raised by further massive dumping of material (527–531), probably derived from the cutting of the second ditch, on which this soil developed. This episode and successive bank constructions seem to have involved dumping upon existing surfaces, rather than any reshaping of the earthwork profile.

Phases 3 and 4 together equate to the 1991 Phase III, the final raising of the bank. Phase 3 was the result of substantial dumping to raise the height of the bank by at least 2 m, the material including several lenses of quite soily material (504, 506, 508 and 510) which rested directly over the Phase 2 material, with layer 504 being interpreted as soil build-up, and a possible turf-line. Phase 4 was the final phase of construction, and consisted of a thin soily layer (502) and a thicker layer of chalk rubble (501), below the present topsoil (500).

The 1992 section was about 2 m to the south of the 1991 section and naturally has the same basic features, such as the buried soil and turf-lines. Although three or four phases of construction seem to be indicated by the 1992 'buried soils' (532 and 524/526), there was little hint of how long a time intervened between the major phases. However, this was apparently sufficient for turf-lines (if that is what they were) to form, Layer 532 probably reflecting the interval between Phase 1 bank construction and cutting of the second ditch. As may be seen in the 1991 section, much chalky material eroded from the bank into the ditch before the slow silting began.

In the Phase 1 bank, the angle of the layers was quite steep, which may suggest that this bank had eroded, and had once been rather higher than the 1.5 m it stood when Phase 2 was raised by the dumping of more material from the Phase II ditch. If Phases 3 and 4 represent a major phase of bank construction, this may have gone with the recutting of the Phase II and cutting of the Phase III ditches, which would then also have provided the material for the embankment.

### *Discussion*

Whilst the work of Fox and Palmer in 1921 to 1922 remains a major source for the history of Fleam Dyke, the present work has confirmed the multi-phase nature of the monument, demonstrated the contemporary environment in which the Dyke was constructed, provided good scientific dating for the likely early Saxon context of the Phase I bank, which survives to 1.5 m high, and produced evidence for the subsequent building of a more imposing earthwork, which survives as a bank with a basal width of approximately 15 m and over 3 m in height, a first phase V-shaped ditch over 2 m deep and probably originally some 6 m wide, and a more substantial second phase ditch 10 m wide and over 3 m deep, with steep sides and a flat base.

The 1991 excavation showed that the dyke was built in at least two phases, beginning with the V-shaped ditch and its bank, followed after a lengthy period of erosion and silting by a much larger bank and a deeper, flat-bottomed ditch. The bank-derived fill in the ditch indicates that the Phase II bank was originally rather higher or of steeper profile. The evidence also suggests that the Phase II ditch was recut at least once, with a corresponding raising of the bank as Phase III, although the bank and ditch phases cannot be equated with any certainty. Whether the post-hole (55) in the front of the bank belongs to a wooden-framed rampart for a later bank remains speculative in the absence of further evidence (none was noted by Fox for Fleam Dyke or Devils Dyke); fronted by a 4 m deep ditch, even an unramparted bank would have been a formidable barrier.

Fox's dating evidence pointed to a late Roman or post-Roman date for the Phase I bank, and the 1991 excavation amply confirms this, with pottery from the buried soil (4), the fourth-century coin from 53 (probably of Constans, 337–350 AD, or Constantius II, 337–361 AD), and the series of radiocarbon determinations which together give a range *cal. AD 330–510* (92% confidence; see Fig. 64 and the section on Radiocarbon determinations below), suggesting a fifth-century date. Together, these determinations indicate strongly that the first phase of the monument belongs in the early Saxon period.

The molluscan evidence from the buried soil reveals that the earthwork was built across an open landscape, cultivated or heavily grazed. Similar results were obtained from soil micromorphology, which revealed a thin rendzina indicative of open downland, but one that was described as having been heavily grazed and severely truncated, presumably deturfed and partly removed as part of the initial construction process (see Murphy and French, below).

Although the final construction phase (or major cleaning out) was before cal. AD 620 (95% confidence), nonetheless the final use of the monument appears to have occurred *between cal. AD 590 and 700* (95% confidence limits; see Fig. 64 and Radiocarbon determinations below). This suggests that the final construction phase was in the sixth century, but that there may have been continued use into the seventh century.

The 1992 work added further detail to that derived from the 1991 excavation, identifying three possible stages in the make-up of the Phase 1 bank (Phases 1A–1C), and three sub-

**Figure 45.** *Devils Dyke from the air, looking south-east from Reach. In the middle distance the Dyke can be seen rising over Gallows Hill, the approximate position of the 1991 section. Fox's excavations were between Gallows Hill and Reach village (photo: Ben Robinson, 1995).*

sequent phases of bank construction; this clarified the ambiguities resulting from the stepped section and tree hollows evident in the upper part of the 1991 trench.

The two main phases of ditch cutting at Fleam Dyke may imply two separate historical contexts for its construction, but this cannot be explored separately from a consideration of the other Cambridgeshire Dykes and related features of the landscape, which must include Fleam's southern continuation to Oxcroft, the possible 'northern extension' at Wilbraham, and a stretch of earthwork along High Ditch, Fen Ditton. The present work has demonstrated an early Saxon context for the construction of the Dyke and has considerable implications for the origins and character of the early Saxon settlement of East Anglia (see below, in Overview).

## Devils Dyke

Ken Penn and Gerald Wait

### *Background*

#### *Geology and topography*

Devils Dyke is the longest of the Cambridgeshire Dykes, and runs for about 11 km, from the fen-edge and 'Roman' lode at Reach in the north west (Fig 45), south-eastwards across open countryside (Fig. 46) to terminate some 600 m into the Boulder Clay plateau at Woodditton (*dic-tun*). Thus, for almost all its length, the monument lies over a natural chalk subsoil.

#### *Previous work*

In the late nineteenth century, McKenny Hughes observed a section of the bank during the construction of the railway cutting at TL

5755 6525 (Fig. 47). He found objects of Roman date within the bank and argued that the monument was therefore of Iron Age origin, but raised in height in the Roman period (Hughes 1913: 148–9). In 1923 and 1924, Fox dug sections across the bank and ditch near the Roman villa at Reach, and demonstrated that the monument was of Roman or later date. He excavated in four places (Fox I–IV; see Fig. 47), obtaining three sections each of the bank and the ditch (Fox 1925: Fig. 2), with similar results at each place. The top of the bank lay almost 9 m above the flat base of the ditch, whose sloping sides continued into the profile of the bank. Fox saw the monument as a single-phase construction; he suggested in his published Section I (*ibid.*: Plate III) that the bank was built in two or three stages, but that these were very close in date.

In Fox's sections, the base of the ditch was flat, and varied in width from 5.7 m to 8.1 m, lying about 4.5 m below the old ground surface, with marked angles to its floor. In each of the ditch sections, Fox found the same three basic fills, an initial frost talus in the corners, followed by a fill of a loamy silt, representing a very slow accumulation, grading upwards into a relatively modern humic topsoil. The fills were quite shallow, between 0.3 m and 1 m deep at the centre of the ditch (discounting the upper chalky fill in his Section III, the probable result of erosion from the bank, as suggested by its concave profile; Fox 1925: Plate IV). The dating of the monument was indicated by the abraded and pulverised Roman pottery, the latest of second-century date ('now regarded as 3rd century': RCHME 1972: 144), found in the buried soil below each of the three bank sections. Similar Roman pottery was found within the bank by both McKenny Hughes and Fox; Fox convincingly argued that this derived from the dumping of nearby topsoil *en masse* during the building of the bank (Fox 1925: 121).

A further section across the bank was dug by B. Hope-Taylor in 1973, in advance of the construction of the A45 Newmarket Bypass (Figs 47–49). This has not been fully published; only a short interim report has appeared (Hope-Taylor 1976). Hope-Taylor recorded a substantial ditch fill, with a chalky lower fill below a loamy upper fill, and a single burial (radiocarbon dated to cal. AD 1180–1290, BM966) dug into the top of the chalky fill and sealed by the upper fill. A layer within the upper fill just above this burial produced potsherds of '*c.*1000–1200'. A fourth-century Roman coin found in the buried soil below the bank pointed to a post-350 date for the bank, whose first stage was thought by Hope-Taylor to have been a 'marker bank'. Environmental analysis was undertaken

**Figure 46.** *Devils Dyke from the air looking north-west, with the 1991 pipeline in the foreground and Gallows Hill beyond. Note the marked change in direction of the Dyke at this point. The 1991 excavation was in the scrub-covered ditch on the line of the water-pipe (photo: Ben Robinson, 1991).*

as part of this work, and the results (previously unpublished) are published here, by kind permission of the authors (Dimbleby and Thomas, below).

To the south of the A45, the Newmarket Racecourse crosses the Dyke at a point called the 'Cambridgeshire Gap', which also represents the line of Ashwell Street Roman road. A resistivity survey conducted by David Trump in the winter of 1988 produced results consistent with a causeway through the ditch at this point, implying that the Dyke builders left a crossing place for this major route.

### *Strategy and methods*

In October 1991 an excavation was carried out in the ditch of Devils Dyke, on the east flank of Gallows Hill, near Ditch Farm (TL 5845 6438; Fig. 47) in the parish of Swaffham Prior. This work, directed by Gerald Wait, took place in

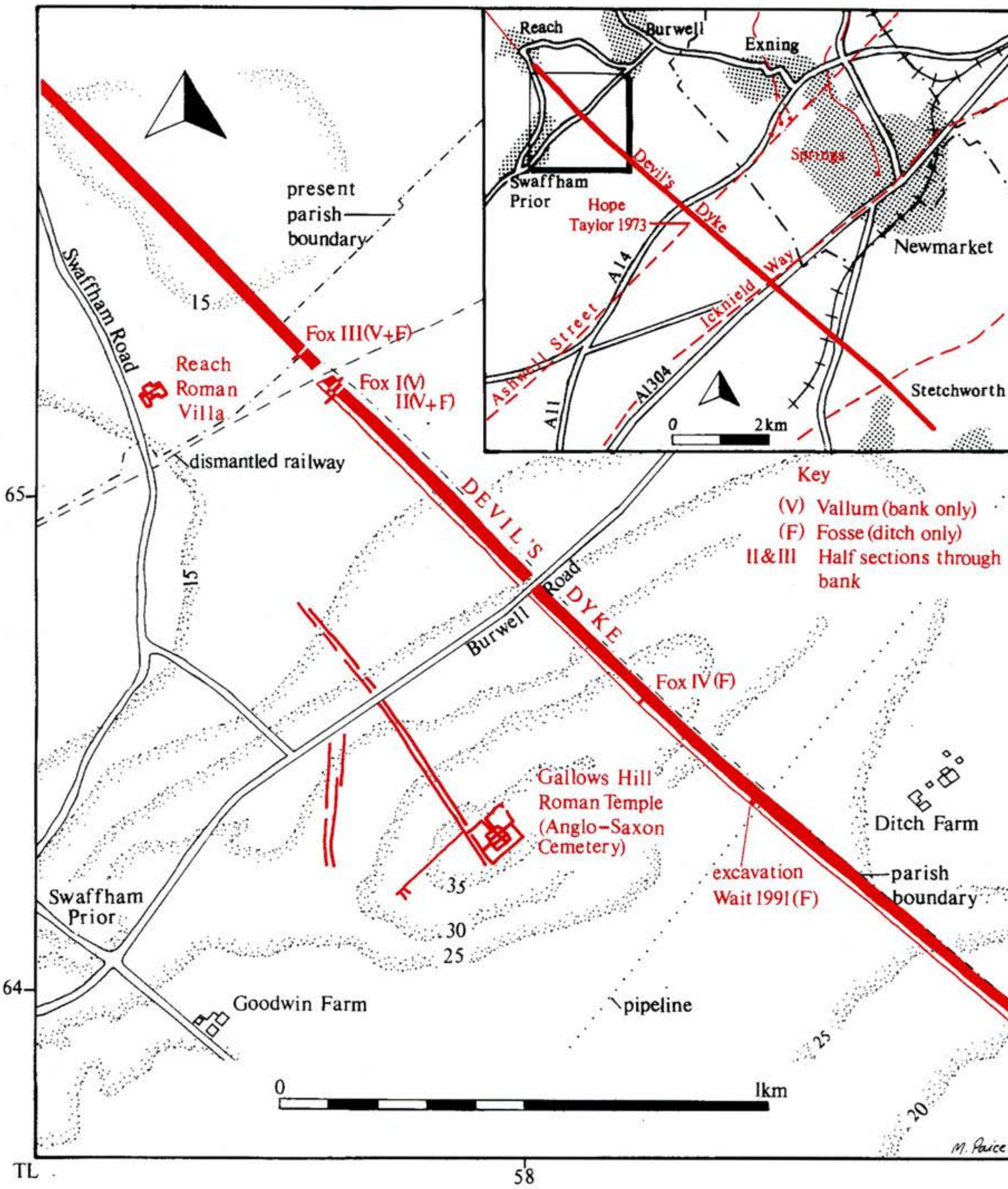


**Figure 47.** *Devils Dyke: location map, showing previous archaeological work, the 1991 trench and associated archaeological sites.*

advance of the construction of an underground aqueduct by Cambridge Water Company.

The work for the aqueduct involved thrust-boring beneath the bank of the monument, but within the anticipated depth of the ditch fills, and thus excavation was restricted to the ditch. The ditch remains open in this stretch to a depth of over 4 m below the ground surface. The excavation was sited immediately adjacent to the location of the projected thrust-bore (Fig. 46). After clearance of scrub in the partially silted ditch, a trench 3 m by 8 m was laid out, and excavated entirely by hand (Fig. 50). The flat-bottomed base of the ditch was reached below 0.75 m of fills, the lowest part of the east side running up out of the excavated section (Figs 51 and 52).

Preservation of molluscs was excellent, and a series of samples was taken in a column through the silts by P. Murphy, whose report (below) is the source of the comments on them

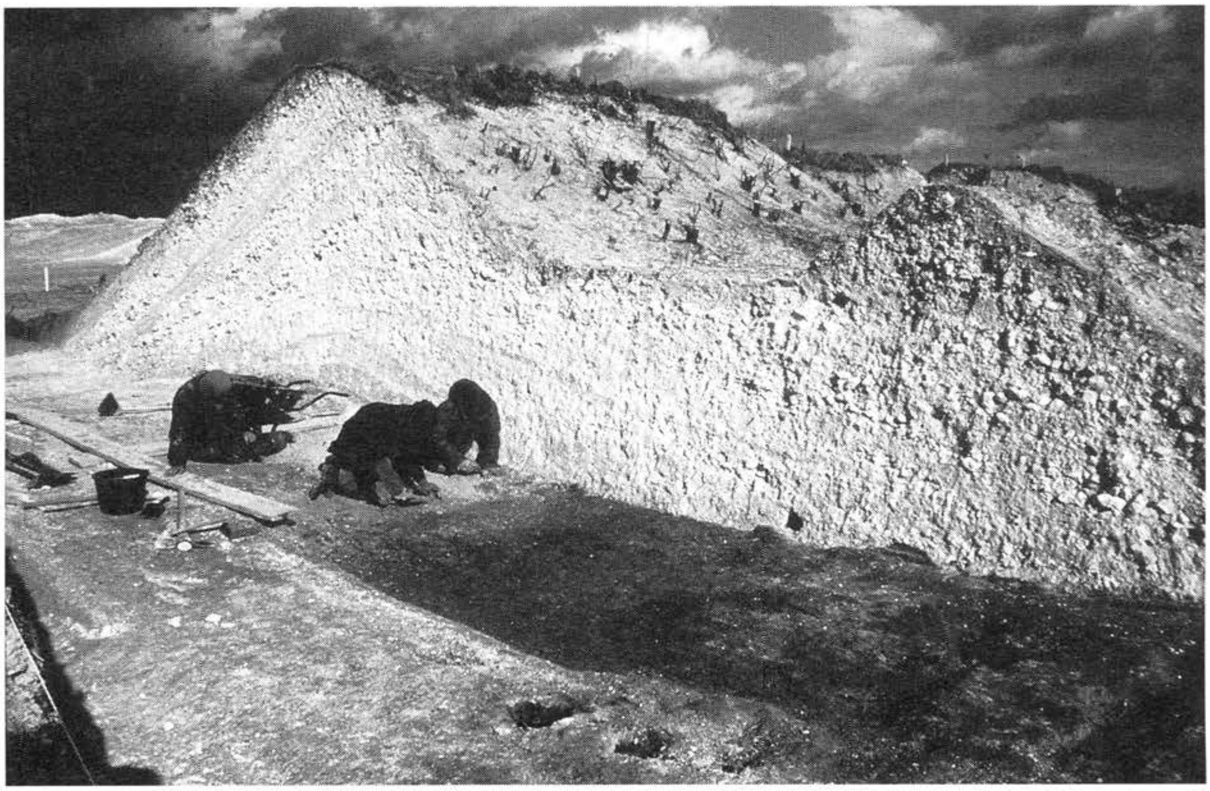

**Figure 48.** *Devils Dyke: south-east facing section of the bank at the level of the buried soil (1973 excavation: photo: Alison Taylor).*

**Figure 49.** *Devils Dyke: north-west facing ditch section (1973 excavation). Figures are on original base of ditch (photo: Alison Taylor).*

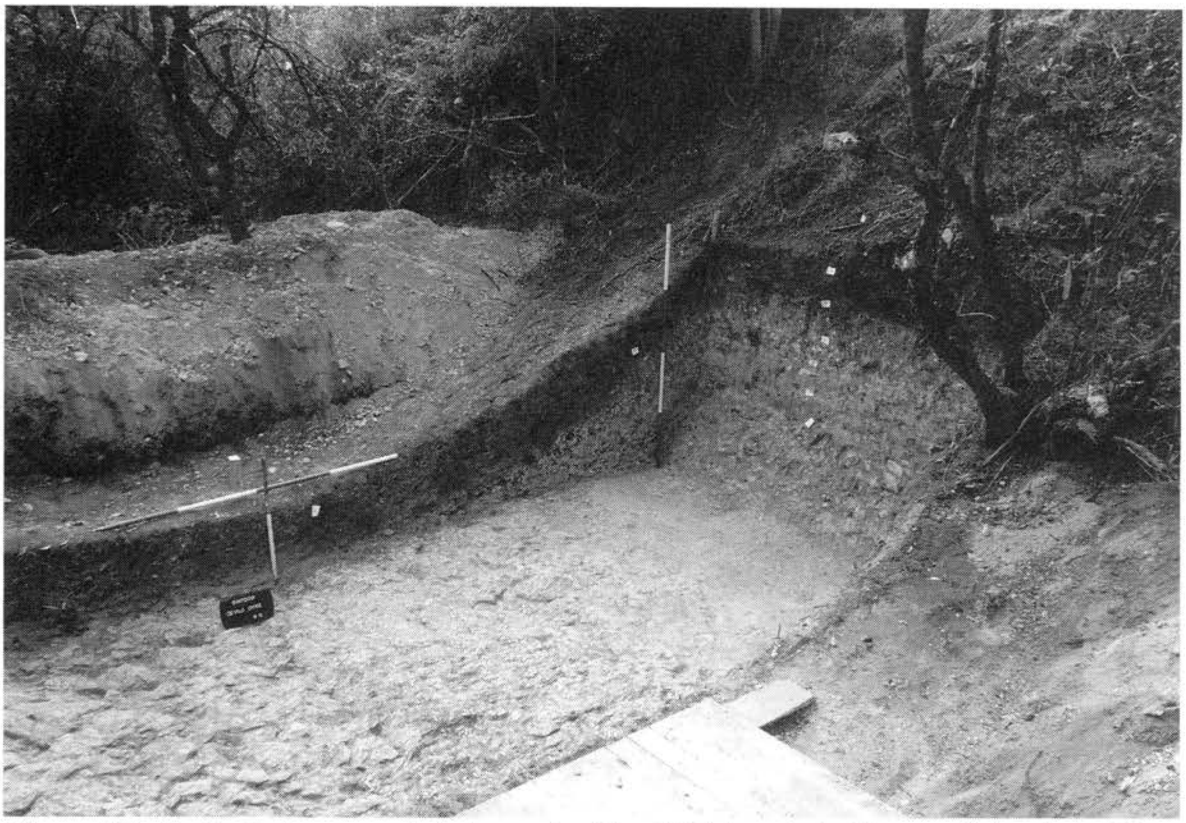

**Figure 50.** *Devils Dyke: general photograph of the 1991 trench, looking north (scale in 0.5 m divisions).*

incorporated in the text. The shallowness of the fills precluded any useful pollen or soil micromorphological analysis.

### *Results* (Fig. 51)

The fill was 0.75 m deep at the centre of the ditch, and lay on a flat-bottomed floor, just over 7 m in width (Fig. 52). Eighteen fills were recorded, mostly very slow silts over a primary deposit of chalky material in the corners of the ditch (Fig. 53). Three basic fills were identified, representing three stages in the silting of the ditch. The initial fills (8, 10–14 and 16–7) were layers of mostly chalk pieces and blocks, typical of frost talus accumulating in the first years of exposure (Jewell and Dimbleby 1966; Limbrey 1975: 291 and Fig. 33). Above these were secondary fills (5–7 and 18) of pale fawn loamy silts, at fairly low 'bedding' angles, reflecting a very slow accumulation of silts over a long period from the surface of the bank. The top layers (1–4 and 15) are part of a humic topsoil with much animal and root action, and are probably relatively modern. These final layers contained various modern artefacts (cf. Limbrey 1975: 292).

*Molluscan analysis*

The preliminary analysis of the molluscs, from column and 'spot' samples, corresponds very well with the three main phases in the ditch fills (frost talus, slow silt, and recent topsoil). The mollusc assemblage from all but the topmost fills was dominated by open-country snails, and shows that the loamy silt of the very long second phase developed within an open-country environment, probably grazed, whilst the snails from the late topsoil, with a mix of open-country and some 'shade' snails, probably reflect the invasion of scrub and the change from extensive grazing to intensive modern farming, with subsequent increased run-off.

### *Discussion*

As already stated, in the region of the excavated section, the ditch of Devils Dyke is still open to about 4 m below the present ground surface, and contains a further 0.75 m of infill. The bank has a fairly regular sloping profile, which continues down into that of the ditch, the original base of which was flat and 7 m wide.

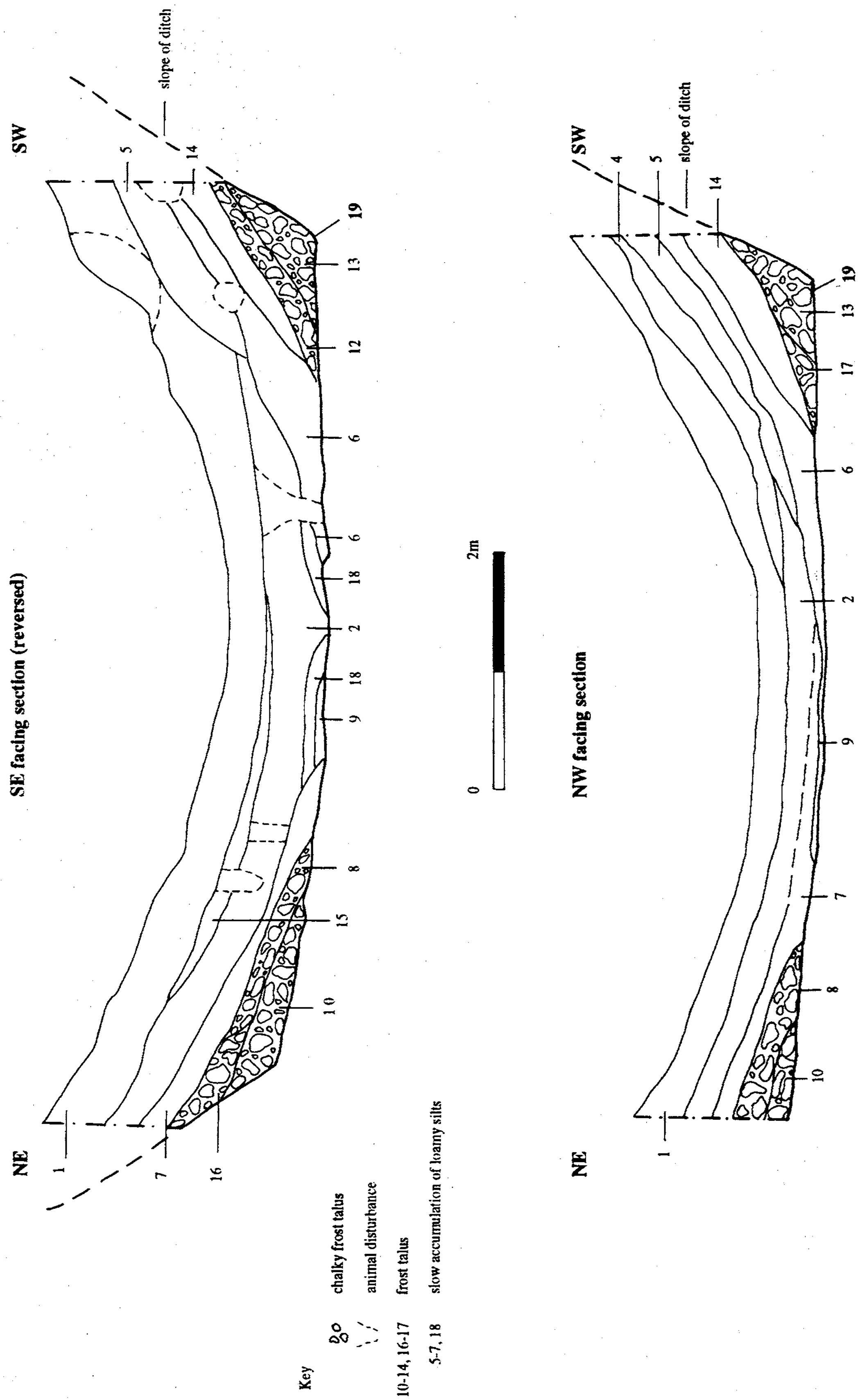


**Figure 51.** *Devils Dyke: sections through ditch fills (1991 trench).*

**Figure 52.** *Devils Dyke: photograph of the south-east facing section through the ditch fills (1991 trench: scale in 0.5 m divisions).*

Although the shallow depth of the ditch fills in 1991 was a little surprising, it is in harmony with Fox's observations in 1923 and 1924 and with his main conclusions. The small amount of frost talus and silting must indicate that little erosion of ditch or bank material has taken place, and this must reflect an original stable angle of repose in both bank and ditch. This seems evident in the character of the secondary fills, representing a very slow silting washed in from the surface of the bank and the adjacent fields (arable in the medieval period), and indicates that the monument very quickly reached relative stability, or indeed was stable from its construction, since it seems to have lost little of its original material, and seems not to have been remodelled. The molluscan evidence points to open-country conditions, probably with much grazing, with little substantial run-off until the advent of intensive agriculture in modern times, the decrease of grazing and the subsequent invasion of scrub into the ditch.

In all the sections excavated by Fox, Hope-Taylor and Wait, the evidence suggests that Devils Dyke is a single-phase monument, with a bank raised above a ditch with sloping sides. There is no evidence of it being ramparted, its effectiveness being a product of its size.

## Environmental Analyses

### *Mollusca and other macrofossils: 1990s excavations*

P. Murphy

The Cambridgeshire Dykes excavations provided an opportunity to obtain palaeoecological information on the Cambridgeshire chalklands from the immediately pre-Roman period into the seventh century AD.

#### *Methods*

Given the dry and highly calcareous nature of the deposits, land molluscs were the main palaeoecological indicators. Shells were extracted from samples using the methods of Evans (1972). The sieved fractions were partly scanned under a binocular microscope at low power to assess

**Figure 53.** *Devils Dyke: photograph of the south-west facing section through fills in the side of the ditch (1991 trench).*

the nature of shell assemblages, and assessment reports were prepared prior to full analysis (Murphy 1992 and 1993 a and b). Samples which were not thought to be worth analysing at this stage have been retained for possible future examination. Bulk samples were also taken from appropriate deposits to retrieve charred plant material by flotation, but these proved to contain little material, with abundant modern roots. Detailed study was not thought to be profitable. Samples from palaeosols and other deposits were examined for pollen by Erika Guttmann for Worsted Street, Fleam Dyke, Devils Dyke and Brent Ditch, but with negative results. Reports on the micromorphology of buried soils are given in separate reports by C. A. I. French (below). The excavation at Bran Ditch was visited by Patricia Wiltshire, who noted the potential of lake sediments in the adjacent Fowlmere for pollen analysis.

*Bran Ditch*

Sections across Bran Ditch were excavated close to its terminus adjacent to Fowlmere. The excavation was on low ground at the foot of a ploughed hillslope.

Contexts sampled by Duncan Schlee were an Iron Age enclosure ditch (34), a pit (Fill 20) and associated post-hole (Fill 23), the buried soil beneath the bank remnant (36) and fills of Bran Ditch itself (11, 37, 38, 39 and 40). Samples were collected from the buried soil as a short column, subdivided at 50 mm vertical intervals. Following assessment (Murphy 1993b), full analysis was confined to four contexts (Table 1).

As at Worsted Street, the base of the buried soil (36; sample 10, 0.30–0.35m) produced an assemblage indicative of shaded conditions (Fig. 55). It is notable that this assemblage is not composed principally of weathered robust shells: a range of taxa differing in durability is represented. For this reason, assemblage composition is not thought to be primarily a taphonomic effect (cf. Carter 1990), but to relate to a pre-monument woodland phase. Dating is a problem.

The base of the Iron Age ditch enclosing a low hill next to the mere (34; sample 12) included a snail assemblage with open-country

**Table 1.** *Molluscs from Bran Ditch.*

| **Context number** | 34 | 36 | 36 | 40 |
|---|---|---|---|---|
| **Sample number** | 12 | 4 | 10 | 15 |
| **Context type** | IA ditch | Buried soil | | Bran Ditch |
| **Open country species** | | | | |
| *Vertigo pygmaea* (Draparnaud) | 2 | 3 | 4 | |
| *Pupilla muscorum* (Linne) | 63 | 30 | 8 | 5 |
| *Vallonia pulchella* (Müller) | 8 | 4 | 1 | 4 |
| *Vallonia costata* (Müller) | 29 | 89 | 54 | 21 |
| *Vallonia excentrica* Sterki | 18 | 39 | 7 | 6 |
| *Vallonia* spp (a) | 156 | 191 | 93 | 50 |
| *Helicella itala* (Linne) | 5 | 22 | 4 | 3 |
| **Catholic species** | | | | |
| *Cochlicopa* spp | 31 | 8 | 26 | 33 |
| *Trichia hispida* group | 145 | 191 | 43 | 114 |
| *Cepaea nemoralis* (Linne) | 2 | | | |
| *Cepaea/Arianta* spp | | 4 | 10 | 10 |
| Limacidae | 6 | 3 | 6 | 11 |
| **Shade-loving species** | | | | |
| *Pomatias elegans* (Müller) | x | 1 | x | 1 |
| *Carychium* spp (b) | 65 | 9 | 286 | 54 |
| *Vertigo pusilla* Müller | | | 2 | |
| *Acanthinula aculeata* (Müller) | | | 32 | |
| *Punctum pygmaeum* (Draparnaud) | 13 | 4 | 10 | 1 |
| *Discus rotundatus* (Müller) | 3 | 1 | 42 | |
| *Vitrina pellucida* (Müller) | | 6 | | |
| *Aegopinella spp* | 2 | 3 | 36 | 5 |
| *Vitrea* spp | 3 | | 35 | 11 |
| *Nesovitrea hammonis* (Strom) | 6 | 1 | 26 | 5 |
| *Oxychilus* sp | | | | 1 |
| Zonitidae indet (a) | 7 | 3 | 49 | 3 |
| *Euconulus fulvus* (Müller) | | | 1 | 4 |
| *Clausilia bidentata* (Strom) | | | 11 | |
| Clausiliidae indet (a) | 3 | 2 | 1 | |
| **Marsh species** | | | | |
| Succineidae indet | | 1 | | 16 |
| *Vertigo angustior* Jeffreys | 3 | | 1 | |
| **Freshwater 'slum' species** | | | | |
| *Lymnaea truncatula* (Müller) | | 1 | 1 | 16 |
| *Anisus* cf *leucostoma* (Millet) | | | 2 | 9 |
| **Freshwater species** | | | | |
| *Valvata cristata* Müller | | | | 1 |
| *Bithynia* sp (opercula) | 1 | | | |
| *Lymnaea* cf *peregra* (Müller) | | | | 22 |
| *Planorbis planorbis* (Linne) | | | | 23 |
| *Armiger crista* (Linne) | | | | 1 |
| Sphaeriidae indet (juveniles) | 1 | | | 1 |
| **Others** | | | | |
| *Vertigo* sp | 1 | 1 | 2 | 4 |
| *Cecilioides acicula* (Müller) | | 7 | 1 | 14 |
| Unidentified (a) | 1 | 4 | | 2 |
| **Sample weight (kg)** | 1 | 1 | 1 | 1 |

Arionid granules present. (a) Immature/small apical fragments; (b) Mainly *C. tridentatum*. *C. minimum* also present.

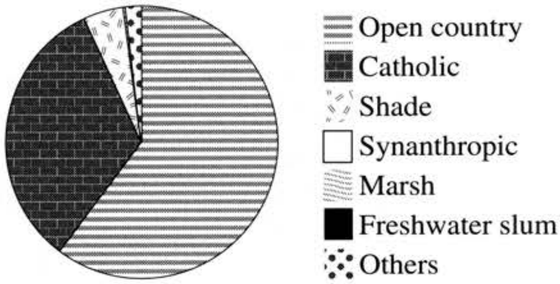


**Figure 54.** *Bran Ditch: molluscs from buried soil (Context 36, upper) (0–0.05 m. N=628).*

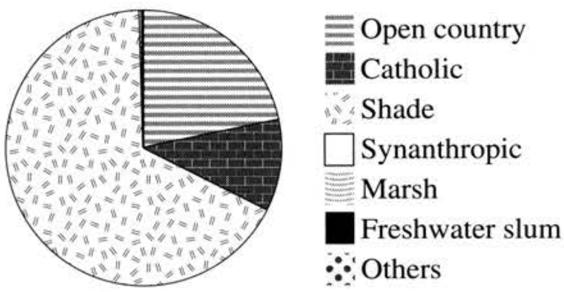


**Figure 55.** *Bran Ditch: molluscs from buried soil (Context 36, lower) (0.30–0.35 m. N=791).*

**Table 2.** *Charred cereals from the buried soil (36) at Bran Ditch.*

| **Context number** | 36 | 36 |
|---|---|---|
| **Sample number** | 4 | 10 |
| *Triticum* sp (caryopses) | 2 | |
| *Triticum* sp (glume base) | 1 | |
| *Triticum* sp (spikelet base) | 1 | |
| *Triticum spelta* L. (glume base) | | 1 |
| *Hordeum* sp (caryopsis fragment) | 1 | |
| **Sample wt (kg)** | 1 | 1 |

and woodland terrestrial species. A possible interpretation is that this ditch enclosed a cleared hummock within a locally wooded environment.

The top of the buried soil under the bank (36; sample 4) contained snails indicating that the earthwork was constructed in open grassland (Fig. 54). However, catholic terrestrial species are common and *Pupilla muscorum* relatively rare. This, together with the presence of *Vallonia pulchella* and *Lymnaea truncatula*, indicates tall, damp grassland, in contrast to the results from Fleam Dyke and Worsted Street.

Context 40, a fill of Bran Ditch, included a mixed shell assemblage comprising open-country, catholic and shade-loving terrestrial species, with marsh, freshwater slum and aquatic molluscs. The deposit presumably contained a substantial allochthonous component of shells derived both from the mere during flooding and shells transported down-slope.

Other noteworthy contexts were the undated pit (15; Fill 20) and associated post-hole (Fill 23). Samples from these were not analysed in detail, but assessment indicated the presence of predominantly open-country snails, associated with abundant avian eggshell fragments, some of which were discoloured by burning. It is possible that these relate to egg collection from wildfowl nests around the mere.

The buried soil (36) produced sparse charred cereal remains, including spelt and barley, presumably of Iron Age or Roman date (Table 2).

### *Brent Ditch*

At this site the monument lay within a ploughed field. The bank and any buried soil beneath it had been levelled and destroyed, and only the ditch was available for sampling. Other small features examined included a small ditch apparently associated with the Roman road.

A discontinuous column of samples was taken from the ditch fills in Section 4 (Fig. 22) with additional topsoil samples from Section 5. Samples processed and assessed were:

| | |
|---|---|
| Topsoil | 3 (101), 4 (102) |
| Upper loamy fills | 8 (103), 9 (105). |
| Underlying chalk rubble fills | 10 (106), 12 (109), 20 (109) |
| Underlying loamy fills | 11 (107), 13 (110), 14 (113) |
| Basal chalk rubble fills | 15 (108), 16 (126), 17 (127) |

From the possible road ditch in Trench C, two samples, 18 (151) and 19 (150), were examined.

The samples consistently produced assemblages of low species diversity, dominated by *Vallonia excentrica, V. costata, Pupilla muscorum, Helicella itala*, and the *Trichia hispida* group. Other taxa included *Pomatias elegans, Cochlicopa, Punctum pygmaeum, Nesovitrea hammonis*, limacids, arionids, *Cepaea* and *Cecilioides acicula. Candidula intersecta* and *C. gigaxii* occurred in the topsoil samples and in 103, and sporadically in deposits as deep as 107, where they were probably introduced by burrowing animals. The presence of these alien species in superficial deposits is unsurprising. Four representative samples from 101, 105, 110 and 127 were fully analysed (Table 3).

It appears that open conditions persisted throughout the period of ditch infilling: there is no evidence for any phase of scrub growth.

**Table 3.** *Molluscs from Brent Ditch.*

| **Context number** | 101 | 105 | 110 | 127 |
|---|---|---|---|---|
| **Sample number** | 3 | 9 | 13 | 17 |
| **Open-country species** | | | | |
| *Truncatellina cylindrica* (Ferussac) | | | | 2 |
| *Pupilla muscorum* (Linne) | 5 | 58 | 165 | 368 |
| *Vallonia costata* (Müller) | 2 | 4 | 4 | 69 |
| *Vallonia excentrica* Sterki | 6 | 16 | 77 | 27 |
| *Vallonia* spp (a) | 6 | 19 | 98 | 87 |
| *Candidula intersecta* (Poiret) | 1 | | | |
| *Candidula gigaxii* (Pfeiffer) | 2 | | 3 | |
| *Candidula* spp (a) | 5 | 1 | | |
| *Helicella itala* (Linne) | 8 | 16 | 38 | 152 |
| *Helicella/Candidula* spp (a) | 2 | | | |
| **Catholic species** | | | | |
| *Cochlicopa* spp | | 5 | 36 | 27 |
| *Cepaea/Arianta* (b) | | 1 | | 1 |
| *Trichia hispida* group | 1 | 2 | 90 | |
| Limacidae | 1 | 2 | 4 | |
| **Shade-loving species** | | | | |
| *Pomatias elegans* (Müller) | 1 | 2 | 3 | x |
| *Punctum pygmaeum* (Draparnaud) | | 1 | | 5 |
| *Vitrina pellucida* (Müller) | | | | 1 |
| Zonitidae (a) | 1 | | | |
| Clausiliidae (b) | | 1 | | |
| **Synanthropic** | | | | |
| *Helix aspersa* (Müller) | x | | | |
| **Freshwater** | | | | |
| *Bithynia tentaculata* (Linne) (c) | | 4 | | |
| **Others** | | | | |
| *Cecilioides acicula* (Müller) | 9 | 13 | | |
| Burnt non-apical fragments | | x | | |
| **Sample weight (kg)** | 2 | 2 | 2 | 2 |

Arionid granules also present. (a) Small apical fragments; (b) Abraded apices; (c) Opercula.

Most of the deposits were rapidly accumulated basal rubble fills, material derived from bank destruction or inwashed ploughsoil. The apparent absence of *Vertigo pygmaea*, a common grassland snail, and the frequent abundance of *P. muscorum*, a species favouring bare ground, implies that phases of stable, complete vegetation cover (if any) are not represented in these deposits. Samples 107 and 105 included a few opercula of the freshwater snail *Bithynia tentaculata*, some discoloured by burning, together with burnt non-apical shell fragments probably of other freshwater taxa. Sample 107 also included scraps of mussel shell. It is probable that these are related to nearby domestic activities – food refuse and perhaps residues from the burning of fen peat.

**Table 4.** *Molluscs from Worsted Street Roman road.*

| **Context no.** | 24 | 24 | 24 | 25 | 25 | 25 |
|---|---|---|---|---|---|---|
| **Sample no.** | 24.5 | 24.6 | 24.7 | 25.1 | 25.2 | 25.3 |
| **Depth (m) from top of context 24** | 0–0.05 | 0.05–0.10 | 0.10–0.15 | 0.15–0.20 | 0.20–0.25 | 0.25–0.30 |
| **Open-country species** | | | | | | |
| *Truncatellina cylindrica* (Ferussac) | 2 | | | | | |
| *Vertigo pygmaea* (Draparnaud) | 7 | 10 | 4 | | | |
| *Pupilla muscorum* (Linne) | 346 | 550 | 167 | 6 | 22 | 7 |
| *Vallonia costata* (Müller) | 78 | 105 | 49 | 2 | 5 | 1 |
| *Vallonia excentrica* Sterki | 114 | 158 | 53 | 2 | 4 | |
| *Vallonia* spp (a) | 270 | 327 | 101 | 2 | 18 | 13 |
| *Helicella itala* (Linne) | 67 | 100 | 35 | 3 | 3 | |
| **Catholic species** | | | | | | |
| *Cochlicopa* spp | 26 | 53 | 19 | 1 | 2 | |
| *Cepeaea/Arianta* (b) | 2 | 4 | 1 | 1 | 7 | 5 |
| Limacidae | | 2 | | | | |
| **Shade-loving species** | | | | | | |
| *Pomatias elegans* (Müller) | 8 | 9 | 8 | 4 | 62 | 15 |
| *Carychium tridentatum* (Risso) | 1 | 3 | | | 7 | 3 |
| *Punctum pygmaeum* (Draparnaud) | 1 | 3 | 2 | | | |
| *Discus rotundatus* (Müller) | | x | | | 3 | x |
| *Aegopinella* sp (b) | | | | | 1 | |
| Zonitidae (b) | | | | | 1 | |
| *Nesovitrea hammonis* (Strom) | 1 | 2 | 1 | | | |
| Clausiliidae (b) | 2 | 4 | 1 | 1 | 7 | 1 |
| **Others** | | | | | | |
| *Helicella/Trichia* sp. | 43 | 47 | 16 | 1 | 1 | 5 |
| **Sample weight (kg)** | 1.8 | 2 | 1.6 | 2 | 2 | 2 |

Arionid granules also present. Shells generally poorly preserved. (a) Immature/small apical fragments; (b) Badly abraded.

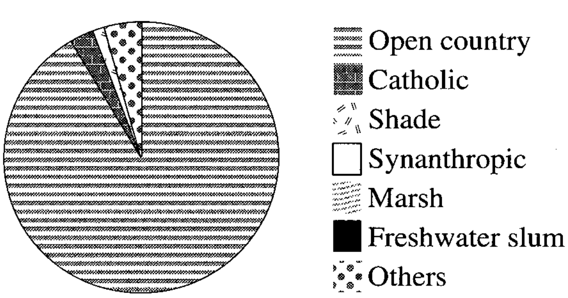


**Figure 56.** *Worsted Street: molluscs from buried soil (Context 24) (0–0.05 m. N=968).*

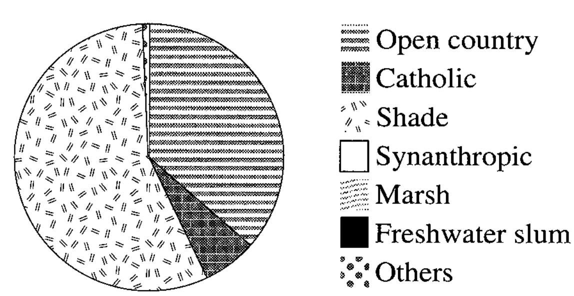


**Figure 57.** *Worsted Street: molluscs from buried soil (Context 25) (0.20–0.25 m. N=143).*

*Worsted Street*

A section across the Roman road, which is perpetuated as a modern lane, showed that layers of chalk and gravel metalling sealed an apparently intact palaeosol formed on chalk. It comprised two distinct horizons: 24, an upper, more organic silt loam (0.15–0.20 m thick) or former A horizon; and 25, a lower, less organic silt loam B horizon (0.15–0.20 m thick) (C. French, personal communication). A short column of samples, sub-divided at 50 mm intervals, was taken by Erika Guttmann from this buried soil for molluscan analysis (Table 4; Figs 56 and 57). Bulk samples were also assessed from Contexts 30, a possible tree throw-hole, and 60, the basal fill of an undated roadside ditch. These included some charcoal, small mammal bone, abundant modern roots, and shells mainly of *Pupilla muscorum* and *Vallonia* spp. Shells were generally poorly preserved, weathered and pitted with holes and, in some cases, surface deposits of secondarily reprecipitated calcite, which has resulted in some identifications being only tentative.

The mollusc assemblages from the A horizon are composed almost entirely of snails characteristic of open conditions. *Pupilla muscorum* consistently predominates, *Vallonia costata, V. excentrica* and *Helicella itala* are common, and there are a few shells of *Truncatellina cylindrica* and *Vertigo pygmaea*. The apparent absence of the commonly associated *Trichia hispida* group at this site is notable. All other taxa occur at percentages of 4% or less. The road was clearly constructed across an open, at least locally treeless, landscape. *Pupilla* is particularly characteristic of earth bare of vegetation; and *Vertigo*, more indicative of stable conditions with a complete grass cover (Evans 1972: 143–148), is rare. This suggests that either there was very intense grazing locally, with soil disturbance by hooves, or that the site was under cultivation just before the road was laid out.

The assemblages from the B horizon also include open country snails, but at 0.20–0.25 m there is a marked concentration of shells of woodland snails, particularly *Pomatias elegans* but also *Carychium tridentatum, Discus rotundatus*, Zonitidae and Clausiliidae. Carter (1990) considers that concentrations of robust shells (e.g. *Pomatias elegans*) in the lower parts of palaeosols are a product of differential preservation, and do not give reliable ecological data. However, these taxa are not represented here by weathered apices, but by many intact, largely unweathered shells. Whatever the precise taphonomy of this assemblage of woodland taxa, it is thought to indicate a woodland or scrub phase at the site. Placing a date on this phase is difficult, although the good preservation of the shells suggests that it did not long pre-date the open conditions represented in the A horizon.

In summary, the road was constructed in an open landscape, possibly under cultivation locally, but woodland had been cleared from the site not long before.

### *Fleam Dyke*

At Fleam Dyke, a section was cut through the bank and ditch just next to the A11. The surrounding area comprised arable fields sloping markedly towards the site. At the top of the dyke was a footpath, but its flanks and ditches were covered with buckthorn, hawthorn, wild privet, sloe, elder, roses, ivy and some fairly mature birches trimmed as a hedge where the scrub bordered the arable.

Beneath the bank, an area of buried soil about 10 by 2.5 m was exposed. From the bank section it was clear that there was more than one phase of construction, and so three column samples at different locations were taken from the soil (Samples 10–12), since it seemed probable that not all areas of soil were buried by bank construction contemporaneously. The columns also provided an opportunity to check for the presence of charred plant material and thereby to determine whether bulk samples from the soil (Samples 1–9) would be worth processing. Assessment of Samples 10–12, however, showed that they included very similar mollusc assemblages and only one (11) was fully analysed (Table 5; Fig. 58). There were only a few charcoal flecks in the samples and further work on charred macrofossils was not thought worthwhile.

The bank was largely constructed of chalk rubble, although there were some more humic layers within it, apparently representing phases of stabilisation between construction phases. Samples from two of these (47 and 22) were analysed. There were two ditch cuts. From the first cut, samples from Contexts 61, 62 and 64 were analysed, and from the second, samples from 6, 43, 44, 45, 71 and 50 (Table 5). Other samples were assessed but seemed very similar to those fully analysed (Murphy 1992).

The assemblages from the buried soil were composed almost entirely of open-country taxa (Fig. 58). Compared to the buried soil under Worsted Street, of late Iron Age or early Roman date, this late Roman or post-Roman soil includes a much higher proportion of *Pupilla muscorum*. Here it comprises up to 77% of total shells, compared to a maximum of 40% at Worsted Street. Apart from *Pupilla muscorum, Vallonia costata, V. excentrica* and *Helicella itala*, other species are rare: *Cochlicopa* spp. comprise up to 3.3%, the *Trichia hispida* group up to 1.6%, and all other snails under 1%. This clearly indicates a very open landscape locally, with soil surfaces apparently more disturbed than at Worsted Street, as a result of cultivation or heavy grazing pressure.

The fills of the first ditch cut produced similar shell assemblages: the basal rubbly fills (e.g. 64) contained fewer shells than upper layers representing a phase of stability (e.g. 61), but there seems to be little variation in species composition. Similar assemblages, dominated by *Pupilla* and *Trichia*, came from the second cut. Only at 2.25–2.35 m in Context 71 were shade-requiring snails present in any significant

**Table 5.** *Molluscs from Fleam Dyke.*

| **Context no.** | 4 | 4 | 4 | 47 | 22 | 61 | 62 | 64 | 6 | 43 | 43/44 | 45 | 71 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample no.** | 11 | 11 | 11 | 13 | 14 | 16 | 18 | 19 | 22 | 23 | 25 | 27 | 28 | 30 |
| **Depth (m), where appropriate** | 0–0.05 | 0.05–0.10 | 0.10–0.15 | | | | | | 0.75–0.85 | 0.95–1.05 | 1.15–1.25 | 1.75–1.85 | 2.25–2.35 | 2.65–2.75 |
| **Context** | Buried soil | | | Layers in the bank | | Layers in the first ditch cut | | | Layers in the second ditch cut | | | | | |
| **Open country species** | | | | | | | | | | | | | | |
| *Vertigo pygmaea* (Draparnaud) | | | 1 | | | | 1 | | 2 | 1 | | 2 | | |
| *Pupilla muscorum* (Linne) | 486 | 530 | 223 | 48 | 43 | 324 | 84 | 66 | 20 | 15 | 122 | 92 | 223 | 29 |
| *Vallonia costata* (Müller) | 17 | 57 | 18 | | 3 | 27 | 10 | 7 | 6 | 1 | | 1 | 50 | |
| *Vallonia excentrica* Sterki | 22 | 37 | 5 | 3 | 1 | 14 | 2 | 7 | 3 | | | 2 | 15 | 1 |
| *Vallonia* spp (a) | 46 | 86 | 16 | 6 | 5 | 41 | 26 | 18 | 6 | 5 | | 2 | 96 | |
| *Helicella itala* (Linne) | 42 | 48 | 19 | 8 | 3 | 97 | 31 | 9 | 1 | 3 | 4 | 9 | 30 | |
| **Catholic species** | | | | | | | | | | | | | | |
| *Cochlicopa* spp | 21 | 27 | 4 | | 1 | 22 | 8 | 4 | | 1 | | | 18 | 2 |
| *Trichia hispida* group | 3 | 13 | 2 | 2 | 3 | 37 | 7 | | 106 | 71 | 93 | 11 | 109 | |
| *Cepaea/Arianta* (b) | | | | 1 | | | 1 | | | | | | | |
| Limacidae | | 1 | | | | | | | 1 | | | | | |
| **Shade-loving species** | | | | | | | | | | | | | | |
| *Pomatias elegans* (Müller) (c) | x | 1 | x | x | x | x | x | 1 | x | x | x | x | 1 | x |
| *Punctum pygmaeum* (Draparnaud) | | | | 1 | | | | | | | 1 | 3 | 6 | |
| *Vitrina pellucida* (Müller) | | | | | | | | | | | | | 1 | |
| *Aegopinella* sp | | | | | | | | | 2 | | | | | |
| *Nesovitrea hammonis* (Strom) | | 4 | | | | | | | | | | | | |
| *Oxychilus* sp | | | | | | | | | 1 | | | | | |
| Zonitidae (a) | | | | | | | | | | | | | 4 | |
| **Others** | | | | | | | | | | | | | | |
| *Cecilioides acicula* (Müller) | | | | | | | 2 | 1 | 5 | 3 | 5 | 9 | 3 | |
| Indeterminate (b) | | | | 1 | | | | | | | | | | |
| **Sample weight (kg)** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

Arionid granules also present. (a) small apical fragments/immature shells; (b) Abraded; (c) Mostly non-apical fragments.

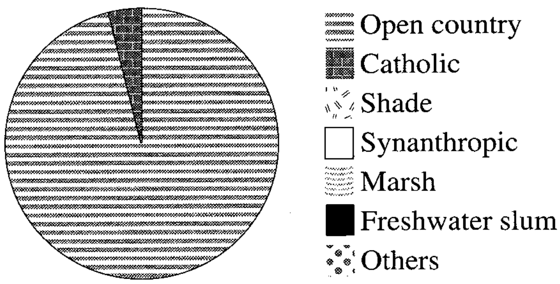


**Figure 58.** *Fleam Dyke: molluscs from buried soil (Context 4) (1991 trench) (0–0.05 m. N=637).*

numbers, but even in this layer there is no evidence for any significant scrub growth.

Layers 22 and 47 in the bank produced rather sparse assemblages of open-country snails, which suggests that insufficient time elapsed between phases of bank construction for many shells to become incorporated into the earlier bank surface.

### *Devils Dyke: pollen analysis, 1973 excavation*

Geoffrey Dimbleby

Dr. Brian Hope-Taylor sectioned Devils Dyke in 1973, and suggested that the opportunity should be taken of obtaining evidence from the buried soil, which might indicate environmental conditions at the time of construction. For botanical evidence, pollen analysis of the soil was carried out; this report discusses the procedure and the findings.

#### *Soil*

An understanding of the nature of the soil is essential to the interpretation of the results. The buried soil was a rendzina, an A/C type soil, developed in Chalky Drift. The A horizon was 0.20 m deep, humus-stained and uniform. Such a horizon would have been intensively mixed by earthworms throughout its depth. It was sharply differentiated from the C horizon, the parent material, which was not investigated.

#### *Sampling and counting*

A column of ten contiguous 20 mm samples was taken, covering the whole depth of the A horizon. The samples were decalcified with hydrochloric acid, treated with hydrofluoric acid and then acetolysed. Slides were prepared on a quantitative basis to allow the calculation of the abundance of pollen, but in the event this proved uninformative and was not continued .

The frequency of pollen was very low, which meant that it was not possible to reach counts large enough to give reliable percentages for each sample; all totals exceeded 200 grains, which gives acceptable values for the better represented taxa. The results are presented in Figure 59.

In order to achieve greater precision, it is acceptable in a mixed soil to add up the counts for the whole profile; Table 6 gives the totalled counts for the ten samples and the percentages based on these. This is in effect a spectrum of all the pollen at the time the Dyke was constructed.

Also included in Figure 59 is a summary diagram of the relative occurrence of three composite categories:

1 Trees and shrubs
2 Herbs
3 Fern spores.

These will be discussed separately to illustrate the different considerations which have to be taken into account when attempting interpretation.

**Table 6.** *Amalgamated analyses of the Devils Dyke pollen.*

| | counts | percent |
|---|---|---|
| **Trees and shrubs** | | |
| *Alnus* | 30 | 1.2 |
| cf. *Castanea* | 1 | <0.1 |
| *Pinus* | 37 | 1.5 |
| *Quercus* | 44 | 1.8 |
| *Tilia* | 1 | <0.1 |
| *Ulmus* | 2 | <0.1 |
| *Corylus* | 77 | 3.1 |
| *Ligustrum* | 1 | <0.1 |
| Sum trees and shrubs | 193 | 7.9 |
| **Herbs** | | |
| Gramineae | 466 | 19.0 |
| Cereal type | 1 | <0.1 |
| Caryophyllaceae | 1 | <0.1 |
| Chenopodiaceae | 1 | <0.1 |
| *Centaurea nigra* | 17 | 0.7 |
| Compositae Liguliflorae | 451 | 18.4 |
| Compositae Tubuliflorae | 20 | 0.8 |
| *Plantago lanceolata* | 96 | 3.9 |
| *Plantago major/media* | 13 | 0.5 |
| *Ranunculus* type | 4 | 0.2 |
| Rosaceae | 1 | <0.1 |
| Rubiaceae | 8 | 0.3 |
| *Succisa* | 28 | 1.1 |
| Varia | 49 | 2.0 |
| Sum herbs | 1156 | 47.1 |
| **Fern Spores** | | |
| Filicales undiff. | 388 | 15.8 |
| *Polypodium* | 69 | 2.8 |
| *Pteridium* | 649 | 26.4 |
| Sum fern spores | 1106 | 45.1 |
| **Total count** | **2455** | |

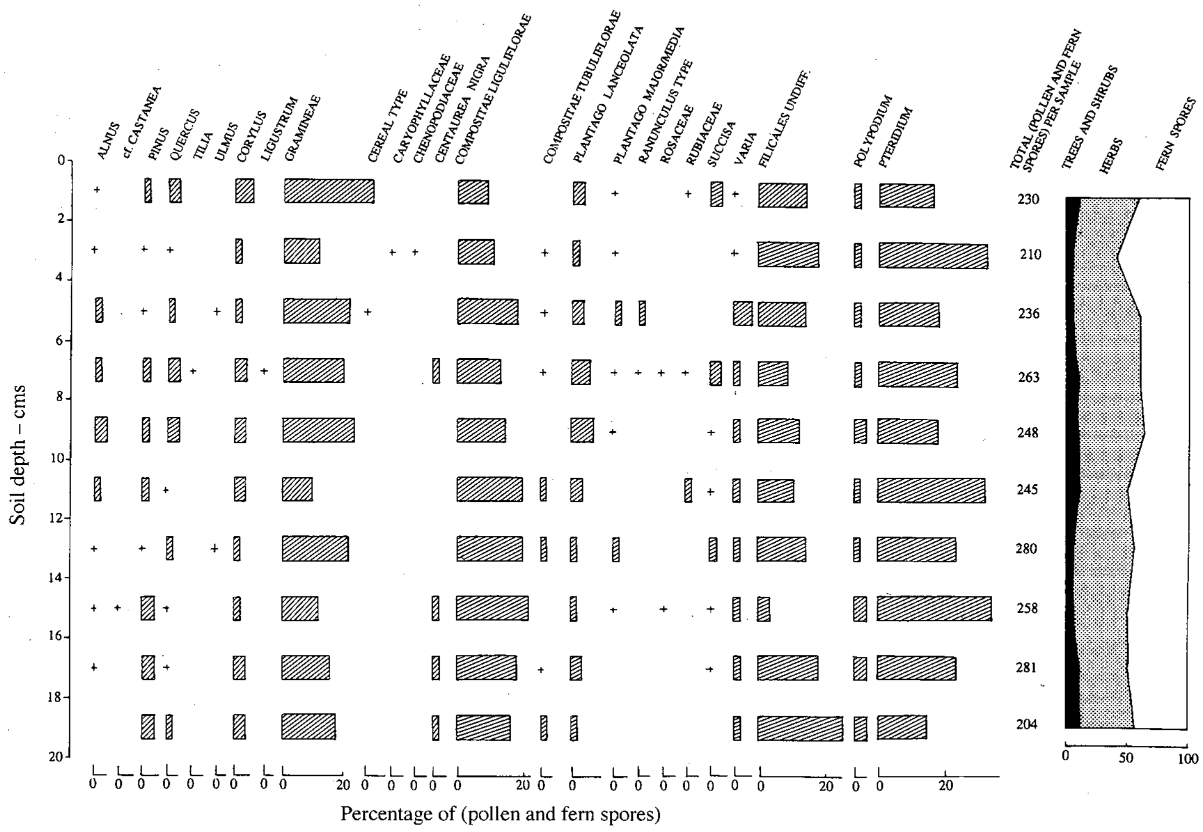

**Figure 59.** *Devils Dyke: pollen diagram (1973 excavation).*

*Trees and shrubs*

This group forms a minority of the pollen count for the whole profile. For dating purposes it is necessary to have an adequate representation of the spectrum of tree pollen at any one time. In this case this is not possible, because the totals are low and the pollen is mixed, so that pollen of different periods may occur together. The best that can be said on dating is that the data are not at variance with the archaeological post-Roman dating.

There is a surprisingly high level of pine (*Pinus*) pollen. At the time the dyke was constructed pine was scarce in southern England, so such a high representation is unlikely to have been due to wind dispersal from other areas. From a number of more recent analyses of chalk soils, both prehistoric and contemporary, there are indications that the traces of pine pollen, which is very resistant to decay and whose grains are easily recognised, may be a relic from a pre-clearance phase (see also Fern spores, below).

The only shrub consistently recorded throughout the profile is hazel (*Corylus*), but its occurrence is low compared with other soil analyses of comparable periods. This may be due to pressure of grazing and browsing; hazel is readily eaten by most grazing stock.

*Herbs*

Grasses (Gramineae) make up the bulk of the herb pollen. In common with almost all other calcareous soils there is a strong element of Compositae Liguliflorae (dandelions, hawkbits, etc.). These have easily recognisable pollen grains, although with preservation as poor as in this soil it is not possible to distinguish different genera. Their pollen is very resistant to decay and this, combined with their ease of recognition, may account for the fact that they are such a conspicuous element of calcareous soil analyses.

One other species figures substantially here and is widely present in soil analyses: ribwort plantain (*Plantago lanceolata*). Today it is a common plant of waysides and wasteland, but its most characteristic habitat is grassland that has been mown or grazed. Other herbs in this analysis which are found in the same habitat are the bedstraws (Rubiaceae), other plantains (*P. major/media*), buttercup (*Ranunculus* type) and the lesser knapweed (*Centaurea nigra*).

Pollen evidence of plants of arable land is low. The families Caryophyllaceae and Chenopodiaceae are present in traces and one grain of cereal-type pollen was recorded.

*Fern spores*

This category is distinct from the previous two in that it is based on taxonomy rather than ecology. Fern spores are remarkably resistant to decay and therefore, through differential decay, they can dominate an analysis. This is a common phenomenon in soils of most types, particularly those which are the most active microbiologically, that is to say, soils of neutral or high pH.

However, fern spores cannot be lumped together as of equal significance. There are three distinct types. Many produce a smooth kidney-shaped spore; it is not possible to identify these further. They are listed as Filicales undifferentiated. Without being able to identify the species, it is not possible to speculate on their origin.

A second type is recorded as *Polypodium*. This is also kidney-shaped, but it is large and has a thick patterned wall which is easily recognisable. The three British species differ somewhat in habitat preference, but their occurrence is of no archaeological significance. They may be relics from an earlier period.

Finally there is bracken (*Pteridium*); this is an important plant today and may be of some archaeological relevance. Its spores, which are quite unlike those of the other groups, occur conspicuously in many chalk soils, although bracken is not a common plant on chalk today, apparently preferring acidic soils. However, it can grow on soils of high pH, and it has been suggested that fire may have been a factor in changing its soil preference. Here, too, there is the possibility that bracken spores may be relic in origin. We urgently need some pollen spectra which relate specifically to the period of conversion from woodland to grassland on chalk soils; such evidence is at the moment lacking.

*Discussion*

Leaving aside those taxa which are probably over-represented because of differential decay, the overall picture presented by these data is of short-turf grassland. Tree and shrub pollen is scarce and probably the result of long-distance wind transport. There is no more than a trace of arable land use; on the other hand there is consistent evidence that the grassland was maintained by grazing.

Although the buried soil contains free calcium carbonate, this can be attributed to the fact that it had been buried for so long under a metre or two of Chalky Drift. The pollen shows no species of high fidelity to chalk grassland, although these have been found in other contexts. Those taxa present here are consonant with a circumneutral soil. This would tally with the deep A horizon, suggesting that it had been undisturbed for long enough for some degree of decalcification to have taken place.

## *Devils Dyke: mollusca, 1973 excavation*

K.D. Thomas

Samples were taken at 100 mm intervals from 0.15 m below the surface of the exposure to a depth of 0.60 m. A sample only 50 mm thick was taken at the surface of the buried soil.

Shells were extracted from 0.5 kg samples of air-dried soil by wet sieving. The numbers of identifiable apical fragments are given in Table 7; non-apical fragments are indicated by a +.

The species of *Vallonia* are entered in Table 7 as a single taxon. Two species of this genus were encountered: *V. costata* (Müller) and *V. excentrica* Sterki. Although in all of the samples *V. excentrica* was the more abundant of the two species, it was not possible to separate all of the specimens with a high degree of certainty. Thus they are treated together.

Figure 60 shows a histogram of the percentage frequencies of molluscs through the profile. Apart from minor fluctuations, there is not a great deal of variation through the profile in the composition of the mollusc assemblages. The deepest sample yielded a rather low total number of shells but, interestingly, had the highest species diversity of all the samples. The relatively high frequencies of *Pomatias elegans* in the lower samples may be a reflection of the resistance of these shells to destruction. However, as is suggested below, they may represent rather different environmental conditions.

The species have been grouped according to their ecological preferences; the frequencies of these groups are shown in Table 8. Open-country species (*Vertigo pygmaea*, *Pupilla muscorum*, *Vallonia* spp. and *Helicella itala*) predominate throughout the profile. A grassland habitat is indicated. This grassland was probably fairly stable, as suggested by the presence of *Vertigo pygmaea*, albeit at rather low

**Table 7.** *Absolute frequencies of Mollusca from the Devils Dyke samples.*

| | Depths (m) | | | | |
|---|---|---|---|---|---|
| | 0.15–0.25 | 0.25–0.35 | 0.35–0.40 | 0.40–0.50 | 0.50–0.60 |
| **Species/genus** | | | | | |
| *Pomatias elegans* (Müller) | 5 | 1 | + | 22 | 28 |
| *Cochlicopa lubricella* (Porro) | 18 | 24 | 15 | 30 | 10 |
| *Vertigo pygmaea* (Drap.) | 5 | 19 | 12 | 5 | – |
| *Pupilla muscorum* (Linn.) | 111 | 304 | 165 | 164 | 95 |
| *Acanthinula aculeata* (Müller) | – | – | – | – | 3 |
| *Vallonia* spp. | 95 | 170 | 171 | 198 | 89 |
| *Clausilia bidentata* (Ström) | 4 | 2 | 1 | 6 | 7 |
| *Cepaea* sp. | + | + | + | 3 | 1 |
| *Trichia hispida* (Linn.) | 24 | 21 | 39 | 61 | 9 |
| *Helicella itala* (Linn.) | 53 | 23 | 21 | 50 | 29 |
| *Punctum pygmaeum* (Drap.) | 4 | 1 | 6 | 3 | 1 |
| *Discus rotundatus* (Müller) | – | – | – | – | 6 |
| *Oxychilus cellarius* (Müller) | – | – | – | – | 5 |
| **Totals** | **319** | **565** | **430** | **542** | **283** |

+ = non-apical fragments

**Table 8.** *Percentage frequencies of ecological groups of molluscs in the Devils Dyke samples.*

| | Depths (m) | | | | |
|---|---|---|---|---|---|
| | 0.15–0.25 | 0.25–0.35 | 0.35–0.40 | 0.40–0.50 | 0.50–0.60 |
| **Ecological preference** | | | | | |
| Catholic | 14.41 | 7.85 | 13.95 | 17.88 | 7.41 |
| Open-country | 82.77 | 91.62 | 85.82 | 76.95 | 75.28 |
| Shade | 1.25 | 0.35 | 0.23 | 1.11 | 7.42 |
| Loose soil | 1.57 | 0.18 | + | 4.06 | 9.89 |

+ = non-apical fragments

frequencies, and the grass fairly short (*Helicella itala* is a heliophilous species, preferring open grassland). Thus, it is possible that the grassland was used for pasture; the palynological evidence points to a similar conclusion (G. W. Dimbleby, personal communication).

The deepest sample is of some interest in that it contains the highest frequencies of those species preferring loose soil or shaded conditions (including *Acanthinula aculeata*, *Clausilia bidentata*, *Discus rotundatus* and *Oxychilus cellarius*). A rather less stable grassland is suggested (*Vertigo pygmaea* is absent) with rather loose or disturbed soil (*Pomatias elegans* is a burrowing species). The relative abundance of shade-preferring species at this level may indicate the presence of tall vegetation, but the fairly high frequency of *Helicella itala* argues against this.

It is possible that this deep sub-fossil assemblage may reflect a land surface which, although largely covered by grass, was rather unstable and littered with calcareous debris. Evans and Jones (1973) have shown that rock-rubble habitats may provide suitable microclimates for typically 'woodland' species of snails, notably of the genera Oxychilus, Vitrea and Discus. The present 'mixed' fauna may reflect similar conditions, as postulated above.

### *Devils Dyke (1991)*

P. Murphy

Excavation at this site was confined to a section through the ditch deposits: the pipeline was tunnelled through the bank, so there was no opportunity to sample the bank make-up or any buried soil beneath it.

The excavation was in an area of scrub, dominated by elder with wild privet, hawthorn, sloe, brambles, ivy, ground ivy and nettles. At the margins of the scrub there was a tall herb vegetation of nettles, goosegrass, hogweed, wild carrot, wild mignonette, musk thistle and greater knapweed, with some brambles and small bushes of sloe and elder. It appeared that this vegetation was of fairly recent development and that scrub was in the process of spreading along the earthwork from the site into areas still under short grassland,

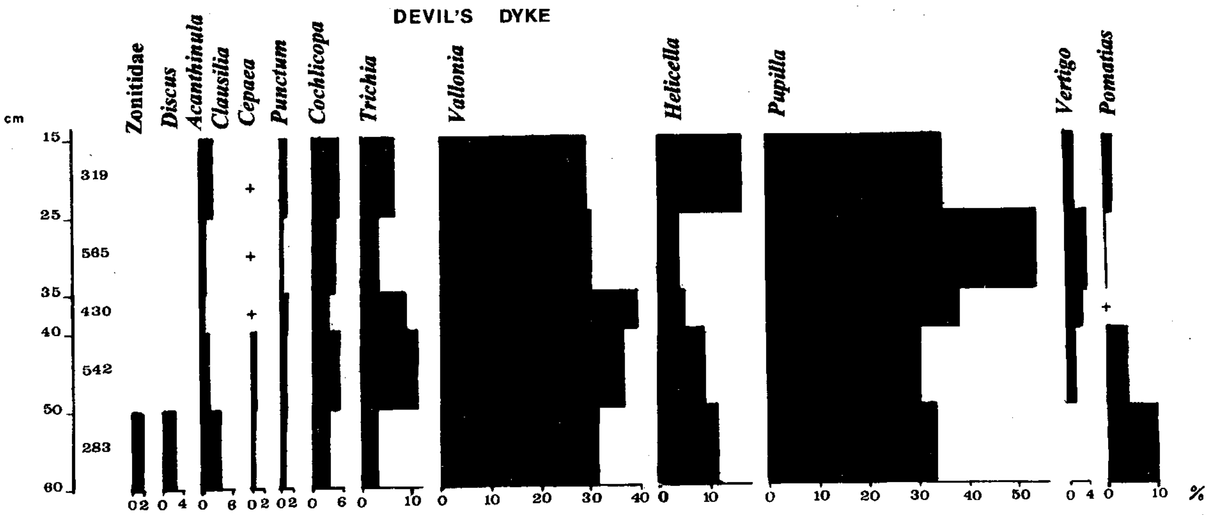


**Figure 60.** *Devils Dyke (1973 excavation). percentage frequencies of mollusc genera (see Table 7 for species identifications). Numbers on the left are numbers of shells per 0.5 kg of soil (K.D. Thomas).*

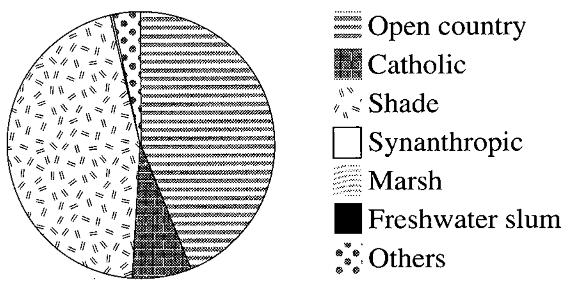


**Figure 61.** *Devils Dyke: molluscs from modern soil under elder scrub (1991 trench) (N=842).*

presumably as a result of reduced grazing pressure.

The following samples were collected from the ditch fills:

a) Central column 1.1
1.2 Layer 1, subdivided at 100 mm intervals
1.3
15.1
2.1
2.2 Layer 2, subdivided at 100 mm intervals
2.3
18.1

b) Spot samples from layers at edges of ditch 7.1, 8.1, 12.1, 14.1 and 16.1.

Assessment of the sieved fractions indicated that there seemed to be three main phases of deposit accumulation: an initial phase of infilling with chalky rubble; stabilisation of the ditch profile and, recently, development of a humic soil under elder scrub.

**Table 9.** *Molluscs from Devils Dyke.*

| | | | |
|---|---|---|---|
| **Context number** | 1 | 2 | 18 |
| **Sample number** | 1.1 | 2.2 | 18.1 |
| **Open country species** | | | |
| *Vertigo pygmaea* (Draparnaud) | 3 | | 2 |
| *Pupilla muscorum* (Linne) | 101 | 80 | 46 |
| *Vallonia costata* (Müller) | 69 | 7 | 9 |
| *Vallonia excentrica* Sterki | 19 | 18 | 24 |
| *Vallonia* spp (a) | 162 | 51 | 37 |
| *Helicella itala* (Linne) | 16 | 9 | 18 |
| **Catholic species** | | | |
| *Cochlicopa* spp | 37 | 2 | 4 |
| *Trichia hispida* group | 18 | 27 | 23 |
| Limacidae | 5 | 1 | 1 |
| **Shade-loving species** | | | |
| *Pomatias elegans* (Müller) (d) | x | x | 1 |
| *Carychium tridentatum* (Risso) | 61 | | |
| *Ena obscura* (Draparnaud) | 4 | | |
| *Punctum pygmaeum* (Draparnaud) | 17 | 3 | 2 |
| *Vitrina pellucida* (Müller) | 109 | | 1 |
| *Aegopinella* spp (b) | 141 | | |
| *Oxychilus* sp | 4 | | |
| Zonitidae (a) | 25 | | 2 |
| Clausiliidae (c) | 1 | | |
| *Trichia striolata* (Pfeiffer) | 20 | | |
| **Synanthropic species** | | | |
| *Helix aspersa* Müller (d) | 1 | | |
| **Others** | | | |
| *Trichia* spp (a) | 17 | | |
| *Cecilioides acicula* (Müller) | 12 | 11 | 6 |
| **Sample weight (kg)** | 2 | 2 | 2 |

Arionid granules also present. (a) Small apical fragments; (b) *A. pura* and *A. nitidula* present; (c) Abraded, (d) Non-apical fragments.

The mollusc assemblages throughout all but the topmost fills were dominated by open-country snails. Two representative samples (2.2 and 18.1) were analysed quantitatively (Table 9). These clearly resemble the open country assemblages from the A horizon under Worsted Street, although the *Trichia hispida* group is common here. Open, disturbed conditions are clearly represented.

The modern topsoil sample (1.1) includes an interesting mixed assemblage of open-country and shade-requiring species (Fig. 61). Some common 'shade' snails are apparently absent (notably *Discus rotundatus*) and this presumably is related to accidents of colonisation: the elder scrub at the site is isolated from any nearby woodland by arable land and short-turfed grassland.

*General conclusions*

P. Murphy

At all sites investigated, molluscs from buried soils and ditch fills clearly indicate construction in open, probably grassland, habitats. However, there are marked variations in assemblage composition (Figs 54, 56, 58 and 62). The assemblage from the top of the buried soil at Fleam Dyke (Fig. 58) produced an extreme open-country assemblage, dominated by *Pupilla muscorum*, indicating a high proportion of bare ground and disturbed soils in the vicinity. At the other extreme is Bran Ditch (Fig. 62), where there was a higher proportion of catholic land molluscs and *Pupilla* was rather scarce. The presence at this latter site of freshwater and marsh species indicates wetter conditions and periodic flooding. Taller, damp grassland is indicated.

At the bases of the buried soils under Worsted Street and the bank of Bran Ditch, snail assemblages indicative of shaded conditions predominated (Figs. 55, 57 and 63). These are considered to relate to more wooded conditions at these sites at an earlier period, rather than being taphonomic artefacts. The basal assemblage from Worsted Street (Fig. 57) resembles, in its gross composition, the assemblage from a modern soil under scrub predominantly of elder at the Devils Dyke (Fig. 61). The main shade snail in the assemblage from Worsted Street is *Pomatias elegans*, indicative of soil disturbance. An assemblage from an Iron Age ditch at the site of Bran Ditch is thought to indicate locally open conditions in a wooded area, and provides support for the ecological interpretation of the basal palaeosol assemblages.

Samples were inspected for charred plant remains, but only at Bran Ditch were significant amounts of charred cereals (spelt, barley) present. It seems likely that these were derived from crop processing activity further up-slope. They are likely to be of Roman or Iron Age date.

The linear earthworks of Cambridgeshire represent fossil transects across the interfluves and there is little doubt that sampling buried soils at intervals along their lengths would provide information on spatial variations in vegetation cover across the landscape just before construction. The suggestion that the south-eastern termini of these earthworks mark the boundary of dense woodland is amenable to testing by mollusc analysis. As has been shown above, the soils also preserve semi-stratified chronological sequences, with potential information on variations in land-use history. Further information on the vegetational history of the area could come from pollen analysis of lake sediments within the Nature Reserve at Fowlmere.

### *Micromorphological analysis of the buried soils: 1990s excavations*

C.A.I. French

*Introduction*

The recent campaign of investigation into the linear earthworks of South Cambridgeshire provided the opportunity to compare and contrast evidence of soil micromorphology across a wide transect of country and to help set these monuments in their contemporary physical context. Accordingly, samples were taken through the banks and associated ditches at Fleam Dyke and through the Roman road at Worsted Street, both of which monuments were found to have preserved buried soils, and a few samples were also taken at Bran Ditch and Brent Ditch. At Bran Ditch, although the bank was largely ploughed out, a buried soil did survive, but at Brent Ditch no palaeosols survived.

*Methodology*

Given the previous lack of evidence for the setting in which these linear monuments were built, the environmental programme combined micromorphological analysis of the buried soils beneath the banks by the present writer and molluscan anlaysis of these same soils and adjacent ditch deposits by Peter Murphy (above).

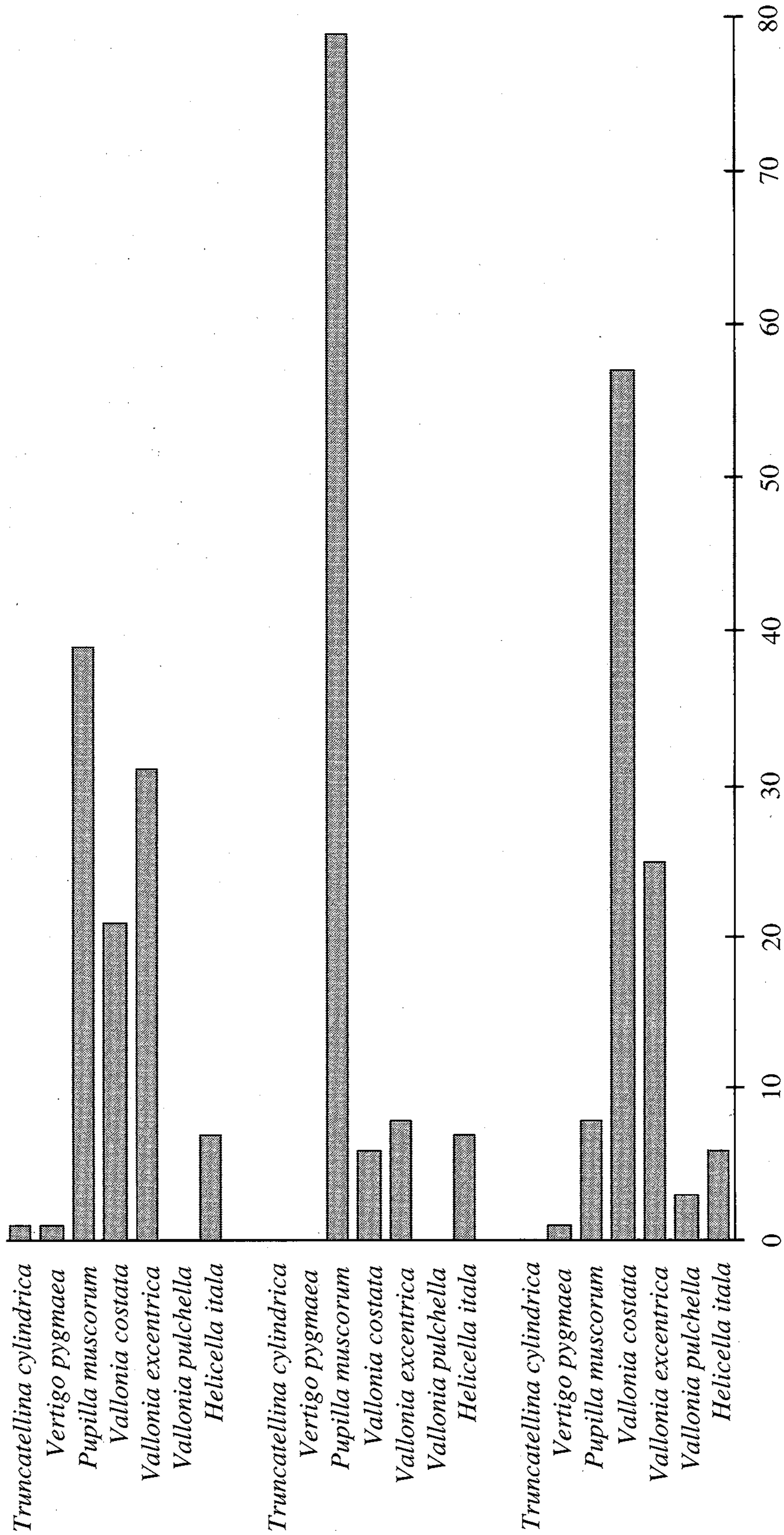


**Figure 62.** *Cambridgeshire Dykes: percentage composition of mollusc assemblages (open country component). Top: Worsted Street, Context 24, N=884. Middle: Fleam Dyke, Context 4, N=613. Bottom: Bran Ditch, Context 36, N=378.*

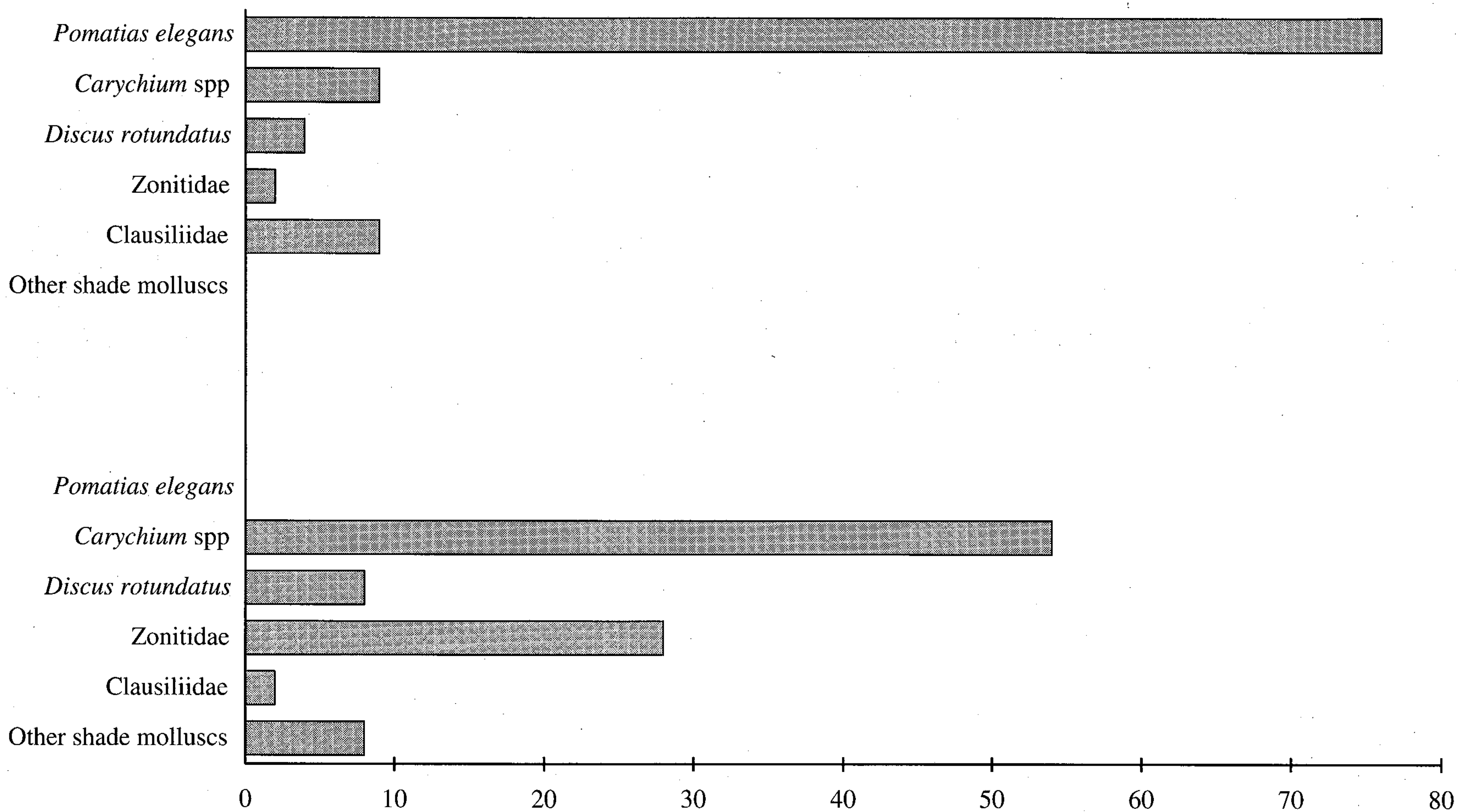


**Figure 63.** *Cambridgeshire Dykes: percentage composition of mollusc assemblages (shade component). Above: Worsted Street, Buried soil, 0.20–0.25 m. N=57. Below: Bran Ditch, Buried soil, 0.30–0.35 m. N=531.*

Accordingly, the buried soil profiles beneath the banks at Fleam Dyke, Bran Ditch, and the Roman road, or Worsted Street, were sampled as intact blocks and made into thin 'mammoth' sections (after Murphy 1985). The thin sections were described in detail (see Appendix) using the internationally accepted terminology of Bullock *et al.* (1985).

*Bran Ditch*

At this site, the bank was almost ploughed away, but consisted of a thin zone of surviving chalk rubble. Beneath this was a *c.* 0.25 m thick, very dark brown loam containing frequent fine (<10 mm) chalk fragments.

In thin section, this palaeosol had a uniform calcitic fine sand composition, with only minor amounts of organic matter and textural pedofeatures (see Appendix). There were few clues as to its past development, except for the incorporation of substantial amounts of amorphous and microsparitic calcium carbonate throughout the groundmass, infilling the void space to a greater or lesser degree.

The surviving palaeosol under the thin remnant of the chalk rubble bank was a structureless fine sand dominated by secondary calcium carbonate formation. There was no evidence of horizonation or significant textural pedofeatures. This suggests that this was a poorly developed rendzina type soil with an A horizon developed directly on the chalk subsoil. The upper humic or Ah horizon has been destroyed by subsequent oxidation and/or the construction of the bank. It is therefore a very similar profile to that observed at Fleam Dyke.

The substantial proportion of secondary calcium carbonate within the groundmass could have resulted from the burial of chalk rubble during the construction of the bank, just as apparently occurred in the Worsted Street and Fleam Dyke profiles. At this site, the subsequent infilling of the void space is probably a more recent feature caused by ploughing and leaching of calcareous soil water.

*Worsted Street*

The section cut through the surviving profile of this Roman road revealed a well preserved buried soil which had developed on the chalk subsoil, sealed beneath the road make-up. This buried soil was composed of two distinct horizons: an upper, brown, more organic silt loam and a lower, less organic, greyish brown silt loam. There were no visual indications of disturbance or truncation.

In thin section, both horizons exhibit relatively similar characteristics, although the upper horizon has a less porous structure, a slightly greater organic component and stronger brown colour (see Appendix). The whole profile exhibits a moderately well developed small blocky ped structure. The sandy loam matrix is characterised by a general absence of organic matter, partially 'cemented' by secondary amorphous calcium carbonate formation and abundant dusty clay formation within the groundmass and as coatings of quartz grains. The upper horizon, in particular, contains a much greater quantity of amorphous organic matter, and is slightly coarser in terms of its quartz sand content. There is no indication of any turf surviving in the upper part of this horizon.

The relative absence of organic matter from the lower horizon of the buried soil beneath the *agger* of the Roman road, as well as the occurrence of illuvial clays well integrated into the groundmass of the soil, suggests that this is a weathered or cambic (Bw) lower B horizon. The illuvial dusty clays indicate a degree of soil disturbance and the movement of soil fines down the profile, but this disruption could have been caused by the building of the road itself; there is no need to invoke former episodes of clearance or ploughing. The abundance of amorphous calcium carbonate formation throughout the matrix suggests continued leaching of lime-rich water, as a result of burying the chalk rubble make-up of the road, and its secondary deposition lower down the profile. The upper horizon is more or less similar to this underlying Bw horizon except for the much greater organic component. Combined with the absence of any evidence for an horizon of turf, this would indicate that this upper horizon is a lower A horizon.

This pre-Roman road profile therefore represents a poorly to moderately well developed brown earth, about 0.40 m thick. The profile has only been slightly truncated, and only its turf removed.

*Fleam Dyke*

Beneath the substantial series of surviving banks, there was a clear buried soil. Unlike that observed at Worsted Street, it was composed of one thin (*c.* 0.20 m) and homogeneous horizon. In this case, the palaeosol was a reddish brown silt loam containing common small, subrounded chalk fragments, developed directly on the chalk subsoil. In thin section, this soil horizon was indeed a silt loam with little or no organic or clay component (see Appendix). As in the Worsted Street section, the groundmass is characterised by the presence of calcium carbonate, either as coarse sand size aggregates or as an amorphous mass. There is no secondary calcium carbonate within the void space.

The high proportion of secondary calcium carbonate material suggests that this soil underwent a considerable period of leaching and calcium carbonate formation and redeposition. This was possibly associated with the disturbance caused by the construction of the bank itself. Significantly, this did not appear to have continued after the construction of the bank.

By comparison with the profile at Worsted Street, the thin single horizon here suggests a much more poorly developed soil, more of a rendzina than a brown earth, that has suffered considerable truncation. It is suspected that most of the turf and upper half of the soil was incorporated into the bank. This type of thin rendzina soil profile is generally associated with deforestation and intensive cultivation after the early Bronze Age on the chalk downlands of the Wessex region (Evans 1972; Limbrey 1975).

### *Conclusions*

Although buried soils survived at all three sites, they were not particularly informative on past environmental conditions and land-use. In general, they were thin rendzina soils (at Fleam Dyke and Bran Ditch), and a thin, very poorly developed brown earth at Worsted Street. These types of soil are generally associated with open downland types of environment, a conclusion that is in broad agreement with the molluscan data (see above).

Although these soil types were to be expected, they have all suffered some truncation of their upper humic A horizons. This truncation is probably associated with the construction of the road and banks themselves.

In addition, each soil profile exhibited considerable secondary formation and intrusion of calcium carbonates. Much of this secondary calcium carbonate deposition is undoubtedly associated with the burial of these soils by either road make-up or banks composed of chalk rubble.

## ***Appendix: the detailed soil micromorphological descriptions***

### *Bran Ditch, Fowlmere* (FOWBD93)

Trench A: Samples 1 and 2

*Structure:* apedal to very weakly developed vughy; homogeneous

*Porosity:* 20%; 15% vughs, irregular to sub-rounded, smooth to weakly serrated, unoriented, 100 µm–6 mm, almost all infilled by amorphous and microsparitic calcium carbonate, original proportion of vughs much higher, *c.* 25%; 5% channels, irregular, smooth to weakly serrated, walls partially accommodated, 100 µm–1 mm wide, 2–8 mm long

*Organic components:* <2% very fine flecks of organic matter in groundmass, 25–50 µm; <2% fine charcoal, sub-rounded to irregular, 50–100 µm and 1–2 mm with cell structure evident

*Mineral components:* Fabric 1: limit 100 µm; coarse/fine ratio: 15/85; coarse fraction: 5% medium and 10% fine quartz, sub-rounded to sub-angular, 100–500 µm; fine fraction: 10% very fine quartz, sub-rounded to sub-angular, 50–100 µm; 5% silt and 5% clay; very weakly speckled; 65% amorphous and microsparitic calcium carbonate; pale greyish brown (CPL), pale brown (PPL), pale yellowish brown (RL); *c.* 50–75% of total groundmass; Fabric 2: intrusive fabric of amorphous and microsparitic calcium carbonate; <25% of groundmass in upper three quarters of profile and up to 50% of groundmass in lower quarter of profile; also discontinuously to continuously infills void space, with *c.* 25–90% of voids infilled

*Groundmass:* fine and related: closed porphyric; coarse: undifferentiated

*Pedofeatures: textural:* occasional (5%) non-laminated dusty clay in groundmass, weak to moderate birefringence, amber (CPL); *fabric:* see Fabric 2 above; *amorphous:* very few (<2%) sub rounded sesquioxide nodules, <250 µm; few shell fragments in cross-section.

### *Worsted Street* (FULMF/91)

Profile 1/2: lower half of Context 24

*Structure:* small sub-angular to sub-rounded blocky peds, <10 mm, all partially cemented with amorphous calcium carbonate

*Porosity:* <35%; 20% interpedal channels, irregular, walls partially accommodated, weakly serrated, <1 mm wide, mainly <10 mm long with one example *c.* 5 mm long; 10% interpedal vughs, sub-rounded to irregular, weakly serrated, <2mm in diameter; 5% intrapedal vughs, sub-rounded to irregular, <2 mm; <2% intrapedal channels, irregular, <75 µm wide, <500 µm long, weakly serrated, walls partially accommodated

*Organic components:* few (2%) very fine flecks of amorphous organic matter, sub-angular, <50 µm, usually well incorporated within groundmass

*Mineral components:* limit 100 µm; coarse/fine ratio: 35/65; coarse fraction: 20% medium and 15% fine quartz, sub-rounded to sub-angular, 100–300 µm, unoriented; fine fraction: 15% very fine quartz, 50–100 µm, sub-rounded to sub-angular; 25% silt, 15% clay, and 10% amorphous calcium carbonate; weakly speckled; reddish brown (CPL), amber (PPL), orange (RL)

*Groundmass:* fine and related: porphyric; coarse: undifferentiated

*Pedofeatures: textural:* rare (<2%) non-laminated limpid clay, moderate to strong birefringence, yellow (CPL); abundant (13%) non-laminated dusty clay in groundmass and of grains, orangey red (CPL); *amorphous:* very rare fragment of shell; generally cemented with amorphous sesquioxides; very few (<2%) sesquioxide nodules, sub-rounded, <250 μm; rare (<1%) amorphous manganese staining of groundmass, <500 μm; few (5%) sub-rounded aggregates of amorphous calcium carbonate, <250 μm, within the groundmass; micrite crystals, 25–50 μm, up to 20% of the fine groundmass.

Profile 1/1: upper half of Context 24

This thin section is similar in its description to Sample 2 above, except for:

*Structure:* denser and smaller ped size than Sample 2, <5 mm

*Porosity:* <20%; 10% interpedal channels, irregular, walls partially accommodated, weakly serrated, <500 μm wide and <1 mm long; 4% interpedal vughs, sub-rounded, weakly serrated, <500 μm; 2% intrapedal channels, irregular, <50 μm wide and <200 μm long; <2% intrapedal vughs, subrounded, <250 μm

*Organic components:* few (5%) very fine flecks of amorphous organic matter, <50 μm; whole groundmass is generally 'stained' with amorphous organic matter

*Pedofeatures: textural:* *c.*10% non-laminated dusty clay of groundmass, poor to moderate birefringence, gold (CPL).

### *Fleam Dyke* (BALFD/ 91)

Profile 1

*Structure:* poorly developed, small, irregular to subangular blocky to cracked to massive structure in places, peds <5 mm

*Porosity:* <20%; 10% interpedal channels, irregular, weakly serrated, walls partially accommodated, <0.5 mm wide, <10 mm long; 5% intrapedal channels, irregular, weakly serrated, walls partially accommodated, <100 μm wide, <0.5 mm long; 5% intrapedal vughs, sub-rounded to irregular, 1–3 mm or <300 μm

*Organic component:* rare (<1%) very fine flecks of black amorphous organic matter/charcoal within fine groundmass, <50 μm

*Mineral components:* limit 100 μm; coarse/fine ratio: 15/85; coarse fraction: 5% coarse, 5% medium and 5% fine quartz, sub-rounded to sub-angular, 100–500 μm; fine fraction: 5% very fine quartz, sub-rounded to sub-angular, 50–100 μm; 50–60% silt; 20–30% amorphous calcium carbonate, often occurring in coarse sand size aggregates; medium brown to greyish brown (CPL), greyish brown (PPL), white and yellow (RL)

*Groundmass:* fine and related: closed porphyric; coarse: undifferentiated

*Pedofeatures: amorphous:* 20–30% amorphous calcium carbonate within the fine fraction; commonly occurs as coarse sand size aggregates within the groundmass; rare (<1%) shell fragment; rare (<1%) calcium carbonate replaced plant tissue.

## The Radiocarbon Determinations

Alex Bayliss, Paul Pettitt & Tim Malim

Eight radiocarbon age determinations were processed by the Oxford Radiocarbon Accelerator Unit in 1993 and 1995 (see Table 10). The laboratory maintains a continuous programme of quality assurance procedures, in addition to participation in international intercomparisons (Rozanski *et al.* 1992; Scott *et al.* forthcoming). These tests indicate no laboratory offsets and demonstrate the validity of the precision quoted.

The seven measurements from Fleam Dyke were on animal bone from the primary or secondary fills of the first phase ditch, or from material upcast to form the banks. Whilst the taphonomy of such samples is not obvious, the absence of other cultural material on the site suggests that it may relate to the use of the monument. The consistency of the results supports this interpretation. The strategy of submitting a number of items for dating was adopted to ensure that any residual samples were identified as such, as it would be unlikely that all the material dated was residual to the same extent, particularly given the lack of earlier archaeological features beneath the excavated section of the Dyke.

The single measurement from Brent Ditch was on a fragment of human bone from the primary silt. The difference in date between this item and the Roman coins from slightly further up the profile strongly suggests that this item is residual.

### *Radiocarbon analysis*

In the laboratory the bone samples were prepared by extracting the protein 'collagen', using a semi-automated continuous-flow process (Law and Hedges 1989), before purification by means of gelatinisation and ion-exchange (Hedges and Law 1989). Combustion to carbon dioxide ($CO_2$) was done using a Europa Scientific Roboprep/CHN analyser (Hedges *et al.* 1992). Correction for isotopic fraction involved measuring the $\partial^{13}C$ of a small aliquot of gas and is to within ±0.5–1.0‰. The age determination was carried out using an accelerator mass spectrometer (AMS) system filled with a $CO_2$ gas ion-source (Bronk and Hedges 1987, 1989

**Table 10.** *Radiocarbon age determinations.*

| Laboratory number | Radiocarbon age (BP) | δ¹³C (‰) | Calibrated date range (1σ) | Calibrated date range (2σ) |
|---|---|---|---|---|
| *Fleam Dyke* | | | | |
| OxA-4066 | 1580±55 | −21.8 | cal AD 410–550 | cal AD 340–610 |
| OxA-5349 | 1530±50 | −20.2 | cal AD 430–600 | cal AD 410–640 |
| OxA-5350 | 1615±50 | −21.2 | cal AD 390–530 | cal AD 260–560 |
| OxA-5351 | 1430±55 | −21.5 | cal AD 590–660 | cal AD 530–680 |
| OxA-5352 | 1535±50 | −21.2 | cal AD 430–600 | cal AD 410–630 |
| OxA-5353 | 1390±45 | −22.1 | cal AD 620–670 | cal AD 590–680 |
| OxA-5354 | 1510±45 | −21.7 | cal AD 530–610 | cal AD 420–640 |
| *Brent Ditch* | | | | |
| OxA-4065 | 2105±55 | −18.5 | cal BC 200–90 | cal BC 360–cal AD 10 |

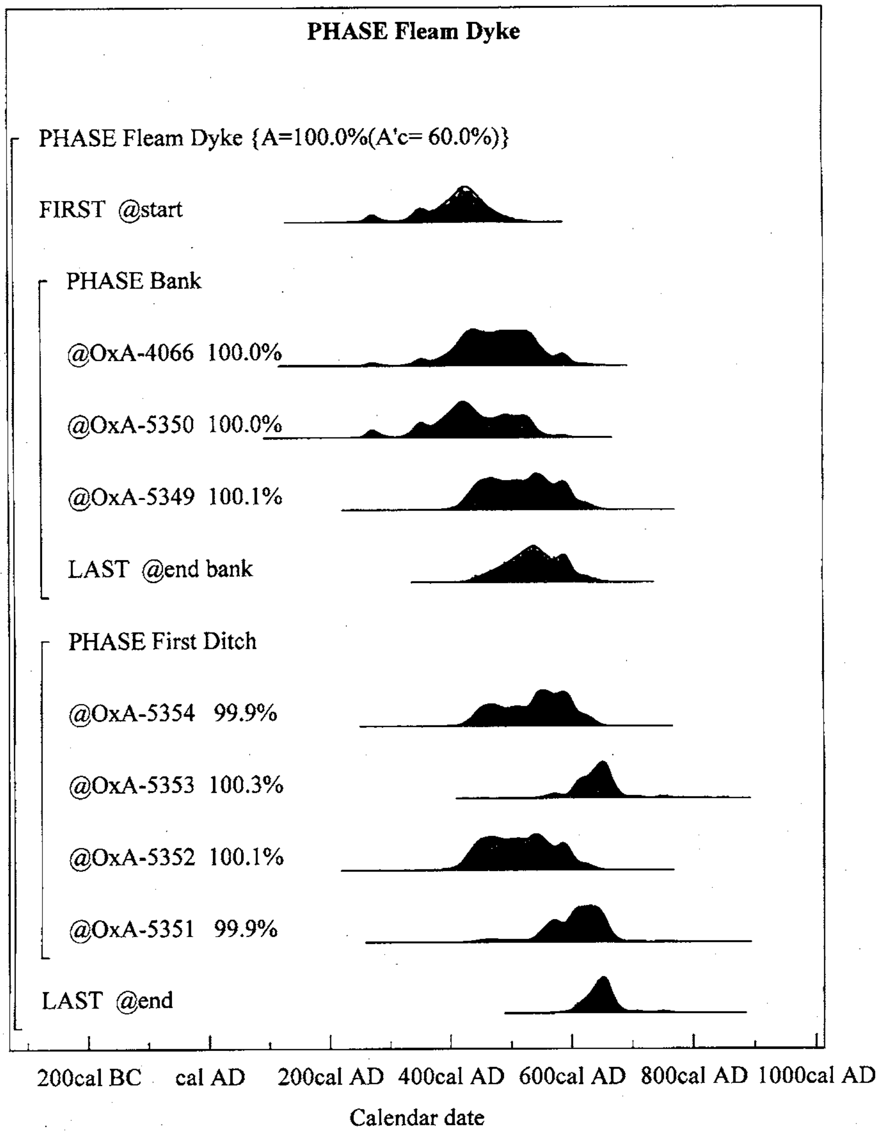


**Figure 64.** *Fleam Dyke radiocarbon dates: probability distributions.*

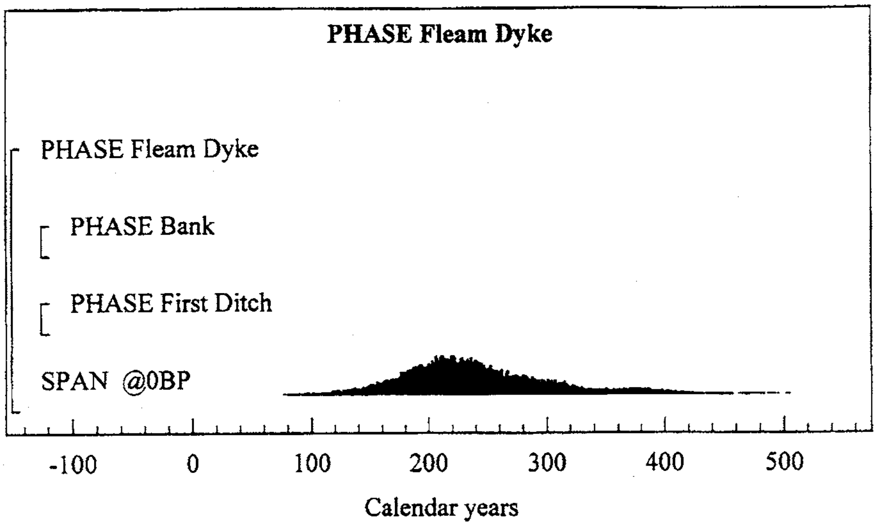


**Figure 65.** *Fleam Dyke radiocarbon dates: probability distribution for span of dated events.*

and 1990; Hedges *et al.* 1992). Uncertainties have been quoted at one standard deviation, and estimate the total error in the system including the sample chemistry. For operational details, error handling, and the estimation of background, cross-contamination, reproducibility, and accuracy, see Hedges *et al.* (1989 and 1992).

*Results*

The results are given in Table 10, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

*Calibration*

The calibrations of these results, which relate the dating evidence directly to the calendrical time scale, are given in Table 10 and Figure 64. All have been calculated using the computer program OxCal (v2.17) (Bronk Ramsey 1994 and 1995) which is based on the dataset published by Stuiver and Pearson (1986). The calibrated date ranges cited in the text are those for 95% confidence. They are quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years.

The ranges in Table 10 have been calculated according to the maximum intercept method (Stuiver and Reimer 1986) – these are best regarded as a 'shorthand' method of referring to the *date of the bones*. The probability distributions (Fig. 64) are a more accurate representation of the calibrated dates, but are obviously rather difficult to cite in text. These have been calculated using the usual probability method (Stuiver and Reimer 1993; Deckling and van der Plicht 1993; van der Plicht 1993). Ranges given in italics have been derived from mathematical modelling of archaeological problems (see below).

*Archaeological interpretation of the results from Fleam Dyke*

The best estimates of the archaeological dates of interest (for instance the start of construction) are not given by the simple ranges or probability distributions, but by estimating the dates of the events (as opposed to calculating the dates of the samples). This is an important distinction, as the 'radiocarbon dates' are no longer regarded as the answer to the archaeological question, but each as a piece of evidence to be interpreted in order to resolve a particular archaeological question – in this case the dating of the construction of Fleam Dyke. This can be done by means of 'Gibbs sampling' (Bronk Ramsey 1994). These estimates are not absolute – they can and will change as more data (such as further $^{14}$C results) are fed into the model. However, they do provide the most realistic *estimate* of the dates of the archaeological events, given the data presently available.

As mentioned above, the taphonomy of the samples we have chosen to date is unclear. All the samples were firmly attributed to contexts during excavation. However, it is not certain how the samples reached these contexts. For example, OxA-5351 (1430±55 BP; cal. AD 530–680) is a sheep/goat metatarsal from a secondary fill of the first phase ditch. This could be derived from weathering or slippage of the first phase bank, or could have been dropped during the use of the monument. The archaeological interpretation of such samples is uncertain, and so we have chosen not to include the stratigraphic order of the samples in the analysis of the results. In fact, when such information is included, the mathematical model is consistent with the extra information, and the resulting estimates are not very different (see archive). Nevertheless, we have chosen to err on the side of caution.

The methodology used below to calculate the chronological limits for the use of the monument is detailed in Bronk Ramsey (1994: 52–4). Figure 64 shows details of the model. A similar problem, which has been tackled using a slightly different methodology, has been published by Buck *et al.* (1994).

The probability distributions for the first and last dated events from the monument are illustrated in Figure 64. It should be noted that, since the dating of use is not constrained by other chronological information, this method tends to suggest that the period of use started rather earlier than it did in reality. This is caused by the scatter of the results provided by radiocarbon measurement, and is unavoidable. The analysis suggests that the monument was first constructed *between cal.* AD *330 and 510 (92% confidence)* or *cal.* AD *260 and 290 (4% confidence)*, and that the last dated use was *between cal.* AD *590 and 700 (94% confidence)* or *cal.* AD *740 and 760 (1% confidence)*. The last dated event from the bank sequence was *between cal.* AD *450 and 620 (95% confidence)*. This may be the most reliable estimate for the last dated construction, as opposed to use.

Figure 65 shows the probability distribution for the span of the dated events, and is the best estimate for the length of time over which the monument was used. In this case the method is liable to suggest that the period of use of the monument is longer than it really was. The analysis suggests that the monument was in use for *between 130 and 340 years (95% confidence)*.

Finally, it must be emphasised here that the ranges given in italics and the probability distributions shown in Figures 64 and 65 are *interpretative estimates* based on the radiocarbon measurements and archaeological evidence currently available. They can and will change if further excavation or radiocarbon dating is commissioned, or if other researchers choose to model the problem in different ways. However, we believe that the estimates for the dates of archaeological interest presented here are the most reliable and robust available on present evidence.

## The South Cambridgeshire Dykes: early medieval documentary evidence

D. Banham

Due no doubt to the Viking depredation of East Anglian and Mercian religious houses, documentary sources do not refer to the south Cambridgeshire Dykes as much as one would like. There is only one early reference to the building of any of the Dykes, and that is certainly erroneous. In any case, at least some of them must have existed before 903 (or probably late in 902, since the annal year runs from March to March), when they are mentioned in the *Anglo-Saxon Chronicle*. The context of this episode is the disputed succession to the West Saxon kingdom between Edward the Elder and his cousin Æthelwold, on the death of Edward's father Alfred the Great in 899. Æthelwold had little support within Wessex, but he made an alliance with the East Angles, now independent once more under a Viking king. The passage from the *Chronicle* reads, in translation, as follows:

> In this year Æthelwold induced the army in East Anglia to break the peace, so that they harried over Mercia until they reached Cricklade. And there they crossed the Thames, and took all they could seize both in and around Braydon, and then turned towards home. Then King Edward went after them, as fast as he could collect his army, and harried all their land *between the dykes and the Ouse* right as far north as the Fens.[1]

It has been suggested that the River Wissey is intended, rather than the Ouse, since the two names are etymologically identical, but in either case the area identified would still be south Cambridgeshire. It is unfortunately impossible to tell which dykes are meant, or even how many. When Matthew Paris (d. 1259) came to describe this episode, he apparently missed the reference to the river, and interpreted the passage as follows: 'King Edward ... followed Æthelwold as he fled towards East Anglia and, finding him with all his men prepared for guerilla warfare (*campestre proelium*) between the

1 Slightly adapted from Whitelock's (1979: 903) translation.
Her aspon Æðelwald þone here on Eastenglum to unfriðe, þæt hie hergodon ofer Mercna land oð hie comon to Creccagelade ⁊ foron þær ofer Temse ⁊ namon ægðer ge on Brædene ge ðær ymbutan eall pæt hie gehentan mehton ⁊ wendan ða eft hamweard. Þa for Eadweard cyning æfter, swa he raðost mehte his fird gegadrian, ⁊ oferhergade eall hira land betwuh dicum ⁊ Wusan, eall oð ða fennas norð. (Bately 1986: 62)

two dykes (*fossata*) of St Edmund, having urged on his own men, rushed manfully upon them.' (Luard 1872–83, vol. I: 437).

Devils Dyke was regularly known as St Edmund's Dyke in the middle ages, because it marked the limit of the jurisdiction of the abbots of Bury St Edmunds. 'Florence' of Worcester, also using the *Chronicle* as his source, described the same territory as lying *inter terrae limitem sancti regis Eadmundi et flumen Usam* ('between the boundary of the holy King Edmund's land and the river Ouse': Thorpe 1848–9, vol. I: 119). But which other dyke Matthew Paris may have had in mind, it is hard to tell. As he was a monk of St Albans, he may not have been particularly familiar with south Cambridgeshire, so his words should not be taken as evidence that two of the dykes were attributed to St Edmund in his time. He may, reading *betweox dicum* as 'between the dykes', have simply assumed that there were two dykes close together and they must both belong to the saint.

Returning to the tenth century, when Edward the Elder finally conquered the Scandinavian kingdom of East Anglia in 917, he seems to have circumvented the Dykes by fighting the East Anglians away from their home territory, first killing their king at Tempsford in Derbyshire, then attacking Colchester and finally seeing them off at Maldon (Stenton 1971: 328–9). It may be that he simply preferred for personal reasons to subdue Essex before East Anglia, and that this worried the now leaderless East Anglians into attacking his garrison at Maldon and dissipating what remained of their strength, but it seems more likely that Edward, well known as a canny campaigner, was deliberately avoiding the Icknield Way bottleneck with its numerous obstacles.

This is the last we hear (or rather, do not hear) of the Dykes in a military context, but, later in the tenth century, we find a reference to a *dic* in the bounds of land at West Wratting granted by King Edgar to his thegn Ælfhelm Polga in 974. It is likely that these bounds are older than the charter in which they occur: while the charters in which they are recorded are normally in Latin, charter bounds are nearly always in Old English, and it is thought that this is because the bounds of estates were preserved orally by the local inhabitants. Thus they must by definition have existed before the charter was drawn up. This is even more likely here, since there is a discrepancy between the hidage stated in the grant (two and a half) and in the bounds (three). However, it is not possible to say just how much older than 974 these bounds might be, since this is the first document in which they occur. The text of the bounds, in translation, reads as follows:

> These are the land bounds of the three hides at Wratting, in wood and field, as it lies within the boundary. First, at the high gate, from the gate east along the street [to the boundary of Weston – crossed out], from the field to the wood boundary, along the boundary to the boundary of the [......]ldings, along the boundary to Wickham [......] boundary, along the boundary to Yen Hall, from the boundary of Yen Hall to the boundary of Balsham, along the boundary that [i.e. then] to the [...] *ditch again.* [2]

Despite the lacunae in the text, most of the course of these bounds can be traced on the map. The road still known as the Street, once part of a major local routeway, leads east from where the Icknield Way crosses Fleam Dyke at Mutlow Hill, presumably the high gate (see Fig. 33 and Fox and Palmer 1923: 32–33). Evidently the Dyke still presented a functional barrier when the bounds were drawn up. The deletion of 'to the boundary of Weston' may be connected with the reduction in size from three to two and a half hides. If the line of the bounds does not run along the boundary with Weston, its course is now obscure, since the field and the wood boundary cannot be identified, and nor can the '.......ldings'. The only place-name in the vicinity containing the element *-inga*, 'people of', is Willingham Green, and, while the form of that name is suitable, the bounds, if they went that far, would include Weston, and thus make the estate much bigger, rather than smaller. After this the bounds are clearer, following the boundaries of West Wratting with West Wickham, Yen Hall (evidently then a separate estate) and Balsham before reaching the Dyke. Although this is not stated, the bounds then presumably return along the Dyke to the gate. In other words, the boundaries of the 974 estate did not differ much from those of the modern parish.

Still in the tenth century, Abbo of Fleury wrote a *Life of St Edmund* while staying at Ramsey Abbey between 985 and 987. This begins with an account of the origins of the kingdom of East Anglia and a description of its terrain, including the following sentence:

---

2 Ðis syndon þara preora hide land gemæra æt wræt tinge wudes ⁊ feldes swa hit binnan þæm mearcum beluð. ærest æt ðan hean gatan fram ðan gatan east ⁊lang stræte ~~oð west tuniga gemæra~~. of þæm felde on þa wude mearca ⁊lang pæs mæres oð [......]ldinga gemæra ⁊lang gemæres oð wichamme [......] gemære ⁊lang gemæres to eanheale of eanheale gemæra to bellesham gemære ⁊lang gemæres þæt [*sc.* ponne] eft on þa [...] dic. (Birch 1885–99, vol. 3: 628–9; Sawyer 1994: no. 794.)
The charter was preserved at Ely, to which house Ælfhelm left the estate *for his sawle* in his will (Whitelock 1930: no. 13; 30–5).

'On that side where the sun sinks to its setting, this kingdom is continuous with the rest of the island, and thus open; but so that the frequent irruptions of the enemy should not break in, it is protected by a rampart in the form of a high wall [and] a ditch in the earth.' (Winterbottom 1972: 69–70). Again, it is not certain that Abbo had actually seen the dyke he was writing about; it is perhaps most likely that he knew that the jurisdiction of St Edmund's was delimited by such an earthwork, and believed that this also marked the boundary of the former kingdom. However, it is not clear whether St Edmund's jurisdiction did extend this far in Abbo's time. The earliest reference I have found to *fossatum Sancti Edmundi* is that of William of Malmesbury, *Gesta Pontificum*, *c.* 1125. 'King Cnut ordered the ditch to be built,' he writes, clearly wrongly, but he may be preserving a tradition that Cnut (1016–35) fixed the boundary of the abbots' jurisdiction at the Dyke (Hamilton 1870: 154).

On the subject of names, both Fleam and Devils seem most commonly to have been referred to simply as the *dic* or *le Micheldyche*, *magnum fossatum* (both 'great ditch') throughout the middle ages (Reaney 1943: 34–5). Fleam Dyke is an early name, first appearing in various forms in Domesday Book and its companion volumes as a hundred name (modern Flendish). The early forms point to a derivation from Old English *fliem*, 'flight', or *flieming*, 'fugitive'. According to Reaney (1943: 140) this is quite a common association with linear earthworks; this may be because fighting usually ended in defeat and flight for one side or the other, or because the ditches later served as refuges for the homeless or fugitives from the law.

Devils Dyke or Ditch is a post-medieval name, presumably deriving from a belief that anything that big must be of supernatural origin; in the Middle Ages, when it was not St Edmund's or just the great dyke, it was usually called Reach Dyke, as for instance in the account of the siege of Ely by William the Conqueror in the *Liber Eliensis*. Here, one of the men posted by the king as a guard *apud fossam de Reche* explains how Hereward the Wake's men had passed by them, set fire to Burwell, and then attacked the Dyke (Blake 1962: 182). The *Liber* would presumably not have presented the Dyke as defensible if this were not plausible to its audience.

Bran and Brent Ditches both have early forms in Brang- or Brank- (Reaney 1943: 33). This may conceivably be connected with the verb 'brank', to prance or strut, but this is not recorded before the late Middle English period, and it is hard to see what it would mean in relation to dykes. At any rate, they are not burnt ditches, nor connected with the Celtic hero Bran, and Reaney (*ibid.*) discounts 'brant' or 'brent' meaning steep.

The larger Dykes are mentioned in the 1279 Hundred Rolls for Cambridgeshire: Bran (Branedich: Illingworth 1812–18, vol. II: 546) in the bounds of a warren in Fowlmere, Devils (*magni fossati*, Brayedich: *ibid.*: 484) in those of Swaffhams Prior and Bulbeck, and Fleam in those of Great Wilbraham (*magnam fossam*) and of the land of Gilbert of Dunmow's tenants in Fulbourn (*magno fossato*, Flemigdich: *ibid.*: 445). By now it seems that their main function is the demarcation of local boundaries: there is no longer a political division between Mercia and East Anglia, the forests are almost gone from the claylands, and the fens, although now getting wetter again, are less sparsely inhabited, and drainage, albeit sporadic and largely unsuccessful, has been going on since probably the tenth century.

## Overview and Discussion: the Landscape of the Dykes during the Roman–Saxon Transition

Tim Malim

The results of the recent work reported in the preceding pages not only endorse much of our existing knowledge and interpretation of the Dykes, but also considerably elaborate many of the details. It is difficult to better the investigation strategies and logical arguments characteristic of Fox's work, even with the benefit of the technology available to us today. We can, however, hone our interpretation, and thus redefine the debate about these monuments, and we need to reappraise accepted wisdom in the light of new avenues of research.

The original research aims of the present project were designed to investigate the constructional episodes of each Dyke, to record their subsequent history of decay, to date their construction accurately, and to establish the contemporary environment in which they were built. These aims have been largely achieved. Fleam Dyke has provided samples that for the first time allow a chronology based upon absolute rather than relative dating methods. Thus we have been able to establish with reasonable precision that the original construction of this earthwork took place during the fifth century, and that its main phases of use occurred during the fifth and sixth centuries (as first sug-

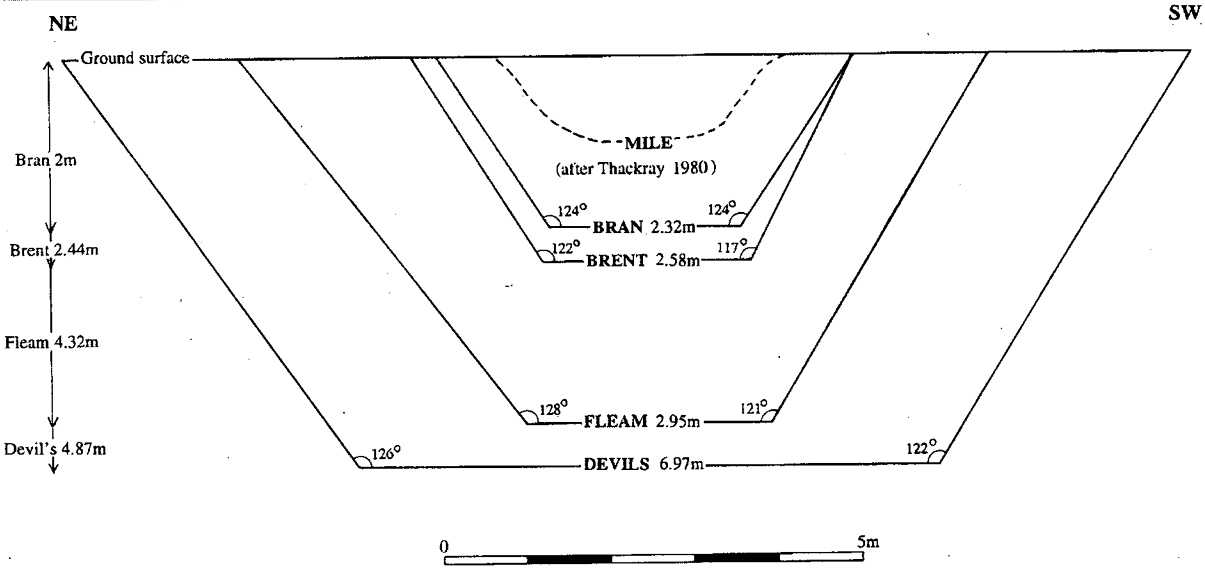


**Figure 66.** *Cambridgeshire Dykes: comparative ditch profiles based on average dimensions from all available excavated data (see Table 11). (Note: the Mile Ditches profile is taken from David Thackray's 1980 observation of the westernmost ditch).*

gested by Fox and Palmer 1924: 25), with secondary construction (the classic profile of the steep-sided, flat-based ditch) probably in the sixth (see Bayliss *et al.*, above) and continued use into the seventh century. Such scientific dating is supported by the stratigraphic and artefactual evidence, which includes a fourth-century Roman coin in the marker bank or turf core for the earthern rampart (created by excavation of the first phase (V-shaped) ditch). This first stage of bank construction was sealed by a temporary stabilization layer within the Phase I bank, which contained bone giving the earliest $^{14}C$ date of *cal.* AD *330–510*, and bone from the last phase of bank construction was dated *cal.* AD *450–620* (see Bayliss *et al.*, above). The historical importance of this is that it places the beginnings of Fleam squarely in the darkest part of the Dark Ages, the immediate post-Roman period, when Anglo-Saxon peoples were establishing themselves over several generations as local communities, and in so doing must have produced a complex pattern of relationships with indigenous populations, and between disparate elements among the migrants.

The landscape in which all the Dykes were built appears to have been remarkably similar, to judge by the evidence of recent work (see French, and Murphy, above) and Hope-Taylor's excavation in 1973 (Dimbleby, and Thomas, above). The molluscan, pollen and soil-micromorphological analyses all point to a largely treeless landscape of thin rendzina or brown earth soils with short-turf (grazed) grassland, but with local variations apparent at each site (for example, the proximity of the northern end of Bran Ditch to wet areas was apparent, and suggested a water-carrying ditch, whilst a woodland phase was possibly of earlier date). It is perhaps significant that samples from Worsted Street suggested a slightly different landscape, in that a brown earth with a woodland or scrub phase was identified, shortly pre-dating the open conditions contemporary with the making of the road (early?) in the Roman period, and thus considerably earlier than the post-Roman Dykes. It was also noted that truncation of soil profiles was consistently evident, as would be expected in earthworks that mounded up the topsoil as a first stage of construction.

*Concept, engineering and design*

All the Dykes and Worsted Street begin or terminate at their north-western ends in wet areas, often with springs, and at their south-eastern ends in the hills which form the tail of the Chilterns, precisely at the junction of the chalk with the Boulder Clay plateau (Fig. 2). This is also largely true of the Mile Ditches, but not of the dykes further west around Baldock and Luton, which tend to run in shorter lengths and are often parallel to the Icknield Way (Bryant and Burleigh 1995; Burleigh 1995). The Icknield Way and other routes into East Anglia were cut at right angles by the Cambridgeshire Dykes and Mile Ditches, whereas Roman roads tend to run parallel or at an obtuse angle to them. All the Dykes have ditches on the west

**Table 11a.** *Cambridgeshire Dykes: table of fieldwork. Ditch details.*

| Name | Excavator | Date of excavation | Trench location | Marker ditch | Width Top | Width Base | Depth from ground surface | Profile | Angle SW | Angle NE | 1st phase | 2nd phase | 3rd phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mile Ditches | Beldam | 1868 | | | 3 ditches = 30m | | 1.5 | | | | | | |
| Mile Ditches | Crawford | 1934 | (W -West<br>C -Central<br>E -East) | | W-$3^{1}/_{2}$ 'paces'<br>C-$2^{1}/_{2}$<br>E -$2^{1}/_{2}$ | | | | | | | | |
| Mile Ditches | Burleigh | 1978 | TL 333 403<br>N side A505 | | W -3.5<br>C -2.0<br>E -3.0 | 0.2 approx | W -1.2<br>C -0.75<br>E -0.95 | W-flat, narrow<br>C & E - dished | 150 - 160 | 150 - 160 | Chalk nodules | Slow silting | Levelling of banks C19 |
| Mile Ditches | Thackray | 1980 | TL 333 403<br>S side A505 | | W -3.9<br>C -2.0 | | W -1.0<br>C -0.9 | W-flat base<br>C-dished | | | | | |
| Bran | Beldam | 1868 | Icknield Way area | | | | | | | | | | |
| Bran | Fox & Palmer | 1923 | A | Yes | 5.3 | 2.7 | 1.5 | Slightly dished | 115 | 125 | Organic 'black soil' | Loamy earth 'recent' infill, *c.*1870 | |
| Bran | Fox & Palmer | 1923 | B | Yes | 6 | 3 | 1.2 | Irregular or recut? | 145 | 125 | Organic 'black soil' | Loamy earth 'recent' infill, *c.*1870 | |
| Bran | Fox & Palmer | 1923 | C | Yes? | 6 | 3.6 | 1.5 | Slightly dished base + burial | c 125 | c 125 | Chalk original weathering | Loamy earth 'recent' infill, *c.*1870 | |
| Bran | Fox & Palmer | 1923 | D | | 4.9 | 1.8 | 2.0 | Flat base | 115 | 110 | Chalk original weathering | Loamy earth 'recent' infill, *c.*1870 | |
| Bran | Fox & Palmer | 1923 | E | Yes? | 4.8 | 1.4 | 2.13 | Flat base | 125 | 120 | Chalk original weathering | Loamy earth 'recent' infill, *c.*1870 | |
| Bran | Fox & Palmer | 1923 | F | ? | 4.9 | 2.7? V-shape below | 2.4 | V-shape (near to brook) | 130 | 120 | Chalk | Loamy earth | Recut |
| Bran | Fox & Palmer | 1923 | G | Yes, with chalk fill? | 4.3 | 1.4 | 2.3 | Flat base | 120 | 125-135 | Chalk mostly SW side | Loamy earth | |
| Bran | Fox & Palmer | 1923 | H | | 5.2 | 2.3 | 2.3 | Flat base | 135 | 105 | Sandy chalk mostly SW side | Sandy earth with hearth | |
| Bran | Lethbridge & Palmer | 1925 | Icknield Way area | Yes? | | 1.83? | 2.70? | Flat base | 120? | 135? | Frost talus | Hearth and infill | Gravel metalling and more infill |
| Bran | Lethbridge & Palmer | 1927 | Fox's A | | | | | | | | | | |
| Bran | Lethbridge & Palmer | 1927 | 'Fowlmere Path' 41m from D | | | | | | | | | Uniform fill to base | Gravel metalling at ground level |
| Bran | Lethbridge & Palmer | 1927 | Fox's D | Yes, possibly = 'mid ditch' | | | | | | | | | |
| Bran | Lethbridge & Palmer | 1927 | Fox's C | | | | 2.44 | | | | 0.3 m with AS sherds above | | |

**Table 11a** (continued). *Cambridgeshire Dykes: table of fieldwork. Bank details.*

| Earlier ditch | Berm | Original core or marker bank | Width | Surviving height | Phases | Contemporary revetment | Contemporary Environment | Dating |
|---|---|---|---|---|---|---|---|---|
| | | 4 banks recorded | 3.95 Earth bank and ditch | 1.5 | | | | |
| | | | Overall width of ditches 21 paces | W-Bank either side C-east side | | | | Prehistoric or RB on morphology |
| | | | 22 Overall widthof ditches | Last bank portions levelled 1940 | | | | Horse jaw in basal fill of W ditch 2040±80 BP (250 cal BC–AD120) RB & Med finds in fills |
| | | | 24.4 Ditch + bank | 2.13 m | | | | No dates |
| Yes - Fox's ditch Y | | | | No evidence of bank found | | Probably but not identified as such by Fox; Fox's ditch X | Black earth as primary ditch fill indicating 'settlement' | IA & RB pot in primary ditch fill |
| | | | | Levelled in C19 | | Probably but not identified as such by Fox; Fox's ditch X | Black earth as primary ditch fill indicating 'settlement' | C3 RB pot in primary ditch fill |
| | | Thin layer of chalk nodules | | Levelled in C19? | 1? | | Possible buried soil | C3 RB pot in ditch fill W–E skeleton in base of ditch (probably later insertion) |
| | 3.5 m with burial | Earth bank | | | 1? | | | No dates |
| | | Chalk rubble? Possible SW counter-scarp | Spread 18.3? | 0.75? Spread earth bank | 1? | | | Knife and RB potsherd in ditch fill |
| | | | | Possible bank — or ancient ground level 0.9 m | 1? | | Wallington Brook 27m to south. Marshy ground and no evidence for a bank. Also test pit with slightly shallower ditch 9m south of Wallington Brook. | No dates |
| | | | | Footpath on bank? | | | | Unabraded C12? pottery in ditch fill |
| | | | | Footpath on bank? | | | | Hearth 2 m deep in ditch, near base |
| | Yes | Yes | | | 3 Phases with road on top | | Possible buried soil | Horse shoes and nails; boot cleats |
| | | | | | | | | Late med. pottery beneath metalled surface; horseshoe nails in metalling |
| | | | | | | | | IA and RB pottery |
| 2 'earlier' | 4.88 m wide with postholes | | 8.53 | 0.68 | | Probably but not identified by Lethbridge ('back ditch') | | Unabraded AS pottery in base of ditch |
| | | | | | | | Buried soil | 50 burials inc. decapitations and mutilations; AS knife and belt fitting |

**Table 11a** (continued). *Cambridgeshire Dykes: table of fieldwork. Ditch details.*

| Name | Excavator | Date of excavation | Trench location | Marker ditch | Width Top | Base | Depth from ground surface | Profile | Angle SW | Angle NE | 1st phase | 2nd phase | 3rd phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bran | Leaf & Lethbridge | 1931 | 269m N(?) of Fowlmere-Royston road | | | | | | | | | | |
| Bran | Taylor | 1968 | TL 41744262 210m NW of Heydon Grange | | 6.4 | | Not bottomed | | 120 | 130 | | | Light brown chalky loam |
| Bran | Welsh | 1993 | Trench A | | 5.75 | 2.45 | 2.1 | Flat base | 110 | 140 | Rapid weathering | Cleaning out | Stable profile. Slow accumulation |
| Bran | Welsh | 1993 | Trench B | | 5.3 | | 1.49 | Flat base | | | Water deposited chalk | Silty layer | Stable profile Slow accumulation |
| Brent | Taylor | 1968 | TL 51104803 366m SSE of Pampisford Hall | Yes? - at back of bank only | 9.14 | 2.44 | 2.13 | Flat base | 135 | 150 | | Sandy loam | Dark brown loam, 4th phase of sand and gravels |
| Brent | Robinson | 1992 | A | | 7.5 | 2.6 | 2.8 | Flat base | 110 | 110 | Initial rapid weathering | Stabilised slow accumulation | Post-medieval ploughing-in |
| Brent | Robinson | 1992 | B | | 7 | 2.7 | 2.4 | Flat base | 105 | 105 | Initial rapid weathering | Stabilised slow accumulation | Slight post-medieval ploughing-in of bank |
| Fleam | Fox & Palmer | 1921 | I | Yes | | 3.73 | 4.88 | Base sloping down to NE | 110 | 115 | Frost talus | Silts | Very late infill, 18th century? |
| Fleam | Fox & Palmer | 1921 | II | | | | | | | | | | |
| Fleam | Fox & Palmer | 1921 | III | Yes | | 2.71 | 4.57 | Flat base ? | 125 | 125 | Frost talus | Silts | Very late infill, 18th century? |
| Fleam | Fox & Palmer | 1921 | IV | Yes | | 3.05 | (4.57) | ? | 110 | 120 | | | |
| Fleam | Fox & Palmer | 1921 | V | Yes | | 2.97 | 3.81 | Base sloping down to NE | 120 | 130 | Frost talus | Silts | Very late infill, 18th century? |
| Fleam | Fox & Palmer | 1921 | VI | Yes | | 2.89 | 4.57 | Base sloping down to NE | 120 | 130 | Frost talus | Silts | Very late infill, 18th century? |
| Fleam | Fox & Palmer | 1921 | VII | Yes | | 2.13 | 4.57 | | 120 | 140 | Frost talus | Silts | Very late infill, 18th century? |
| Fleam | Fox & Palmer | 1921 | 1 | | | | | | | | | | |
| Fleam | Fox & Palmer | 1922 | 2 | | | | | | | | | | |
| Fleam | Smith | 1971 | Fulbourn pumping station TL542548 | | 12? | | | | 150 | 145 | Chalk and clay | Silts | Very late infill, C18 (chalk) |
| Fleam | Taylor | 1976 | Near The Ambush, beyond scheduled area | | | | | | | | | | |
| Fleam | Wait | 1991 | A11 south side | Yes | 10 | 3.2 | 3.3 | Sloping down to NE | 115 | 120 | Frost talus | Silts | Slumping from bank, 4th phase late infill |
| Fleam | Pelling | 1992 | A11 south side | | | | | | | | | | |

**Table 11a** (continued). *Cambridgeshire Dykes: table of fieldwork. Bank details.*

| Earlier ditch | Berm | Original core or marker bank | Width | Surviving height | Phases | Contemporary revetment | Contemporary Environment | Dating |
|---|---|---|---|---|---|---|---|---|
| 'earlier mid-ditch' | 2.44 m wide | Yes | 4.88 | 0.61 | | Probably but not identified by Lethbridge ('mid ditch') | Buried soil | 6 burials with wounds; C5? pottery (revised Lethbridge 1935) |
| No 'earlier' ditches | | | | | | | | No dates |
| | 1.5 | Yes | 9.3 | 0.13 | | Yes | Buried soil: tall damp grass-land; open down-land. Ditch:periodic flooding, open continuously | Late IA & RB pottery beneath buried soil |
| | | | | None found | | | | No dates |
| Possibly, or marker ditch for bank | Ledges both sides | | 8 | Less than 1m | | | Buried soil | No dates |
| | Probable | | | None visible but rise in chalk | | | | No dates |
| | | | | Ditch fills circumstan-tial evidence | | | Molluscs: open country | Human bone 110 cal BC (351 BC–AD 17) from primary fills; RB coins 2nd century |
| | | | | | | | Buried soil | RB pot in ditch |
| | | | | | | | | Medieval pot in ditch at 0.75m |
| | | Yes | 15.85 | 3.6 | 1, 2, 3 | | Buried soil | |
| | | | 12.8 | 3.05 | 1?, 2 & 3 +? | | Buried soil | 1st century AD Roman and IA pot sherds |
| | | Yes | 12 | 3.6 | Several | | | |
| | | | 11? | 3 | Several | | | |
| | | Yes | 14 | 3 | 1, 2, 3 | | Buried soil — thin rendzina; open country, grassland | 1st bank cal AD 330-530; 2nd 380-560; 3rd 440-630. Phase 1 ditch silts 410-590. C2 Roman pot, C4 coin |
| | | Yes | 17 | 4 | 1, 2, 3 and 4 | | | |

**Table 11a** (continued). *Cambridgeshire Dykes: table of fieldwork. Ditch details.*

| Name | Excavator | Date of excavation | Trench location | Marker ditch | Width Top | Base | Depth from ground surface | Profile | Angle SW | Angle NE | 1st phase | 2nd phase | 3rd phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Devils | Fox | 1923-4 | I | | | | | | | | | | |
| Devils | Fox | 1923-4 | II | | 18.3 | 5.8 | 5.2 | Flat base | 140 | 145 | Frost talus | Silt | |
| Devils | Fox | 1923-4 | III | | 18.5 | 6.9 | 5.4 | Flat base | 120? | 115 | Frost talus | Silt | (Recent?) Chalk rubble |
| Devils | Fox | 1923-4 | IV | | c 15.2 | 8.2 | Approx 4.9 | Flat base | 115 | 115 | Frost talus | Silt | |
| Devils | Hope-Taylor | 1973 | | | | | | | | | Chalk from erosion (frost talus) | Loamy silts; delib. infill from counterscarp bank | |
| Devils | Wait | 1991 | | | | 7 | 4 | Flat base | 115 | 130 | Frost talus | Slow accumulation loamy silts | Modern topsoil |

Notes:
1 Dykes listed in order from west to east with Mile Ditches at beginning for comparison.
2 All measurements in metres: all conversion calculations from feet to metres at 0·3048.
3 This table does not include all finds of burials at Fleam and Devils Dykes: see Lethbridge 1958.
4 IA and RB pottery generally referred to as 'abraded' by excavators.
5 Since this table was compiled a further section has been excavated across Bran Ditch at Heydon Grange: see Lee 1996.
6 SAM=Scheduled Ancient Monument; SMR=Sites & Monuments Record.

**Table 11b.** *Cambridgeshire Dykes: topography at terminals and present status of monuments.*

| Name | Terminals SE End | NW End | Status | Parish boundary | Footpath | Survival |
|---|---|---|---|---|---|---|
| Mile Ditches | Therfield Heath chalk 85 m OD | Bassingbourn Springs 30 m OD | SAM 244 SMR 3353 | No | No | Cropmarks |
| Bran | Boulder clay, hills 120 m OD | Black Peak Fowlmere Moor 25 m OD spring | SMR 7802 | N of Heydon Grange | S of Icknield Way | Field Boundary |
| Brent | Boulder clay spur, 80 m OD | Dickmans Grove spring feeds tributary of Cam 30 m OD | SAM 2 SMR 6227 | No | No | Earthwork ditch |
| Fleam | Boulder clay 90–100 m OD | Shardelows Well, Fulbourn Fen, 15 m OD Wilbraham river | SAM 6 SMR 7889 | Yes | Yes | Earthwork bank and ditch |
| Devils | Boulder clay 100 m OD | Reach Lode (Fen) 3 m OD | SAM 5 SMR 7801 | Yes | Yes | Earthwork bank and ditch |

side and banks on the east (whereas Crawford's (1934) evidence suggests that a bank also occurred on the *west* side of the Mile Ditches); thus they effectively barred access to the east and linked the lowland rivers and fens with the local uplands. The general south east to north west alignment can be seen in many features including the Dykes, Mile Ditches, Roman roads such as Ermine Street and Worsted Street, and field boundaries (medieval furlongs?) seen on air photographs and reported by Crawford (1937). This pattern is a product of the hills that form the eastern continuation of the Chilterns, running in a south west to north east direction immediately south of Royston and Newmarket, to which major archaeological features have been aligned at right angles.

The Dykes are all extremely similar in overall design, but they are distinct in individual execution, suggesting that they were neither planned nor undertaken as a single programme, but rather followed a known model, amended for each in turn. The diagram in Figure 66 shows the comparative ditch sections of all four

**Table 11a** (continued). *Cambridgeshire Dykes: table of fieldwork. Bank details.*

| Earlier ditch | Berm | Original core or marker bank | Width | Surviving height | Phases | Contemporary revetment | Contemporary Environment | Dating |
|---|---|---|---|---|---|---|---|---|
| | | Yes, NE side of bank | 19.8 | 4.5 | Single | | Buried soil | 377 sherds RB pot from buried soil, mostly C2, some C3–4. C3 coin |
| | | Yes | 22 | 4.6 | | | Buried soil | IA and RB pot from buried soil. Fragment of human jaw from ditch |
| | | Yes | 18.9 | 4.6 | | | Buried soil | IA and RB pot from buried soil and ditch. Small horse skeleton, C16 pottery in ditch |
| | | Yes | 23 | 5.3 | | | | No dates |
| | | Yes and counterscarp bank ?on SW side of ditch | | | Single | | Buried soil. Pollen: grazed grassland. Molluscs: grassland | C4 RB coin in buried soil. Ditch burial cal AD 1180–1290 (BM966). Potsherds above burial 1000–1200 |
| | | | | | | | Ditch fill: open country, probably grazed | No dates |

Dykes, using average dimensions for each based upon all available excavated data (see Table 11), and includes measurements of the Mile Ditches for comparison, although it excludes the first phase of Fleam. This clearly shows the systematic increase in scale from the westernmost Dyke (Bran) eastwards to the massive Devils Dyke. The maximum variation between the four averages is 4.65 m for the basal width of the ditch, 2.87 m for the depth, and 7° and 6° for the angles of the south-west and north-east sides respectively. This demonstrates that the slope of the ditch, as well as its flat base, was a crucial and constant factor common to all the Dykes, which can be expressed as the ratio between optimum defensive steepness and least erosion. In the case of Devils, this equilibrium appears to have been achieved for the bank as well as the ditch, as Fox and Hope-Taylor have described (Fox 1925; Hope-Taylor 1976; and Fig. 51): a massive piece of engineering executed in a single phase, which needed no maintenance or remodelling even after settling and weathering, as revealed by the minimal natural infill and lack of evidence for recutting at any of the excavated sections. Perhaps this optimum design was achieved only after several previous attempts, which would be consistent with Devils being the latest in the sequence.

All the main ditches show similar patterns of infill: frost talus (representing initial erosion), followed by a long period of very slow silt accumulation, and then subsequent, probably deliberate infill, from post-medieval times onwards, but especially prevalent after enclosure. However, at Fleam there were two other important dimensions to the ditch: a first phase V-shaped ditch and at least one major recut of the fills in the main ditch (Fig. 37), clearly showing major reuse over a long period of time; this would accord with a theory of the Dykes as defensive boundaries moving back and forth across the region depending upon military conditions. This first phase of construction at Fleam shows the original core of the bank close to the edge of a V-shaped ditch, which is not paralleled in the other Dykes. At Devils there is a similar original core bank, composed of stripped topsoil and turves mounded up as a marker – but this occurs at the rear (north-eastern side) of the bank, a considerable distance from the ditch; a counterscarp on the south-western side has been argued for by both Fox and Hope-Taylor, which would mean that there had been a second marker 'bank' on this side, indicating the full width within which the dyke builders had to operate. At Brent a shallow ditch at the rear (north-eastern side) of the bank, observed by Taylor (1969), might have been a similar marker.

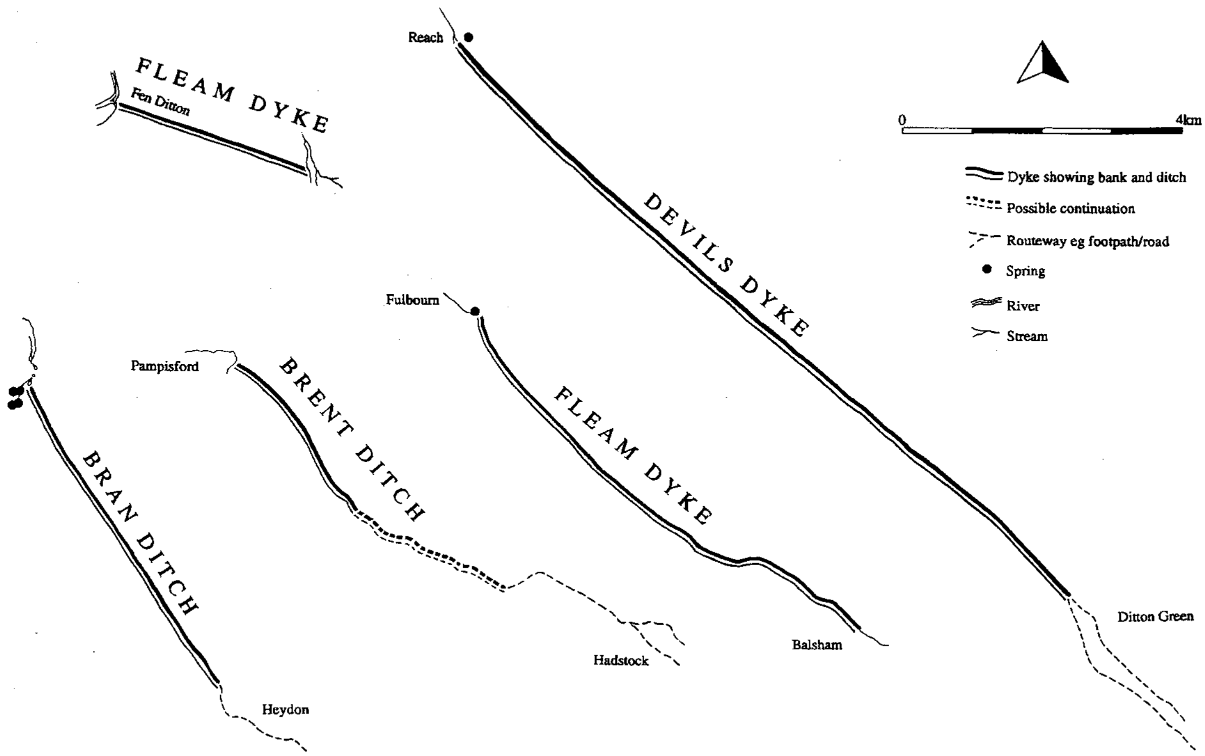


**Figure 67.** *Cambridgeshire Dykes; comparative plans. Note the straightness of Bran and Devils in comparison to the more sinuous course of Brent and Fleam.*

There are other aspects of Fleam that suggest differences from the rest of the group. Fox remarked on the standstill stages in its construction, and a visit to the monument today reveals lengths with slightly different undulations, possibly suggesting mounding and slumping at the junctions of portions built by different work gangs. Fleam is a very sinuous monument, similar to but far longer than Brent, but distinctly different from the much straighter courses of Devils and Bran (Fig. 67). The southern end is known to have continued beyond its present termination, just beyond Dungate Farm, to Oxcroft Farm (Palmer 1935: 33–34), and at its northern end there are three possible termini, one of which is its present end at Shardelow's Well and Ashwell Street; however, air photographs and nineteenth-century maps (such as the first edition OS) show that an arm of the Dyke ran obliquely to the north east, past a possible henge, to meet with Wilbraham River at a Neolithic causewayed enclosure, and this may have been its original end (Figs 33 and 35). The river and Wilbraham and Teversham Fens would have formed a wet barrier, and on their northern side a further ditch and bank ran to the third possible terminus at Fen Ditton (Fig. 1). This has been known as the northern Fleam Dyke and can be seen today as High Ditch Road. Anglo-Saxon burials were found at its southern end on Newmarket Road in 1957 (Lethbridge 1958; Hutchinson 1964). It would seem that these three northern termini reflect the composite nature of the monument and its successive phases of construction. The arm from Shardelow's Well to Great Wilbraham is *probably* a later addition to the main Dyke, and possibly much later. In 1990, the laying of a water pipeline presented the opportunity to observe this northern extension close to Shardelow's; it was reported as consisting of a ditch 10 m wide and 1 m deep (Ette 1993: 9). The field records, however, suggest that this 'ditch' may in fact have consisted of lynchets. Although the pipeline must have crossed the line of the northern extension, conditions on such schemes are often not ideal for observing complex archaeology; if this feature was part of the original Fleam Dyke, it would have been substantially deeper than one metre and evidence ought to have survived for a bank on the east side (as can be seen in air photographs (Fig. 35)).

The continuation to Fen Ditton, on the other hand, would seem to be contemporary with, if not earlier than, the main Fleam Dyke; Taylor (1973: 63–66) suggests that Horningsea and Fen Ditton formed a Roman tenurial unit, and the early Saxon skeletons found buried in the infilled ditch (Lethbridge 1958) would support such a hypothesis; if this is true, it implies a complex use of Dykes and waterways to define areas of settled land over a long period of time.

*Place-names and boundaries*

There is ambiguity in modern usage as to which river is the Cam, as opposed to the Rhee or Granta, south of Cambridge. In this article, I use 'Rhee' for the tributary running west to east alongside Barrington, 'Cam' for the river running north from Great Chesterford, and 'Granta' for the tributary that joins this from Bartlow and Linton (see Fig. 1).

There are many problems with using place-names as historical evidence, since onomastics is a relatively modern science, and interpretation is constantly undergoing revision. The ancient names for the Dykes help us very little in examining their date and function (Reaney 1943; Banham, above). Names of settlements and parishes in the area of the Dykes are, perhaps, more useful in this context. David Thackray (1980: 77), following in the footsteps of Arthur Gray, points out that the earliest Anglo-Saxon settlement names, those with *-ham* endings, are concentrated, although not exclusively, to the east of Fleam Dyke (Fig. 68). In fact it is truer to say that Worsted Street forms the western boundary for *-ham* suffixes, a place-name type that extend eastwards into Suffolk and Norfolk and north-westwards in a zone running as far as the Huntingdonshire fen edge and including parts of the Isle of Ely. To the south of the Dykes as far as the vicinity of the Blackwater estuary and Chelmer River, it is noticeable that *-ham* place names are virtually absent between the Rivers Lea in the west and Colne in the east, in other words over much of Hertfordshire and Essex, which formed in Roman times the heartland of the *civitates* of the Catuvellauni. In addition Taylor (1973) refers to the presence of a number of village names with the prefix 'West' which he ascribes to satellite settlement from origins in Suffolk, probably connected with forest clearance during a later phase of expansion (expressed in *-ley* suffixes), which congregate at the south end and immediately to the east of Fleam Dyke. Such differences in the distribution of early settlement names within the region suggest that the 'wooded' hills at the southern end of the Dykes formed a very real boundary during early Anglo-Saxon times.

A look at the map shows how thinly settlement is spread nowadays, and probably always was, along the Boulder Clay hills between Royston and Newmarket. There is little evidence of prehistoric or Roman settlement in this area, probably due to the lack of easily accessible water sources, but it is also evident that the zone of sparse early settlement as recorded in Domesday Book (Fox 1923a: Map V; Meaney 1993: Map 1) includes the Icknield Way corridor, which is occupies a tract of land north of the Boulder Clay, sloping down to the springs along Ashwell Street (thin settlement continued westwards along the Icknield Way: Davis 1982: 58–9). The exception to this rule is the band of settlements running upstream along the Cam to Great Chesterford and along the Granta to Bartlow, where the proximity to water allowed a different early pattern to develop.

This tract of land providing the corridor for the Icknield Way was probably composed of dry moor and heathlands, as indicated on early maps such as the *Comitatis Cantabrigiensis* (1646), enclosure and tithe maps (and described as such in VCH VII), a landscape more suitable for grazing stock than arable agriculture (as evidenced by the molluscan, soils and pollen reports presented above), and it is precisely this corridor of land which the Dykes cut, dividing it into approximately equal parts. Both the northern and the southern ends of the Dykes and Mile Ditches are roughly equidistant, at an interval of 5–6 miles, thus creating blocks of moorland with borders three miles wide south to north, and five to six miles long west to east. Thackray (1980: 314–319) suggested that a Dyke may have existed at the boundary of Snailwell and Chippenham, which would have filled the gap in the sequence between Devils Dyke and the Black Ditches in Suffolk (Fig. 1). The existence of this feature is hypothesised solely on the basis of a single reference in the 1637 edition of Camden's *Britannia*, and no physical evidence can be traced. Nevertheless, such a consistent pattern of regular spacing suggests there was more to the creation of the Dykes than purely successive defensive barriers. It is more akin to the (prehistoric) division of the landscape suggested by Dyer (1961: 39–43) for the Hertfordshire dykes and familiar on moors elsewhere in the country (for instance the Dartmoor reaves, which often use streams in a similar manner to the Cambridgeshire Dykes, to continue their boundary function: Fleming 1988: 40). It is not surprising that, in a region largely devoid of clear landscape features, the Dykes were used for later estate and parish boundaries. Brent, which is not a parish boundary (although a possible continuation to the southeast might be presumed from the line of the present county boundary) appears to be

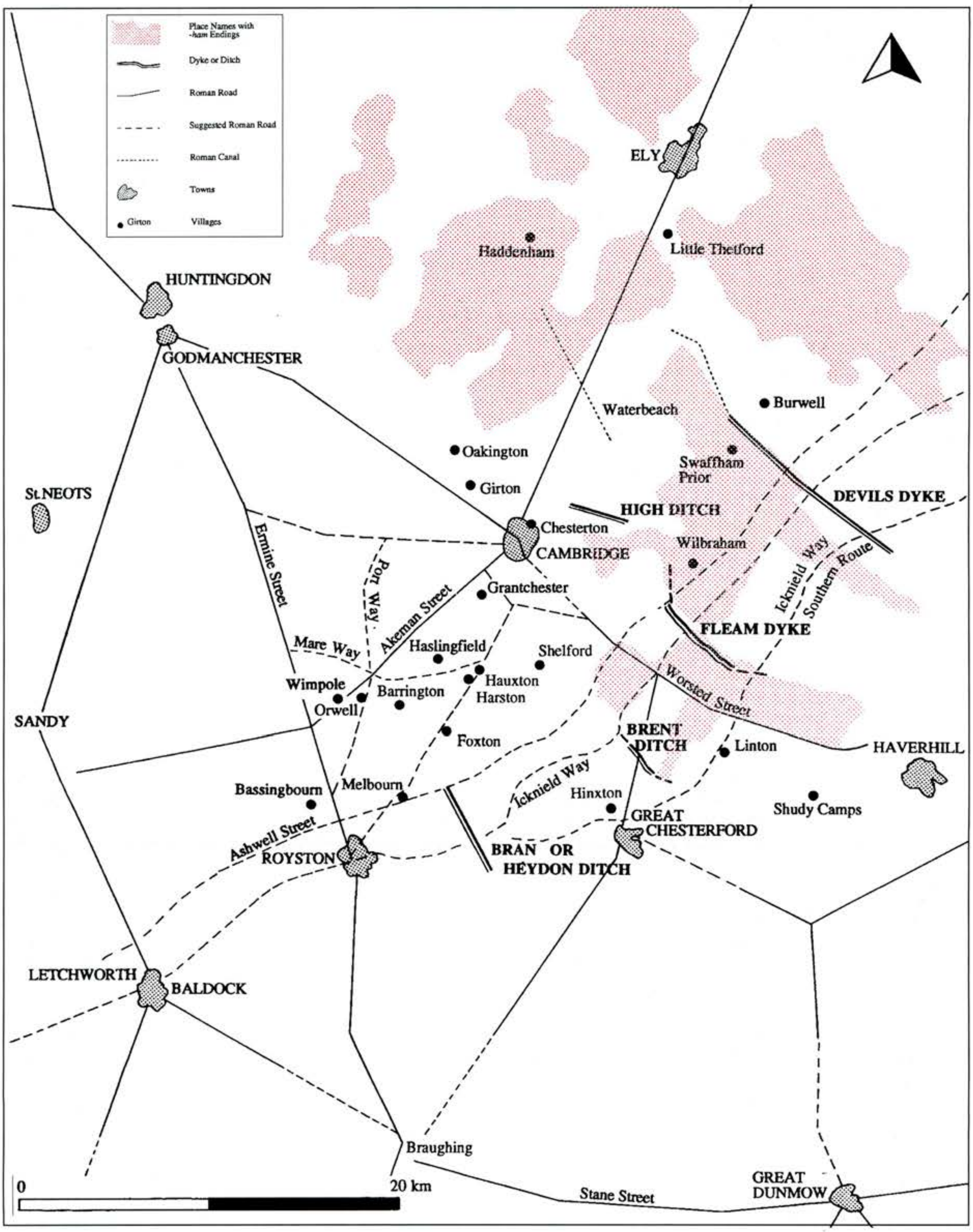


**Figure 68.** *Map of South Cambridgeshire, showing the Dykes and Worsted Street, other Roman Roads, and -*ham *place-names.*

an exception, but the presence of rivers nearby on either side meant that there was less need for an artificial feature to fill this role.

### *Early Anglo-Saxon settlement evidence*

It has been suggested that the late survival of Great Chesterford was due to its importance as a north-eastern bastion of the Romano-British canton based on *Verulamium*, and recent work has identified large-scale re-fortification in the fourth century, which tends to support such theories (Chris Going personal communication). The evidence for settlement continuity between late Roman and Anglo-Saxon times is tenuous, and derives largely from the association of early Germanic burials with Roman towns and villas. It may only have been after their desertion that such Roman sites acted as a focus for Anglo-Saxon activity, rather than settlement being continuous, but the presence of the cemeteries nonetheless suggests Anglo-Saxon settlement in reasonably close proximity to Roman centres. Such evidence is reasonably clear for Cambridge and Great Chesterford, but for the villas it is only recently that excavations have begun to demonstrate re-use or continuity. Great Staughton (Greenfield *et al.* 1994) and Haddon (Upex 1993) have both provided such data in terms of burials and settlement, and to these can be added Anglo-Saxon burials at the Romano-Celtic temple on Gallows Hill, Swaffham Prior (Simon Bray personal communication), close to Reach villa and Devils Dyke (Fig. 47). By analogy, the Little Wilbraham cemetery (Fig. 33) and those at Linton may relate to adjacent villa complexes (Ette and Hinds 1993a and b), and this may also be true of Foxton villa and an Anglo-Saxon (estate centre?) settlement at *Appesford* (Manor Farm, Harston: Malim 1993), where late Roman and 'Romano-Saxon' pottery has been found associated with a *Grubenhaus*.

Recent excavations have added to the number of known Anglo-Saxon settlement sites, mainly through accidental finds of hall-like timber buildings, *Grubenhäuser* and associated artefacts during general purpose rescue work. Sites that appear to be early, with some evidence of fifth century date, include Hinxton (Hall and borrow pit: Denham *et al.* 1996; Evans 1993), Bourn Bridge in Pampisford (Pollard 1996), Linton and Little Linton (Collins 1980; Taylor *et al.* 1995; Bray 1992), Harston (Malim 1992), and Waterbeach (Robinson 1996; Denham *et al.* 1996), beside the Car Dyke, supplementing evidence found by Lethbridge.

As outlined above, the evidence is scant, but it has grown in recent years compared to the distribution of late Roman sites in *VCH Roman Cambridgeshire* (VCH VII: 36), where only nine sites are listed for the period AD 400–450.

### *Associated burial evidence*

Burials and Anglo-Saxon weaponry have been found in association with all the Dykes save Brent. The debate about the 'massacre' at Bran Ditch (Lethbridge and Palmer 1929; Gray 1931; Palmer *et al.* 1932; Lethbridge 1935) unfortunately diverted attention from methodical examination of the evidence concerning the earthwork itself, and Lethbridge's reports are not clear about the extent of the ditch and bank, lacking precision and consistency in text or illustration. The opinion of Fox (Fox and Palmer 1926) and later of Hill (1976), that these burials (found lying within and over a series of small ditches between the main Bran Ditch and the bank) relate to a nearby gallows site or *cwealmstow* of possible tenth to eleventh century or later date, appears very sensible, and is supported by local field names (Fox) and quoted parallels (Hill).

However, the stratigraphic relationship of these burials to the bank needs explaining; Lethbridge attempted this in 1935 when he revised his opinion of their date to the fifth century, based on the discovery of one skeleton in a ditch with a fifth century pot placed around its head (see Lethbridge 1932: 55 and his Fig. 1), and suggested a first phase of defence consisting of shallow ditches with a timber palisade between. However, the presence of post-holes and 'earlier' ditches on the berm or cut by the main ditch could also indicate structural elements of the original earthwork, such as a contemporary revetment (see Welsh, above). The regular square cut of one of these 'earlier' ditches found by Lethbridge in his original excavations, and also found to contain the burials in 1931, was similar to one found by Fox in his sections A and B, and to a feature excavated by Welsh, who interprets it as a palisade trench for a contemporary revetment of the bank. The squareness of the surviving cut in all cases, as well as its general dimensions, support Welsh's interpretation as a palisade trench rather than one of a pair of open ditches subject to erosion, as proposed by Lethbridge (Lethbridge and Palmer 1929; Lethbridge 1935). Instead, the burials may indicate a remodelling of this part of Bran as a gallows site (some of the post-holes referred to by Lethbridge might be associated with this) and associated graveyard situated adjacent to a way through the earthwork ('Fowlmere path'). The considerable distance between the ditch and bank is an indication that the bank may have been shifted to the east as part of this re-use as pathway and *cwealmstow*. Soil from the redeposited bank could have fallen over some of the Anglo-Saxon burials, which were apparently found stratigraphically beneath the redeposited bank.[3] There is much here which needs further investigation; more precise data are needed before an interpretation can be convincingly argued. This could be achieved firstly by osteological re-examination and carbon-dating of the skeletons, and secondly by fresh fieldwork, including excavation around this location, to establish the extent of the deviation and produce an accurately surveyed stratigraphic and descriptive record.

Cemeteries broadly contemporary with the Dykes (fifth to seventh centuries) are found throughout south Cambridgeshire, and recent finds of possible pagan settlement are also plotted on the map (Fig. 68). How do we reconcile this evidence for settled rural life with the turbulence and warfare indicated by the great defensive earthworks?

Of the 20 to 25 cemeteries and burial places listed by Meaney (1964; 1992 unpublished revision) which are relevant to south Cambridgeshire and the Dykes, most can be dated to a particular century. Not surprisingly, the majority are of sixth-century date, with varying degrees of overlap at either end of the century. Some burials with fifth-century attributes were found at Barrington B, Cambridge St John's, Great Chesterford, Cratendune (Ely), Girton, Haslingfield, Sawston and Trumpington: a group clearly concentrated along the Cam, mostly around the fortified Roman towns of Cambridge and Great Chesterford, and along Akeman Street towards Ely, with another at Little Wilbraham associated with a villa. Cremations are almost exclusively confined to this early group, whereas the predominantly inhumation cemeteries of the sixth century are distributed more widely, expanding to fill the area at the northern end of the Dykes to the west, and spreading east, as well as south-east along the Granta past Hildersham and Linton. The pattern is amplified by the continued use of some cemeteries, and the establishment of others, in the seventh century. This evidence corresponds well with the distribution of early place-names in Cambridgeshire outlined above.

The contrast between this distribution and that of pagan Anglo-Saxon burials in Hertfordshire and Essex is stark. A handful of locations represents the total number of inhumations from this region (seven reasonably certain from Essex and two from Hertfordshire, compared to 87 entries for modern Cambridgeshire: Meaney, *ibid.*; and SMRs), most of which are so close to the Cambridgeshire border that they are in fact part of the south Cambridgeshire pattern (Great Chesterford, Wendens Ambo, Ashwell, Therfield). Comparison of published maps with such distributions clearly illustrate this contrast between the regions (OS Map of Britain in the Dark Ages, 1966; Davis 1982: Maps 3 and 4, updated by Wingfield 1995; Robinson and Duhig 1992: Fig. 12, after Meaney; Evison 1994: Fig. 10). It is also worth pointing out the interesting variation within the modern (post-1974) county of Cambridgeshire, in that much of Huntingdonshire (apart from St Neots) contains little evidence for pagan Anglo-Saxon activity, with no concentration of burials, for example, around Godmanchester, although some continuity at Great Staughton and Haddon villas has recently been suggested (see above).

The fifth-century pattern around Roman towns and major roads is consistent with that seen in Oxfordshire and the Thames Valley, where it has been suggested that these burials represent Germanic *foederati* (e.g. Welch 1992: 101–2). According to Gildas, this was a period of great upheaval with civil war, Anglo-Saxon uprising, British counter-attack and eventual victory in the battle of Mount Badon around AD 500 (Thackray 1980: 55–65). This was followed by a period of greater stability and then Anglo-Saxon offensives during the sixth and into the seventh centuries (Brooks 1991: 9–10). The distribution of cemeteries discussed above would fit the historical model of a strife-ridden landscape, with south Cambridgeshire one of the main areas of contest, leading to construction of the Dykes as defences across a strategically important no-man's land; it was only with the onset of comparatively peaceful times that the Anglo-Saxon population expanded in this area,

[3] If the burials were fifth-century, they would have been covered by the original bank, and could have remained covered if the bank material was moved to the east. However, if the bank is in its original position it must have been diverted to avoid the burial-ground, but still covered some of the easternmost burials. If the skeletons were late Anglo-Saxon or medieval, associated with a gallows site, and the bank was remodelled to allow room for the gallows, then a burial-ground in a widened area between ditch and bank is explained, and some of the redeposited bank material might have been used to cover some of the burials. The smaller ditches were presumably visible when the bodies were interred, as some skeletons are lying in them. If they were visible, they are probably not much older than the burials, since otherwise the ditches might have silted up. Taking into consideration the west–east burial on the floor of Bran Ditch, the whole situation is bizarre, and on present evidence must remain ambiguous.

witnessed by the proliferation of sixth to seventh-century cemeteries. The existence of these cemeteries would seem to indicate a stable and prosperous community living along the Cam, Granta and Rhee valleys and utilising all the landscape dominated by the Dykes. Such a hypothesis, based on available dates for the cemeteries and current understanding of the historical situation, might be somewhat simplistic but forms a sound springboard from which to launch further research. This hypothesis would assign the construction of the Dykes to the fifth and sixth centuries and would also suggest that the British victory at Mount Badon threatened Anglo-Saxon occupation of south Cambridgeshire and East Anglia, and that the main phase of the Dykes was built to counter this. The skeletons and Anglo-Saxon weapons found at so many locations on the Dykes could represent the burial of warriors killed in action, as argued by Lethbridge (1958), but a thorough re-examination of the associated equipment is needed to see if it is indeed possible to attribute a fifth-century date to them, while an osteological examination would determine the nature of any skeletal injuries and indicate the relative proportion of male to female.

### *Functions of the Dykes*

The Dykes were clearly barriers across the Icknield Way zone. The concept and scale of their construction argues for a strong central authority, which could call on support from a wide population base in order to execute the scheme of works envisaged, and for a home territory that made the exercise essential. They were in this sense political manifestations, clearly stating that beyond them was alien territory.

Defence was the most obvious function for the Dykes, as suggested by antiquarians, the argument presented succinctly by Ridgeway (1893) with his elegant map, and elaborated by Fox (1923a) and Lethbridge (1935). Documentary sources always refer to the Dykes as *dic* or *fossa*, demonstrating that it was the *ditch* which was significant, rather than the bank behind (see Banham, above). The depth, steepness and precision of construction all suggest a military origin, and the overall strategic positioning of the Dykes between (probably) wooded hills in the south, and wet areas connecting with the fens in the north gave the defenders control of the Icknield Way corridor. As the banks were all on the eastern side, the builders and defenders were clearly East Anglian.

When the average dimensions of the Dykes are drawn up for comparison, it can be seen that there are two distinct groups in terms of scale (Fig. 66): Bran and Brent form a slighter group while Devils and Fleam, in its later form, are considerably more massive, a pattern consistent with an eastwards progression, suggesting defence in depth, or a development of ever larger barriers with which to defend the territory to the east. Even the smaller dykes, however, are not unimpressive as defensive structures compared to known Iron Age examples, such as the ditches of the fort at Stonea Camp (Malim 1992). At Stonea, similar design elements were used: deep, steep-sided ditches (130–140° inclinations) with flat bases up to 1.75 m deep and 2.8 m basal width, and large, possibly revetted banks behind, but their execution appears to have been less regular than has been evident in the numerous Dyke excavations. Such dimensions, from a known defensive earthwork, demonstrate that even the smallest of the Dykes, Bran, exceeded the size previously considered appropriate for effective defence. A revetted bank at Bran (and possibly at Fleam) has been suggested (see Welsh, and Penn and Wait, above) which would have enhanced its defensive properties, although the evidence adduced has occurred at locations close to possible crossing-places (Ashwell Street and 'Fowlmere path' at Bran, and Icknield Way on Fleam), which might indicate special construction measures at these points.

Defensive qualities can therefore be definitely attributed to the Dykes, distinguishing them from the Mile Ditches, for instance, but we need to examine in more detail exactly how such a defence would actually have been used. It is unlikely that the full lengths of these defences could have been permanently manned, so their main function would have been more that of an obstacle, perhaps allowing time for an armed force, alerted by lookouts, to move rapidly to the point of incursion. This would still suggest the presence of a handy garrison and well-organised reconnaissance and communication system. An examination of the lie of the land in which the Dykes have been built reveals drawbacks to the defensive argument, because the Dykes are not all sited in the best place for defence, the crests of hills or existing natural barriers such as rivers. This was noted by McKenny Hughes (1886: xiii–xiv), who stated that Fleam and the other Dykes

> did not run along the most easily defended positions or those most exposed to attack, but in a nearly straight line [that is, like the military Roman roads], often obliquely down the slope of one side of the valley and obliquely up the other, in a manner that rendered it extremely improbable that they were meant for defence, as in one part they were commanded from the West and in the other from the East,

and supported by Babington (in Hughes, *ibid.*), who attributed their function not so much to defence as delaying marauders or cattle raiders; it was also noted that excavation of Fleam Dyke north of Brymbo Hall had shown that no ditch existed but instead the steep hillside had been cut away so as to create the bank alone. David Thackray (1980) undertook an exhaustive study of these monuments for his PhD thesis, and presents much information of value regarding the topographical situations of the Dykes. At Devils, similar positioning can be noted, with the Dyke running downslope on the east side of high land at Gallows Hill, Swaffham Prior, while at its southern end near Stetchworth the Dyke is found in the valley base, downslope from a western crest. Thackray (*ibid.*: 406) argues that all changes in alignment are the result of variations in topography, and that at Camois Hall and Stetchworth the adjustment is needed to cross the head of a valley (*ibid.*: 221).

Brent lies between two streams, either of which, and especially the Cam, would have formed a barrier in its own right and could have been effectively defended from the eastern bank without the effort of constructing Brent Ditch between them. However, Thackray points out (*ibid.*: 47) that Brent was positioned to straddle two Roman roads (Margary 21b and 230): 'no more than 1 mile apart they were forced through a narrow neck of Middle Chalk between Fen and probably wooded boulder clay', which gave the Ditch strategic importance and a clearly defined role.

J.S. Conder (quoted in Lethbridge 1935: 95) questioned the East Anglian origin of the Dyke builders, if the primary function was to delay cattle-raiders, because the ditch would then have to be on the 'home' side of the bank. Lethbridge (*ibid.*) consequently suggested the Dykes were constructed by Romano-British people against Anglian raiders and expanded this theory after the discovery of more Anglo-Saxon warrior burials at Fleam, when he argued the Dykes served to trap Anglo-Saxon maurauders during Theodosius's campaigns around AD 367 (Lethbridge 1958). Rutherford Davis's (1982) masterly synthetic study of the Chiltern area argues for the continued existence of a Romano-British territory immediately south and west of south Cambridgeshire, probably well into the sixth century. The use of cavalry by the Roman army, enhanced by the traditional affinity of the Celts for horses, suggests that Romano-British military tactics would have made extensive use of mounted soldiers, with their ability to respond rapidly to attacks from unexpected directions and to hunt down adversaries whose retreat would be impeded by the Dykes. However, the same line of argument could be used to present the opposite case, that the Dykes were built as a defence specifically against fast moving cavalry because they would have seriously impeded the deployment of mounted troops.

*Ritual*

Ritual connotations are an aspect of the Dykes that has not previously been explored and needs to be mentioned here, not in order to present speculation such as Lethbridge's chalk-cut figures of Gog and Magog at Wandlebury, but to indicate an area that could benefit from further study and debate.

There is a significant number of burial places and possible sacred sites along the route of Fleam and Devils Dykes, and the northern terminals of all the monuments are in wet areas, often with springs: locations that attracted ritual activities during prehistoric, Roman and later times. Coincidence could play a part in aligning the Dykes on prominent features used earlier as ceremonial venues, but it is also possible that the builders of the Dykes wanted to include these points for their very sacredness. Mutlow Hill and other barrows have been identified on their routes, sometimes incorporated in the earthwork, and the ditches of the Dykes attracted Anglo-Saxon and later burials.

Roman temples have been found at Mutlow (Neville 1852) on Fleam Dyke and Gallows Hill, Swaffham Prior (adjacent to Devils Dyke) (Simon Bray, unpublished archive), and also near the southern end of Brent Ditch on the hill above Great Chesterford (Miller 1996). At the southern end of Bran, a Roman rectangular building was recorded (Fox 1923a: 187), for which Thackray suggested a possible function as a signal station, along with the circular example at Mutlow (1980: 43); however, the obvious interpretation of the latter as a temple (see Fox and Palmer 1924: 30) would suggest that the building on the relatively unoccupied highland at Heydon was also a temple. Its excavator Lord Braybrooke implied such an interpretation by using the word 'altar stone' and referring to associated finds of bullocks' horns, a bronze bell and other metalwork (Neville 1848; see also Babington 1883). The Mile Ditches terminate at their southern end beside the barrow field on Therfield Heath, into which some secondary Anglo-Saxon burials were introduced. Halfway along their length northwards, these ditches run downslope to the east of Limlow Hill, another possible Romano-British temple site.

The sinuous shapes of Fleam and Brent are remarkably similar to one another, and recall prehistoric 'avenues' such as those associated with Avebury. Similar symbolic ways leading to sacred sites could be represented by the Dykes, which terminate at their southern ends in (apparently) wild heath and woodland, and at their northern ends at springs, places notorious for votive offerings in Anglo-Saxon as well as earlier times. At Shardelow's Well, for example, at the northern end of Fleam, a concentration of rich Roman finds has been discovered by metal-detectorists, as well as Roman burials and some Anglo-Saxon jewellery, discoveries which lend weight to the idea that the spring may have been a focus for ritual activity.

Precursors to the Dykes could have been prehistoric ditches similar to the Mile Ditches (Burleigh 1980; and see Place-names and boundaries, above). The fact that none except the Mile Ditches have survived from this earlier period could be accounted for by the massive scale of the later Dykes, which would have obliterated any trace of smaller prehistoric features. Associations with other prehistoric sites, such as a henge and causewayed enclosure near the northern 'extension' of Fleam Dyke, lend support to such a possibility. That the Anglo-Saxons may have revered these sites is suggested by finds from the peat fen just outside the Great Wilbraham causewayed enclosure. A trench excavated here in 1976 revealed organised deposits of horse bone, including a ring of longbones with a skull in the middle. A radiocarbon sample from this material produced a post-Roman date (Ian Kinnes personal communication).

In short, there is no proof that the Dykes were anything other than secular, a prosaic response to troubled times, but their coincidence with known ritual sites, and with potentially sacred ones, such as the springs at the northern end of each (except Devils), a situation similar to the Mile Ditches, suggests deeper motives and religious connotations, which perhaps gave the builders an added psychological defence against their enemies. The association between sacred sites and boundaries has been discussed on many occasions for many different periods.

### *Routeways*

Most of the Dykes survive today in part as footpaths, the exceptions being Brent and the northern end of Bran. The possibility that they were constructed as routeways linking the fens (lowlands) with the hills is one that has received but scant attention. Fox refers to a lack of evidence for wheel ruts in the ditch at Devils (Fox 1925: 121), and earlier writers dismissed the idea of 'covered ways'. Nonetheless, Worsted Street was considered to be one of the group of Cambridgeshire Dykes by McKenny Hughes (Ridgeway 1893: 204; Hughes 1913: 144–5) and, although this has been disproved in terms of construction technique and date, the similarity of orientation between Worsted and the Dykes could argue for a similar purpose. McKenny Hughes (1895) refers to a 'dyke' at Cherry Hinton, directly in line with Worsted Street, and although this 'dyke' may have been part of the defences of an Iron Age fort known as the War Ditches, Hughes does not correct this in his later report (1904), where he keeps the presumed line of Worsted Street (and presumed 'dyke') in his map of the district alongside, but detached from, the ditch of the ringwork. However, the presumption that Worsted Street was laid out to pass between Wandlebury and the War Ditches, either to terminate at the springs in Cherry Hinton, as suggested by Hughes and on analogy with the Dykes, or to continue the same alignment through modern Cambridge to meet the Cam nearly opposite the Belgic settlement on Castle Hill, is a very reasonable one. Prehistoric origins for Worsted may be indicated by the occurrence of two Iron Age forts near its northern terminal, one on either side (a situation perhaps paralleled by the henge and causewayed enclosure either side of the northern 'extension' to Fleam), and also by the alignment that it follows, common in ridgeways, keeping to the high ground a couple of kilometres east of and parallel to the River Granta. The strategic location of this route would be similar to that of the Dykes, which allowed rapid deployment along them and safe passage behind them, principally for military purposes, but also secondarily for the secure movement of the civilian population, protected by the Dykes.

Penn and Wait (above) argue that Worsted Street as a Roman road was primarily built to connect Cambridge with the Icknield Way in the Worsted Lodge–Mount Farm area. It is also suggested that there was no Roman road beneath the A11 north of Worsted Lodge, but that the Icknield Way ran parallel and a little to the north of the modern road (Fox 1923a: Map III), and that, to the south, a Roman road ran to Great Chesterford, with a less important route continuing the line of Worsted Street to the south east, demonstrating that Worsted Street played an important role in the communications network.

Along its length south of Worsted Lodge, Worsted Street seems to get less like a Roman construction until it appears to peter out somewhere near Horseheath. In fact, footpaths continue the general line until they meet a tributary of the River Stour that runs down the valley in which modern Haverhill is situated. Between Fulbourn and Balsham one of the main routes could well have been along the bank of Fleam Dyke, the parish boundary and present footpath, and again the watershed of the Stour is perhaps the end point of the footpaths that continue the sinuous line of Fleam past Oxcroft and Yen Hall. At Devils Dyke also, a footpath continues from the southern end through Ditton Green towards Kirtling Green and the headwaters of the River Stour.

All of the paths mentioned above could be aiming for the same general point, a passage through the hills and an easy descent beyond them following the valley of the Stour (as suggested for another route in VCH VII: 28), and as such they would represent routes between the fens and communities on the far side of the relatively barren areas of the Icknield Way and the Boulder Clay lands. Such a pattern was reproduced during parish formation when good and bad lands were shared out so that no particular community was advantaged over another; many fen-edge parishes are long parcels of land which take in fen at one end and chalk upland at the other, with the main settlement situated centrally to exploit both types of terrain.

Both Brent and Bran also have footpaths emanating from their southern ends, a function certainly of more recent times, but nonetheless a feature common to all the Dykes and to Worsted Street. At their northern ends no such pattern appears, but more importantly they all (except Devils) terminate along the supposed route of Ashwell Street (Street Way), a Romanised prehistoric trackway (Fox 1923a: 147–150 and Map V). How early in their history the Dykes were used as paths cannot be ascertained, but it appears that at an early stage they must have made very convenient routes between the lowland Ashwell Street and the hillside Icknield Way, and beyond to the south side of the Boulder Clay hills. However, even though considerable wealth is known to have been invested by some cultures, such as the Roman, in an intricate system of communication, the design and size of the Dykes argue that their principal purpose was not that of a roadway. All the dating evidence places the Dykes unambiguously in the Dark Ages, and the pagan Anglo-Saxon period is not one renowned for road building, but a combination of roles, a defensive obstacle also designed to enable rapid defensive deployment of troops, could constitute a valid military function lying behind the construction of the Dykes, and resulting in their added value as routeways.

## Conclusions

The recent investigations and reappraisal of existing sources have succeeded in establishing a tighter understanding of the Cambridgeshire Dykes, and have pointed the way for future research.

Carbon-dating of Fleam Dyke, in association with the phasing postulated from stratigraphic data, has refined our knowledge of the initial construction and subsequent use of this monument, so that we can put its first stage of construction in the fifth century AD, from the date of *cal. AD 330–510 (92% confidence)* for the first phase bank. That the main activity relating to its use and remodelling (which resulted in the steep-sided flat-based ditch profile common to all the Dykes) occurred around the sixth century is reflected in a range of *cal. AD 450–620 (95% confidence)* for the last dated event from the bank sequence, and a range of *cal. AD 590–700 (94% confidence)* for the last dated use of the monument (see Bayliss *et al.*, above). It is obviously dangerous to extrapolate more widely than this to the entire length of the Dyke, and although the environmental evidence shows that all the Dykes were built in a similar landscape of grazed pasture or moorland, suggesting they are contemporary, it is even more dangerous to assign the other Dykes to the same period on the basis of a single sequence of dates from one monument. However, the weight of previous work has established that they are all post-Roman but earlier than late Anglo-Saxon, and the finer pieces of the dating jigsaw, including pottery, and artefacts accompanying burials, point to fifth and sixth-century dates (see for example Lethbridge 1935: 94; and the many references to skeletons with Anglo-Saxon weapons by Fox, Lethbridge and Hutchinson).

To this relatively direct evidence must be added more circumstantial but still pertinent evidence from the cemetery distribution in the area, the clear distinction between south Cambridgeshire and Hertfordshire indicating a major cultural boundary, the occurrence of early place-names east of Worsted Street and north along Akeman Street, and indications of Romano-British sites acting as focuses for early Anglo-Saxon activity at Cambridge, Great Chesterford and some of the villas. All of these strands of evidence point to the Dykes having been constructed and used during early pagan times, emphasising their likely origin in the fifth century and continued use in the sixth as a defence against British counter-attacks into one of the heartlands of Germanic settlement. The early Anglo-Saxon settlers here must have been closely involved with the construction of the Dykes, and distinctly different from the people further south, perhaps a British population with its power-base at St Albans (Chris Going, personal communication). The Dykes were barriers in both the political and military spheres, and were designed specifically as defensive obstacles, probably to counter the rapid deployment and mobile nature of British 'cavalry', which could have had a devastating effect on settled communities of Anglo-Saxons. The wars of this period were not a Romano-British defence against sea-borne maurauders, but instead internecine conflicts between British 'tyrants' and attacks by them on farming communities established by Germanic migrants.

Building on the excellent field observations and synthesis of previous work presented by Thackray (1980), we can see that further close study of the full extent of each Dyke, in relation to the topography in which each section was constructed, is essential for the depth of knowledge necessary to interpret them fully. Such fieldwork should be combined with a programme of field walking adjacent to the earthworks, and a plotting of all available air photographs, so as to identify any areas of settlement or other activities. This would help in targeting excavations to obtain further samples for dating and environmental study.

The potential of these linear earthworks for extensive environmental reconstruction, reaching from the fens to the hills, has been indicated by both French and Murphy (above). They provide transects across the landscape which could be systematically sampled to reconstruct the conditions of early Anglo-Saxon and late Roman times, and this timespan could perhaps be extended back into the late Iron Age, especially at Worsted Street. So far, most investigations have taken place in, and all environmental evidence has come from, the central and northern parts of the Dykes. We have no definite evidence for the long-held belief that there was dense woodland at their southern ends, and it would be relatively easy to undertake small-scale excavations on each Dyke at a suitable location, in order to confirm the existence of contemporary woodlands.

These locations would also be some of the most likely to produce samples for carbon-dating, as trees would have been cut down (and possibly burnt) during construction of the Dykes, leaving some of their remains trapped between the buried soil and the construction phases of the bank. Other potential sources of dating evidence include the Bran Ditch skeletons, from which a large enough sample could be extracted to obtain a reasonably close carbon date, and the hearths discovered at the base of Bran Ditch, or some of the enigmatic pottery found during excavation there (Lethbridge 1929; Palmer *et al.* 1932), which could be used for thermoluminescence dating. Close dating of all weapons found at the Dykes might, as proposed above, also help to confirm (or deny) a fifth and sixth-century date.

On the wider scale, the Cambridgeshire Dykes need to be considered together with other dykes in neighbouring counties, those along the Icknield Way in Bedfordshire and those in Norfolk and Suffolk, many of which seem to be of Iron Age date, a period in which the Cambridgeshire Dykes might also have originated, as suggested for the Mile Ditches. There can be little doubt that the Cambridgeshire Dykes in their extant form are of Anglo-Saxon construction, and therefore a comparative study of continental examples from the Anglo-Saxon homelands would be an important exercise. It is also clear from the arguments presented above that a proper study of these monuments cannot be isolated, but must comprise a series of different areas of research, including archaeology and related scientific techniques of environmental reconstruction and absolute dating, as well as historical and place-name evidence, and that the more obvious functional interpretations of the Dykes should not blind us to the fact that, in contemporary eyes, the Dykes probably fulfilled several roles.

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