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INTRODUCTION

This report examines the results from a multi-disciplinary investigation of the route and structure of a Roman road west of Carmarthen (Fig. 1). The possible presence of the road, and its destination in Pembrokeshire, has long been the subject of discussion. However, it was not until the early 1980s, when sections of a possible route were identified from aerial photographs, that it received general acceptance. Since then the road line has been traced westwards from Carmarthen for a distance of 38km. Its final destination is still unknown although there are several possibilities. The investigation of the road comprised historiography, aerial photography, survey, evaluation, excavation and digital mapping. Although collected at various times through separate projects, the accumulated evidence has allowed an overview of the road line, the technical characteristics of the road and some assessment of its wider implications.

The report brings together evidence from the different strands of investigation to provide a discussion on the pre-Roman landscape. This includes evidence for route selection, ground preparations for the road, the construction methods, the significance of the road in the Roman settlement of southwest Wales and for the wider environment. A brief history of the discovery and re-discovery of the road is included by way of introduction to the study. This is followed by a brief discussion of the route of the road. A more detailed discussion of the topographical factors that determined its line and its present condition, and a brief comment on route selection and marking out techniques is included in Appendix 1. The following section describes the excavation and earlier assessment results before a discussion attempts to draw the information together and begins to assess the road and its significance in the context of the Roman military conquest of southwest Wales. Details of the data and analysis of the wood and palaeoenvironmental samples are given in Appendices 2 and 3.

THE PROJECTS

The results described below are largely from two major projects carried out between 1993 and 1995. The first was a joint project between Cambria Archaeology (Dyfed Archaeological Trust) and the Archaeology Department, Trinity College, Carmarthen, to establish the line of the road on the ground, to assess the condition of any surviving sections and to investigate the structure of the road through small-scale trial trenching. The two year programme, funded by Cadw: Welsh Historic Monuments, had both research and management objectives. The survey of the road was carried out through a programme of field visits and documentary, cartographic and aerial photograph searches. Field recording included all details likely to affect the survival and management of the road such as past and present land use and ownership. After the line and condition of the road were established two small trial trenches were excavated to investigate its structure.

While the survey project was being carried out the preferred route for the A40 Whitland Bypass was announced. A desk-based assessment of the proposed route corridor showed that it crossed the line of the Roman road to the north of the town. Therefore, it was recommended that the affected section should be excavated ahead of the bypass construction works (Crane 1994, 2). This recommendation was accepted by Cadw and the excavation took place during the early summer of 1995 funded by Welsh Office Highways.

Subsequently, a programme of aerial photography and digital mapping of the Roman roads in the old county of Dyfed (present day Carmarthenshire, Ceredigion and Pembrokeshire) was funded by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW). This identified many new sections of the road west of Carmarthen.

HISTORICAL AND ARCHAEOLOGICAL BACKGROUND by H. James

The identification, survey and excavation of new lengths of Roman road in west Wales coincides with a renewed interest by students of Roman Britain in the meaning and purpose of the road system as a whole. It is hoped, therefore, that this report will contribute to that debate. Beyond the significance of the road for the extent of Roman military activity in the territory of the *Demetae*, the tribal group of west Wales, the road may be seen as the primary visual and psychological impact of *imperium* in a late Iron Age tribal group hitherto little affected by Rome. The historiography of the road is thus of more than antiquarian interest since it encapsulates changing views on the nature of late Iron Age west Wales and the impact of Roman conquest and authority.

There is a curious twist to the story of what must be termed a *re*-discovery, rather than a discovery, of a Roman road west of Carmarthen extending to an as-yet-unknown destination or destinations in Pembrokeshire. There are good antiquarian references to the course and location of the road and a strong local tradition. Both can now be seen to be well-founded. But a modern archaeological acceptance of the route has, until the recent aerial reconnaissance, fieldwork and the excavation reported upon here, been withheld, because of the lasting influence of a very clever 18th century forgery.

The forger was 'Professor' Charles Bertram of The Manne Academy, Copenhagen - an English language reader there (Piggot 1950). In 1755 he provided the great antiquarian William Stukeley with a copy of a map of Roman Britain, said to have been discovered together with a hitherto unknown Roman Itinerary, copied by a 14th century monk Richard *Coriensis*, called *De Situ Britanniae*. Independent proof of Bertram's claims seemed to be provided by the discovery that the genuine 14th century Richard of Cirencester, a monk of Westminster, was the author of a *Speculum Historiale*. Therefore, another, similar work seemed wholly probable. What made the forgery so attractive was that Bertram had skillfully imitated the style and contents of the Antonine Itinerary and that the 'new' Itinerary, the *De Situ Britanniae*, seemed to fill those gaps left by the genuine classical sources.

Many antiquaries of the late 18th and early 19th centuries accepted the work as genuine. Although it had been exposed as a fake by the mid 19th century, the forgery had become so deeply ingrained that the bogus Roman place-names proved hard to eradicate from Ordnance Survey maps and local antiquarian lore.

Two of the most enthusiastic and certainly the most influential supporters of the *De Situ Britanniae* were the travellers and antiquarians Sir Richard Colt Hoare and Richard Fenton, of Fishguard, Pembrokeshire. Colt Hoare included a detailed section, with map, on Roman Wales in his monumental edition of the 12th century Gerald of Wales' *Journey through Wales* and *Description of Wales* (Colt Hoare 1806). There he reproduced parts of 'Richard of Cirencester's' spurious Itinerary. He also compounded the problem, both by giving his own Latin names to the main Roman roads in Wales known to him and by embroidering on Bertram's. Thus Bertram's *Via Julia* became Colt Hoare and Fenton's *Via Julia Maritima* and they added a *Via Julia Montana* across Pembrokeshire and the Teifi Valley. By doing so, Colt Hoare put the stamp of authority on the forgery for west Wales.

This is what Bertram compiled for South Wales; false names are indicated in bold.

> *ITER XI*
> *Ab Aquis Per **Viam Juliam Menapiam** usque, sic:*
> *Ab Abonam m.p. vi ad Sabrina vi unde trajectu intras*
> *Britanniam Secundam Et Stationem Trajectum III, Venta Silurum*
> *VIII Isca Colonia VIIII Unde fuit Aaron Martyr, **Tibia Amne***
> *VIII Bovio XX Nidio XV Leucaro XV **Ad Vigesimum XX Ad***
> ***Menapiam XVIIII Ab hac per m.p. XXX Navigas in Hyberniam***

Colt Hoare translated and discussed the entry. From Bath, route XI crossed the Severn to *Venta Silurum* or Caerwent. He referred to Coxe's *Historical Tour through Monmouthshire* for further discussion of the southeast Wales section. From Caerwent the route was traced to Caerleon. The fictitious *Tibia Amne* was thought to be on the Taff near Cardiff and *Bovium* near Ewenny. Looking at the mileages, Colt Hoare concluded that *Moridunum* (Carmarthen) had been left out.

In May 1805 more evidence in favour of Richard of Cirencester was provided by Richard Fenton's discovery of Roman pottery and bricks from a small, square, earthwork with rounded corners, near Ambleston in Pembrokeshire, known as Castell Flemish (PRN 1278[1]; NGR SN17702679). He and Colt Hoare immediately equated this site with the *Ad Vigesimum* of the *De Situ Britanniae* (Fenton 1903, 25). Bertram's destination for the road was *Menapia* (a name in fact taken from a north Gaulish tribe, the Menapii), which was close enough to *Menevia*, the medieval name of St. David's, to be convincing. Quite reasonably, he looked to Porth Mawr or Whitesands Bay, the wide sandy beach to the west of St. David's "where, for ages, it was usual to take shipping for Ireland" (Fenton 1903, 65) and concluded that the site of Menapia lay buried within the sands of The Burrows inland of the beach. The distance given for the sea voyage to Ireland is fairly accurate.

All this was so convincing to Fenton and Colt Hoare that they looked around for other Roman routes converging on *Menapia*. The so-called Flemings Way, a track across the Preseli Mountains, first mentioned by George Owen of Henllys, the Elizabethan antiquary, was strongly argued by both men to be of Roman origin, heading, by some yet unestablished route to *Loventium*, then thought to be the Roman name for Llanio on the Upper Teifi close to Llanddewi Brefi. However, it is fair to say that the forgery seemed so convincing because it confirmed and extended earlier antiquarian knowledge and local tradition. It seems unlikely that this tradition was well known to Bertram, but it seems equally, if not more, unlikely that his route was, as described by Randell (1933), simply an inspired guess.

The principal area of local knowledge of an old road, interpreted by local antiquarians as Roman, that coincides with the recent air photographic and excavation evidence is near Whitland. Fenton writes:

> *"Being not far from the supposed course of the Roman road that led from the Roman city of Maridunum, now Carmarthen, through the vale of Whitland and the station of Ad Vicessimum to Menapia near the present St. David's, I was reminded of a promise made me two years before by Mr. Lewis, of Henllan, to shew me some portions of it . . . took the liberty of calling on him. An account of its appearance in the vale of Whitland, where, after a long drought in the summer, it is in many places discernible passing through the meadows, by the bareness and colour of the herbage, must be left to its proper place when I come to treat of Carmarthenshire... The first portion shown me was near Glanrhyd, entering a boggy place of ground called Corssyched and up through Glanrhyd Garden to Park yr Eglwys, a field to the north of the chapel of Castell Dwyran . . . It is most generally known by the name Fordd Helen, though some call it the road of Howel Dda and others limit its commencement to Whitland Abbey. The peasants will track it without fault for miles; but it must be observed, that unless where it forms part of the modern road, it is more known by a line which is traditionally preserved, than by any determined appearance".*

(Fenton, *Historical Tour Through Pembrokeshire*, 262-3)

The next stage in the transmission of this mixture of forged and genuine information on Roman roads and placenames came in revisions of the Ordnance Survey. Archaeological sites had been marked on the old series Ordnance Survey one inch to one mile maps of 1831, but not in any systematic way (Seymour 1980). Dissatisfaction with the original topographical survey was principally on the basis of trigonometrical inaccuracies in certain areas and registration of place names. Reforms carried out by Thomas Colby included consultation with local people of consequence and it may well have been through Fenton and Colt Hoare's influence that a continuous road was marked across the Preseli Mountains as a

[1] PRN = Primary Record Number, the unique identification number allocated to a site recorded on the regional Sites and Monuments Record held by Cambria Archaeology, Llandeilo, Carmarthenshire.

result of their conviction that the Flemings Way was in fact a Roman road (James 1996). By the mid-19th century, in the course of the large-scale survey, resulting in the 1:2500 maps of the 1880s, many archaeological sites and features were surveyed and marked and the legend 'Roman road' was added to the Flemings Way route in the large-scale Ordnance Surveys of the later 19th century. Information was supplied by local and national antiquarian societies and local people. In Carmarthenshire and Pembrokeshire local knowledge and the abiding influence of Fenton and Colt Hoare over-rode scholarly refutation of Bertram's forgery and the *Via Julia* was marked on maps.

By the time of the Royal Commission for Ancient and Historic Monuments of Wales and Monmouthshire's surveys, resulting in the Inventories for Carmarthenshire (1917) and Pembrokeshire (1925), there was a reluctant acknowledgment that there was no classical authority for the *Via Julia Maritima* and *Via Julia Montana*. Nevertheless unspecified references were made in the entries on parishes through which it was reputed to have passed and the relevant 6 inch OS map sheets cited where the term Via Julia had been attached to roads. In west Carmarthenshire these are sheet SN39NW, on the approach to Meidrim, the B4298. Not until O G S Crawford was appointed as the first Archaeology Officer of the Ordnance Survey in 1920 were these names excised from the maps.

Dr G Wainwright's influential overview of Romano-British Demetia in his excavation report on Coygan Camp in Carmarthenshire noted the lack of forts and roads west of Carmarthen and argued for a peaceful accommodation with Roman power (Wainwright 1967). He argued that the hierarchy of settlement types had much in common with southwest England, both being outside the 'villa-belt' and indicated a low level of Romanisation. The influence of Roman building styles and traded goods was more marked on the coastal sites in Carmarthen Bay. This seemed to tie in well with Boon's discovery of Preseli phyllite slate used as make up for the second century Roman legionary quays at Caerleon, presumably brought back as part of coastal trading between southeast and southwest Wales (Boon 1967). The recognition of third century coastal defences at Holyhead and Cardiff opened the possibility of a Roman naval presence off the coast of Wales in response to what was thought to be evidence for increased levels of Irish raiding and piracy. Earlier antiquarian linkages between Roman roads and the distribution of finds of Roman material, and in particular hoards, was broken.

In the late 1960s and early 1970s, the study of Roman Carmarthenshire sprang to life under the aegis of Dr G D B Jones of Manchester University and John Little, then curator of Carmarthen Museum. Important excavations in Carmarthen established the existence and extent of the Roman town of *Moridunum*, seen as the *civitas* capital of the *Demetae*. Other excavations were carried out on Iron Age and Romano-British sites in the rural hinterland of Carmarthenshire, at the Roman gold mines at Dolaucothi and the fort at Pumpsaint. Aerial reconnaissance was seen as an integral part of this programme of fieldwork and excavation, particularly to establish road lines. Considerable progress was made on the course of the Roman road between Llandovery and Carmarthen along the Tywi Valley. However, despite overflying of the area to the west of Carmarthen, no aerial photographic evidence of a road was forthcoming there.

The distribution of the *Sarn* (Welsh: causewayed road), possibly Roman as in *Sarn Helen*, place-name element seems significant when plotted on a map and corroborated by fieldwork. Over a three-mile length, where the placenames Sarnau, Pen-yr-Rheol, Caerlleon and Sarn Goch occur a combination of hillside terrace, causeway and hedgelines were taken to indicate a Roman road line proceeding west-northwest of Carmarthen via Meidrim. This line is to the north of the recently established line, but there is a clustering of *Sarn* placenames beyond Meidrim.

Despite Jones' and Little's dismissive comments on the imprecision of the Carmarthenshire Inventory, this 'place-name' route line northwest of Carmarthen in fact coincides with that marked as the *Via Julia* on the first and second edition OS 6" maps (sheets SN39NW, approaching Meidrim - modern road B4298). A distribution map of placenames with the *Sarn* element drawn from a combination of *Enwau*, the Carmarthenshire Antiquarian Society's database of placenames from 19th and 20th century maps and the Regional Sites and Monuments Record (held by Cambria Archaeology, Llandeilo) is shortly to be published by TA James (James 1997). There is a coincidence, though not an exclusive one, between *Sarn* placenames and known Roman roads. *Sarn* names occur along the recently recognised stretch of Roman road and also along the B2498 to Meidrim and beyond. It is possible that there were two Roman routes west of Carmarthen; it is equally possible that the *Sarn* names indicate an important early medieval route (Thomas 1994, 147-9).

The establishment of the Dyfed Archaeological Trust in 1974 (Cambria Archaeology since 1997), one of four Trusts in Wales to cover 'rescue' archaeology, led to excavations of Roman sites in Carmarthen and on a group of Iron Age defended enclosures near Llawhaden, Pembrokeshire. Traces of Roman influence were sparse. By the early 1980s a cycle of aerial inspection of the scheduled monuments in Dyfed was being carried out by T A James, then of DAT, for Cadw: Welsh Historic Monuments. When additional funds allowed, the flying was extended into aerial reconnaissance. An area west of Carmarthen and north of the A40 proved particularly productive of cropmark sites in dry conditions and cropmarks of defended enclosures of possible late Bronze Age, Iron Age and Romano-British type were discovered to complement the known distribution of earthwork sites. Clearly, not all such sites were in contemporary occupation, but the density strongly suggested a well-settled, farmed and cleared landscape in the first century AD.

During the aerial photographic searches James noted a linear cropmark that bore all the hallmarks of a Roman road. The line was so clear that checks were immediately made to establish that the cropmark was not a pipeline. The discovery was published in *Archaeology in Wales* with a summary route detail, giving grid references and course alignments (James 1990). That initial discovery was followed up by more flying, principally by C R Musson, of the Royal Commission for the Ancient and Historic Monuments of Wales (RCAHMW) and through the fieldwork and excavation, described below.

A SUMMARY OF THE ROAD LINE

The eastern starting point of the road is the fort and town of Moridunum at Carmarthen . From here it can be traced for a distance of 38km to the village of Wiston , Pembrokeshire (Figs 2 and 3). For the first 30 km west of Carmarthen the road is never more than one kilometre from the Carmarthen-Fishguard railway line or from the present A40 Trunk road. However, the westernmost, identified section of the road was laid out over more hilly terrain to the north of the modern A40.

Much of the archaeological evidence for the road is in the form of cropmarks, of which parchmarks, representing the former causeway, are the most common. In total, 14km of parchmark agger has been recorded. Earthworks form the second type of archaeological evidence for the road. In three lengths totalling 2.7km the agger survives as an earthwork up to 1m high. Historic elements of the landscape such as hedgebanks, trackways and roads comprise the remainder and less definite evidence for the line of the road. With so much of the line between Carmarthen and Wiston now established, the course of the road within the gaps of the archaeological evidence can be conjectured with a high degree of confidence.

The road was laid out in a series of straight lengths of between 4- 6km Six of these lengths have been identified: Ffordd-las to Wenallt (Fig. 2A), Llwynbrain to Bryngwyn (Fig. 2B), Bryngwyn to Fforest (Fig. 2B), Fforest to the Afon Taf (Fig. 3A), the Afon Taf to the Afon Daulan (Fig. 3A) and from the Afon Daulan to Sarn-gwm (Fig. 3A & B). The change of direction between lengths usually occurs on hill summits or on ridge crests - Llwynbrain, Bryngwyn, Fforest- Sarn-gwm - indicating that these were used as both forward and backward sighting positions. The 4- 6km length of each section may be an indication that the road was laid out across a landscape cleared of most of its woodland and forest. This suggestion is supported by the palaeoenvironmental evidence that shows that the road was constructed across a landscape of open grassland with local stands of woodland (see Appendix 3).

THE EXCAVATIONS - CIRCUMSTANCES & NATURE

As part of the joint Dyed Archaeological Trust/Trinity College fieldwork along the road route, in 1993 single trenches were cut across the road in locations where the agger or causeway was most prominent. The first of these trenches was excavted at Bryn Farm, Llanddewi Velfrey (SN15151822) and the second at Pwll-y-hwyaid, Whitland (SN19901734). In both locations the road crossed localised peat bogs. Both trial trenches were 16m long and 2m wide and both exposed a narrow area of road which was totally excavated leaving two sections to record from either side of the trenches.

At Bryn Farm a simple single structural sequence was recorded. The agger was made up of a foundation layer of large boulders of various rock types. These would all have been locally available either as country rocks or glacially deposited material from the riverbed of the Taf, some 300m to the north. Above the boulders the agger was formed by a layer of shale chippings on top of which was the cobbled surface of the road itself. This lay between 0.10 and 0.3m below the present day field surface. This uppermost surface had clearly been robbed out in places in the past since there were areas where the shale was immediately encountered below the topsoil. However, sufficient of the uppermost surface of the road survived to preserve the traces of two gullies, probably wheel ruts, about 1m apart and running parallel to the line of the road. On either side of the shale/boulder causeway were flanking deposits of sand and silt that filled two small scoop ditches clearly seen in section on either side of the agger.

At Pwll-y-hwyaid (Plate 1) the trench cut across an equally pronounced agger across boggy ground and yielded a similar picture to Bryn Farm in quality of preservation and the character of the road. However, there were some significant differences. The boulders of the foundation layer that were laid over peat were smaller than those at Bryn Farm, probably reflecting differences in locally available stone. Above the boulders was a similar layer of compacted shale. The upper layer of cobbling, forming the road surface above the shale, was better preserved than that at Bryn Farm. This was because it was actually sealed by a sandy clay deposit that covered the surface and extended across the whole trench beyond the edges of the agger. Another difference with the structure of the road at Pwll-y-hwyaid was that there was only one ditch, on the north side of the road. This was more substantial than the scoop ditches at Bryn Farm and cut down into the underlying peat.

The excavators were careful to recognise the limitations that single narrow trenches have in elucidating the structural character and sequence of a linear monument like a Roman Road. The construction of the Whitland by-pass offered the opportunity to area excavate a length of Roman road close to the initial Pwll-y-hwyaid trench. This was welcome and the results described below amply demonstrate how area excavation can produce a more complete sequence.

The larger-scale excavations at Pwll-y-hwyaid, prior to the construction of the Whitland bypass, took place between April and May 1995. This was followed by limited excavation and recording during a watching brief phase. The line of the new by-pass ran obliquely across the line of the Roman Road and in all a 150m stretch was destroyed by road construction (Plate 2). A deep cutting was required at this point in order to pass under the unclassified North Road from Whitland to Cwmfelin Boeth. The Roman Road survived in this area both as a length of well-preserved agger and also as a less distinct earthwork with a hedge along part of its northern side. The agreed mitigation specified archaeological excavation and recording along a 60m length that was to be stripped of topsoil by machine and then cleaned and recorded by hand. Within this length five sections were to be cut through the road surface.

In the event, other restrictions imposed by the wayleave agreements and the local topography meant that the archaeological investigations were in fact effectively divided into two separate areas either side of a small stream (Fig. 4). The stream rose close to Pwll-y-hwyaid farm and ran northeastwards into a hollow area within which a peat bog had formed - already present in Roman times. The portion of Roman Road examined was bisected obliquely by a modern hedge bank, itself cut across by the stream and peat bog. The agger of the Roman road survived to within about 15m east of the stream. Undoubtedly, despite attempts in the more recent past to drain the boggy area, the wet conditions that prevented ploughing and drainage had preserved the structure and line of the Roman Road. West of the stream the land rose in level and excavation showed that the peat deposits thinned out correspondingly. This area had been extensively drained in the nineteenth century and heavily cultivated in the past reducing the Roman road to a slight earthwork.

These circumstances meant that to the west of the stream the full width of the Roman Road could be exposed along a 70m length - an impressive sight. To the east of the stream some 50m were exposed but not to the full width of the road throughout. Following machine stripping and then cleaning by hand down to the surviving uppermost Roman Road surfaces, a total of five areas were selected for total excavation down through the road structure (Fig. 4, Sections 1-5). Two of these (Sections 4 and 5) were narrow trenches dug mainly for the sections they provided. Section 4 had been overcut during machine stripping and Section 5 originated as an earlier geotechnical test pit dug by the by-pass engineers. A number of monolith samples were taken for a substantial programme of palaeoenvironmental analysis (Fig. 4, Whitland 1- 5). The monolith samples were taken from beneath and to both sides of the road and spot samples were taken from the underlying drain and ditch fills. The samples were analysed for pollen, plant macrofossils and fossil insect remains and produced valuable information on the pre-Roman and Roman environment (see Appendix 3). A two-week extension to the work was agreed as a result of the unexpected discoveries of timber structures in Sections 1 and 3 towards the end of the excavation period.

THE STRUCTURE OF THE ROAD

Summary of the sequence

The Whitland by-pass excavations at Pwll-y-hwyaid Farm produced an interesting sequence of 5 main phases of construction and use of the Roman Road as well as evidence for use of the area preceding the construction of the road. The latest phase of use, and the first encountered on excavation, was the most fully exposed. This was the uppermost surviving surface of the Roman Road itself. Below this were extensive and deep deposits of clay, representing a leveling up of the whole area of the Roman Road as a preparation for the upper surface. Beneath the clay was a well-preserved lower road surface. This sequence clearly demonstrated that at Pwll-y-hwyaid, unlike Bryn Farm, there were two distinct Roman Road surfaces representing two periods of construction and use. Beneath the lower surface were timber structures, convincingly identified as drains, evidence for extensive and skilled site preparation for carrying the Roman Road surface across boggy ground. Earliest of all, sealed by and thus pre-dating the Roman Road there were a number of postholes of possible Iron Age date.

The upper road surface

The topsoil was removed by machine from an area 110m long and up to 15m wide, either side of the stream, to expose the uppermost surviving structural elements. To the west of the stream, the overlying deposits comprised mainly a thin turfline and ploughsoil. At the base of the ploughsoil, and cutting into the road structure, was a series of 19th century field drains running diagonally across the road in a herringbone pattern. Also towards the western end, the road was crossed by a modern watermain. On the northern edge of the road, there was some indication of colluvial deposits and ploughwash. It is possible that on this side the road may have originally been terraced into the hillslope. To the east of the stream, where the road survived as a well-defined agger, the uppermost structural elements were covered by a thicker turf layer with little evidence of ploughing, at any rate in recent times.

The upper road surface (Fig. 5, 018 and Fig. 6a, 052) was 5m wide and was composed of angular sandstone blocks (varying in size from 0.1m x 0.1m to 0.3m x 0.2m) and rounded cobbles (up to 0.15m x 0.1m). The sandstone slabs were sparsely scattered across the uneven uppermost surviving surface (plates 3 and 4). However, sufficient were present to suggest that the Roman Road surface in this area was paved with sandstone set onto a cobble base. It seems probable that these sandstone blocks were 'robbed-out' for use as building material after this section of road went out of use in post-Roman times. The random uneven surface suggests that quarry pits were dug down through the topsoil for robbing whole blocks of road metalling. Unfortunately, there were no datable surface finds of pottery or coins to give any indication of when such piecemeal picking over might have taken place.

The cobbles and boulders together with the few surviving sandstone slabs of the latest Roman Road surface were set into a uniform matrix of yellow/grey silty clay (Fig. 5, 028) This layer extended out beyond the stone surface of the road. It effectively formed a 'soft verge' either side of the exposed road surface to the west of the stream. It was not recorded to the same extent east of the stream where there was more shale in the material flanking the upper road surface.

There was a suggestion that this 'soft verge' was preceded by shallow side ditches (Fig. 5, cut 123 and Fig. 6a, iron panning 176). Both of these features appeared to reflect the position and profile of the underlying original side ditches relating to the primary road surface. Possible reasons for the abandonment of these side ditches and their replacement by a clay 'verge' or berm are discussed below.

In Sections 1 and 2 the upper road surface overlay compact, dumped layers of clay and shale to form a firm base for the new surface. In Section 3, this clay and stone foundation (070) was thinner and much more irregular. It was not clear whether the decrease in thickness of this foundation layer was because the later road was being feathered out at this point to rejoin the original surface, or whether it was the result of post-abandonment disturbance.

In Areas 1 and 2, the upper road surface was almost half a metre higher than the earlier road. This resulted in the pronounced bank or agger across the wet ground. Again, possible reasons for this major remodelling of the Roman Road are put forward in the discussion section.

The earlier road surface

The upper road overlay an earlier, worn road surface made up of stones ranging in size from flat sub-angular stones, up to 0.4m x 0.4m, to small cobbles and gravel in a matrix of grey/orange shaley silty clay (Fig. 5, 029). The differences in the size of the stones across the surface appeared to suggest widespread patching and repair and a number of longitudinal grooves in the surface suggested wheel ruts (Fig. 7). This surface was laid on a layer of grey/orange clay, (Fig. 5, 118), c.0.15m thick which contained some shale and patches of mixed brown/grey clay. This in turn overlay a layer of yellow/grey clay (116), *c*.0.15m thick. This clay layer overlay a deposit predominately made up of shale chippings and grey clay (Fig. 5, 114 and Fig. 6a, 54) up to 0.2m thick. Beneath this was a foundation layer, 0.15-0.25m thick, composed of sandstone blocks in a clay matrix (Fig. 5, 122 and Fig. 6a, 171).

In Section 3, at the western end of the excavated area, the foundation layer of sandstone blocks overlay a timber corduroy, which was patchy and poorly preserved. The road surface of sub-angular stones and cobbles directly overlay this foundation layer with no obvious intervening shale core as in Sections 1 and 2 (114 and 054). The road surface (069) in Section 3 was much less well preserved than surface 029 in Section 1.

Although evidence for ditches flanking the primary road surface were encountered in each of the five areas and in the 1993 trial trench, the full profile of the road and both side ditches was only recorded in Section 2 (Fig. 6). Here the north ditch (178) measured *c*.1m wide and 0.6m deep with gently sloping sides and a rounded base. The south ditch (173) was *c*.1.4m wide and 0.5m deep with gently sloping sides and a flat base. The southern ditch showed evidence of having been recut in Sections 1, 2 and 5, although only its northern side was recorded in Sections 1 and 5. In Section 5 the northern side of this ditch had been recut as step-sided and it was 0.6m-0.7m deep. The southern edge of the north ditch in Section 4 also appeared to be step-sided, although only part of this was uncovered. The north ditch in Section 2 had also apparently been recut on a number of occasions.

The ditch fills were investigated in three of the Sections (Sections 1, 2 and 5) and there were similarities between all the fills, although, inevitably there were also localised differences. Not all the deposits are described here. Where both ditches were recorded in Section 2 the ditches were *c.*0.25m away from the edges of the road. A similar gap was evident between the south ditch and the road in Section 4. The basal fills of both ditches in Section 2 were a gritty, silty grey/green clay with a high organic content (Fig. 6a, 175 – south and 179/180 - north). The gritty texture was caused by silt nodules. Similar deposits of grey/green silty clay were also present in the south ditch in Sections 5 and 1 (Fig. 5, 120). In Section 1 this layer (120) was a secondary fill, possibly filling a recut. The primary fill (115) was a dark grey silty clay deposit. The plant macrofossil and insect remains from the fills of the south ditch in Section 1 (115 and 120) and from fills of the north ditch in Section 2 (179 and 180) showed that the ditches held standing water and that ditch side plant communities had developed by the time these deposits were being laid down (see Appendix 3).

In Section 2, following the deposition of the initial fills (175 and 179/180), it seems that secondary deposits formed between the road edges and the ditches. On the south of the road a layer of cream/brown clay (174) extended from the edge of the road into the south ditch and partially overlay the original fill (175). On the north side of the road a layer of cream/yellow/grey sticky, silty clay (188) overlay the edge of the north ditch. Both these deposits appeared to have been truncated, possibly by a recut of the ditches during cleaning. The fill of the recut of the south ditch was a layer of grey/brown silty clay (176) with iron panning at the interface with the primary fill (175). The recut of the north ditch was filled by a layer of dark grey/green gritty, silty clay (181).

Between the southern edge of the road and the south ditch, a small feature, 0.3m wide x 0.2m deep, (187) cut the southern edge of the road foundations (171), the shale core (054) and the clay deposit (174). This feature was itself cut by another recut of the south ditch. This later recut was subsequently filled with a layer of orange silty clay (177). Silt nodules in this layer gave it a gritty texture. Another possible recut was evident in the extreme south end of Section 2. This was filled by the clay layer (052) that was laid over the early road and carried the foundations for the later surface.

On the north side of the road, the fill of the recut of the north ditch (181) was overlain by a mixed layer of grey/green/orange silty clay (182). This was in turn overlain by a layer of orange silty clay (183). This deposit was cut to the south by a possible ditch filled by a very silty, gritty grey clay (185) (possibly formed by material washed out of the shale and clay core of the road) and a mixed orange/brown/grey silty clay (184). This was overlain by the foundation deposit (052) for the later road surface.

The foundation of the earlier road (Plate 5)

Within all of the excavated sections, a wooden raft overlay the natural peat and organic clays and provided a foundation for the road (e.g. Fig. 6b). This comprised a corduroy of brushwood and branches of alder, oak and hazel. It is likely that the corduroy derived from the clearance of localised stands of woodland and scrub along and close to the line of the road. There was no evidence at Whitland to suggest any reduction of the original ground surface. By contrast, at Bryn Farm, some 3km to the west, the peat surface immediately below the road appears to be of a Bronze Age date, suggesting some truncation and leveling (Caseldine 1997).

Excavation also revealed three separate wooden structures, one in Section 3 (198) and two in Section 1(125 and 142), which have all been interpreted as drains, or culverts. It was a remarkable coincidence that these structures were encountered in two of the five sectioned areas. The remainder of the road and underlying peat and clays were stripped during bypass construction and a watching brief revealed no trace of similar features below the affected section of the road. A full analysis of these timber drains is given with the specialist report on the timbers and woodworking techniques (Appendix 2). However, the principal structures are briefly described here beginning with the westernmost end of the road in Section 3 (Drain 198) eastwards to Section 1 (Drains 125 and 142).

Drain 198 (Section 3)

Drain 198 (Figs 8, 9 and 10) was aligned obliquely across the road. It was constructed of longitudinal oak timbers laid on cross-bearers (Fig. 8). These rested on the edges of a shallow trench, 0.7m wide and 0.2-0.3m deep, cut into the underlying organic clay. The excavated section was 5m long. The cut was filled with very shaley clay deposits (see below). The base of the trench was slightly irregular, but for the most part flat and sloped gently from northwest to southeast (Fig 9). Split oak uprights had been driven along both sides of the trench (Fig. 10).

The longitudinal timbers and the cross-bearers were too poorly preserved to be retained for further analysis. Six longitudinal timbers and five fragments were recorded. Five of the six timbers appeared to have been tangentially split from the outer part of relatively slow grown trees. The sixth was radially split from a fast grown oak. The width of the structure was covered by four of the longitudinal timbers laid side-by-side. When excavated, there were gaps of up to 0.15m between the longitudinal timbers. Whether they were originally touching or not is unknown. However, the relatively large size of the shale fragments (up to 5cm x 3cm) present in the fills below the planking, that had apparently percolated down from the road structure above, would suggest that the cover was never 'tight-fitting'. All the cross-bearers were half, or radially split oak with the exception of W149 which was bark. A radiocarbon date of 2100±80BP (Beta-84187) was obtained from two of these timbers. The structure was 'pegged' onto place by lines of driven stake uprights (41 in all). These were aligned down the side of the trench cut to contain the timber drain (Fig. 9).

Drains 125 and 142 (Section 1)

The situation in Section 1 was more complicated with one of the two drains (125) replacing the other (142). The excavation was further complicated in that some of the timbers from the early drain (142) had apparently been reused in the later structure (125). However, it was possible to identify the principal elements of the two structures, although some of the lesser elements were not attributable to either structure with any degree of certainty. Both structures were aligned north-northeast - south-southwest, at roughly 90^0 to the line of the road.

Drain 125 comprised a double line of uprights aligned along the edges of a linear cut capped by longitudinal timbers supported on four cross-bearers (Figs 11-13). The cut for the drain was 0.3-0.35m wide and 0.35m deep and sloped gently from north to south. A 4.5m long section was excavated. The cover (Fig. 11) consisted of poorly preserved longitudinal oak timbers, a tangentially split plank (W156), a half-split timber running parallel to it (W157) and a half-split branch (W159).

The tangential plank (W156) was sampled for dendrochronology (see Appendix 2 below, page 00) but proved too poorly preserved for measurement. The regular surfaces of the sample may suggest conversion by sawing rather than splitting. The estimated ring count suggested that it was derived from a tree with a moderate growth rate. Timber W157 was very compressed but appeared to be a very fast grown, half-split oak with sapwood and bark on its underside. The northernmost part of the cover (W159) was a half-split oak branch with trimmed side branches. Some or all of the timbers used in this cover may have been reused from the earlier drain (142). As with the drain in Section 3 (198), the sides of the structure were formed from driven uprights, with remnants of associated wattling. A group of larger uprights, recorded but not lifted, at the southern end of the drain may have been, along with other lost elements, some kind of outfall structure designed to stop erosion where the structure joined the southern roadside ditch.

The most notable element recovered from the underlying drain (142) was a near horizontal oak plank (W152), *c*.300cm long, 22.5cm wide and 4.5cm thick (Fig. 14; Plate 6). Following excavation, this proved to the sole remaining longitudinal timber from the drain cover. The overall construction of this earlier drain had similarities with both the other excavated features (198 and 125), with two lines of uprights, and traces of associated wattling. These were driven along the edges of a shallow trench cut and capped by a cover of cross-bearers that supported longitudinal timbers. A radiocarbon date of 2030±80BP (Beta-841788) was obtained from one of these cross-bearers (W291).

Following the discovery of the structures, rapid investigations were carried out outside the road line to determine whether the drains were carrying small watercourses, or any other type of linear feature that extended beyond the limits of the road. In the event, no features were recorded outside the line of the road. Consequently, it is concluded that the drains were intended to act as culverts beneath the road. They were presumably designed to carry excess water from one ditch to the other in order to avoid rising water levels in one ditch causing problems of overflowing. Presumably, the drains 142 and 198 were part of the initial ground preparation works, but later problems necessitated the replacement of 142 with the later structure 125 (Plate 7). A schematic profile showing the relationship between drains 142 and 125 is given in Figure 15.

The similarities in the construction of the three timber structures suggests they had the similar functions. The techniques used in their construction are all comparable with known Roman woodworking practice. Very similar stake and wattle-lined gulleys have been recorded at Annetwell Street, Carlisle, and Copthall Avenue, London (Nigel Nayling *pers comm*), where they have been identified as drains, with the wattle sides intended to stop erosion. It seems reasonable to assume a similar function for the Whitland structures. A wattle structure was also recorded in association with a 1st- or early 2nd-century road at South Ferriby in the Ancholme Valley, Lincolnshire. However, in this instance the structure was parallel to the road side and may have been intended as a revetment for the edge of the causeway (Chapman *et al* 1998, 242-244). A similar revetment has also been recorded alongside a road running close to 2nd -century buildings at the Lanes, Carlisle (Nigel Nayling *pers comm*).

The Whitland structures passed beneath a road, so they required covers. The use of planked covers supported by cross bearers for box-drains and other structures was common throughout the period. It seems evident that the covers were never tight fitting and that there were originally gaps between the planks. Even though the gaps were partially covered by the stones of the road foundation, they were obviously still wide enough for shale from the road structure to fall through and ultimately block the drains. The use of wattling rather than simple post and plank revetments and the conversion of the planks by splitting and hewing rather than sawing for the Whitland drains is somewhat unusual. However, this probably reflects the ease of supply of small and medium diameter roundwood compared with sawn timber.

Pre-Road features

Six features were noted in the peat surface below the corduroy at the eastern end of the site (Figs 4 and 16). The features were small hollows (128, 130, 132, 134, 136 and 138) filled with grey clay and shale. Feature 138 was a shallow, crescent-shaped scoop and appeared to have been a natural depression in the peat surface. Of the others, four were of similar size and shape, ranging from 0.48m x 0.42m (128) to 0.6m x 0.44m (134) and formed a line running eastnortheast - westsouthwest. The central two features in the line (128 and 130) had stones in the bottom which may have acted as post-pads (Plate 00). The line ran at approximately 40^{0} to the later road line. The remianing feature (136) was 2m to the north of the line of four and measured 0.5m x 0.48m. There was indication that the features had been cut through the road, so it has to be assumed that they were created prior to road construction. Despite being shallow (the deepest, 128, was only 0.2m deep) it is thought possible that the hollows may be the bases of former postholes.

No evidence to suggest a function for these features was recovered. However, the position of feature 136 on the inner edge of the north ditch may suggest that it was a marking out post for the road line.

DISCUSSION

Dating

It was disappointing but not surprising to have recovered no datable finds from either the surface, make-up or below the road. Five metal fragments were recovered by using a metal detector on spoil heaps and two pieces of flint came from the topsoil. Dating therefore depends on radiocarbon dates obtained from 2 samples from timbers of the drains 198 (2100±80 BP (Beta-84187)) and 142 (2030±80 BP (Beta-841788) and also radiocarbon dates from the pollen sample columns (see Appendix 3).

There can be no doubt that the road is Roman in date so the important question to be answered is how early is it? Excavations on the site of the fort in Carmarthen (James forthcoming) and others in west Wales (Pumsaint, Burnham forthcoming) have not changed the accepted view that the main invasion and conquest of west Wales followed from Frontinus's campaigns of AD 75 which rapidly established a network of roads and forts across Wales. The radiocarbon dates from the construction phase of the road at Whitland also suggest a similar, early date. Although we do not yet know where the road is heading to beyond Whitland, the early date and indeed the pattern of other Roman roads over most of Wales argues for a military origin and thus forts still to be discovered along its length. In terms of average distance apart - conventionally a day's march, we must expect there to have been a fort in the Whitland area.

The road structure

This picture of a rapidly constructed road by professional military engineers provides the framework for considering the similarities and differences between the two sections of the road so far investigated by excavation at Bryn Farm and Pwll-y-hwyaid. Both were over wet ground entailing the construction of an agger or causeway. The dates from the pollen sample taken through the peat at Bryn Farm do not extend beyond the Bronze Age suggesting that the later surface of the peat over which the road had been constructed had been removed, perhaps to create a more compact and level surface. There was no suggestion that this kind of surface preparation had been carried out at Pwll-y-hwyaid. Instead, a foundation of corduroy of brushwood and branches was identified in all the excavated sections. This perhaps was the best means of using the oak, alder and hazel stands that were felled and cleared along the intended course of the road here. The detailed specialist wood report gives ample evidence of carpentry skills.

It is estimated that the stone and clay foundation for the earlier road surface would have required approximately 4 cubic metres of clay and 2 cubic metres of stone cobbles and boulders for each 5m section of road. This foundation was overlain by further alternate layers of clay and shale requiring a further 4 cubic metres of clay and 4 cubic metres of shale per 5m section. Finally the road surface itself would have required approximately 2.5 cubic metres of cobbles per 5m section. As noted in the descriptions above, the stone would have been readily and locally available as water worn pebbles and boulders in streams and rivers. In addition, as the section describing the whole course of the road and the aerial photographic evidence makes clear (Appendix 1), quarrying for clay, gravel, shale and stone took place along the whole length close to the road. Where it crossed the wetter ground, the later road surface would also have required substantial quantities of stone and clay, probably in excess of 6 cubic metres of clay and 4 cubic metres of stone per 5m section. In addition, the sandstone slabs for the upper road surface must have been obtained from quarries further afield.

The two-phase construction of the Roman Road at Pwll-y-hwyaid is one of the most interesting results of the excavation. It is thought most likely that this rebuilding and heightening of the road was a localised response to a particular circumstance. This road heightening was most noticeable in the central section of the excavation where the ground was both lower and wetter. By contrast, it was noticeable that there were no intervening layers of clay and shale in Section 3 at the western end of the excavation. The earliest road surface in the central area seemed to have been frequently patched and a number of longitudinal grooves also suggested considerable wear. However, there was no sign of any slumping or subsidence. It is possible that the decision to raise the road level and construct a new surface here was prompted by a rise in water levels in the surrounding bog. We have no idea how long an interval there was between the primary and secondary surfaces.

A general reduction and virtual withdrawal of many military garrisons had taken place by AD 120. However, even though forts and their attached *vici* or civilian settlements may have been abandoned, roads between them seem to have continued in use. Therefore, we can conclude that there was likely to be continued maintenance of the Roman Road west of Carmarthen following the initial period of construction between the first and the fourth centuries AD.

The destination of the road

As has been seen, the line of the road has now been traced as far as Wiston (NGR SN02561851), but from here its line, or lines, is unknown. Whatever its final destination, it seems that Wiston is a significant point, because it is here that evidence for the road disappears, apparently completely. At present, there is no evidence to suggest significant Roman activity at Wiston, to date only a small number of sherds of 1st or 2nd century pottery have been recovered from the area (Murphy 1997, 89-90). There are several possible explanations for what happened at Wiston: the road may have headed for a single coastal destination; it could have bifurcated and extended to multiple coastal and, or, inland destinations; or it could have ended at, or near to, Wiston, where it possibly linked into an existing network of roads and tracks.

So far it has been assumed that the road was heading for a location on the coast, and if that was the case there are many possibilities from Wiston: it could have headed southwest to the Broad Haven area, at the southern corner of St Brides Bay at Goultrop Roads; the Nolton area of St. Brides Bay; north-west to Porth Mawr or Whitesands Bay; St. David's; or north along the western Cleddau Gorge to Fishguard Bay. All, especially Porth Mawr are known embarkation and arrival points to and from Ireland in the early medieval period (Hughes 1960). These sites - the sheltered upper reaches of estuaries or easily approachable open beaches - are typical of coastal transport before the construction of quays and harbours.

There is evidence for knowledge of the coastal waters around this area in the names of some of the headlands and rivers in Ptolemy's *Geography* (Rivet and Smith 1979). Furthermore, evidence for coastal traffic between the region and southeast Wales is also available in the makeup of the second century quay at the legionary fortress of *Isca* (Caerleon) which contains phyllite roofing slate from the southern Preseli Mountains, Pembrokeshire (Boon, 1978). Whatever the final conclusions, it is clear that coastal trading in the Romano-British period in west Wales must have depended on minor roads and tracks from the beachheads and heads of estuaries to their markets. A single military road (or roads) could thus have functioned as a major axial route(s). Without suggesting a situation as developed as that of Roman Brittany, the physical similarities between west Wales and the Armorican peninsula make comparison with its Roman road system very instructive (Galliou 1983 and 1991).

If a landing place was established on the west Wales coast in the late 1st century, was it intended to serve as an embarkation point for Ireland. The only known Roman military intentions towards Ireland come from Tacitus' biography of his father-in-law, Agricola (Ogilvie and Richmond, 1967). During his campaigns in southern Scotland and the fringes of the Highlands, in Galloway, in AD 82 he is reported to have received a refugee Irish prince whose information, together with that of merchants regarding harbours and approaches, led him to conclude that the country could be conquered with one legion and some auxiliary forces. His fleet had certainly carried out coastal survey off the Scottish coast. This came to nought with rapid changes in political circumstances and military objectives. But that combination of sufficient military forces at a period of campaigning when proximity to one of the 'jumping-off' points for sea-crossings to Ireland allowed the possibility to be entertained, could have also occurred in either north-west or south-west Wales in the late AD 70s.

Roman settlement in southwest Wales

The lack of recognisable military sites west of Carmarthen has led past commentators to argue for a peaceful, or even an acquiescent, relationship between the Demetae and the Romans (cf. Wainwright 1967, 62; Wacher 1995, 391). Many sites in both north and south Pembrokeshire have yielded up finds of Roman date and these, along with an increasing number of reported stray finds, indicate widespread Roman influence and Romano-British settlement throughout the region. But, significantly, so far no military settlements have been discovered. If they did exist where are they likely to be located? Given a generally accepted average of 15 miles (24km), or a day's march, distance between Roman auxiliary forts, a fort could be expected in the Whitland area, but Wiston is only just over 11 miles (18km) from Whitland. A 6km arc from Wiston would include Haverfordwest to the southwest and extend to the Spittal area to the northwest. Finds of Roman coins have been made at Whitland, Haverfordwest and a hoard of possible Roman coins was recovered the Spittal area in the 16th century, but to date, despite aerial reconnaissance, no identiifiable Roman military sites have been found.

It could be that the fort at Carmarthen and the presence of the Roman fleet operating around the coast was enough to exercise control without the need for actual campaigning into the Pembrokeshire peninsular. Viewed in this context, the road can be seen to have been a potent symbol of *imperium*. Not only would the road have had a physical impact on the landscape and on the social structure of the area by crossing existing landholdings and boundaries, in effect, slighting tribal lands and their associated heritage (Witcher 1997, 7), it would also have carried an implicit threat by being a constant reminder of the army stationed along the road at Carmarthen. The fact that the road ran close to several late Iron Age sites, particularly the enclosures at Llawhaden, which have been demonstrated to be high status sites may have been a deliberate decision on behalf of the road builders to make a political point. On the other hand, the road and the Llawhaden enclosures being close to each other at this point may simply reflect the fact that this area was the best crossing place, or a convenient landing place, on the eastern Cleddau river.

As well as providing military options the road also had an important economic role to play in the region by opening up access to the fertile farmland of west Carmarthenshire and Pembrokeshire and by giving the local population access to imported goods and the markets at Carmarthen.

Post-Roman abandonment and the survival of the road in the landscape

This section aims to briefly outline some of the possible processes and landscape changes that have resulted in sections of the road becoming fossilised in the present network of roads, tracks and boundaries and some sections being abandoned.

The withdrawal of the Roman army from Britain in the early 5th century and the resultant breakdown of centralised government created a vacuum that was filled throughout Britain by local affiliations, social, political and military, which redefined the way in which regions were governed. This change in government would have been accompanied by significant reorganisation of the social and physical landscape, possibly tied in with changes in landownership and agricultural practice (Fenton Thomas and Drew 1997, 23). One of the major factors in the new style of government may have been the reduction in importance and use of the long distance communications routes such as the Roman road. This would ultimately have led to some sections of the road becoming abandoned as the foci of power were shifting and regional relationships changing. These changes would probably have been felt first in the extreme outlying regions like *Demetia* where reorganisation of the landscape could have started quite early on. This may have been a significant factor in the apparent disappearance of the road west of Wiston.

Between Carmarthen and Wiston the process of abandonment appears to have been a more piecemeal affair with some stretches of the road continuing in use as roads or tracks, some lengths becoming fossilised in boundaries and some stretches being abandoned completely. A bi-lingual (Roman and Ogham scripts) memorial stone to *Voteporigis* (the Voteporix stone PRN 3731), a 5th century king of Dyfed, was discovered in the last century built into the wall of a chapel at Castell Dwyran (Fig. 3A) close to the line of the Roman road (NGR SN14421821). The Roman road line at this point is now represented by a parchmark and a small unclassified road. The original location of the stone is unknown, but it has been considered that it came from the near vicinity (Wyn Evans 1991), possibly alongside the road itself. If that was so it suggests that this section of the road maintained a significance beyond being just a local by-way well into the 5th century (Fenton Thomas and Drew 1997, 22).

Other significant places developed along the road during the early medieval period. Carmarthen had maintained its importance throughout the period and Whitland came to prominence in the early 10th century as the place that Hwyel Dda drew up the first Welsh laws. It seems reasonable to assume that the Roman road route was still viable between these two places at the time, although, that does not necessarily mean that the structure itself remained intact or in its original form for the whole route. There is evidence to suggest that the route, if not the road itself, was still in use in the 12th century when Gerald of Wales (*Giraldus Cambrensis*) made his 'Journey Through Wales'. The route he took, like the road, ran from Carmarthen to Llawhaden, via Whitland (Thorpe 1978).

Today there is a short stretch of bridleway that links Whitland Abbey to North Road in modern Whitland town. This has always been known locally as the Roman road and it does indeed run close to the line of the road and only 100m north of the excavation site. It meets the Roman road at the point where the Roman line crosses modern North Road. To the west of this point the line of the Roman road survives as a farm track, but to the east it survives only as the earthwork agger investigated during the excavation. Here it seems likely that the foundation of the abbey in the 12th century prompted the construction of an access road to link the abbey with the Roman road, some 1km to the southwest. In time it seems that this link road took over in importance and use from the original Roman road line, which passes to the south of the abbey, as traffic now tended to pass directly by the abbey (Fenton Thomas and Drew 1997, 23).

The rate of landscape change accelerated during the post-medieval and modern periods as the amount of enclosed land increased and more intensive agricultural techniques were introduced. All these factors have played a part in the survival and present condition of the road and how it is visible today. Fieldwork carried out in 1993 and 1994 by the Archaeology Department, Trinity College, Carmarthen, showed that the areas where the road survived as an earthwork, agger, terrace or hollow, were generally low grade agricultural land. Inevitably, ploughing has had a dramatic effect on the survival of the road structure. Over large stretches, where the upper levels of the agger have been leveled, the foundation stones have been exposed and are now frequently dislodged during current ploughing. Large earthwork features are also being affected, such as the cutting at Zabulon Farm (NGR SN23691674) where it is being flattened by continued ploughing.

In other cases it is likely that the road has been covered by alluvium or colluvium and may survive beneath the present ground surface. This may be the situation at Trewern where the road runs through water-meadows alongside the River Taf, which are prone to flooding. Very clear parchmarks are visible here on aerial photographs. Another threat to the road structure is erosion through river action. At Llwyn-Drissi Farm (NGR SN18381726) a section across the road is clearly visible in the bank of the Nant Cwmfelin-boeth. Here the road is made up of compacted layers of shale and cobbles and is about 15m wide. Other examples of this kind of damage must exist in spite of the lack of similarly clear evidence (Fenton-Thomas and Drew 1997, 12).

Conclusions

The identification and investigation of the road has answered one of the most enduring questions in Roman studies in Wales, that of the presence of a road west of Carmarthen. It has also provided technical information about the construction of a rural road on the very edge of the Empire, including the large assemblage of wood from the drains. However, there are fundamental questions left unanswered, where was it going? Were there associated military settlements along or close to its line? Tracing the road line will undoubtedly allow for a more focused search for military sites and its possible destination, the discovery of which will lead to a greater understanding of the role of the road and of the nature of Roman settlement in southwest Wales.

APPENDIX 1

THE COURSE OF THE ROMAN ROAD WEST OF CARMARTHEN

By Ken Murphy

This section is largely based on the results of a programme of mapping the Roman road of Dyfed from aerial photographs funded by RCAHMW (Murphy 1997).

The Roman road west of Carmarthen can be traced for more than 38 km to close by the village of Wiston, Pembrokeshire (Figs 2 and 3). Its eastern starting point is the fort and town of Moridunum at Carmarthen. Its destination is currently unknown. The overall course of the road is 3^0-5^0 degrees south of due west. For the first 30 km west of Carmarthen the road follows a route recognised as the most convenient by recent engineers - the Roman road is never more than one kilometre from the Carmarthen-Fishguard railway line or from the A40 Trunk road. From Carmarthen to Bancyfelin, this natural route lies in a wide open valley. From Bancyfelin to St Clears an interfluve comprising low hills divide this valley from that of the Afon Taf. The natural route corridor from St Clears now follows the course of the Taf valley until approximately 4-5km west of Whitland. From here no one definite natural route takes precedence; the Roman road was laid out over hilly terrain; the A40 takes a route to the south across lower-lying land whilst the railway continues to follow the Taf valley and then the valleys of the Eastern and Western Cleddau and their tributaries.

The geology traversed by the road from Carmarthen to Whitland comprises Ordovician shales of the Arenig Series overlain by boulder clay on the valley sides. Valley bottoms are filled with alluvium (Geological Survey of Great Britain 1967). To the west of Whitland the geological sequence becomes more complex. Ordovician shales of the Llanviren Series lie to the north of Whitland with alluvium in the valley bottoms. From the Afon Taf to Bryn Farm (Fig. 3A), the road crosses Ordovician shales and mudstones of the Bala Series. To the west, the hill at Bryn Dwyrain is capped with glacial sands and gravels with boulder clay on the slopes (Geological Survey of Great Britain 1974). The hills crossed by the road to the west of Bryn Dwyrain are composed of Silurian Cethings Sandstone Black Shales and Conglomerates with Ordovican shales and mudstones of the Bala Series on lower slopes and boulder clay in some of the valley bottoms. Alluvium fills the valley floor of the Eastern Cleddau.

The road was laid out in a series of straight lengths of between 4- 6km. Six of these lengths have been identified: Ffordd-las to Wenallt (Fig. 2A), Llwynbrain to Bryngwyn (Fig. 2B), Bryngwyn to Fforest (Fig. 2B), Fforest to the Afon Taf (Fig. 3A), the Afon Taf to the Afon Daulan (Fig. 3A) and from the Afon Daulan to Sarn-gwm (Fig. 3A & B). The change of direction between lengths usually occurs on hill summits or on ridge crests - Llwynbrain, Bryngwyn, Fforest- Sarn-gwm - indicating that these were used as both forward and backward sighting positions. The 4- 6km length of each section may be an indication that the road was laid out across a landscape cleared of most of its woodland and forest. This suggestion is supported by the palaeoenvironmental evidence which shows that the road was constructed across a landscape of open grassland with local stands of woodland.

The majority of the archaeological evidence for the road is in the form of cropmarks, of which parchmarks, representing the former causeway, are the most common. In total, 14km of parchmark agger has been recorded. Cropmark evidence for roadside ditches is rare, though the location of many former quarries has been identified on aerial photographs. In some instances these former quarries are evidenced by slight surface depressions in addition to the cropmarks. It is assumed that these quarries are of Roman date and provided roadstone and aggregate for the road's construction. At three locations where the road descends a steep slope before crossing a river or stream a possible silted hollow-way is visible on aerial photographs, and in one location an extant hollow-way is present. Earthworks form the second type of archaeological evidence for the road. In three lengths totalling 2.7km the agger survives as an earthwork up to 1m high. Historic elements of the landscape such as hedgebanks, trackways and roads comprise the remainder and less definite evidence for the line of the road. With so much of the line between Carmarthen and Wiston now established, the course of the road within the gaps of the archaeological evidence can be conjectured with a high degree of confidence.

For 5km to the west of Carmarthen the course of the road is not known, though it is suspected that at least some sections of it are overlain by the historic line of the A40, including Lammas Street which leads out of Carmarthen town to the west. The first clear evidence for the road, in the form of a agger parchmark, is obtained at Ffordd-las (Fig 2A). This parchmark lies to the west of a low hillock. Projected eastwards, the road would seem to run over the summit or a high shoulder of this hillock, perhaps indicating that it was used as a sighting position. To the west the road follows a very slightly curving course evidenced by agger parchmarks and the lines of hedgebanks for 5.5 km before curving sharply to the south at Wenallt. For these 5.5kms the road lies low on the northern slopes of a wide, open valley. A valley which is now occupied by a misfit stream and is the natural route west out of Carmarthen. Several south-flowing streams are crossed by the road, but it is not until 0.6km to the east of Wenallt that a river, the Afon Cywyn, is encountered. The modern and historic A40 and the railway all bridge the Cywyn 1km downstream on a broad floodplain which is subjected to occasional flooding and may have been susceptible to infrequent tidal inundation in the Roman Period. The Roman road crosses the Cywyn where the flood plain is only 400m wide.

The road's sharp turn of 30 degrees to the south-west at Wenallt seems to have been dictated by the decision to avoid climbing a steep south-east facing valley side. This is the only sudden change of course in the whole of the 38km. The curve here is around the base of a low hillock on the summit of which is located an Iron Age defended enclosure with presumed Roman road quarries in the form of cropmarks on its side. Following this new course, evidenced by an agger cropmark, for just 0.8km, the road then turns back through 26 degrees to pursue a route close to its previous line; this was presumably engineered in order to return to the overall intended line after the 'diversion' at Wenallt to avoid too steep an ascent. To the west there are two stretches of over 1km each where there is no evidence for the road (Fig. 2B), but its general conjectured line is clear from the known sections of agger cropmark and from cropmark quarries. At Llwynbrain the projected line of the road runs over the crest of a spur whilst undergoing a slight change of course of 5^0 to the south-west. This spur is a probable sighting point as the road then maintains a straight course for 6 km to Bryngwyn, running across an undulating plateau dissected by south flowing streams. The west-east aligned valley of the Afon Taf into which these streams flow lies between 1 and 2km to the south of the road. The Afon Dewi Fawr and the Afon Cynin are the only major watercourses in this 6km. The road crosses them approximately 1.5km upstream from the modern high tide mark.

A low eminence at Bryngwyn signifies another sighting point, backward to Llwynbrain and forwards to Fforest, as here the road undergoes another subtle change of course, 13 degrees to the north (Fig 2B). Between Bryngwyn and Fforest, a distance of 4km, the road maintains a straight course across a low plateau dissected by south-flowing streams - topography similar to that previously traversed to the east. Evidence for a cropmark agger is almost continuous in this stretch. Many cropmark quarries are also present. All the quarries between Wenallt and Fforest are situated on high-ground and seem to have been dug to obtain the Ordovician shale where it is not masked by boulder clay and alluvium on the lower slopes and valley bottoms. To the south-east and south-west of Gorsgandrill, roadside ditches are visible on aerial photographs. On the descent onto the floodplain of the Afon Fenni, the road ran in a hollow-way, now silted, and showing on aerial photographs as a cropmark.

A gentle 12 degree curve of the road to the north over a low ridge at Fforest represents another sighting point, back to Bryngwyn. The next high point at Bryn Dwyrain (Fig 3A) is not visible from Fforest, though the valley of the Afon Taf can be seen. Other changes in direction in the road seem to be quite abrupt; the gentle curve at Fforest is well-evidenced by aerial photography (RCAHMW 1994, 1995). The road now maintains a straight course for 5.2 km, crossing a low plateau dissected by three south-flowing streams: the Nant Allwyn, the Afon Gronw and the Nant Cwmfelin-boeth. In addition to the six relatively short lengths of agger cropmark and three cropmark quarries, the road is evidenced in this stretch by a

400m section of agger earthwork. It was at the western end of this earthwork, where it is now crossed by the A40, that the 1995 excavations took place.

From here the road descends into the Taf valley necessitating a 2^0 adjustment of course to the south (Fig 3A). This slight adjustment to the course takes the road around the base of a steep-sided spur on the south side of the Taf valley. In the valley, on generally flat but slightly rising ground, the road is manifest as a earthwork agger over first a 1.4km section and then at Bryn Farm over a 0.9km length. In both areas well-preserved cultivation ridges of medieval and/or post-medieval date are present. The presence of these would seem to indicate that no modern ploughing has taken place; this may be a factor in the preservation of the road as an earthwork. When projected, these two lengths of earthwork do not meet - there must be an as yet undetected kink in the road line. To the west of Bryn Farm the road crosses the Afon Daulan, undergoes a 3^0 change of alignment to the south, and climbs a steep slope onto a ridge towards Bryn Dwyrain.

It is from this point, when the road climbs onto the Bryn Dwyrain ridge, that the natural east-west route corridor is lost. The railway begins to swing away to the north heading for Fishguard and the A40 to the south making for Haverfordwest. The terrain now traversed by the road until it is finally lost at Manor Farm, a distance of 15km, is too broken to be termed a ridge-way. The road does, however, run across the summits of several low, broad hills, any or all of which could have served as sighting positions. Interspersed with the hills are descents and ascents of deeply incised valleys of south-flowing streams and rivers. Because of the greater and steeper relief of the landscape more frequent changes of direction of the road were required to maintain its general westward trend. The archaeological evidence is also here more fragmented and dispersed than previously encountered. Quarries, presumably of Roman date, were dug on the crests or high slopes of many of the hills crossed by the road in order to exploit the Silurian sandstones, shales and conglomerates. Only at Bryn Dwyrain, a hill capped by glacial sands, gravels and boulder clay are quarries absent or undetectable by aerial photography.

Climbing up from the Afon Daulan (Fig. 3A), evidenced as an agger cropmark, the Roman road line is then overlain by a modern minor road. On the summit of the hill the road passes close by a Bronze Age burial mound at Bryn Dwyrain. This is a good sighting point, to the west and east, though the road does not change course. Fragmented sections of cropmark agger, hedgebank alignments and lengths of modern road indicate that the road maintains a fairly straight course for 4km from the Afon Daulan to the crossing of a small tributary stream of the Daulan. The descent to this stream is via a silted hollow-way. From the stream there is a change of direction of 8 degrees to the south. The road now follows a slightly curving course over the summit of a hill near Sarn-gwm before a steep descent into the valley of the Eastern Cleddau.

To the east of the Eastern Cleddau evidence in the form of agger cropmarks and quarry cropmarks becomes even more fragmented and dispersed. There are frequent minor changes of direction as the road seeks to find a route across hilly terrain whilst maintaining its course of 3-5 degrees south of due west. From the Eastern Cleddau the road ascends the steep valley side via a tributary valley. There is then good cropmark evidence for the road where it crosses a broad hill near to Highfield, including a cropmark hollow-way on the eastern descent. At Longlands Farm cropmark evidence for an agger, quarries and roadside ditches indicates that the road undergoes a sharp dog-leg kink. There is no apparent topographical reason for this. The dog-leg does however ensure that the road runs over the crest of a hill at Fernhill, 250m to the west. The final western piece of agger cropmark is at Manor Farm, just to the east of the village of Wiston. From this point the course of the road has not yet been established.

APPENDIX 2

THE WOOD ASSEMBLAGE REPORT

By Nigel Nayling and Richard Brunning

Summary

This report synthesises data gathered from site wood records, on-site assessment, post-excavation assessment, and subsequent detailed recording and post-excavation analysis of wood held in store at Carmarthen Museum. The wood assemblage includes four major structural groups: each of these are considered separately as analytical units. Details of the dendrochronology results with selected ring-width data, and details of samples by structure can be found in the site archive.

Introduction

The main author of this report was initially contracted to provide on site advice and limited assistance with the recording and selective recovery of the wood assemblage from the site. Following completion of the excavations, a post-excavation assessment was carried out to determine the potential of this assemblage and its associated record and to make recommendations on an appropriate post-excavation programme of analysis. This report provides a synthesis of the results of this work, complementing an archive comprising wood record sheets, photographs, drawings, tree-ring width data and a database.

Methodology

Two sites visits were made during the course of the excavations. Dendrochronological samples were taken from one 'bog oak' excavated by machine during construction works and another found *in situ* in the river bank on the line of construction works. Poorly preserved, horizontally laid timbers forming the surface of structure 198 (Section 3) were examined and sampled *in situ* before being discarded. A single large plank associated with structure 142 (Section 1) was lifted and sampled and general advice given on the recording and recovery of the remaining elements of structures 198 and 125/142.

After the completion of the excavations, wood held in store at Carmarthen Museum was examined using a hand lens and the naked eye. All pieces were examined for evidence of conversion from the parent tree and any subsequent woodworking. Oak (*Quercus* Spp.) pieces were identified and notes taken on ring counts, average ring width, presence of bark and season of felling. Where sufficient rings were present (minimum 50) dendrochronological samples were taken. Identification samples, which had been taken in the field, were not examined in detail.

Post-excavation analysis of the material was guided by the recommendations in the assessment report (Nayling, 1996). Selected pieces were examined for woodworking evidence (point type, cutting angles, toolmarks, jam curves and tool signatures) and data recorded on existing wood record sheets. The shape of the points were classified according to certain established types (Coles and Orme 1985; O'Sullivan 1991). These point types indicate the form of point produced, and indirectly both the style of working and the amount of wood removed during the process. Chisel-ends are cut down one side of the stem only, with the opposing side of the trunk remaining intact. The worked area may be uniformly in one plane or as a chisel-variant with two closely adjacent worked faces. Wedge-ends are cut on opposing sides of the trunk, either directly opposite or as in the case of Wedge Variants on almost adjacent faces. Pencil-ends show the most amount of working, being cut on three or more faces completely around the diameter of the trunk.

The 'cutting angle' denotes the angle of the worked surface to the length of the stem. However a variety of angles can be found on a single piece, so both the minimum and maximum cutting angles were recorded to present the cutting angle range. The means of measuring the angles was by laying the point against a perspex template, graduated into intervals of degrees. A very shallow cutting angle (0-20 degrees) indicates a concern for a sharp point, as well as the ability of the blade to cut into the wood successfully when wielded at steep trajectories. A thin, flat and very sharp blade is required to make successful blows at angles under 10 degrees. Medium to straight cutting angles at timber ends or inside mortises usually result in jam curves, a useful feature of toolmarks to be discussed below. Cutting angles can be referred to in numerical values or as categories. These are 0-20 degrees (very shallow), 21-40 degrees (shallow), 41-60 degrees (medium), 61-80 degrees (steep) and finally 81-90 degrees (straight).

A selection of pieces were drawn at 1:1 on clear acetate, indicating conversion, presence of main natural wood features and working evidence. The assemblage was selectively photographed for archive, publication and educational purposes. Both black and white photographs (with attached contact sheets) and mounted colour slides were produced.

Dendrochronological samples were prepared and analysed as detailed in the dendrochronology section contained in the site archive.

Samples from non-oak pieces were identified, where possible, by taking thin sections from three planes and examining them at high magnification and comparing them with widely-accepted wood anatomy atlases (eg Schweingruber 1978, Cutler *et al* 1987), and reference collections of stained slides compiled from authenticated wood samples from the Royal Botanic Gardens, Kew. Where samples contained the full ring sequence, including bark, and were well preserved, ring counts and assessment of felling season were attempted.

Minor Contexts

In addition to the main structural groups, a relatively small number of samples and pieces of wood were recovered from a number of contexts. Dendrochronological samples taken from one 'bog oak' excavated by machine during construction works and another found *in situ* in the river bank on the line of construction works were analysed *gratis* by Jennifer Hillam at the Sheffield Dendrochronology Laboratory as part of an ongoing initiative to extend and consolidate prehistoric chronologies for the United Kingdom. The tree-ring curves produced neither cross-matched with each other nor with dated regional or site chronologies (Hillam pers comm).

Four samples (121-124), from context 023 associated with a basal stone strew, were identified as a compressed roundwood stem of alder (*Alnus* Spp.) and a radial split, half split and roundwood stem of oak (*Quercus* Spp., 3). Preservation was too poor to allow ring counts.

A single sample of a compressed roundwood upright from the northern ditch, context 043, was not identified.

Two pieces were recorded from the upper peat layer at the base of the road, context 111. The identification sample of wood 126, a third split stem, was not located. The other piece, wood 135, was an oak roundwood stem with a pencil point and trimmed sidebranches. The heavily worked point exhibited flat tool facets with surviving widths of up to 29mm. The stem had an off centre heart (possibly indicating it was a branch), no heartwood and 20 sapwood rings. It exhibited slow/medium growth rate (average ring width 1.6mm) and was summer felled.

Two samples from context 122, for which no wood record sheets exist, were identified as oak heartwood (12 rings) and a piece of hazel roundwood with 8 rings and a narrow last ring suggestive of summer felling.

Six pieces (283-288) were found lying outside structure 125 (context 126) and interpreted on site as possible woodworking waste. Two of these were identified as hazel (*Corylus avellana*), both apparently unworked roundwood. One of these, wood 285, exhibited a narrow last ring possibly indicating summer felling. Three poorly preserved pieces were identified as oak, one apparently unworked roundwood, and two apparently tangentially split. One of the latter, wood 288, had over 70 heartwood rings but was so slowly grown that dendrochronological measurement proved impossible. This piece does not appear to be a fragment of plank 152 from structure 142 as its growth rate was significantly lower. Given the poor preservation of this small group, the absence of any woodworking evidence is not surprising, and the tentative interpretation of this material as woodworking waste associated with construction of structure 125 or 142 could still be valid.

Structure 125

This structure appears to comprise a double line of driven and wattled uprights aligned along the edges of a linear cut feature capped by a cover of cross-bearers and longitudinal timbers which could have acted as a drain crossing beneath the Roman road. Its exact composition is not completely clear as this feature cuts an earlier structure (142) passing along a similar alignment. Some of the wood assigned to structure 125 could have been reused from structure 142.

The 'cover' comprised three poorly preserved oak longitudinals: a tangential plank (156), a half split timber running parallel to it (157), and to the north a half split branch (159). The tangential plank was sampled for dendrochronology but proved too poorly preserved to allow measurement. Estimated ring count (57 heartwood rings and 7 sapwood rings with an average ring width of 1.9mm) suggest it was derived from a tree of moderate growth rate. The very regular surfaces of the dendro sample might suggest conversion by sawing rather than splitting. Timber 157 was very compressed but appeared to be a very fast grown, half split oak with sapwood and bark on its underside. The northernmost part of the cover, 159, was a half-split oak branch with trimmed sidebranches, approximately 100m in diameter. Some or all of the timbers used in this cover may have been reused from structure 142.

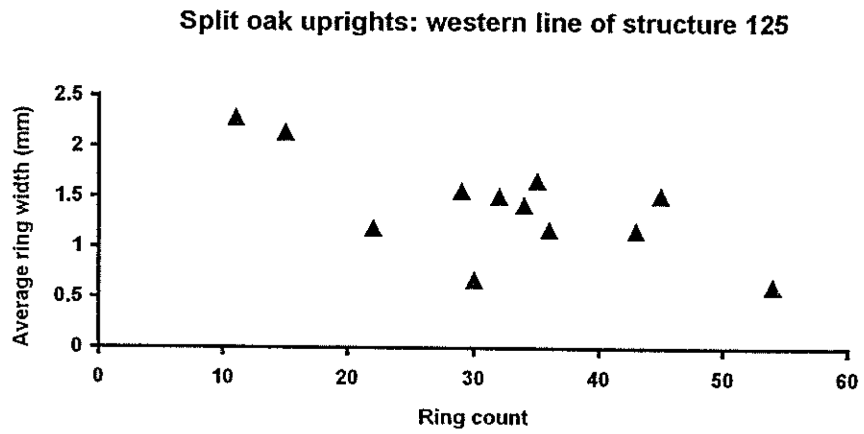
Cross bearer 163, a poorly preserved oak tangential plank, was possibly part of a larger tangential plank that had split in two. Its 'inner' face appeared split rather than sawn and its 'outer' face was probably axed and adzed rather than sawn or split. Poorly preserved tool facets had widths of 71mm. These features are reminiscent of plank 152 (structure 142). Interestingly, the surviving heartwood ring sequence of 163 matches visually (and has a t value of 4.8 [CROS-73]) with plank 152. This suggests that timber 163 was originally employed in structure 142 and then reused in structure 125. Bearers 164 and 165 were compressed split alder branches (?) and 184 was a very compressed and fast grown split oak branch.

Driven uprights formed the sides of the structure, in some cases with associated wattling. These are considered initially as separate rows. Of the 25 numbered uprights from the eastern line, one was totally sampled for radiocarbon dating, 4 were not lifted and one could not be found during the assessment. Wood 171, a very compressed piece of oak with 25 heartwood rings, may be a fragment of either an upright or one of the cover timbers.

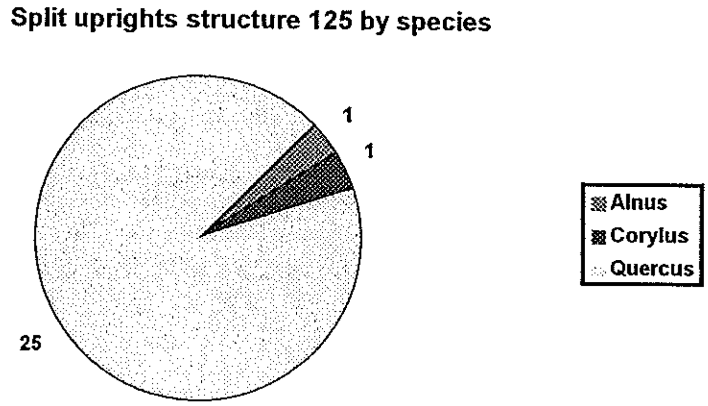
The remainder can be divided into roundwood and split uprights. The ten roundwood uprights comprised a 13 year old alder stem with a pencil point; five hazel stems with pencil (3), wedge variant and chisel points, three of which had trimmed sidebranches; two oak stems, 10 and 20 years old, both with pencil points; and two, poorly preserved, unidentified uprights. One of the oak uprights was summer felled although one of the hazel stems appeared to have a complete last ring. All the points examined in detail exhibited very shallowly angled, flat tool facets. Maximum facet width ranged from 18 to 29mm. Oak upright 263, probably branchwood with trimmed sidebranches, exhibited a flat jam curve of 23mm.

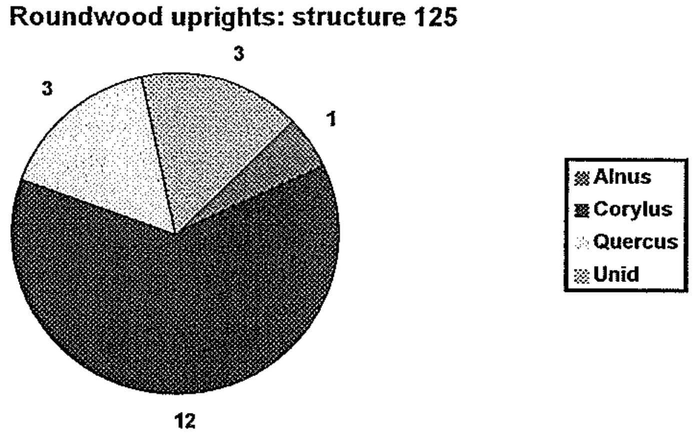
Eight uprights had been converted to some extent, generally half or quarter split. Six of these were oak including 271, a summer felled, 24 year old stem with two opposite edges trimmed flat, a trimmed sidebranch and a finely cut pencil point. Unusually this point retained slightly concave facets up to 69mm wide. The rest of the oaks were too poorly preserve to provide useful growth data, but had pencil (or in one case wedge) points, two with flat facets of maximum width 23 and 25mm. Two quarter split uprights were hazel and alder stems with wedge variant points, the latter with five rings.

Uprights in the western line were assigned 31 wood numbers. Five uprights were not lifted. Of the nine roundwood uprights, 8 were hazel with between 9 and 14 rings, pencil or wedge variants points and very shallow tool facets with maximum widths of 18-25mm. Two of these had narrow last rings suggestive of summer felling. The remaining roundwood upright was an 13 year old oak stem with a pencil point. In contrast with the eastern line, the majority (18) of the western uprights were made from split oak. These ranged from the large southern terminal upright, 270, with only two opposite edges trimmed flat and parallel like 271 on the opposite row, to off-square stakes produced by cross splitting radial splits. Where average ring widths could be determined, the oak's growth rates were slow to medium (Fig. 00).



Points were predominately of pencil type with 4 wedge or wedge variants and a single possible chisel point. Facets angles were very shallow and maximum facet widths 19-52mm. Four pieces exhibited trimmed sidebranches. An eighth-split piece had an incomplete, flat jam curve of 45mm, and the large upright 270 had a flat jam curve of 46mm. A single upright (W183) from the north end of the structure may be part of structure 125 or 142.

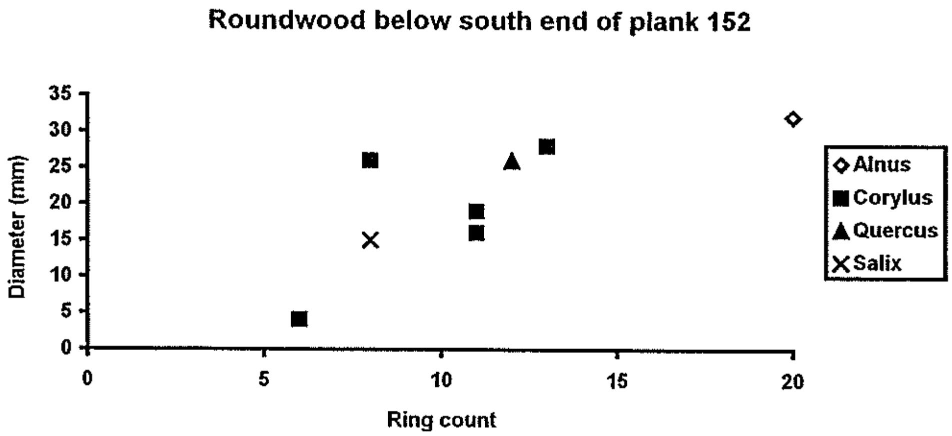




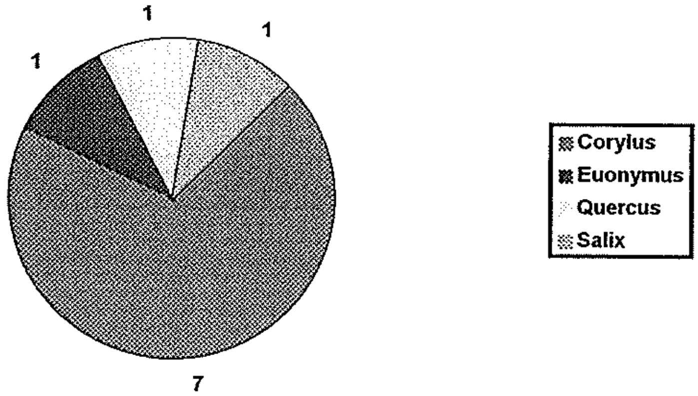
Examined as a whole, the species composition of the uprights from both sides of the structure (Fig. 00) highlights the predominant use of oak for split stakes and hazel for roundwood uprights.

Smaller roundwood lying approximately horizontally in the structure can be divided into two main groups: roundwood located beneath plank 125 and wattle found either woven around or in close association with the driven uprights.

Wood 166-8 are individually numbered roundwood whilst 276 was assigned to a group of roundwood from which eight samples were taken. Hazel dominates this group with single occurrences of alder, oak, spindle (*Euonymus europaeus L.*), and willow (*Salix* spp.) (Fig. 00). Age and diameter data, available for 10 of the 11 samples (Fig. 00), show a spread of ringcounts between 6 and 13 with the exception of the 20 year old alder stem. Two of the hazel stems (166 and 168) exhibited narrow last rings suggestive of summer felling.

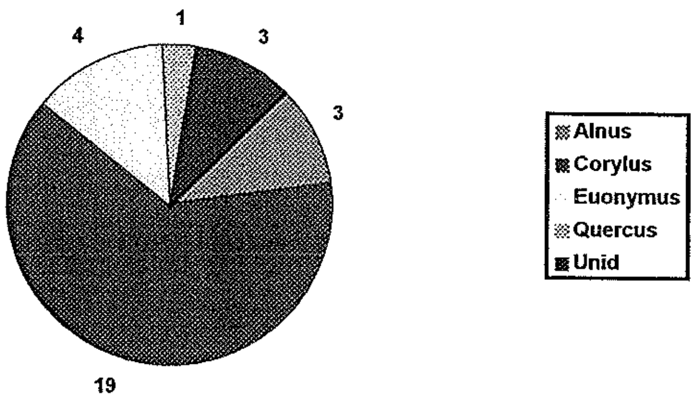


Roundwood beneath south end of plank 152

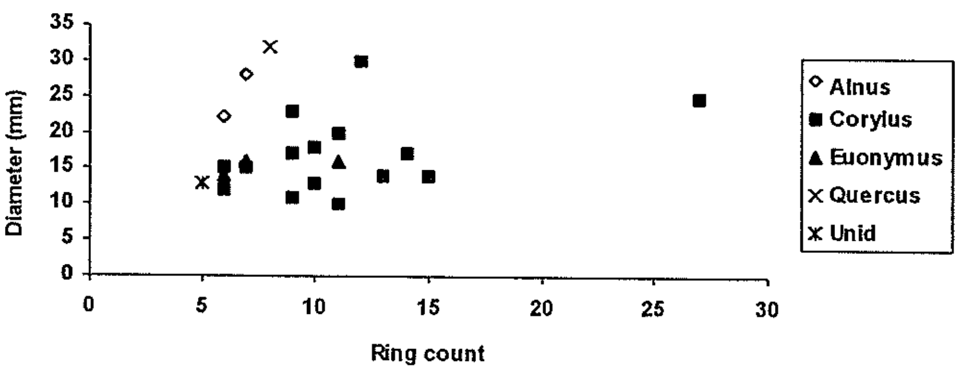


A total of 30 samples from roundwood associated with the uprights and covers of structure 125 were examined. There may be some duplication of individually numbered pieces which may also have been sampled in two transects of wattle, wood numbers 181 and 182, which generated 5 and 8 samples respectively. Hazel dominates the assemblage with lesser quantities of alder, oak and spindle (Fig. 00).

Wattle structure 125



Wattle from structure 125



Where age (ring count) and diameter data are available (Fig. 00), ring counts fall within 5-15 with the exception of a single hazel piece. The scatter does not show any close clustering of age that might be associated with exploitation of closely managed coppice. Two hazel stems and one oak piece had narrow/incomplete last rings indicative of summer felling. Simple wedge of chisel cut ends, noted on three samples probably related to felling, although one sample 181.2 had chisel cuts at both ends (with a length of 190mm). One sample of alder (181.1) had 3 trimmed sidebranches.

Structure 142

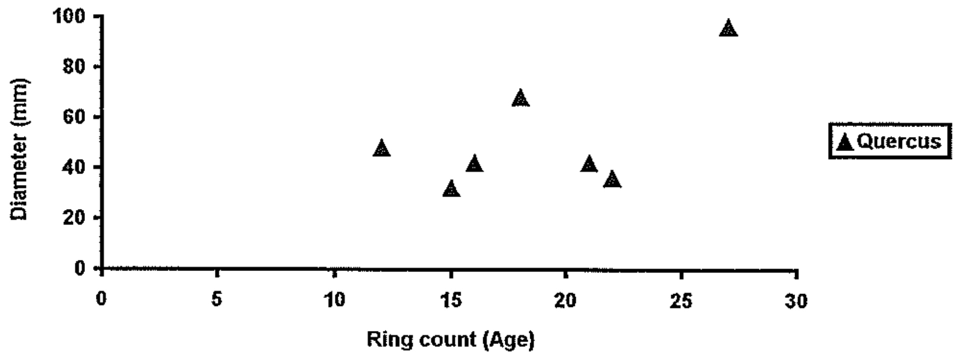
The precursor to structure 125 is a similar construction apparently comprising remnants of a possible cover (horizontal timbers), two lines of driven roundwood uprights along each side of a linear cut feature, and wattling woven between the uprights.

The near horizontal oak plank W152 was tangential in conversion and the underside exhibited numerous facets from secondary hewing. The timber was derived from an oak of at least 75 years but conversion and subsequent trimming had removed any traces of the pith or bark. The timber was probably split tangentially from the parent log and then cut down on its outer face. The *in situ* upper face was eroded and decayed and only one toolmark, of an adze with a width of 71mm, survived. The underside (outer face) was axed and adzed over its whole length. Adze marks, concave facets with maximum widths of 71mm, came in from several directions. One or two straight cut marks (only 35mm in width) suggest the use of an axe or adze to cut vertically into the timber during the process of cutting down the outer, curved face of the log to parallel the split inner face. At one point on the underside, the surface was poorly preserved (see archive drawing 30) possibly where it had become compressed by an underlying cross-bearer. It is recommended that at least part of this timber is conserved.

The other surviving horizontal, cross-bearer 291, was poorly preserved and derived from a 26 year old, summer felled oak tree with moderate growth rate. In addition to 2 trimmed sidebranches, the timber had an apparent half lap cut into one end in which toolmarks, with flat facets up to 67mm wide, survived. The lap may have been cut to take an overlying longitudinal plank, or reflect previous use in a structural context. A radiocarbon sample from this piece gave an uncalibrated date of 2030±80 BP (BETA-841788). This timber is recommended for conservation.

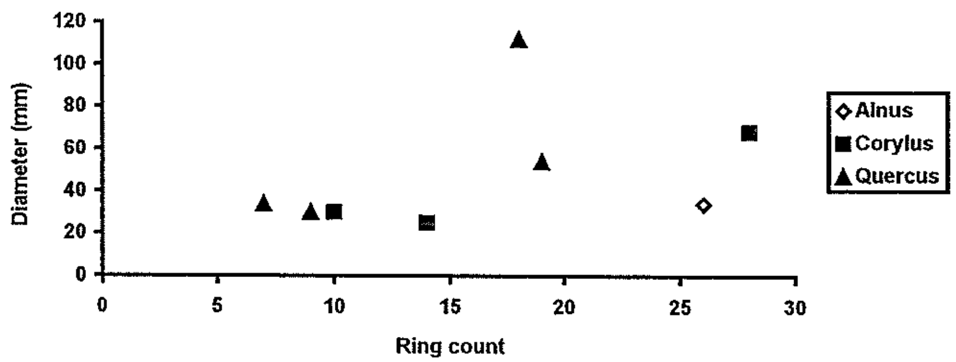
Sharpened uprights with associated wattling were encountered along both sides of the feature. Nine uprights along the eastern edge comprised 7 roundwood oak stems, predominantly young, three of which were summer felled, a single quarter split alder piece, and a roundwood upright identified as Pomoideae. A fragment of oak found on this line, 308, had no clear function. With the exception of terminal (?) upright 310, the oak uprights form a loose cluster in terms of age and diameter, ranging from 32-68mm in diameter and 12-22 years in age. The more substantial upright 310 was 27 years old and 96mm in diameter. All these uprights had been sharpened to pencil points with the exception of a wedge variant on 298. The technology of seven pieces was examined in detail. These pieces all had at least one (and up to five) sidebranches removed in antiquity. The toolmarks were very shallow ($<20^0$) in all cases, indicating care taken to produce well sharpened stakes. Facets visible on both the trimmed sidebranches and worked points were universally flat, up to 38mm wide. Jam curves, indicating the full width of the blade, were observed on the large trimmed sidebranch on 294 (26mm wide) and the point of 309 (18mm wide). Two of the uprights had been driven 'upside down'.

Oak uprights: east side of structure 142

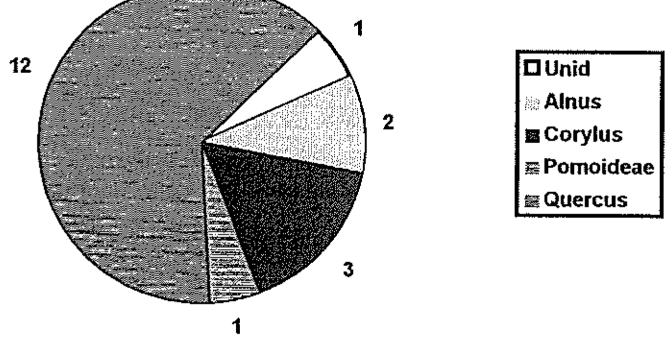


The ten uprights recorded in the western line were more mixed in term of species with 5 oak, 3 hazel and one alder roundwood identified. Upright 301 could not be identified. Ages/ring counts were quite variable although, with one exception, they fell within a diameter range of 25-70mm. Again, the southernmost upright (306) was significantly larger with a diameter of 112mm. Four of the five oak uprights were clearly summer felled whilst one, 292, appeared to be winter felled. In addition, the single alder upright had a narrow last ring suggestive of summer felling. Uprights were sharpened with wedge, wedge variant or more commonly pencil points. The technology of four pieces (300, 303, 305 and 306) was examined in detail. These all exhibited finely cut pencil points with very shallow facet angles, and trimmed sidebranches. All facets were flat with facet widths up to 41mm. Jam curves on the point of 300 (width 23mm), a trimmed sidebranch of 306 (width 23mm), and the point of 306 (width 41mm) suggest the use of more than one blade in preparation of these uprights.

Uprights: west side of structure 142



Uprights Structure 142

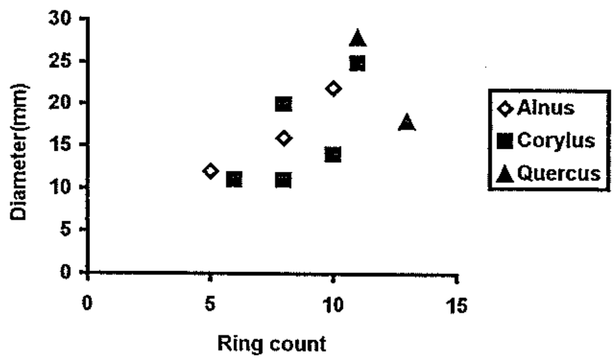


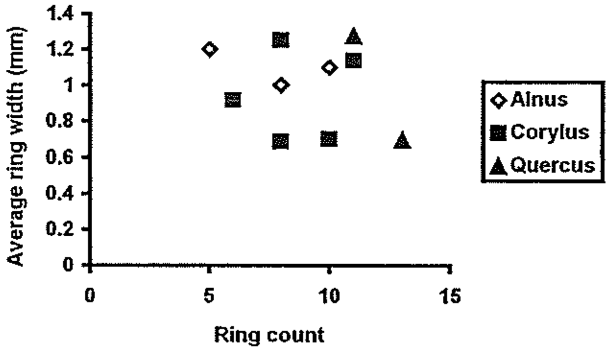
The overall species composition of the uprights from structure 142 (Fig. 00) highlights the preference for oak with secondary selection of hazel and alder. It is recommended that one or more of uprights 294, 309, and 310 are conserved.

Wattle along either side of the structure were assigned overall numbers. Five samples from 289, wattling from the east side were identified (4 hazel, 1 oak). Narrow last rings in the hazel and an absence of latewood growth in the oak stem suggest summer felling. Ring counts ranged from 8 to 11 and growth rates were slow. Five samples from 290, wattling from the west side, were identified as alder (3), hazel (1) and oak (1). One alder stem and the hazel stem had narrow last rings suggestive of summer felling. Ring counts ranged from 5 to 13 and growth rates were slow.

Plots of ring counts for the wattling against diameter and average ring width do not indicate tight clustering of any species, either in age or size (Fig. 00). The relatively slow growth rates suggest the wattling may have been derived from branch wood rather than regenerating coppice stools.

Wattle: structure 142





Context 168

A total of 8 samples from this context were examined. Preservation prevented any ring analysis in all but one instance, and prevented species identification of two pieces. Three pieces of oak and two of alder appeared to derive from young stems, whilst one sample of oak (wood 113) contained 53 heartwood rings. No wood record sheets exist for these wood numbers.

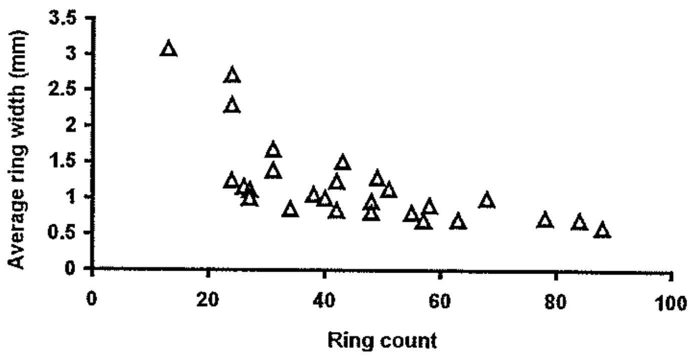
Structure 198

This structure comprised longitudinal oak timbers laid on cross-bearers apparently contained by split oak uprights driven along both sides. Wood record sheets exist for each wood number.

Eleven wood numbers were assigned to longitudinal timbers (6) or fragments (5) of these. All were identified in the field as oak. Poor preservation precluded retention for further analysis, although field examination suggested that five of the six timbers had been split tangentially from the outer part of relatively slow grown trees. This is supported by annual ring width data from the tangentials and fragments (Fig. 00). The sixth timber was a relatively fast grown (average ring width 2.39mm), radially split oak. The five numbered cross-bearers were half or radial split oak with the exception of 149 (bark). Ring width data from two half splits indicates slow growth. A radiocarbon sample comprising wood numbers 149 and 150 gave a date of 2100±80BP (BETA-84187). No evidence of subsequent woodworking survived on this group of poorly preserved timbers.

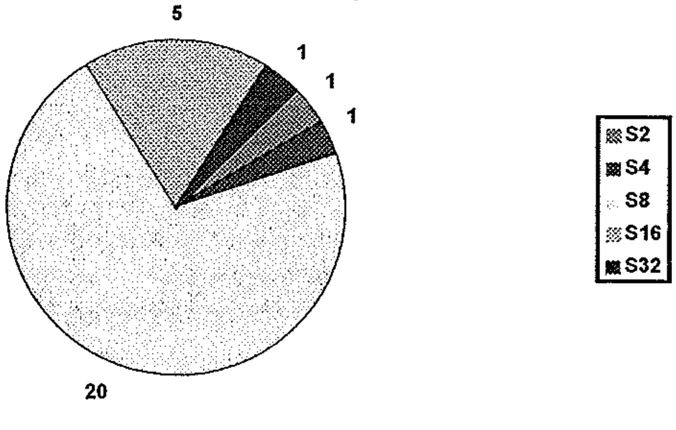
The driven uprights which ran along each side of the structure are considered as a group. Wood numbers were assigned to 41 individual uprights. With the exception of a single roundwood alder with a wedge variant point (214) and an apparently half split alder (134), all the uprights were split oak. The complete growth sequence of the parent log is rarely retained in such timbers, and compressed sapwood and frequently narrow annual rings made both ring counting and dendrochronology problematic. Nonetheless, average ring width data available for 28 samples, highlights the usually very slow growth of the parent trees (Fig. 00). With few exceptions, growth rates are slow even where ring counts are relatively short. Whilst to some extent this is a reflection of conversion, it also points to parent trees with unusually slow growth for relatively modest girth. Even taking account for compressed sapwood, most of the stakes could have been split from branches or boles with diameters of 200mm or less. In the three instances where the pith and bark were both present, ring counts were 26+, 27+ and 34, and average ring widths were 1.15 or less: the parent logs must have been 60-100mm in diameter.

Split oak uprights: structure 198



Of the 38 oak uprights for which there is data on their conversion, five are tangential in cross section probably through cross splitting of radial splits to form two or more stakes. One of these (224, archive drawing 7) exhibits the only clear evidence from the total wood assemblage for the use of a saw. This seems to have been employed to guide tangential sub-splitting of a radial. The majority of stakes are however simple radial splits of which the majority appear to comprise approximately one eighth splits (Fig. 00).

Uprights structure 198: radial split arcs



In the 31 instances where point type was categorised, 11 were pencil points, 9 wedge, 6 chisel and 5 wedge variant. Tool facets were generally well preserved at their points. Working varied from only a couple of cuts to sharpen already thin split ends, to complex pencil points requiring extensive tooling. Maximum facet angles ranged from 8-25^{0}, slightly higher than in the uprights of 125 and 142 but still quite shallow, reflecting finishing of predominantly split timber. Maximum facet widths ranged from 12 to 47mm, although only the widest encountered on wood 235 (47mm) may be complete. Facets were universally flat.

9 dendrochronological samples were taken from split uprights (see dendrochronology appendix). Uprights 201 and 221 cross-matches to form a mean curve of 85 years with possible bark edge in relative year 85

for upright 201. Four uprights (202, 208, 209, and 227) cross-matched to form a four timber mean with possible bark edges in relative years 78 and 79 for 209 and 202 respectively. Neither these means nor individual tree-ring curves from this structure cross-matched against other tree-ring sequences from the site, or dated chronologies. Widespread slow growth, and common narrow bands of rings made measurement difficult.

Two dendrochronological samples were taken in the field from two pieces of oak (W161 and W162) from outside the line of the Roman road. These may be outliers of structure 198, or be *in situ* remnants of an oak tree, possibly even one felled for the construction of structure 198. Both samples contained very narrow bands of rings which made measurement very difficult. Although heartwood sequences of 93 (161) and 128 (162) years were generated, cross-matching proved unsuccessful.

Conclusions

Species selection: In the case of all three 'covers' of structures 125, 142 and 198, oak was selected for the majority of timbers with the occasional exception of a split piece of alder. Approximately half of the uprights examined in structure 125, and the vast majority in structure 198 comprised split oak. In contrast, the roundwood uprights from structure 125 were predominantly hazel. The picture for structure 142 is more mixed: although the majority of uprights were unconverted roundwood, 63% of identified samples from these were oak, with lesser percentages of hazel, alder and Pomoideae. Growth rates tend to be slow, aprticualrly from the oak in structure 198.

Small roundwood assemblages were identified from structures 125 and 142, beneath plank 152, and context 168. Species identified comprise oak, hazel, alder, spindle and willow. Hazel is dominant in the groups from structure 125 and below plank 152 whilst oak formed 50% of the group from structure 142 along with lesser quantities of hazel and alder. Growth rates of this material is generally slow and ring counts are quite variable. The data is not consistent with exploitation of managed coppice and is more likely to reflect use of branch wood.

Comparison with contemporary pollen and plant macrofossil data would help in assessing whether only a sub-set of existing woodland resources was exploited.

Conversion: No uprights assigned to structure 142 appear to have been split. In contrast, approximately half of the uprights in 125, and all those in 198 were made from split wood. Usually the parent log has been half, quarter or radially split. In a minority of cases, radials have been cross-split to provide tangential stakes. Tangential splitting also appears to have been employed to produce the longitudinal timbers for 198 (by splitting away the outer faces of slow grown oaks) and plank 152 from structure 142. Cross-bearers are often half-split.

Hewing: The majority of worked points had been carefully sharpened to ensure good penetration during driving, even into resistant sub-strates. Tool facets are usually very shallow, only just exceeding 20^0 on some of the split uprights from structure 198. Limited evidence from wood 152 and 163 point to hewing of tangential splits to form planking rather than sawing. No definite carpentry joints were identified, although the apparent half lap and trimmed sidebranch on cross-bearer 291 may have had a structural function either in drain 142, or an earlier structure.

Tool Usage: Evidence for this is generally confined to tool facets, jam curves and tool signatures on worked points. Saw marks were observed on only one timber (224), a tangential stake from 198. The saw appears to have been used to guide tangential sub-splitting of a radial. Tool facets are almost universally flat and angled tool signatures point to the predominant use of axes rather than adzes. Jam curves on the worked points are rarely complete: possibly complete blade widths with flat facets range from 18mm to 47mm. Slightly concave jam curves of 71mm width, with associated signatures running at right angles, found on planks 152 and 163 indicate the use of an adze to cut down the outer face of a tangentially split oak. A slightly concave jam curve of 69mm on the large upright 271 might indicate use of an adze here but tool signatures ran at an oblique angle, more usually associated with use of an axe.

APPENDIX 3

PALAEOECOLOGICAL INVESTIGATIONS

By A.E.Caseldine, M J C Walker, J H James, S Johnson and M. Robinson

Introduction

Monoliths were taken from five locations (Fig. 4). Whitland 1 is from a peat sequence immediately to the north of the road, while Whitland 2 (some 12m to the southwest) was obtained from a peat deposit that underlies the Roman road (Fig. 5). Whitland 3 and Whitland 4 are adjacent samples from a trench at the western end of the site; column 3 underlies the road, while column 4 lies beneath drain 198. Finally Whitland 5 was taken from a context at the eastern end of the excavation close to columns 1 and 2 and comprises sediment from the north roadside ditch. In addition five spot samples were taken for plant macrofossil and insect analyses from ditch fills and from deposits associated with drain 125.

The stratigraphy of the five samples is as follows:

Whitland 1 (section north of the road)

0-11.5cm	Well humified fibrous dark brown peat containing monocotyledenous remains. Fairly compacted. *Juncus* seeds abundant.
11.5-65cm	Well humified dark brown woody peat with monocotyledenous remains. Bark, wood, roots, leaf scars and leaf fragments present. Quite compacted down to *c*.25cm but becoming more fibrous with larger pieces of wood, especially between 30-44cm. Increasingly compacted from 49cm. *Betula*, *Viola*, *Carex* and *Juncus* seeds. *Juncus* female cone scales. Moss.
65-99cm	Well humified more compacted fibrous woody peat. Wood, roots, bark and leaf fragments present. Monocotyledenous remains visible. *Betula*, *Alnus*, *Carex* and *Juncus* seeds. *Betula* cone scales. Bud scales.
99-123cm	Light grey silty clay containing shaley stones. Orange brown iron pan in top 1cm. *Juncus* seeds present.

Whitland 2 (under road and adjacent to drains *125* and *142* in Section 1)

0-4cm	Large stone.
4-6cm	Fibrous dark brown peat. Monocotyledenous remains and wood present. *Sphagnum* moss abundant at 5cm.
6-7cm	Band of grey clay.
7-13cm	Greyish brown clayey peat becoming peatier with depth.
13-24cm	Fibrous orange brown peat with monocotyledenous remains. *Sphagnum* moss and occasional, twigs and leaf fragments present. *Carex*, *Ranuculus*, *Potamogeton*, *Lycopus europaeus*, *Hydroctyle*, *Betula*, *Potentilla* and *Juncus* seeds.
24-35cm	Dark brown very fibrous peat with wood and monocotyledenous remains. *Carex*, *Viola*, *Hydrocityle vulgaris*, *Potamogeton*, *Juncus*, *Ranuculus*, *Alnus*, *Betula*, *Lycopus europaeus* and Poaceae seeds.
35-40cm	Orange-brown more compact peat. Fragment of *Alnus* wood at 37cm. *Potamogeton*, *Carex*, *Ranunculus*, *Betula* and *Juncus* seeds.
40-72cm	Dark brown very fibrous peat with monocotyledenous and wood remains. Slightly clayey band at 54.5-56.5cm. *Alnus* wood fragment at 47cm. *Corylus* wood fragment at 64cm. *Carex*, *Bidens cernua*, *Oxalis acetosella*, *Lynchis floscuculi*, *Sagina*, *Viola*, *Alnus*,

	Betula, *Callitriche*, *Cirsium*, *Rubus* and *Juncus* seeds. *Betula* and *Alnus* cone scales and buds and bud scales. Moss present. Charcoal.
72-78cm	Brown peaty clay still quite fibrous.
80-100cm	Greyish brown very silty peaty clay. Very fibrous with monocotyledenous remains. Wood, bark and leaf fragments. Stone present at *c.*88cm. *Alnus*, *Carex*, *Ranunculus*, *Viola*, *Sagina* and *Juncus* seeds. *Betula* female cone scales. Charcoal.
100-110cm	Dark brown slightly clayey woody peat. Still quite fibrous. Clay band at 105cm. Quartz present at 106cm. *Carex*, *Stellaria uliginosa*, *Betula* and *Juncus* seeds.
110-130cm	Light gry clay with small angular stones. Plant remains present, including wood, bark and leaf fragments. Bud scales frequent. *Carex*, *Ranunculus*, *Oxalis acetosella*, *Betula* and *Juncus* seeds. Moss.

Whitland 3 (under road in Section 3)

0-10cm	Light grey clay with iron staining. Contains stone fragments and large stone at *c.*1-8cm. *Juncus* seeds abundant.
10-40cm	Light brownish-grey clay with plant remains. Slightly darker below 23cm, i.e. more organic. *Juncus* seeds abundant and *Carex*, *Hypericum*, *Ranunculus*, *Potentilla* and *Potamotegon* seeds present. Occasional *Sphagnum* leaf.
40-46cm	Brown organic clay with monocotelydenous remains. *Juncus* seeds frequent. Charcoal.
46-50.5cm	Brownish-grey clay. *Juncus* seeds frequent.
50.5-81cm	Yellowish-brown organic clay with monocotelydenous remains. Flecks of peaty material. Occasional woody root and bark. *Juncus* seeds. Charcoal.
81-105cm	Brown organic clay with plant remains. Small stones present, becoming grittier towards base. Wood, buds and bud-scales frequent. *Stellaria uliginosa*, *Ranunculus*, *Carex*, Poaceae and *Juncus* seeds. Moss present. Charcoal.
105-122cm	Crumbly shale bedroak with clay and iron staining.

Whitland 4 (under drain *198* in Section 3)

0-7cm	Grey brown sticky clay. Plant remains visible. *Juncus* seeds frequent. Charcoal present.
7-22cm	Dark yellowish grey gritty clay with smal stones. Larger stones *c.*18-22cm. Charcoal.
22-24cm	Orange grey fine clay.
24-25.5cm	Dark yellowish grey gritty clay with small angular stones. *Juncus* seeds.
25.5-45cm	Yellowish brown organic clay with plant remains. Occasional monocotyledon and woody remains. *Juncus* seeds.
45-84cm	Light yellowish grey clay with plant remains. Flecks of peaty material. Iron staining *c.*65.5-76.5cm. Wood remains frequent at 76.5-84cm. *Juncus* seeds. Charcoal.
84-86cm	Orange-grey gritty silty clay.

Whitland 5 (north roadside ditch)

0-20cm	Light grey silty clay with orange flecks of iron. Very gritty at 14-18cm. *Juncus* seeds present, particularly abundant at *c.*20cm.
20-28cm	Brownish-grey silty clay with orange lenses of iron staining. *Juncus*, Poaceae, *Potamogeton* and *Stellaria uliginosa* seeds and macroscopic charcoal present.
28-40cm	Very gritty grey silty clay with layers of orange iron staining.
40-59cm	Grey silty clay with dark/light grey lenses becoming increasingly brown and organic downwards. Monocotyledon remains and *Juncus* seeds present.
59-66cm	Very gritty grey silty clay with quartz pebbles. Monocotyledon remains visible and Poaceae, *Ranunculus* subgenus *Batrachium*, *Stellarias uliginosa*, *Juncus* and *Potamogetom* seeds. *Pteridium aquilinum* leaf fragments.

66-72cm	Grey silty clay with light/dark lenses. *Juncus* and *Ranunculus* subgenus *Batrachium* seeds present as well as monocotyledon remains.
72-80cm	Grey silty clay with iron staining. Small quartz pebbles. *Pteridium* leaf and moss fragments.
80-91cm	Light grey sticky clay with darker lenses of peaty material. *Pteridium* leaf fragments, *Potentilla*, *Carex* and *Juncus* seeds, bud and deciduous leaf fragments. Occasional *Sphagnum* leaf.
91-101cm	Dark brown fibrous woody peat. *Juncus* and *Carex* seeds.

Methodology – laboratory work

Pollen analysis

Subsamples for pollen analysis were removed from the monoliths at 5cm intervals. These were treated using conventional procedures (Moore *et al*, 1991), including disaggregation in 10% KOH followed by Erdtman's acetolysis preceded, where necessary, by heating in 40% HF. The residues were mounted in safranin-stained glycerine jelly and counted on a Vickers MISC microscope at x400 magnification, with critical identifications under oil at x1000. The state of preservation of the pollen was generally good, and a sum of 300 grains was achieved for all levels.

The results of the pollen analyses are shown in Figures 00 - 00 in which nomenclature follows Stace (1991) and Bennet *et al* (1984). The pollen diagrams from the five profiles, which have been prepared using TILIA and TILIA.GRAPH (Grimm, 1991), have been divided into Local Pollen Assemblage Zones (LPAZs) on the basis of fluctuations in the curves for the principal pollen taxa. Inferred relationships between the LPAZs in the pollen diagrams is shown in Table 1.

Plant macrofossil analysis

Subsamples were extracted from the spot bulk samples taken from the ditch and drain *125* deposits. Initially 250g from each sample was processed. Following preliminary examination the sample size of the two richest samples was increased by a further 250g t0 500g. The samples were allowed to soak in water to which hydrogen peroxide was added, because of the minerogenic nature of the samples, prior to washing through a nest of sieves with 2mm, 1mm, 500μ and 250μ meshes. In addition to the sievings retained on the 108micron mesh during the pollen preparations as well as a few larger samples, removed separately from the pollen monoliths, were rapidly scanned for plant remains to supplement the stratigraphic and pollen data. Plant macrofossils were identified using a Wild M-5 stereo-microscope. Identification was by comparison with modern reference material and standard identification texts, including Berggren (1969, 1981) and Schlock *et al* (1988). Nomenclature follows Stace (1991) and Smith (1978). The plant macrofossil results from the pollen monolith samples are incorporated into the stratigraphic descriptions.

Fossil insect analysis

Five samples of organic sediment from ditches and drain fills were analysed for insect remains. Sub-samples of 1kg each were washed onto a 0.2mm sieve, subjected to paraffin flotation and the flots scanned. Insect remains were recovered from four of the samples, but only Context 009 from the south roadside ditch, contained a sufficiently high concentration for more detailed analysis. A further 4kg of this sample was similarly processed and both flots from this sample were fully sorted. The results are given in Tables 3 and 4. The nomenclature of the Coleoptera follows Kloet and Hincks (1977). The few insects noted from Contexts 025, 026 and 027 were all species also recorded in Context 009.

Radiocarbon dating

After the pollen analytical work had been completed, six biostratigraphic horizons from the two most detailed pollen diagrams, Whitland 1 and Whitland 2, were selected for radiocarbon dating. At each level, a slice of sediment approximately 2cm in thickness was cut from the monolith and despatched to the radiocarbon dating laboratory at BETA Analytic in Miami, USA. The results of the radiocarbon assays are shown at the appropriate levels on the pollen diagrams.

Results

The pollen data

Whitland 1

LPAZ W1-a	*Alnus-Quercus-Corylus* (below 77.5cm)	
Characteristics	A biozone dominated by *Alnus*, with significant counts for *Quercus* and *Corylus avellana* type.	
Vegetation	An alder scrub, prabaly on wetter substrates, with hazel and oak on drier areas nearby.	
Chronology	Base of paz:	4700±70BP (BETA 98684)
	Top of paz:	*c.*4065 BP (interpolated)
LPAZ W1-b	*Corylus-Alnus-Quercus-Betula* (77.5-32.5cm)	
Characteristics	A biozone dominated by *Corylus avellana* type with significant counts for *Quercus*, *Alnus* and *Betula.*	
Vegetation	Expansion of hazel scrub, with stands of birch and oak. Alder was present but less abundant - perhaps reflecting drier conditions locally.	
Chronology	Base of paz:	*c.*4065BP (interpolated)
	Top of paz:	*c.*2670BP (interpolated)
LPAZ W1-c	*Corylus-Alnus-Quercus-Betula*-Poaceae (32.5-12.5cm)	
Charactreistics	A biozone dominated by *Corylus avellana* type with significant counts for *Quercus*, *Alnus*, *Betula* and Poaceae.	
Vegetation	This biozone reflects a phase of woodland clearance, and the expansion of grassland habitats. Characteristic open-ground herbs include *Plantago lanceolata* (evidence of human impact?), *Potentilla*, *Anthemis* type, *Aster* type, Lactuceae and *Rumex.*	
Chronology	Base of paz:	*c.*2670BP (interpolated)
	Top of paz:	*c.*1935BP (interpolated)
	Radiocarbon date of 2130±70BP (BETA 98683) at 15cm.	
LPAZ W1-d	Poaceae (12.5-0cm)	
Characteristics	A biozone dominated by Poaceae, with *Corylus avellana* type, *Betula*, *Quercus* and *Alnus.*	
Vegetation	This biozone reflects an acceleration in the rate of woodland clearance, with further expansion of grassland habitats. Characteristic open-ground herbs include similar to those is W1-c.	
Chronology	Base of paz:	*c.*1935BP (interpolated)
	Top of paz:	1030±60BP (BETA 98682)

Whitland 2

LPAZ W2-a	*Alnus-Quercus-Corylus* (below 112.5 cm)
Characteristics	A biozone dominated by *Alnus*, with significant percentages of both *Quercus* and *Corylus avellana* type.
Vegetation	An alder scrub, probably on wetter substrates, with hazel and oak on drier areas nearby.
Chronology	Base of paz: *c*.4500BP (interpolated) Top of paz: *c*.4150BP (interpolated)

LPAZ W2-b	*Corylus-Alnus-Quercus* (112.5-67.5cm)
Characteristics	A biozone dominated by *Corylus avellana* type with *Quercus*, *Alnus* and *Betula*. *Salix* is also present.
Vegetation	Expansion of hazel scrub, with stands of birch, oak and willow. Alder was present but less abunadant, again perhaps reflecting drier conditions locally.
Chronology	Base of paz: *c*.4150BP (interpolated) Top of paz: *c*.2540BP (interpolated) Radiocarbon dates of 4080±70BP (BETA 98687) at 109cm and 2570±70BP (BETA 98686) at 71cm.

LPAZ W2-c	Poaceae (67.5-5cm)
Characteristics	A biozone dominated by Poaceae, with *Alnus*, *Corylus avellana* type, *Quercus* and Cyperaceae. *Ptreidium* is also present in consistent frequencies.
Vegetation	This biozone reflects a phase of woodland clearance, with the expansion of grassland habitats. Characteristic open-ground herbs include *Plantago lanceolata*, *Plantago coronopus*, *Potentilla*, Caryophyllaceae, *Aster* type, Lactuceae and *Ranunculus*. Bracken (*Pteridium*) was also present locally.
Chronology	Base of paz: *c*.2540BP (interpolated) Top of paz: 1970±70BP (BETA 98685)

<u>Whitland 3</u>

LPAZ W3-a	*Quercus-Corylus-Alnus* (below 62.5cm)
Characteristics	A biozone dominated by *Quercus* and *Corylus avellana* type with significant counts for *Alnus*.
Vegetation	The pollen spectra reflect the presence of extensive stands of oak woodland, with hazel on more open sites and alder locally present on wetter substrates.

LPAZ W3-b	*Corylus-Quercus-Alnus* (62.5-22.5cm)
Characteristics	A biozone dominated by *Corylus avellana* type with significant counts for *Quercus*, *Alnus* and *Betula*. Poaceae is also present in the middle and upper levels of the zone.
Vegetation	An episode of hazel scrub, with stands of birch and oak. Alder was present locally and birch was also a component of the nearby wood and scrubland.

LPAZ W3-c	*Corylus*-Poaceae (with *Alnus* and *Quercus*) (22.5-0cm)
Characteristics	A biozone still dominated by *Corylus avellana* type, but Poaceae is also abundant along with *Quercus* and *Alnus*.
Vegetation	This biozone reflects the continued presence of hazel and oak wood and scrub, but with open areas of grassland within and around the woodland stands. Characteristic open-ground taxa include *Plantago lanceolata*, *Potentilla*, Lactuceae and *Pteridium*.

<u>Whitland 4</u>

LPAZ W4-a	*Quercus-Corylus-Alnus* (below 22.5cm)

Characteristics	A biozone dominated by *Quercus* and *Corylus avellana* type, along with *Alnus.*
Vegetation	Oak and alder woodland, with alder on wetter sites.

LPAZ W4-b	Poaceae-*Corylus* (22.5-0cm)
Characteristics	A biozone dominated by Poaceae, with *Corylus avellana* type, *Quercus* and *Alnus.*
Vegetation	This biozone reflects a phase of woodland clearance, with the expansion of woodland habitats. Characteristic open-ground taxa include *Plantago lanceolata*, Lactuceae, *Ranunculus* and *Potentilla.* Bracken was also abundant locally and there is evidence of local heathland (*Calluna vulgaris*).

<u>Whitland 5</u>

LPAZ W5-a	*Alnus* (below 92.5cm)
Characteristics	A biozone dominated by *Alnus*, with small numbers of *Quercus* and *Corylus avellana* type.
Vegetation	An alder scrub, prbably on wetter substrates, with hazel and oak on drier areas nearby.

LPAZ W5-b	Poaceae-*Corylus-Alnus* (92.5-0cm)
Characteristics	A biozone characterised by a rising curve for Poaceae, with *Corylus avellan* type, *Betula*, *Quercus* and *Alnus* also present.
LPAZ W5-b	This biozone reflects a phase of wodland clearance, with the expansion of grassland habitats, but with stands of alder, hazel, oak and birch still present in the vicinity. Characteristic open-ground herbs include *Plantago lanceolata*, *Plantago coronopus*, *Potentilla*, lactuceae and *Ranunculus*. *Pteridium* was also abundant locally.

Correlation between the LPAZs (Table 1) suggests that at Whitland 4 and 5 the equivalent biozones W1-b, W2-b and W3-b is missing. This accords with the lithostratigraphic evidence which points to an unconformity in the former two profiles. In Whitland 4 the fine clays in the upper part of the profile are interrupted and 24-25cm by a more gritty horizon with small stones, the precise nature of which is unclear, but it clearly marks an interruption in the accumulation of otherwise exclusively fine-grained sediment. Either an interval of non-deposition or an erosional episode may be reflected in this distinct stratigraphic change. In Whitland 5 there is a clear break at *c.*91cm between the overlying grey clays and basal peats, which marks the interface between the natural peat and later ditch deposits. In terms of the vegetational sequence, therefore, these stratigraphic breaks mean that the episode of hazel wood and scrub recorded in W1-b, W2-b and W3-b is not preserved in the pollen diagrams from Whitland 4 and 5.

Table 1: Correlation of local pollen assemblage zones

Whitland 1	**Whitland 2**	**Whitland 3**	**Whitland 4**	**Whitland 5**
W1-d				
W1-c	W2-c	W3-c	W4-b	W5-b
W1-b	W2-b	W3-b		
W1-a	W2-a	W3-a	W4-a	W5-a

Plant macrofossil data

The plant macrofossil results from the pollen monoliths will be considered first followed by the evidence from the spot samples.

The results from Whitland 1 reflects the nature of the local pat and hence the local plant community. The lowest deposits are minerogenic and contain few plant remains, only the occasional *Juncus* (rush) seed. The peat deposits above are wody with fragments of bark, wood, roots and leaf fragments as well as seeds of *Alnus* (alder) and *Betula* (birch. *Betula* cone-scales are also present. Herbaceous plats are represented by seeds of *Carex* (sedge) and *Juncus*. Higher in the stratigraphy *Juncus* dominates with the occasional *Carex* seed. The evidence suggests birch-alder carr woodland with an understorey of sedges and rushes which is later replaced by a more open environment dominated by rushes and sedges.

Although the stratigraphic sequence is slightly more complicated in Whitland 2, again the occurrence of woody remains and *Betula* and *Alnus* seeds and cone-scales throughout much of the profile indicates the existence of woodland locally. Further confirmation of this is the presence of seeds of *Oxalis acetosella* (wood sorrel), a species commonly found in woods and often on humus but tending to avoid particularly wet soils. Occasional charcoal indicates some burning of woodland either as a result of natural or human agencies. However, the generally wet nature of the immediate area is demonstrated by *Carex*, *Juncus* and *Bidens cernua* (nodding bur-marigold) seeds. The last species is generally found besides ponds and streams and in marshy areas. *Lychnis flos-cuculi* (ragged robin) is another plant of marshy ground and seeds of *Viola* (violet) may represent viola species found in such an environment.

In the upper part of the statigraphy there is evidence for wet conditions with the appearance of *Potamogeton* (pondweed) seeds, indicating the presence of pools of standing water. *Hydrocotyle vulgaris* (marsh pennywort) and *Lycopus europaeus* (gypsywort), which grow in fens, are also represented. Immediately below the road there is evidence for a thin layer of *Spahgnum* moss. The evidence intimates fairly open and very wet marshy ground.

The deposits from the remaining columns were essentially minerogenic in nature with a varying degree of organic material. *Juncus* seeds throughout the deposits in Whitland 3 suggest wet rushy ground in the vicinity. In the upper deposits below the road seeds of *Juncus*, *Carex*, *Ranunculus*, *Hypericum* (St. John's wort), *Potentilla* (tormentil) and *Potamogeton* and the occasional *Sphagnum* leaf occur, an assemblage not dissimilar to the ground flora assemblage from the upper deposits of Whitland 2. The evidence suggests wet marshy ground, perhaps with a small stream or pools.

Plant remains were scarce from Whitland 4 and only seeds of *Juncus* were recorded, again reflecting wet or damp rushy ground. In contrast there was a greater variety of seeds from Whitland 5 taken through ditch deposits in the north roadside ditch. The lowest deposits comprised a woody peat into which the ditch had been cut. Seeds present in the ditch deposits include aquatics such as *Potamogeton* and *Ranunculus* subgenus *Batachium* (crowfoots). *Stellaria uliginosa* (bog stitchwort) and Poaceae (grass) seeds and *Pteridium aquilinum* (bracken) leaf fragments probably reflect vegetation growing on the ditch sides or close to the ditch.

The plant macrofossil assemblages from the larger spot samples from the ditch deposits are similar to that from Whitland 5, although a greater range of species is present. Many of the taxa are indicative of the ditch environment itself. *Callitriche* (water-starwort), *Potamogeton*, *Ranunculus* subgenus *Batrachium* and *Ranunculus flamula* type (spearwort) reflect the presence of standing water. Other species such as *Juncus*, *Luzula* (wood-rush), Poaceae and the Carices may represent rushes grasses and sedges either growing on the ditch sides or the environment close to the ditch. A number of other taxa are typical of grassland environments, including *Hypericum*, *Prunella vulgaris* (selfheal), *Hypochaeris radicata* (cat's ear), *Rumex acetosella* (sheep's sorrel) and *Potentilla erecta* (tormentil). A few species such as *Urtica dioica* (common nettle), *Chenopodium album* (fat-hen and *Aphanes arvensis* (parsley-piert) could indicate cultivation in the area but their presence may equally be due to the existence of bare ground and disturbed habitats. seeds of *Betula* and *Alnus* suggest the continued occurrence of some birch and alder woodland locally.

The remaining two spot samples were from deposits associated with drain *125* and contained a similar range of plants to that from the ditches, but comparatively few. The only species recorded not found in the other samples was *Persicaria lapathifolia* (pale persicaria), a species sometimes indicative of cultivation but also found on waste ground and especially damp ground, often besides water.

Table 2: Plant macrofossil data

	southern roadside ditch	southern roadside ditch	northern roadside ditch	drain *125*	drain *125*
SAMPLE	8	9	25	26	27
CONTEXT	120	115	179	139	140
TAXA					
Ranunculus sp. (Buttercup)	1	-	2	-	-
Ranunculus flammula type (Lesser spearwort)	2	93	26	1	1
Ranunculus subgenus *Batrachium* (CD.) A. Gray (Crowfoots)	1	3	14	-	-
Urtica dioica (Common nettle)	-	1	4	-	-
Betula sp. (Birch)	-	-	5	-	-
Alnus glutinosa (L.) Gaertner (Alder)	-	4	1	-	-
Chenopodium album L. (fat-hen)	-	-	1	-	-
Stellaria media (L.) Villars (Common chickweed)	-	2	-	-	-
Stellaria uliginosa Murray (Bog stichwort)	-	13	39	1	-
Cerastium sp. (mouse ears)	1	5	6	-	-
Sagina sp. (Pearlworts)	-	5	17	-	1
Lychnis flox-cuculi L. (Ragged robin)	-	2	-	-	-
Persicaria lapathifolia (L.) Gray (Pale persicaria	-	-	-	-	1
Rumex acetosella L. (Sheep's sorrel)	1	5	3	-	-
Hypericum sp. St. John's-worts)	2	47	7	2	3
Viola sp. (Violets)	-	25	3	-	-
Cardmine flexuosa (Wavy bitter-cress)	-	8	-	-	-
Erica textralx L. (Cross-leaved heath)	-	1	-	-	-
Rubus fruticosus agg. (Brambles)	-	2	-	-	-

Potentilla erecta (L) Raeusch (Tormentil)	1	20	6	-	1
Aphanes arvensis agg. (Parsley piert)	-	-	3	-	1
Ulex sp. (Gorse) leaf frags.	-	-	7	-	-
Epilobium hirsutum (Great willowherb)	-	1	-	-	-
Myosotis sp. (Forget-me-nots)	-	5	10	-	-
Prunella vulgaris L. (Selfheal)	-	2	-	-	-
Lycopus europaeus L. (Gypsywort)	-	4	-	-	-
Mentha sp. (Mints)	-	3	-	-	-
Callitriche sp. (Water-starworts)	1	138	1043	-	5
Veronica sp. (Speedwells)	-	-	6	-	-
Cirsium spp. (Thistles)	-	13	-	-	-
Hypochaeris radicata L. (Cat's-ear)	-	-	1	-	-
Potamogeton spp. (Pondweeds)	2	130	6	5	1
Juncus spp. (Rushes)	172	1006	855	12	112
Juncus spp. Capsules	5+7 frags	37	6	-	-
Luzula sp. (Wood-rushes)	-	3	-	-	-
Isolepis setacea (L.) R. Br. (Bristle clu-brush)	-	5	1	-	-
Carex spp.-biconvex	1	142	6	2	-
Carex spp.-trigonous	-	76	3	1	1
Poaceae>2mm (Grasses)	3	34	71	-	-
Poaceae<2mm	9	50	129	7	6
Poaceae Glume frags.	2	-	-	-	-
Tree buds	-	1	-	-	-
Pteridium aquilium (L.) Kuhn (Bracken)	40	3	-	-	-
Sphagnum sp.	-	5	-	-	-
Moss n.f.i.	-	+	-	-	+

Fossil insect data

The insects from Context *009* suggest that the ditch held stagnant water. The more numerous Coleoptera included *Helophorus* cf. *brevipalpis* and *Limnebius* cf. *papposus*, beetles which readily colonise stagnant water. Larval remains of Trichoptera (caddis flies) and Chironomidae (midges) were also present. Some indication of aquatic vegetation in the ditch was given by *Plateumaris discolor* or *serica*, which feds of Cyperaceae (sedges) and *Prasocuris phellandrii*, which feeds on aquatic Umbelliferae such as *Oenanthe* spp. (water dropwort).

The majority of the Coleoptera had been derived from the terrestrial environments alongside the ditch. They included Carabidae (ground beetles) such as *Trechus obtusus* or *quadristriatus* and *Calathus melanocephalus* which occur in a range of habitats whereas *Pterostichus diligens* and *P. nigrita* favour damp ground. One species, *Pterostichus niger*, is generally regarded as a woodland beetle, but under the more humid conditions of Wales and Northern England it also occurs in grassland and on arable land.

Some weedy ground was present in the vicinity of the ditch. The most numerous phytophagus beetle was *Brachypterus* sp. which feeds on *Urtica dioica* (stinging nettle). Other phytophagus beetles included *Gastophysa viridula*, which feeds on *Rumex* spp. (dock) and the elaterids *Cidnopus aeruginosus* and *agriotes* sp., whose larvae feed on the roots of grassland herbs. The grass-feeding bug *Aprodes* sp. was also present. The only indication of trees or shrubs came from a single specimen of the bug *Aphrophora* sp., which feeds on a variety of such plants.

About 25% of the terrestrial Coleoptera were scarabaeoid dung beetles from the genera *Geotrupes*, *Apodius* and *Onthophagus*, the most numerous being *A. contaminatus*. They feed on the droppings of larger herbivores, including domestic animals on pastureland. Such a high value would suggest that domestic arrivals were concentrated in the vicinity of the site (Robinson 1991, 278-80). One of those beetles, *Onthophagus nutans*, which was represented by a single elytral fragment, is now extinct in Britain. However, there are other archaeological records of it and it survived as a member of the British insect fauna well into the 19th century (Allen and Robinson 1993, 138).

The insects gave no evidence for the proximity of human settlement. Synanthropic species were entirely absent and the beetles of decaying organic material such as *Cercyon ustulatus* and *Megasternum obscurum* would have found suitable habitats in plant debris on the edge of the the ditch or in the dung.

Table 3: Coleoptera data

	Context *009*; minimum number of individuals
Trechus obtusus Er. or *quadristriatus* (Schr.)	1
Pterostichus diligens (Sturm)	3
P. Niger (Schal.)	1
P. Nigrita (Pk.)	1
P. Cupreus (L.) or *versicolori (Sturm)*	1
Calathus fuscipes (Gz.)	2
C. Melancocephalus (L.)	1
Agonum muelleri (Hbst.)	1
Anara cf. *Consularis* (Duft.)	1
Haliplus sp.	1
Hydroporus sp.	1
Agabus bipustulatus (L.)	1
Hydrochus sp.	2
helophorus sp. (*Brevipalpis* size)	9
Coelostoma orbiculare (F.)	3
Cercyon ustulatus (Preys.)	2
Megasternum obscurum (Marsh.)	1
Hydrobius fuscipes (L.)	1
Anacaena globus (Pk.)	4
Laccobius sp.	3

Enochrus sp.	1
Chaetarthria sminulum (Hbst.)	3
Limnebius cf. *Papposus* Muls.	6
Silpha atrata L.	1
Olophrum fuscum (grav.) or *piceum* (gyl.)	1
Lesteva lomgoelytrata (Gz.)	3
Stenus spp.	2
Anotylus rugosus (F.)	1
Lathrobium sp.	1
xantholinus linearis (Ol.) or *longiventris* Heer	1
Eriuchsonius so.	1
Philonthus sp.	2
Tachyporus sp.	1
Aleocharinae indet.	1
Geotrupes sp.	1
Aphodius contaminatus (Hbst.)	10
A. Cf. *Sphacelatus* (Pz.)	4
Onthophagus nutans (F.)	1
Onthophagus sp. (not *nutans, ovatus* or *taurus*)	1
Phyllopertha horticol (L.)	1
Dascillus cervinus (l.)	1
Dryops sp.	1
Cidnopus aeruginosus (Ol.)	1
Agriotes sp.	1
Cantaris sp.	1
Brachypterus sp.	5
Corticariinae indet.	1
Plateumaris discolor (Pz.) or *sericea* (L.)	2
Gastrophysa viridula (Deg.)	1
Prasocuris phellandrii (L.)	1
Gallerucella sp.	1
Phyllotreta vittula Redt.	1
Longitarsus sp.	1
Sitona sp.	1
Bagus sp.	1
TOTAL	**103**

Table 4: Other insects

	Context *009*; minimum number of individuals
Aphrophors sp.	1
Aphrodes sp.	2
Aphidoidea indet.	2
Momoptera indet.	3
Trichoptera indet. - larva	5
Myrmica sp. - worker	1
Lasius sp. (not fuliginosus) - female	1
hymenoptera indet.	2
Chironomidae indet. - larva	+
Diptera indet.	1

Discussion

The three different types of palaeoecological evidence (pollen, plant macrofossils and fossil insect remains) from the various contexts associated with the Roman road, and with the underlying Iron Age track way, combine to provide a remarkably coherent (and consistent) picture of vegetation and local environment in the period leading up to the construction of the road. Indeed, some of the pollen diagrams contain a record of vegetational history extending back into the Bronze Age and Neolithic periods, commencing shortly after the 'elm decline'. At that time, this part of south Wales was covered by a mixed oak woodland, with stands of birch and hazel on more open sites and extensive thickets of alder and willow in damper localities. Gradual clearance of the woodland resulted in the expansion first of hazel, a notable light-demanding species, presumably onto ground that had formerly been occupied by mixed woodland taxa, and subsequently by grassland plants. The evidence suggests that this increase in areas of grassland began during the early Iron Age with a further marked expansion during the later Iron Age/Romano-British period so that by the time of road construction, extensive areas of open ground existed in the vicinity. However, the pollen record does indicate that some arboreal and scrub stands were still present in the area, and that these continued into the medieval period. There are strong suggestions that the clearance of the forest was an anthropogenic phenomenon, for the decline in woody plant pollen is accompanied by an increase in all of the pollen profiles by taxa associated with agricultural activity.

Herbaceous plants found today growing in short-turf communities, and hence typically correlated in prehistoric pollen records with pastoral activity, include, *inter alia, Plantago lanceolata, Plantago coronopus*, and species of *Ranunculus, Potentilla, Anthemis, Aster* and Lactuceae. Interestingly, there are only isolated grains of Cerealia-type pollen, which suggests that pastoral rather than arable was the dominant form of prehistoric farming practiced in the area and that this continued through into historical times.

This reconstruction based on the palynological evidence is strongly supported by both the plant macrofossil and fossil insect records. The plant macrofossils from the peats confirm the presence of carr woodland locally throughout most of the period. The evidence from the deposits below the road indicate clearly the wet marshy conditions the builders of the track ways and the road had to contend with in this particular area. Plant remains from the ditch and drain suggest a largely grassland environment was contemporary with construction of the road. As was noted above, the Coleoptera recovered from the ditch deposit are typically associated with grassland habitats, and only a very few are characteristic of woody environments. Moreover, around one quarter of the terrestrial Coleoptera are dung beetles, which corroborates the pollen evidence that suggests that a well-established pastoral economy was operating in the area in the period prior to the construction of the Roman road. The dates suggest that this type of farming was of some antiquity, the first indications in the pollen record dating to the Bronze Age.

Unfortunately, there are few other palynological records from lowland south-west Wales with which these sequences can be compared, for Donald's (1987) evidence focuses more on the early and middle Flandrian, while Seymour's (1985) data are from sites on the Preseli uplands some distance to the north. The nearest published pollen diagram is from Llanllwch immediately to the west of Carmarthen (Thomas, 1965), and some 15 km to the east of the Whitland sites. There, a raised bog contains a vegetational record that appears to extend up into the Norman period. The evidence from Llanllwch is in close agreement pointing to a relatively low level of agricultural activity during the Neolithic period but a marked intensification during the Iron Age and Roman-British periods. Interestingly, cereal pollen is relatively well-represented in that profile, by contrast with the records from the Whitland sites, suggesting significant variations in prehistoric land-use in this part of south-west Wales. There are, however, a number of similarities between the Whitland records and those obtained from the Bryn Farm profiles, some 2-3 km to the west of Whitland, and which also underline the Roman road (Caseldine, in preparation). The upper parts of the Bryn Farm sequence also show an alder phase succeeded by a wood and scrub episode (this time dominated by birch rather than hazel) followed, in turn, by the demise of woodland and the expansion of grassland. As in the Whitland diagrams, the rise in Poaceae pollen is accompanied by an increase in 'agricultural weeds'. Again, however, there are no indications of arable activity. In contrast to Whitland, at Bryn Farm, the onset of woodland decline dates to the Late Neolithic (c. 4100 ^{14}C yrs BP).

Conclusions

1 - Pollen, plant macrofossil and fossil insect data provide a detailed environmental record for the period leading up to the construction of the Whitland Roman road.
2 - The evidence points to the existence of a landscape of mixed woodland during the Neolithic.
3 - Woodland clearance may have begun in Neolithic times, with the removal of broad-leaved trees, and ultimately of hazel and alder scrub.
4 - A pastoral economy, reflected in all of the proxy records, was established in the area during Bronze Age times.
5 - There is no unequivocal evidence of arable farming in any of the records.
6 - The Roman road was constructed across a predominantly open grassland landscape, but stands of oak, hazel, alder and birch were also present in the vicinity.

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FOR SITE ARCHIVE

Dendrochronology -

Introduction

On site sampling and subsequent sampling of timbers in store generated 14 samples for measurement, one of which was rejected (see table #)

Details of samples

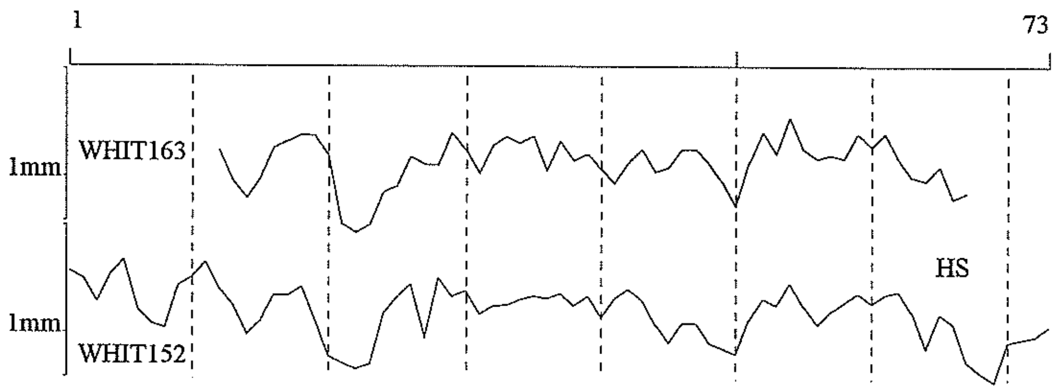
Wood no	Context	Species	Rings	Bark	Arw (mm)	Dimensions (mm)	Comment
131	198	oak	53H	N			Sample discarded as too slow grown
152	142	oak	66H+7S	N	1.28	180 x 35	Tangentially split and adzed plank
161	198?	oak	93H	N	0.37	105 x 50	V narrow and difficult bands
162	198?	oak	128H	N	0.69	225 x 100	V narrow bands
163	125	oak	56H	N	1.27	107 x 37	
201	198	oak	54H+30S	B?	0.69	60 x 21	
202	198	oak	25H+26S	B?	1.13	62 x 60	Sapwood crushed next to bark
208	198	oak	41H+37S	N	0.73	62 x 40	
209	198	oak	26H+31S	B?	0.69	50 x 12	
219	198	oak	52H+36S	N	0.63	62 x 32	V slow grown
221	198	oak	57H+1S	N	0.91	75 x 36	Sap v crushed
222	198	oak	41H+22S	N	0.71	51 x 25	
223	198	oak	34H+14S	N	0.81	63 x 25	
227	198	oak	43H+25S	N	0.99	70 x 13	

Methodology

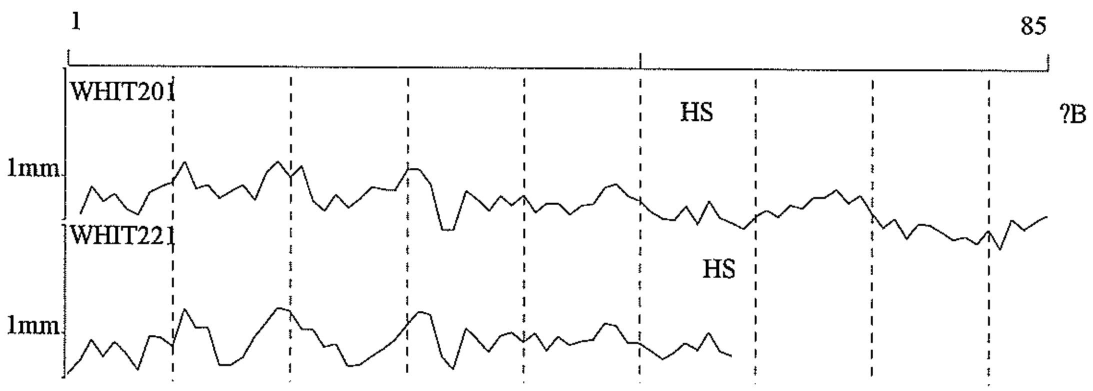
Dendrochronological samples were prepared by freezing them for at least 48 hours and then cleaning their cross-sections with a surform plane. Ring widths were measured to an accuracy of 0.01mm on a travelling stage connected to an Atari microcomputer, using the suite of dendrochronology programs written by Ian Tyers (pers comm 1993) at the Dendrochronology Laboratory, University of Sheffield. The measured ring sequences were plotted as logarithmic scale plots. Crossmatching was attempted, first visually by comparing the graphs on a light box, and then by using computer software to measure the amount of correlation between ring sequences. These crossmatching routines are based on the Belfast CROS program (Baillie & Pilcher 1973; Munro 1984). Crossmatch *t* values of 3.5 or above were taken to indicate a match provided that the visual match between the tree-ring graphs was acceptable. Raw and mean curves generated by this process were compared with dated Roman and late prehistoric national, regional and site chronologies in an attempt to generate calendrical dates for the site sequences.

Results

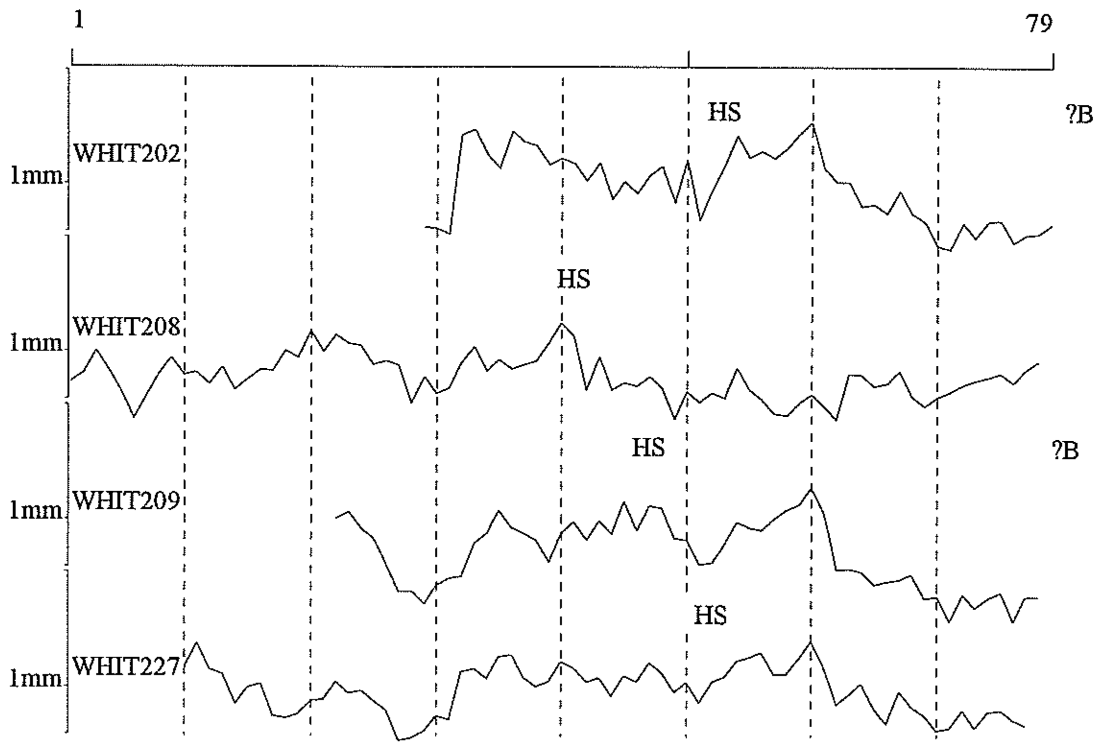
Attempts to cross-match individual tree-ring sequences from site timbers were successful in three instances.
The tangential oak plank from structure 142 (timber 125) cross-matched visually against an oak cross-bearer (163) from succeeding structure 125 (fig #) with a *t* value of 4.84. Given the similarity of technological evidence on the two pieces, timber 163 was probably a reused fragment of plank 152.



The nine samples measured from structure 198 had common narrow bands and generally very slow growth which made measurement difficult. Two split uprights (201 and 221) cross-matched with a *t* value of 7.27 (fig#) and could have derived from the same tree given their very similar raw data.



A further four uprights cross-matched to give a four timber mean, with possible bark edges occurring in relative years 78 and 79 (see fig #)



The ring width and cross-match data for these sequences are presented below (tables #).

Attempts to cross-match individual sequences against these site means were unsuccessful as were attempts to date any site sequences against external dated chronologies.

Comments

The tree-ring sequences produced may reflect local rather than regional/climatic conditions. Certainly the majority of timbers measured from 198 were very slow grown possibly reflecting low nutrient levels or generally poor growing conditions locally. Nonetheless, several cases of internal cross-matching of site sequences were successful. Lack of cross-matches with external dated chronologies could be both a function of local environmental conditions at variance with the wider contemporary climate, and the lack of nearby contemporary tree-ring sequences.

Table: Matrices of t values.
\ = overlap < 15 years
- = t-values less than 3.00
* = empty triangle

4 timber mean, structure 198

Wood no			whit208	whit209	whit227
	start	dates	1	22	10
	dates	end	78	78	77
whit202	29	79	4.47	-	5.54
whit208	1	78	*	-	5.53
whit209	22	78	*	*	5.09

2 timber mean, structure 198

Wood no			whit221
	start	date	1
	date	end	58
whit201	2	85	7.27

2 timber mean, structures 125 (163) and 142 (152)

Wood no	-	-	whit152
-	start	dates	1
-	dates	end	73
Whit163	12	67	4.86

Table: Ring width data

Title : 201/221 2 timber mean
QUSP data of 85 years length
Undated; relative dates - 1 to 85
2 timbers raw data mean
Average ring width 74.81 Sensitivity 0.16

1	55	61	88	69	82	67	57	87	89	87	1	2	2	2	2	2	2	2	2	2
-	133	95	99	67	71	79	82	111	135	119	2	2	2	2	2	2	2	2	2	2
-	112	89	71	82	62	68	79	82	87	113	2	2	2	2	2	2	2	2	2	2
-	126	111	59	53	96	83	69	87	85	83	2	2	2	2	2	2	2	2	2	2
-	81	74	83	72	79	81	103	103	83	80	2	2	2	2	2	2	2	2	2	2
51	70	63	66	78	66	89	68	63	48	57	2	2	2	2	2	2	2	2	1	1
-	63	57	68	65	76	77	86	70	79	61	1	1	1	1	1	1	1	1	1	1
-	49	56	42	52	51	46	41	43	39	48	1	1	1	1	1	1	1	1	1	1
-	36	56	48	54	59						1	1	1	1	1					

Title : WHIT 4 timber mean: 202/208/209/227
QUSP data of 79 years length
Undated; relative dates - 1 to 79
4 timbers raw data mean
Average ring width 84.86 Sensitivity 0.19

1	66	74	100	78	58	40	54	73	91	101	1	1	1	1	1	1	1	1	1	2
-	127	95	99	68	83	90	71	82	79	107	2	2	2	2	2	2	2	2	2	2
-	91	110	104	96	80	70	55	45	52	54	2	3	3	3	3	3	3	3	4	4
-	54	111	129	104	118	131	113	107	100	127	4	4	4	4	4	4	4	4	4	4
-	120	86	109	77	102	85	110	106	72	94	4	4	4	4	4	4	4	4	4	4
51	61	77	92	128	110	113	101	109	130	158	4	4	4	4	4	4	4	4	4	4
-	104	68	79	75	63	59	76	61	52	46	4	4	4	4	4	4	4	4	4	4
-	45	58	50	59	61	50	55	58	58		4	4	4	4	4	4	4	3	1	

Title : 152_163 2 timber mean
QUSP data of 73 years length
Undated; relative dates - 1 to 73
2 timbers raw data mean
Average ring width 138.34 Sensitivity 0.24

1	243	218	156	230	288	140	114	105	197	223	1	1	1	1	1	1	1	1	1	1
-	279	166	121	84	107	160	166	188	149	103	1	2	2	2	2	2	2	2	2	2
-	56	50	55	104	126	166	105	168	178	164	2	2	2	2	2	2	2	2	2	2
-	116	151	163	161	174	136	171	136	154	117	2	2	2	2	2	2	2	2	2	2
-	126	154	154	109	99	130	131	103	85	68	2	2	2	2	2	2	2	2	2	2
51	122	178	143	221	147	120	136	141	181	154	2	2	2	2	2	2	2	2	2	2
-	181	156	116	86	123	92	71	55	48	87	2	2	2	2	2	2	2	1	1	1
-	91	94	109								1	1	1							

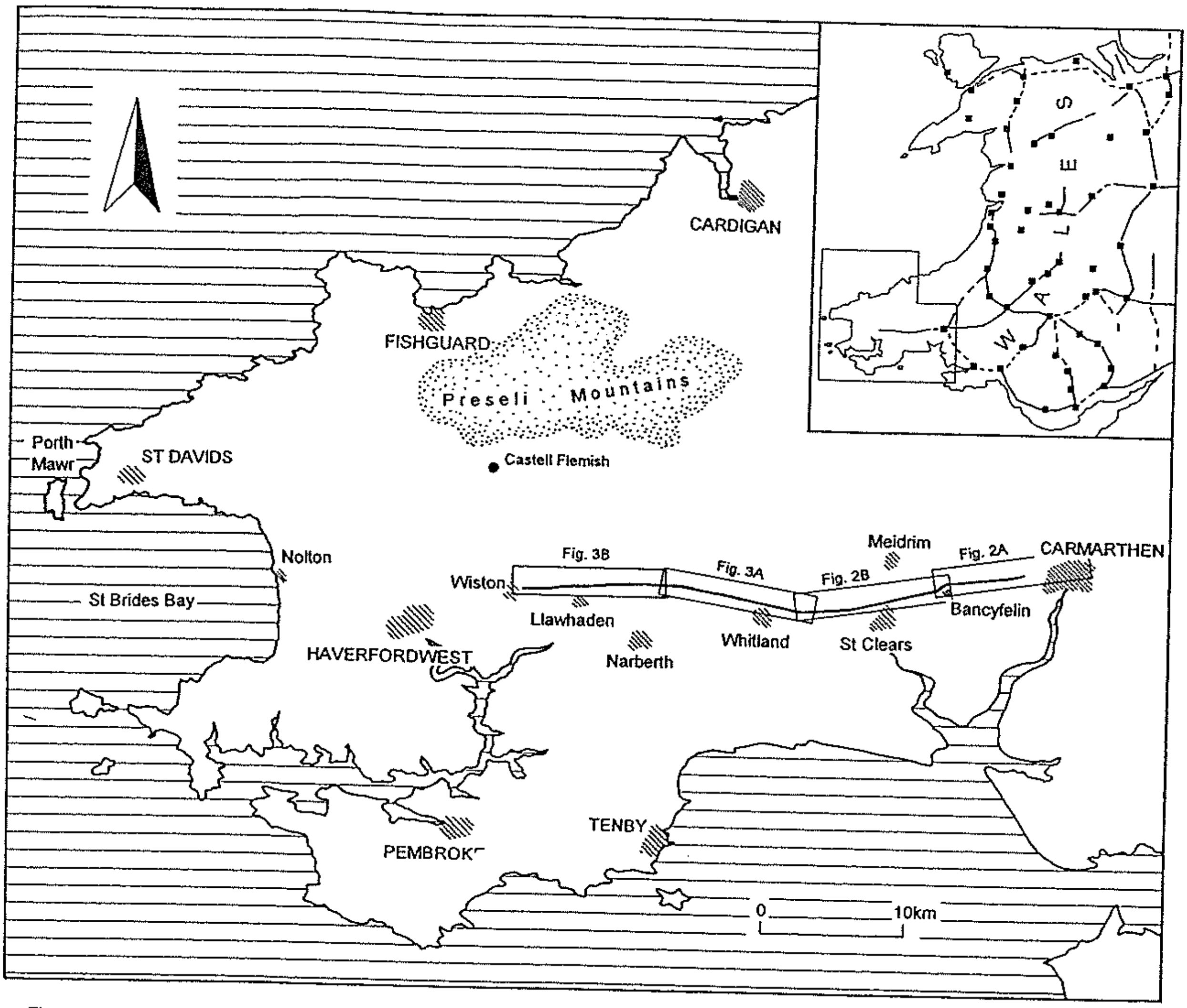


Figure 1: location maps including Wales showing Roman roads and forts

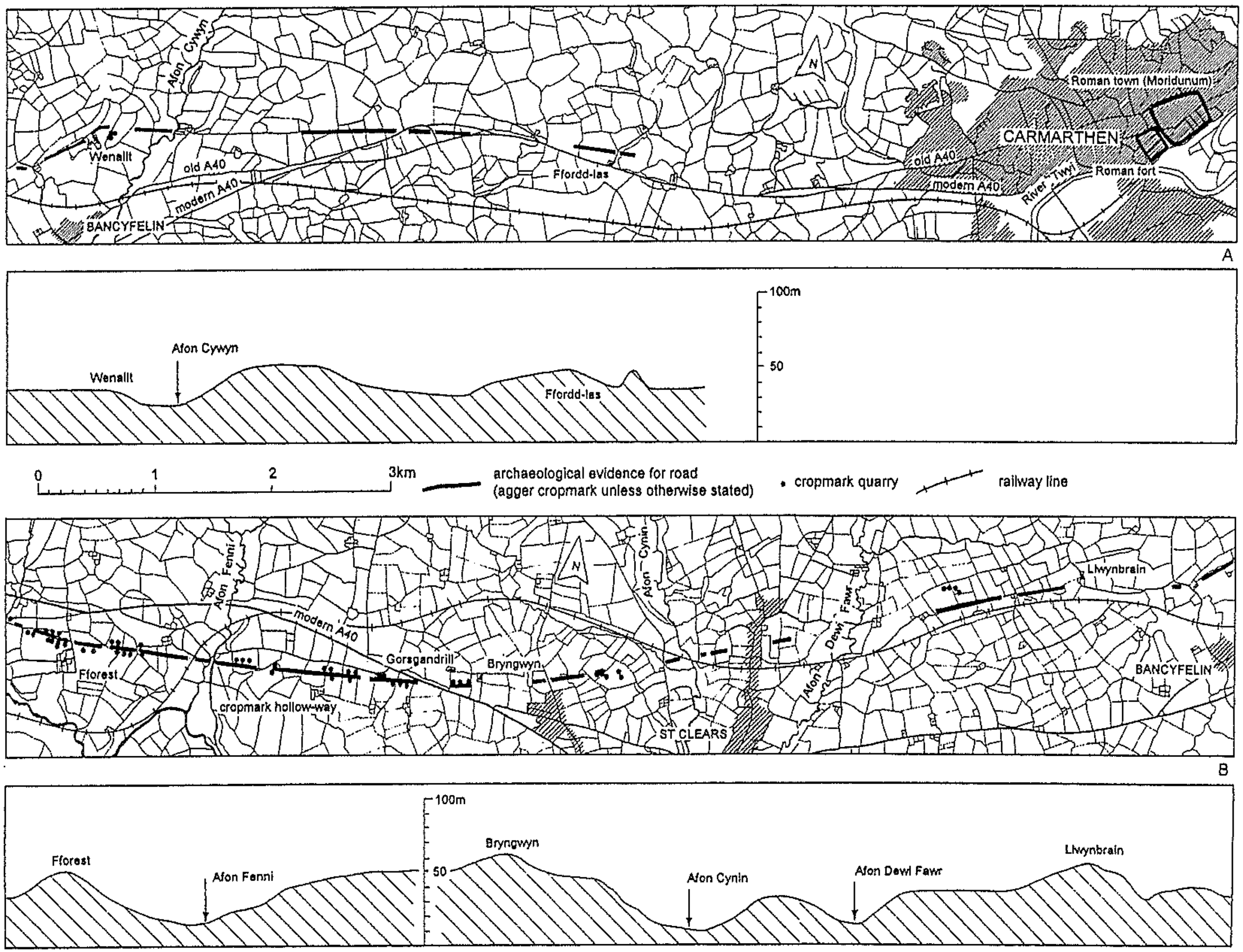


Figure 2: the road route – Carmarthen-Fforest

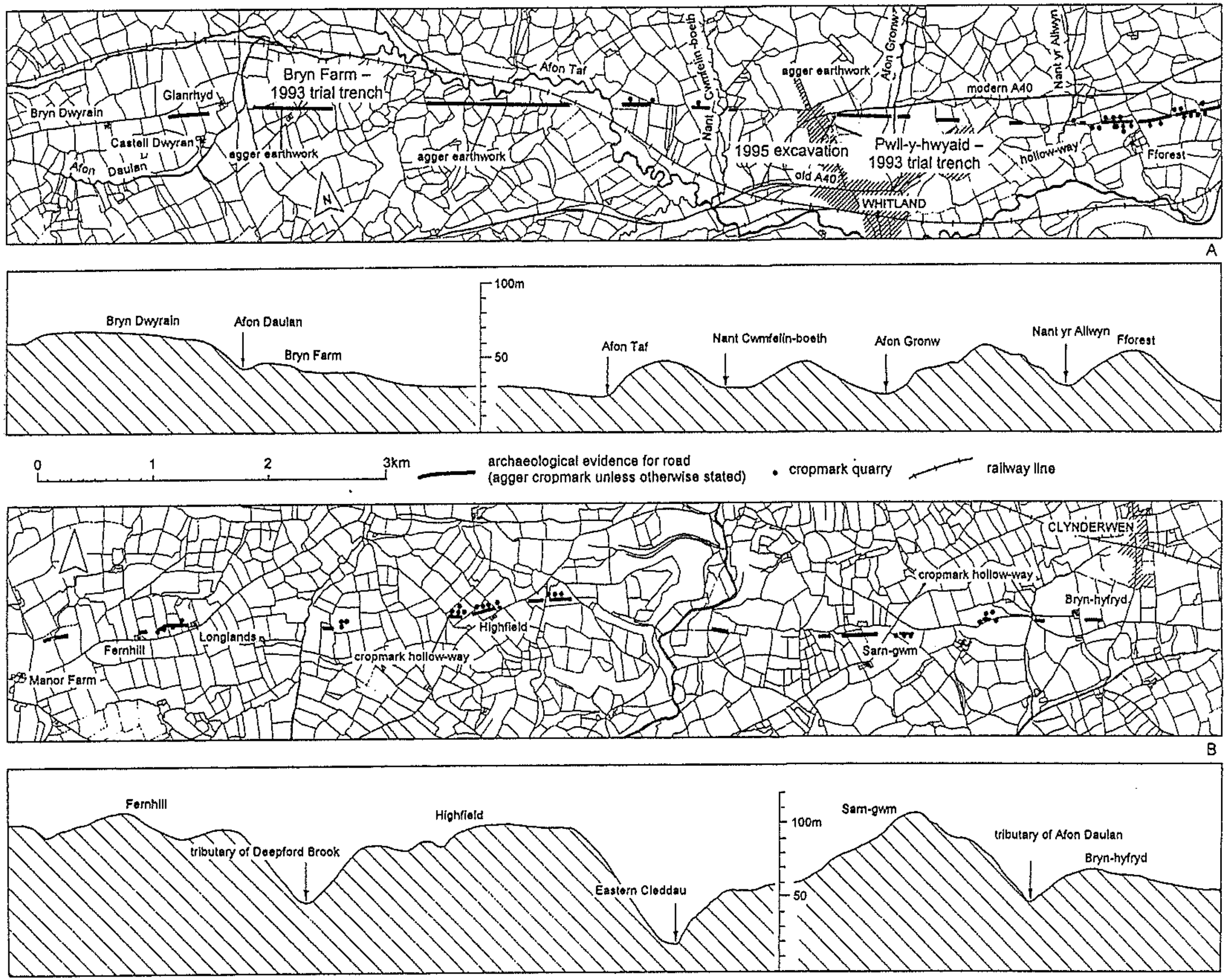
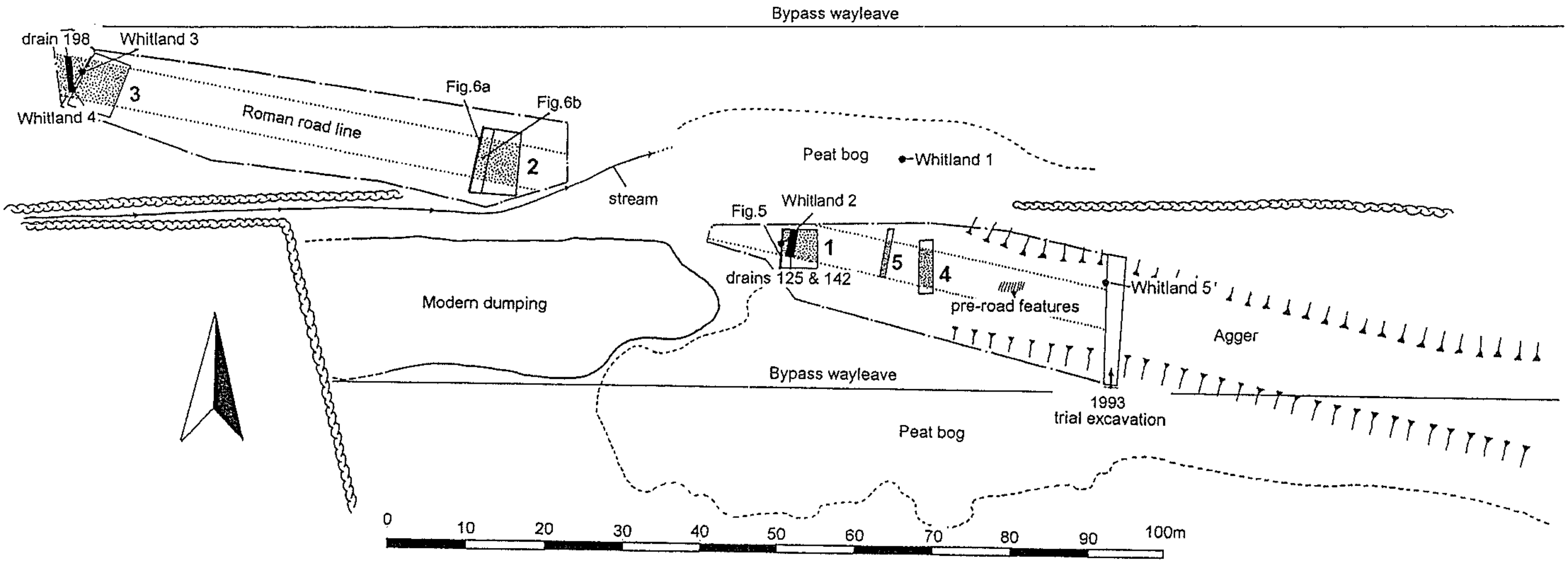


Figure 3: the road route – Fforest-Wiston



Numbers 1-5 - excavated sections
Whitland 1-5 - positions of monolith samples
-·-·-·-·- area of topsoil stripping

Figure 4: excavation areas

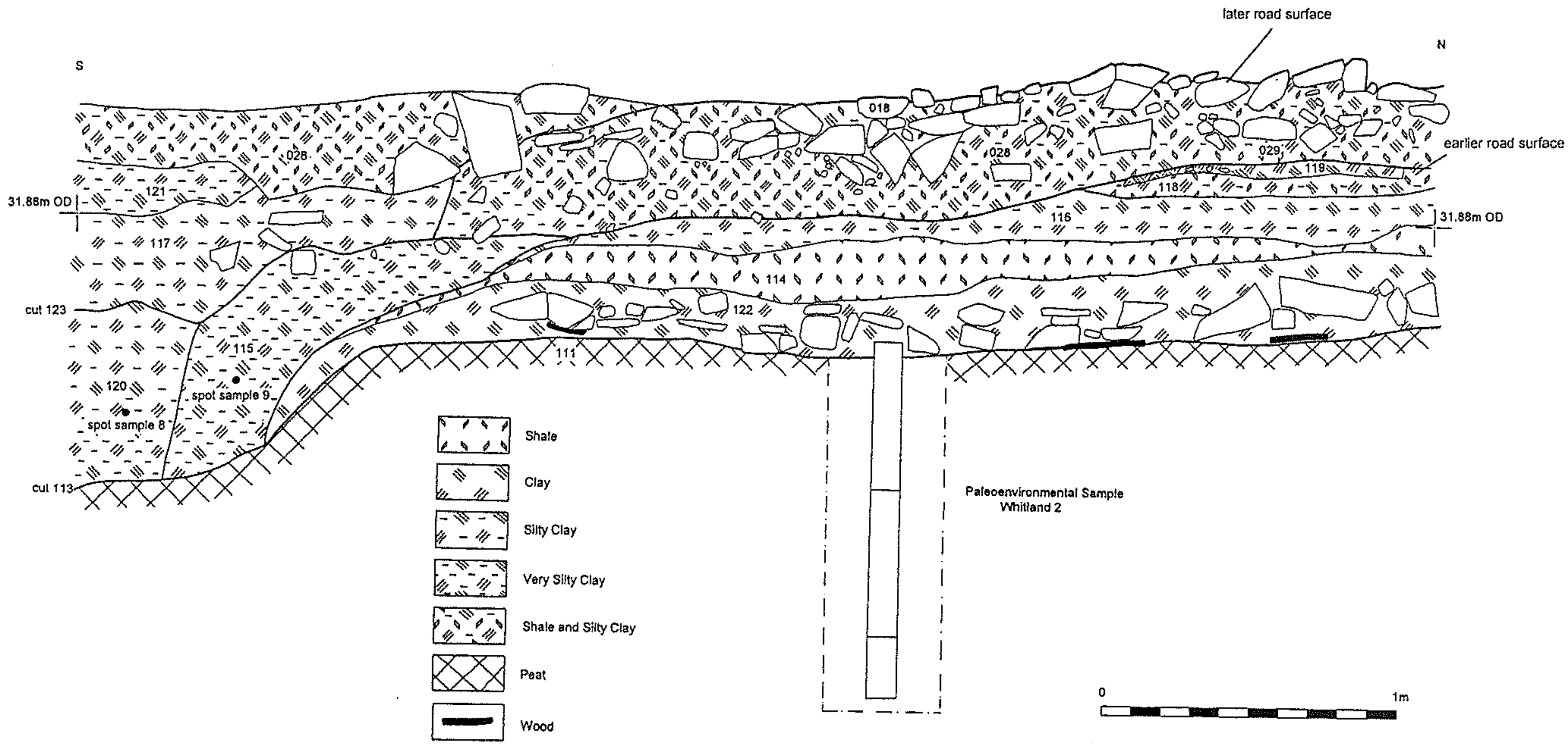


Figure 5: profile of west face in excavated section 1

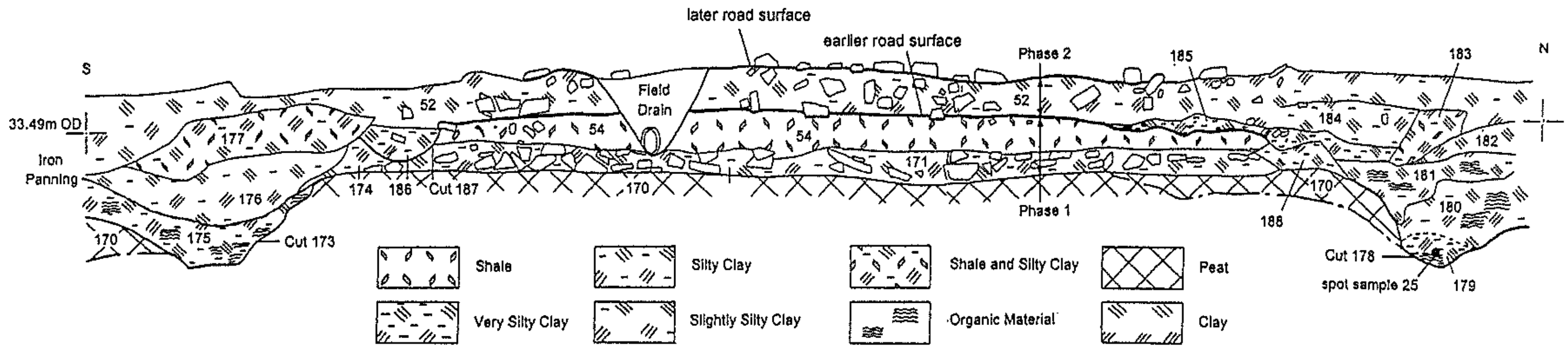


Figure 6a: profile of west face in excavated section 2

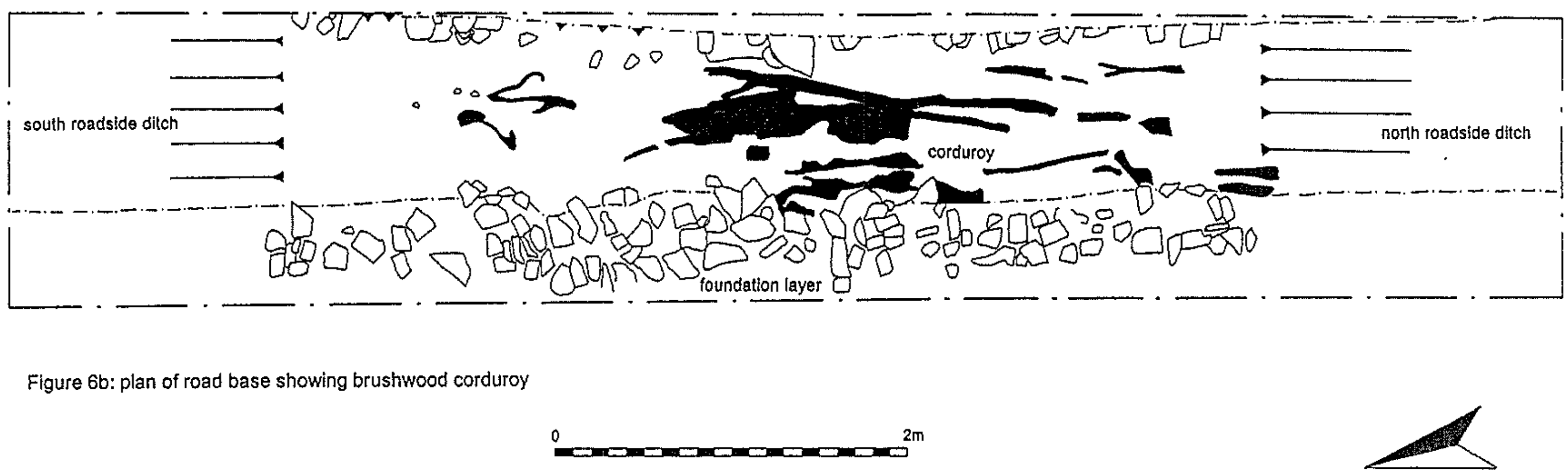


Figure 6b: plan of road base showing brushwood corduroy

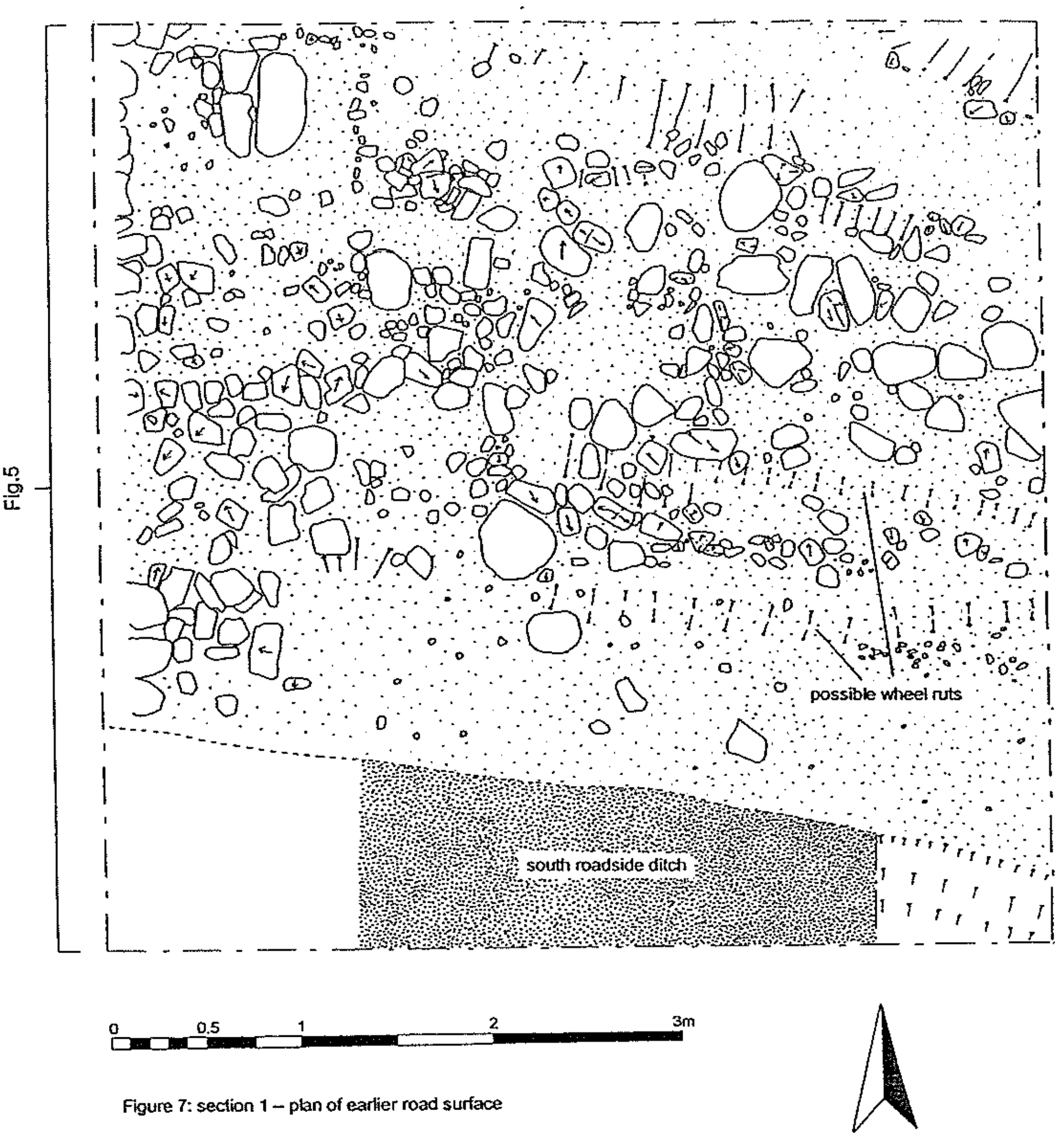


Figure 7: section 1 – plan of earlier road surface

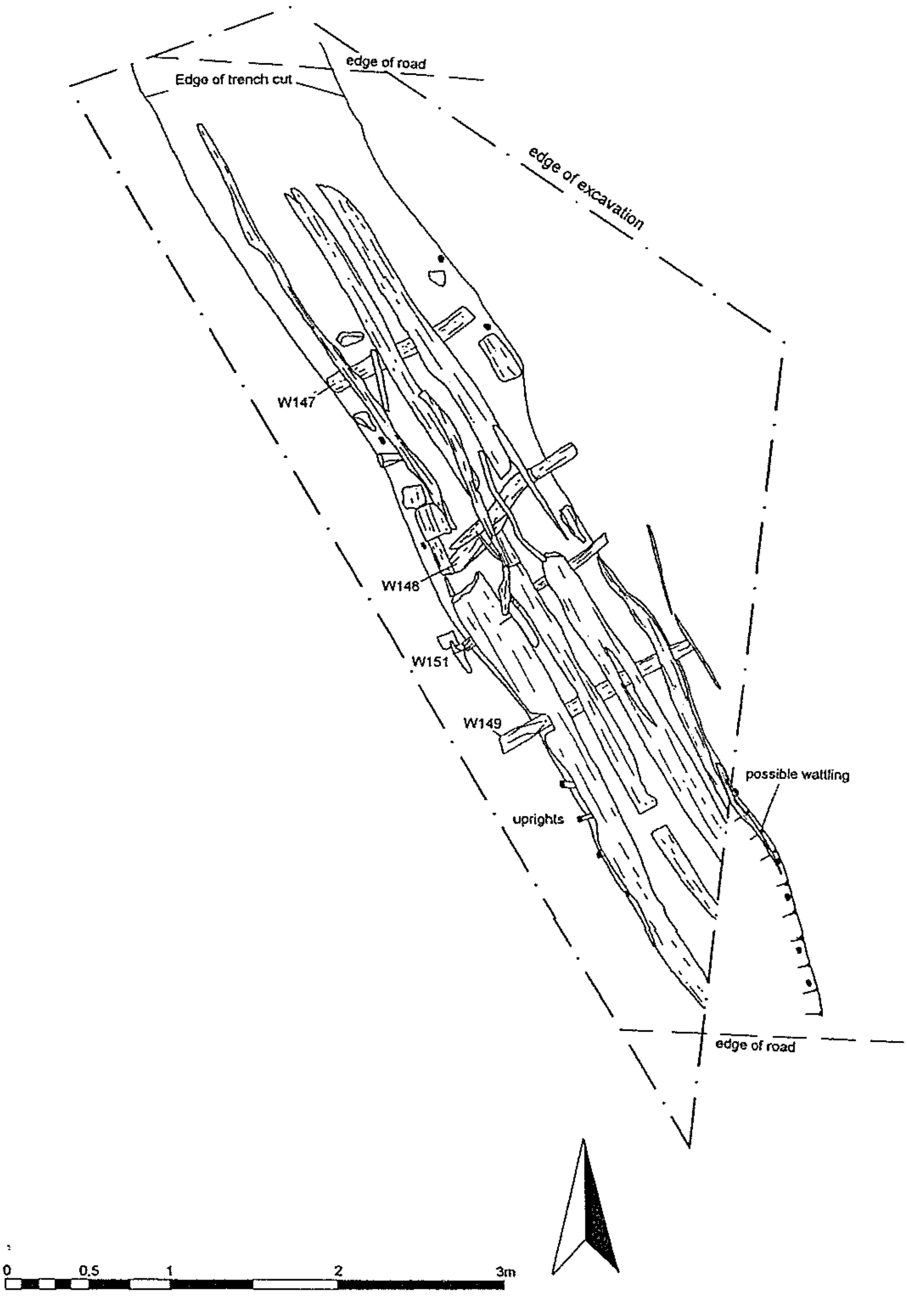


Figure 8: plan of drain 198 showing planked cover

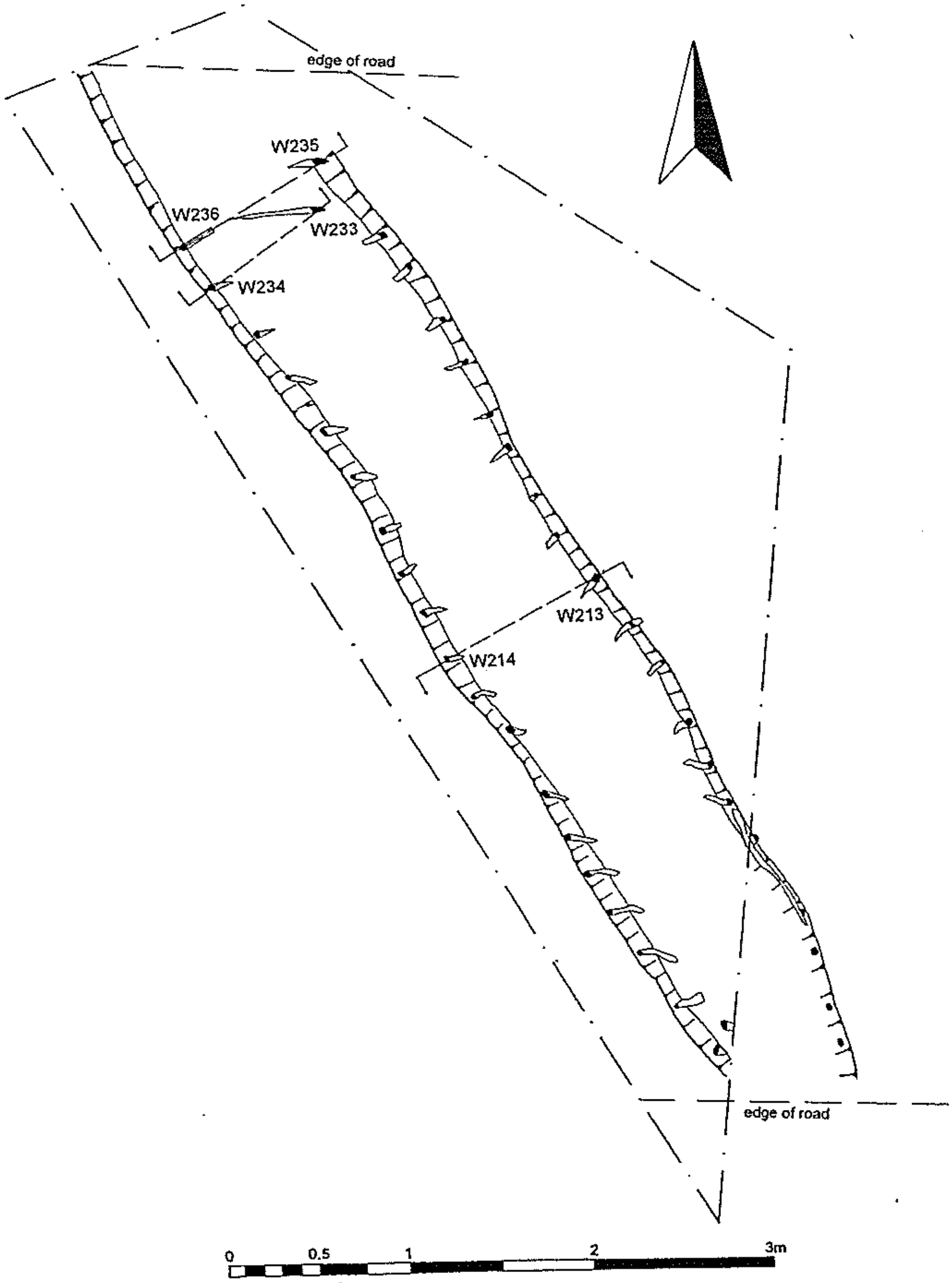


Figure 9: plan of drain 198 showing uprights and trench cut

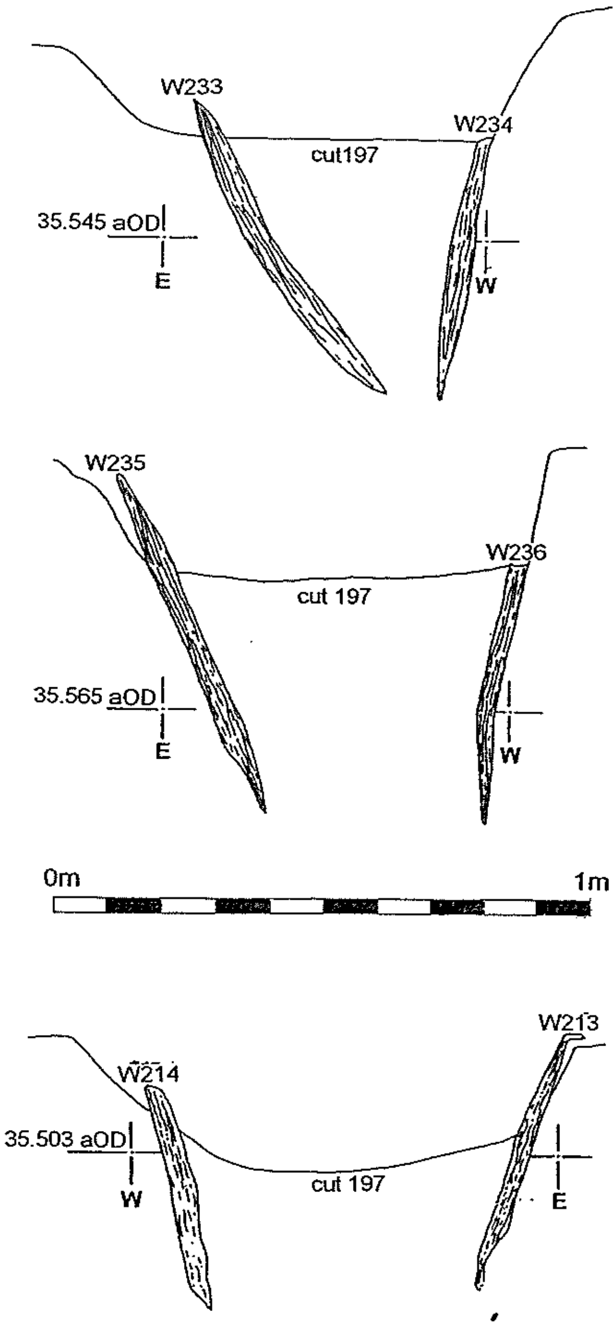


Figure 10: profiles through drain 198 (see Fig.8 for locations)

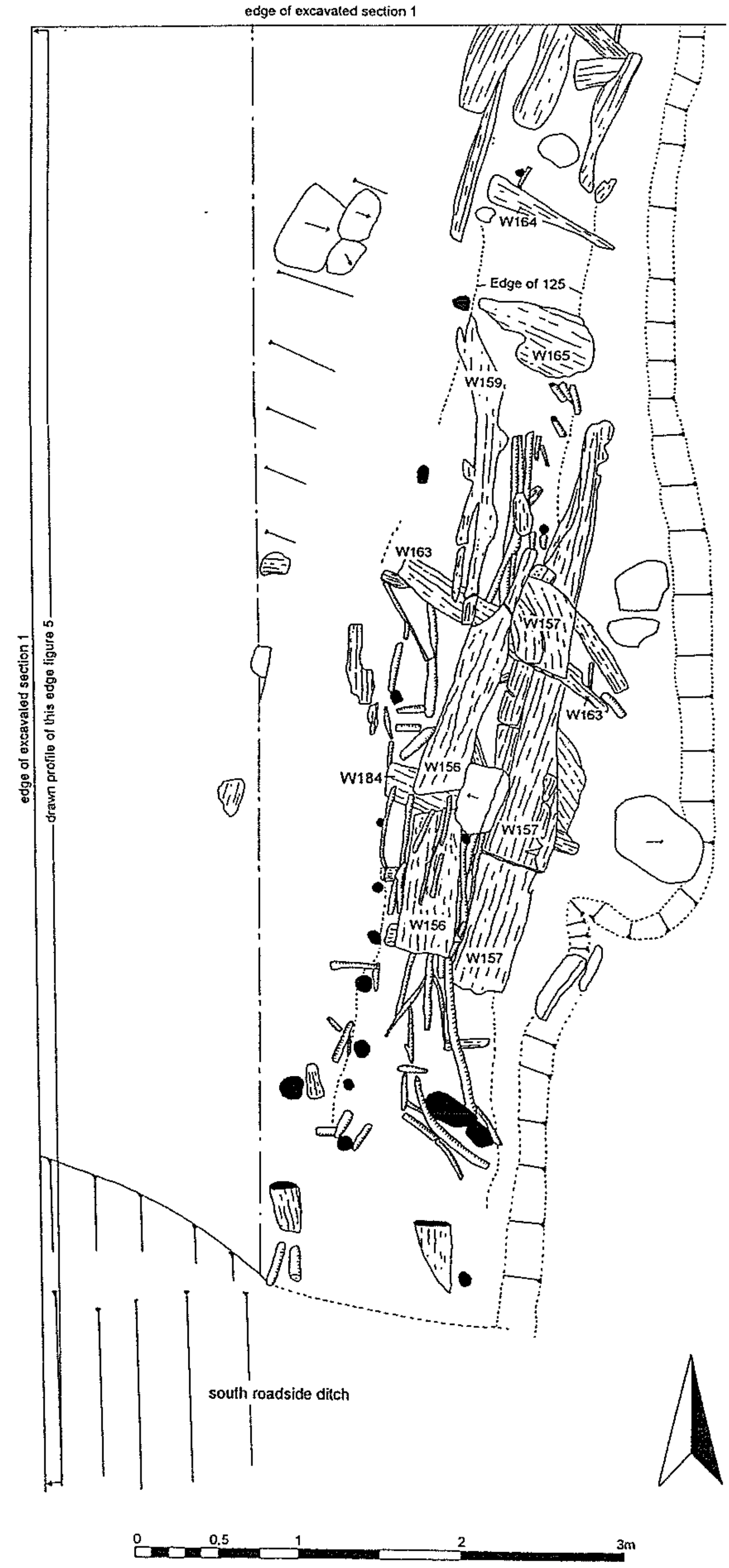


Figure 11: plan of drain 125 showing planked cover

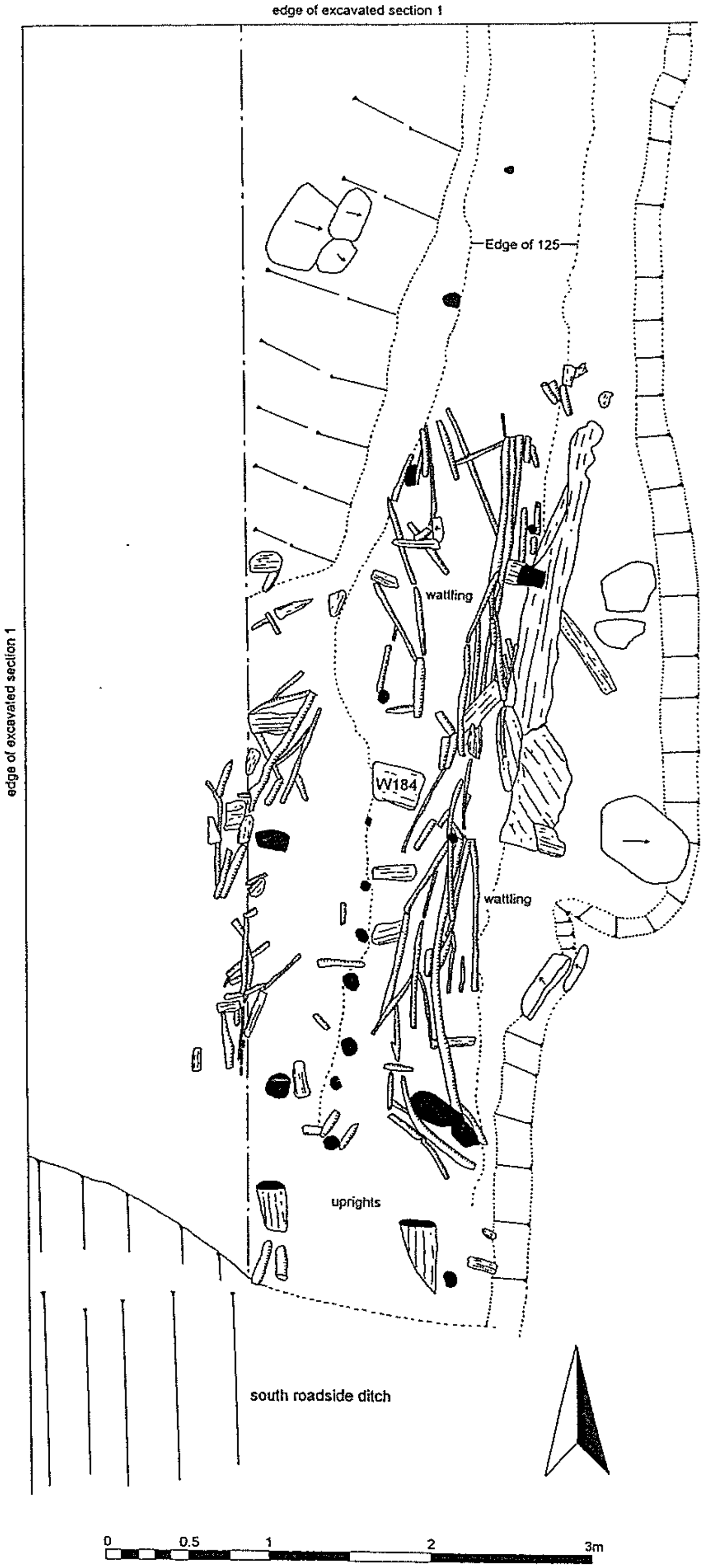


Figure 12: plan of drain 125 after removal of planked cover

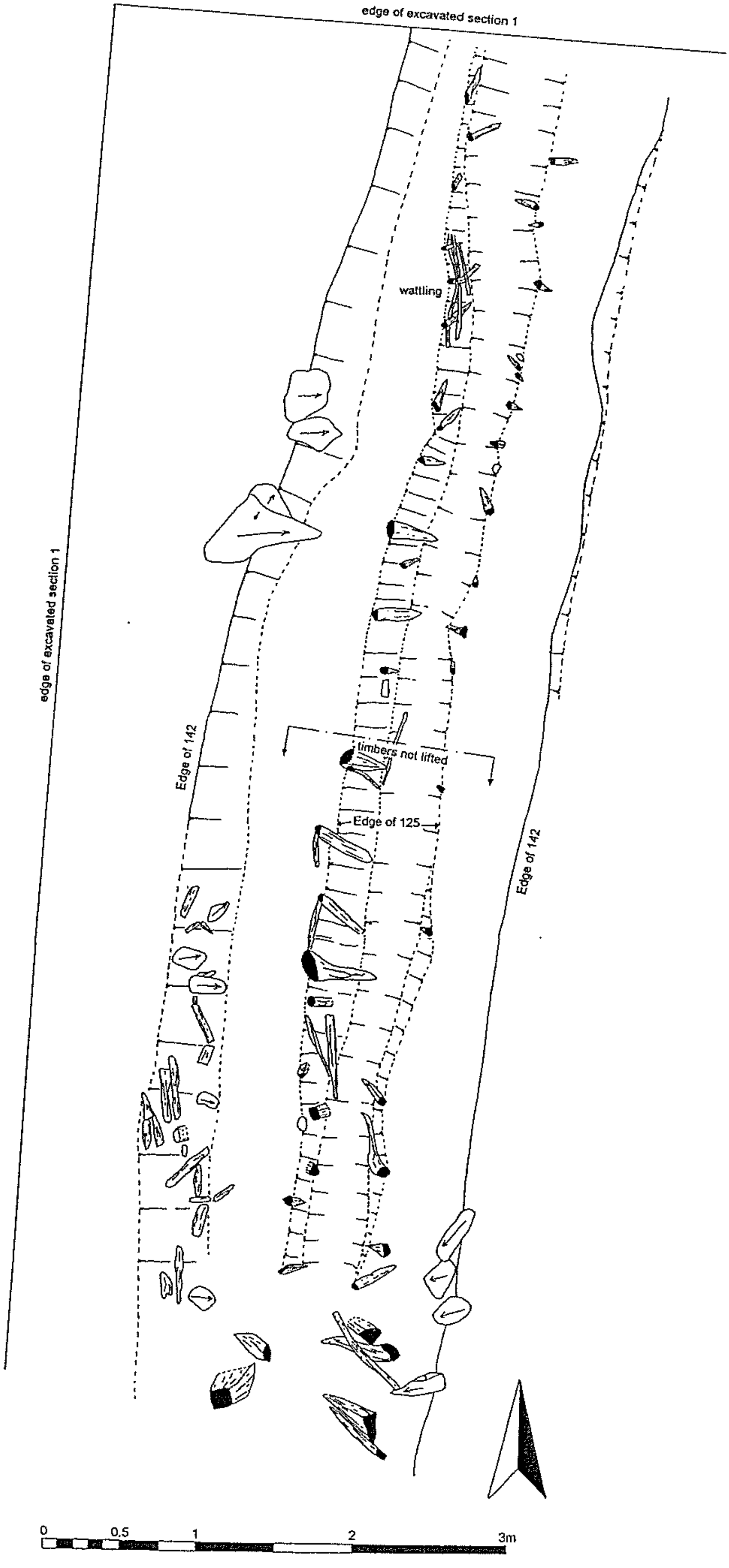


Figure 13: plan of drain 125 showing uprights and trench cut

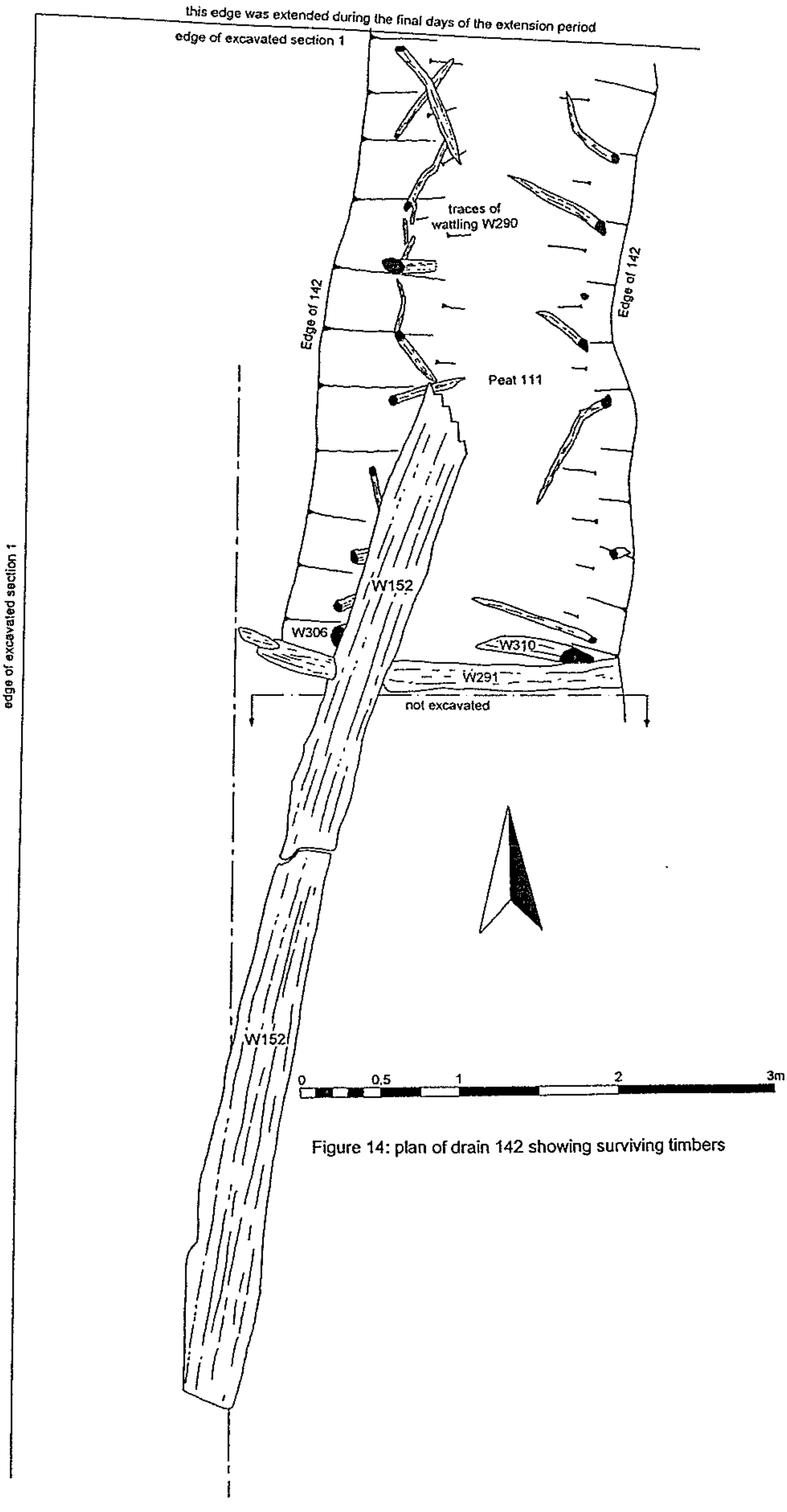
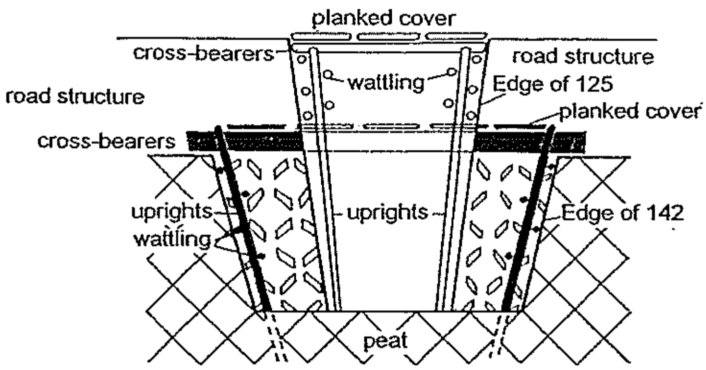


Figure 14: plan of drain 142 showing surviving timbers



Elements of 125 shown as open
Elements of 142 shown filled

Figure 15: schematic profile showing the relationship between drains 142 and 125

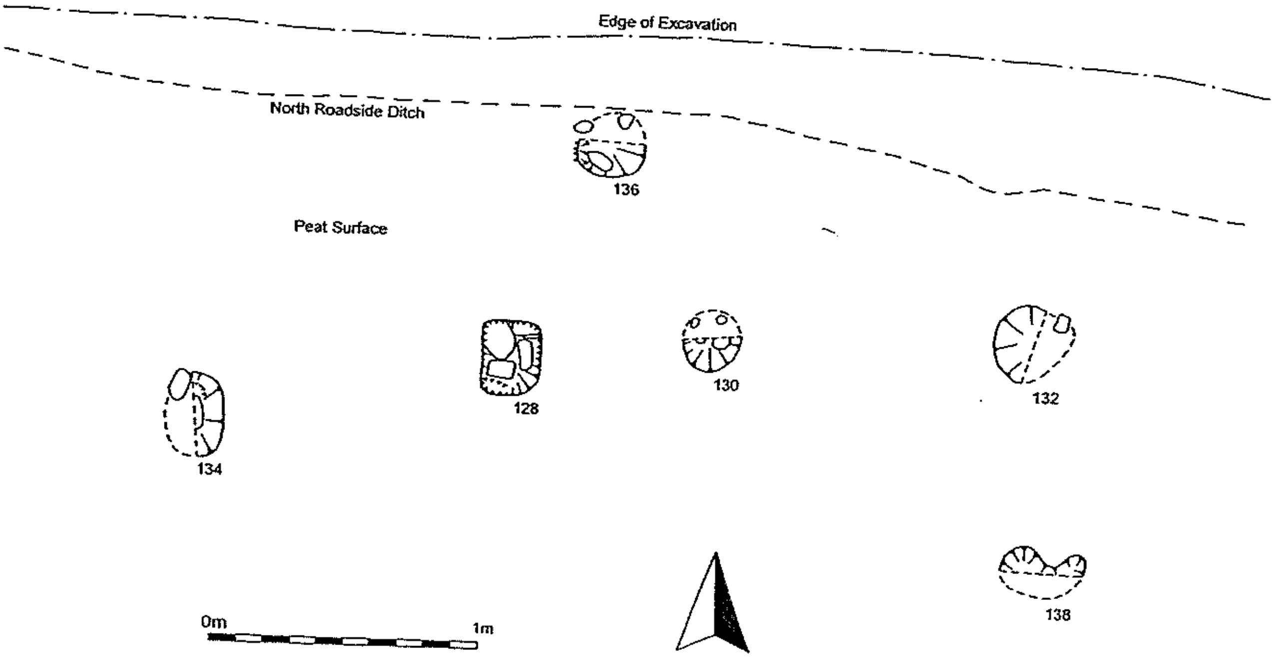


Figure 16: pre-road features to the east of excavated section 4

Plate 1: View southeast of the excavation, with the agger, flanked by boggy ground, clearly visible running towards the top left.

Plate 2: View west-northwest along the line of the Roman road with the bypass route crossing it from bottom right to top left. The Roman road line runs from the bottom of the picture along the excavated area and is continued in the farm track and tree lines towards the top.

Plate 3: Recording the southern half of the upper road surface. View east.

Plate 4: The upper road surface in the northern half of the site, looking northwest.

Plate 5: Section 2 showing the timber corduroy and the foundation stones for the earlier road. Parts of the upper road surface can be seen to the right and left.

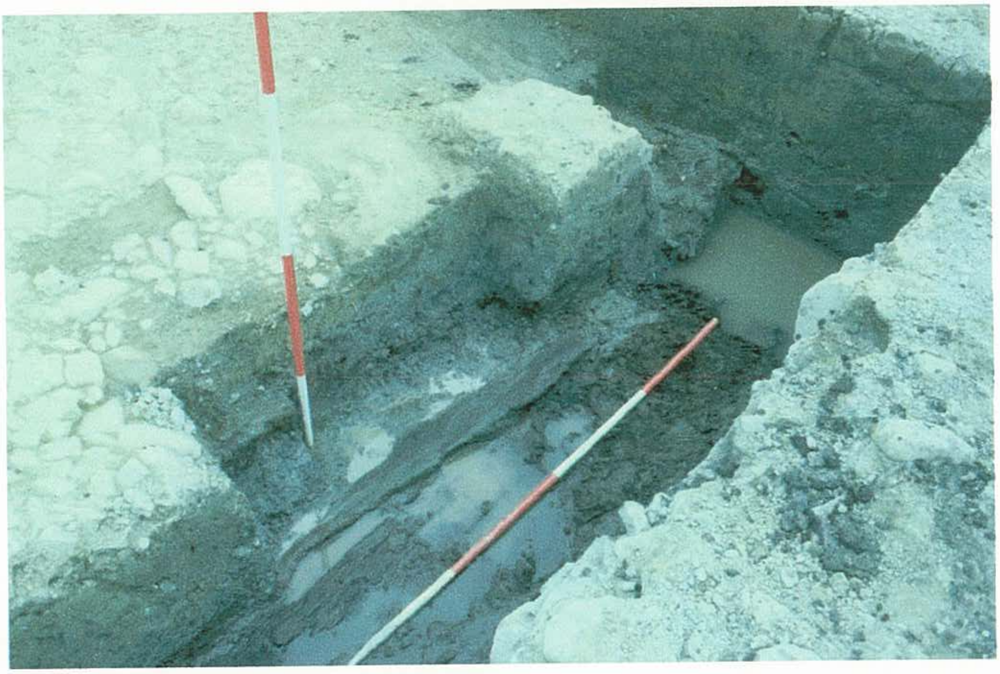


Plate 6: Drain 142 showing the planked cover (timber W152) when first exposed.

Plate 7: Recording drains 125 and 142 during the last days of the excavation. The extension to the original excavation period meant that bypass construction continued right up to the edge of the excavated area.

THE DISCOVERY AND INVESTIGATION OF A ROMAN ROAD
WEST OF CARMARTHEN

REPORT NUMBER 2002/4

This report has been prepared by Gwilym Hughes

Position Director

Signature .... Date ...11/1/02......

This report has been checked and approved by Ken Murphy on behalf of Cambria Archaeology, Dyfed Archaeological Trust Ltd.

Position Principal Archaeologist

Signature .... Date...11/01/02........

As part of our desire to provide a quality service we would welcome any comments you may have on the content or presentation of this report