THE CLWYD-POWYS ARCHAEOLOGICAL TRUST

# *Buttington Waterfront*
## PROJECT REPORT

CPAT Report No 471.1

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Report for Cadw: Welsh Historic Monuments

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## 1 INTRODUCTION

1.1 In September 2001 the Clwyd-Powys Archaeological Trust (CPAT) was alerted to the presence of a series of substantial timbers which had been identified projecting from the east bank of the River Severn, upstream of Buttington road and rail bridges. Following an initial evaluation by CPAT, a request was made to Cadw: Welsh Historic Monuments for contingency funding to enabled a programme of survey, recording and assessment to be undertaken.

1.2 The programme of work, which was undertaken between October 2001 and July 2002, initially included a detailed topographical survey of the exposed timbers and the immediate area and dendrochronological dating of the timbers. In order to place the timbers in a more informative context a programme of geomorphological analysis was commissioned to investigate the local development of the river channel and, finally, the timber structure itself and in particular its method of construction was the subject of more detailed investigation.

## 2 LOCATION AND DISCOVERY

2.1 The site of the timbers lies 150m upstream of the bridge carrying the Shrewsbury to Aberystwyth railway line over the River Severn at Buttington (SJ 2470 0869; figs 1-2). The timbers were initially identified during a period of low river flow by John and Ginny Graham, the owners of the Malt House, which lies on the opposite, west bank of the river. Following their reporting of the discovery to CPAT, an inspection of the site revealed a number of substantial timbers protruding from the river bank and others partly submerged in the river.

2.2 At this point the river forms a substantial meander (Plate 1) which is actively eroding to the east and south-east. Comparison of the present river course with that mapped by the Ordnance Survey in 1964 (fig. 2) shows that the meander has moved *c.* 50m to the south-east since that date. Although the river channel is generally active in this area the situation around the Malt House has been exacerbated by the restriction of the channel downstream, beneath the railway bridge, together with the construction of several stone piers upstream on the west bank, designed to prevent further eastward movement of the river towards the Malt House. These factors appear to have resulted in the more active movement of this particular meander.

2.3 A period of extensive flooding and generally high river flow during the autumn and winter of 2000-2001 led to significant further erosion of the eastern bank of the river, which at this point is formed by a river cliff up to 3.75m high, consisting of soft sediments above more stable clays which encase the timbers. This period of erosion led to the exposure of the timbers, which generally lie around the mean water level.

2.4 The discovery of the timbers was given additional interest by their proximity to the projected line of Offa' Dyke, which has been tentatively identified as a cropmark extending to the river's edge, some 35m downstream of the timbers. In the fields to the east the Dyke survives as a low earthwork where it crosses the valley floor, possibly heading for a river crossing.

## 3 GROUND SURVEY

3.1 A detailed total station survey was undertaken to record the position of each timber and the wider setting, including changes in the river channel. The exposed timbers occupy a stretch of riverbank some 30m in length and consist of three main horizontal timbers associated with at least 25 uprights or stakes. The main concentration of timbers is shown in fig. 4.

3.2 On the west bank of the river a number of low terraces could be traced, associated with former river channels presumably dating to the last 40 years. No timbers have been recorded on this side of the river and an investigation of the east bank on either side of the exposed timbers failed to reveal any further traces. Continued monitoring of the timbers through the winter of 2001-2002 showed that the river was continuing to actively erode in this area. The upper soft sediments had been cut back by perhaps a further 2m since September 2001, largely as a result of undercutting and bank collapse, which at one point had at least partly buried the main timbers. By July 2002, although a few additional uprights had been exposed, there seemed generally to be little further erosion of the clays within which the timbers are generally encased. There seems little doubt, however, that the active erosion will continue and there will therefore always be the potential for further discoveries.

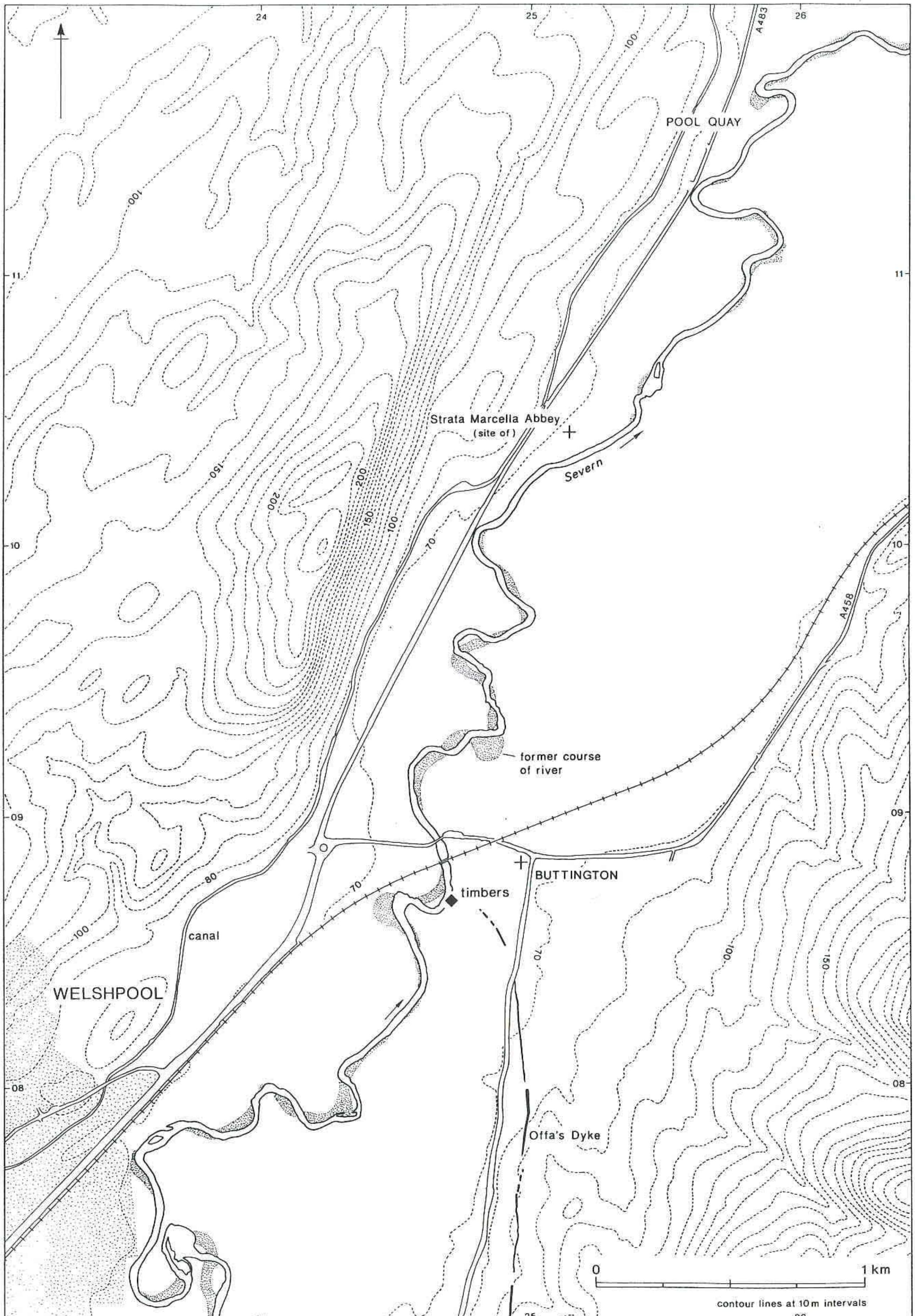


Fig. 1 Severn Valley around Buttington

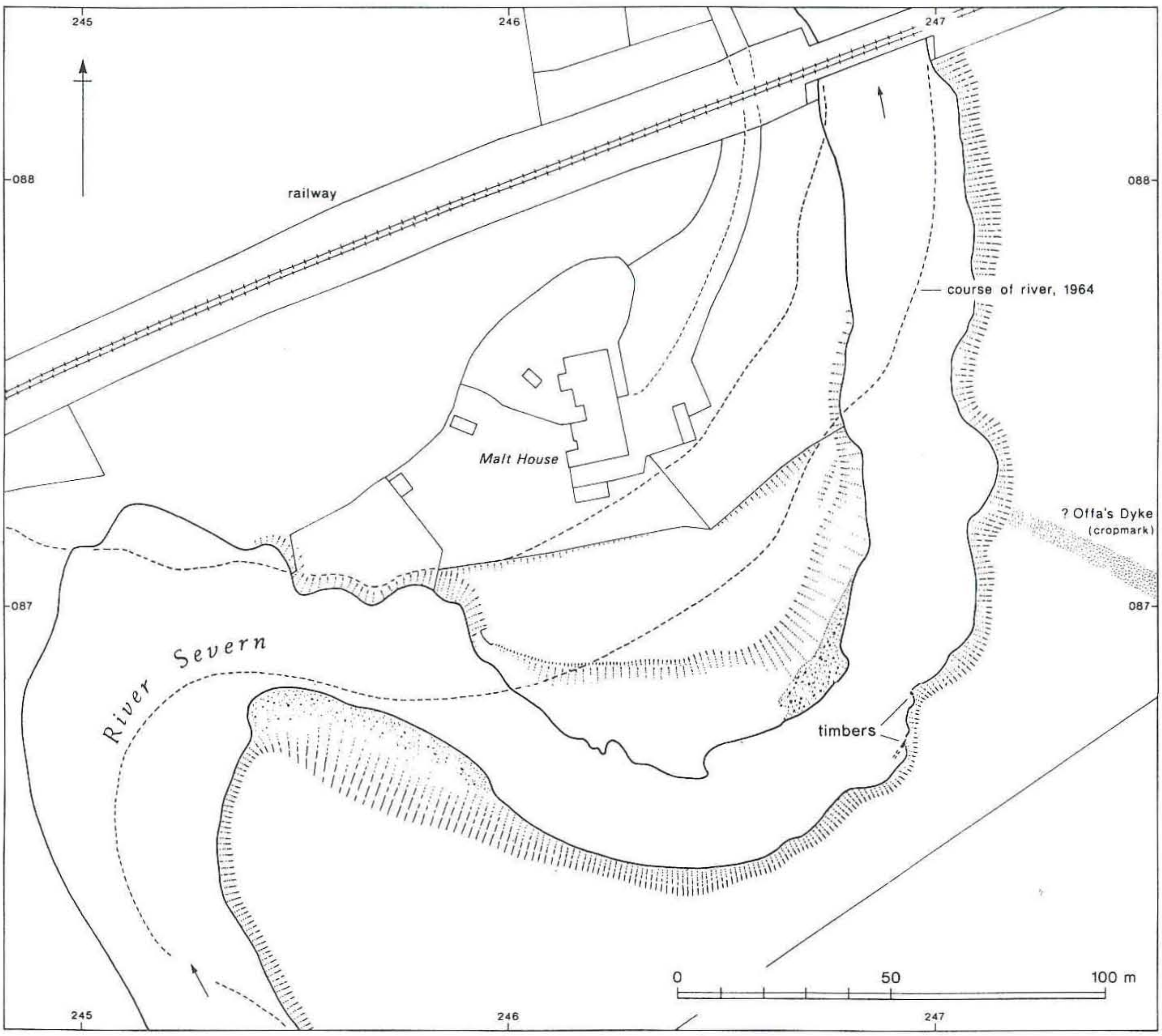


Fig. 2 Location of timbers

## 4 TIMBER STRUCTURE from comments by Nigel Nayling

4.1 The following comments are based on the examination of photographs and drawings of the of timbers. The site is only exposed during unusually low river levels, and the author has not been able to visit the site at such a time. Geomorphological studies (Fluvio 2002) and interim dendrochronological dates (Worthington and Miles 2001) provide insights into possible contemporary palaeochannel positions, and probable date range for the timbers themselves. Interpretation of the function of the structure, or structures, is nonetheless hampered by the partial nature of their exposure, and the eroded nature of the exposed timbers. The fact that the form and extent of this structure has significantly changed during the period of monitoring encourages caution in making any definitive attempt at interpretation.

4.2 The most obvious structural element consists of a horizontal timber (butt 1; fig. 3; plate 2) 0.46 x 0.56m in section which extends over 4.6m, aligned roughly south-west to north-east. Four dove-tail joints are visible cut into either side of the timber towards the south-west end (plate 3), one of which contained an eroded upright, although as a secondary feature which was not part of the dove-tail joint (butt 4). The dove-tails had been cut through the full thickness of the timber and are all tapering so that the corresponding timbers would be prevented from falling through the joint. A rectangular mortise had also been cut vertically through the timber near this end, also with an upright (butt 3) *in situ*, although again this may be secondary as the timber is rather smaller in section than the mortise. A substantial through mortise, forming a slot cut vertically through the timber, was identified in April 2002 following further bank erosion and this was investigated further during limited excavation undertaken in June 2002. The slot, which was 0.16-0.22m wide, extended for at least 2.8m, within which were the remains of 13 uprights. The uprights appear to have been placed through the slot without any additional jointing and may have been driven into the sediments below. It remains uncertain whether the main timber may have been reused, particularly since there are no surviving timbers associated with any of the dovetail joints and indeed one appears to have had an upright inserted at a later date.

4.3 A second substantial horizontal timber was visible below the water level, generally aligned with, but not directly beneath the upper timber. This lower timber measures 0.44 x 0.40m in section and has a single through dovetail joint cut horizontally in the upper surface towards the southern end. It would appear that the upper timber (butt 1) has been displaced slightly to the north-west and its original position may have been such that the uprights placed through the mortises were set against the south-east side of the lower timber, but not jointed to it. The upper timber is heavily eroded, but there is no indication of a scarf at its southern end continuing the line of the structure as indicated by the underlying beam. Further submerged timbers, possibly displaced, are visible in the deep water channel at times of low flow and these have yet to be investigated.

4.4 At least 17 other uprights (plate 4) were observed further downstream (to the north), along with a third substantial horizontal timber (butt 2). The latter was only visible for 0.6m but was aligned north-west to south-east and also has a mortise or slot cut through in which two upright timbers are visible. An area of stone was noted on the river bed beneath the timber, although no structural masonry was identified. A further two timbers were recorded further downstream, along with what appeared to be some stone in the bed of the river, although this was by no means clear. The scatter of stakes are not clearly patterned, although they appear to be generally aligned north-south, obliquely to the two main beams. This could, however, be illusory, a function of erosion rather than evidence for a separate phase of construction.

4.5 A number of functions for this structure are possible with its association with the river encouraging consideration of bridges, mills, and fish weirs. Initially, when less well exposed, the two adjacent beams could have been seen as elements in a closed form of trestle bridge (Rigold 1975, type IIIa), although this seems an unsuitable form for use in a river with a strong flow rate (but possibly usable in a cut off channel). Subsequent erosion has shown that the lower beam is not directly overlain by the upper one making such an interpretation unlikely. Beams with long through mortises and dovetails do not feature in the extensively preserved timbers from Bordesley Abbey (Astill 1993) where a number of tail and head races, and parts of the mill buildings survived in a waterlogged state. Mortises were present on one set of base timbers of a tail race but these were apparently designed to take relatively insubstantial uprights to brace the tail race side timbers. The well-preserved remains of the 14th-century Batsford Mill in Sussex had no comparable carpentry, although upright timber planking was used to enclose the waterwheel compartment (Bedwin 1980).

4.6 The long through mortises would also not necessarily be expected in a fish weir on the upper Severn.

Long-running studies of fish weirs occupying former courses of the River Trent (Losco-Bradley and Salisbury 1978; Salisbury 1991) have recorded a variety of structural forms associated with rivers rather than estuarine environments. Again, the extensive use of baseplates is not a feature of those recorded by Salisbury. More recent excavations of further structures at Hemington may provide more appropriate parallels. Here, structures known as 'shoots' have been recorded providing protection from erosion to the riverbanks (Cooper forthcoming).

4.7 A further possible interpretation is that the remains may be part of a sluice, with the upright timbers raised and lowered within the long through mortise to control the flow of water, although as yet there appear to be no close parallels within Britain (F Olding pers comm.)

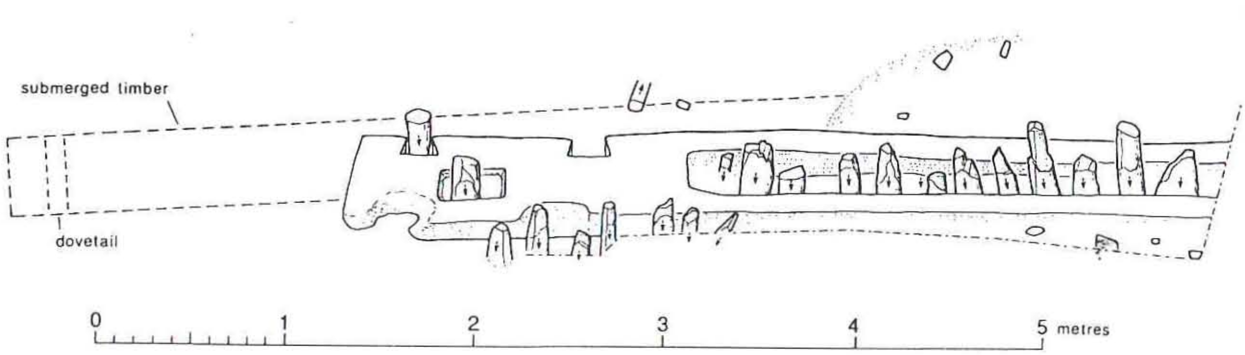


Fig. 3 Plan of main horizontal timber (butt 1)

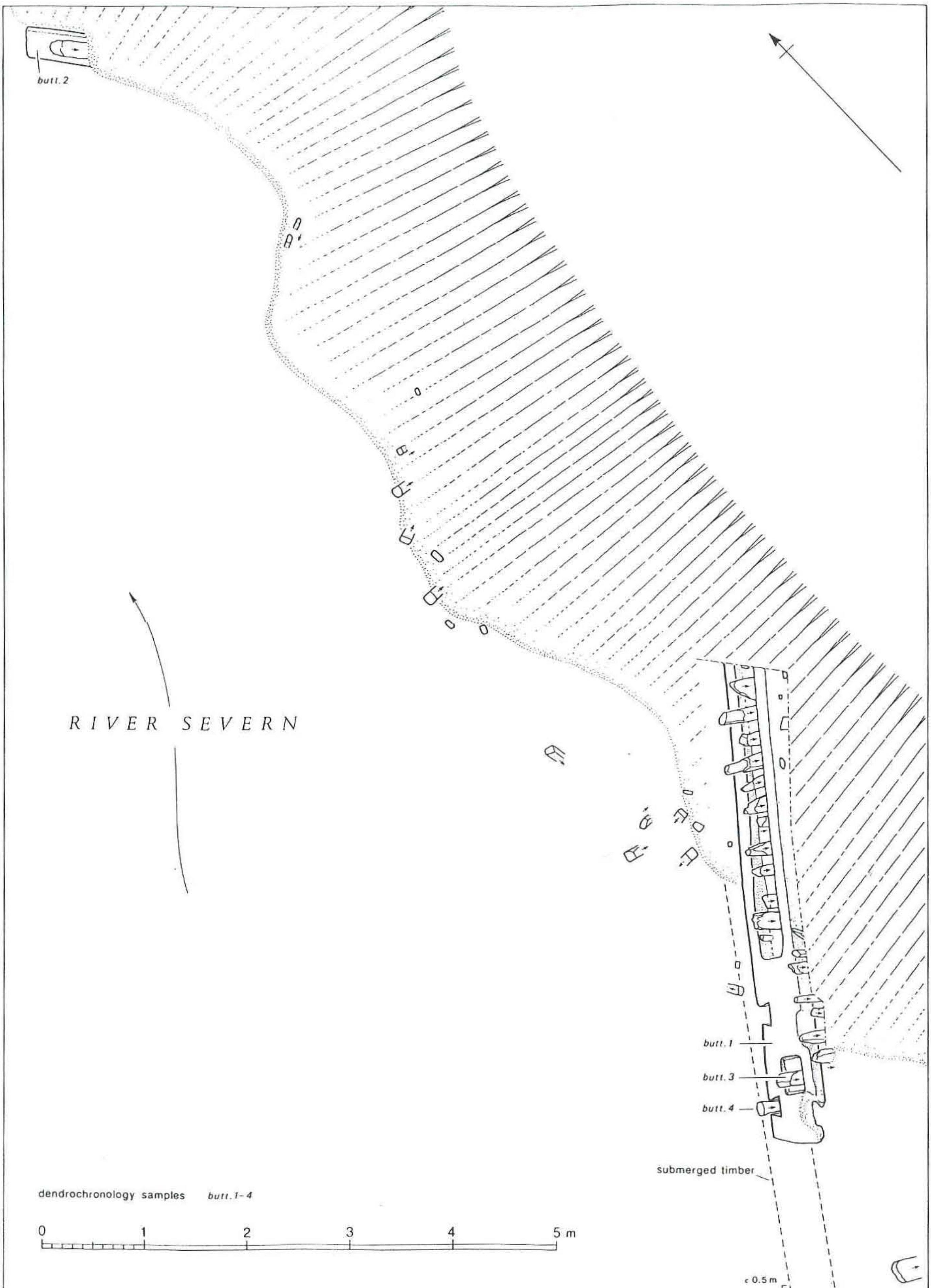


Fig. 4 Plan of timbers

## 5 DENDROCHRONOLOGICAL DATING

5.1 The potential of the timbers for dendrochronological dating was assessed by Michael Worthington of the Oxford Dendrochronology Laboratory and a report of the findings is contained in Appendix 1.

5.2 The assessment of the visible timbers suggested two or possibly three phases of construction. The initial phase comprised the main horizontal timber and presumably also the second horizontal timber beneath. The uprights associated with the upper horizontal timber (butt 1) were considered to constitute a second phase of development, while the third horizontal timber, further downstream, could represent a third phase.

5.3 Four timbers were sampled (fig. 4), all of which were identified as oak (*Quercus* spp.), and three of which were found to be suitable for dating: the main upper horizontal (*butt1*); the separate downstream horizontal timber (*butt2*); and an upright jointed to the main horizontal timber (*butt4*). As none of the samples retained the heartwood/sapwood boundaries, only a *terminus post quem*, or earliest felling date, could be given for each sample (Table 1).

Table 1 Dendrochronological dating

| Sample | last measured ring date | *felled after* |
|---|---|---|
| *butt1* | AD 1114 | AD 1125 |
| *butt2* | AD 1164 | AD 1175 |
| *butt4* | AD 1076 | AD 1087 |

5.4 The limitations of having no surviving sapwood and only three datable samples have restricted the conclusions which can be drawn from the analysis. It is clear that the main structure cannot have been constructed before AD 1125, even though one of the component uprights may have been felled somewhat earlier. The separate horizontal timber was felled after AD 1175 and may represent a later phase, or alternatively may suggest that the whole structure. What these ranging dates may imply, along with evidence from the joining in the main timber, is that the structure may to some extent have been constructed using reused timbers.

## 6 GEOMORPHOLOGY AND RIVER DEVELOPMENT

6.1 A key element of the project was an attempt to place the timber structure in its original context by identifying the likely course of the River Severn during the 12th century. To this end a geomorphological investigation was commissioned from Fluvio, Department of Geography and Earth Sciences, University of Wales, Aberystwyth. The team, led by Professor Mark Macklin and Dr Paul Brewer, conducted a study of the former river channels, including a programme of ground survey, coring and ground penetrating radar (GPR).

6.2 The results (Appendix 2) have provided significant evidence for the development of the River Severn in the area surrounding the timbers. The geomorphological mapping of the area, based on the detailed ground survey and field identification, has identified a number of palaeochannels which are evident as slight differences in elevation (Appendix 2, Figure 3). One palaeochannel is crossed by Offa's Dyke and must therefore have been abandoned by the 8th century AD. This has been cut by a second palaeochannel, which in part appears to be respected by the line of the Dyke, suggesting that it may have been an active channel during the 8th century. Although the Dyke terminates where it meets this palaeochannel, it is unclear whether this was the original terminus, or whether the Dyke has been truncated by the river. Between the second palaeochannel and the present eastern bank of the river is a raised area interpreted as a natural levée.

6.3 Although the geomorphological survey provided useful evidence for palaeochannel development, the timber structure did not appear to be contemporary with any of the surface features identified. A programme of GPR and percussion coring was therefore employed to provide information about sub-surface features and the alluvial sequence. This revealed evidence for several channels for which there is now no surface indication, including one aligned north-west to south-east which may be associated with the timbers. A core (Core 2) located adjacent to the timbers identified a very hard, probably stone layer at a depth of 4.3m. This could be bedrock or glacial material but its location, together with the possible identification of stone in the river bed close by, suggest that there may be stonework of some nature associated with the timbers.

6.4 The nature of the sediment surrounding the timbers, which consists of clay, suggests that this was deposited under conditions of low river flow. Such conditions could arise outside the main river channel, perhaps in a backwater, or may have formed within the main channel as a result of a ponding effect caused by the timbers, which may have impeded the river flow.

6.5 Organic material recovered from two cores was submitted for $^{14}$C dating, as well as a sample taken from a small tree trunk buried in sediments, but exposed along the river bank.

| Sample | Lab. No. | Measured $^{14}$C age | calibrated age (2 sigma) |
|---|---|---|---|
| Core 1 | Beta 164537 | 860 ± 40 BP | Cal AD 1160-1280 |
| Core 3 | Beta 166217 | 1080 ± 40 BP | Cal AD 910-920 and AD 960-1030 |
| tree trunk | Beta 164538 | 1010 ± 50 BP | Cal AD 960-1160 |

6.6 A further conclusion from the study was that there appears to have been a high rate of sedimentation during the medieval period, accounting for the majority of the silts which have accumulated above the timbers. This extensive sedimentation also has an implication for the proposed continuation of Offa's Dyke since it now seems likely that the land surface during the 8th century would have been considerably lower than at present, with the depth of sediments making it extremely unlikely that the Dyke, and in particular its ditch, could result in the formation of a cropmark. Further negative evidence for a continuation of the Dyke as far as the present river channel has been provided by GPR transects 2 and 3, neither of which revealed any buried features which could be interpreted as being associated with the Dyke.

## 7 CONCLUSIONS

7.1 Since the timbers were brought to the attention of CPAT in September 2001 they have prove rather enigmatic, due largely to the partial nature of their survival and exposure and also to the significant changes in river coarse over the intervening centuries. The visible timbers are assumed to be part of an extensive structure which may have been built in phases and is likely to have reused timbers from an earlier structure. A sample was taken from the main visible horizontal timber for dendrochronological dating, producing a felling date of after AD 1125, although an upright jointed to it produced a felling date of after 1087 and a second horizontal timber was felled after AD 1175.

7.2 The date could suggest some connection with the abbey of Strata Marcella, originally founded in 1170 at an unknown location thought to be near Welshpool, and relocated in 1172 at a site *c.* 1.8km downstream of the timbers, on the west bank of the River Severn (Williams 2001, 15). Monastic waterfront structures have been recorded elsewhere in Wales, such as Woolaston Grange Quay, where a mid-12th century stone and timber harbour was uncovered associated with Tintern Abbey (Williams 2001, 261). Strata Marcella is known to have had a mill on the Severn, although it has been assumed that this was further downstream in closer proximity to the abbey precinct (Williams 1990, 59-61). The visible timbers do not obvious belong to a mill although could be part of an associated sluice. The abbey lands extended along the western bank of the Severn as far as the Buttington site, and it could therefore have been within the abbey holdings depending on which side of the river it originally lay. There is, however, also a record of two mills within the parish of Buttington, Trewern and Hope in 1311, although the locations are not known (Barton 1999, 77).

7.3 Monastic establishments are also known to have developed fisheries on rivers within their estates. Although there are no known records of such relating to Strata Marcella, fish weirs have been identified further down the Severn, associated with both Shrewsbury Abbey and Haughmond Abbey. In fact, the Domesday Book of 1086 records at least eight fisheries on the Severn in Shropshire and a further six in Worcestershire (Pannett 1988). At present, however, the Buttington timbers do not appear to form part of a fishweir.

7.4 Although Buttington appears to have been an historic crossing point of the Severn and is situated on a spur of higher ground where the river valley narrows, the nature of the carpentry and construction would appear to preclude the possibility that the timbers are part of a trestle bridge. Indeed, it has proved difficult to find any parallels from comparisons with other medieval waterfront structures such as mills and fishweirs. At present it would seem that the closest parallel is with a form of revetment known as a 'shoot', examples of which have been recovered during excavations at Hemington (Cooper forthcoming). It may therefore be the case that the Buttington timbers were part of a structure designed to prevent erosion of the river bank, although this then poses the question of why this was necessary and what structures may have been situated along the river bank which required protection.

7.5 The geomorphological survey have clearly demonstrated the complex and dynamic nature of river channel development. The survey has identified a buried channel which could be contemporary with the timbers, although this is unproven. It is possible that during the 12th century the river may have had more than one active channel at this point. Towards the end of the 13th century there appears to have been a major transformation in the river landscape, after which up to 3m of silts and clays were deposited across the valley floor, burying the timber structure.

7.6 The river is actively eroding the area surrounding the timbers and it would seem inevitable that further timbers will be revealed with each successive episode of erosion. The site will continue to be monitored for further developments.

## 8 ACKNOWLEDGEMENTS

8.1 CPAT would like to thank the following for their assistance and co-operation: Regional Sites and Monuments Record, CPAT, Welshpool; Brian Williams and Wendy Owen, CPAT, for assisting with the survey; John and Ginny Graham for their assistance and co-operation; Powis Estates for allowing access to undertake fieldwork; Michael Worthington and Dan Miles, Oxford Dendrochronology Laboratory for preliminary tree-ring dating; Nigel Nayling, St David's College, University of Wales, Lampeter for analysis of the worked timber; Mark Macklin and Paul Brewer, fluvio, Institute of Geography and Earth Sciences, University of Wales, Aberystwyth, for analysing the local geomorphology.

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Plate 1 Aerial view of River Severn, Buttington. Photo CPAT 01-c-126

Plate 2 Main horizontal timber (butt 1). Photo CPAT cs02/28/33

Plate 3 Detail of joints in main horizontal timber (butt 1). Photo CPAT cs01/34/07

Plate 4 General view of timbers. Photo CPAT cs02/34/04

## APPENDIX 1

## PRELIMINARY TREE-RING DATING OF WATERFRONT TIMBERS FROM BUTTINGTON, WELSHPOOL, MONTGOMERYSHIRE, WALES

**M J Worthington and D W H Miles**

### Description of structures and preliminary phasing

During the floods of early 2001, a timber structure was exposed in the bank of the river Severn at Buttington. The remains were investigated by Chris Martin of the Clwyd-Powys Archaeological Trust and commissioned a limited assessment and dating of a few timbers from the structure. It was hoped that a date might help determine the archaeological significance of the find, and whether further investigation was desirable or practicable.

An initial draft phasing of the structure suggested that there was more than one phase of construction, and with as many as three possible different phases. The first phase is a large 18 inch by 22 inch horizontal beam (*butt 1*) that is visible in the bank side for about 12 fed with a row of timber stakes running through it. A second timber underneath this could be contemporary.

What might relate to a secondary phase or repair consists of a double row of timber stakes running at an angle to the main timber beam (*butt 1*). To allow the end stake (*butt 4*) to be placed a slat had been cut into the side of the main beam suggesting that it was positioned when the beam was already in its present location.

To the left about 30 feet of the main timber structure there was just visible in the river bank the end of another horizontal timber (*butt 2*). There was no visible physical relationship with main sections of the timber structure and this short beam, and it may constitute a third phase of construction.

### Methodology

Four timbers were sampled from the structure, and are detailed in Table 1. Sample butt1 was from the main timber beam in the first structure, and *butt3* and *butt4* were from the staves fixed to this beam. From the second structure, *butt2* was taken from the smaller beam. These samples were taken purely on the grounds of accessibility as a visual dendrochronological assessment failed to determine the timbers suitability for dating, primarily due to the timbers being covered in mud and highly decayed on the outer surfaces. However, it was possible to identify all of the timbers sampled as being of oak
(Quercus spp.).

The samples were taken using a 6mm hollow increment auger or by sectioning. The samples were mounted on timber batons and sanded on a finisher using 60 to 1000 grit abrasive paper. These were then measured to an accuracy of 0.01 mm using a travelling stage attached to a microcomputer based measuring system (Reynolds pers comm. 1998).

The samples were compared with each other using dendrochronological techniques as outlined in English Heritage (1998). This involved both visual comparisons using semi-logarithmic graphs as well as statistical cross-correlations using a computer. This utilised cross-correlation algorithms (Baillie and Pilcher 1973) which have been implemented using computer software written for Windows in Visual Basic by MR Allright and PA Parker. In comparing two individual samples, a t-value of 3.5 or higher is usually indicative of a good match, whilst t-values of 10 and above often suggest that samples have originated from the same parent tree. All individual samples showing a match with consistently high correlation during cross-matching are averaged together to form a mean site master. On comparing this site master with dated reference chronologies, t-values of 5 and above are normally expected. A conclusive match should also exhibit the highest matches with reference chronologies of local origin as well as with well-replicated regional chronologies. Matching positions suggested by computer are confirmed by satisfactory visual matching.

Once a ring sequence has been dated chronologically, the date of felling needs to be interpreted. If the outer most rings are missing but the heartwood-sapwood boundary survives, then the number of missing sapwood rings can be estimated using an empirically derived sapwood estimate. The sapwood estimate used in this report is 11 to 41 rings, the 95% confidence range calculated by Miles (1997a) for Shropshire and the Welsh borders. Samples only having heartwood but without any indication of heartwood/sapwood transition are given a terminus post quem or felled after date which is calculated by adding a minimum of 11 years to the last ring present on the sample. As none of the samples taken from the site retained any evidence of sapwood, only a *terminus post quem* could be given.

It should be remembered that dendrochronology can only date when the tree died, not the date of construction for a building or artefact. The interpretation of a felling date relies on having a good number of precise felling dates rather than just one or two. Nevertheless, it was common practice to build timber-framed structures with green or unseasoned timber and construction usually took place within twelve months of felling (Miles 1997a).

**Interpretation of the dates**

Three timbers were dated, but as none retained any evidence of sapwood or heartwood/sapwood transition, only termini post quem could be offered for each. The main base timber (*butt1*) had a last measured ring date of AD 1114, giving a *terminus post quem* of after AD 1125. A stake from the same structure (*butt4*) produced a last measured ring date of AD 1076, giving a *terminus post quem* of after AD 1087. The third timber was from the separate base timber nearby (*butt2*) which produced a last measured ring date of AD 1164 and giving a *terminus post quem* of after AD 1175. All three dated samples were combined to form the site master butt124 as shown in Table 2 and dated with very high t-values against a selection of regional reference chronologies as shown in Table 3.

With only one sample dating from each possible phase, and none with any evidence of sapwood or heartwood/sapwood transition, no meaningful interpretation of the dates can be given regarding phasing. Clearly the stake which produced the *terminus post quem* of after AD 1087 could not predate the beam onto which it had been introduced and which dated to after AD 1125. Thus, this main structure could not have been constructed prior to AD 1125.

The other detached timber beam (*butt2*) produced a last measured ring date of AD 1164, giving a *terminus post quem* of after AD 1175. It is possible that both structures might date to after AD 1175, but without further samples and/or some evidence of sapwood, no further conclusions can be reached.

**Limitations of this assessment**

This assessment is intended as a guide to the dating of some of the elements within the timber structure. There has not been any excavation or detailed recording therefore the precise relationships between any of the timbers can only be supposition. Any reused or replaced timbers cannot be identified clearly.

**Further recommendations**

Clearly more sampling is required to try and ascertain a felling period, or ideally a precise date, as well as to identify any sort of phasing within the structures. It is essential that more samples be taken either retain a clear heartwood/sapwood transition, or better still with sapwood complete. These may well be found on the underside of the main beams when excavated. The limited assessment carried out here has shown that the material is sensitive and suitable through tree-ring analysis, so it is important to concentrate on obtaining samples which will allow a better interpretation of the felling period. If no samples are available with any evidence of sapwood, then it is important for all available timbers to be analysed see if any common end date might become evident from which a felling period could be deduced. It is therefore essential that a dendrochronologist be on call at the time of further excavations.

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Table 1: Summary of tree-ring dating

| Sample no. and type | Timber and position spanning | Dates AD bdry | Sapwood complement | No. of rings | Mean width mm | Std Devn mm | Mean sensitivity mm | Felling dates/ranges |
|---|---|---|---|---|---|---|---|---|
| **butt1* | Long horiz. beam | 1047-1114 | none | 98 | 1.23 | 0.74 | 0.29 | felled after AD 1125 |
| **butt2* | Short horiz. beam | 1093-1164 | none | 72 | 1.37 | 0.70 | 0.22 | felled after AD 1175 |
| *butt3* | Stake | - | ? | | | | | sample unsuitable |
| *butt4a1* | *Ex situ* stake | 1010-1064 | none | 56 | 1.85 | 0.60 | 0.23 | |
| *butt4a2* | *Ex situ* stake | 1023-1076 | none | 54 | 1.58 | 0.48 | 0.20 | |
| *butt4* | Mean of 4a1 and 4a2 | 1010-1076 | none | 67 | 1.73 | 0.61 | 0.22 | felled after AD 1087 |
| ***BUTT124*** | **Site Master** | **1010-1164** | | **155** | **1.51** | **0.70** | **0.23** | |

Table 2: Matrix of *t* -values and overlaps for components of BUTT124

| Vs | butt2 | butt4 |
|---|---|---|
| | 1093-1164 | 1010-1076 |
| | | |
| butt1 | 7.42 | 5.02 |
| 1047-1114 | 52 | 30 |
| | | |
| | butt2 | no test |
| | 1093-1164 | |

Table 3: Dating of BUTT124 (AD 1010-1164) against reference chronologies at AD 1164

| Reference chronology | Spanning | Overlap | t-value |
|---|---|---|---|
| SALOP95 (Miles 1995) | 881-1745 | 112 | 5.78 |
| ENGLAND (Baillie and Pilcher 1982) | 404-1981 | 219 | 8.93 |
| NORTH (Hillam and Groves 1994) | 440-1742 | 155 | 8.68 |
| BRISTOL (Hillam 1994) | 770-1320 | 155 | 8.70 |
| WALES97 (Miles 1997b) | 404-1981 | 155 | 8.98 |

Chronologies shown are composite chronologies

## APPENDIX 2

## A GEOMORPHOLOGICAL INVESTIGATION OF THE HISTORICAL AND HOLOCENE DEVELOPMENT OF THE RIVER SEVERN VALLEY FLOOR AT BUTTINGTON, POWYS

**Fluvio report No. 2002/3/9**

**Contents**

## 1 Introduction

Following major floods in the upper Severn valley during the winter of 2000-2001, a large timber structure was exposed at the base of the east bank of the River Severn at Buttington (Figure 1). This structure (only visible at low river flows) is buried by *c.* 3 m of fine-grained river alluvium and preliminary tree-ring dating of the timbers indicate that it dates to the 12th century, with evidence for at least 2 phases of construction sometime after AD 1125 and AD 1175 (Worthington and Miles, 2001). The purpose of this structure is currently being evaluated by the Clwyd-Powys Archaeological Trust but the present view is that it is a waterfront feature, possibly the footings for a bridge, mill, or wharf.

One of the keys to resolving the exact function of this structure is knowing where the River Severn channel was located in the 12th century, and documenting river movement, erosion and sedimentation both before and after its construction. In light of this, the Clwyd-Powys Archaeological Trust commissioned fluvio to undertake an investigation of the historical and Holocene history of the River Severn channel and floodplain at Buttington.

Buttington is also important because Offa's Dyke crosses the River Severn valley floor *c.* 400 m from All Saints Church (Figure 1). However, it can only be traced to a point *c.*150 m east of the present River Severn channel. The relationship between the positioning of Offa's Dyke and the location of the River Severn in the eighth century has never been established in this area and we anticipated that our investigation could provide information on this important topic.

## 2 Methodology

The River Severn floodplain investigated at Buttington extends between 300-500m south from the Welshpool to Shrewsbury railway line and the A458 road, and is bounded along its eastern margin by a prominent Late Pleistocene terrace on which the All Saints Church is located.

To establish the historical and Holocene alluvial history of this reach a wide range of geomorphological and geophysical techniques were employed. First, a high resolution (sub cm), and highly detailed (726 survey points), topographic survey was undertaken using Total Station and Electronic Distance Measurement techniques. This was used to enhance a walk-over-survey of the reach, from which an interpretative geomorphological map was produced.

Second, river channel movement since the end of the nineteenth century was documented using digitised overlays of serial large scale OS maps and aerial photographs.

Third, once the major geomorphic units had been identified, a series of ground penetrating radar (GPR) transects (7 in total, covering 740m) were carried out to establish subsurface alluvial sedimentary structures and sequences, as well as to try and identify any buried archaeological features, particularly adjacent to the 12th century timber structure.

Finally, four sediment cores were collected using a percussion corer to provide 'ground truth' for the GPR survey, and to attempt to collect organic material for $^{14}C$ dating. Wood and plant remains were recovered from 2 of the cores (cores 1 and 3) and were sent to Beta Analytic, Florida, USA for AMS dating. In addition, a seemingly unworked small tree trunk from clays immediately beneath the timber structure was also sent for conventional $^{14}C$ dating. All sediment samples collected from the four cores have been archived in Aberystwyth should, in the future, chemical and physical analyses be required.

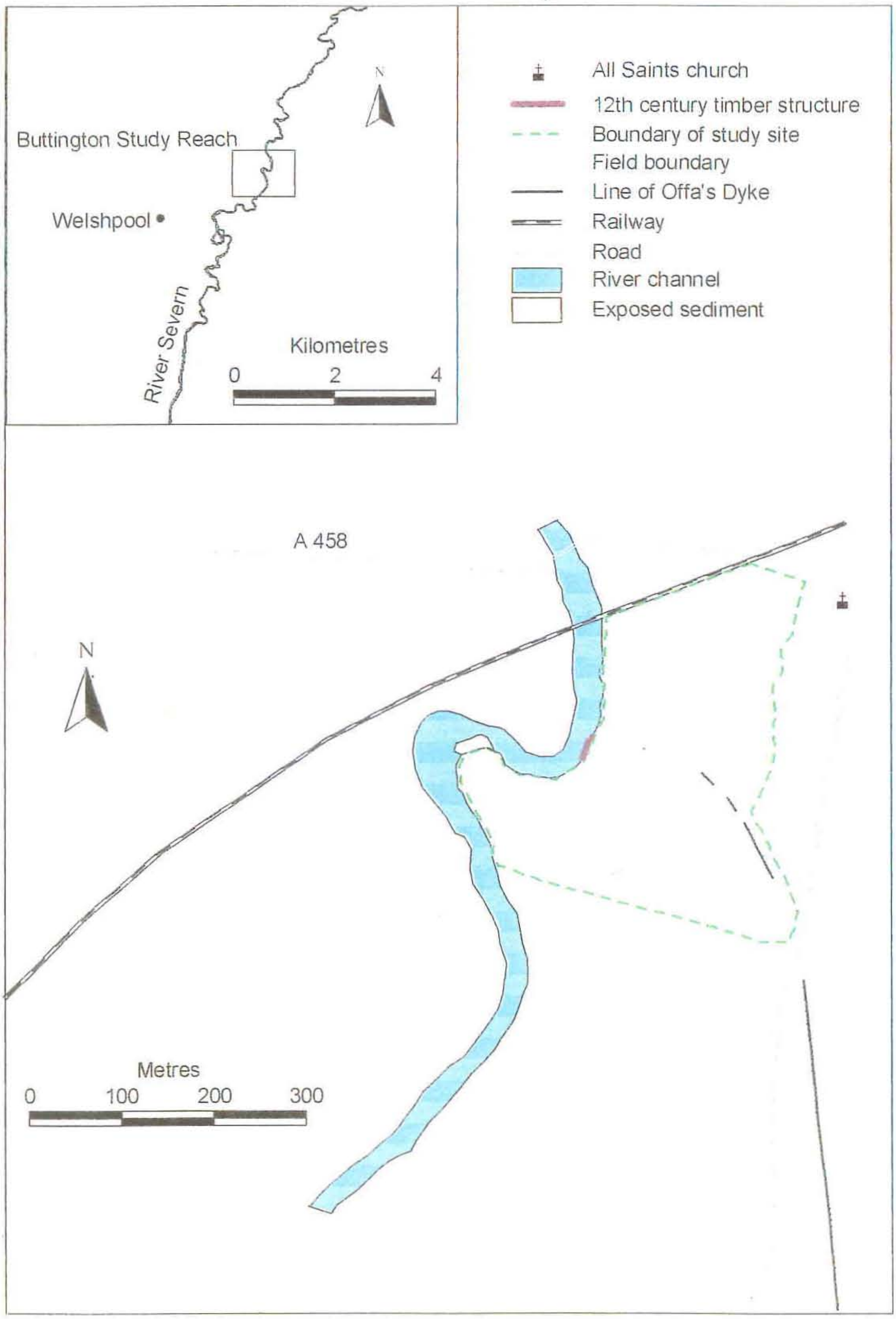


Figure 1: Buttington study reach showing location of 12$^{th}$ century timber structure and Offa's Dyke.

## 3 Alluvial geomorphology of the Buttington reach

Figure 2 shows a topographic map of the study reach with contours plotted at 0.25m intervals. The Holocene alluvial valley floor is of low relief (<2m) but can be separated into a relatively high area extending 50–200m east of the present right bank of the River Severn, adjacent to which is a 100–200m wide depression that runs approximately north-south but at the northern end of Offa's Dyke (in the central part of the study reach) splits into two branches. The eastern edge of the depression is bounded by the Late Pleistocene terrace in the northern part of the reach, and in the central and southern section by a lower lying Holocene river terrace.

Figure 3 is an interpretative geomorphological map of the Buttington reach produced from the walk-over survey. On the basis of small differences in elevation, shown on cross sections 2 and 3 (Figure 4), palaeochannel A appears to pre-date, and have been cut off from the active river channel before palaeochannel B. This geomorphological interpretation is also supported by the fact that Offa's Dyke runs across the southern end of palaeochannel A but stops at, and appears to respect, the eastern edge of palaeochannel B. In the unlikely event that Offa's Dyke was built across an active river channel, palaeochannel A was probably abandoned sometime before the 8$^{th}$ century.

Palaeochannel B trends in a more northerly direction and is accommodated by the Welshpool-Shrewsbury railway line by a second smaller bridge crossing. It is not known when palaeochannel B was an active river channel but it must have been before AD 1890 as a map of that date shows the River Severn in its present position at the northern end of the study reach (Figure 5). Indeed, the major channel change evident from serial map and aerial photographic analysis is the south-westerly movement, and tightening up, of the meander loop immediately upstream of the railway bridge. One important consequence of which has been higher erosion rates on the right hand bank of the River Severn since AD 1948 and the recent exposure of the medieval timber structure.

The 50-200m wide upstanding area next to the River Severn is broadly convex in cross profile (Figure 4), with ground levels highest close to the channel bank, and progressively decreasing in elevation towards palaeochannel B. This alluvial landform is interpreted as a natural levée, the development of which has been partly promoted by the relatively slow rates of channel movement but also by the construction of the Welshpool – Shrewsbury railway bridge and embankment, which has slowed down and ponded the movement of floodwaters downstream. This has resulted in accelerated floodplain sedimentation, particularly immediately upstream of the crossing point (Figure 2).

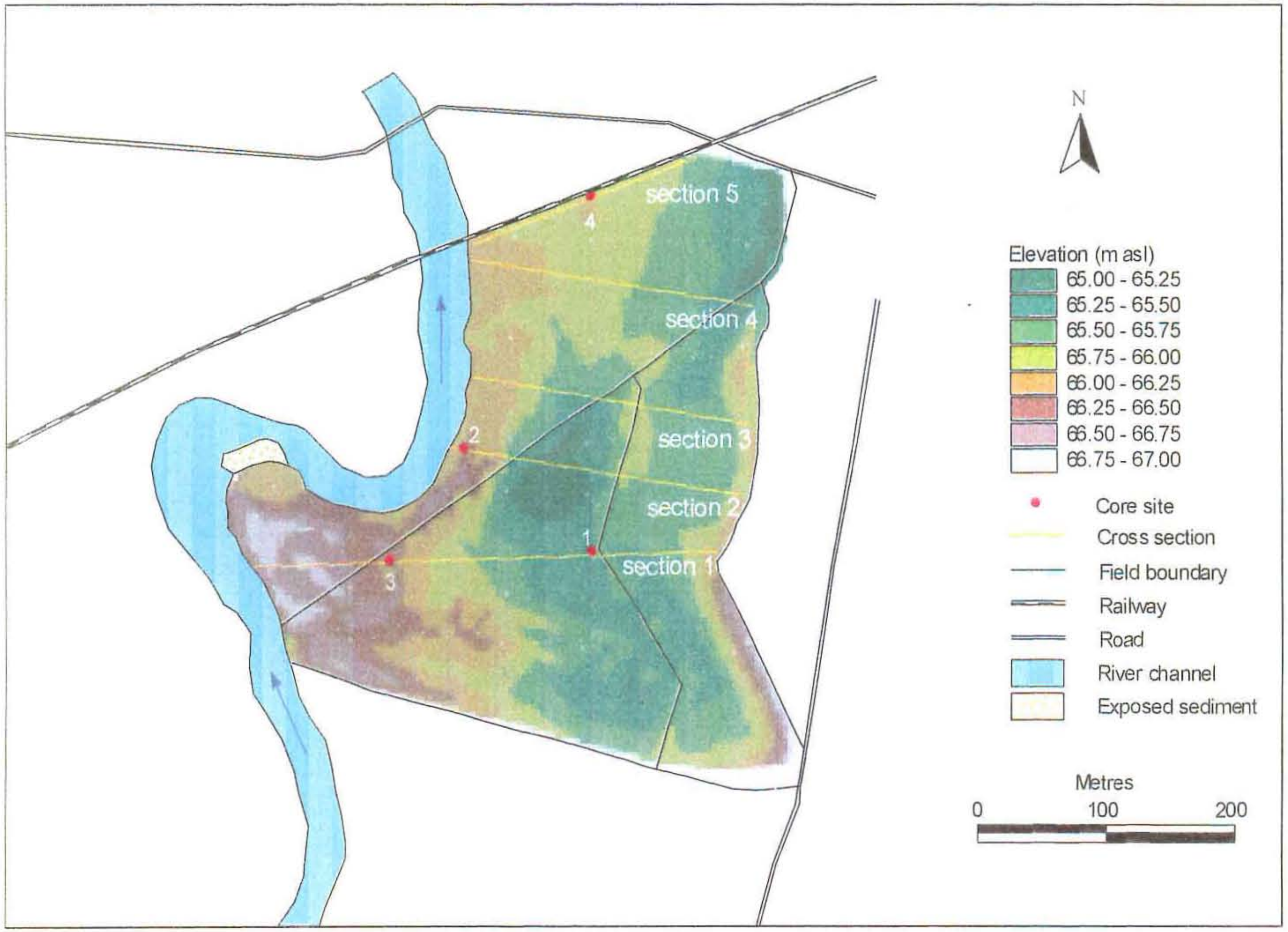


Figure 2: Topographic map of Buttington study reach showing locations of core sites and surveyed cross sections.

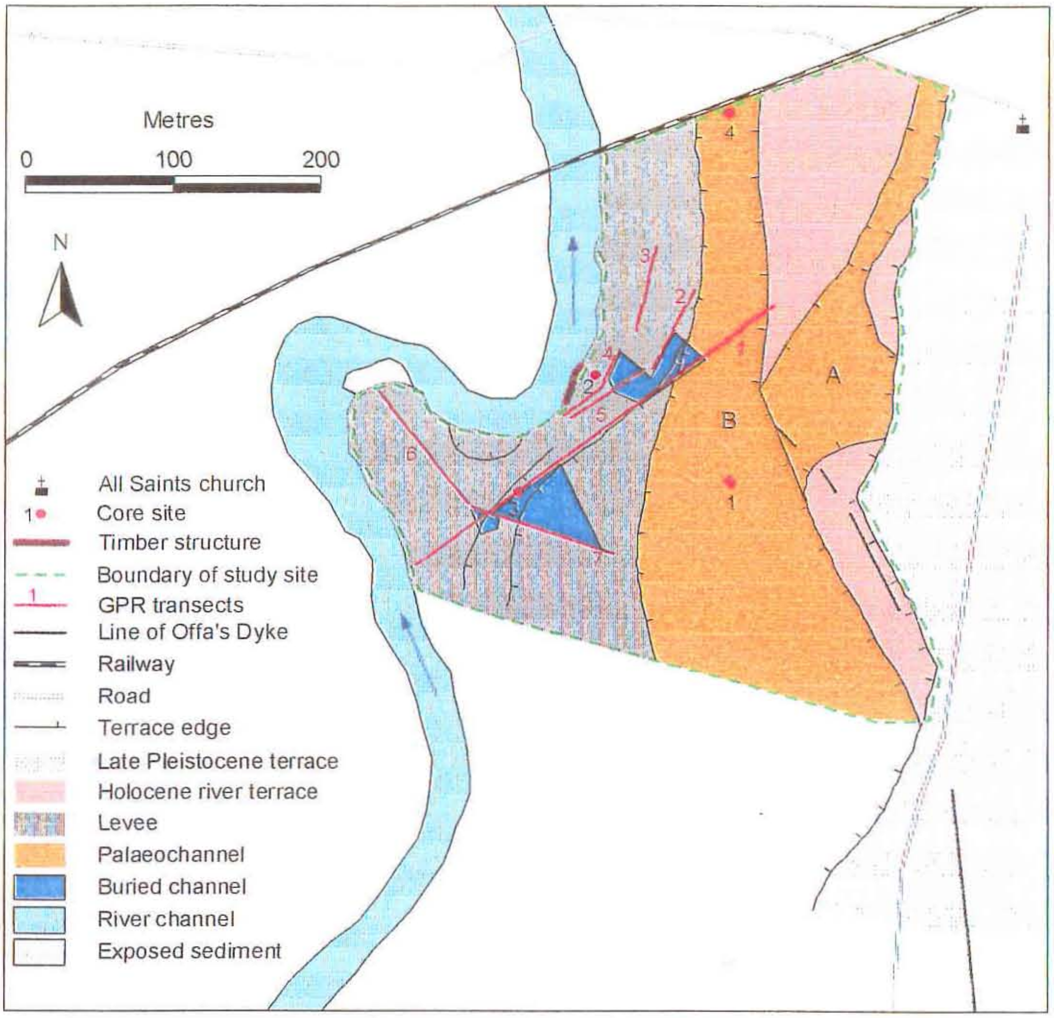


Figure 3: Geomorphological map of the Buttington study reach.

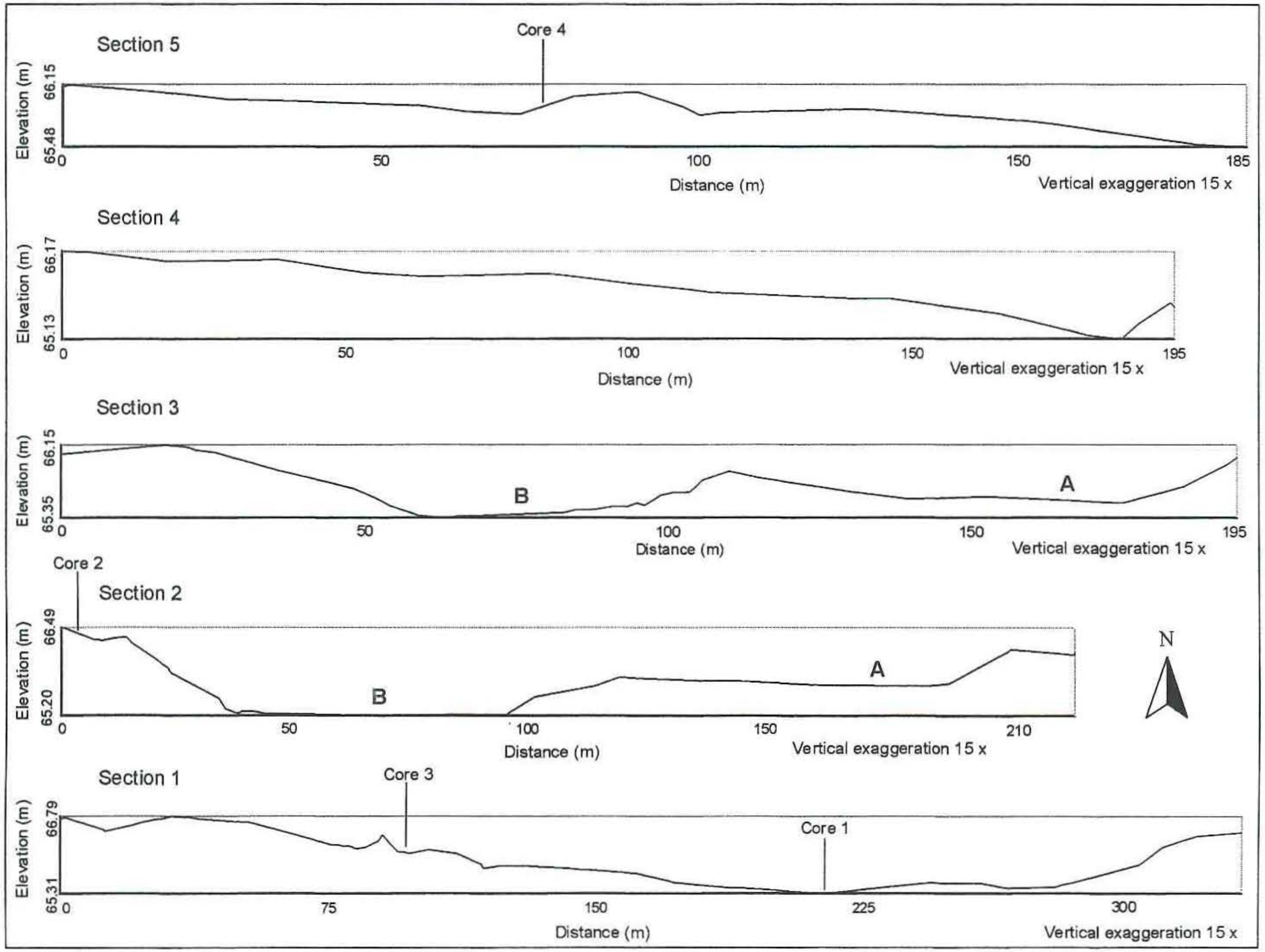


Figure 4: Topographic cross sections of the Buttington Holocene alluvial valley floor.

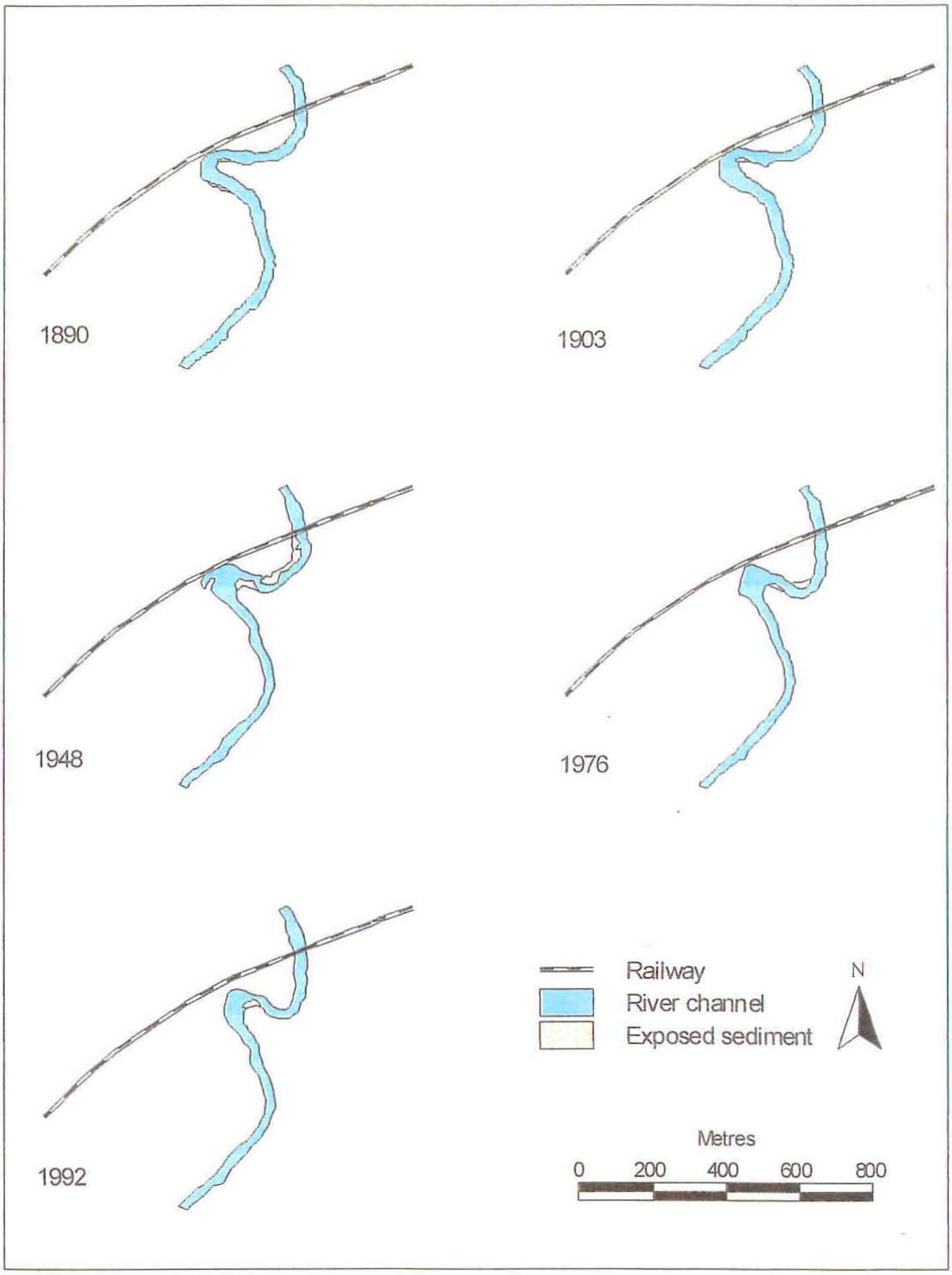


Figure 5: River channel change at the Buttington study reach 1890-1992.

## 4 Subsurface alluvial features and sequences

Although the geomorphological survey of the Holocene valley floor at Buttington proved to be very useful in providing a relative chronology of palaeochannel development (especially with respect to Offa's Dyke), the buried medieval timber structure does not appear to relate to any of the surface palaeochannels. GPR surveys and percussion coring of the Holocene alluvial sequences were undertaken around the archaeological site to address this problem, and were found to be invaluable for understanding both the vertical and lateral sequencing of alluvial units within the study reach.

The first, and longest GPR transect was run in a south-west to north-east direction across the levée and palaeochannel B, approximately 50 m east of the timber structure (Figure 3). This revealed (Figure 6) 3 major channel-like features, which through the cross cutting of their relatively steep sided channel margins, can be placed in a stratigraphic sequence. Towards the south-west end of GPR line 1, centred at c. 210 m, is a triangular shaped channel which has a maximum width of between 60-100 m. It appears to have been infilled in 2 phases, with an earlier small box-shaped channel (channel 1), followed by a much larger channel fill (channel 3) with very well developed large-scale inclined stratification, which most probably represents within-channel lateral accretion. Neither of these channels, however, have any surface expression and have both been masked by the more recent phase of levée sedimentation.

The north-eastern end of GPR line 1 runs across palaeochannel B (channel 2, Figure 6), and it is clear that the western edge of the channel has been partially buried, and narrowed, by levée sediments that were also responsible for infilling channel 3.

Although alluvial sediments that entomb the timber structure are not presently well exposed in the river bank section, at low flow there is a suggestion that the timbers are set within a channel-like feature. Two GPR transects (lines 4 and 5) were run *c.* 15 and 25 m respectively, south-east from the river bank in an attempt to try and pick up this channel. What both GPR surveys show very clearly (Figure 7) is a buried channel running in a north-west to south-east direction. If, as it seems likely, the medieval structure is associated with this channel, the large timber beams run across this feature and are aligned at right angles to the direction of flow.

To validate the sub-surface stratigraphy identified by the GPR surveys, and to establish the nature of the alluvial fill in palaeochannel B, four percussion cores were collected (for locations see Figure 3). Cores 2 and 3 (Figure 8) confirmed the results of the GPR survey, with coarse (sand and gravel) channel bed and bar material overlain by between *c.* 3-4m of finer grained (silty clays and clayey silts) sediments, initially deposited within channel cut-offs and later as overbank material on the levée. Organic material was recovered from core 3 at a depth of 3.75m and $^{14}$C dated. One very interesting discovery in core 2 was that at 4.30m below ground level a very hard, probably stone layer was found, which the percussion corer was not able to penetrate. This could be bedrock, or glacial material, but lying less than 10m from the exposed timbers it may form part of the medieval structure. This interpretation could be easily tested by further coring, in conjunction with excavation back into the eroding river bank.

Alluvial sediments in palaeochannel B, particularly below 2-2.5m, were generally finer (clays, as opposed to clayey silts) than those in cores 2 and 3. Although coarser channel bed and bar sediments were recovered from core 4, if such material is present at core 1 it must lie 5m below present day ground level. Organic material was also recovered from core 1 at a depth of *c.* 2.75m and $^{14}$C dated. One consistent feature evident in all of the cores was a coarsening upwards (clays replaced by silts) within the upper fine-grained unit. This was most prominent in the cores closer to the present channel of the River Severn (cores 2, 3 and 4) and reflects more recent levée development.

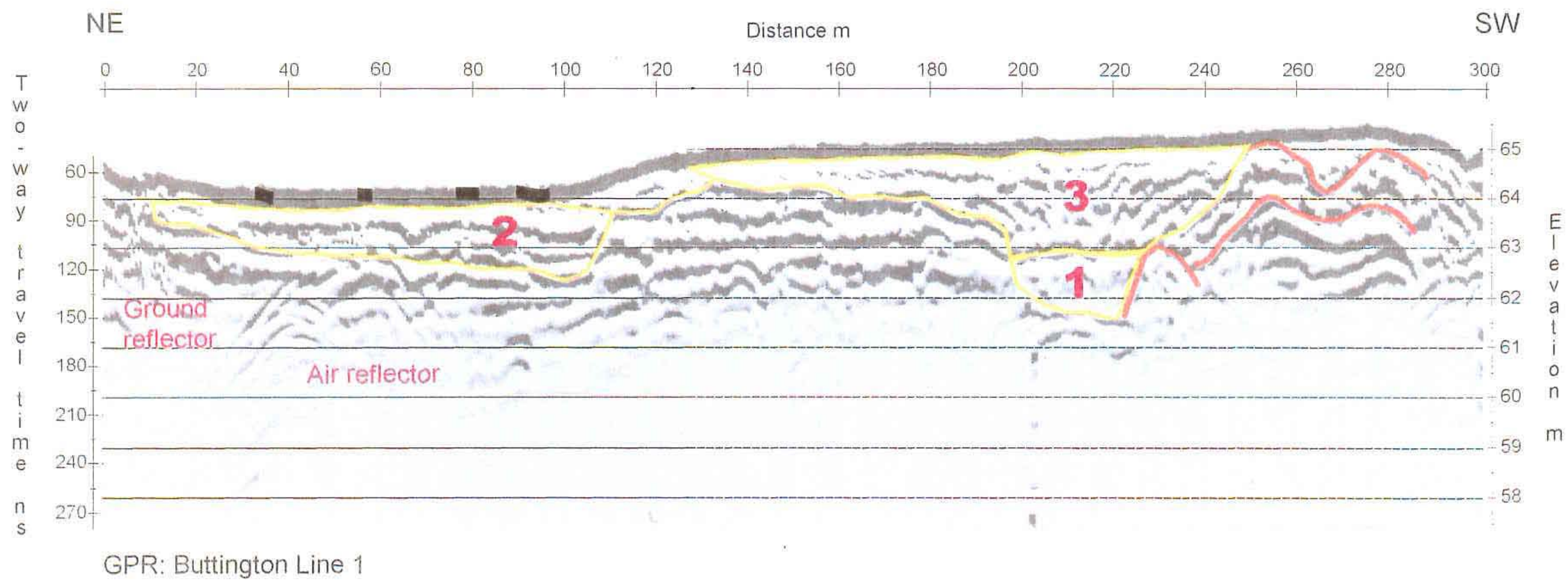


Figure 6: GPR survey Buttington line 1.

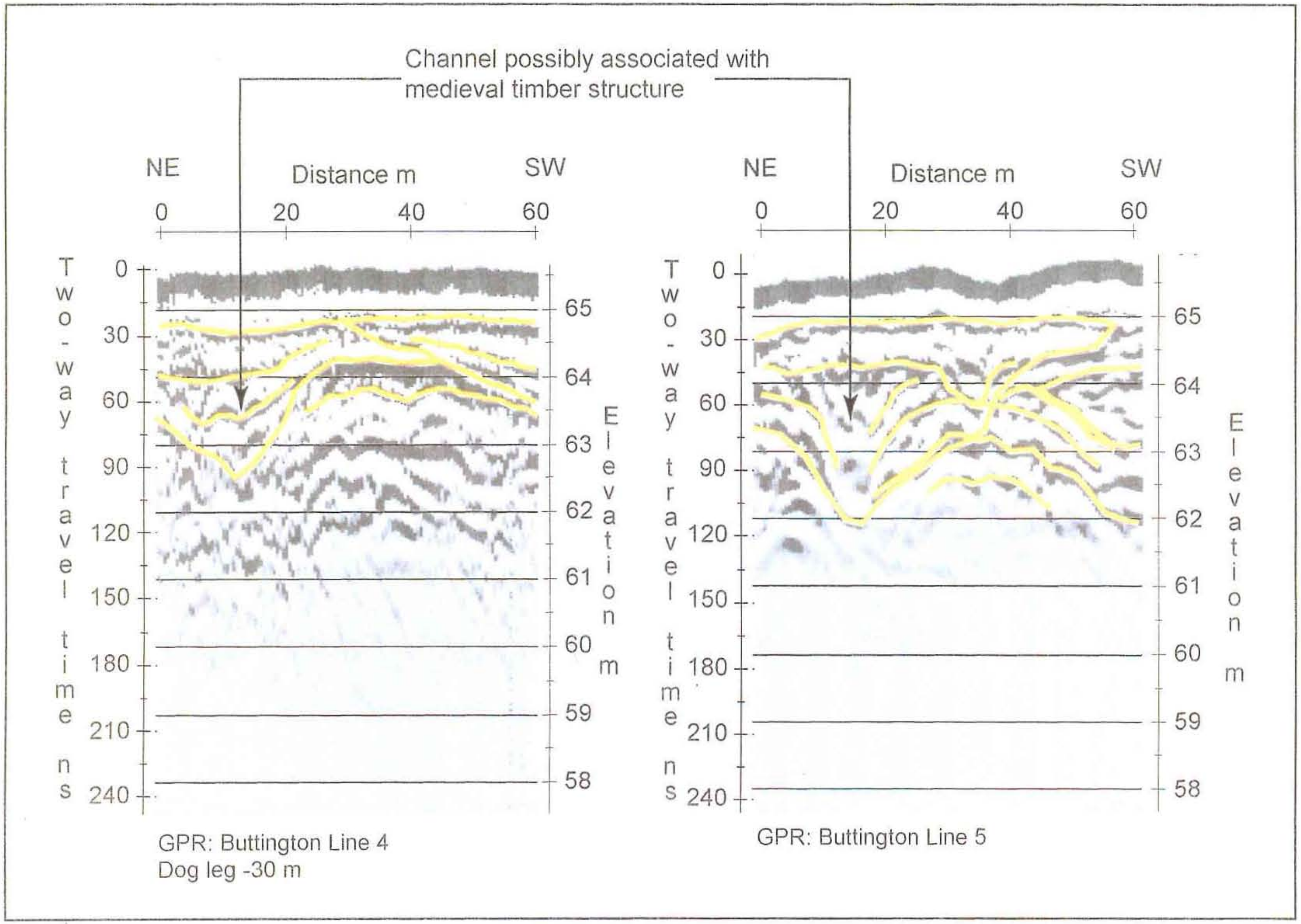


Figure 7: GPR survey Buttington lines 4 and 5.

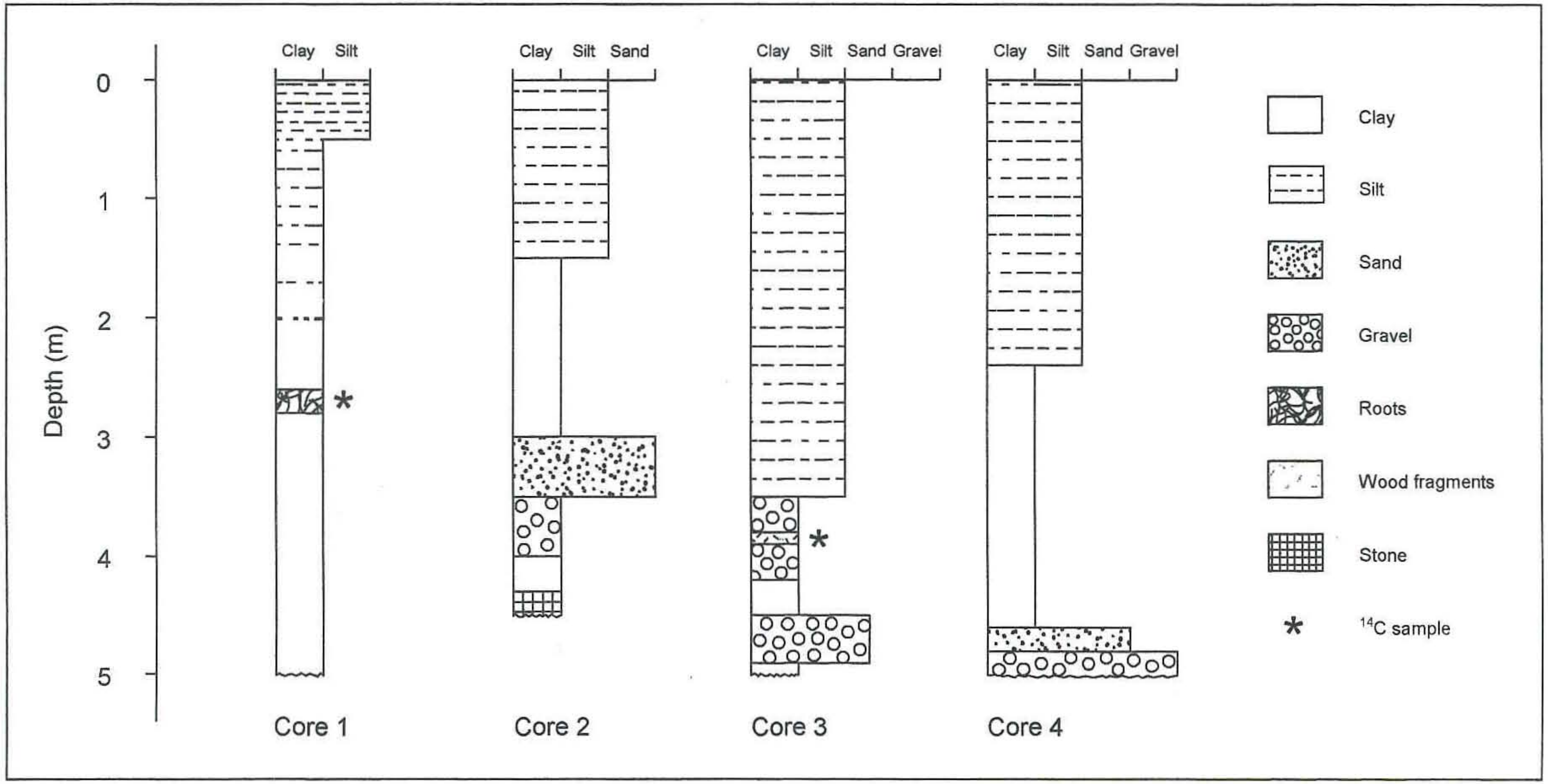


Figure 8: Sedimentary logs of cores collected at the Buttington reach.

## 5 Radiocarbon dating of Holocene alluvial units at Buttington and a provisional chronology of river development since the 10th century

At the time of writing the report only two of the three $^{14}C$ dates are available and these are summarised in Table 1. Using the full 2 sigma calibration, both of these dates overlap with those from the timber structure. However, the Buttington river bank sample, both in terms of its stratigraphic position and its earlier age range, is likely to predate the medieval structure. While the Buttington core 1 sample may post date the waterfront feature.

Table 1: Radiocarbon dates of alluvial units at Buttington.

| Sample | Laboratory Number | Measured $^{14}C$ age | Calibrated age (2 sigma calibration) |
|---|---|---|---|
| Buttington core 1 2.75 m | Beta 164537 | 860+/-40 BP | Cal AD 1160-1280 |
| Buttington core 3 4.20 - 4.30m | Beta 164538 | 1080 $\pm$ 40 BP | Cal AD 910-920 and AD 960-1030 |
| Buttington river bank, 3.31 m | Beta 164538 | 1010+/-50 BP | Cal AD 960-1160 |

The date on the small tree trunk collected from beneath the timber structure, suggests that the buried channel immediately east of (and probably associated with) the waterfront feature was active in the middle of the 10th century. The radiocarbon date from core 1 indicates that palaeochannel B was not a part of the main river channel at the time the waterfront structure was constructed, and that it must have been cut off some considerable time before the 12th century.

What is very striking, however, is the significant thickness (*c.* 3 m) of fine-grained alluvium that has been deposited at Buttington since the end of the 13th century. These have effectively buried a 12th century and earlier river landscape, of which the recently discovered medieval timber structure may be just a small part. The particularly high rates of alluvial sedimentation would also have had a significant impact on the use of the upper Severn for transport and fisheries. Indeed, a number of authors (e.g. Jones 2000; Langdon 2000) have commented on the significant reduction in the extent of river navigation between the late 13th and 15th centuries which, in the light of these new dates from the upper Severn, may be partly attributed to accelerated sedimentation.

## 6 Conclusions and further recommendations

Geomorphological and geophysical investigations of alluvial sediments at Buttington in the upper Severn valley, in conjunction with $^{14}C$ and archaeological dating, have demonstrated a highly complex and dynamic history of Holocene and historical river development. GPR survey, validated using percussion coring, has revealed a series of buried channels, one of which appears to relate to the 12th century timber structure recently exposed on the east bank of the River Severn. There is evidence of a major transformation in the river landscape towards the end of the thirteenth century with deposition of up to 3m of silts and clays across the valley floor. These sediments infilled and subsequently buried earlier channels and, adjacent to the present River Severn, resulted in the formation of a prominent levée. It is likely that the River Severn up until the end of the 12th century may have had more than one active channel in the Buttington reach but accelerated sedimentation after this period rationalised the river into a single channel. More recent levée development has 'fixed' the channel into its present position by restricting lateral migration.

The alluvial archaeology of non-tidal river valleys in Wales has been considerably under-researched in comparison to other parts of the UK. The results of this pilot study at Buttington, however, clearly demonstrate the enormous potential for recovering archaeological and environmental data of the highest quality in Welsh river systems. In the light of the success of this project we strongly recommend that a more detailed geophysical and coring survey is undertaken of the floodplain at Buttington. In conjunction with this, we also recommend that a geomorphological reconnaissance survey is undertaken of the upper Severn valley between Buttington and Llandrinio, where we expect buried early historic, and perhaps prehistoric landscapes are also preserved.

## References


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