RPS Planning, Transport and Environment

INDEX DATA	RPS INFORMATION
Scheme Title Gwent Approaches to the Second Severn Crossing	Details Archaeological Investigations in 1992
Road Number	Date May 1994
Contractor Birmingham University Field Archaeology Unit	
County Glamorgan	
OS Reference ST 48	
Single sided ✓ Double sided A3 O Colour O	

Birmingham University Field Archaeology Unit

Report No. 302

May 1994

Archaeological Investigations in 1992 on the Gwent Approaches to the S cond Severn Crossing

Edited by I.M. Ferris
with contributions by J.R.L.Allen, M.Bell,
L.Bevan, A.E.Caseldine, J.Crowther, B.Dickinson,
L.Dingwall, J.Evans, S.Limbrey, J.James,
S.Johnson, D.Smith, and M.J.C.Walker.

For further information please contact:
Simon Buteux (Manager), Peter Leach or Iain Ferris (Assistant Directors)
Birmingham University Field Archaeology Unit
The University of Birmingham
Edgbaston
Birmingham B15 2TT
Tel: 021 414 5513
Fax: 021 414 5516

Archaeological Investigations in 1992 on the Gwent Approaches to the Second Severn Crossing

CONTENTS

Archaeological Investigations in 1992 on the Gwent Approaches to the Second Severn Crossing

Edited by I.M. Ferris, with contributions by J.R.L.Allen, M.Bell, L.Bevan, A.E.Caseldine, J.Crowther, B.Dickinson, L.Dingwall, J.Evans, S.Limbrey, J.James, S.Johnson, D.Smith, and M.J.C.Walker

Introduction

This report summarises the results of a field project carried out by Birmingham University Field Archaeology Unit at three locations along the Gwent Approaches to the Second Severn Crossing in July and August 1992, following on from the evaluation of the route by the Glamorgan Gwent Archaeological Trust. The work, sponsored by the Welsh Office, was directed by Iain Ferris and Lucie Dingwall with the accompanying environmental fieldwork and study being undertaken by specialists from the Palaeoenvironmental Research Centre, University of Wales, Lampeter and the University of Birmingham under the co-ordination of Dr. Martin Bell and with consultancy by Professor John Allen of Reading University.

In this report the findings from the three sites will first be discussed chronologically, with the environmental data then being presented as a series of individual specialist reports. Finally, conclusions will be drawn about the overall results of the project.

THE SITES (Figure 1)

Prehistoric Activity at Stoop Hill and Vurlong Reen

by L. Dingwall

Introduction

The following evidence for prehistoric activity in the Caldicot Level resulted from archaeological investigations on the Gwent approaches to the Second Severn Crossing, for which the main construction works commenced at Easter 1993. Access to the new bridge will be via a new road leaving the M4 east of the Magor junction and crossing the Caldicot Level. A programme of assessment along the route of the new road and a more limited survey in the intertidal zone to be affected by the bridgeworks was undertaken by GGAT in 1990 - 1991 (Parkhouse and Lawler 1990), followed by more detailed investigations at three locations along the route by BUFAU in 1992, two of which produced evidence of prehistoric human activity (Dingwall and Ferris 1993). Accompanying environmental fieldwork and survey was undertaken by specialists from St Davids University College, Lampeter and the University of Birmingham, with consultancy by Professor John Allen of Reading University.

Background

The Severn Levels comprise areas of low-lying, partially reclaimed coastal wetland bordering the shores of the Severn Estuary, fringing a densely settled area of lowland South Wales and south west England. The Caldicot Level, extending to the confluence of the River Wye at the Severn Bridge, is separated from the Wentlooge Level to the west by the River Usk, which debouches at Newport.

The Severn Estuary experiences a vast tidal range and is swept by powerful currents, a factor leading to the provision of extensive sea defences, thus dividing the levels into an inner surface with continuing sediment deposition, and an outer surface which no longer receives tidal sediment (Allen and Rae 1988). It is thought that the first extensive wetland reclamations occurred in the Roman period (Allen and Fulford 1986)

The solid geology (mainly mercia mudstone with some sandstone and limestone) is for the most part deeply buried by gravels and estuarine deposits and the contact point of the levels with the solid geology inland is demarcated by boundary slopes which have been tentatively identified as a former cliff line (Allen and Fulford 1986). The estuarine sediments are post-glacial in origin and consist mainly of a series of clays and peats formed by the processes of accretion and erosion within the estuary. The peats represent temporary halts in an overall trend of gradual sea-level rise, which has apparently been an ongoing post-glacial process (Allen and Rae 1988). Gravel is exposed in the intertidal zone off Sudbrook Point.

The route of the new road crosses solid geology in two locations; the area between the M4 and the Cardiff-London railway line (ST 4405 8795 to ST 4495 8748) and the small promontory projecting into the estuary at Stoop Hill, south of Caldicot (ST 4802 8722 to ST 4833 8728).

The sedimentary processes and history of the estuary have greatly influenced the archaeology of the Caldicot Level, both in terms of the potential level of preservation of any archaeology present and the visibilty and ease of detection of archaeological sites on the different landscape types. On the areas of solid geology, archaeological remains tend to have a relatively high visibility and sites are more conducive to the use of conventional fieldwork techniques. The depositional processes in the reclaimed wetlands have rendered all but the latest periods of archaeological activity invisible, a fact which is reflected in the distribution of sites in the Gwent Sites and Monuments Record. However, the potential for good preservation of deeply buried archaeological and palaeoenvironmental deposits representing earlier human activity is high. Erosion of sediments in the intertidal zone has led to the exposure of archaeological deposits which can be detected by surface examination when tides and weather permit. Many Late Bronze Age and Iron Age sites have been exposed in the Upper Estuary through tidal erosion. However, once exposed the same erosional process then poses a threat to the survival of the archaeology.

The archaeological potential of the Caldicot Level is considered to be high, not only in terms of potential survival of archaeological evidence but also in terms of the nature of past human activity carried out on the different types of landscape. Both of the sites discussed in detail below are located at the interface of the solid geology and the reclaimed wetlands, a type of habitat thought to be conducive to prehistoric human settlement, since the interface of different landscapes represents the zone of greatest diversity of exploitable resources.

Previous discoveries in the Caldicot Level

The Caldicot Level has revealed traces of activity from the lower Palaeolithic onwards, including many stray finds from the intertidal zone of the Gwent foreshore. Palaeolithic material has been recovered off Sudbrook Point (Green 1989, Godbold and Turner 1992) and auroch skeletons of mesolithic and Mesolithic/Neolithic date have been discovered off Uskmouth and Sudbrook point (Trett and Parry 1986, Trett 1987, Godbold and Turner 1992), indicating grazing herds on or near the levels at these periods. Mesolithic human and animal prints are recorded on the foreshore at Magor and Uskmouth (Green and Whittle 1990) and Neolithic and Bronze Age finds have been recovered from Portland Grounds south of Magor (Green 1989).

Discovcrics further afield include Palaeolithic material from the foot of Sedbury cliffs near the Severn Bridge and auroch remains and Bronze Age material from the intertidal zone of the Wentlooge Level at Rumney Great Wharf (Green 1989, Trett and Hudson 1991).

The Neolithic and the early Bronze Age are poorly represented in the wetlands, but dryland burial sites attest settlement nearby in these periods (Savory 1980). Various Bronze Age and undated prehistoric findspots are recorded from the dryland zone to the north of the new road , as well as a prehistoric flint scatter (Gwent SMR).

A Mesolithic site was recorded at Goldcliff (Parkhouse 1990) whilst Bronze Age occupation sites have been excavated at Chapel Tump and Cold Harbour Pill on the foreshore near Magor (Whittle 1989). Further inland, excavations at Caldicot Castle Lake revealed considerable Late Bronze Age remains (Parry 1990, Nayling 1991 and 1992). A standing stone lying in a field to the south of the M4 at Llanfihangel Rogiet (Whittle 1992) may be the sole survivor of several, which according to local sources were removed before construction of the motorway. Geophysical survey in the vicinity of this stone during assessments for the Second Severn Crossing in 1990 located low-level anomalies of potential archaeological interest (Parkhouse and Lawler 1990) ,but watching brief work here during various stages of the contractor's groundworks proved entirely negative, and no features were observed or artefacts recovered. The wooden structures and trackways discovered on the peat shelf at Goldcliff have been dated to the Iron Age (Bell 1991a, 1991b, 1992), as have the Upton Trackway (Trett and Parry 1986)to the west of the Chapel Tump sites (Whittle 1989), the material from the natural channel at Magor pill (Whittle 1989) and the coastal camp at Sudbrook Point (Nash-Williams 1939).

The Site at Stoop Hill (Figure 7).

The site at Stoop Hill (ST 4833 8730), a small promontory at the very edge of the levels, was considered to be of significance primarily due to the discovery of a cropmark enclosure which was interpreted as a Romano-British Villa (St Joseph 1953, Robinson 1988) and designated a Scheduled Ancient Monument. The cropmark 'faded' to the southwest, and it was unclear whether this was because features did not exist in this area or because they were deeply buried by colluviation. The location of the site at the interface of the marine and terrestrial deposits was also considered to be of significance, both in archaeological and palaeoenvironmental terms.

1990 Investigations

The archaeological programme in 1990 was designed to assess the implications of the route of the new road crossing the corner of the area scheduled as an Ancient Monument. The programme consisted of geophysical surveys in the areas of the known cropmark and to the southwest where the cropmark 'fades'. Auger surveys and trial trenching were undertaken in the immediate vicinity to examine the deposits at the interface.

The auger surveys suggested the existence of a possible former cliffline and accumulation of colluvial sediments at the base of the slope. The trial pit (Trial Pit 013) encountered evidence for possible prehistoric human activity occurring in stratigraphy with both terrestrial and marine influences, in the form of several flint flakes and a sherd of possible Bronze Age pottery. Flint, charcoal and animal bone were also recovered from a palaeochannel near the south eastern end of the trial pit. The flint assemblage was not found to be chronologically diagnostic but the pieces were in a fresh condition and showed little evidence of having travelled any great distance.

Samples were collected from the trial pit for soil/sediment analysis, pollen analysis and macrofossil and plant macrofossil analysis. The palaeochannel contained waterlogged environmental evidence. Although the palaeochannel was quite possibly of natural origin, a high magnetic susceptibility value from the basal channel fill suggested anthropogenic activity. Episodes of colluviation from the western end of the pit were tentatively associated with activity on the slope in the Bronze Age and Romano-British peiods.

Although the quantity of archaeological material recovered was not great from a trench of this size, it was clear that the possibility of evidence for significant human activity in this area in the prehistoric period within deposits of considerable palaeoenvironmental interest could not be discounted.

1992 Investigations

Area excavation of that part of the 'villa' complex to be affected by the road construction was carried out in 1992, covering an area of approximately 500 square metres (Figure 7). The Romano-British activity is discussed below. The objectives concerning the prehistoric activity in this area were to define the extent and chronological duration of the activity more clearly and to relate this activity to depositional processes.

Methodology

The main excavation trench (Trench 1A) lay in the corner of the field included within the scheduled area. Topsoil and the upper colluvial deposits were removed by machine and excavation of the Romano-British and earlier deposits then proceeded by hand. The machine was subsequently used to remove pre-Roman colluvial layers. Trench 1A was extended by machine through a hedgeline to the southeast (Trench 1B) and a third trench (Trench 1C), 2 metres wide and 75 metres long, was excavated by machine to the west.

Trenches 1A and 1B

Only one feature of possible prehistoric origin, a ditch or gully (F7), was encountered during the area excavation, in the southeast of the main trench (Trench 1A), at the interface of a mixed, gravel-like deposit (1027), interpreted as a 'high-energy beach deposit', and an orange sandy silty clay (1003). The gully had vertical sides and an even base sloping gradually southwards, ending in a rounded butt end to the north. Only a short stretch of this feature lay within the area of excavation. It was backfilled with a lower deposit of reddish brown silt with clay patches and manganese nodules (1030) overlain by a grey clay with silt and manganese flecks (1032). A tiny undiagnostic sherd of heavily gritted pottery, possibly Bronze Age (identification by A. Woodward), was recovered from the upper deposit and no finds came from the lower fill. Bulk samples of both fills were taken, but processing revealed that no charred plant remains ,or other significant material ,were present.

The only other evidence for prehistoric activity was represented by residual worked flints found mixed with Romano-British and later material, occurring in a sequence of what were interpreted in the field as colluvial deposits (1001, 1002, 1008, 1022, 1023, 1024, 1029) overlying both identified phases of Romano-British activity at the site.

Trench 1C

No evidence of prehistoric activity was encountered in this trench.

Palaeoenvironmental Sampling

Soil and sediment analysis and soil micromorphology focused on the colluvial deposits and their apparent intermixing with estuarine deposits. Two samples of sediments were taken to be examined for microfossils indicative of marine conditions and samples of some of the basal silty sediments of possible loessic origin were taken for mineralogical analysis (Dingwall and Ferris 1993).Results of this work are presented below.

Discussion

Although the results of the archaeological work carried out at Stoop Hill show evidence of some level of prehistoric activity in the area, they have not made it possible to define the extent and chronological duration of such activity. An in situ prehistoric pot sherd from a gully and residual flints from post-Roman layers shed little light on the activity suggested by the material discovered at the trial trenching stage. The combined flint assemblage is indicative of small scale flintworking in the area, but no specific period can be assigned, and the two potsherds (one from 1990 and one from 1992) recovered were undiagnostic. However, the palaeoenvironmental studies carried out on the samples from Stoop Hill will contribute greatly to the understanding of deposition sequences together with land use and surface conditions in prehistoric times.

Vurlong Reen (Figure 2)

The sites at Vurlong Reen (ST 4500 8740), on the seaward side of the Cardiff to London railway line, lay in the peat margin of the levels, at the interface of the solid geology and the estuarine levels. Vurlong Reen was identified as an area providing considerable scope for palaeoenvironmental studies.

The area of Vurlong Reen takes its name from the former hedged drainage channel which ran approximately northeast - southwest across the field, forming the boundary between what was the enclosed common land on the solid geology and the open peat moorland. Although no longer visible on the ground, the former position of the watercourse still demarcates the parish boundary of Llanfihangel Rogiet and roughly correlates with the ground at the flat edge of the field. The field slopes upwards to the west of the proposed new carriageway. A terrace feature lying on the slope is thought to be a lynchet, although it has also been suggested that this feature may represent a former cliff line. The hummocky appearance of the ground surface indicates the extent of desiccation of the peat and the differential shrinkage rates. This area was considered to be of particular significance as, like the site at Stoop Hill, it lies in the zone of contact between former coastal wetland and dryland, a type of biodiverse habitat thought to be conducive to early human settlement.

1990 Investigations

During the assessment phase (Parkhouse and Lawler 1990), an auger survey was carried out to try and identify the contact point of the wetlands with the solid geology, and to investigate depositional processes. The survey showed the sediments on the slope were terrestrially derived, and those at the base were mixed with deposits formed under waterlogged conditions. Two trial pits (015 and 016) were excavated in the north west corner of the field, which proved to have relatively simple sedimentary sequences. Trial pit 016 revealed a layer of woody fen-peat containing lenses of organic silt and clay, overlying a sequence of sands, silts and clays of estuarine origin. Several flint flakes were recovered from the main peat deposit, including one from the fill of a pit or gully feature cut through the lower part of the peat and thought to be of anthropogenic origin. The flints have been tentatively assigned to the Bronze Age on the basis of evidence from the peat sequence in which they were found. Trial pit 015, 36 metres to the east of pit 016, revealed thicker peat overlying estuarine clay. The auger transect showed thickening peat deposits eastwards towards the existing reen. Samples from trial pit 016 were collected for soil/sediment and pollen analysis and the evidence identified this area as a potential site of prehistoric human activity, in association with well-preserved biological evidence.

The field to the east is flat, with the characteristic hummocky appearance indicative of desiccation of the underlying peat, and lies at the lowest elevation along the proposed road route. On the basis of borehole data from W.S. Atkins (Parkhouse and Lawler 1990), indicating deep peat deposits which probably represent the results of a backwater fen swamp, this field was selected as the most suitable location for exposing a peat section, in order to obtain a complete pollen profile and radiocarbon dates from the deepest part of the peat. There was also a high probability that the peat would contain preserved wood of sufficient quality and quantity for dendrochronological studies to be carried out, thus extending existing tree-ring sequences in the Severn Estuary area. The exposed section would also permit the collection of insect and mollusc columns.

1992 investigations

The aim of the 1992 excavation was to try and exploit the high potential for recovery of palaeoenvironmental information in close proximity to evidence for prehistoric human activity, specifically in the immediate vicinity of the site identified at ST 4503 8741, with the possibility of more detailed investigations should any structural evidence be recovered. The field to the east was targeted for the purpose of gathering palaeoenvironmental information, and, in particular, for the recovery of a full pollen diagram from the deepest part of the peat.

Methodology

The recommended palaeoenvironmental sampling programme required the machine excavation of a deep trench (Trench 3A) through the peat deposits in the eastern field. Further investigation across the interface, in the immediate vicinity of trial pit 016, was undertaken by means of excavating a trench (3B) down to just below the base of the peat. The excavation was carried out entirely by hand, with random sample sieving of topsoil and peat, in order to recover any flint artefacts present and to locate any anthropogenic features cutting the peat layers or the underlying deposits, with a contingency plan for more detailed investigation if in situ archaeology was encountered. A flexible programme of palaeoenvironmental sampling was also provided for, the extent of the sampling depending on the discovery of *in situ* archaeology.

Trench 3A (Figures 3 and 4)

Trench 3A was 22.5 metres long, approximately 2.7 metres deep and excavated in three steps. The earliest deposit encountered, visible in patches on the trench floor and in the sections, consisted of yellow brown sandy clay (3006) containing occasional rotten sandstone clasts and some pebbles. Overlying this was a thin layer of humified silty clay (3005), exposed on the trench floor and in the sections. Both deposits were very uneven, consisting of ridges, mounds and hollows, particularly noticeable at the south-eastern end of the trench where a hummock rising 0.4 metres above the trench floor was visible in the section.

Overlying the clay was a thick layer (roughly 1.2 metres deep) of peat (3004) containing considerable quantities of preserved wood varying from small fragments to pieces almost 0.8 metres diameter in size, as well as the remains of a tree base, extending for approximately 3 metres along the south-west-facing section. Above this was another deep layer of peat (3003), blacker and less woody, and getting drier towards the top. The interface between the two layers was difficult to define, especially at the north-western end of the trench, where the tree base in the lower peat layer (3004) obscured the boundary considerably. The black peat (3003) also contained some wood, consisting mostly of small, poorly-preserved fragments. Above this was a thin layer of desiccated, woody peat (3002), overlain by a band of peaty, silty clay with desiccation cracks, in turn overlain by weathered topsoil (3000) varying in depth from 0.15 - 0.30 metres.

Trench 3B (Figure 5)

Trench 3B was 30.7 metres long, 2 metres wide and varied in depth from 0.7 - 1.3 metres. The base of the trench, excavated down to the beginning of the estuarine deposits, was extremely uneven, containing numerous hollows, mounds and ridges. Due to these irregularities, stratigraphic relationships were difficult to establish. Two sondages were excavated along the south-west-facing section, to try and clarify these relationships, and to ensure that all the peat had been removed.

The earliest deposit encountered was a silty clay (3058) at the bottom of the eastern sondage. Only a few centimetres were exposed, from which a sample was collected for analysis. The predominant material exposed in plan along the base of the trench consisted of undulating, laminated clay loess (3055). Deposited in the various dips and hollows in this layer were two different types of material: a mixed orange and black clay (3056) and a peaty clay silt (3057). An unworked piec of flint was recovered from the latter material.

Overlying all these deposits, and also dipping into some of the hollows in the clay (3055), was a layer of woody peat (3054), approximately 0.8 metres thick at the south-eastern end of the trench and tapering out towards the north-western end. Six pieces of flint were recovered from this material, of which three were flakes and one was a flake knife (Figure 6;see below). The thick peat at the south-eastern end of the trench contained several pieces of well-preserved wood. Above this was a layer of darker, drier peat (3053), containing an irregular horizon of extremely desiccated material towards the top. At the north-western end of the trench, the peat (3053) was overlain by a layer of desiccated clay (3052), which tapered out rapidly, but reappeared at intervals in small, triangular shaped patches, interrupting the peat horizon. A layer of weathered topsoil (3050) overlay these deposits.

At the north-western end of the trench, cutting through the topsoil and the underlying deposits was the edge of a recent disturbance (F104), backfilled with a mixed deposit of peat and lumps of clay (3059) and covered with a very thin layer of turf.

Palaeoenvironmental sampling

Columns of peat were collected from both trenches for pollen and plant macrofossil analysis and for radiocarbon dating. Separate columns were also taken for beetle studies. Wood was sampled for identification and possibly also for dendrochronology and radiocarbon dating. Samples from deposits underlying the peat were taken from Trench 3B for mineralogical analysis (Dingwall and Ferris 1993).
See below for the presentation of these analyses.

Discussion

The excavations at Vurlong Reen, although lacking any significant archaeological deposits, were productive in terms of palaeoenvironmental evidence, particularly from Trench 3A. This trench showed simple stratigraphy, with a horizon (3005) which M. Walker's analysis suggests could be a marine sediment (see below). This underlies deep peat deposits. In both trenches, silty clay deposits (3001 and 3052) lay beneath the topsoil, probably representing an episode of flooding after the peat had dried out. The irregular patches of this material visible in Trench 3B probably resulted from the deposition of the silty clay down the desiccation cracks in the peat.

Trench 3B, which was excavated in the area identified as a potential 'site' of prehistoric human activity, revealed no anthropogenic features of prehistoric origin. The uneven hummocks on the trench floor were characteristic of the results of tree-throws, with crescent-shaped hollows and adjacent mounds. They showed no evidence of cuts or backfilling, the material infilling the hollows consisting of natural peaty clay mixtures, which produced no artefacts. All the flints were recovered from the peat immediately overlying the estuarine deposits (3054), apart from one unworked piece which was found in underlying silt (3057). The floor of Trench 3A also displayed an uneven surface, and the hummock at the eastern end of the trench probably represented another tree-throw. Similarly, the pit or gully discovered in trial pit 016 during the 1990 assessment may possibly have been a natural tree-throw rather than an anthropogenic feature. However, it must be noted that the fill of this feature did produce a flint flake.

On the basis of the results from both phases of assessment, there is very little evidence to suggest that a prehistoric settlement site existed here, since no in situ archaeology was located and the sum total of artefacts recovered was very small. Although the implement recovered in 1992, a broken flake-knife (Figure 6), is finely-worked and in excellent condition, it is isolated and remains undated. The meagre archaeological evidence recovered from Trench 3B did not merit an extension to the excavations in this area.

Summary

Although the level of prehistoric activity registered at both Stoop Hill and Vurlong Reen was rather limited, and neither site produced enough evidence to suggest occupation, the fact that a small amount of prehistoric material was present indicates some level of activity in the vicinity of the Second Severn Crossing route, which, together with the palaeoenvironmental evidence, can be fitted into a framework of occupation and activity both in the Caldicot Level and in the wider context of the Severn Levels.

Settlement on the dryland bordering the Levels in the late Bronze Age and Iron Age is well attested by the distribution of hillforts such as LLanmelin near Caerwent (Nash-Williams 1933) and the coastal camp at Sudbrook Point (Nash-Williams

1939), as well as further afield at Mynnyd Bychann (Savory 1956) and Castle Ditches (Hogg 1976) in Glamorgan. Excavations at Thornwell Farm, Chepstow in 1992 revealed evidence of Neolithic and Bronze Age occupation below the Iron Age/Romano-British enclosure (Hughes 1992).

Knowledge of the precise nature of prehistoricsettlement in the reclaimed wetlands is at a more preliminary stage, but recent fieldwork in the estuary is gradually improving the picture. Excavations on the foreshore south of Magor, at Cold Harbour Pill and the Chapeltump sites (Whittle 1989), have uncovered evidence for later Bronze Age structures and other occupation activity, as well as the Iron Age Upton Trackway (Trett and Parry 1986, Whittle 1989), in relatively close proximity to the Second Severn Crossing sites. However, the length or permanance of this occupation remains in some doubt, as does that of the Iron Age occupation at Goldcliff (Bell 1991a, 1991b, 1992) represented by rectangular wooden structures and trackways. It is possible that these sites, on peat shelves on the foreshore, may represent seasonal utilisation of wetland resources. Evidence recorded from the site at Caldicot Castle Lake (Parry 1990, Nayling 1991, 1992), lying on the north east fringes of the level, indicates that Caldicot was an important focus for maritime and wetland exploitation during the Later Bronze Age, and the amount of refuse at the site suggests a high potential for the existence of sites in the immediate vicinity. However, the flint and pottery assemblages from the Second Severn Crossing sites are not large enough or sufficiently diagnostic to be able to draw firm parallels from these sites.

On the English side of the estuary, a long sequence of largely Bronze Age occupation and activity has been revealed in excavations at Brean Down (Bell 1986, 1991), and the Somerset Levels have produced evidence for a considerable level of exploitation in prehistoric times (Coles and Coles 1986). Although the assessment for the Second Severn Crossing English Approaches discovered virtually no evidence for prehistoric activity prior to the late pre-Roman Iron Age (Parkhouse 1991), this is much more likely to be due to the difficulties involved in recovering evidence from belowdeep alluvium, than to lack of activity in these periods.

The evidence from the Second Severn Crossing, although providing only limited understanding of prehistoric activity in the immediate area, forms part of an evergrowing database indicative of wide-ranging wetland activity in the prehistoric period, and has helped to elucidate the palaeoenvironmental conditions and the depositional sequence at the wetland/dryland interface of the Caldicot Level. It has also involved valuable archaeological investigations in an area of landscape with considerable prehistoric potential, which is unconducive to site recognition and has an extremely sparse distribution of recorded sites.

The Flint

by Lynne Bevan

Stoop Hill

The flint assemblage comprises 31 items: 11 from the evaluation and 20 from the subsequent excavation which are combined in the following discussion. The material ranges from beige and light yellowish grey to dark grey in colour. The majority of the flint is of a poor quality with a high incidence of crystalline inclusions and may have originated from a local gravel source but some of the darker grey pieces, particularly a small discoidal scraper and a knife/scraper both of which bear traces of chalk, rather than pebble, cortex, have been made from chalk flint imported from further afield.

While most of the tools and larger flakes are made from the darker, finer flint, the two cores are of pebble flint, their small size and unpredictable quality - one core may have shattered during the reduction process - attest to the difficulties of working this material.

In addition to the flint, an abraded lump of water-rolled chert was recovered and one struck chert flake, a material which may have been present in the gravels and have been utilised together with the pebble flint. A number of small, unworked fragments of the latter were found during the evaluation, supporting the presence of this material in the local geology.

No chronologically diagnostic implements are present in this small collection which includes two cores, a scraper, a curved and extensively retouched piece - an indeterminate knife/scraper made from a core rejuvenation flake, part of a blade shaft and a bifacially-worked tool of unknown purpose. The scraper has previously been described as probably `Mesolithic' (Savory eval report) but this shattered tool may have been part of a discoidal "thumbnail" type typical of the early Bronze Age. The remainder are flakes and struck pieces, four of which have retained some traces of retouch.

Although removed from their original contexts of loss or discard and found mixed with Roman and later material, the flint flakes and artefacts were recovered in a generally `fresh' condition showing little evidence of water-rolling, patination or edge-abrasion.

This small collection cannot be attributed to a specific period but indicates that flint working occurred in the area during prehistoric times, probably on a small and perhaps episodic scale.

Vurlong Reen

One flint tool, a flake knife of indeterminate age (Figure 6) and three flakes, two of which are very abraded, were recovered from Trench 3B. The knife is retouched along its curved edge from its blunted tip to the point of breakage. The knife is in excellent condition and appears to have been broken prior to its deposition in the peat. One of the flakes, a primary flake struck from a nodule for the removal of cortex, is also in a fresh condition and, despite its small size, is probably of the same good quality grey flint as the knife.

Romano-British Activity at Stoop Hill

by I.M. Ferris

Introduction

Excavations and trial trenching were undertaken at Stoop Hill (ST 483 873) (Figures 1 and 7) as part of the archaeological requirement for the road line as it approaches the bridgehead, the area having been assessed during the evaluation in 1991 by GGAT. The aims of the work were twofold; firstly, to investigate the possible extension into this area of Romano-British activity whose main focus had previously been identified to the east, and, secondly, to investigate the nature of colluvial deposits here and their relationship to the expected land/marine interface to the south.

Background

Stoop Hill itself is a small promontory, formed of Keuper Marl, projecting out into the Severn Estuary. To the east of the hill was identified from the air in the 1950s a cropmark enclosure which was interpreted as a Romano-British villa, though the unusual and perhaps contradictory location of the site was also noted. This site was subsequently scheduled.

The first attempt to further define the site occurred as part of the initial evaluation of the implications of the present road/bridge scheme (see GGAT 1990) and involved geophysical survey, largely outside the actual landtake for the roadline, trial trenching and augering. While the geophysical survey confirmed the presence of many of the previously noted cropmark features, it also indicated that activity either fell away to the west, towards the base of Stoop Hill itself and thus of the proposed new roadline, or that any features here were 'masked', possibly as a result of colluviation. The trial trenching encountered no Romano-British features but instead, around the land/marine deposit interface, recovered evidence for possible prehistoric activity here in the form of residual flints and a sherd of ?Bronze Age pottery from a palaeochannel (see above for full details of the prehistoric activity recorded here).

In earlier 1992, a watching brief during geotechnical test-pitting along the road line to the west, on the lower slopes of Stoop Hill (see GGAT 1992 for location), produced no evidence for the presence of Romano-British features here, though a number of sherds of pottery were recovered from colluvial deposits.
The location of these excavated and surveyed areas is shown on Figure 7, along with the plan of those areas subsequently examined in 1992.

Methodology

An area of approximately 500 square metres within the road line was designated for area excavation (Trench 1A), being the corner of the field included within the scheduled area. Topsoil and the upper colluvial deposits were removed by mechanical excavator under archaeological supervision and excavation then proceeded by hand. The machine was later used to remove pre-Roman colluvial layers, again under archaeological supervision. A full site record, in the shape of pro forma sheets, drawings and photographs was made and forms the site archive.
Trench 1A was extended through a hedgeline to the southeast, by a machine excavated trench with stepped section (Trench 1B), to link with the GGAT assessment Test Pit 013. The main section was then cleaned, recorded and sampled.

A third trench, c.2 metres wide and c.75 metres long (Trench 1C), was machine excavated under archaeological supervision to the west.

The results of the excavation of each area will now be summarised with the sequence in Trenches 1A and 1B being conflated to form an integrated account.

Trenches 1A and 1B (Figures 8-12)

The earliest layer encountered was a mixed, gravel-like deposit (1027), corresponding, both stratigraphically and in its nature, to the so-called 'high-energy beach deposit' defined by the GGAT augering in this area and dropping away sharply at the northwest end of Trench 1B (Figure 11). This deposit was exposed in plan at the western end of Trench 1A where a number of large angular boulders were embedded in its upper surface. In this western area, overlying the beach surface, was a wedge-shaped deposit of dark reddish/purple brown clay with very few sub-angular and rounded small stones (1007), increasing in depth upslope to the west. This same deposit was noted around the lower slopes of Stoop Hill to the southwest and the west, both in Trench 1C and in the exposed sections of the drainage gulley cut alongside the construction access road. On-site inspection by Dr. S. Limbrey led to the identification of this clay as a probable solifluction deposit (Figure 10). A number of cracks or wedges in the clay were infilled with a light orange-yellow silty sand with c.30% sub-angular gravel (1004, 1025) with some noted vertical sorting of stones which might suggest these to be cryoturbation deposits. A bowl-shaped depression (F1) in the upper surface of the clay was backfilled with an almost solid dark orange brown sand and gravel (1005). Another possible ice wedge feature (F4) was found in the top of the beach deposit to the west of the clay.

Both 1027 and 1007 in Trench 1A were overlain by an orange sandy silty clay (1003), one of a series of such deposits (1003, 1002, 1001 in ascending order) largely indistinguishable in plan one from another. These were all originally thought to be colluvial deposits but on-site inspection by the environmental specialists suggested that some of them, particularly 1003, could be of loessic origin. At the interface of 1027 and 1003 in the southeast of Trench 1A was cut a gully or ditch (F7), with vertical sides and an even base sloping gradually southwards, ending in a rounded butt end to the north. Only a short stretch of this feature lay within the area of excavation. It was backfilled with a lower deposit of reddish brown silt with clay patches and ?manganese nodules (1030) overlain by a grey clay with silt and charcoal flecks (1032). A tiny undiagnostic fragment of pottery, possibly prehistoric, was recovered from 1032 and no finds came from 1030. Bulk samples of both features were taken, but no further artefacts or ecofactual material was recovered from the processing of these samples.

In the section faces of Trench 1B the simple sequence of 1003 overlying 1027 seen elsewhere was not repeated. Here, at the northwestern end of the trench was a number of intermediate layers (1014, 1020, 1020, 1015) which indicated that between the colluvium and the sands and gravels was a buried soil overlying a sequence of sandy clay loams, silt loams and clay loams. Layer 1015 seemed particularly mixed at its southeastern end and it may show the characteristics of being at the land/marine deposit interface, something seen much more clearly in the deposits above at this end of the trench.These field observations are here repeated, though they have subsequently been shown to require revision in the light of detailed laboratory examination of soil and sediment samples.

In Trench 1A the upper surface of deposit 1003 was cut by a curving, butt-ended gulley (F4) (Figure 8) 1.25 metres wide, narrowing to 0.40 metres wide at base, and c.0.45 metres deep with a flat base. It was backfilled with a very mixed, yellow grey-brown silt clay (1012) containing some sherds of Romano-British pottery. Possibly contemporary, and possibly forming part of the same feature, was a gulley (F6) recorded in the section of Trench 1B (Figure 11); being virtually at the land/sea interface and cutting a mixed yellow brown sandy clay (1019) interleaved at its western end with 1003, the exact stratigraphic correlation was impossible to establish. This second gulley was backfilled with what appeared to be an ?inwashed deposit of grey-blue clay with a few rounded stones (1018), containing a fragment of tile and some flecks of animal bone.

A second phase of Romano-British activity in Trench 1A was represented by a patchy, and probably truncated, cobbled surface (F2), formed of compacted small pebbles, cobbles and occasional chunks of tile (1009) (Figures 8 and 9). This surface partially sealed, and in places dished into, the backfilled gulley F4. A number of small pieces of pottery was recovered from the matrix of 1009. Sealing gulley F6 in Trench 1B was an orange-brown yellow clay silt with occasional sub-angular stones (1017), overlain in turn by a mixed clay silt with c.10% rounded stones (1016); again, being at the interface it is difficult to characterise these deposits before analysis of the column samples through this area.

The sequence over both Trench 1A and Trench 1B now consists of the build up of what were interpreted by the archaeologists in the field as colluvial deposits, obviously thicker towards the northeast of the excavated area. Virtually indistinguishable in plan one from another, these were assigned layer numbers both during their excavation in artificial spits and during the cleaning and recording of section faces (variously, in number order only; 1001, 1002, 1008, 1022, 1023, 1024, 1029). Some Roman pot and tile and some worked flints came from these deposits. During interludes in the non-use of this area two features were dug, both undated but cut from high enough in the colluvial sequence to be at least medieval, and more probably post-medieval, in date; these are a linear gulley (F3) running northeast-southwest across Trench 1A and backfilled with a purple brown silt clay, pebbles and charcoal flecking (1011) and a pit (F8) recorded in section towards the northwest corner of Trench 1A.

The sequence in both trenches was completed by a 0.10-0.15 metre thick topsoil (1000).

Samples were taken in Trenches 1A and 1B for deposit characterisation (see below) but it was not deemed worthwhile to collect samples from this site for any other forms of analysis.

Trench 1C

This trench was dug by machine through the colluvial sequence for a length of c.75 metres. No features, finds or significant deposits were noted in the cleaned sections or in the base of the excavated trench, save the presence of the dark red/purple brown clay recorded in Trench 1A (see above).

Discussion

The excavations at Stoop Hill were in some respects most disappointing and in others realised their research objectives. Some Romano-British features were encountered but these were slight and suggest that the area lies at the periphery of the Roman site (see Figure 7); the features threw no light on the function of that site. As has been noted by J. Evans in his report on the pottery from the recent work at Stoop Hill (below) there is a clear early bias to the assemblage, with the majority of the material being second century in date.Clearly it would be stretching the interpretation of this small dataset to breaking point to extrapolate a similar early date for activity at the main complex of cropmarks.If such an early date were to be suggested for this structure then its identification as a villa would seem unlikely.Some "official" function for this building would appear more likely. The relative scarcity of apparent Caldicot greywares again makes even the local contextualising of the Stoop Hill activity impossible.

Pottery and tile from Stoop Hill, Gwent

by Jeremy Evans
with contributions by B. Dickinson

Some 91 sherds, 524g, of pottery and 128 fragments of tile, 780g, were recovered from Stoop Hill. All the pottery, excepting a single sherd of possible Bronze Age date (a. Woodward pers.comm.) was Romano-British and came from eight contexts and is catalogued here by context.

Catalogue.

Gully F7
Primary fill 1030
A handmade organically and grog tempered bodysherd, possibly Bronze Age (A. Woodward pers.comm.). Wt 4g

Gully F4
Fill 1012
Seven Severn Valley bodysherds. Wt 42g
Two Severn Valley ware joining rimsherds from a wide-mouthed jar, cf. Webster 1993, type 12.1, second-third century. Wt 60g . (Figure 13 No 1).
A Central Gaulish samian dish bodysherd, Hadrianic-Antonine. Wt 3g
One sandy oxidised bodysherd. Wt 4g
Eight sandy reduced bodysherds. Wt 44g
Two sandy reduced jar rimsherds, cf. Webster 1993, type 17?, later first to early second century. Wt 9g. (Figure 13 No 2).
A sandy reduced ware jar rim, cf. Webster 1993, type 26.2, second century. Wt 7g . (Figure 13 No 3).
A sandy reduced ware jar rim with everted rising rim, cf. Webster 1993, type 22, perhaps third century. Wt 5g . (Figure 13 No 4).
A sandy reduced ware bodysherd with common mica inclusions, cf Gloucester fabric TF5. Wt 5g
A reduced ware bodysherd in a fairly fine fabric. Wt 2g
Tile
14 tile fragments. Wt 200g
Two imbrex fragments. Wt 125g
A tile fragment, probably from a tegula. Wt 250g
Two tile fragments from a tegula edge with a rectangular sectioned flange. Wt 225g
Two joining tegula edge fragments with a rectangular sectioned flange. Wt 325g

Gully F6
Fill 1018
Tile
A thick floor/pila tile fragment. Wt 150g

Cobbled surface F2 1009 - sealing F4
A Caerleon ware mortarium bodysherd, cAD 110-80. Wt 4g
Five Severn Valley ware bodysherds. Wt 40g
A Severn Valley ware everted jar rim, cf. Webster 1993, types 8 and 10, first-second century. Wt 20g. (Figure 13 No 5).

A sandy oxidised bodysherd. Wt 2g
A reduced ware bodysherd, possibly Caldicot. Wt 6g
A reduced ware everted jar rim, possibly cf. Webster 1993, type 27. Wt 4g. (Figure 13 No 6).
A reduced ware constricted-neck jar with everted rising rim, cf. Webster 1993, types 6-8. Wt 11g. (Figure 13 No 7).

Tile
Six tile fragments. Wt 260g
Two tile fragments, probably tegula. Wt 200g
A tegula edge fragment with rectangular sectioned, tapering flange. Wt 500g
A thick tile fragment, probably from a floor tile or pila. Wt 150g
A flat tile fragment, one side with two curving grooves. The presence of keying grooves suggests this might have been a from a box flue tile. Wt 200g

"Colluvial" deposits

Context 1003 - orange silty clay - colluvial deposit
Five Severn Valley ware bodysherds. Wt 12g
Nine sandy reduced bodysherds. Wt 33g
One sandy reduced bodysherd, abraded with a fragment of applied decoration, possibly rusticated. Wt 2g
A constricted-necked jar, probably handled, in a sandy reduced fabric, cf. Webster 1993, type 1, first-fourth century. Wt 22g. (Figure 13 No 8).
A narrow-necked jar with double beaded rim, grooved into two beads on the top, cf Webster 1993, types 2 and 10, mainly later Roman. Wt 32g. (Figure 13 No 9).
A wide-mouthed jar rim in sandy greyware, cf Barnett et al 1990 , nos 62 and 64, and Webster 1993, type 38.3, second-fourth century. Wt 16g .(Figure 13 No 10).
An everted rimmed jar rim fragment in sandy greyware. Wt 7g
Tile
Thirteen tile fragments. Wt 210g
Context 1007=1003
A fairly thick tile fragment. Wt 175g
A thick tile fragment, c5cm, from a pila or floor tile. Wt 625g

Context 1002 - orange silty clay over 1003
A Severn Valley ware bodysherd. Wt 2g
A Severn Valley ware bodysherd cut into a counter, diameter c30mm. Wt 7g
Three sandy greyware bodysherds from a single vessel, fabric similar to the Caldicot kilns. Wt 4g
Two joining sandy greyware sherds from a simple base of a jar or bow. Wt 8g
Tile
41 tile fragments Wt 1135g
A large tile fragment, probably slightly curved, a pan tile, probably post-medieval. Wt 850g
Three thick tile fragments, probably floor tile/pila. Wt 850g

Context 1008
A Caerleon ware mortarium bodysherd, cAD 110-80. Wt 6g
A BB1 bodysherd, interior burnished, exterior abraded, probably from a bowl, Hadrianic or later. Wt 4g
A Central Gaulish samian dish bodysherd, Antonine. Wt 1g
A Central Gaulish samian Dr 31R base sherd with stamp. B. Dickinson reports it is stamped by 'Albacianus of Lezoux, Die 6c. The form of the vessel itself provides evidence of activity after cAD 160, as does its use on forms 79, 79R and 80. The stamp is known from Haltonchesters and, perhaps, from Pudding Pan Rock (Canterbury Museum 1032, unprovenanced, but clearly from the sea). Stamps from

some of his other dies have been noted from this late Antonine wreck. cAD 160-200. Wt 13g
Eleven abraded Severn Valley ware bodysherds. Wt 25g
An oxidised jar base with beaded base in a fine oxidised fabric. Wt 6g
Six sandy reduced ware bodysherds. Wt 33g
An everted rimmed jar with rising rim, possibly compare Webster 1993, type 27.4, first-second century. Wt 4g .(Figure 13 No 11).
Tile
27 tile fragments. Wt 460g
A flat tile edge fragment. Wt 25g
A tile fragment, possibly tegula. Wt 110g

Context 1010
A Severn Valley ware bodysherd. Wt 5g
Tile
Two tile fragments. Wt 100g

Feature F3
Fill 1011 - post Roman
A broken BB1 jar rimsherds, form uncertain but probably later second-early third century. Wt 13g
Tile
Three tile fragments. Wt 110g

Context 1016 - post Roman
A very abraded ?Severn Valley ware bodysherd. Wt >1g

Context 1031
Tile
A thick tile fragment, floor tile/pila, probably pila. Wt 625g.

Discussion

Table 000 gives a breakdown of the material from Stoop Hill by sherd count and weight for major fabric classes. The high proportion of Severn Valley wares and low incidence of BB1 and TF5 compared with Thornwell Farm, Chepstow (Evans forthcoming a) and other sites in the region (Allen and Fulford 1987) seems to suggest an early bias to the assemblage as does the shortage of apparent Caldicot greywares. The samian ware, BB1 and Caerleon mortaria are all of Hadrianic or later date, although probably all second century. There is no clear evidence of third century occupation on the site, and neither for that matter is occupation in the first century demonstrated.

Table 1 Fabric proportions from Stoop Hill, Gwent

	Count	%	Weight	%
SV wares	35	40	214	41
Other oxidised wares	3	3	10	2
Gloucester TF5	1	1	5	1
Other Greywares	42	48	249	48
BB1	2	2	17	3
Samian	3	3	17	3
Caerleon mortaria	2	2	12	2
	88		524	

Acknowledgements

The samian has been identified by Brenda Dickinson. The drawings are the work of Mark Breedon.

Medieval and Post-Medieval Activity at Nine Meads (Figures 14-17)

by I.M. Ferris and L. Dingwall

Introduction

Excavations and augering were undertaken at Nine Meads(ST 4610 8720) (Figures 14 and 17) in order to fulfil the archaeological requirement for the Toll Plaza area of Rogiet Moor. Recommendations were made for limited excavation work to be carried out on the edge of an area of early land reclamation, prior to the commencement of construction work. It was proposed that in Medieval times Nine Meads was an 'island' or peninsula of dry land bounded by two large drainage channels and surrounded by coastal wetland. The aim was to investigate this possibility and to try and establish whether the peninsula or 'island' had developed over an earlier natural or man-made feature, as well as to examine the relict drainage channels in more detail.

Background

The parcel of land known as Nine Meads lies on the Caldicot Level, in reclaimed coastal wetland where the solid geology (consisting for the most part of Mercia Mudstone) is deeply buried by estuarine deposits. The relatively rapid localised change in landscape in this area could be observed in an adjacent field, to the west of West Pill Reen, where a long, deep ditch had been recently excavated. The beginning of the fen-peat was clearly visible in the section, appearing initially as a thin layer, thickening rapidly towards the west. Aerial photography and documentary evidence indicate that in the past Nine Meads was a narrow peninsula of land, or possibly an island, bounded to the east by Nine Meads Reen and to the west by the 'New Dicked Ditch' (West Pill Reen), representing an example of very early land reclamation. Two trial pits excavated in the Nine Meads area in 1990 (Trial Pits 001 and 002, GGAT) showed there to be more prominent humified clay silts in this area than elsewhere on Rogiet Moor, indicating a tendency towards relatively drier conditions. Potentially, this could have significantly affected the archaeology of the area, although the 1990 assessment produced no direct evidence for prehistoric human activity.

The documentary evidence shows that Nine Meads Reen possibly existed as a boundary ditch before the Norman Conquest, and although the first mention of 'New Dicked Ditch' does not appear until 1599, when Nine Meads had been enclosed and was being held as a tenancy-at-will, it is highly likely that this may have been transcribed from an earlier document (GGAT). The 'New Dicked Ditch' was the more important of the two, since it was the parish boundary, as well as the boundary between the reclaimed land and the open peat moors. After the general act of 1850, the final phase of enclosure led to extensive alteration and straightening of the drainage pattern of the levels in the 1860's. However, both of these reens were extant until after enclosure and the dry courses are still clearly visible on the surface of the field in the form of differential vegetation growth and occasional slight banks. The present farmer was responsible for the last backfilling episode of West Pill Reen.

These two reens were deemed the most suitable for archaeological examination, since they were the only two of the major drainage channels to be disturbed by the proposed carriageway, that did not carry large quantities of water.

Methodology

In order to satisfy the archaeological requirement, a two-fold approach was adopted, combining excavation and augering. Each drainage channel was examined by means of a machine-excavated trench, exposing deep sections across the full width of West Pill Reen and Nine Meads Reen. Due to the danger attached to working in such deep trenches, the sections were excavated in a series of steps. The trenches were cleaned by hand and an archive consisting of scale drawings, photographs and a written record (on pro forma record sheets) was produced for each trench. Accurate recording of the deposits was slightly impeded, both by the rapid drying of the upper deposits into a cracked, concrete-like consistency and by waterlogging occurring at the bottom of both trenches. A programme of palaeoenvironmental sampling was provided for, but on consultation with the appropriate specialists in the field, it was decided that no useful additional information would be gained from such samples.
The second approach consisted of an auger transect conducted across the 'island' or peninsula, in order to examine differential sedimental accretion over time. Five holes were bored across the 'island' using a 0.5 metre gauge auger, to a depth of 5 metres, and the material was recorded on site. The results of the auger survey are summarised below.

In addition to the recommended work, a hachure and vegetational survey of the two former drainage channels was carried out by a B.U.F.A.U. post-graduate student, using a Total Station EDM., since the courses of the reens had never been accurately plotted.The location of the survey areas and the excavated trenches is shown on Figure 14.

Trench 2A (Figure 15)

Trench 2A was opened up through the former drainage channel (West Pill Reen) which formed the western boundary of Nine Meads. The stepped trench was 16 metres long and approximately 2.8 - 3 metres deep. The earliest deposit encountered was a dark grey clay (2014) containing decaying root material and tiny fragments of shell. Contained within this deposit, visible in the north-facing section, was a darker lens of organic clay silt (2016). Overlying the clay (2014) was a series of blue grey clays (2011, 2012 and 2013), mottled with iron and with poorly-defined interfaces. The middle layer of these three (2012) was a thinner band of organic clay.

A large, slightly asymmetrical ditch (F101) cut through the clay layers (2011, 2012, 2013 and 2014). The lowest fill of this feature consisted of dark grey brown silty clay (2010), containing a line of irregular limestone fragments (less than 0.3 metres in diameter) running along the base of the cut for approximately 2 metres. A cow's tooth in the lower part of this fill was the only stratified find recovered from Trench 2A. A darker lens of silty clay (2009) was contained within this fill. The uppermost fill of the feature consisted of grey clay with red iron mottles (2008).

Possibly overlying F101, or possibly cut by it, was a band of dark, reddish brown silty clay (2007), with some root penetration, which merged into grey clay (2017) at the eastern end of the trench, all overlain by a layer of silty clay loam (2006) with dense root penetration and no stones.

Cutting the silty clay layers (2006 and 2007), and the ditch (F101), was a smaller ditch (F100), approximately 1.1 metres deep. The lowest fill was composed of grey brown silty clay (2005) containing decaying root material and shell fragments. Overlying this was a series of shallow fills (2001, 2002, 2003, 2004 and 2015), mostly consisting of compacted sand, clay and pebbles, with fragments of brick and tile present in one of the sand layers (2015). A thin layer of silty clay loam turf (2000) sealed the deposits.

Trench 2B (Figure 16)

Trench 2B was excavated through the drainage channel (Nine Meads Reen) bounding the eastern side of Nine Meads. The trench was 14 metres long and approximately 3 metres deep, with stepped sections. The lowest deposit contacted was dark grey clay (2055), probably equivalent to the lowest clay located in Trench 2A (2014). Above this were two layers of yellow brown clay (2054 and 2053 respectively), with poorly defined interfaces. Contained within the upper layer (2053) was a dark lens of humified clay silt (2059), approximately 2 metres long.

The earliest feature, cutting through the bands of clay (2053, 2054 and 2055), was an asymmetrical ditch (F103), backfilled with three different silty clays (2057, 2058 and 2060). The earliest fill (2058), a grey silty clay containing decaying organic material, was overlain by two yellow brown silty clays (2060 and 2057 respectively). The interfaces of the middle fill (2060) were diffuse, making it difficult to accurately define the western edge of F103.

Overlying the ditch was a layer of silty clay (2052), with some root penetration, in turn overlain by silty clay loam (2051) with dense root penetration, containing shell and charcoal fragments and one piece of animal bone. A second ditch (F102) cut the silty clay and clay layers (2051 - 2054), as well as the earlier ditch (F103). The fill of the later ditch (2056) consisted of reddish brown silty clay with iron mottles, containing shell fragments and root material. A thin layer of silty clay loam turf (2050) sealed the deposits.

Discussion

The sections through the reens show that the original drainage channels were features of considerable size. The exact dimensions are impossible to calculate due to truncation by later features, but the original cut of Nine Meads Reen (F101) is approximately 6 metres across and that of the 'New Dicked Ditch' roughly 9.5 metres. The traces of the former watercourses visible on the surface of the field show that the reens were meandering and Trench 2B appears to have cut Nine

Meads Reen on one of the meanders. Both the ditch cuts in this trench (F102 and F103) clearly displayed a steep slope on one side and a gentle slope on the other, characteristic features of a curving watercourse. The only evidence for possible banks associated with the original drainage channels was the grey clay deposit (2017) occurring in Trench 2A. Remnants of banks associated with the later channels were still visible in parts of the field.

The rather ambiguous relationship of the original ditch cut in Trench 2A (F101), with the silty clay layer (2007), may be due to reen cleaning, which was probably an on-going process. The material silting up the ditches would be very similar to the material into which they were cut, and if they were being continually cleared out, the original cuts would eventually become obscured.

After the original channels had become infilled and soil had formed over the top, smaller ditches (F100 in Trench 2A and F102 in Trench 2B), were cut into the earlier features. This must have been a relatively recent event, since in both trenches only a thin layer (approximately 0.1 metres) of topsoil had formed over the top of the ditch cuts. The build-up of soil occurring in both trenches before the later ditches were cut indicates that there must have been a period when there were no extant drainage channels. This fact is not mentioned in any of the documentary or cartographic evidence, where it was noted that most of the major reens survived the straightening process carried out in the 1860's. The present-day West Pill Reen which carries water down to the estuary is clearly a straightened version of the original watercourse, where the curving loops have been by-passed.

Trench 2A showed a thin band of organic clay (2012) occurring at a depth of approximately 5.45 metres AOD., truncated by the cut of the reen (F101). This may represent a buried soil horizon, indicating a period of relatively drier conditions and may be consistent with similar organic clays located in trial pits 001 and 002 in the assessment (GGAT).

<u>Summary</u>

The results of the auger survey (see below for full details) suggest that the tendency towards periods of relatively drier conditions at Nine Meads in the past was due to the occurrence of a thicker deposit of upper estuarine clays of the Wentlooge formation in this area. This could be confirmed by dating the deposits at Nine Meads, and indicates that the original reens were cut into undisturbed pre-Roman deposits, since no evidence of prehistoric human activity was recorded in either of the excavation trenches. The excavation and survey work carried out at Nine Meads show how evidence of former environments and past land management can aid understanding of the state of the Levels at various periods in time.

The Auger Survey

by D. Smith

<u>Introduction</u>

In the assessment report of Bell et al. 1990 it was suggested that an auger transect should be conducted between the two major reens bounding the "Island/Peninsula" of the Nine Meads area (Figure 17). This survey was aimed to address two related questions:

1. To investigate the possibility that Nine Meads represented an "island" of dry material extending out into the unreclaimed levels during the Medieval period, and to examine where the edge of the encroaching fen peat may lie in relation to this area.
2. To examine whether this "island" lay on the top of any earlier natural or man-made feature.

Methodology

In total five auger bore holes were placed between the two machine dug trial pits which cut through the dry reens that bound this area (see Figure 14). A 0.5m gauge auger was used throughout. Unfortunately, the total possible length of the auger was limited to 5m and as a result the sedimentary deposits of this area could only be investigated to this depth. All material was recorded on site.

Results

The nature of the stratigraphy revealed by the auger transect is described below and is illustrated in Figure 17.

Stratigraphic descriptions

1. Modern Topsoil- Clay loam developed on estuarine clays. No stones. Dark brown 10YR 4/0. No mottling. High organic content. Dense fine grass root penetration. Moderately developed granular peds. Diffuse boundary with underlying layer.

2. Modern soil B horizon with iron deposition- Clay loam developed on estuarine clay. No stones. Dark blue/grey 10YR 5/1. Distinct, very many red iron mottles, stronger to base. Reduced organic content. Root penetration but less than above. Moderately developed blocky ped structure. Diffuse boundary with below.

3. Estuarine clays with iron deposition- Clay. No stones. Dark Grey 10YR 4/2. Distinct, many red iron mottles. No root penetration. Moderately sticky, Moderately plastic. Diffuse boundary with below.

4. Waterlogged unbanded estuarine clays- Clay. No stones. Blue/light great 2.5 Y 4/0. Few red iron mottles, common black (manganese?) mottles. No root penetration. Very sticky, plastic. Clear boundary with below.

5. Banded thin reed peats and estuarine clays. Blending to east?

   Estuarine clays: Blue/light grey 2.5 Y 4/0. No plant remains to west. Very sticky plastic. Clear boundary with peats in east. Blended to west.

   Peats: Gritty/sandy mineral inclusions. Light/grey Brown 7.5YR 3/2. Reed leaf fragments and plant materials present. Crumbly, non-sticky, slightly plastic. Distinct methane smell. Clear boundary with estuarine clays in west. Blended to east.

   Whole unit clear boundary with underlying peats.

6. Thick band sphagnum peat with mixed estuarine/inwash band.

Peats: Little mineral inclusions. Dark brown/Black 10YR 2/1. Dense sphagnum and fibrous plant remains. Crumbly, non-sticky, non-plastic. Distinct methane smell. Diffuse boundary with silty band.

Mixed estuarine/inwash band: Silty clay. Grey 10YR 3/1. Some reed and sphagnum remains. Moderately sticky, moderately plastic. Distinct methane smell. Diffuse boundary with peats.

Whole unit clear boundary with underlying estuarine clays.

Interpretation

Layers 1 to 4 represent a 3.5 to 4m depth of an unbanded estuarine clay with a modern soil development at the top. The stratigraphic elements within these units result from the transportation of iron down through the deposit and waterlogging in the lower levels.

Layer 5 appears to contain two periods of reed swamp development. These two deposits are interbedded with distinct layers of estuarine clays in the west of the transect. However, these bands appear to blend towards the east. This may be the result of contemporary mixing of deposits on the edge of the reed swamp or smudging of materials within the auger.

Layer 6 appears to contain two periods of development of a sphagnum bog. Between these two layers a period of silty inwash of estuarine or terrestrial material occurred.

Discussion

From a purely geological point of view the results of this auger transect suggest the sedimentary deposits lying between and below the two machine dug pits at Nine Meads are probably a local occurrence of the Severn estuary wide lithostratigraphic unit known as the Wentlooge formation (Allen and Fulford 1986). This is characterised by an unbedded estuarine clay interbedded by peat deposits. This interbedding of clays and peats is not normally repeated in subsequent lithostratigraphic units in the Severn estuary (Allen and Rae 1987). Locally this lithostratigraphic unit has been identified on the Caldicot levels at a number of places, noticeably Goldcliff (Smith and Morgan 1989) and on Caldicot moor itself where the depth of the peat horizons reaches 3-4m (Locke 1971).

If the deposits examined here do represent the Wentlooge formation this would give a pre-Roman date for these deposits. The upper peat horizon sealed in the Wentlooge deposit has been radiocarbon dated to 2180 plus or minus 50 bp at Wentlooge level (Allen and Fulford 1986) and 3380 BP at Goldcliff. It is possible that a similar date can be expected for the peats seen at Nine Meads.

In terms of the aims of this auger project if the drainage channels at Nine Meads are Medieval they were cut into probably undisturbed pre-Roman deposits. If the Nine Meads area represents drier, more easily drained material, this is probably the result of the chance occurrence here of a deposit of the upper estuarine clays of the Wentlooge formation which are thicker than those seen at the adjoining Vurlong Reen area, rather than any intrinsic geological difference.

Palaeoenvironmental Studies of the Gwent Approaches to the Second Severn Crossing, 1992

Edited by Martin Bell

Introduction

This report completes the palaeoenvironmental investigation of the Second Severn Crossing approaches in Gwent. It follows an earlier assessment of the environmental archaeological implications of the crossing which was prepared by the Palaeoenvironmental Research Centre for the Glamorgan-Gwent Archaeological Trust (Parkhouse and Lawler 1990). The timetable for assessment meant that at that stage only very limited analytical work was possible. Two contexts were identified for more detailed analytical investigation at the next stage: a peat sequence at Vurlong Reen and a sediment sequence at Stoop Hill. Both are at, or close to, the interface of former wetland and dryland environments. It was anticipated that these ecotonal situations might have attracted past human activity and at both sites the preliminary assessment produced artifacts. In the event, larger scale excavations by Birmingham University Field Archaeology Unit in 1992 produced surprisingly limited evidence of occupation and artifacts at both sites. However, Vurlong Reen produced an important sequence relating to people / environment relationships between the later Mesolithic and the Iron Age.

Although the broad stratigraphic sequence of the Severn Estuary is well known, particularly in the intertidal area (Allen & Fulford 1986; Allen 1987; Allen & Rae 1987), comparatively little detailed analysis of the peats of the Wentlooge formation, of which the peats at Vurlong Reen are a part, has taken place. Hence the excavations at Vurlong Reen provided an opportunity to carry out a detailed programme of integrated palaeoenvironmental investigations, comprising palynological, Coleoptera and plant macrofossil studies, on these landward peats. Analytical work at Stoop Hill has been of a more limited nature but has helped to clarify the origins of the various sediments revealed by excavation on that site and the environmental context of human activity.

VURLONG REEN (Figures 2-5)

The Pollen Record

M.J.C. Walker & J.H. James

Introduction

The area known as Vurlong Reen lies on Caldicot Moor (NGR 452 873), on the seaward side of the Cardiff to London railway line, some 2.5 km west of Caldicot and 12 km east of Newport. It consists of two fields, and takes its name from the former hedged drainage channel which ran approximately northeast-southwest across the western of the two fields, forming the boundary between what was the enclosed land on the solid geology to the north and the open peat moorland to the south. Some prehistoric artifacts were recorded here during the assessment in 1990 (Parkhouse and Lawler 1990) which also revealed the presence of variable thicknesses of fen peat beneath the fields, these terrestrial and semi-terrestrial organic deposits overlying sediments of estuarine or marine origin. The deposits proved to be highly polleniferous and also to contain abundant plant macrofossils. In addition to the archaeological interest, therefore, it was anticipated that the site would provide evidence of local and regional vegetational history, as well as contributing to the developing picture of prehistoric sea-level change along the northern shores of the Severn Estuary (Allen 1987; Allen & Rae 1987).

Field and Laboratory Work

A deep trench,Trench 3A , was the site of pollen diagram Vurlong Reen I. This trench was aligned approximately NW-SE and was cut by machine down to the level of the underlying estuarine deposits approximately 3 m below the present ground surface. The sides of the trench were then graded into steps each approximately 1 m deep and 1 m across for safety. Samples for pollen analysis were taken from a single vertical column in the NE face where the greatest thickness of peat was exposed, using 10 x 10 x 30 cm and 10 x 10 x 50 cm monolith tins. The previous reconnaissance had shown that the contemporary soil and uppermost sediments in the profile, which are of a friable and desiccated nature, were effectively devoid of pollen, and hence sampling began at C. 30 cm below the ground surface. A second trench,Trench 3B ,was the site of pollen diagram Vurlong Reen II. This trench was immediately to the west of Vurlong Reen I and excavated by hand, with random sample sieving of topsoil and peat in order to recover any flint artefacts present, and to locate any anthropogenic features cutting the peat layers or the underlying deposits . A pollen monolith was taken from the north-facing section where the deepest peat was present. Again, sampling began below (in this case 50 cm below) the dried-out surface layers. Both sets of monoliths were sealed in cling film and tin foil, removed to the laboratory and kept in a refrigerator prior to subsampling.

Samples for pollen analysis were taken at 5 cm intervals throughout the two profiles. 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. Samples were mounted in safranin-stained glycerine jelly and counted on a Vickers M15C microscope at x400 magnification, with critical identifications under oil at x1000. The state of preservation of the pollen was not always good, with many levels showing relatively high numbers of corroded and amorphous grains (*sensu* Lowe 1982). In addition, there was considerable variation in abundance. In some levels a pollen sum of 300 grains could be achieved relatively easily, while in others, despite counting several slides, a sum of only 100 land pollen could be attained. The results of the pollen analyses are shown in Figures 18 and 19. Plant nomenclature follows Clapham *et al.* (1987).

Radiocarbon dating

Following the completion of pollen counting and the construction of the diagrams, nine levels were chosen for radiocarbon dating, six from Vurlong Reen I and three from Vurlong Reen II. Slices of sediment 1.5 to 2.0 cm in thickness, each of 150 to 200 gm wet weight, were cut from the monoliths and despatched to BETA Analytic in Miami, USA. The resulting age determinations are shown in Table 2 and at the appropriate levels on the pollen diagrams (Figures 18 and 19). Table 3 shows the 14C ages from Vurlong Reen calibrated using the revised CALIB 3.0 14C age calibration programme (Stuiver & Reimer 1993). Age depth curves for Vurlong Reen I and Vurlong Reen II based on the nine 14C dates are presented in Figures 20 and 21.

The radiocarbon dates from the Vurlong Reen profiles are internally consistent and form two coherent dating series. There is no evidence of contamination by younger or older carbon residues and isotopic fractionation as shown by the 13C/12C ratios (Table 2) appears to have been minimal. Moreover, the independent pollen stratigraphic record shows the dates from the two profiles to be in close agreement (see below). The radiocarbon evidence indicates that the sequence at Vurlong Reen I spans more 3550 years of the mid-late Flandrian from shortly before 5800 14C yrs BP to ca. 2300 14C yrs BP. The sedimentary record preserved in the Vurlong Reen II profile covers a much shorter timespan comprising most of the fifth millennium and the early part of the fourth millennium (measured in 14C years) BP.

Lithostratigraphy

The sediment sequences at the two sampling sites were as follows:

(A) VURLONG REEN I (VR-I)

0-16 cm	Soil layer: dry, friable, not sampled
16-30 cm	Grey silt clay, iron-stained with fine rootlets; sampling began at 25 cm
30-35 cm	Transition layer from silt/clay to fine, dry, dark brown/black peat
35-47 cm	Dry, friable, brown-black peat, with rootlets penetrating to base
47-129 cm	Well-humified peat with abundant monocotyledonous remains; very fine in texture and with no apparent structure. Increasing moisture content below 52 cm
129-156 cm	Humified Phragmites peat with occasional wood fragments
156-226 cm	Fibrous peat and Phragmites rhizomes with woody macrofossil fragments (Alnus 180-181 cm) increasingly common below 172 cm
226-263 cm	Brown black, well humified, fine grained woody peat (Alnus 251-254 cm)/organic mud
263-266 cm	Transitional layer: fine organic mud with increasing mineral content
266-276 cm	Green-grey silty clay with some small stones and occasional organic lenses Upper levels contain reed fragments

(B) VURLONG REEN II (VR-II)

0-23 cm	Modern soil
23-50 cm	Very dry, humified black peat with rootlets from above 50-70 cm Dry, relatively friable, brown-black, humified woody peat with Phragmites remains
70-116 cm	Brown-black, well humified wood peat 116-118 cm Transition layer: fine organic mud with increasing minerogenic content
118-130 cm	Green-grey silty clay with small stones and fragment of reeds.

Local Pollen Assemblage Zones

The pollen diagrams were divided into Local Pollen Assemblage Zones (LPAZs) on the basis of fluctuations in the curves for the principal pollen taxa. The biozones, their salient characteristics, vegetational reconstructions, and possible ages are shown below. Three of the four zone boundaries in the Vurlong Reen II profile have been dated directly by radiocarbon. In Vurlong Reen I, however, the dates on the zone boundaries are based on interpolations from the age-depth curve shown in Figure 20, and these should be regarded as no more than general approximations of age.

(A) VURLONG REEN I

Paz VR-Ia: Alnus-Tilia-Corylus

Depth: 265-275 cm

Characteristics:
Alnus values of around 30%; Tilia counts ca. 20%; Corylus frequencies 10- 20% TLP; low but consistent counts for Pinus, Quercus and Ulmus; presence of Gramineae, Compositae (Tubuliflorae & Liguliflorae), and Chenopodiaceae; Filicales values up to 60%.

Vegetation:
Alder carr with local mixed woodland dominated by Tilia, with Corylus, Quercus, Ulmus and Pinus. Some open conditions locally; possible residual marine influence (Chenopodiaceae).

Age: pre- ca. 5740 14C yrs BP (pre- 6506 Cal yrs BP)

Paz VR-Ib Alnus

Depth: 240-260 cm

Characteristics:
Alnus values in excess of 50% TLP in all horizons; falling Tilia counts, lower Corylus percentages, Ulmus not present in all levels; slightly higher Pinus and Quercus frequencies; Cyperaceae values generally lower; Gramineae and Chenopodiacaeae present; Filicales values reach 117%; Polypodium well represented; Potamogeton occurs throughout.

Vegetation:
Expansion of alder and reduction in mixed woodland trees, especially Tilia and Corylus. Slight increase in pine abundance. Increase in Rumex may indicate local interference with woodland.

Age: ca .5550 to 5740 14C yrs BP

Paz VR-Ic Cyperaceae-Alnus

Depth: 220-235 cm

Characteristics:
Cyperaceae rises to 50%; Alnus and Tilia counts fall to <20% and <5% TLP respectively; Corylus present throughout; Ulmus and Quercus decline to very low values; Gramineae and Ericaceae rise near upper contact of zone; consistent record for Rumex; Filicales fluctuate from <50% to almost 120%; Polypodium declines.

Vegetation:
Expansion of local sedge and reed-communities. Reduction in both local and regional woodland cover is reflected in falling arboreal pollen frequencies, the occurrence of Ericaceae and continued presence of Rumex and other open-habitat herbaceous taxa.

Age: ca .5300 to 5550 14C yrs BP

Paz VR-Id Alnus-Cyperaceae-Tilia

Depth: 195-215 cm

Characteristics:

Alnus values peak at around 45% TLP and decline thereafter; Cyperaceae rises to > 50% near the top of the zone; Tilia is well represented (8-12% TLP) throughout, Quercus, Corylus and Salix are also present; Ulmus, Betula and Pinus occur sporadically; some open-habitat herbs: eg. Sinapis type; Filicales up to 80% TLP, Polypodium well represented; Potamogeton record continuous.

Vegetation:
Episode of initial woodland recovery, with Alnus, Tilia and Quercus all expanding. Local establishment of Salix. Open-habitat taxa become increasingly sporadic. Sedge fen development apparent towards the close of the biozone.

Age: ca. 4800 to 5300 14C yrs BP

Paz VR-Ie Alnus-Corylus-Salix-Cyperaceae

Depth: 170- 190 cm

Characteristics:
Alnus (25 to 50%), Corylus (10 to 30%) and Salix (1-20%) are the dominant arboreal components of the pollen spectra; Cyperaceae initially ca. 20%, but falls to very low levels near the top of the zone; Quercus present, Pinus rises near the upper zone boundary, Ulmus effectively absent, Tilia values very low (<5%); Gramineae present, Ericaceae recorded; Open-habitat herbs relatively abundant Potamogeton disappears in mid-zone; Filicales fall but subsequently recover to values >200%.

Vegetation:
Local development of Alnus and Salix carr. Tilia less common in regional woodland; Ulmus disappears completely. Pinus and Quercus relatively more abundant. Evidence of open areas in the woodland canopy - Gramineae, Ericaceae, Rumex, and species of Compositae, Chenopodiaceae and Cruciferae. Onset of drier conditions locally

?Age: ca. 4300 to 4800 14C yrs BP

Paz VR-If Alnus-Tilia-Corylus-Cyperaceae

Depth: 125-165 cm

Characteristics:
Alnus values consistently exceed 25% with one level in excess of 50% TLP; Tilia rises to >30% TLP and subsequently declines; Corylus variable (5-25%); Pinus, Betula and Ulmus well represented in some levels, but never >5%; Quercus 5-10% TLP throughout; Salix consistently around 5%; Cyperaceae varies from 5% to values in excess of 25%; Gramineae increases near top of zone; open-habitat herbs sporadically represented; Filicales (including Polypodium) exceed 200% in some levels.

Vegetation:
The distinctive feature of this phase of vegetational history is the expansion and subsequent decline in Tilia. The initial Tilia-dominated forest with Quercus, Alnus and Pinus, is succeeded by more open woodland with Corylus, while alder carr continues to develop locally. The demise of Tilia and the subsquent expansion of grass and herbaceous taxa may again be indicative of human interference in the regional vegetation cover.

Age: ca. 3900 to 4300 14C yrs BP

Paz VR-Ig Cyperaceae-Gramineae-Corylus-Alnus

Depth: 75-120 cm

Characteristics:
Non-arboreal pollen dominate the spectra including Cyperaceae (up to 88%), Gramineae (>20%), Ericaceae and a range of open-habitat herbs; Alnus and Corylus fall to less than 5%, Tilia and Betula disappear from the record; Quercus and Salix are present throughout; Filicales values exceed 300% TLP in some levels; the curves for Pteridium and Potamogeton become continuous.
Vegetation: This zone marks the beginning of woodland decline, with marked reductions in Tilia and Corylus in particular. Reed- and sedge swamp continues to develop, but the stands of alder appear to have been significantly reduced. The increase in Gramineae and in pollen of a wide range of open-habitat herbs also indicative of a marked reduction in extent of woodland canopy.

Age: ca. 3050 to 3900 14C yrs BPPaz VR-Ih Cyperaceae-Corylus/Myrica-Gramineae

Depth: 55-70 cm

Characteristics:
Cyperaceae remains a dominant element of the pollen spectra (typically >20%), along with Gramineae (15-20%) and Corylus-Myrica (15-20%). Betula and Quercus are also well represented, as also are Ulmus and Salix. Open-habitat herbs (especially Chenopodiaceae and Rumex) are relatively abundant. Filicales values fall from values >140% to <40%; Potamogeton present throughout.

Vegetation:
Although clearance of the landscape continues throughout this biozone, there are indications of a short-lived re-expansion of woodland, involving all the principal arboreal taxa.

Age: ca. 2700 to 3050 14C yrs BP

Paz VR-Ii Cyperaceae-Gramineae

Depth: 30-50 cm

Characteristics:
Cyperaceae (typically 40-50%) and Gramineae (20-40%) dominate the pollen spectra. Arboreal pollen are low - <5%, while open habitat herbs are relatively abundant in all levels. Filicales counts (20-30%) are at their lowest levels in the profile; other spores include Polypodium, Pteridium and Sphagnum. Potamogeton is present throughout the zone.

Vegetetation:
A predominantly open landscape with only isolated woodland stands is now reflected in the pollen data

Age: ca. 2250 to 2700 14C yrs BP

(B) VURLONG REEN II

Paz VR-IIa Alnus-Tilia

Depth: 125 cm (one spectrum)

Characteristics:
Alnus and Tilia attain values of around 40% TLP, while Corylus and Quercus are present in low quantities (<5%). Filicales attain values of almost 30%.Vegetation: A mixed woodland dominated by Tilia, but with Quercus and Corylus, is reflected in the pollen data. Local alder carr development is also indicated.

Age: Unknown

Paz VR-IIb Alnus-Tilia-Corylus

Depth: 110- 120 cm

Characteristics:
Alnus remains the dominant element in the pollen spectra (typically in excess of 40%); Tilia falls to around 10% TLP; Quercus and Corylus values increase. Slightly higher frequencies of Gramineae and Cyperaceae are recorded, while open-habitat herbaceous taxa are present in all levels. Filicales and Polypodium abundant throughout.

Vegetation:
Regional woodland persists but Tilia, although still important, is no longer the overwhelmingly dominant component, as Quercus and Corylus are now more abundant. Alder carr continues to develop locally. Some open areas within the woodland canopy are indicated by the relative abundance and variety of herbaceous taxa, and by the appearance of Ericaceae.

Age: Pre-4720 14C yrs BP (pre- 5449 Cal yrs BP)

Paz VR-IIc Alnus-Pinus-Corylus

Depth: 95- 105 cm

Characteristics:
Alnus dominates the pollen spectra (>50% in all levels),Corylus values rise to >20% TLP while Tilia disappears from the record. Quercus is present but in low frequencies. Gramineae, Cyperaceae and herbaceous taxa are less abundant; Filicales and Polypodium are present

Vegetation:
Alder remains the dominant tree in the vicinity of the site, although Corylus expands at the expense of both Quercus and Tilia. The occurrence of open-habitat taxa in the lower levels of the zone indicates the persistence of open areas within the woodland stands.

Age: 4260 to 4700 14 C yrs BP (4769 to 5440 Cal yrs BP)

Paz VR-IId Alnus-Tilia-Corylus

Depth: 75-90 cm

Characteristics:
Alnus values exceed 40%, Tilia rises to 15% and subsequently falls, while Corylus values are consistently above 15% TLP.Quercus, Ulmus and Salix are present throughout. Cyperaceae are recorded in low but consistent frequencies, but other herbaceous taxa occur sporadically. Filicales and Polypodiutn abundant in all levels.

Vegetation:
This zone marks an episode of woodland recovery and subsequent demise with the expansion and decline in Tilia and, to a lesser extent, in Quercus and Alnus. Corylus, by contrast, shows a reciprocal pattern of behaviour. Evidence of open conditions is slight and is restricted to the early and later parts of the biozone.

Age: 4010 to 4260 14C yrs BP (4525 to 4769 Cal yrs BP)

Paz VR-IIe Cyperaceae-Alnus

Depth: 60-70 cm

Characteristics:
Cyperaceae dominate the spectra with values in excess of 40% TLP Alnus counts fluctuate between 20 and 50%; Corylus and Quercus are present throughout, with Tilia recorded in most levels. Gramineae rises towards the upper levels of the zone, while herbaceous taxa are relatively abundant throughout. Filicales values range up to 50%; Polypodium and Potamogeton are present in all levels.

Vegetation:
This biozone reflects the demise of mixed woodland, the spread of grassland and associated habitats and the expansion of sedge-fen and reedswamp in the vicinity of the site.

Age: post 4010 14C yrs BP (post 4525 Cal yrs BP)

Paz VR-IIf Cyperaceae-Alnus-Corylus/Myrica-Gramineae

Depth: 50-55 cm

Characteristics:
Alnus (ca 20%) and Cyperaceae (ca 20%) are the dominant elements in the pollen spectra, along with Gramineae, Corylus (and/or Myrica) and Quercus. Filicales values exceed 40% TLP in the upper level of the zone.

Vegetation:
This zone reflects a slight re-expansion of Quercus and Corylus woodland. Alnus is still abundant locally, although there are increasing areas of grassland and related habitats.

Age: Not known

Regional Pollen Assemblage Zones

The local pollen assemblage zones from the two Vurlong Reen profiles can be integrated into a system of regional pollen assemblage zones. This focuses attention on changes in the regional vegetation cover (ie variations in woodland types), as opposed to site-specific changes involving, for example, episodic development of alder carr reflected in fluctuations in abundance of Alnus and Cyperaceae pollen. The relationships between the local pollen assemblage zones in the two profiles, and a provisional timescale for vegetational change is shown in Table 4 .

Discussion

(a) Sea level change

Estuarine clays with interbedded peats have been described at a number of sites in the Caldicot Levels (Anderson 1968; Locke 1972; Allen & Rae 1987) and have been designated as the Wentlooge Formation by Allen (1987). The sequence typically consists of a lower unit of marine or estuarine sediments which are overlain, by semi-terrestrial and terrestrial peats and by an upper clay unit of estuarine silts and clays. This stratigraphic record reflects a marine regression followed by an episode of fen, carr and raised bog development which was, in turn, succeeded by a further phase of estuarine sedimentation prior to the draining of the tidal mudflats during the Roman period (Allen & Fulford 1986).

In the Vurlong Reen I profile, the lithostratigraphic transition from basal minerogenic (ie marine) deposits to organic (semi-terrestrial) sediments is diffuse and hence, in order to avoid contamination from reworked or secondary material, a horizon for dating was selected just above the transition from clays to organic muds where the minerogenic content was minimal. The sample provided an age of 5740 + 70 14C yrs BP (BETA 63595; 6547 Cal yrs BP), which suggests that marine regression occurred around, or a short time before, 5800 14C yrs BP. This would accord with evidence for coastal change from other parts of the Caldicot Level, for at Goldcliff on the present-day coastline some 8 km to the southwest of Vurlong Reen, the base of the peat bed has been 14C dated in two profiles to 5950 + 80 BP and 5660 + 80 BP, while further west in the intertidal zone near Uskmouth power station, a peat bed has yielded a basal 14C date of 6260 + 90 BP (Smith & Morgan 1989). The Vurlong Reen I date therefore accords with the regional pattern which indicates marine regression from the northern shore of the Severn Estuary late in the seventh or early in the sixth millennium BP (measured in conventional 14C yrs).

The uppermost organic deposits at Vurlong Reen I have been dated to 2470 + 60 BP (BETA 63590; 2544 Cal yrs BP). This dated horizon lies ca. 5 cm below the transition from monocotyledonous peat to minerogenic sediments, and hence the transition from ombrogenous mire to tidal mudflats in this part of the Caldicot Level must have occurred shortly thereafter. Dates on the comparable horizon from other sites in the north shore of the Severn Estuary include 2180 + 50 BP at Rumney Great Wharf to the east of Cardiff (Allen & Fulford 1986), and 2660 + 100 BP at Llanwern Power Station some 5 km to the west of Vurlong Reen (Godwin & Willis 1964). The dates from Rumney and Llanwern, in association with the new date from Vurlong Reen, would appear to lend support to the suggestion (based on evidence from the Somerset Levels) of a marine transgression in the Severn Estuary region beginning around 2600 BP (Hibbert, 1970). If this is correct, the date of 3130 + 70 BP for the peat/marine clay contact at Goldcliff is in error by up to 500 years, a point acknowledged by Smith & Morgan (1989), who raised the possibility of a depositional hiatus at the site to account for the apparent discrepancy between this and other dates from similar contexts. Examination of the pollen record from the Vurlong Reen I profile, however, suggests a marine influence in the vicinity of that site well before the lithostratigraphic transition from terrestrial and semi-terrestrial peats to marine silts and clays, for the curve for Chenopodiaceae (which includes several species of saltmarsh, sand-dunes and similar habitats) in particular is more or less continuous from around 3400 14C yrs BP onwards, while other plants with possible maritime affinities (eg Aster type) are also present from about that time. The evidence suggests that a saltmarsh environment existed in close proximity to the site for several hundred years prior to the Flandrian marine transgression that subsequently deposited the clays and silts of the Upper Wentlooge Formation. In view of the fact that Goldcliff is on the present coast whereas Vurlong Reen is some 2km inland and at an elevation of ca. 4 m OD, it is quite conceivable that parts of the raised bog at Goldcliff were inundated by the sea before the same process occurred at Vurlong Reen. This, in turn, would imply that the Late Flandrian transgression in this part of the Severn Estuary was a protracted process, and that while it might have culminated around 2400-2600 14C yrs BP, it began some considerable time prior to that date.

(b) Vegetational history

On the local scale, the pollen record from the Vurlong Reen sites reflects the development of an alder carr, which dominated the area around the site for ca. 1800 years, and its subsequent demise and replacement by a sedge-fen around 4000 14C yrs BP. Regionally, the data suggest the presence of a mixed woodland, dominated by Q ercus, Tilia, Ulmus and Corylus, with stands of Pinus, Betula and Alnus. Episodes of woodland clearance occur throughout the two profiles, but the most sustained phase of human interference occurs during the early part of the fourth millennium BP, ie in early-middle Bronze Age times. The regional vegetational seq ence is more clearly displayed in the Vurlong Reen II profile where the curve for local Cyperaceae pollen is more subdued than in VR-I where it tends to 'mask' the regional arboreal pollen signal.

The retreat of the sea from the site, and the development of a brackish and eventually a freshwater wetland, is reflected not only in the lithostratigraphic change from silts and clays to organic muds and wood peats in VR-I, but also by the decline in plants typically associated with saltmarsh communities, most notably Chenopodiaceae and certain species of Compositae (eg Aster type), and in the gradual increase in freshwater taxa such as Potamogeton. The record suggests that alder was well established locally immediately prior to the reduction in marine influence (paz VR-Ia), and that it subsequently expanded into the developing wetland. This alder carr, with its rich pteridophyte ground flora (Filicales, Polypodium etc) persisted for the next 700-800 years (pazs VR-Ib to VR-Id; VR-IIa & VR-IIb). Episodes of sedge fen development, possibly accompanied by short-lived declines in Alnus, and perhaps related to fluctuations in the local water table, are apparent, however, the most marked occ rring towards the end of paz VR-Ic (ca. 5400 14C yrs BP) and VR-Id (ca. 4900 14C yrs BP). From around 4800 14C yrs BP, there are indications of the beginning of drier conditions (disappearance of Potamogeton, for example), which allowed the local expansion of Salix and perhaps also of Corylus (local pazs VR-Ie and If; VR-IIc and IId). This phase appears to have lasted for almost 900 years and was succeeded at ca. 3900 14C yrs BP by a return to wetter conditions. The reduction in Alnus pollen frequencies in the uppermost biozones in the two profiles suggests, however, that the alder carr gradually gave way to a more open sedge fen (perhaps reflecting more ombrotrophic conditions) with increasingly scattered stands of alder and other tree types. This habitat change occurs significantly later than at the Goldcliff site to the south-west, where the transition from alder carr to ombrogenous mire has been dated to around 5400 14C yrs BP (Smith & Morgan 1989). From around 3400 14C yrs BP, there was an increasing marine influence in the vicinity of the Vurlong Reen (see above), which culminated some time after 2500 14C yrs BP in the transition from open mire to salt marsh and, event ally, to tidal mudflats.

On the regional scale, the pollen evidence points to a mixed woodland early in the sixth millennium BP in which Quercus, Ulmus, Corylus and especially Tilia were the dominant elements, with Pinus perhaps also present in small numbers. Alnus may also have been a component of the regional woodland, growing not only in the wetlands in the vicinity of Vurlong Reen, but also in a range of habitats including streamsides, flushed hillsides, fens and other low-lying areas of impeded drainage (Bennett, 1990). In terms of its contemporary ecology, it is significant that alder has been widely recorded as characteristic of brackish-freshwater transitions in estuaries and sea-lochs, a situation directly comparable with that in the lower levels of the Vurlong Reen profile. The relatively high pollen counts for Tilia in the lower biozones of both Vurlong Reen profiles are of particular interest, as they tend to confirm the suggestion that lime (mainly Tilia cordata) was a dominant component of the forests of many (although not all) parts of southern Britain during the mid-Flandrian (Greig 1982). For reasons which are not apparent, a comparable Tilia episode is not recorded at the Goldcliff site (Smith & Morgan 1989). Nevertheless successful establishment of Tilia-dominated woodland, which is clearly manifest in both profiles from Vurlong Reen, has led to the suggestion that summer temperatures between 6000 and 5500 14C yrs BP may have been 2-3√C higher than those of the present day (Birks 1989). If so, the decline in Tilia, which began at Vurlong Reen I around 5700 14C yrs BP, and continued in a somewhat erratic manner for the next 1000 years, may perhaps be seen (at least in part) as a response to a gradual reduction in summer warmth, evidence for which is available from a range of independent proxy data sources (Bell & Walker 1992). During the course of the decline in lime, Ulmus disappears from the pollen record. This is the classical 'elm decline', which is apparent in most mid-Holocene pollen diagrams from North-West Europe, and which is now generally regarded as reflecting the spread of a pathogen (similar to the recent outbreaks of Dutch Elm Disease), possibly assisted in some situations by the effects of human activity (Rackham 1980; Peglar 1993; Peglar & Birks 1993). At Vurlong Reen I, the elm decline occurs near the end of paz VR-Id at a date of around 4900 14C yrs BP. This agrees well with age determinations at other sites in Britain and Europe which place the elm decline at around 5000 14C yrs BP (Huntley & Birks 1983).

Following the decline in Ulmus and Tilia, the character of the regional woodland changed with the expansion of Quercus and, in particular, Corylus, the latter presumably taking advantage of the gaps in the woodland canopy left by the demise of lime and elm. Around 4250 14C yrs BP (virtually identical dates being obtained from this horizon in the two Vurlong Reen profiles), Tilia suddenly expanded once more (pazs VR-If; VR-IId), to achieve values comparable with those in the lower levels of the pollen diagrams. This episode of renewed woodland development proved to be short-lived, however, for by ca. 4000 14C yrs BP, Tilia frequencies at Vurlong Reen II had fallen by more than 50%, and by 3950 14C yrs BP, counts for Tilia at Vurlong Reen I had declined from >30% some 200 years earlier to <10%. This abrupt rise and fall in Tilia which, if the dates are correct, took place within the space of no more than 300 years is difficult to explain, but may possibly be related to the activities of late Neolithic or early Bronze Age communities (see below). A similar episode of Tilia development is recorded at Goldcliff, although lime percentages are significantly lower than at Vurlong Reen, the episode is more protracted, and the eventual decline in Tilia has been dated to ca. 3700 14C yrs BP (Smith & Morgan 1989).

The upper parts of the pollen records chart the progressive decline in woodland communities. Tilia disappears from the record completely in pazs VR-Ig and VR-IIf, while Alnus also declines significantly. By contrast, Quercus maintains its position in the pollen spectra suggesting that stands of oak woodland persisted locally, while Corylus pollen values also remain relatively high. It is possible, of course, that these latter grains are derived, at least in part, from shrubs of Myrica gale, which could by that time have been growing on the surfaces of the mires that appear to have characterised large areas of the Caldicot Levels (Smith & Morgan 1989). The increase of Alnus, Quercus, Corylus and Ulmus in paz VR-Ih (between ca. 2700 and 3050 14C yrs BP) is a curious phenomenon, and appears to reflect a short-lived expansion of local woodland, although why this should have occurred is not at all clear. By the middle of the third millennium BP, with tidal mudflats once again established in the Vurlong Reen area, the formerly extensive woodland of the mid-Flandrian had been reduced to scattered stands of oak, elm and hazel, with local growth of alder and willow on damper sites and in the increasingly exposed coastal wetlands.

(c) Evidence of human activity

Although the pollen-stratigraphy of the Vurlong Reen profiles reflects, in the main, vegetational change in response to local hydrological and regional climatic controls, certain features of the pollen diagrams are difficult to explain simply in the context of natural processes. In these cases, the records seem more likely to be attributable to anthropogenic activity. The earliest example occurs during pazs VR-Ib and c, where the reductions in Tilia and Ulmus are accompanied by an increase in pollen of open-habitat taxa including Ericaceae, Gramineae and, especially, Rumex. This episode has been dated to ca. 5300-5500 14Cyrs BP, and adds to the growing body of evidence for human impact on the woodlands of the British Isles well before the classical elm decline (Edwards & Hirons 1984; Edwards 1988). There are further indications of anthropogenic activity around the time of, and immediately following, the elm decline itself. In paz VR-Ie Tilia values fall to very low levels, Quercus declines initially, Gramineae values increase, and there are records for a range of open-habitat plants, many of which have been noted as indicators of agricultural (especially pastoral) activity (see eg Behre 1986). These include species of Caryophyllaceae, Chenopodiaceae and Compositae, Sinapis, Rumex, Plantago lanceolata, P. media and P. major. This episode, which lasted from around 4900 to 4250 14Cyrs BP, finds parallels in the Goldcliff record where woodland decline was followed by phases of pastoral farming, mixed farming and eventually by woodland recovery. At that site, however, the duration of the early Neolithic agri ultural period seems to have been no more than ca 300 years (Smith & Morgan 1989).

The woodland recovery reflected in pazs VR-If and VR-IId at Vurlong Reen, and in which Tilia was the principal component, proved to be short-lived, however. The reappearance of open-habitat herbs in the pollen records around 4000 14C yrs BP, and the complementary fall in tree pollen, points to a major reduction in woodland cover from the middle Neolithic onwards. The decline of Tilia is especially pronounced and may reflect the increasing use of lime for leaf fodder by pastoral communities (Turner 1962), a practice which has also been suggested as a contributory factor in the elm decline some 1000 years previously (Edwards 1993). Subsequently, apart from the short-lived episode of woodland recovery early in the third millennium BP (see above), forest clearance was effectively unidirectional, and the 'cultural landscape' of this part of South Wales firmly established by the middle of the Bronze Age period.

Conclusions

1. Vurlong Reen contains a record of environmental change from shortly before 5800 to 2500 14C yrs BP.
2. Marine regression occurred around 5800 14C yrs BP, and was followed by the development of alder carr which existed for some 2000 years. There are indications of more ombrotrophic conditions from around 3900 14C yrs BP, and the wetland was eventually submerged beneath the rising sea some time after 2500 14C yrs BP.
3. The early part of the pollen record reflects a mixed woodland with Quercus, Ulmus, Alnus, Corylus and Pinus, but in which Tilia was the dominant component.
4. The decline in Tilia began around 5750 BP and was followed at ca. 4800 BP by the disappearance of Ulmus from the record (the 'elm decline'). This marks the begining of woodland clearance in the vicinity of the site.
5. Clearance was interrupted by short-lived episodes of forest regeneration: (a) ca. 4000-4250 14C yrs BP - Tilia, Quercus and Ulmus (b) ca. 2700-3050 14c yrs BP-Corylus, Quercus, Ulmus, Alnus.
6. There are indications of human impact throughout the pollen record: (a) ca. 5300-5500 14C yrs BP - small-scale clearance of the woodland, perhaps by Late Mesolithic hunter-gatherer groups or by early farmers. (b) ca. 4900-4250 14C yrs BP - more extensive clearances probably by Neolithic farmers. (c) ca. 4000 14C yrs BP onwards - widespread woodland clearance by Late Neolithic and Bronze Age farming communities.

Plant Macrofossils from Vurlong Reen

by Astrid E. Caseldine

Introduction

This investigation was carried out in order to complement the pollen and beetle studies of the Vurlong Reen sequence.

Sampling and analysis

Two series of monoliths were taken for pollen and plant macrofossil analyses and radiocarbon dating from the profiles exposed in the two trenches at Vurlong Reen. In the laboratory eight samples were selected from the monolith sequence from the eastern Trench 3A (pollen diagram I) and two samples selected from the sequence from the western Trench 3B (pollen diagram II). Each sample was 200ml in size and taken over a depth of 5cm. Each sample was allowed to soak in dilute sodium hydroxide prior to washing through a nest of sieves with 1mm, 500 micron and 250 micron meshes. All of the 1mm and 500 micron fractions were sorted but only 25ml of the 250 micron fractions. The samples were sorted and identified using a Wild M5 stereo-microscope. Identification was by reference to standard seed identification keys and by comparison with modern reference material. The nomenclature follows Stace (1991) and Smith (1978). The results are presented in Tables 5 and 6.

The Local Environment

The longest sequence is from the eastern Trench 3A (pollen diagram I) and the plant macrofossils indicate some distinct changes in the local environmental conditions. The lowest sample (265-270cm), which is from the underlying clay, contains a few wood fragments and rootlets as well as fruits and cone-scales of *Alnus* glutinosa and an abundance of Carex nutlets, possibly Carex pendula. The latter is frequently found in damp woods, particularly hazel-ash-oak woods (Jermy *et al.* 1982), usually on clays and often where there is a constant water supply. A similar assemblage is present in the the sample (255-260cm) above. In this and the next two samples, well humified wood fragments dominate and the presence of *Alnus* remains together with nutlets of Carex paniculata suggests a community of *Alnus* glutinosa-Carex paniculata woodland (see Rodwell 1991 for a full description of this community). The tussock-forming Carex paniculata is the most outstanding feature of the distinctive herbaceous layer in this type of woodland. Urtica dioica and Eupatorium cannabinum in the samples represent the other tall herbs which generally form a prominent part of the fen community. In addition Solanum dulcamara indicates another distinctive element, that of 'sprawlers', in the herb layer while Rubus fruticosus agg. reflects the undershrubs likely to be present. Moehringia trinervia is another herb of woodland though it is described as being of well-drained soils (Clapham *et al.* 1987). Of note is the quite frequent occurrence of charcoal in the sample from 210-215cm which indicates some burning in the area. In sample 150-155cm, although wood remains continue to account for most of the sample, *Phragmites* is more frequent and whereas Alnus dominates the earlier samples, Betula fruits suggest the presence of some birch fen woodland. In the following sample, 115-120cm, *Phragmites* australis dominates indicating a diminution in local woodland and more open reedswamp. Other herbs represented are Lychnis flos-cuculi and Typha, while the dark slender rhizomes of the marsh fern, Thelypteris palustris, are also present. The latter tends to grow in fen and reedswamp conditions which are permanently wet but not highly acidic and also tends to be a coloniser during the early stages of vegetation closure (Page 1982). Today this species is commonly found associated with reedswamp in the fenland communities of East Anglia and is considered to be essentially a plant of continental climatic conditions, becoming scarcer in western Britain. This change in the local vegetation appears to have occurred around 3950+70BP. Again there is some macrofossil evidence for fire but this time the charcoal seems to be of reed. In the remaining two samples, 50-55cm and 80-85cm, there is some evidence for the presence of base-rich and calcareous waters, notably the presence of Cladium mariscus, Chara and the moss Calliergon giganteum. Equally there is some evidence for acidification from the presence of the pondweed Potamogeton polygonifolius. The occurrence of the latter along with other species such as Eleocharis palustris/uniglumis and Menyanthes trifoliata tends to suggest pools of open water. Other fen species represented include Carex spp., Ranunculus spp., Hydrocotyle vulgaris, and Mentha arvensis/aquatica. Aster tripolium and Chenopodiaceae in the penultimate sample and Atriplex sp. in the final sample .provide some evidence for a marine influence. To summarise, throughout the Neolithic carr woodland seems to have dominated the local vegetation giving way to a more open environment with, ultimately, pools of open water which persisted throughout the Bronze Age.

The two samples, 65-70cm and 97-102cm, from Trench 3B (pollen diagram II) both mainly comprise well humified wood fragments. *Alnus* glutinosa and Carex paniculata remains are present in both samples but more frequent in the upper in which Urtica dioica and Eupatorium cannabinum are also present. Rubus fruticosus agg. occurs in both samples. In addition, in the upper sample, aquatic Ranunculus spp. Polygonum minor, Apium graveolens and Alisma sp. all provide evidence for some standing water. As at 3A there is a little evidence for burning with macroscopic charcoal recorded at 65-70cm. Overall the assemblage represented is similar to that recorded in the lower peats from 3A and reflects *Alnus* glutinosa-Carex paniculata woodland of Neolithic date.

Comparison with the pollen and Coleopteran evidence

There is close agreement between the pollen and plant macrofossil records for the presence of alder woodland with *Alnus* well represented in both assemblages from the Neolithic peats. There is also evidence from the lower samples in the Coleoptera record for fen woodland. Sedges are present throughout the pollen and plant macrofossil records and, from the plant macrofossil evidence, at least some of the Compositae Tubuliflorae pollen may be derived from Eupatorium cannabinum. Similarly, the macrofossil evidence helps to confirm that many of the Filicales spores are likely to be attributable to Thelypteris palustris. All three lines of investigation provide some evidence for an open local Bronze Age environment with pools of open water. Potamogeton pollen is reasonably well represented in the upper peats from 3A while fruits of Potamogeton confirm its local presence. In addition to pondweed, species such as Eleocharis palustris/uniglumis and Menyanthes trifoliata, which grow around the edge of pools, in the plant macrofossil record and many Carabidae and the Dryops spp. in the Coleoptera record provide further evidence for this type of environment. Equally a possible marine influence is suggested by Chenopodiaceae pollen and Atriplex seeds.

Comparison with other macrofossil evidence from the estuary

Although the basic stratigraphic sequence in the intertidal area (Allen & Fulford 1986, Allen 1987, Allen & Rae 1987) is well known on the Welsh side of the estuary the only detailed analysis of the peats is at Goldcliff (Smith & Morgan 1989) where the vegetation succession is shown to develop through to raised bog prior to being annihilated by the deposition of estuarine clay. In contrast at Vurlong Reen, fen woodland and fen conditions persist throught the period, when at Goldcliff the succession to raised bog took place. The end of the succession at

Goldcliff is marked by a brief period of reedswamp prior to the deposition of the clay and is dated to 3130+70 BP, although it is suggested that there may be a hiatus between the top of the peat and the clay and deposition of the latter could have taken place c. 2700BP. The evidence from Vurlong Reen tends to support the earlier evidence for sea-level change at Goldcliff as the top two samples both contain some indications, if slight, for a marine influence and the interpolated date for the lower of the two samples is c. 3200BP.On the English side of the estuary, in the Somerset Levels, the peat succession is well known (Godwin 1941, 1948) with a number of detailed analyses of the peats (Beckett 1978, 1979, Caseldine 1984) demonstrating the succession from fen to raised bog. However, at one site, the Baker site which is a late Neolithic wooden platform on the edge of Westhay island, plant macrofossil analysis (Caseldine 1980) indicates the continued presence of carr woodland and fen conditions while raised bog predominates elsewhere in the Somerset Levels. Similarly, in the immediate area of Glastonbury Lake Village raised bog failed to develop and alder fen carr was succeeded by a fine detritus mud via a reedswamp phase (Housley 1988). It is suggested that this progression to a wetter environment started c. 2800BP and is related to sea-level change, as are the flooding horizons recorded elsewhere, for example at Meare Heath (Coles *et al.* 1988), in the raised bog peats of the Somerset Levels. Clearly there are similarities between the wetland environments on both sides of the Severn Estuary and further investigations in the future will enable the later changes to be more precisely related to sea-level change.

Acknowledgements

I would like to thank Kath Dowse for the processing, sorting and preliminary identification of the samples.

Wood Identifications

by Su Johnson

Twenty six wood samples were received for identification and the results are summarised in Table 7 and detailed in Appendix VI. The wood from Trench 3A (pollen diagram I) was predominantly found in the lower part of the peat sequence in Context 3004. The majority of the samples were alder (*Alnus* glutinosa) with single examples of oak (Quercus sp) ash (Fraxinus excelsior) and willow (Salix sp). This agrees with the pollen and macrofossil evidence for alder carr woodland in the lower part of the peat sequence.

Table 7: Vurlong Reen wood identifications

	Quercus sp	Fraxinus excelsior	Salix sp	*Alnus* glutinosa	TOTAL
Trench 3A		1	1	19	21
Trench 3B	1			4	5
TOTAL	1	1	1	23	26

The oak sample was large and fragile, in the small sub-sample examined there were approximately 10 growth rings to the 1cm, bark was absent. A section of this tree was sent to the University of Sheffield Dendrochronological Laboratory, who reported (J. Hillam pers. comm. 26.1.93) that the sample was in several pieces and none of them had sufficient rings to make it worthwhile doing dendrochronology. A sample has been retained for possible radiocarbon dating.

Coleoptera from a Neolithic and Bronze Age Eutrophic Fresh Water Swamp at Vurlong Reen, Caldicot Levels

by David Smith

Introduction

This report outlines the results from the analysis of the Coleoptera preserved within the peats exposed during the excavation at Vurlong Reen.

Sampling

Fifteen samples were taken for analysis from the eastern trench (3A) and seven from the western trench (3B). The samples were taken as a continuous column in 20 cm units in both trenches. Although each individual sample depth is perhaps larger than that normally taken for coleopterous work, shallower sampling seemed potentially unprofitable given the homogenous nature of the material and the constraints imposed on the project. It was also decided to only undertake analysis on seven samples from the eastern trench (3A) and three from the Western trench (3B). The nature of these samples and their dating is described in Table 8.

Processing and Identification

Each sample was left to soak in a 10% solution of sodium hydroxide. Matter that had floated free was washed through a 300μ sieve until the sample was fully processed. At this point the resulting slurry was paraffin floated using the method outlined in Coope and Osborne 1968 and subsequently improved upon in Kenward *et al.* 1980. Coleopterous remains were sorted from the flot under a binocular microscope, stored in alcohol and identified using a range of entomological keys and by direct comparison to specimens in the Gorham collection housed in the Department of Earth Sciences, University of Birmingham.

Results

The species lists for the eastern Trench (3A) are presented in Table 9. The species lists from the western trench are presented in Table 10. The taxonomy follows Lucht 1987.

Interpretation

Trench 3A

The Coleoptera from the six samples from the Eastern trench (3A) at Vurlong Reen tell a consistant story as to the long term environmental conditions within this deposit.

The water beetles present from both the Neolithic and Bronze Age peats suggest that these deposits were all laid in aquatic environments. The presence of species such as the Dytiscids *Agabus bipustulatus* (L.) and *Ilybus ater* (Deg.) and the Hydrophilid *Laccobius bipustatus* (F.) all suggest the presence of slow moving, sometimes muddy, fresh eutrophic water throughout the history of the deposit (Balfour Brown 1950, Hansen 1987). The presence of eutrophic waters throughout the deposits as a whole is also supported by the ecology of *Ochthebius minimus* (F.), *Hydraena riparia* (Kug.), *H. palustris* Erich. and in particular *H. testacea* Curt. (Hansen 1987). There is ,however ,a suggestion of possibly more acidic waters present in the upper Bronze Age deposits from this trench. *Hydraena britteni* Joy is thought to be a stenotope in acid pools in woodland and moorland (Hansen 1987, Koch 1989), *Hydrochus ignicollis* Mots. is also thought to favour more acidic waters (Hansen 1987).

The nature of the surrounding vegetation in both periods is also suggested. Many of the dominant species in the lower samples, are inhabitants of wet, decaying detritus filled environments found around the base of waterside vegetation. Included in this ecological grouping are *Hydrochus ignicollis* Mots., the Scirtidae *Cyphon* spp., the Hydrophilidae *Cercyon tristis* (Il.), the various species of Pselaphidae and the Corylophid, *Sericoderus lateralis* (Gyll.). Other species suggest the type of reed present in the middle of this section, the Chysomelid *Plateumaris braccata* (Scop.) feeds on *Phragmites communis* L. and the Carabidae *Odacantha melanura* (L.) feeds only on *Typha* reeds (Harde 1984, Girling 1976). The lower samples also contained evidence of other plant species. The small Curculionid weevil *Tanysphyrus lemnae* (Payk.) feeds exclusively on duck weed floating on the water surface (Harde 1984). The presence of fen woodland in the area at the time of the deposition of the lower samples is suggested by the presence of a few individuals of *Dorytomus taeniatus* (F.), and other *Dorytomus* spp., which feed on broad leaf *Salix* species (Koch 1992).

Although there is evidence for stands of waterside vegetation in the area; the upper Bronze Age samples (Contexts 3002, 3003) are probably not derived from the detritus within the mat at the base of the reed beds. There is a move away from the dominance of the species seen above towards those which favour areas of mud and plant matter around the margins of small still pools and lakes. Included in this ecological grouping are many Carabidae and the *Dryops* spp. .

There are only a few individuals present that might suggest human activity within the area. In sample 4 there are the remains of three *Aphodius* spp. dung beetles. These species live and feed on the dung of large herbivores, mainly cattle, although they are sometimes encountered in rotting vegetation and flood refuse (Jessop 1988), There is therefore a possibility of grazing in the area.

In summary, the majority of the species present in the lower samples, tentatively assigned to the Neolithic period, suggest the development of a eutrophic freshwater reed bed possibly near a wooded fen. In the upper Bronze Age deposits there seems to be a move away from the dominance of the reed bed to a less vegetated area with pools of stagnant, muddy and possibly more acidic water.

Trench 3B

The Coleoptera species present in the three samples examined from the western trench (3B), Vurlong Reen, strongly resemble those from the lower samples from the eastern trench (3A). Similarly, the deposit appears to have resulted from the build-up of the detritus mat at the base of a freshwater eutrophic reed bed. There is again the suggestion that fen woodland was present in the area. In particular *Salix* spp. (the host plant of *Dorytomus taeniatus* (F.)) and *Fraxinus* spp. (the host plant of the Scolytidae *Hylesinus oleiperda* (F.)). In addition, the single individual of

Anobium punctatum (Geer.) the "common furniture" beetle is thought to feed on standing dead timber in woodland when away from human habitation (P. Osborne *per comm.*). As with the eastern trench there are a few individuals of the dung feeding Scarabaeidae which may indicate the presence of pasture in the area.

Overall, this suggests that the peat deposits in this trench developed in similar conditions, at a similar period, as the Bronze Age peats in the eastern trench.

Species of Biogeographical Importance

The majority of the species present in the deposits from both trenches at Vurlong Reen are common in the late Holocene and are found in reed beds throughout mainland Britain in the present. However, one species does appear to have a temporal biogeographical importance. In sample 4 from the eastern trench (3A), dated to 3320±60 RCYBP, half of a well preserved thorax has been identified as a *Chalenius sulcicollis* (Payk). This species is a relatively well known inhabitant of soft mud and plant stems among reed beds on the continent (Lindroth 1986). However, it is not a native species in the British Isles at present and is, therefore, believed to be extinct in this country (Kloat and Hinks 1977, Girling 1984). This species has been found in geological samples in the past, mainly from the Bronze Age peats from the Somerset trackways (Girling 1984). Girling (1984) suggests that the presence of this species can be taken as a sign of warmer summer temperatures and more pronounced continental conditions. One noticeable absentee from these faunas *is Anthicus gracil*is Panz. which, although not common, persistently occurs in Bronze Age peats from the Somerset Levels and other sites (Girling 1976, 1977, 1980, 1984 Dinnin M. per com.).

Acknowledgements

I would like to thank the staff of BUFAU for their assistance during sampling. I would also like to thank both Peter Osborne and Russel Coope for allowing me to have access to the Gorham Collection and for their aid in identification. I would also like to thank Jon Sadler for advice on the processing of the material and the manuscript.

STOOP HILL

Sediments and Colluvial Deposits at Stoop Hill (Figures 10-12).

J. Crowther

Introduction

Initial excavations at Stoop Hill (trial pit 013) in 1990 revealed a complex series of deposits in the transition zone between the hillslope and the estuary (Bell 1990; Crowther 1990). The sequence observed at the north-western (i.e. landward) end of the pit is summarised in Table 11. The uppermost 1.6 m of these deposits (contexts 261-266, Appendix I) were thought to be potentially of palaeoenvironmental interest because they contain interbedded colluvial material from the hillslope and estuarine sediments, and might therefore provide evidence relating to sea level fluctuations and/or periods of active colluviation on the slope. In addition, pottery sherds (one possibly Bronze Age) and fragments of tile (Romano-British) were found within the colluvial deposits, and these therefore merited more extensive excavation from an archaeological viewpoint. Consequently, the 1992 excavations at Stoop Hill focused largely upon the area extending inland/upslope from pit 013 to the lower part of the adjacent slope . The aim of the present study was to investigate spatial variations in the sequence of colluvial deposits and associated sediments. The work complements the studies of sediment micromorphology undertaken by S. Limbrey.

Analytical work was undertaken on deposits from four locations: Columns 1-4 . In the case of Columns 1-3 samples were taken in 2 cm slices centred on points at 5 cm intervals down the exposed section (i.e. 4-6, 9-11 cm, etc.). However, in the case of Column 4 (sampled by BUFAU), a series of 23 samples (labelled 73-95) was taken, with the uppermost sample being taken below the modern topsoil at 24-26 cm . In the present report samples are referred to according to sample number]. Attention focused upon the following properties: (i) stone content and particle size; (ii) LOI (loss-on-ignition @ 375oC for 16hr; Ball 1964), which provides an indication of the relative concentration of organic matter; (iii) pH (1:2.5, water); (iv) phosphate-Pt (total phosphate) determined by alkaline oxidation with NaOBr using the method described by Dick and Tabatabai (1977); and (v) c (low frequency magnetic susceptibility). Of these, phosphate-Pt and c are particularly significant from an archaeological viewpoint. Phosphates, which are present in all organic matter, including plant material, bones and excreta, are relatively insoluble and tend to become 'fixed' in the mineral fraction of soils and sediments as they are released during organic decomposition processes. Topsoils, and material such as colluvium which has a substantial topsoil component, thus tend to have higher phosphate concentrations than subsoils, especially where there has been enrichment through human activity (see reviews by Proudfoot 1976; Hamond 1983). Similarly, topsoils and colluvium tend to display enhanced c. In this case, enhancement largely reflects the concentration of magnetic forms of iron oxide (e.g. maghaemite) ⊥ this being dependent upon the presence of iron and of alternating reduction-oxidation conditions which favour the formation of magnetic minerals. Enhancement is characteristically associated with mircrobial activity in topsoils and, more locally, with burning (see reviews by Clark 1990; Scollar et al. 1990).

Results and Discussion

The four sample columns are considered in order of increasing distance inland/upslope. Full analytical data are presented in Appendices II-V. In each case the sequence of deposits is interpreted on the basis of this analytical data, working up from the base of the sample column. All cross-references to contexts identified in trial pit 013 are shown thus: {013/context number}.

1. COLUMN 4, Trench 1B (see Figures 11 and 12 ;data in Figure 22)

This is located less than 1 m landward, and overlaps with the section investigated in trial pit 013 ,though the surveying of that trench was found to be inaccurate, thereby enabling the present investigations to be closely but not totally accurately tied in with the previous work. The following discussion relates to sample numbers, which range from 73 at the top of the sequence to 95 at the base.

Sample	Characterisation/interpretation (N.B. Stone content was not measured down this column)
95	Brown (7.5YR5/4) silty loam. Characterised by very high silt content (70.2%), very low coarse sand content (0.8%), low LOI (1.02%) and low phosphate-Pt concentration (0.410 mg g▲1). Most likely to be a loess deposit {almost certainly the same as 013/context 268}.

94-86	Reddish brown (5YR4/4) clay loam at base giving way to reddish grey (5YR5/2) silty clay loam further up the sequence. Distinguished from underlying deposit by higher sand content, higher LOI and higher phosphate-Pt concentrations (range, 0.567-0.741 mg g-1). The generally coarser nature of this deposit and its relatively high phosphate concentration is indicative of a significant colluvial component (same as 013/context 266}.
85-79	Grey (5YR5/1) silty clay giving way to brown (7.5YR4/2) silty clay, with some Fe staining. Distinguished from underlying deposits by its low very low sand content (<5.0%), higher clay content (range, 40.8-47.8%), and higher LOI. It is probably largely of low-energy, estuarine origin ⫫ the higher LOI perhaps reflecting vege ation growth/proto-pedogenesis development. The fact that relatively high phosphate-Pt concentrations are sustained suggests a continued input of sediment from the adjacent slopes, though this appears to have been confined to fine material. This could reflect a period when the ground surface on the slope was relatively undisturbed, and sediment movement was mostly in the form of surface wash. Alternatively, if this was a time of increasing sea levels, coarse material accumulating at the foot of the slope may have been subject to periodic sorting by marine action. {Equivalent to 013/contexts 265 and 264}
78-73	Brown (7.5YR4/2) silty clay giving way to brown (7.5YR4/2) clay loam. Distinguished from underlying deposit by its higher sand content, which increases up through the deposit, lower clay content and lower LOI. Almost identical in character to the deposit at 94-86 [sample numbers] and presumed to be largely colluvial material {equivalent to 013/context 263}.

2. COLUMN 1, Trench 1B (see Figure 11;data in Figure 23).
Although this column is located only 8 m from Column 4 (above) and extends to a similar depth, it includes some older deposits which increase in elevation inland.

<u>Depth</u> (cm)	<u>Characterisation/interpretation</u>
>190-178	Reddish brown (5YR4/4) sandy loam, with many small stones/gravels (stone content 20.7%). LOI, phosphate-Pt and c are all extremely low. This is from context 1027 {same as 013/270}. It is almost certainly a high-energy beach deposit.
178-173	Yellowish red (5YR4/6) sandy silt loam, very few small small stones. This thin band of material is distinguished from that above and below by its smaller sand content and higher silt and clay content, and by its slightly higher LOI, phosphate-Pt and c. Possibly represents a period of surface exposure and weathering/proto-pedogenesis, or the accumulation of loess.
173-147	Yellowish red (5YR4/6) sandy loam merging upwards with yellowish red (5YR4/6) sandy silt loam, with very few small stones. Probably a beach deposit {013/context 269}.
147-?127	Yellowish red clay loam (5YR4/6) giving way to yellowish red (5YR4/6) silty clay loam, stonefree. The high silt content (maximum, 67.7%) combined with he paucity of sand (no coarse sand) suggests that this is an extension of the loess deposit found at the base of Column 4 {013/context 268}.
?127-113	Yellowish red sandy silt loam (5YR4/6) merging upwards with yellowish red (5YR4/6) clay loam, few small stones. Higher sand content than the loess deposit. Similar in character, and probably in origin (i.e. beach deposit), to that at 173-147 cm.
113-77	Reddish brown (5YR4/4) clay loam, with up to 9.2% small-medium stones. Charcoal generally present, particularly in the lower half and

	peaking at about 105 cm. Distinguished from underlying deposit by higher stone and coarse sand content, and by higher LOI, phosphate-Pt and c values. The increase in the latter two properties is particularly marked. These findings suggest that the deposit has a substantial colluvial component, and is an extension of that of samples 94-86 in Column 4 {013/context 268}.
77-68	Reddish brown-brown/dark brown (5YR4/4-7.5YR4/4) clay loam, very few stones. This is distinguished from underlying deposit by its paucity of stones. Its position within the sequence suggests that it is the equivalent of the deposit between 85-79 [sample numbers] in Column 4 {013/265 and 264}, though it displays no appreciable increase in LOI, phosphate-Pt or c.
68-52	Brown/dark brown (7.5YR4/4) clay loam merging upwards with brown/dark brown (7.5YR4/4) sandy silt loam. Distinguished by higher stone content and sand fraction (especially coarse sand) than underlying deposit. Similar in character to the colluvium identified at 113-77, and presumably of similar origin {equivalent to 013/context 263}.
52-33	Reddish brown (5YR4/4) sandy silt loam, many small-medium rounded/subrounded stones (19.8-32.8% by weight). It is distinguished from the underlying deposit by its higher stone and sand content (especially coarse sand), and by its lower phosphate-Pt concentration (minimum, 0.549 mg g-1). The stoniness and texture are indicative of further colluviation, with the lower phosphate concentration possibly reflecting a more substantial subsoil component (perhaps resulting from disturbance near the base of the slope?).
33-18	Brown (7.5YR5/4) sandy silt loam merging upwards with brown (7.5YR5/4) clay loam, few small stones. Distinguished from underlying deposit by much smaller stone content, which may simply reflect reworking of colluvial material by earthworms. Alternatively, this might be the product of further estuarine sedimentation. This material forms the B horizon of the modern soil.
18-0	Modern topsoil: brown/dark brown (7.5YR4/2) clay loam, stonefree (due to earthworm sorting).

3. COLUMN 2, TRENCH 1A (data in Figure 24).
This column is located along the line of the present-day base of slope, c. 30 m inland from Column 1 (above).

<u>Depth</u> (cm)	<u>Characterisation/interpretation</u>
>132-93	Yellowish red (5YR4/6) sandy loam with high stone content (maximum, 36.6% by weight) merging upwards into a more silty and slightly less stony (typically, 10-15% stones) reddish brown clay loam. LOI, phosphate-Pt and c remain consistently low. The generally high sand content and stoniness of this deposit is indicative of a coarse beach deposit, and is presumably an extension of context 1027 {same as 013/270}. The marked increase in silt content up through this deposit may be due to a progressive change towards a lower-energy depositional environment, or alternatively may reflect a loess input.
93-84	Reddish brown (5YR5/4)-yellowish red (5YR5/6) clay loam, few small stones. This deposit is distinguished from the underlying material by its much smaller stone content and higher silt content. Transitional in character and, presumably in origin, between the underlying beach material and the (probable) loess deposit which overlies it.

84-71	Reddish brown (5YR5/4)-yellowish red (5YR5/6) silt loam, very few stones. This deposit is distinguished by its very high silt content (maximum, 66.8%), and is almost certainly loess. It has similar LOI, phosphate-Pt and c values as at 147-127 cm in Column 1, and is likely to be a continuation of the same deposit {equivalent to 013/context 268}.
71-48	Dark reddish brown (5YR3/4) clay loam, with 10.6-15.2% (by weight) stones. This deposit is distinguished from the underlying loess by its coarser texture, higher stone content, and, in particular by its higher phosphate-Pt and c values. These characteristics are indicative of material with a substantial colluvial component, probably corresponding with the one of (or both) the deposits recorded at 113-77 cm and 68-52 cm in Column 1 (in the present column there is no intervening stonefree deposit).
48-21	Brown/dark brown (7.5YR4/4) sandy silt loam, many small-medium stones (maximum, 31.7% by weight). It is distinguished from the underlying deposit by its higher stone and sand content (especially coarse sand), and by its lower phosphate-Pt concentration (minimum, 0.511 mg g-1). This closely resembles the colluvial deposit at 52-33 cm in Column 2, in which the lower phosphate concentration is tentatively attributed to a greater subsoil component.
21-16	Brown/dark brown (7.5YR4/4) sandy silt loam, few small-medium stones. Distinguished from underlying deposit by much smaller stone content, which may simply reflect reworking of colluvial material by earthworms. Alternatively, this might be the product of further estuarine sedimentation. This material forms the B horizon of the modern soil.
16-0	Modern topsoil: brown/dark brown (7.5YR4/2) clay loam, few stones from 16-7 cm, the uppermost 7 cm being stonefree (due to earthworm sorting). Interestingly, the topsoil in this column (and also Column 3, below), displays generally higher levels of c enhancement than in the other two columns studied ⊥ this presumably reflecting better drainage inland away from the estuarine flats.

4. COLUMN 3, TRENCH 1A (data in Figure 25).

This column is located along the line of the present-day base of slope, c. 25 m west of Column 2 and at a slightly higher elevation.

Depth (cm)	Characterisation/interpretation
>60	Dark reddish brown (2.5YR3/4) clay, stonefree. This fairly localised deposit is distinguished by its very high clay content (maximum, 60.2%). It could possibly be a weathering product of the Keuper Marl ⊥ the very low phosphate-Pt concentration (0.118 mg g▲1) certainly suggests that this material is purely of subsoil origin.
60-43	Reddish brown/dark reddish brown (5YR4/4) sandy loam merging upwards into sandy silt loam, many small-medium stones. Quite pronounced manganese staining occurs at around 53 cm. This stony deposit (stone content 18.5-32.4% by weight) shows a very marked increase in phosphate up through the section, and would seem to be colluvial in origin.
43-28	Reddish brown/dark reddish brown (5YR4/4) clay loam, very few small stones. This deposit is distinguished from the adjacent deposits by its very low stone content. It also has a relatively high phosphate-Pt concentration, peaking at 29-31 cm (0.679 mg g-1). This layer could represent a worm-sorted horizon within an sequence of colluvial deposits, as might occur if there was a hiatus in colluvial

	accumulation. However, the absence of peaks in LOI and c cast some doubt on this interpretation.
28-14	Reddish brown/dark reddish brown (5YR4/4) sandy silt loam, many small-medium rounded stones (maximum stone content, 30.8% by weight). This material is very similar in character to the colluvial deposit identified at 60-43 cm, and is assumed to be of similar origin. In this case, however, the material forms the B horizon of the modern soil, and this probably accounts for the increase in LOI and c up through the deposit.
14-0	Modern topsoil: brown/dark brown (7.5YR4/2) clay loam, quite stony from 14-4 cm, but the uppermost 4 cm is stonefree (due to earthworm sorting).

(Preliminary Conclusions)

1. The study demonstrates the extent and substantial thickness of the colluvial deposits at Stoop Hill, which were initially identified in trial pit 013.
2. Evidence from three of the four columns studied (1, 3 and 4) suggests that there were two major phases of colluviation — a finding which supports the preliminary work undertaken in trial pit 013.
3. The preliminary interpretations advanced above of the columns studied, based on detailed sediment characterisation, differ in many places from those put forward in Dingwall and Ferris (1993) in terms of both the boundaries identified in the sections and the interpretations given. Clearly, therefore, further work could be done in order to integrate more fully the different sources of evidence available.

Acknowledgements

Laboratory analysis was undertaken by I.B. Clewes and J.H. James, and the diagrams were produced by M. Edwards and M. Bell.

Report on Sediment Samples 98 and 96

by J.R.L. Allen
(Sedimentology Unit, Reading University)

In each case lumps of the samples were broken down and a smear slide was made from material scraped from the exposed interior, after disaggregation in a warmed aqueous solution of sodium hexametaphosphate.

Sample 98 (Context 1018).
The location of this sample is shown on Figure 11. The sediment is a pale brownish gray silty clay with very occasional granules and small pebbles, with traces of a coarse lamination of cleaner silt. In addition to clay mineral grains and some quartz particles, the smear slide revealed abundant flecks of black organic material and common broken siliceous sponge spicules. No carbonate particles were present. The sediment is of estuarine origin but the lack of carbonate suggests preservation in a context permitting substantial leaching.

Sample 96 (Context 1019).

The location of this sample is shown on Figure 11. The sediment is a structureless reddish-brown sandy silty clay with scattered granule-size grains. In addition to clay minerals and quartz sand and silt, the smear slide showed common broken siliceous sponge spicules and one fragment of an open-marine diatom. No carbonate particles were present.

The sediment is of mixed origin. The strong reddish-brown colour suggests a component derived from either the Trias (perhaps accompanied by a fluvial terrace gravel) or from a head derived from the Trias (perhaps accompanied by a fluvial terrace gravel). The sponge spicules, however, indicate that there was also an estuarine supply. The lack of carbonate grains is again compatible with a context permitting substantial leaching.

Pedogenesis and Colluvial Deposition at Stoop Hill: Micromorphological Studies

by Susan Limbrey

Summary

Approximately 70cm of colluvium overlies a buried soil. The buried soil is formed on a silt-dominated deposit about 80cm deep, consistent with loess, possibly having a high input from local sources and with an additional component of rounded medium and coarse sand. The deposit was formed before the peak of the last cold phase of the Devensian glaciation, and shows the effects of permafrost, which preconditions the substrate for development of later soil characteristics. Soil formation in the Flandrian resulted in the development of an argillic brown earth with fragipan. Conditions for translocation of fine soil materials continued during the development of the colluvial deposit, which was deposited by gradual or incremental processes with incorporation by faunal activity, in two phases, involving transport of materials from soils of slightly different characteristics.

Fieldwork and sampling

Soils and sediments were studied at the north end of Area B, where deposits identified in the field as colluvium overlay a buried soil. The soil was developed in a silt-dominated deposit overlying sand and then gravels.

Because of the dry state of those parts of the section which had been exposed longest, and the way in which the end section was battered below a hedge, the sections were studied and sampled in two parts: the colluvium and the upper part of the buried soil were sampled in a column adjacent to J. Crowther's sediment sample column 1. The soil was too dry for insertion of Kubiena tins, but the development of prismatic structure and the ped strength meant that large blocks could be freed from the section to form a continuous column to be divided in the laboratory for micromorphology blocks and samples for analysis. The rest of the profile was sampled in the end section where more recent exposure had left it moist enough for isolation of undisturbed blocks over which Kubiena tins were placed before detachment from the section. The micromorphology samples obtained in this way, 10cm deep, were placed with overlaps so as to cover the profile and include lateral variation. Bag samples for analysis were taken, respecting soil horizons and lateral variation. There is a gap of about 10cm in the thin sections in the upper part of the buried soil, because levelling had not been done at the time of sampling and it was thought that the complete profile had been covered. The similarity of the micromorphology above and below the gap suggests that no significant features have been missed.

Sampling for analysis, covering the same materials as those analysed for sedimentological purposes by J. Crowther, was necessary to control interpretation of particle size distribution in pedological terms, with respect to soil horizon boundaries and the lateral textural variations which are significant in the soil type represented here.

~~Soil descriptions were made according to standard terminology (Hodgson 1976).~~

Laboratory methods

Samples were examined under stereomicroscope for greater detail in description and as the first stage in micromorphological analysis.

Micromorphology samples were dried by acetone replacement and impregnated with Crystic resin by slow concentration from diltute acetone solution, and cured under step-wise increase of temperature. Thin sections, 9x5cm and 5.5x4cm, were prepared from the impregnated blocks in the soil Science Laboratories of the Universities of Aberdeen and Newcastle-upon-Tyne.

Particle size analysis was carried out by sieve, for sand grades, and SediGraph X-ray Particle Size Analyzer for silt and clay grades, after pretreatment to remove organic matter and ultrasonic dispersion. Iron and manganese oxides were not removed, and it is clear from examination of the sand separates that many of the nodules and impregnations by these oxides which are apparent in the thin sections contribute to the medium and fine sand fractions. This is readily accommodated in pedological terms but distorts the characteristics of the materials considered as sediments. Since sand content is low, however, distortion is not great.

pH, loss on ignition and organic matter content were determined by standard methods.

Thin sections were examined in broad field at low magnification, with polarizing attachment on a stereomicroscope, and by standard petrological microscope; micromorphological descriptions follow the terminology of Bullock *et al.* (1985), with some use of Brewer's (1964) terms.

Soil Descriptions

Depths are given from ground surface at the position of Sediment Column 1 (Crowther) and the upper part of the soil sampling column, referred across to the position of the lower part of the soil sampling column by levelling. Site datum, 7.695m, is at 1.02m in the sequence described here.

0 - 20cm Dark brown humic top soil. Not described in detail because of disturbed condition of surface at time of sampling.

20 - 35cm Brown to dark brown, 7.5YR 4/4 moist, 7/3 dry with many prominent dark reddish brown, 5YR 3/4 moist, 7.5YR 5/6 dry, medium and fine clear mottles and common black very fine sharp mottles. Sandy silt loam, with few small and very small stones, increasing with depth to many small to medium stones. Strongly developed very coarse prismatic and moderately developed fine angular blocky structure. 5% very fine macropores. Very strong when dry, weak when moist. Slightly sticky, slightly plastic, non-

swelling. Few pale thin clay coatings, and very pale silty coatings increasing with depth. Boundary formed by clear increase in stoniness

35 - 55cm Stoney layer, small to medium stones in a matrix of soil as above. Boundary formed by clear decrease in stoniness.

55 - 68cm Brown to dark brown, 7.5YR4/3 moist, 6/3 dry, with dark reddish brown mottling as above but increased size and frequency of black mottles; zones of mottling in vertical orientation, spacing and width 1-2cm. Sandy clay loam with few to common small and very small stones. Structure, porosity, strength and consistency as above. Few pale clay coatings and very pale silty coatings. Clear boundary.

68 - 77cm Brown to dark brown, 7.5YR 4/3 moist, 6/3 dry, with common prominent sharp, fine, dark brown, 7.5YR 3/4, mottles. Sandy clay loam with few very small stones. Moderately developed very coarse prismatic structure. Less than 5% fine macropores. Strength and consistency as above. Few pale clay and very pale silty coatings. Charcoal present. Boundary not observed clearly because of condition of section.

77 - 110cm Brown to dark brown , 7.5YR 4/3 , 5.5/4 dry, with prominent common clear fine ferruginous and sharp fine black mottles in vertically orientated zones, c. 1 - 2 spacing and width. Between the brown mottled zones, and increasingly with depth, pinkish grey to light brown, 7.5YR 7/3-6/4. Silty clay loam, becoming sandy silt loam with depth, as the paler, siltier, soil occupies more of the volume. Coarse prismatic and fine angular blocky structure, c. 5% fine macropores. Strong when dry, weak when moist, slaking. Slightly sticky, slightly plastic, slightly swelling. Common black coatings in fine macropores, and spreading into fabric to form mottles, some with subsequent pale silty coatings. Common clay coatings, same colour as matrix and darker. Charcoal present. Clear boundary

110 - 124cm Brown, 7.5YR 5/3 moist, 7/4 dry, brown to dark brown, 7.5YR 4/4 moist, 6/4 dry, and strong brown, 7.5YR 5/6 moist, 5/5 dry, with prominent clear, fine and medium dark brown , 7.5YR 4/4, and diffuse fine feruginous mottles. Darker, more mottled, and paler, less mottle soil in 1 - 2cm patches, tending to vertical orientation. Silty clay loam with few very small stones.Moderately developed prismatic and fine angular blocky structure; common fine macropores. Moderately strong when dry and weak when moist, slaking. Slightly sticky, slightly plastic, slightly swelling. Common thin ferruginous and black coatings and common thin dark brown coatings to fine macropores. Abrupt boundary, but tongues of pale soil which are prominent below the boundary begin above it, making the boundary indistinct within them.

124 - 153cm Dark reddish brown, 5YR 3/4 moist, 5/6 dry, and light brown, 7.5YR 6/3 - 6/4 moist, 7/2 dry, with tongues of the paler colour tapering downwards; each colour also occurs as patches in the other. Common prominent fine, sharp, dark reddish brown and black mottles occur in the reddish brown soil. Silty clay loam, tongues silt loam; increasing sand content with depth, becoming sandy silt loam. Few very small stones. Strongly developed prismatic and weakly developed fine angular blocky structure, predominantly in the more clayey parts, with 5% very fine macropores. Very strong when dry,

brittle when moist, slaking. Clayey parts fairly sticky, fairly plastic and slightly swelling. Common ferruginous and black coatings, and common pale and darker thin clay coatings. Abrupt, wavy boundary.

153 - 177cm White sand with pink clay, giving colour pinkish grey and pale brown, 7YR 6/3 6/4 moist, 8/2dry, and with areas of reddish brown loamy sand 5YR4/4 moist, 5/6 dry. Common diffuse ferruginous mottles and black mottles. Common dark brown clay skins. Abrupt bounday to gravels and sands, with reddish brown loamy sand layers.

On the basis of stone content, colour, and intensity of development of mottled zones, the surface of the buried soil is taken as approximately 68cm.

Analytical results

Results are given in Table 12, and the particle size distribution in Figure 26. It should be noted that in the case of analyses for pedological purposes, percentages of the size fractions are based on "fine soil", that is, material less than the 2mm upper limit of sand grades. The coarser material, stones, is additional to this, and because of the small sample sizes used, stones larger than the "small stone" category, 2cm, are under-represented. The descriptions, and the sedimentological analyses give a proper indication of stone content.

The conventional subdivisions of the particle size continuum mean that a bipartite distribution in the silts and sands is obscured. It is clear in the thin sections that the fine sand is predominantly in the lower part of its size range and forms a contiuum with the coarse silt, while the medium and coarse sand forms a distinct size class, most of the coase sand being, in the buried soil, in the lower part of its range.

Micromorphology

Colluvium: 30 - 68cm, with a gap 45 - 55cm where stone abundance prevented extraction of a block.

Throughout the material identified in the field as colluvium, stones are randomly distributed and orientated. Stones are predominantly rounded, with a few sub-angular. Quartzose sandstones and siltstones and quartzites predominate, with a smaller quantity of mudstones and metamorphics.

Structure is fine angular to sub-angular blocky, with planar voids, partially accommodated, curved to zig-zag. There are some channels and chambers, and common vughs. Texture is open porphyritic with respect to coarse and medium sand, these grains, predominantly medium sand, in loose strings and clusters, and closed porphyritic in the fine sand/silt grades. The fine material is unevenly distributed, tending to concentrate in poorly marked interlaced intercalations within the finer-textured areas. Colour of the fine material is light yellowish brown to yellow to reddish brown in reflected light, light brown to dark brown and dark reddish brown in plane polarized light, the fabric being variably stained with isotropic organic matter and with iron oxides which appear dark reddish brown under crossed polarizers. Colour is redder and the iron stained zones more strongly marked above the stony layer within the deposit. The cores of iron stained areas are sometimes black, and there are black impregnations, increasingly with depth. Iron staining is concentrated in zones on a scale of 1 - 2cm, with depleted zones between. It is apparant from orientation of silt particles and vertical layering of soil of different texture that , particularly in the lower part of the deposit, depleted zones are centred on infilled channels or wide cracks; in some cases a fine fissure or sections of the channel remain at the centre.

Birefringence is predominantly crystallic, dominated by the quartz silts, but there is also speckled and reticulate striation, and grano- and poro-striation. The porostriation referred to vertical voids or their remnants is associated with infill materials. In addition to infill which is broadly of the same texture as the soil fabric, though weakly sorted in layers, there are infills and complex coatings of limpid, dusty and silty clay, increasing with depth, and particularly common in the material below the stone concentration. Layered coatings commonly have limpid clay preceding dusty clay or silty clay. Commonly a latest coating has the same texture as the bulk of the fabric. Locally, particularly in the upper part, loose infillings of ovoid faunal excrements, c. 0.2mm, can be seen to be coalescing to form a coating or a complete infill. While these excrements are dark brown where they are still separate, where they are in the process of coalescing they are paler and have the same mineral content as the finer components of the soil fabric. All stages are seen, between distinct ovoids, through coalesced layers forming coatings, to the rounded forms seen as the margins of major aggregates and the distribution of amorphous fine material on the same scale within aggregates. One very large chamber has a partial infill of a cluster of coarse sand grains, one of which is a bone fragment, surrounded and overlain by sorted laminae and lenses of silt and dusty clay.

The following sequence of processes is suggested:

1. Accumulation of soil by colluviation, and faunal sorting producing the relative distribution of the medium and coarse sand and the finer material, and associated interlaced intercalations within the finer textured areas - total faunal structure, obliterating any lamination resulting from the depositional process. Collapse of the structure, leaving vughs as remaining porosity.
2. Gleying, associated with formation of deep channels and cracks, with depletion spreading from these voids; the process continues progressively, so that depletion begins to affect earlier formed stains and impregnations adjacent to the voids.
3. Translocation of limpid clay.
4. Translocation of dusty and silty clay.
5. Faunal infilling of some of the remaining voids. Contemporaneity of some of these processes is apparant, with iron staining affecting limpid clay coatings in the zones of iron enrichmenet, and sequences of limpid, dusty and silty clay translocation alternating in some voids. There is no iron staining of the void fillings or coatings by the coarser materials, however.

The earlier stage of faunal working would be consistent with earthworm activity; the later stage is more consistent with arthropod activity. The implication is of increasing soil acidity. Earthworm activity would be low at the present pH values, but the partial infill of one chamber could be an earthworm eastivation deposit followed by infiltration of fine material, probably from the recent active surface soil.

Buried soil, upper horizon: 68 - 110cm. There is a gap in the thin sections between 87 and 92cm. There is no clear distinction in micromorphology at the 77cm level to distinguish the boundary identified by Crowther, though a textural change at that level, with a lower sand content below it, is apparant in the slides as in the analyses.

Structure is weakly developed, with few planar voids, accommodated and partly accommodated, predominantly vertically aligned, curved to zig zag. Porosity mainly vughs, with weakly developed channels and few chambers. Texture sorted, with coarser element open porphyritic, loose chains and clusters, finer element closed porphyritic, with traces of interlaced intercalations of the finest fraction.

Colours are brown to dark brown and dark reddish brown in reflected light, light brown and dark to very dark brown in plane polarized light. Under crossed polars, brown amorphous fine material is isotropic. Birefringence is crystallic, dominated by quartz silt, with slight speckled and reticulate striation; slight granostriation and marked porostriation. Black impregnations, coating and hypocoatings are common and sharply defined, ferruginous staining both diffuse and more sharply defined as small spots. There is a tendency for unstained patches to develop downwards into depleted zones encroaching upon stained areas. Some stained areas appear to be disrupted by faunal activity.

Porostriation is, as in the overlying deposit, formed by coatings and infillings in channels and planar voids. Some voids have complete bowlike infillings similar in texture to the surrounding fabric, and complex coatings to channels include similar silty and fine sandy soil as well as silty and dusty clay. The complex silty and dusty clay coatings are predominantly subsequent to iron staining and depletion, the depletion zones being centred upon channels or planar voids which become infilled by progressive coating. There is occasional superposition of iron or manganese staining on a coating. Limpid clay coatings only occur towards the bottom of the horizon; where they do occur, there is no consistent order of limpid and dusty coatings. Embedded fragments of limpid coatings, with laminar iron staining, occur in the fabric. Charcoal fragments occur throughout, and there is abundant fine black particulate material.

Second horizon, 10 - 124cm.
Microstructure weakly developed sub-angular blocky and platy: few planar voids, accommodated and partially accomodated, zig-zag; channels poorly defined, mostly becoming discontinuous; porosity predominantly vughs, vesicles, often prolate, and chambers . Texture very open porphyritic with repect to coarser fraction, closed porphyritic in the finer fraction, with brown opaque amorphous material unevenly distributed. Traces of sorting of fine components in the platy units.

Colour is pale brown to reddish and very dark brown under reflected light, light brown to dark and very dark brown under plane polarized light. Under crossed polarizers, the diffuse and uneven staining is yellowish to reddish brown and the amorphous fine material, unevenly distributed, stained brown. Birefringence is crystallic and there is porostriation. Coatings are compound and often layered, Limpid coatings, variably iron-stained, occur in situ, and always first in a sequence, and as a few embedded fragments. Dusty and silty clay coatings occur in voids with and without limpid coatings, and in various sequences, often with a later coating of the same texture as the fabric.

Third horizon 124 - 153cm
Microstructure very weakly developed sub-angular blocky, platy, locally and weakly developed in the upper part, becoming better developed with depth but failing again near the base. Porosity mainly vughs and vesicles, tending to be prolate, with some chambers, which increase in the lower part.

Texture is open porphyritic with respect to the coarse component, closed porphyritic in the finer. There is a marked increase in medium sand in the lower few centimetres. Platy structure has sorting in the finer fractions within the units, finest upwards. There are areas in which platy structure has been disrupted, forming jumbled units at various angles and sometimes clustered in bow-like arrangement.

Colour in reflected light very pale yellowish brown and yellowish brown to strong brown, with reddish brown and very dark brown and black impregnations and mottles in the darker areas, becoming intense yellow in the lower part. In plane polarized light colours are very light brown and dark brown with black mottles. Colour is patchy, with pale, clay- and iron- depleted areas and the more strongly coloured areas tending to form vertical zones, 1 - 2cm across, but with smaller patches. Colour intensifies downwards until the lowest 5 - 10cm, where it becomes duller, and the pale areas are lost in the lower 10 - 15 cm.

Under crossed polarizers, colour of amorphous fine material, now mainly confined to the clay -rich patches, is yellow to reddish brown; birefringence is crystallic, becoming, in the non depleted zones, increasingly speckled and then reticulate striated with depth. Large amounts of variably iron-stained limpid clay coatings occur in the clay-rich areas, both in-situ and as fragments embedded in the fabric, and they infill some of the voids of the platy structure. Complex and layered dusty and silty clay coatings, including those of the same texture as the fabric, occur in voids in the depleted zone as well as subsequent to limpid coatings in the clay-rich areas. Towards the bottom of the horizon, there are areas of segregation of both limpid and dusty clay occupying much of the fabric.

Interpretation and discussion

Colluvium

The bipartite character of the colluvium, with a stony horizon between the lower, browner and less strongly mottled and the upper, more reddish brown and more strongly mottled soils suggests a transition to derivation from lower in the profile of the source soils as the erosive process progressed, or erosion encroaching on a slightly different source soil cutting into the redder components of the complex soil pattern on the slope above. Micromorphological characteristics are consistent with gradual or incremental deposition and incorporation by earthworm activity, but as the deposit grew, the soil progressively isolated from surface activity suffered collapse of structure and became gleyed, processes promoted by the high silt content and low pH, as mineralization of organic matter proceeded. Cracks developed, which acted as conducting channels for leaching and depletion of iron oxides from adjacent zones. Failure of flocculation adjacent to the leached channels allowed infill by downwashing of finer soil components, limpid clay when the process began, but then including silt. Exposure of the surface to rain splash and surface flow as the soil was being deposited probably contributed to inwash of fine material. Later stages of internal reorganization were dominated by arthropods rather than earthworms, by earthworm activity in the active soil at the surface continued, with penetration to greater depth for aestivation.

Buried soil

The upper 10cm or so of the buried soil has an increased sand content in comparison with the subjacent material and is comparable in this repect with the colluvium. One explanation for this would be initiation of colluvial deposition, but alternatively, the increase in sand without an increase in stones could have been a result of wind blow from the sandier soils whose disturbance would subsequently result in their erosion by colluvial processes. Low stone content of this same zone, noted by Crowther, could be a result of earthworm sorting. There is no evidence to support Crowther's suggestion of an inwash of estuarine material.

While the total depth of the upper horizon is greater than would be expected for an A horizon, micromorphological evidence of former humus content, in the staining and the localization of iron oxide on concentrations of organic matter, and in the internal sorting brought about by faunal activity, suggests that, as in the case of the colluvial deposit, there has been increased thickness of topsoil by deposition, in this case from topsoil of the same kind locally upslope, with total incorporation of increments. The upper 10cm or so is slightly darker in colour, and could represent a period of stabilty, with only the addition of wind-blown sand.

Within this former deep A horizon, there is considerable evidence for translocation of silty and dusty clay, but very little limpid clay. Many of the same processes of collapse of soil structure and inwash and of soil material occurred as in the case of the colluvial deposit, but gleying was less marked, with a tendency for manganese mobilization to be more marked than that of iron. There are spotty depositions of manganese dioxide suggestive of microbiological foci where organic material was humified.

Depletion zones become marked in the lower part of the A horizon, suggesting the development of an E_b horizon.

The second horizon, 110 - 124cm, shows the characteristics of both a B_t horizon and an E_b horizon, with large quantities of translocated clay, but there are two different phases of development: limpid clay, variably and sometimes strongly iron stained in layered patterns, in situ as coatings to existing pores and as fragments of coatings embedded in the fabric, and dusty and silty clay, as a further stage in already coated pores and as new coatings in others. This evidence, which becomes increasingly marked with depth, with the formation of marked tonguing of depleted (E_b) soil into the clay-rich horizon (124 - 153cm) indicates a polygenetic soil, with a phase of limpid clay translocation followed by disruption and then translocation of coarser material.
There is also, in the lower horizon, marked development of lenticular and laminar patterns of sorting, which has also been subjected to disruption.

These characteristics, of sorting, formation and then disruption of iron-rich clay coatings, followed by tonguing of E_b into the B_t horizon, identify the soil as a glossic argillic brown earth with fragipan. This soil type (Fraglossudalf) is well known in North America and in northern Europe, especially in loess deposits, and has been studied by micromorphology in Belgium and France, (Langohr & Pajares 1985; van Vliet & Langohr 1985), and recently in northern England (Payton 1992, 1993). The effects of permafrost in producing compaction and lenticular and banded textural sorting predispose the soil to development of impermeability and gleying, and collapse of soil structure, and the translocation of fine material in the distinctive patterns observed in this soil contributes to the induration. Indurated horizons, or fragipans, are widely identified in soils in former permafrost zones, and occur in the soil types of this region (Rudeforth *et al.* 1984), but the glossic phenomenon has not been noted as widely in Britain. The processes by which the fragipan becomes disrupted and degraded may be complex. Here, some evidence for earthworm activity, in the form of clusters of disrupted parts of platy units lying in bow-like infillings, can be seen. The fragmentation of the limpid clay coatings, however, which precedes the development of glossic features and the emplacement of dusty and silty clay coatings, but must have followed the major period of post-glacial pedogenesis in which the coatings were formed, could perhaps be attributed to rooting and wind-rock of trees. The depletion zones appear in this profile not to follow infillings of cracks (as they do in the colluvium), and could be following former root positions.

T e implications of this profile are that the silty material on which this soil has formed was deposited before or during the Devensian last cold phase (Loch Lomond stadial). This loess deposit, some 80 -80cm deep, overlies sand and gravels. The lower part of the silty material has a high content of the rounded quartz sand in the finer end of the coarse sand and the medium sand grade, and it is this sand which is admixed in smaller quantities throughout. The size distribution of the rest of the material is perhaps somewhat high for loess in this locality, having a considerable component of very fine sand (Catt 1978). A high contribution from local sources, where fine sandstones and siltstones occur, would account for this.

CONCLUSIONS

by Martin Bell

The lack of traditional archaeological evidence (settlements and artifacts) from the Gwent Approaches to the Second Severn Crossing is compensated for by a good record of environmental change and its relationship to human activity. Both the sites investigated in detail at Vurlong Reen and Stoop Hill are at the margins of the former wetland, and relate to changing environmental conditions at the interface between the estuary and dry land and the activities of past communities at this ecotonal interface. This evidence is particularly welcome in view of the rather limited evidence, until recently, for prehistoric activity and human environmental relationships in lowland south east Wales. A survey by Caseldine (1990) shows a distinct paucity of pollen sites in this area by comparison with the Welsh uplands. This gap is rapidly being filled by research in the Severn Estuary. It is now clear that on the Gwent Levels there was in the Neolithic and Bronze Age a great peat bog complex on a comparable scale to the much more well known and partially surviving bogs of the Somerset Levels. Smith and Morgan (1989) were the first to appreciate the extent and significance of the former Gwent bog complex in their detailed analysis of Goldcliff, a sequence which is now complemented by the Vurlong Reen pollen diagrams presented here.

The Vurlong Reen diagram provides a vegetation sequence of some 3550 years from around 5800-2300 radiocarbon years BP. It contains significant evidence for prehistoric impact on the environment. The earliest such evidence at Vurlong Reen is between 5300-5500BP, which predates the elm decline. This might relate to the activities of hunter-gatherers. Alternatively, these vegetation changes might relate to precocious agricultural activity. There is further evidence of anthropogenic impact around the time of and following the elm decline. The evidence from Vurlong Reen itself does not resolve the question of whether these impacts were the work of hunter-gatherers or farmers, but it does demonstrate that people were having a significant impact on the environment of the area during the key phase of the Mesolithic / Neolithic transition as seems to have been the case in a number of coastal areas of Wales. Nearby at Goldcliff there was widespread burning, indicated by charcoal around 6400BP (Bell 1993) and later clearance around the elm decline (Smith and Morgan 1989). In Pembrokeshire a number of coastal sites also have evidence of burning around the Mesolithic Neolithic transition (Lewis 1992), and at Prestatyn in Clwyd coastal shell middens of this date have recently been investigated (Bell et al . 1993).

Following a major reduction in woodland cover from the middle Neolithic, it is clear that at Vurlong Reen a mainly cleared cultural landscape had emerged by the middle Bronze Age. This picture is of particular contextual interest in view of growing evidence for prehistoric structures, perhaps of a temporary or seasonal nature, on the peats. This occurs in the later Bronze Age (c.1000 radiocarbon years BC) at Chapel Tump (Whittle 1989), 2km south of Vurlong Reen. Later in the Iron Age there is much more extensive evidence of buildings and trackways on the peat at Goldcliff (Bell 1993) 9km south west of Vurlong Reen. The implication is that by the time of these structures on the bog parts at least of the Levels were fringed by a largely open agricultural landscape owing much of its character to human agency. At Vurlong Reen despite the evidence for clearance and some dung beetles (Smith 1993) possibly indicating grazing animals, there is no clear evidence of settlement nearby. The small number of undiagnostic flint flakes and tools found in 1990 (Parkhouse and Lawler 1990, 57) and 1992 (Dingwall and Ferris 1993, 10) can probably be interpreted as the result of casual losses whilst doing tasks at the wetland fringe.

Vurlong Reen is rather a good example of how various strands of palaeoenvironmental evidence can complement one another. The pollen, plant macrofossils and beetles tell an essentially similar story of alder carr being replaced by wetter sedge fen and eventually overwhelmed by estuarine deposits, yet each source of evidence adds colour and clarity to the picture.

The Stoop Hill site is much less straightforward and more restricted in terms of its implications. The deposits investigated here in 1992 were entirely minerogenic in character and analytical work has accordingly been of a more limited nature. The evidence indicates a long, complex sedimentary history which it was not possible to investigate comprehensively within the terms of the present archaeological project. The main analytical emphasis has been on the later part of the sequence which contains some artifacts. As regards the earlier deposits, significant changes of interpretation have now been made subsequent to the provisional, largely field-based interpretations put forward by Bell in Parkhouse and Lawler (1990). These arise as the result of more detailed examination of the lower sediments by specialists in 1992 and from subsequent analytical work. The main issue which has been clarified has been the date of the basal beach deposits. These were examined by Professor J.R.L. Allen who is of the opinion that they correspond to the last interglacial beach now known from a number of sites in the Gwent Levels. Similar beach deposits with cemented sandrock are present at Goldcliff (Bell 1993). The second major revision concerns the overlying silt-rich deposits. In 1990 these were not investigated in detail and their origin was unclear. The possibility was suggested that they represented lower energy estuarine deposits postdating the beach. However, in 1992 Dr Susan Limbrey examined this sediment in the field and came to the conclusion that it was loess, and this identification is confirmed by her detailed laboratory analysis. That interpretation is supported by the high proportions of silt indicated by John Crowther's particle size analyses. When the section was extended to the west it became clear that these deposits extended upslope which rules out an estuarine origin. Dr John Catt (1978) has carried out a detailed and long-term investigation of the mineralogical composition of loess. He has agreed to examine the mineralogy of sample 97 from context 1010 (Dingwall and Ferris 1993, Figure 4) and this will provide a further test of the nature of this deposit. With the overlying deposits there remains a degree of uncertainty about the precise boundary between the probable loess and the overlying Holocene stratigraphy. Crowther (above) infers the position of that boundary on the basis of the physical and chemical properties of the sediments. Further information is provided by Dr Limbrey's micromorphological work. On present evidence, however, it appears that the 1990 context 013: 267 (Parkhouse and Lawler 1990, Figure 9) and the 1992 contexts 1A:1003;1019 mark the probable base of the Holocene sequence. This interpretation seems to be in line with the reported presence of charcoal and a few artifacts in the 1990 and 1992 trenches.

The earliest well-defined Holocene deposits consist of a series of apparently fine-textured estuarine bands in the middle of the 1990 trench (Parkhouse and Lawler 1990, Figure 9). To the west these interleaved with lenses of probable colluvial origin (eg 013:266). To the east they appeared to have been cut away by a palaeochannel which contained some flint artifacts. This is the only context on this site to produce waterlogged biological evidence (Parkhouse and Lawler 1990, Chapter 5) which indicated a brackish / marine influence. The palaeochannel was filled with clays which are interpreted as of marine origin. At the eastern end of the 1990 Trench 013 these make up the rest of the sequence. At the western end the content of stone, sand and silt is greater, indicating that at the base of the slope the marine deposits are intermingled with a colluvial component derived from erosion on the slope. This is indicated by John Crowther's particle size and chemical data, and is confirmed by Professors Allen's report based on estuarine microfossils and sediments which indicates that context 1018 (Dingwall and Ferris 1993, Figure 4) is estuarine and that context 1019 is a mixture of colluvial and estuarine material. The micromorphological study clarifies the relative contributions of these two processes to individual sedimentary contexts. At present the Holocene sequence at the wetland / dryland interface at the west end of Trench 013 (Parkhouse and Lawler 1990, Figure 9 and 10) and the east end of Trench 1A appears to be as follows:-

(1) Weathered loess? The micromorphological study helps to clarify the extent of Holocene pedogenesis.

(2) Sediments with a colluvial component (1A-1019; 013-266). This contained a possible prehistoric sherd in 1990 (Parkhouse and Lawler 1990, 57) and ?? no later material?

(3) Estuarine sediment (1A-1018 and ? 1017; 013-265 and ? 264).

(4) Sediments with a colluvial component (1A- 1001; 013-263, 262). In 1990 262 and 263 contained a little material of probable Roman date.

The last unit may therefore relate to activity associated with the hypothesised Roman villa or may contain reworked Roman material in a later deposit. The presence of significant colluvial deposits at the base of Stoop Hill would seem to explain the way that the crop marks of this site appear to fade towards the base of the slope. The relative paucity of artifacts in the Stoop Hill colluvial deposits may put a questionmark over the nature or longevity of the hypothesised villa and is certainly in very marked contrast to the artifactually very rich colluvial deposits previously investigated in South East and Central Southern England (Bell 1986).

Acknowledgements

Thanks are due to the field teams who undertook the excavation work; Ian Ferris, Lucie Dingwall, Jon Sterenberg, Ed Newton, Sally Finter, Bob Burrows, Mark Hewson, Laurence Pontin, Mark Williams, Laurence Jones and Chris Wild. Thanks also to the various specialists who made field and sampling visits and whose names appear on the various sections of the report, and to Professor John Allen for his on-site discussion of the work.

At B.U.F.A.U. Lynne Bevan reported on the flints and Dr. Ann Woodward on the prehistoric pot sherd; Dr. Jeremy Evans examined the Roman pottery. The figures for this report were prepared by Mark Breedon; the report was typed and formatted by Ann Humphries.

Bibliography

Allen, J.R.L. (1987) Late Flandrian shoreline oscillations in the Severn Estuary: the Rumney Formation at its typesite (Cardiff area). Philosphical Transactions of the Royal Society, London, B315, 157-184.

Allen, J.R.L. & Fulford, M.G. (1986) The Wentlooge Level: a Romano-British saltmarsh reclamation in southeast Wales. Britannia 17, 91-117.

Allen, J.R.L. and Rae, J.J. (1988) Vertical saltmarsh accretion since the Roman period in the Severn Estuary, South West Britain Marine Geology 83, 225-235.

Allen, J.R.L. & Rae, J.E. (1987) Late Flandrian shoreline oscillations in the Severn Estuary: a geomorphological and stratigraphical reconnaissance. Philosophical Transactions of the Royal Society, of London B315, 185-230.

Anderson, J.G.C. (1968) The concealed rock surface and overlying deposits of the Severn Valley and estuary from Upton to Neath. Proceedings of the South Wales Institute of Engineers 83, 27-47.

Balfour-Browne, F. (1950) British Water Beetles. II. The Ray Society, London.

Ball, D.F. (1964) Loss-on-ignition as an estimate of organic matter and organic carbon in non-calcareous soils. Journal of Soil Science 15, 84-92.

Barnett, C., Stanley, P., Trett, R. and Webster, P.V. (1990) Romano-British pottery kilns at Caldicot, Gwent. Archaeological Journal 147, (1991) 118-147.

Behre, K.-E. (ed) (1986) Anthropogenic Indicators in Pollen Diagrams. Balkema, Rotterdam.

Bell, M. (1986) Archaeological evidence for the date, cause and extent of soil erosion on the chalk. SEESOIL 3, 72-83.

Bell, M. (1986) Brean Down Excavations, Current Archaeology 102 1986, 218-221.

Bell, M.G. (1990) Interpretation of stratigraphy. Pp. 21-24 in Archaeology of the Second Severn Crossing: Assessment and recommendations for Gwent (J. Parkhouse and M. Lawler, eds). Swansea: Glamorgan-Gwent Archaeological Trust.

Bell, M. (1993) Field survey and excavation at Goldcliff, Gwent 1993. Archaeology in the Severn Estuary 1993: Annual Report of the Severn Estuary Levels Research Committee. Lampeter: SELRC, 79-100

Bell, M. & Walker, M.J.C. (1992) Late Quaternary Environmental Change. Physical & Human Perspectives. Longman, London.

Bell, M. et al. (1993) A palaeoenvironmental study of the Nant Hall Road and Melyd Avenue sites, Prestatyn, Clwyd. Unpublised report to Clwyd-Powys Archaeological Trust by the Palaeoenvironmental Research Centre, Lampeter.

Beckett, S. (1978) The environmental setting of the Meare Heath Track. Somerset Levels Papers 4, 42-46.

Beckett, S. (1979) The environmental setting of the Sweet Track, Drove site. Somerset Levels Papers 5, 75-83.

Bennett, K.D. (1990) Postglacial history of alder (Alnus glutinosa (l.) Gaertn.) in the British Isles. Journal of Quaternary Science 5, 123-133.

Birks, H.J.B. (1989) Holocene isochrone maps and patterns of tree-spreading in the British Isles. Journal of Biogeography 16, 503-540.

Caseldine, A.E. (1980) Palaeoenvironmental reconstruction at the Baker site .Somerset Levels Papers 6, 29-36.

Caseldine, A.E. (1984) Palaeobotanical investigations at the Sweet Track. Somerset Levels Papers 10, 65-78.

Caseldine, A.E. 1990 Environmental Archaeology in Wales. Lampeter: St David's University College.

Caseldine, A. (1991) Recent pollen investigations at Uskmouth. Severn Estuary Levels Research Committee Annual Report 1991, 4-5.

Catt, J.A. (1978) The contribution of loess to soils in lowland Britain. In Limbrey, S. and Evans, J.G. (eds.) The effect of man on the landscape: the lowland zone. London: Council for British Archaeology Research Report 21, 12-20.

Clapham, A.R., Tutin, T.G. & Moore, D.M. (1987) Flora of the British Isles. 3rd edition. Cambridge University Press, Cambridge.

Clark, A.J. (1990) Seeing beneath the soil. Batsford, London.

Coles, B. and Coles, J. (1986) Sweet Track to Glastonbury.

Coles, J.M., Coles, B.J., Morgan, R.A. and Caseldine, A.E. (1985) The Meare Heath Track . Somerset Levels Papers 14, 6-33.

Coope, G.R. and Osborne, P.J. (1968) Report on the Roman Well at Barnsley Park, Gloucester. Transactions of the Bristol and Gloucestershire Archaeological Society 86, 84-87

Crowther, J. (1990) Laboratory report on sediments. Pp. 31-36 in Archaeology of the Second Severn Crossing: Assessment and recommendations for Gwent (J. Parkhouse and M. Lawler, eds). Swansea: Glamorgan-Gwent Archaeological Trust.

Dick, W.A. and Tabatabai, M.A. (1977) An alkaline oxidation method for the determination of total phosphorus in soils. Journal of the Soil Science Society of America 41, 511-14.

Dingwall, L. and Ferris, I. (1993) Archaeological Investigations in 1992 on the Gwent Approaches to the Second Severn Crossing: a Post-Excavation Assessment BUFAU Report no. 236.

Edwards, K.J. (1988) The hunter/gatherer/agricultural transition and the pollen record in the British Isles. In The Cultural Landscape - Past, Present and

Future (edited by H.H. Birks, H.J.B. Birks, P.E. Kaland & D. Moe), Cambridge University Press, Cambridge, 255-266.

Edwards, K.J. (1993) Models of mid-Holocene forest farming for north-west Europe. In Climatic Change and Human Impact on the Landscape (edited by F.M. Chambers), Chapman & Hall, London, 133-145.

Edwards, K.J. & Hirons, K.R. (1984) Cereal pollen grains in pre-elm decline deposits: implications for the earliest agriculture in Britain and Ireland. Journal of Archaeological Science 11, 71-80.

Ferris, I. & Dingwall, L. (1992) Archaeological investigations in 1992 on the Gwent Approaches to the Second Severn Crossing. In Severn Estuary Levels Research Committee, Annual Report, 1992 (edited by M. Bell), CADW: Welsh Historic Monuments, Cardiff, 39-44.

Fulford, M.G. Wales. Britannia 17, 91-117.

GGAT (1990) Archaeology of the Second Severn Crossing: Assessment and Recommendations for Gwent.

GGAT (1991) Second Severn Crossing: A Watching Brief Undertaken at Stoop Hill, Caldicot, Gwent.

Girling, M. (1976) Fossil Coleoptera from the Somerset Levels: The Abbots Way. Somerset Levels Papers 2, 28-33.

Girling, M. (1977) Fossil Insect Assemblages from Rowland's Track. Somerset Levels Papers 3, 51-60.

Girling, M. (1980) The Fossil Insect Assemblage from the Meare Lake Village. Somerset Levels Papers 6. 24- 32.

Girling, M. (1984) Investigations of a Second Insect Assemblage from the Sweet Track. Somerset Levels Papers. 10, 78-91.

Godbold, S. and Turner, R. (1992) Second Severn Crossing 1991: Welsh Intertidal Zone .Severn Estuary Levels Research Committee Annual Report 1992, 45-56.

Godwin, H. (1941) Studies in the post-glacial history of British vegetation. IV. Correlations in the Somerset Levels. New Phytologist 40, 108-132.

Godwin, H. (1948) Studies of the post-glacial history of British vegetation. X. Correlation between climate, forest composition, prehistoric agriculture and peat stratigraphy in Sub-boreal and Sub-atlantic peats of the Somerset Levels. Philosophical Transactions of the Royal Society of London B233, 275-286.

Godwin, H. & Willis, E.H. (1964) Cambridge University Natural Radiocarbon Measurements. VI. Radiocarbon, 6, 116-137.

Green, S. (1989) Some recent archaeological and faunal discoveries from the Severn Estuary Levels .Bulletin of the Board of Celtic Studies 36 1989, 187-199.

Green, S. and Whittle, A. (1990) Mesolithic footprints at Uskmouth and Magor Pill .Severn Estuary Levels Research Committee Annual Report 5.

Greig, J. (1982) Past and present lime woods of Europe. In Archaeological Aspects of Woodland Ecology (edited by M. Bell & S. Limbrey), British Archaeological Reports International Series 146, 23-35.

Hamond, F.W. (1983) Phosphate analysis of archaeological sediments. Pp. 47-80 in Landscapc and archaeology in Ireland (T. Reeves-Smyth and F.W. Hamond, eds). BAR 116.

Hansen, M. (1987) The Hydrophilidea (Coleoptera) of Fennoscania and Denmark. Fauna Entomologica Scandinavica Vol.18.

Hansen, M. 1987. The Hydrophilidea (Coleoptera) of Fennoscania and Denmark. *Fauna Entomologica Scandinavica.* Vol. 18.

Harde, K.W. (1984) A Field Guide in Colour to Beeltes.

Hawkins, A.B. ? Sea Level Changes around South West England in ed. D.J. Blackman Marine Archaeology, 67-89.

Hibbert, F.A. (1980) Possible evidence for sea-level change in the Somerset Levels. In Archaeology and Coastal Change (edited by F.H. Thompson), Society of Antiquaries of London, 103-105.

Hincks, W.D. n.d. Handbook for the Identification of British Insects 11(3). Royal Entomological Society of London.

Hodgeson, J.M. (1976) Soil Survey Field Handbook.

Hogg, A.H.A. (1976) Castle Ditches, Llancarfan, Glamorgan. Archaeologia Cambrensis 125, 13-39.

Housley, R.A. (1988) The environmental context of Glastonbury Lake Village. Somerset Levels Papers 14, 63-82.

Hughes, E.G. (1992) Thornwell Farm, Chepstow, 1992: Area II Assessment and Post-Excavation Research Design BUFAU Report no. 232.

Huntley, B. & Birks, H.J.B. (1983) An atlas of past and present pollen maps of Europe: 0-13,000 years ago. Cambridge University Press.

Jermy, A.C., Chater, A.O., and David, R.W. (1982) Sedges of the British Isles. BSBI Handbook No 1, Botanical Society of the British Isles, London.

Jessop, L. (1988) Scarabidae. Handbooks for the identification of British Insects. Vol.V (11) The Royal Entomological Society of London.

Kenward, H.K., Hall, A.R. and Jones, A.K.G. (1980) A tested set of techniques for the extraction of plant and animal macrofossils from waterlogged archaeological deposits. Scientific Archaeology, 22, 3-15.

Kloet, G.S. & Hincks, W.D. (1977) A check list of British Insects (2nd. ed.) Coleoptera and Strepsiptera. Handbooks for the Identification of British Insects. 11(3). Royal Entomological Society of London.

Koch, K. (1989) Die Käfer Mitteleuropas. Ökologie. Band 1.

Koch, K. (1992) Die Käfer Mitteleuropas. Ökologie. Band 3.

Langohr, R. and Pajares, G. (1983) The chronosequence of pedogenic processes in Fraglossudalfs of the Belgian loess belt. In P.Bullock and C.P. Murphy (eds) Soil Micromorphology. Vol 2: Soil Genesis. Berkhampstead: A.B., 503-510.

Lewis, M.P. (1992) Mesolithic coastal exploitation in south west Wales with particular reference to submerged forests. Ph.D. thesis, Saint David's University College, Lampeter.

Lindroth, C.H. (1985) The Carabidae (Coleoptera) of Fennoscandia and Denmark. Fauna Entomologica Scandinavica. Vol.1, Part 1.

Lindroth, C.H. (1986) The Carabidae (Coleoptera) of Fennoscandia and Denmark. Farna Entomological Scandinavica. Vol.1, Part 2.

Locke, S. (1972) The post-glacial deposits of the Caldicot Level and some associated archaeological discoveries. Monmouthshire Antiquary 3, 1-16.

Lowe, J.J. (1982) Three Flandrian pollen profiles from the Teith Velley, Perthshire, Scotland. II. Analysis of deteriorated pollen. New Phytologist 90, 371-385.

Lucht, W.H. (1987) Die Käfer Mitteleuropas. Katalog.

Morgan, L.A. ? Parallel to the Peats of the Somerset Levels. New Phytologist 112, 145-167.

Moore, P.D. Webb, J.A. & Collinson M.E. (1991) Pollen Analysis. 2nd edition. Blackwell, Oxford.

Nash-Williams, V.E. (1933) An Early Iron Age Hillfort at Llanmelin near Caerwent. Monmouthshire Archaeologia Cambrensis 88, 237-315.

Nayling, N. (1991) Caldicot Castle Lake. Archaeology in Wales 31, 20-21.

Page, C.N. (1982) The Ferns of Britain and Ireland. Cambridge University Press, Cambridge.

Parkhouse, J. (1990) Goldcliff .Severn Estuary Levels Research Committee Annual Report 1990, 11-16.

Parkhouse, J. and Lawler, M. (1990) Archaeology of the Second Severn Crossing: Assessment and Recommendations for Gwent. Swansea: Glamorgan-Gwent Archaeological Trust.

Parkhouse, J., Trett, R. and Upton, D. (1990) Goldcliff. Archaeology in Wales 30 1990, 49-51.

Parkhouse, J. (1991) Second Severn Crossing, English Approaches Stage 2 Archaeological Assessment. Severn Estuary Levels Research Committee Annual Report 1991, 29-32.

Parry, S. (1987) Gwent Levels Survey. Archacology in Wales 27 1987, 41-42.

Parry, S. (1990) Caldicot: A Late Bronze Age Maritime Site in Gwent. Severn Estuary Levels Research Committee Annual Report 1990, 5-11.

Parry, S. and Parkhouse, J. (1989) Caldicot Castle Lake. Archaeology in Wales 29 1989, 47-48.

Payton, R.W. (1992) Fragipan formation in argillic brown earths (Fragiudalfs) of the Millfield Plain, north-east England. I. Evidence for a periglacial stage of development. Journal of Soil Science 43, 621-644.

Payton, R.W. (1993a) as above. II.Post-Devensian development processes and the origin of fragipan consistence. Journal of Soil Science 44, 703-724.

Payton, R.W. (1993b) as above. III. Micromorphological, SEM and EDXRA studies of fragipan degradation and the development of glossic features. Journal of Soil Science 44, 725-740.

Peglar, S.M. (1993) The mid-Holocene Ulmus decline at Diss Mere, Norfolk, UK: a year-by-year pollen stratigraphy from annual laminations. The Holocene 3, 1-13.

Peglar, S.M. & Birks, H.J.B. (1993) The mid-Holocene Ulmus fall at Diss Mere, South-East England - disease and human impact? Vegetation History and Archaeobotany 2, 61-68.

Proudfoot, V.B. (1976) The analysis and interpretation of soil phosphorus in archaeological contexts. Pp. 93-113 in Geoarchaeology (D.A. Davidson and M.L. Shackley, eds). London: Duckworth.

Rackham, O. (1980) Ancient Woodland. Arnold, London.

Rodwell, J.S. (ed.) 1991 British Plant Communities: Volume 1 Woodlands and Scrub. Cambridge University Press, Cambridge.

Rudeforth, C.C., Hartnup, R. Lea, J.W. et al (1984) Soils and use in Wales. Bulletin No 11. Harpenden: Soil Survey of England and Wales.

Savory, H.N. (1954) The Excavation of an Early Iron Age Fortified Settlement on Mynydd Bychan, Llysworney (Glam.) 1949 - 50. Archaeologia Cambrensis 103 1954, 85-108.

Scollar, I., Tabbagh, A., Hesse, A. and Herzog, I. (1990) Archaeological prospecting and remote sensing. Cambridge University Press.

Smith, A.G. & Morgan, L.A. (1989) A succession to ombrotrophic bog in the Gwent Levels, and its demise: a Welsh parallel to the peats of the Somerset Levels. New Phytologist 112, 145-167.

Smith, A.J.E. (1978) The Moss Flora of Britain and Ireland. Cambridge University Press, Cambridge.

Smith, D. (1993) Coleoptera from Vurlong Reen, near Caldicot, South Wales. Archaeology in the Severn Estuary 1993: Annual Report of the Severn Estuary Levels Research Committee. Lampeter: SELRC, 71-74.

Stace, C. (1991) New Flora of the British Isles. Cambridge University Press, Cambridge.

Stuiver, M. & Reimer, P.J. (1993) Extended 14C data base and revised CALIB 3.0 14C age calibration program. Radiocarbon 35, 215-230.

Trett, R. and Parry, S. (1986) Newport Museum. Archaeology in Wales 26 1986, 6-7.

Trett, R. (1987) Reported Finds - Mesolithic/Neolithic. Archaeology in Wales 27 1987, 41.

Trett, R. (1987) Newport Museum. Archaeology in Wales 27 1987, 6.

Turner, J. (1962) The Tilia decline: an anthropogenic interpretation. New Phytologist 61, 328-341.

van Vliet, B. and Langohr, R. (1983) Evidence of disturbance by frost of pore ferriargillans in silty soils of Belgium and northern France. In P. Bullock and C.P. Murphy (eds) Soil Micromorphology. Vol 2: Soil Genesis. Berkhampstead: A.B., 511-518.

Webster, P.V. (1993) The post-fortress coarsewares, in Manning, W.H.(ed), Report on the excavations at Usk 1965-1976; The Roman pottery 227-364, Cardiff.

Whittle, A. (1989) Two later Bronze Age occupations and an Iron age channel on the Gwent foreshore. Bulletin of the Board of Celtic Studies 36, 200-223.

Whittle, E. (1992) A Guide to Ancient and Historic Wales: Glamorgan and Gwent. CADW (187).

Williams, G.J. (1968) The buried channel and superficial deposits of the River Usk, and their correlation with similar features of the Lower Severn. Proceedings of the Geologists' Association 79, 325-348.

List of Figures

(All drawings by M. Breedon)

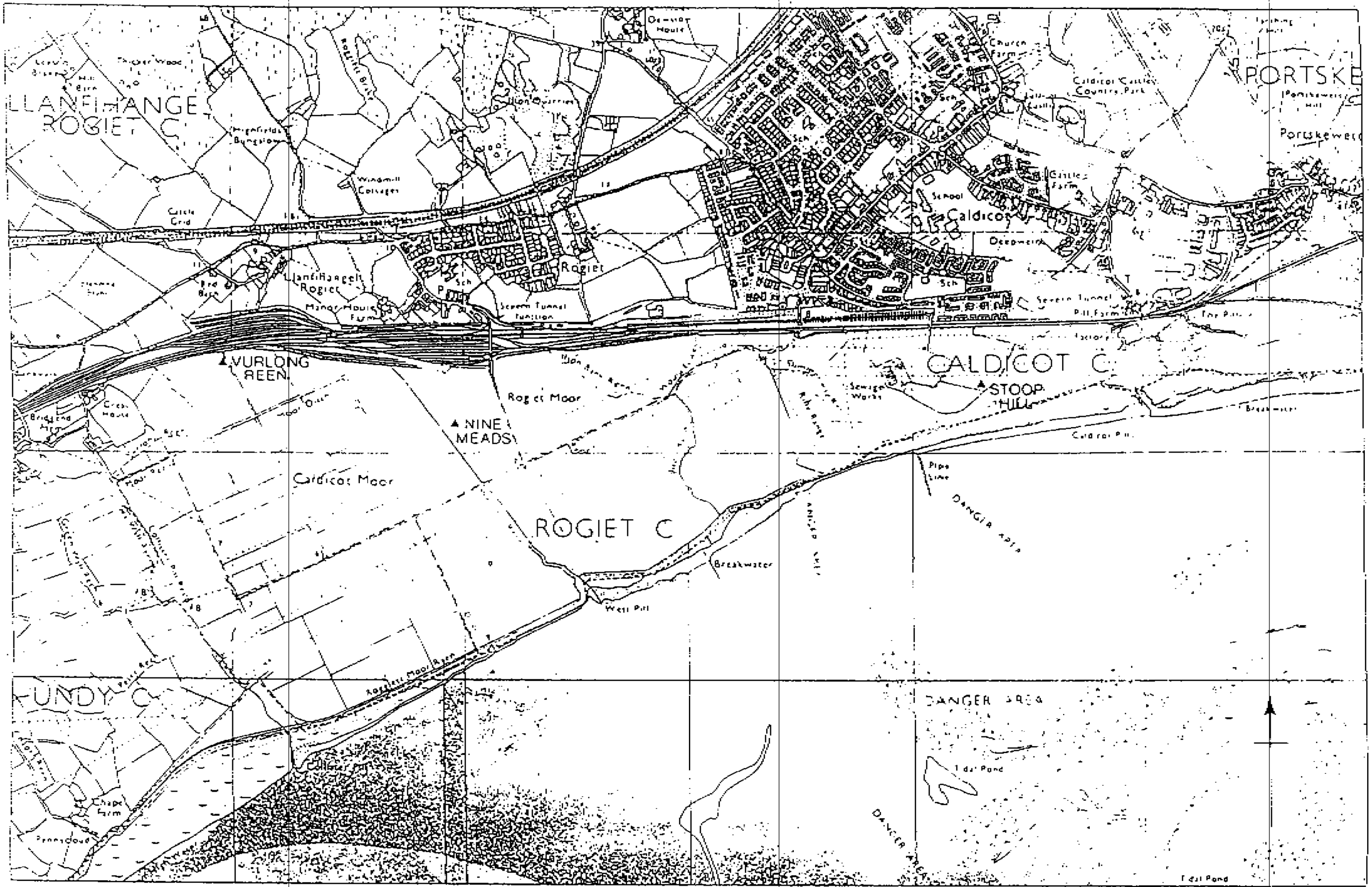

LLANFIHANGE
ROGIET C
PORTSKE
Portskewett
Caldicot Castle Country Park
Church Farm
Caldicot
School
Deepweir
Rogiet
Llanfihangel Rogiet
Manor House Farm
Severn Tunnel Junction
Severn Tunnel
Pill Farm
Windmill Cottages
Highfields Bungalow
VURLONG REEN
NINE MEADS
Rogiet Moor
CALDICOT C
STOOP HILL
Sewage Works
Caldicot Moor
ROGIET C
Breakwater
Well Pill
UNDY C
Chapel Farm
DANGER AREA
Tidal Pond
Caldicot Pill
Pipe Line

Figure 1

Vurlong Reen – Trench Locations

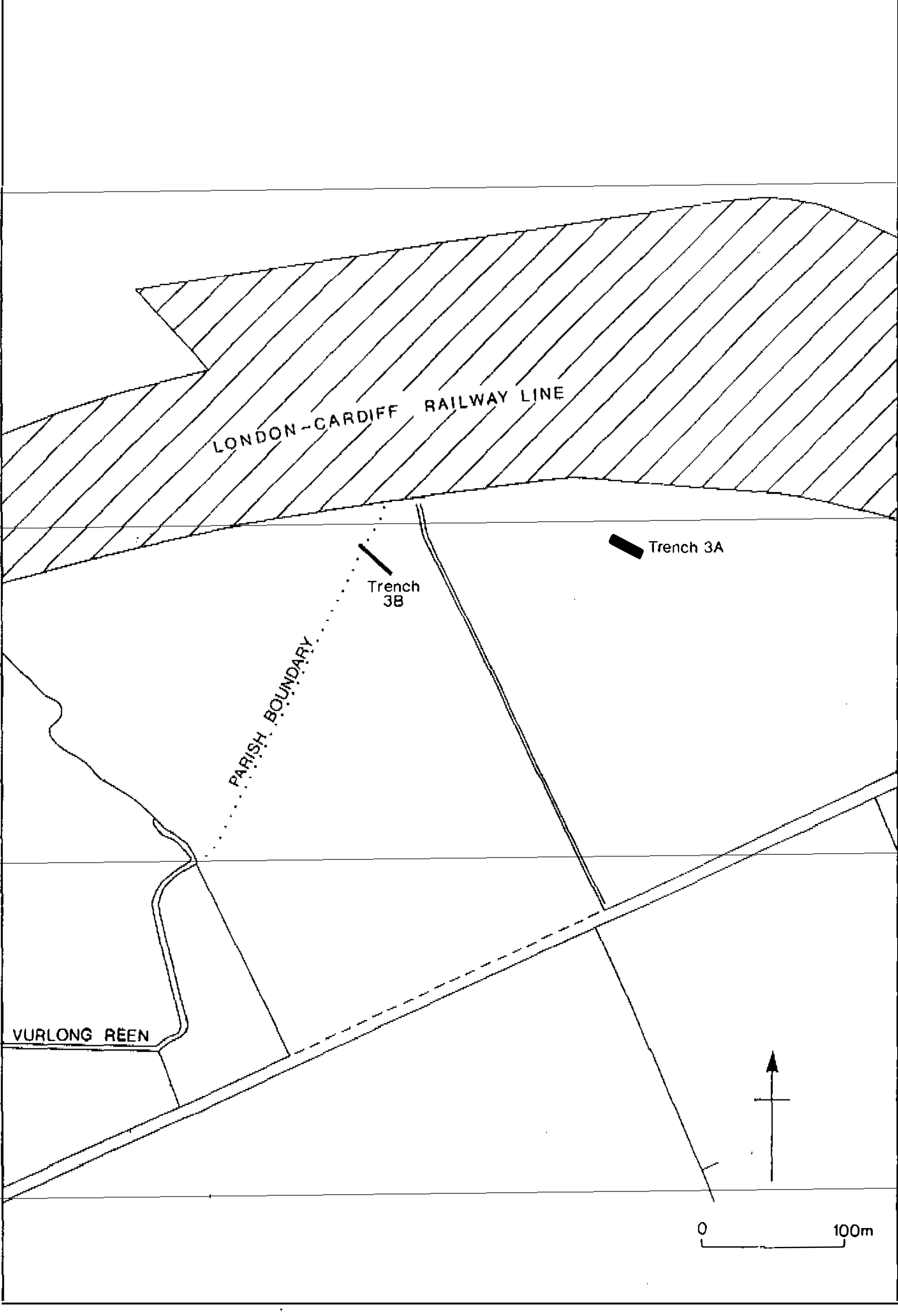


Figure 2

Vurlong Reen – Trench 3A

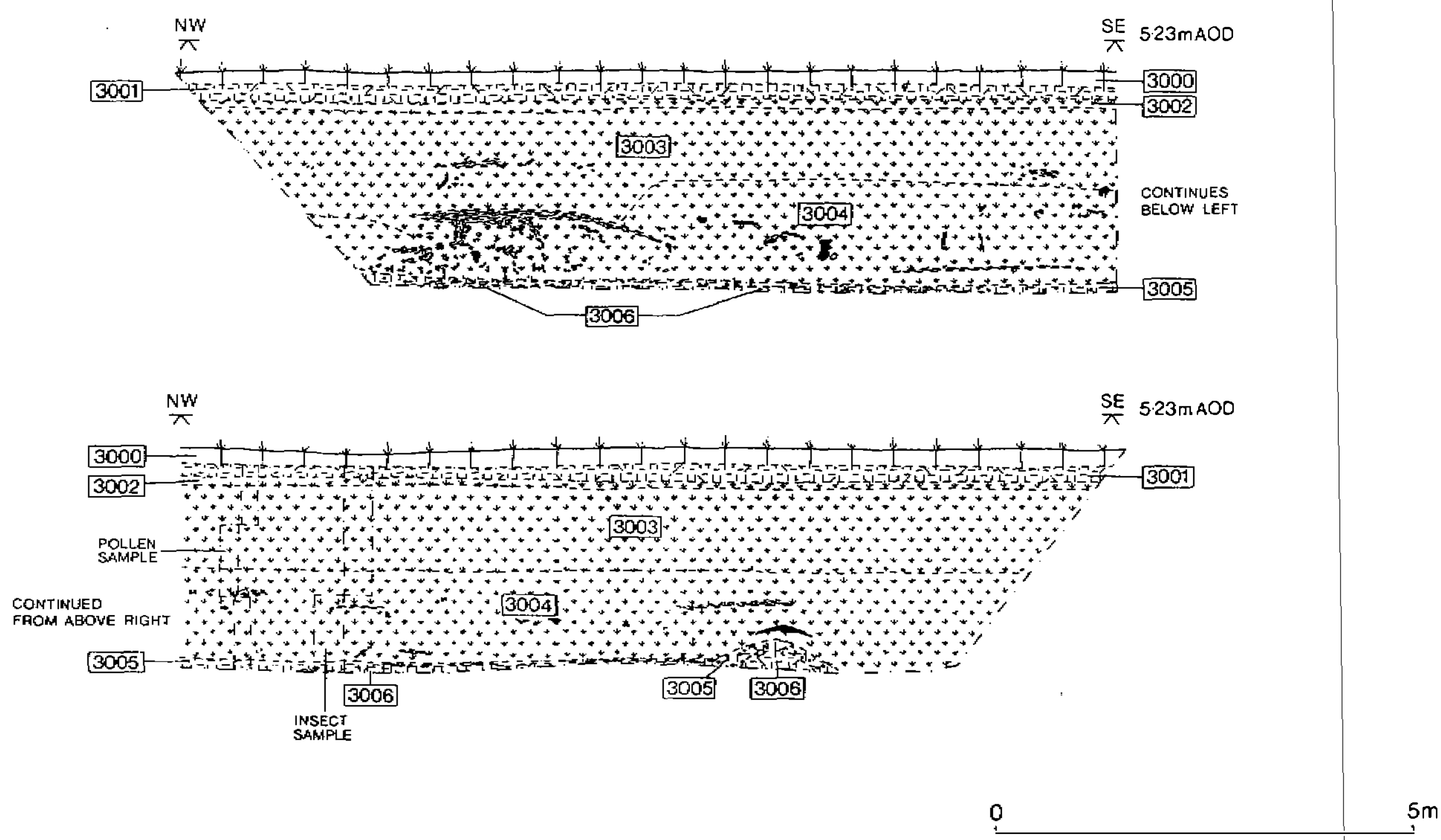


Figure 3

Vurlong Reen – Trench 3A

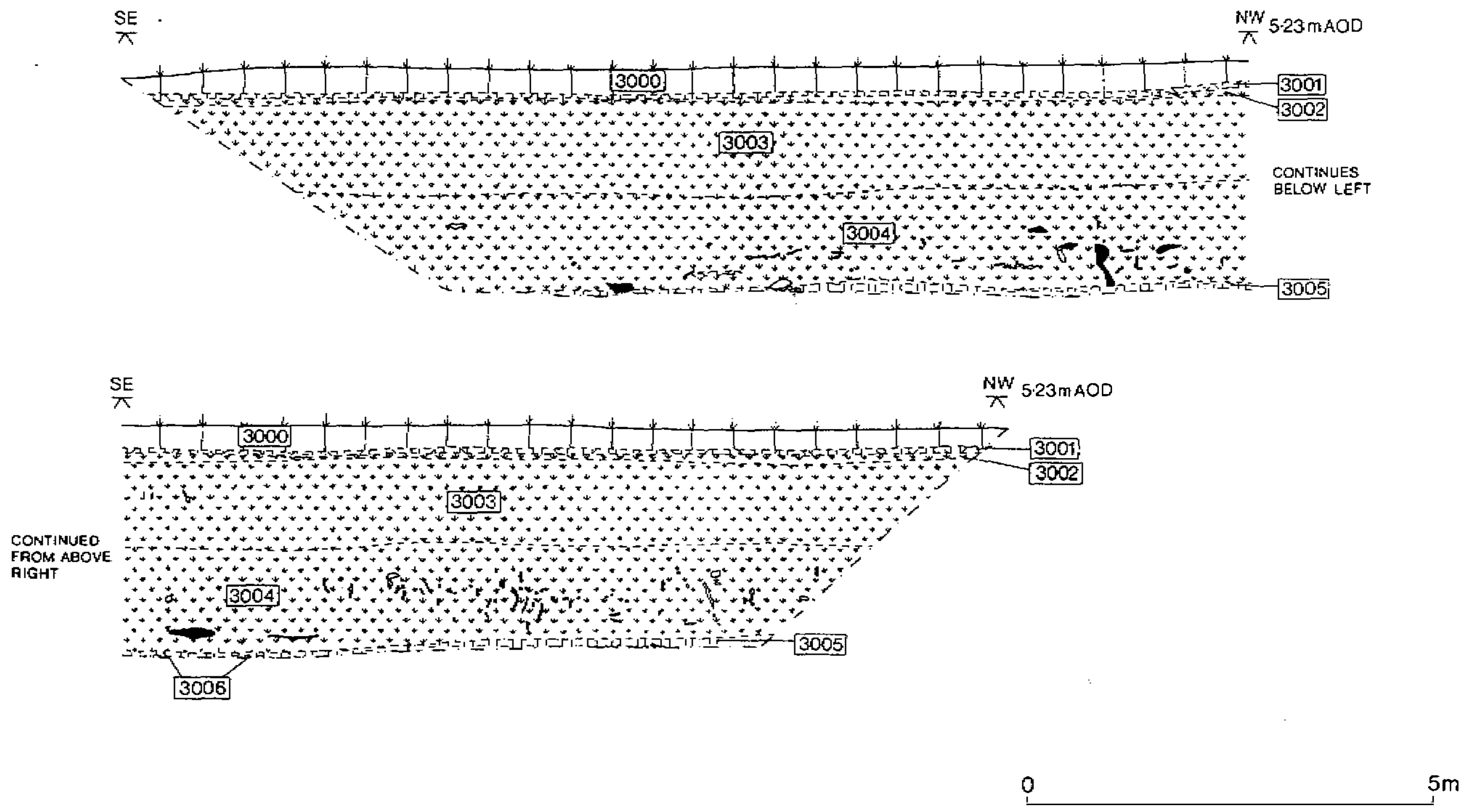


Figure 4

Vurlong Reen – Trench 3B

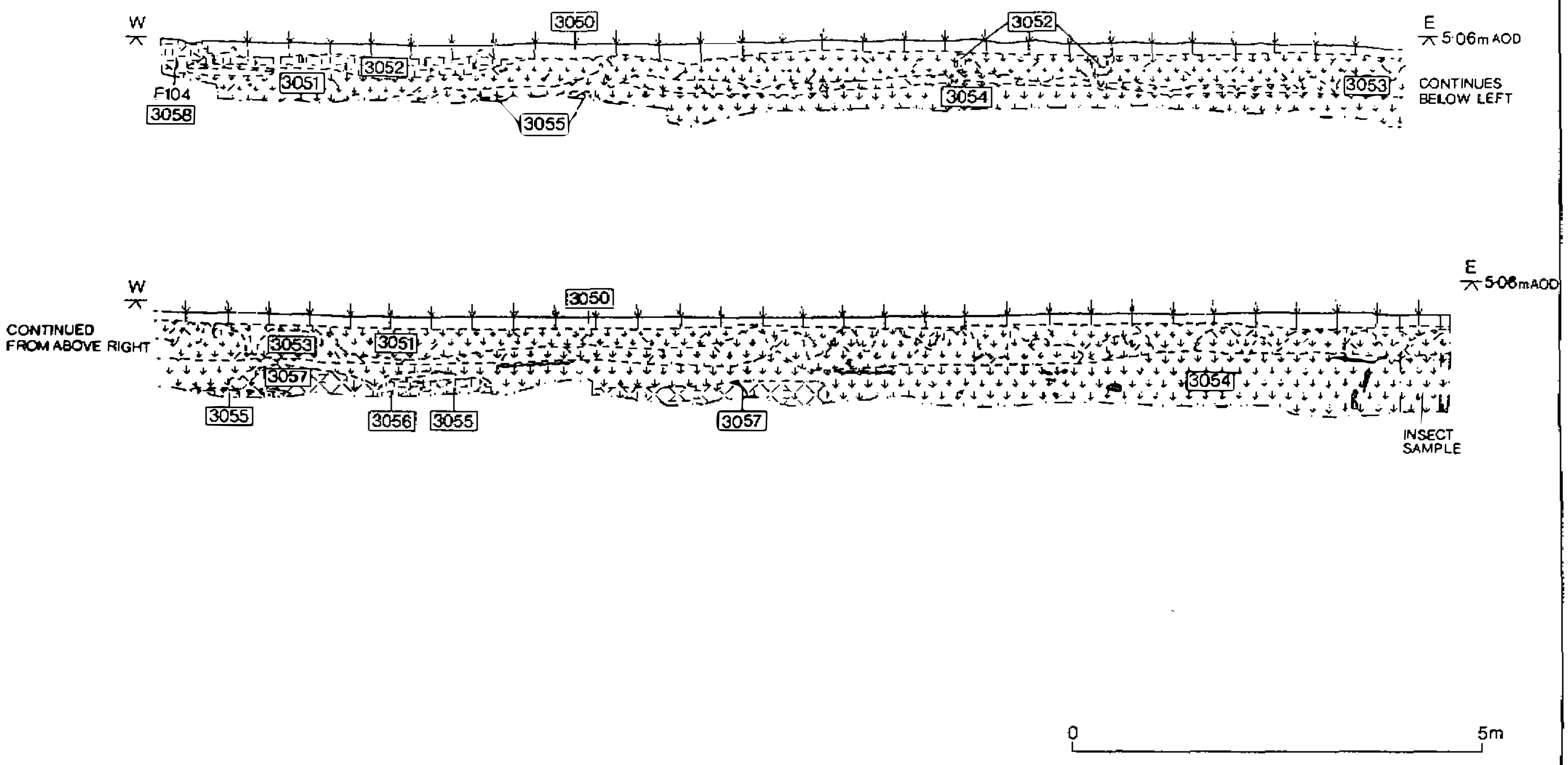


Figure 5

Vurlong Reen - Flint

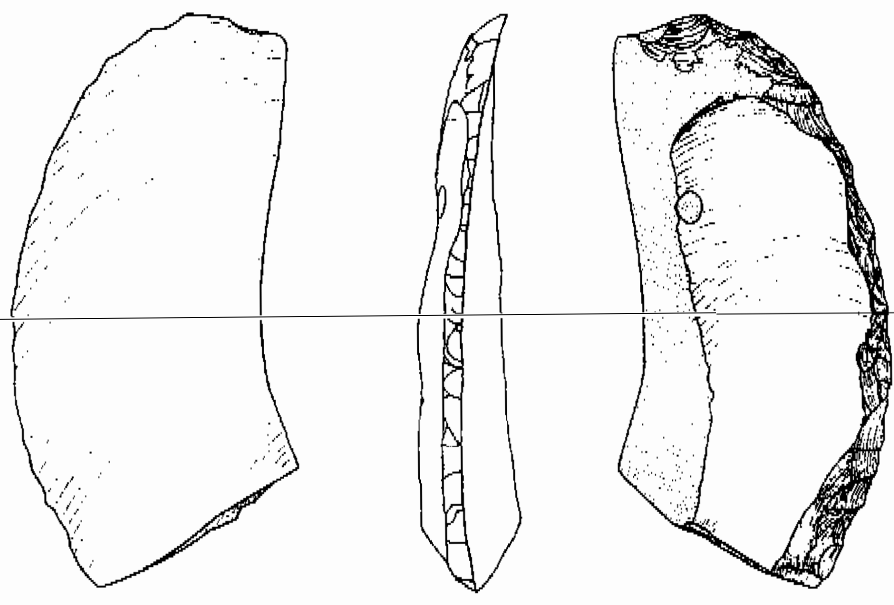


Figure 6

Stoop Hill - Trench Locations

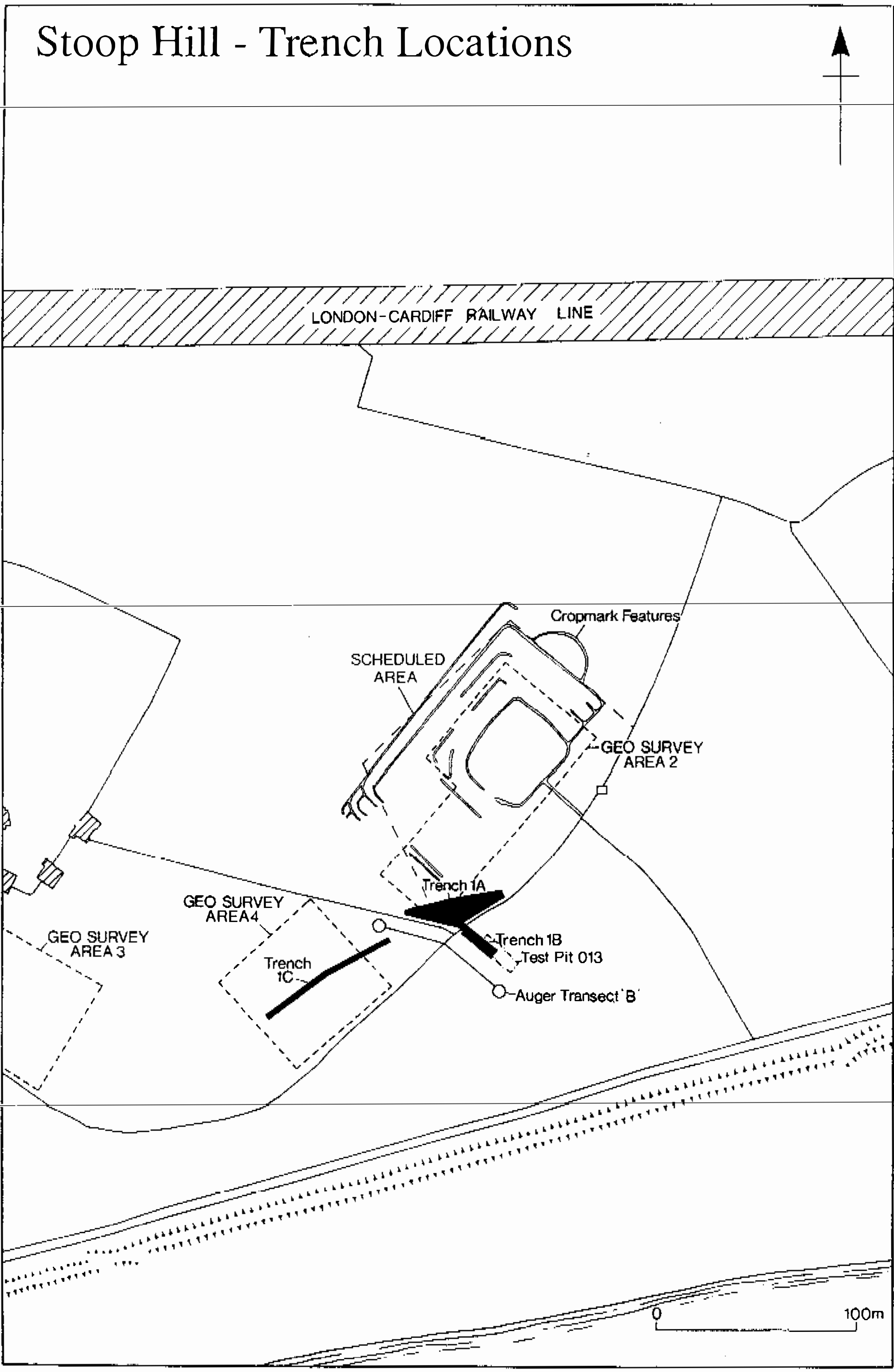


Figure 7

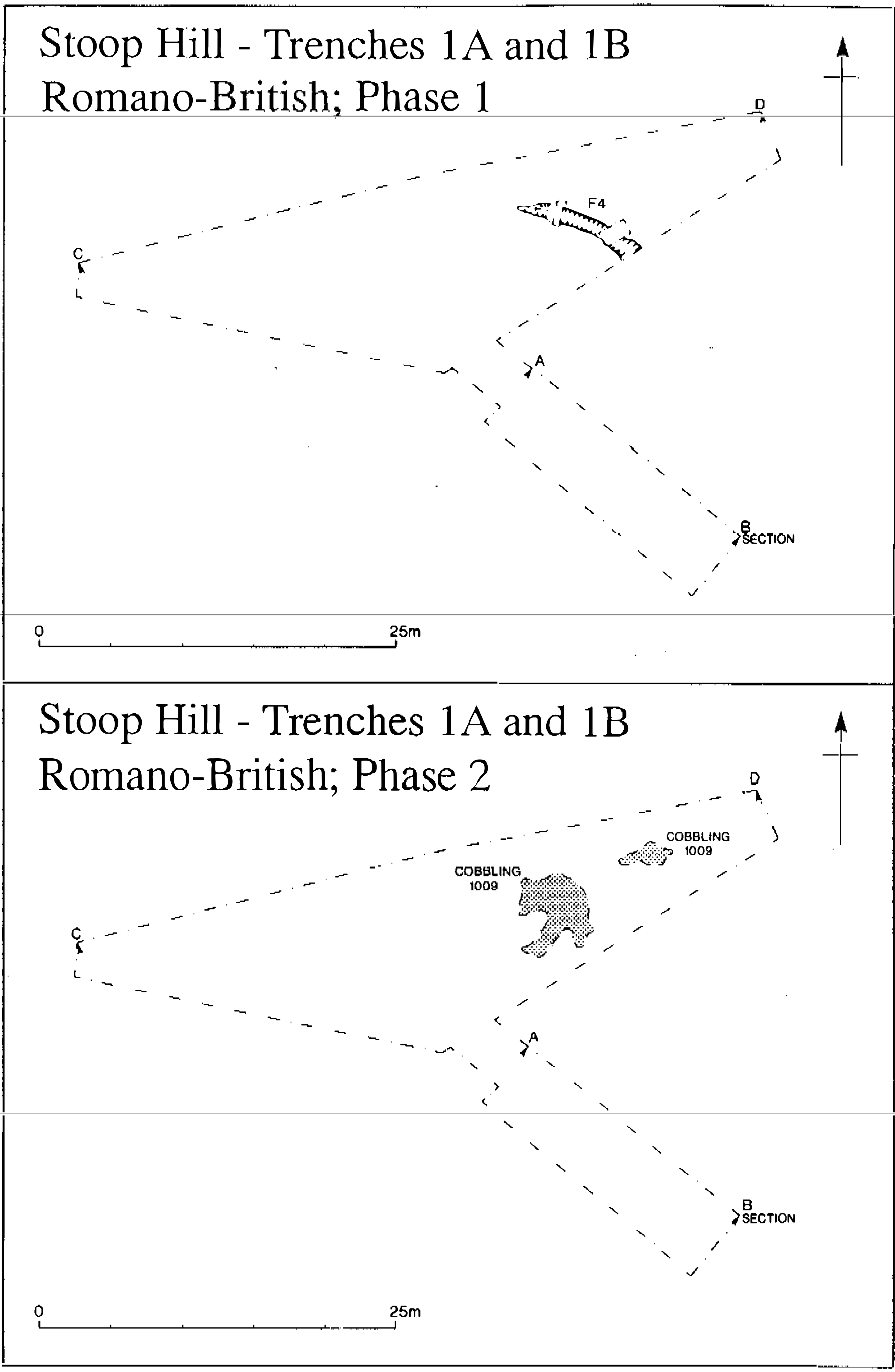

Stoop Hill - Trenches 1A and 1B
Romano-British; Phase 1
D
F4
C
A
B
SECTION
0
25m
Stoop Hill - Trenches 1A and 1B
Romano-British; Phase 2
D
COBBLING
1009
COBBLING
1009
C
A
B
SECTION
0
25m

Figure 8

Stoop Hill - Trench 1B
Phase 2. Cobbling (detail)

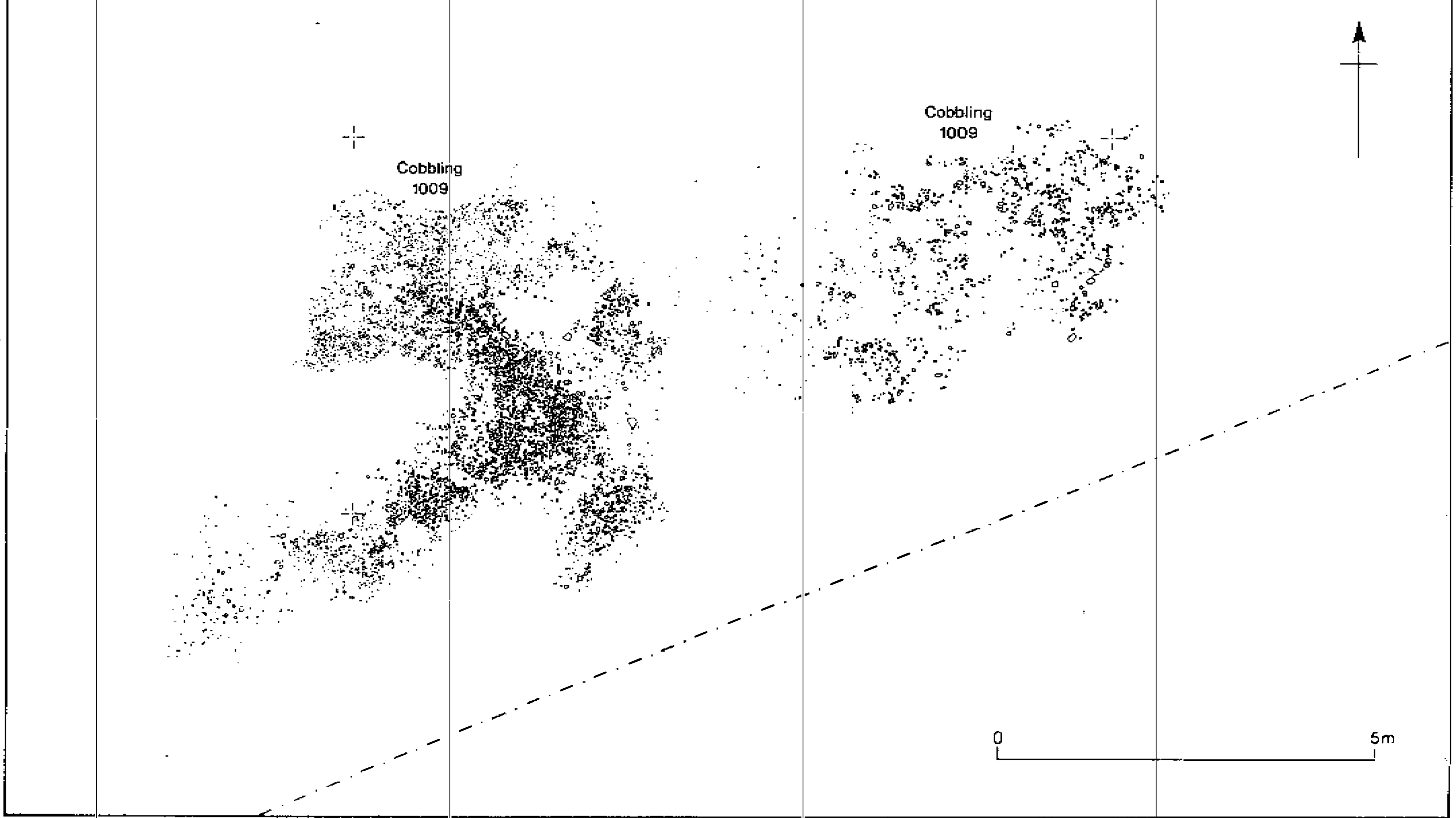


Figure 9

Stoop Hill - Trench 1A

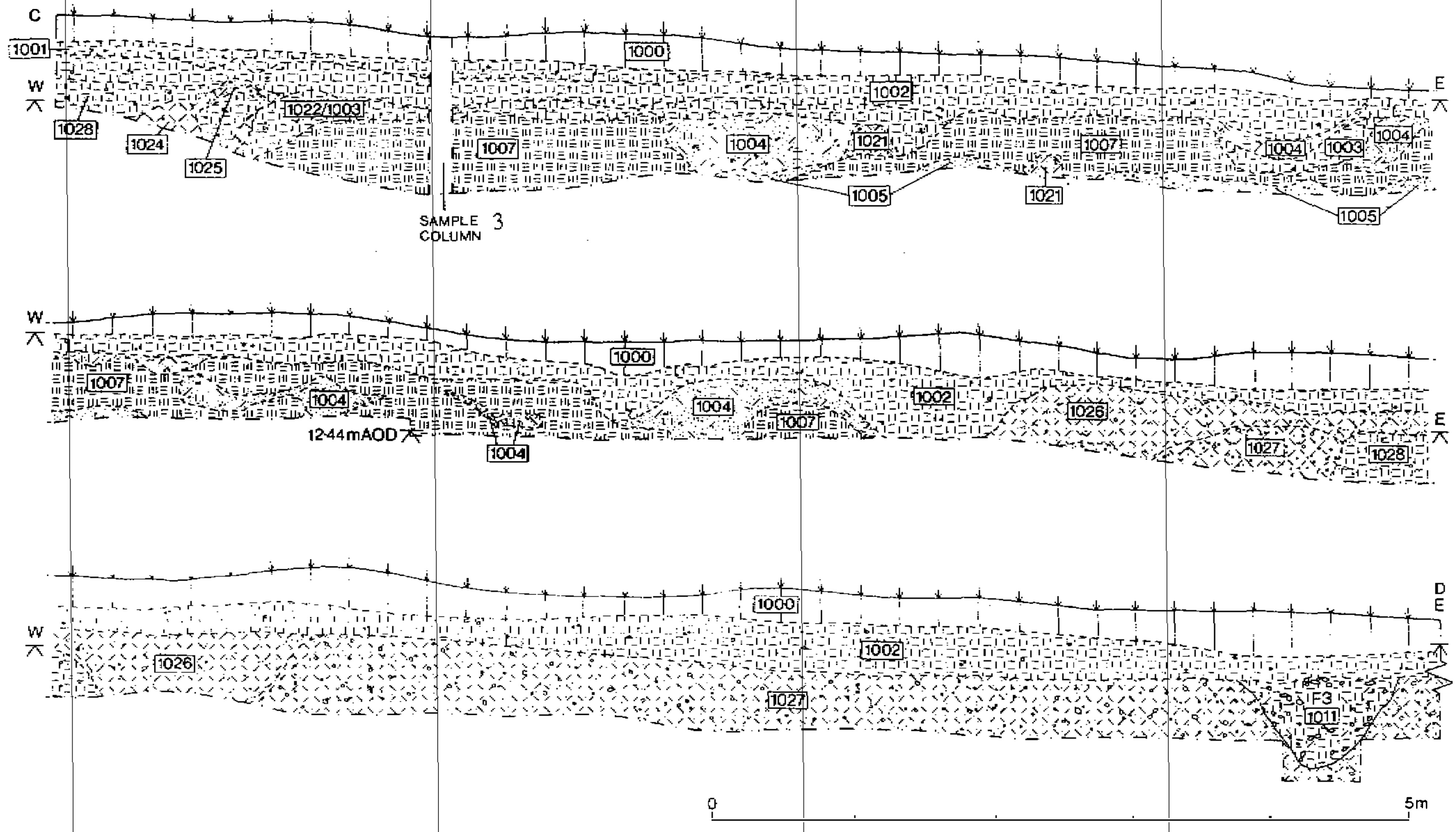


Figure 10

Stoop Hill - Trench 1B

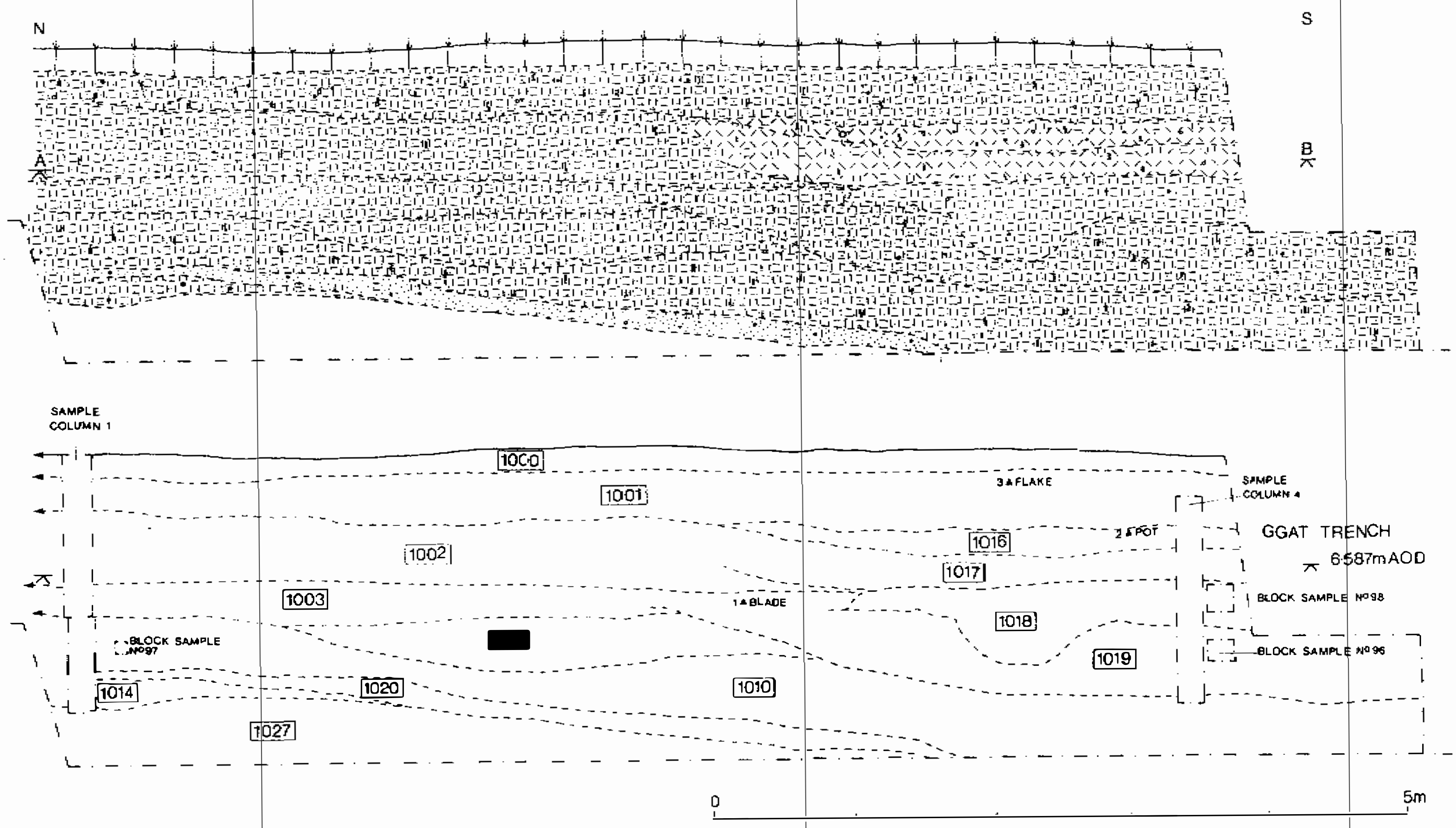


Figure 11

Stoop Hill

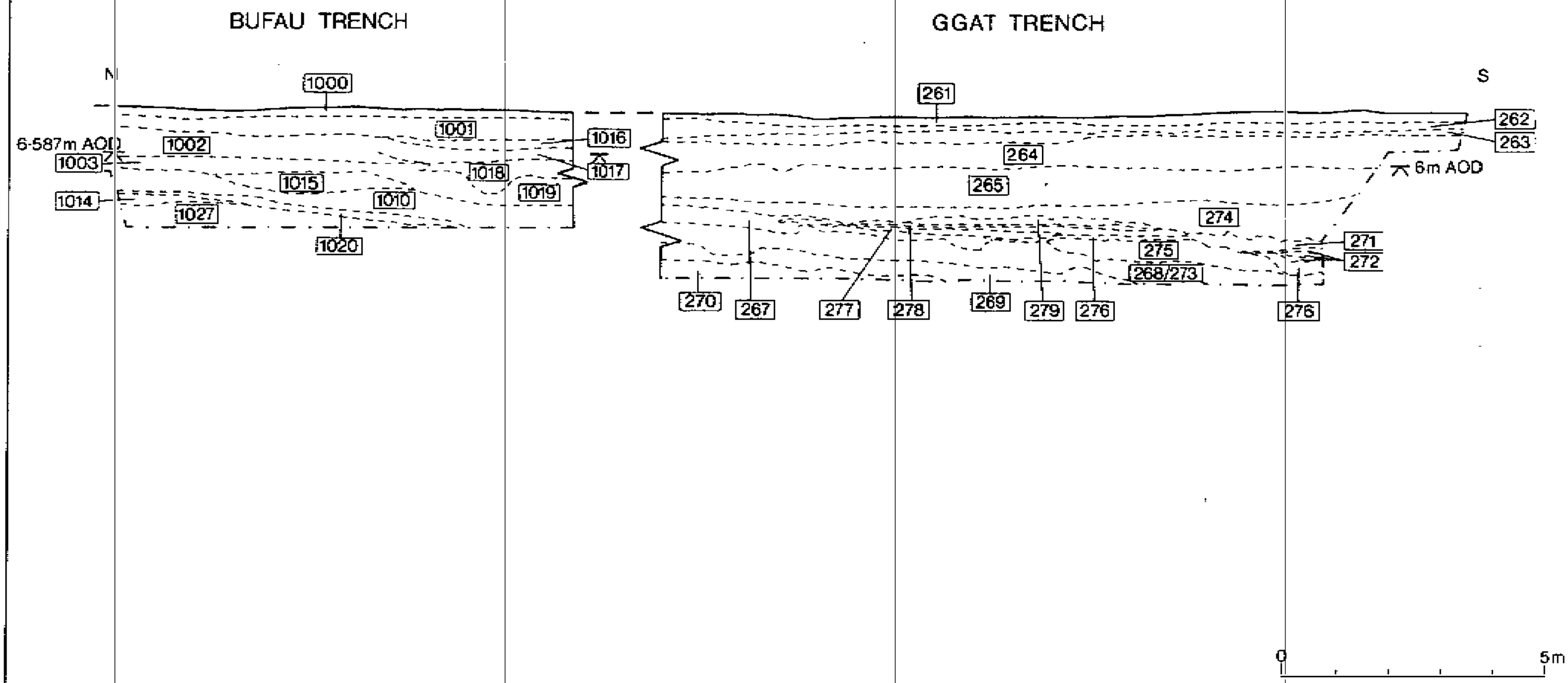


Figure 12

Stoop Hill - Roman Pottery

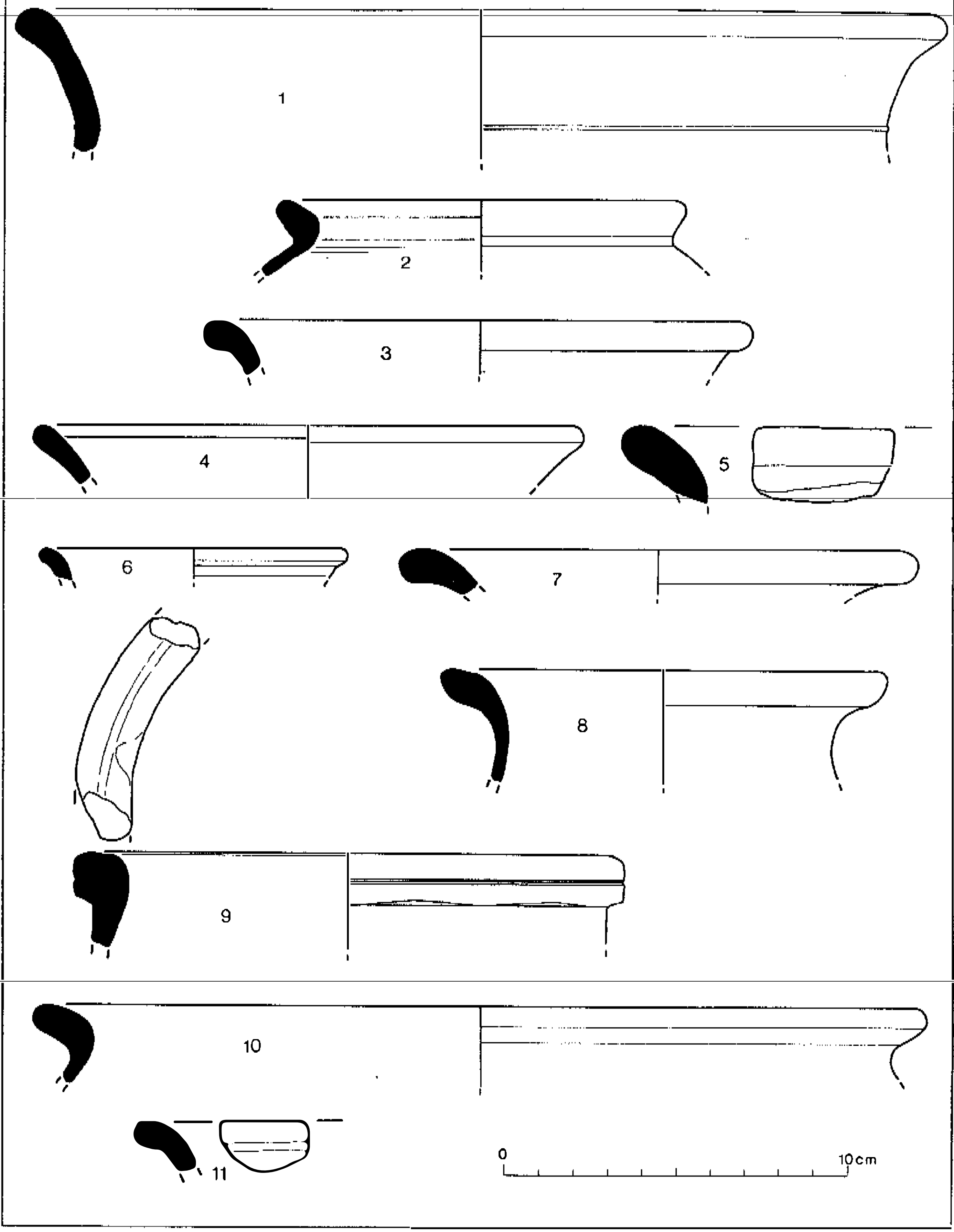


Figure 13

Nine Meads – Trench Locations

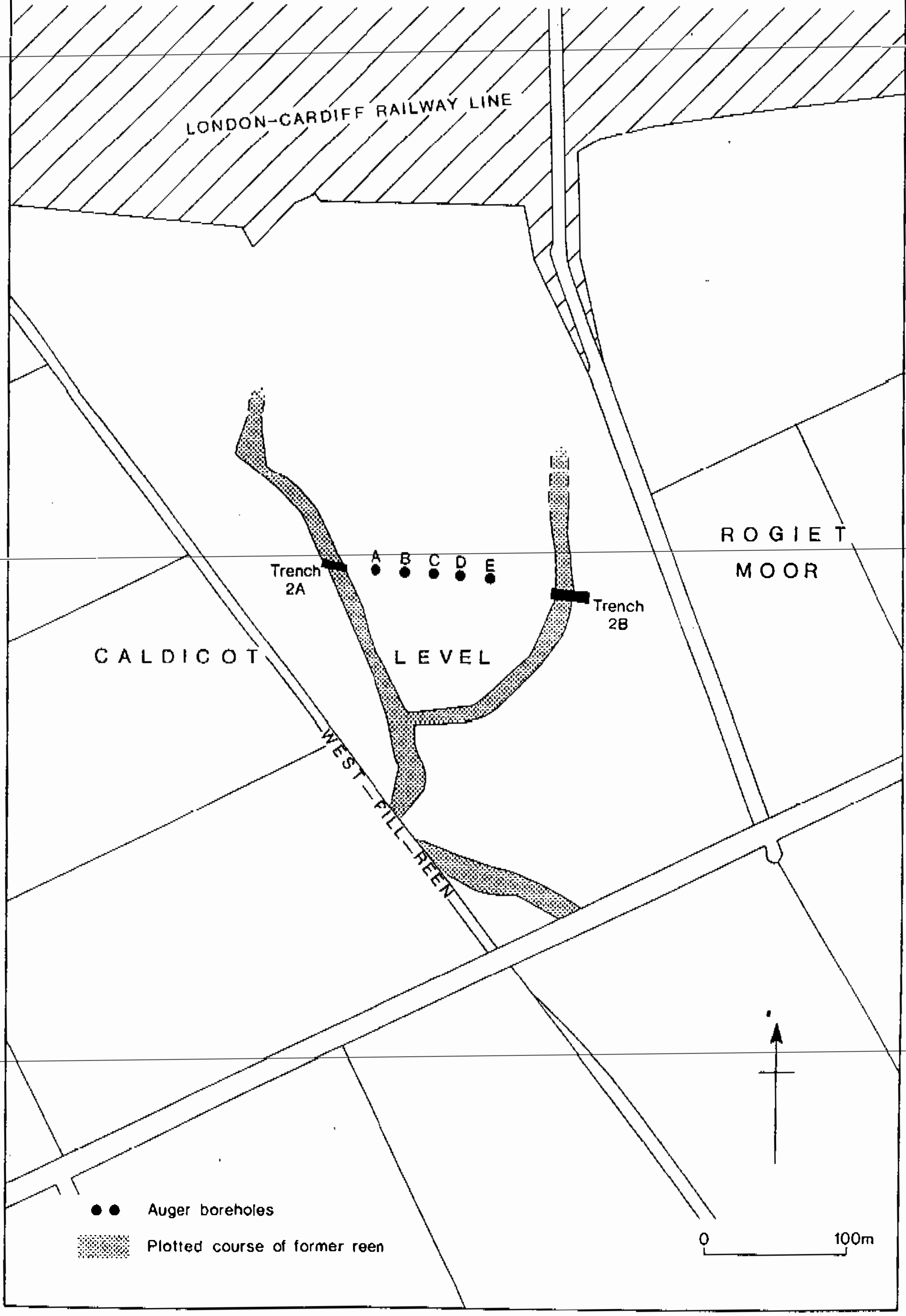


Figure 14

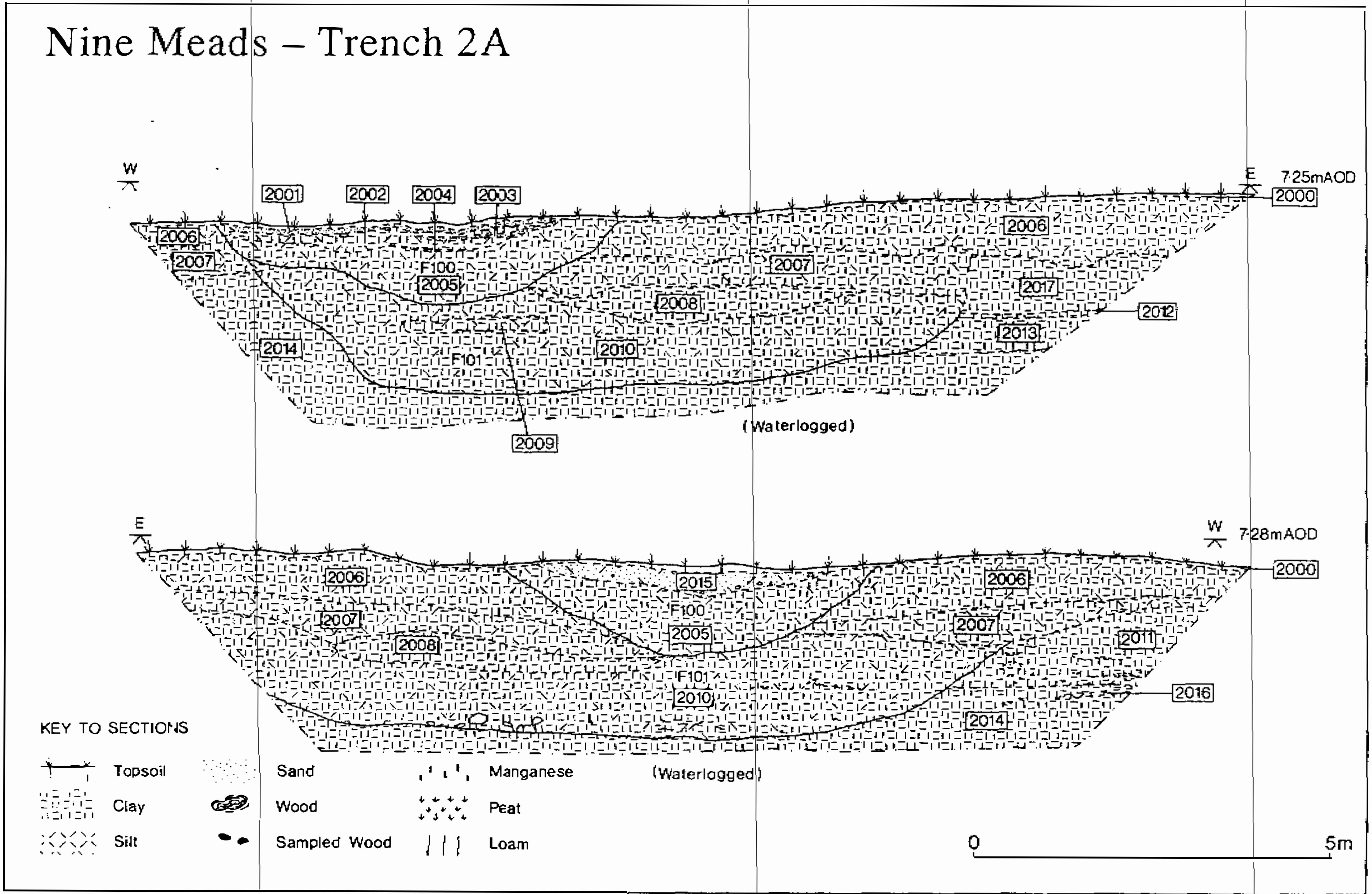

Nine Meads – Trench 2A
W
E
7·25mAOD
2000
2001
2002
2004
2003
2006
2007
F100
2005
2008
2017
2012
2013
2014
F101
2010
2009
(Waterlogged)
E
W
7·28mAOD
2000
2006
2015
2007
F100
2005
2008
2011
F101
2016
2010
2014
(Waterlogged)
KEY TO SECTIONS
Topsoil
Clay
Silt
Sand
Wood
Sampled Wood
Manganese
Peat
Loam
0
5m

Figure 15

Nine Meads – Trench 2B

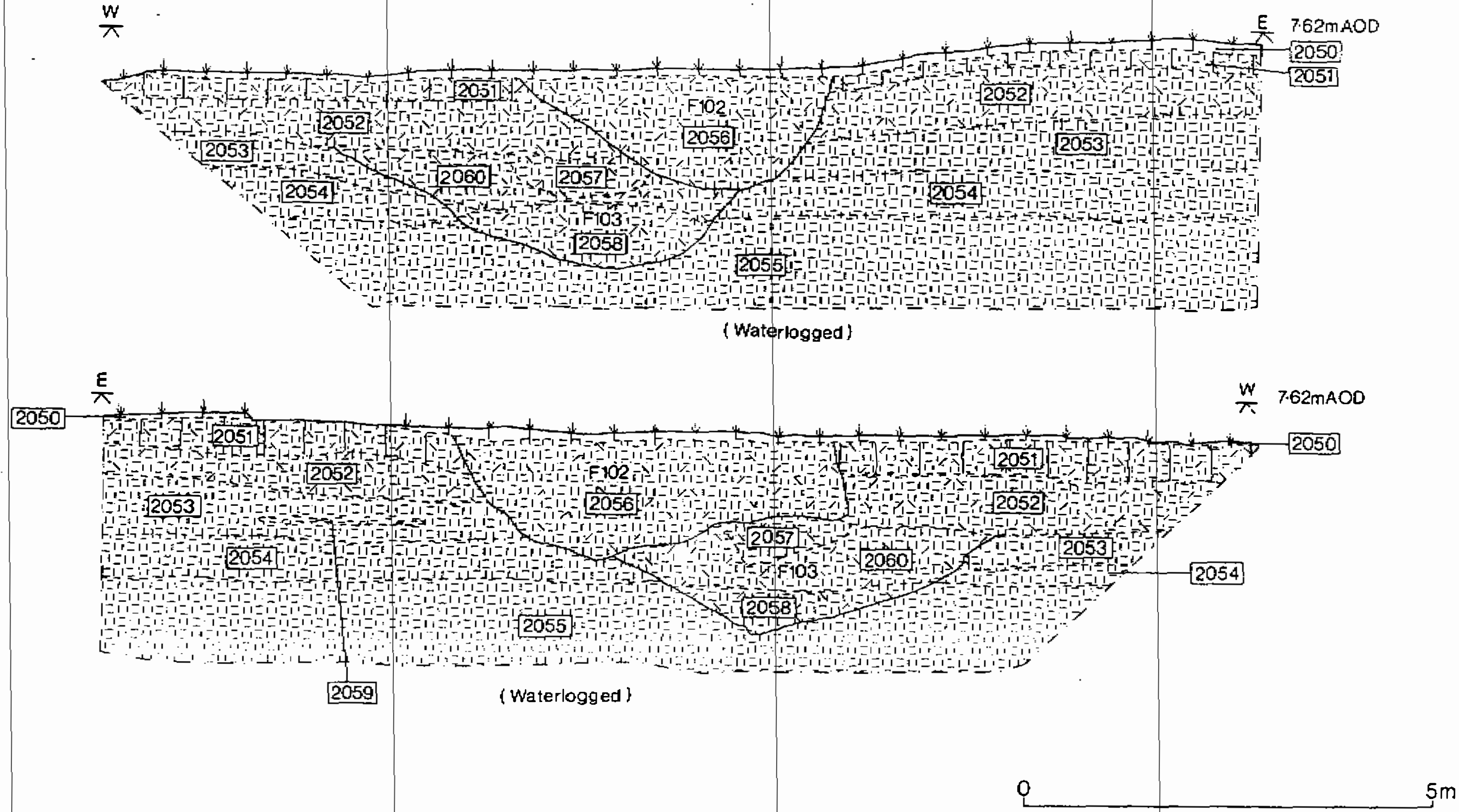


Figure 16

Nine Meads – Auger Transect

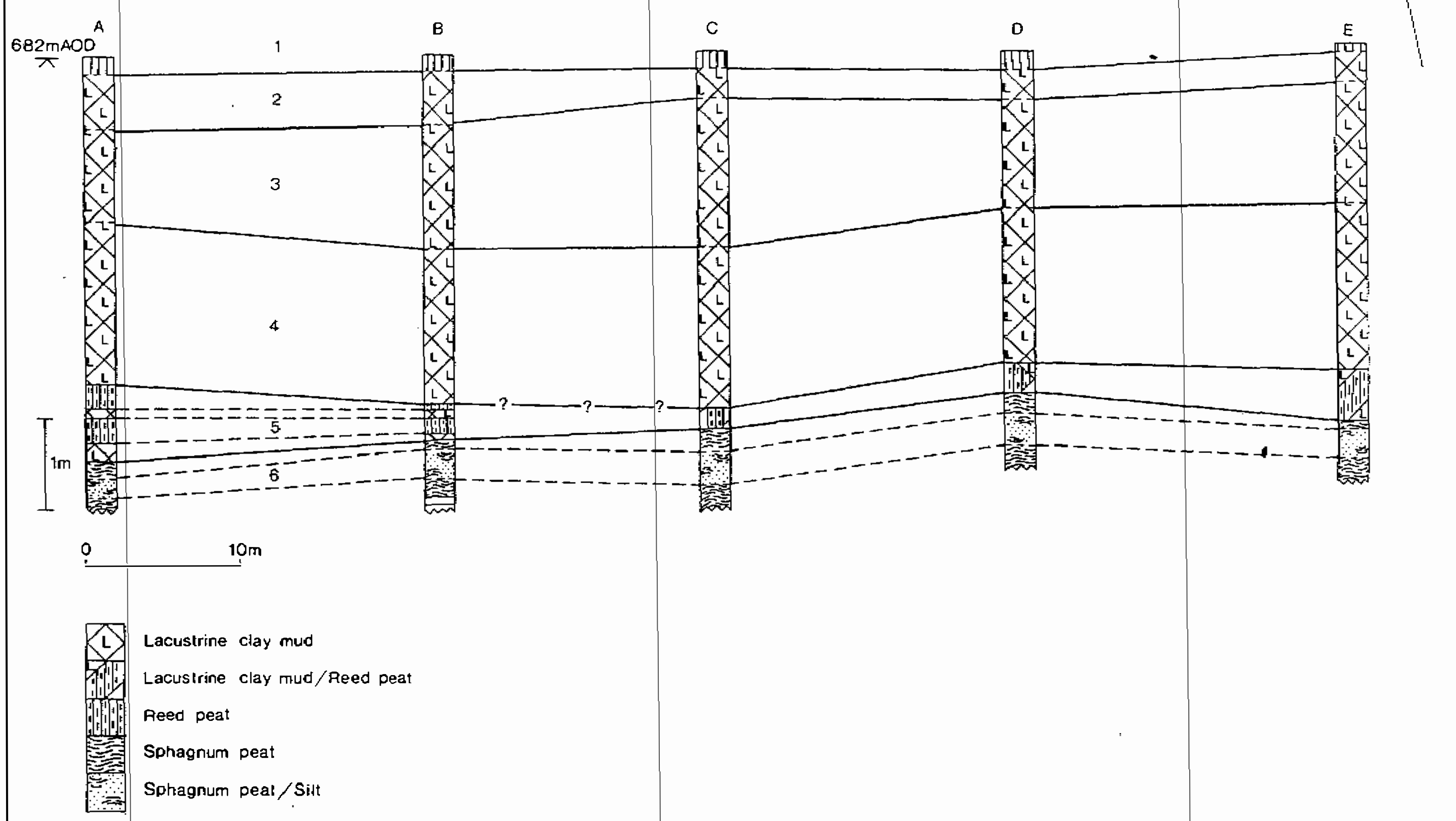


Figure 17

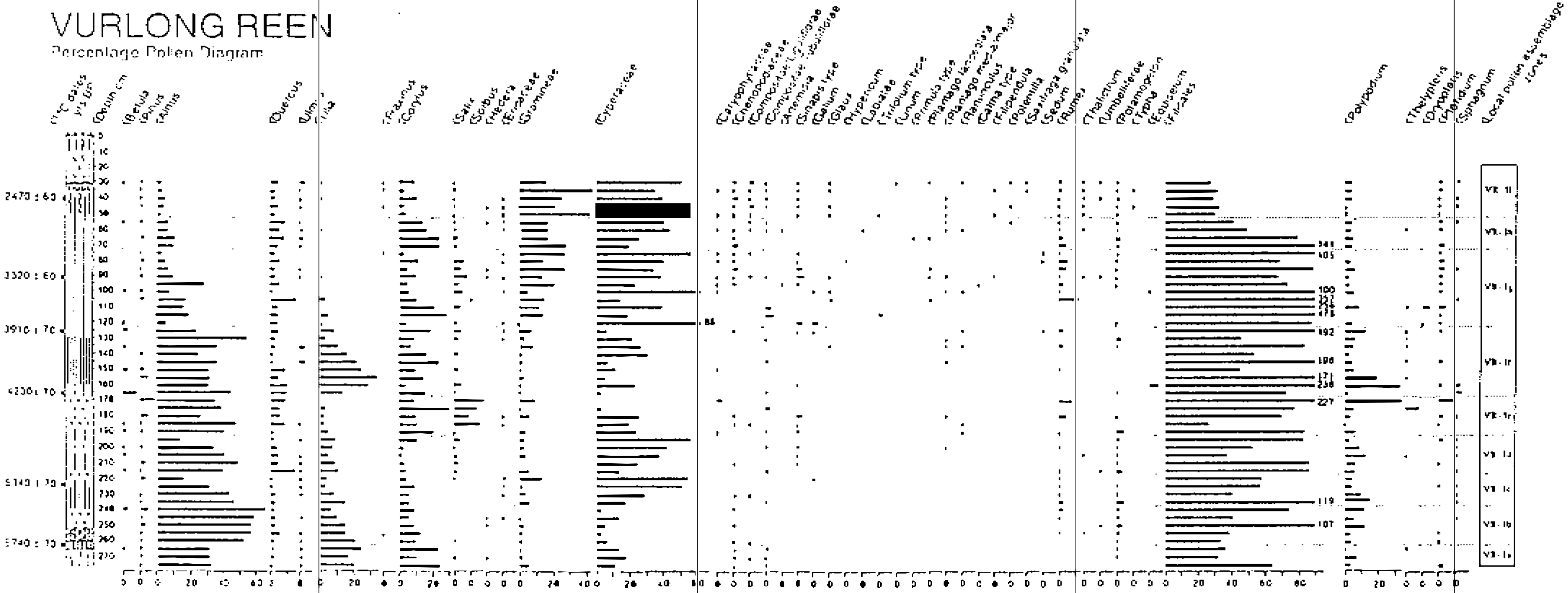


Figure 18 : Percentage pollen diagram from Vurlong Reen 1.

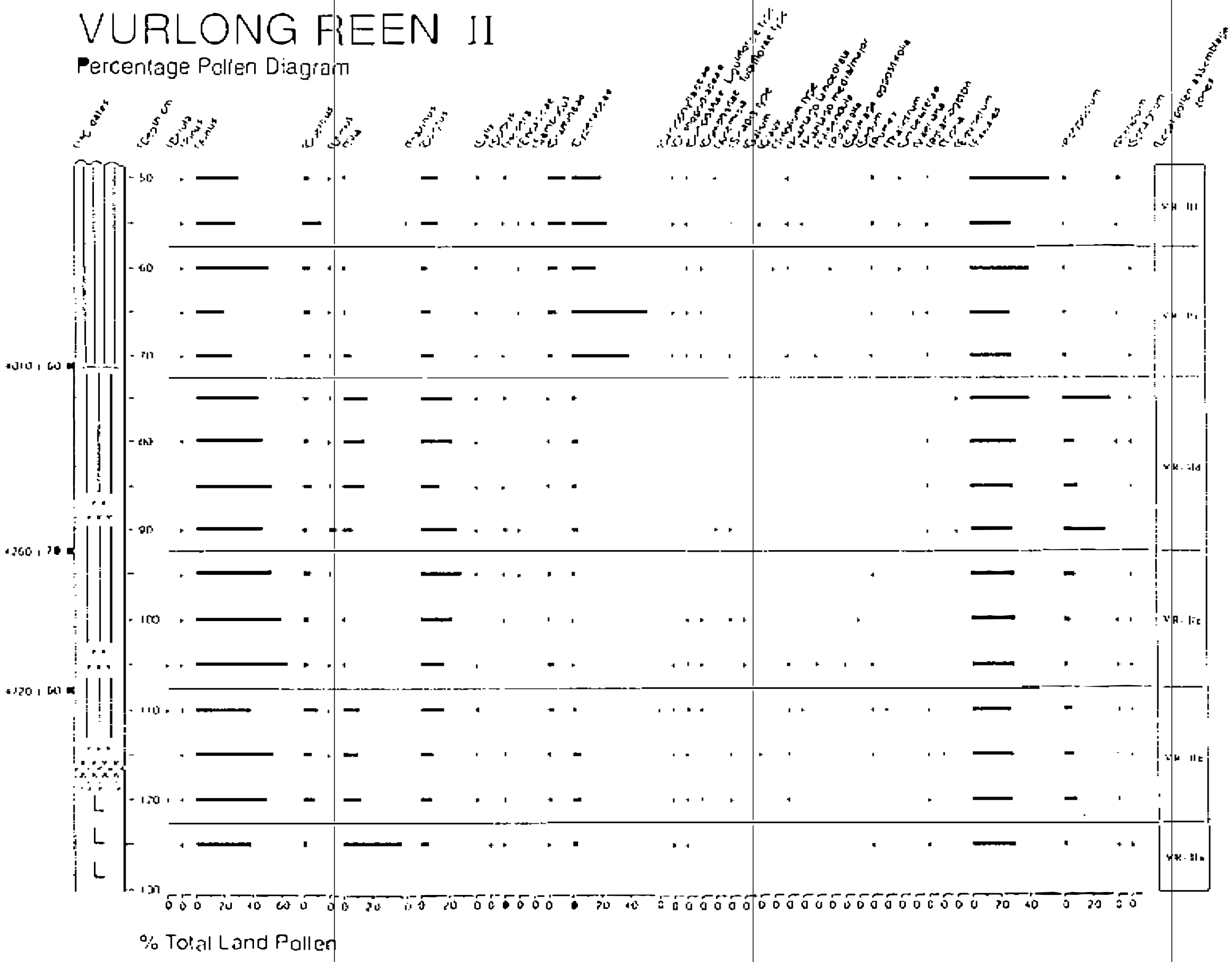


Figure 19 : Percentage pollen diagram from Vurlong Reen II.

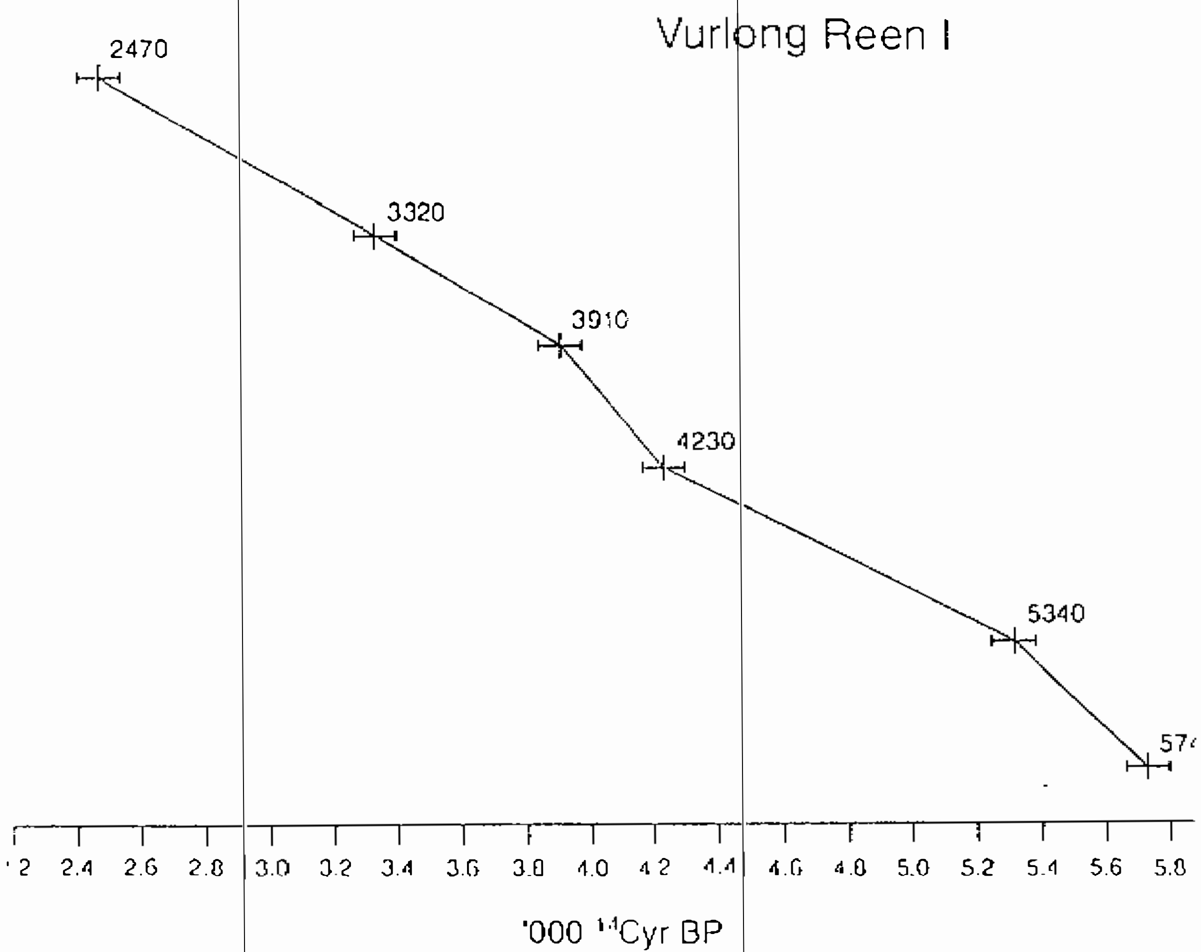


Figure 20 : Age-depth curve for the Vurlong Reen I profile. The dates on the curve are in ^{14}C years before present; the horizontal bars represent the 1σ range on the age determination.

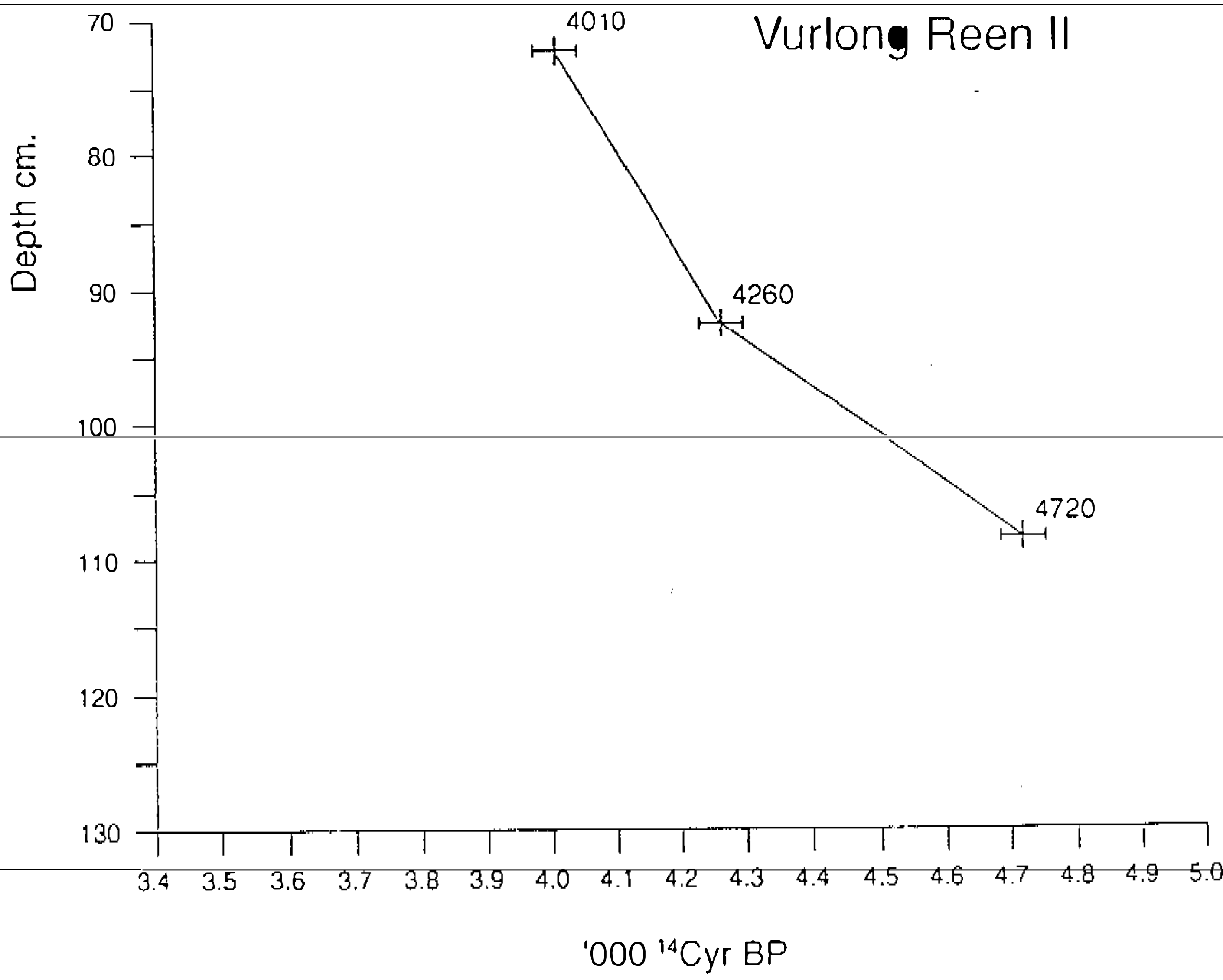


Figure 21 : Age-depth curve for the Vurlon Reen II profile. The dates on the curve are in ^{14}C years before present; the horizontal bars represent the 1σ range on the age determination.

STOOP HILL, COLUMN 4

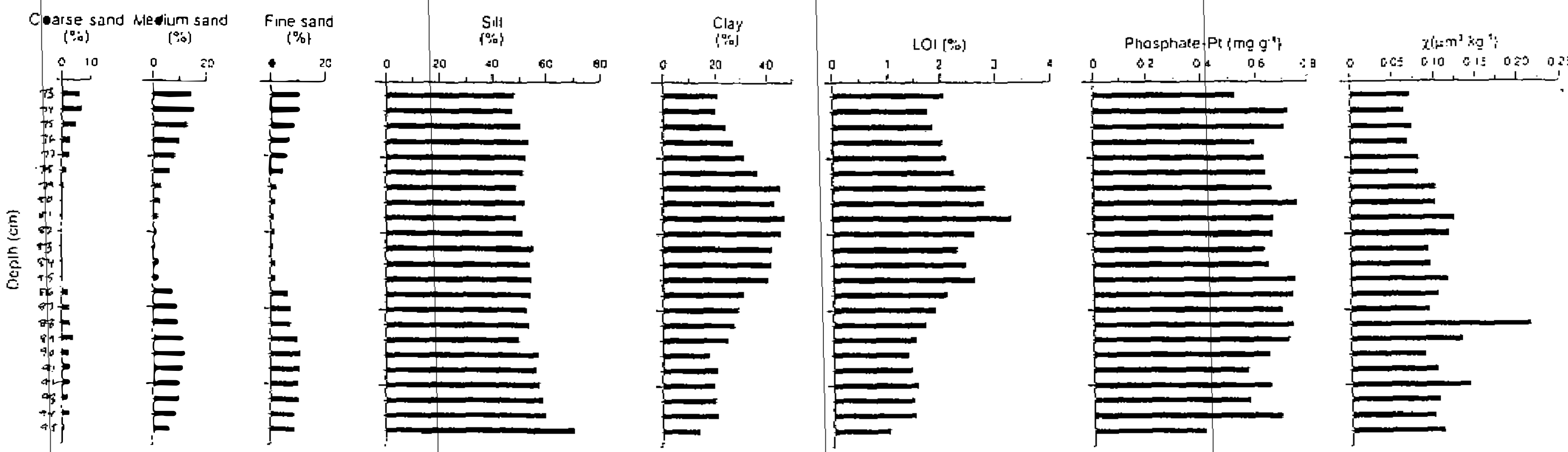


Figure 22

STOOP HILL, COLUMN 1

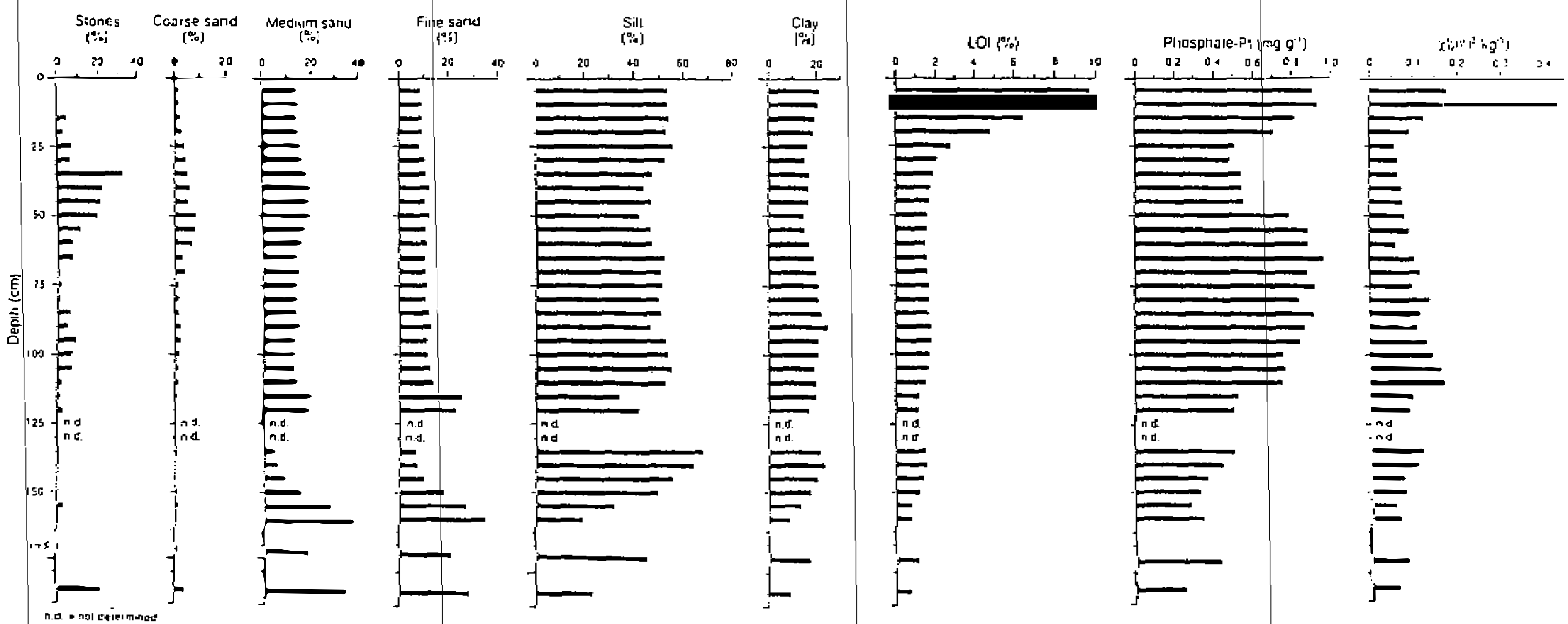


Figure 23

STOOP HILL, COLUMN 2

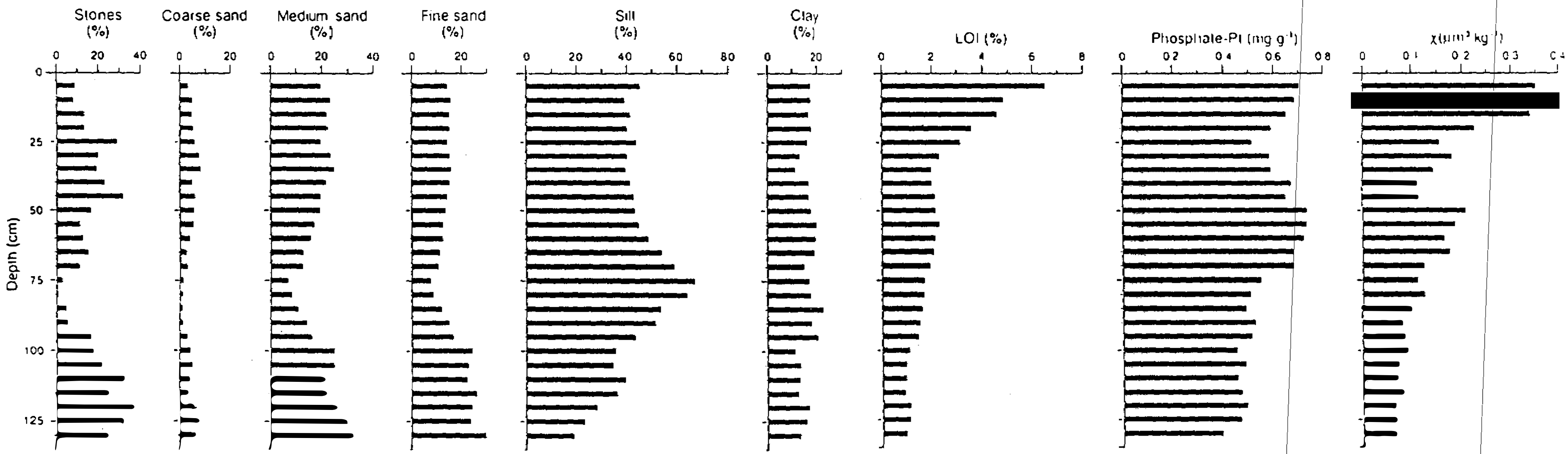
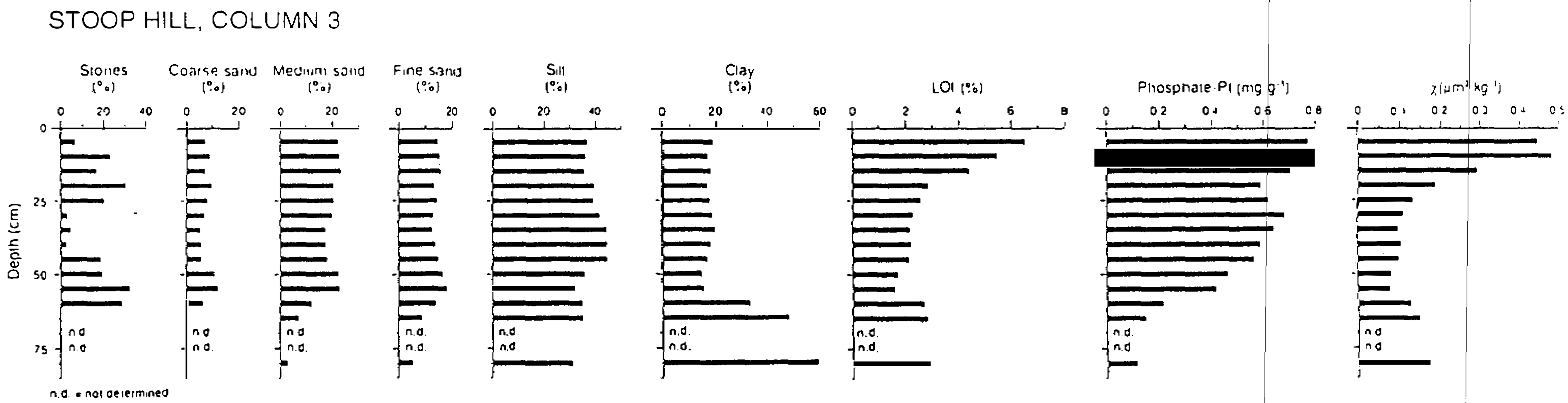


Figure 24



STOOP HILL, COLUMN 3
Stones (%)
Coarse sand (%)
Medium sand (%)
Fine sand (%)
Silt (%)
Clay (%)
LOI (%)
Phosphate-Pi (mg g⁻¹)
Depth (cm)
n.d.
n.d. = not determined

Figure 25

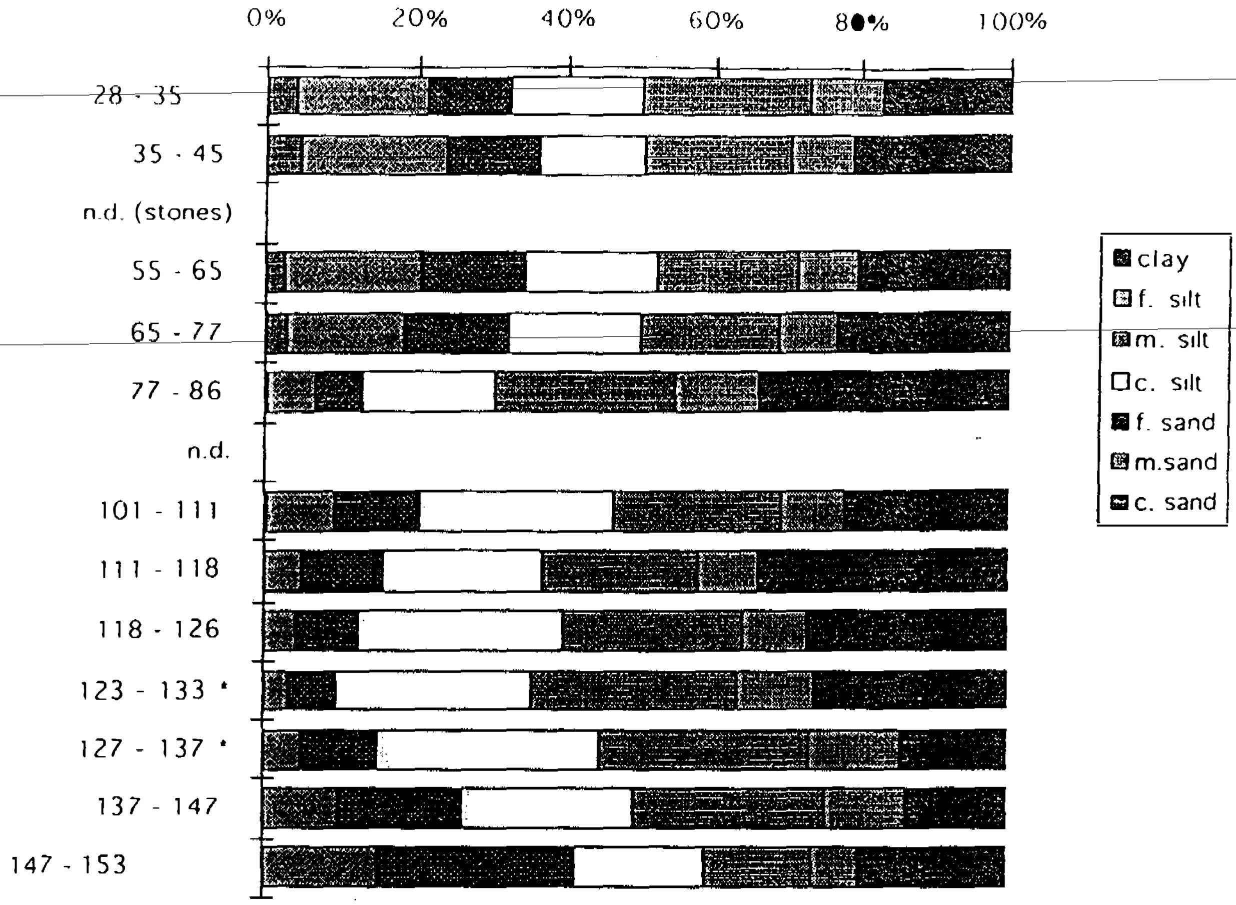


Figure 26 . **Particle size distributions of fine soil.** Asterisked samples are clay-rich an d depleted samples within the same horizon and approximately the same level, adjacent areas.

List of Tables

*These tables are in the text. Other tables are together towards the end of the report.

Table 2. : ^{14}C dates from Vurlong Reen

Sample	Lab No	$^{13}C/^{12}C$ per mil	^{14}C date BP
VR-I 40	BETA-63590	-27.8	2510 ± 60
VR-I 90	BETA-63591	-28.2	3380 ± 60
VR-I 125	BETA-63592	-27.4	3950 ± 70
VR-I 165	BETA-63593	-26.0	4250 ± 70
VR-I 222	BETA-63594	-29.5	5420 ± 70
VR-I 262	BETA-63595	-26.7	5740 ± 70
VR-II 72	BETA-63596	-27.1	4010 ± 60
VR-II 92	BETA-63597	-28.5	4260 ± 70
VR-II-108	BETA-63598	-28.9	4720 ± 60

Table 3. **: Calibration of ^{14}C dates from Vurlong Reen**

Sample	Lab No	^{14}C date BP	Cal range (2s) BP*	Mid Cal date BP
VR-I 40	BETA-63590	2510 ± 60	2346-2741	**2544**
VR-I 90	BETA-63591	3380 ± 60	3385-3687	**3536**
VR-I 125	BETA-63592	3950 ± 70	4091-4520	**4306**
VR-I 165	BETA-63593	4250 ± 70	4452-4959	**4706**
VR-I 222	BETA-63594	5420 ± 70	5926-6286	**6106**
VR-I 262	BETA-63595	5740 ± 70	6358-6735	**6547**
VR-II 72	BETA-63596	4010 ± 60	4265-4784	**4525**
VR-II 92	BETA-63597	4260 ± 70	4551-4987	**4769**
VR-II-108	BETA-63598	4720 ± 60	5303-5595	**5449**

*Calibration ranges obtained using CALIB's Method A (intercepts) based on the Decadal Data Set from the University of Seattle (see Stuiver & Reimer, 1993).

Table 4. **Regional pollen assemblage zones (VR) for Vurlong Reen based on the local pollen assemblage zones at VR-I and VR-II**

Date (^{14}C yrs BP)	Vurlong Reen I	Vurlong Reen II	Regional pollen assemblage zones
- 2000 -			
	VR -Ii Cyperaceae-Gramineae		VR-9 Cyperaceae-Gramineae
- 2500 -			
	VR-Ih Cyperaceae-*Corylus*/*Myrica*-Gramineae	VR-IIf Cyperaceae-*Alnus*-*Corylus*/*Myrica*-Gramineae	VR-8 *Corylus*/*Myrica*-Gramineae
- 3000 -			
- 3500 -	VR-Ig Cyperaceae-Gramineae *Corylus*-*Alnus*	VR-IIe Cyperaceae-*Alnus*	VR-7 Gramineae-*Alnus*-*Corylus*
- 4000 -	VR-If *Alnus*-*Tilia*-*Corylus* Cyperaceae	VR-IId *Alnus*-*Tilia*-*Corylus*	VR-6 *Alnus*-*Tilia* *Corylus*
- 4500 -	VR-Ie *Alnus*-*Corylus*-*Salix*	VR-IIc *Alnus*-*Corylus*	VR-5 *Alnus*-*Corylus*
- 5000 -	VR-Id *Alnus*-Cyperaceae-*Tilia*	VR-IIb *Alnus*-*Tilia*-*Corylus*	VR-4 *Alnus*-*Tilia*-*Corylus*
- 5500 -	VR-Ic Cyperaceae-*Alnus*	VR-IIa *Alnus*-*Tilia*	VR-3 *Alnus*-*Tilia*

- -	VR-Ib *Alnus*	VR-2 *Alnus*
- - 6000 -	VR-Ia *Alnus-Tilia-Corylus*	VR-1 *Alnus-Tilia-*

Corylus

Table 5. Plant macrofossils from Vurlong Reen 3A

Taxa	Depth	50-55cm	80-85cm	115-120cm	150-155cm	175-180cm	210-215cm	255-260cm	265-270cm
Ranunculus cf. *repens* L.		1	-	-	-	-	-	-	-
Ranunculus cf. *lingua* L.		2		-	-	-	-	-	-
Ranunculus cf. *flammula* L.		-	27	-	-	-	-	-	-
Ranunculus sp.		-	-	-	-	-	-	-	2
Papaver rhoeas/dubium		1	-	-	-	-	-	-	-
Urtica dioica L.		5	1	-	2	15	43	5	-
Betula sp.		-	1	-	142	-	-	-	-
Alnus glutinosa (L.) Gaertner-		-	-	1	1	5	19	1	8
Alnus glutinosa cone frags		-	-	-	-	1	-	3	-
Alnus glutinosa cone-scale		-	1	-	4	1	11	7	23
Atriplex sp.		2	-	-	-	-	-	-	-
Chenopodiaceae		-	1	-	-	-	-	-	-
Moehringia trinervia (L.) Clairv.		-	-	-	-	-	1	-	-
Stellaria uliginosa Murray		-	1	-	-	-	-	-	-
Sagina sp.		1	-	-	-	-	-	-	-
Lychnis flos-cuculi L.		2	1	3	-	-	-	-	-
Poygonum aviculare agg.		-	2	-	-	-	-	-	-
Anagallis/Glaux maritima		-	-	-	-	-	1	-	-
Rubus fruticosus agg.		1	1	-	1	1	-	-	-
Rubus cf. *caesius* L.		-	2	-	-	-	-	-	-
Potentilla anserina L.		-	2	-	-	-	-	-	-
Hydrocotyle vulgaris L.		2	35	-	-	-	-	-	-
Apium graveolens L.		13	7	-	-	-	-	-	-
Apium nodiflorum (L.) Lag.		-	5	-	-	-	-	-	-
Menyanthes trifoliata L.		44	7	-	-	-	-	-	-
M. trifoliata rhizomes		+	-	-	-	-	-	-	-
Solanum dulcamara L.		-	-	-	-	2	-	-	1
Mentha arvensis/aquatica		-	13	-	-	-	-	-	-
Aster tripolium L.		-	1	-	-	-	-	-	-
Eupatorium cannabinum L.		-	-	2	1	6	88	-	-
Potamogeton polygonifolius Pourret		4	1	-	-	-	-	-	-
Juncus sp.		26	174	-	-	-	-	-	-
Luzula sp.		-	-	-	-	-	-	1	1
Eleocharis palustris/uniglumis		1	8	-	-	-	-	-	-
Cladium mariscus (L.) Pohl		-	15	-	-	-	-	-	-
Carex paniculata L.		38	23	35	71	3	17	-	-
Carex pseudocyperus L.		2	2	-	-	-	-	-	-
Carex cf. *pendula* Hudson		-	-	10	2	-	7	59	191
Carex viridula type		18	48	-	-	-	-	-	-
Carex sp.- trigonous		-	2	3	-	1	-	-	-
Carex sp.		1	-	1	-	-	1	-	-
Phragmites australis (Cav.) Trin. ex Steudel rhizomes		-	+	+	+	-	+	-	-
Poaceae		-	2	-	-	-	-	-	-
Typha sp.		1	-	1	-	-	-	-	-
Other remains									
Leaf scar		-	7	5	5	6	5	112	14
Thorns		-	2	-	-	-	-	-	-
Charcoal		-	-	-	-	-	+	-	-
Charred monocot.		-	-	+	-	-	-	-	-
Ferns									

Thelypteris palustris Schott	-	-	+	-	-	+	-	-
Mosses								
Drepanocladus aduncus.(Hedw.) Warnst.	+	-	-	-	-	-	-	-
Drepanocladus sp.	+	+	-	-	-	-	-	-
Calliergon cuspidatum (Hedw.) Kindb.	+	+	-	-	-	-	-	-
Calliergon giganteum (Schimp.) + Kindb.	+	-	-	-	-	-	-	
Eurhynchium praelongum (Hedw.) Br. Eur.	-	-	+	-	-	-	+	+
Stoneworts								
Chara	91	3	-	-	-	-	-	-

Table 6. Plant macrofossils from Vurlong Reen 3B

Taxa	Depth 65-70cm	97-102cm
Ranunculus sceleratus L.	2	-
Ranunculus Subgenus *Batrachium* (DC.) A.Gray	1	-
Urtica dioica L.	20	-
Alnus glutinosa (L.) Gaertner	69	2
Alnus glutinosa cone-scale	71	2
Alnus glutinosa cone frags.	9	-
Polygonum minor (Hudson) Opiz	2	-
Rubus fruticosus agg.	2	16
Apium graveolens L.	21	-
Eupatorium cannabinum L.	30	-
Alisma sp.	1	-
Carex paniculata L.	31	4
Carex pseudocyperus L.	1	-
Carex sp. - trigonous	1	-
Other remains		
Bud scales	-	7
Leaf buds	-	2
Leaf scars	21	6
Thorns	1	-
Charcoal	+	-

Table 8. **Coleoptera sample descriptions from trenchs 3A and 3B**

	Trench 3A Sample 1.	Trench 3A Sample 4.	Trench 3A Sample 7.	Trench 3A Sample 11.	Trench 3A Sample 14.	Trench 3A Sample 15.	Trench 3B Sample 1	Trench 3B Sample 3	Trench 3B Sample 5
Context No.	3002	3003	3003	3004	3004	3005	3051-3053	3054	3054
Description	Humifed peat	Dark fiberous peat	Dark fiberous peat	Dark woody peat	Dark woody peat	Grey esturine clays	Light dry peat	Dark woody peat	Sandy woody peat
Inclusions	root mat	Reeds & root mat	Reeds & root mat	Tree branches and reed fragments	Tree branches and reed fragments		Fibres and root mat	reed fragments with some tree branches	Some tree branches
Depth BGS	0.3m-0.4m	0.8m-1.0m	1.4m-1.6m	2.15m-2.3m	2.75m-2.85m	2.85m-2.95m	0.2m-0.4m	0.6m-0.8m	1.0m-1.20m
Volume Lt.	8	7	4	7	7	5	11	10	12
Weight Kg.	22	24	9	18	18	15	8	8	9
Nearest Radiocarbon date (RCYBP).	2470±60 at 0.40m	3320±60 at 0.90m	4230±70 at 1.65m	5340±70 at 2.25m	5740±70 at 262m			4010±60 at 0.72m	4720±60 at 1.08m

Table 9. **Coleoptera species lists from Trench 3A**

	Sample 1.	Sample 4.	Sample 7.	Sample 11.	Sample 14.	Sample 15.
Carabidae						
Dyschirius spp.	1	3			1	
Bembidion assimile Gyll.		6	1			
B.? doris (Panz.)		1				
B. guttula (F.)			1			
B. spp.	1		3			
C.F. *Chlaenius sulcicollis* (Payk.)		1				
Pterostichus strenuus (Panz.)			2			
P. gracilis (Dej.)		1				
P. minor (Gyll.)	2	5	3	4		
P. strenuus (Panz.)		2				
P. spp.	2					
Agonum spp.	1	1				
Odacantha melanura (L.)		2	1			
Dytiscindae						
Hygrotus spp.	1					
Hydroporus spp.	1	4	3	5	3	2
Graptodytes granularis (L.)			1	10		
Agabus guttatus (Payk.) or *A. biguttatus* (Oliv.)			1	6	1	
A. bipustulatus (L.)		1		1		
Ilybius ater (Deg.)		1				
Ilybius spp.		1		6		
Rantus spp.				2		
Hydraenidae						
Hydraena palustris Er.			1	1		
H. britteni Joy			5			
H. riparia Kug.		2				
H. testacea Curt.				6	1	
H. spp.			12	9	3	1
Ochthebius dilatatus Steph.		1		2		
O. minimus (F.)		2	1	5		
O. spp.	13	19	4	7		5
Hydrochus ?ignicollis Mots.		11				
H. spp.	1					1
Helophorus spp.	1	4	1			
Hydrophilidae						
Cercyon ustulatus (Preyssl.)		2	1			
Cercyon melanocephalus (L.)	1	1				3
C. tristis (Ill.)		1	7	12		
C. spp.	2	3	1			1
Megasternum boletophagum (Marsh.)				1		
Cryptopleurum minutum (F.)		1				
Hydrobius fuscipes (L.)	1	3	1	3		1
Anacaena globulus (Payk.)	1	9	1	4		
Laccobius bipunctatus (F.)	2	4	3			
Laccobius striatulus (F.)			1	1		
L. spp.	6	3	5			1
Enochrus spp	1	12	1			
Silphidae						
Silphid sp.			1			
Scydmaenidae						
Scydmaenidae gen. + spp. indent.				1		
Orthoperidae						
Sericoderis lateralis (Gyll.)	1	4	4	24		
Orthoperus spp.	1	1				1
Ptiliidae						
Ptiliidae gen. + spp. indet.		1	1			
Acrotrichus spp.		7	1			

	Sample 1.	Sample 4.	Sample 7.	Sample 11	Sample 14.	Sample 15
Staphylinidae						
Omalium spp.		1				
Olophrum piceum (Gyll.)			4	2		1
Lesteva heeri Fauv.		1				
Lesteva longoelytrata (Goeze)	5	2	2	11	3	
Trogophloeus spp.	1	2				
Oxytelus sculptus Grav.			1			
O. nitidulus Grav.		1				
O. spp.						
Platystethus cornutus (Grav.)		1				
Stenus spp.	5	16	7	4		1
Stilicus? orbiculatus (Payk.)	1	1		1		1
Lathrobium brunipes (Group)	1			7	3	
Lathrobium spp.	1		2	1	2	
Othius spp	2			1		1
Xantholinus spp.		1				
Philonthus spp.	1	4	2			
Staphylinus sp.	1	1				
Quedius spp.	1		2	1		
Aleocharinae gen. indet.	3		4	5	3	
Pselaphidae						
Euplectus spp		1				1
Bryaxis spp.		1	6	6	2	1
Rybaxis laminata (Mots.) or *longicornis* (Leach)	1		1	3		
Bracygluta or Reichenbachia spp.				3		
Trissemus impressus (Panz.)		1		3		
Elateridae						
Actenicerus sjaelandicus (Mull.)	1					
Helodidae						
Cyphon spp.	3	3	16	43	17	11
Dryopidae						
Dryops spp.	8	17	6	2	2	
Heteroceridae						
Heterocerus flexuosus Steph. or *H. fossor* Kies.		1				
Cryptophagidae						
Atomaria spp.		2				
Coccinellidae						
Coccidula rufa (Hebst.)		1				
Scarabaeidae						
Aphodius prodromus (Brahm.) or *A. Sphacelatus* (Panz.)		1				
A. putridus (Herbst.)		1				
A. spp.		1				
Chrysomelidae						
Plateumaris braccata (Scop.)		1	5	2		
P. spp.	1					
Phyllotreta spp.	1				1	
Chaetocnema spp.	1	2				
Curculionidae						
Tanysphyrus lemnae (Payk.)		1	2	5	1	
Dorytomus taeniatus (F.)			3			
D. spp.	1	1	3	5	1	1
Ceuthorhynchus spp.	1	1				1

Table 10. Coleoptera species lists from Trench 3B

	Sample 1	Sample 2	Sample 3
Carabidae			
Bembidion assimile Gyll	1	1	
B. guttula (F.)		3	
B. spp.	1	3	1
Pterostichus strenuus (Panz.)			1
P. minor (Gyll.)			1
P. melanarius (Ill.)	1		
P. spp.		1	1
Agonum spp			1
Dytiscidae			
Hydroporus spp	4	1	3
Agabus guttatus (Payk.) or *A. biguttatus* (Oliv.)		2	2
A. bipustulatus (L.)			1
Colymbetes fuscus (L.)			1
Hydraenidae			
H. ?britteni Joy		2	1
H. testacea Curt	1	4	2
H. spp	4	11	2
O. minimus (F.)		2	2
O. spp.	2	2	6
Limnebius spp.			1
Helophorus spp	1	1	
Hydrophilidae			
Cercyon ustulatus (Preyssl.)	2	2	
C. tristis (Ill.)	5	12	8
C. spp.	2	5	3
Hydrobius fuscipes (L.)	3	4	2
Anacaena globulus (Payk.)	1		
Laccobius bipunctatus (F.)	2		
L. spp.		10	12
Silphidae			
Silphid spp.	1		
Scydmaenidae			
Neuraphes elongatulus (Mull. Kunze)		3	
Stenichnus ?collaris (Mull. Kunze)			1
Scydmaenidae gen. + spp. indent	1	4	1
Orthoperidae			
Sericoderus lateralis (Gyll.)	2	18	4
Orthoperus spp	1	1	1
Ptiliidae			
Ptiliidae gen. + spp. indet		1	
Acrotrichis spp		1	
Staphylinidae			
Omalium spp		2	
Olophrum piceum (Gyll.)		4	1
Lesteva longoelytrata (Goeze)	1	9	
Trogophloeus spp		2	
Oxytelus spp		2	
Platystethus cornutus (Grav.)			1
Stenus spp	1	2	4
Euaesthetus ruficapillus Boisd. Lacord			1
Lathrobium brunnipes (Group)	2		
Lathrobium spp	1	6	2
Xantholinus spp		2	
Othius spp			4
Philonthus spp		2	
Staphylinus sp	1		
Quedius spp	1		
Tachyporus spp	1		
Aleocharinae gen. indet	1	2	5
Pselaphidae			
Bryaxis spp	1	5	1
Rybaxis laminata (Mots.) or *longicornis* (Leach)	1	3	4
Brachygluta or *Reichenbachia* spp.	3		
Trissemus impressus (Panz.)	1	1	
Elateridae			
Agriotes spp.		1	
Selatosomus spp	1		

	Sample 1.	Sample 3.	Sample 5.
Helodidae			
Cyphon spp.	10	56	22
Dryopidae			
Dryops spp.	3	3	
Rhizophagidae			
Rhizophagus spp.	1		
Cryptophagidae			
Cryptophagus spp.		1	
Atomaria spp.		1	
Anobiidae			
Anobium punctatum (Geer)		1	
Scarabaeidae			
Onthophagus ovatus (L.) or *joannae* Goljan			1
Aphodius spp.	1	1	
Chrysomelidae			
Plateumaris braccata (Scop.)	1	1	
Scolytidae			
Hylesinus oleiperda (F.)		2	
Curculionidae			
Tanysphyrus lemnae (Payk.)	1	1	2
Sitona spp.	1		
Dorytomus taeniatus (F.)		2	
D. spp.	1	3	
Ceuthorhynchus spp.	1	2	

Table 11. **Sediment sequence at landward end of trial pit 013 – total depth *c.* 3.30 m -after Bell, 1990; Crowther, 1990 [Subsequently revised interpretations are given in square brackets].**

Context	Provisional interpretation: principal features
261	A horizon (topsoil) of modern soil: dark grey silty clay loam, very few stones.
262	B horizon of modern soil, possibly comprising largely material of estuarine origin: brown-dark brown silty clay loam, few stones.
263	Colluvial deposit: brown-dark brown clay loam, many small rounded stones (up to 25% of area of exposed face).
264	Estuarine deposits: dark grey (with brown-dark brown mottles) silty clay, very few stones.
265	Estuarine deposit with colluvial component: brown-dark brown clay loam, few medium and large stones.
266	Colluvial deposit [with estuarine component] : brown-dark brown (with strong brown mottles) clay loam, few small stones and intermittent band of medium-large stones.
267	[possibly weathered loess or estuarine deposit]
268	[Probable loess]: reddish brown (with yellowish red mottles) silt loam (76% silt), stoneless.
269	Beach sand: reddish brown sandy loam, stoneless.
270	Coarse beach deposit: reddish brown sandy loam, many small-medium rounded stones (up to 35% of area of exposed face).

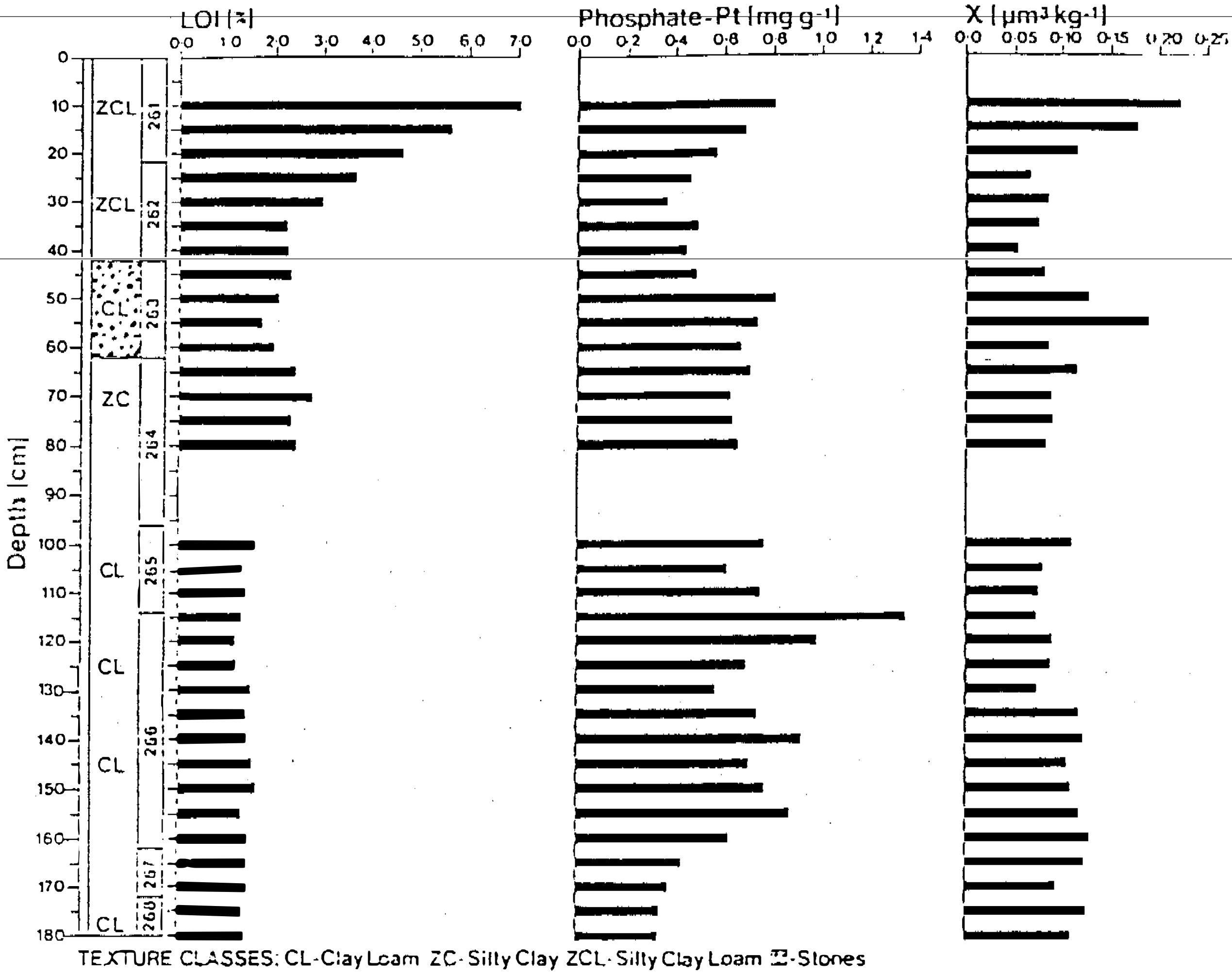
Table 12.

Analytical results
Sand, silt and clay fractions expressed as percentages of total "fine soil"; stone content is additional. Samples marked with asterisk represent the clay-depleted tongue (127-137 cm) within the more clay rich material (123-133 cm) in the same horizon.

	stones	c.sand	m.sand		f.sand	c.silt	m.silt	f.silt	clay	pH
OM										
28 - 35	3.5	3.9	17.2	11.1	18.0	22.7	10.2	16.9	5.4	1.0
35 - 45	3.0	4.6	19.0	12.5	14.4	19.8	8.6	21.1	5.5	0.5
n.d. (gravelly)										
55 - 65	2.2	2.4	18.0	13.8	18.1	19.1	8.2	20.4	5.5	0.5
65 - 77	4.0	3.1	15.4	14.3	18.1	19.5	8.1	23.5	6.0	0.5
77 - 86	0.0	0.5	6.2	6.3	17.4	24.4	11.3	33.9	5.6	0.5
n.d.										
101 - 111	0.0	0.4	9.3	11.4	27.2	23.7	9.1	22.9	6.2	0.1
111 - 118	0.0	0.1	5.1	10.4	21.1	21.1	8.4	33.8	6.3	0.2
118 - 126	0.0	0.1	4.4	8.2	27.1	24.4	8.7	27.1	6.1	0.3
123 - 133 *	0.0	0.1	3.1	6.5	25.7	28.0	10.8	25.8	6.0	0.2
127 - 137 *	0.0	0.1	4.8	10.1	29.7	28.5	12.8	14.0	6.0	
n.d.										
137 - 147	0.0	0.1	9.8	16.4	23.2	25.8	11.4	13.3	6.8	0.4
147 - 153	0.0	0.2	14.7	26.6	17.6	14.6	6.4	19.9	6.8	0.3

List of Appendices

APPENDIX I. COLUMN 4, TRIAL PIT 013.



Variations in LOI, Phosphate-Pt and X down the colluvial sequence (column 4) in Trial Pit 013.

APPENDIX II: Analytical data for Column 4, TRENCH 1B.

Sample No.	LOI (%)	Phos-Pt (mg/g)	χ (μm³/kg)	pH (1:2.5, water)	Coarse sand (%)	Medium sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture class*
73	2.06	0.521	0.071		6.4	14.6	9.7	48.0	21.3	CL
74	1.71	0.721	0.064	6.9	6.8	15.6	10.0	47.3	20.3	CL
75	1.81	0.705	0.074		5.2	12.7	8.2	49.8	24.1	CL
76	2.03	0.592	0.069	7.0	3.1	9.6	7.0	53.0	27.3	CL
77	2.09	0.632	0.083		2.6	8.0	6.2	52.0	31.2	ZyCL
78	2.25	0.638	0.081	7.1	1.8	6.1	4.7	51.1	36.3	ZyC
79	2.80	0.657	0.103		0.8	2.9	2.2	48.4	45.7	ZyC
80	2.79	0.758	0.103	7.4	0.3	2.5	2.0	51.5	43.7	ZyC
81	3.27	0.667	0.126		0.5	1.9	1.5	48.3	47.8	ZyC
82	2.60	0.659	0.119	7.8	0.2	1.5	1.5	50.8	46.0	ZyC
83	2.31	0.632	0.093		0.2	1.1	0.9	55.1	42.7	ZyC
84	2.44	0.645	0.097	8.4	0.4	2.2	1.8	53.4	42.2	ZyC
85	2.62	0.748	0.117		0.5	2.4	2.0	54.3	40.8	ZyC
86	2.09	0.741	0.106	8.2	2.4	7.3	5.9	53.6	30.8	ZyCL
87	1.87	0.695	0.095		2.9	8.7	7.2	52.2	29.0	ZyCL
88	1.70	0.740	0.213	8.0	3.4	9.1	7.0	53.0	27.5	CL
89	1.53	0.724	0.134		4.5	11.3	9.3	49.6	25.3	CL
90	1.38	0.649	0.090	7.8	3.1	11.9	10.4	56.8	17.8	SyZL
91	1.41	0.567	0.103		2.8	10.5	10.1	56.0	20.6	CL
92	1.55	0.656	0.143	7.7	2.8	10.0	9.6	57.6	20.0	CL
93	1.48	0.577	0.106		2.4	9.6	9.5	58.5	20.0	CL
94	1.53	0.697	0.101	7.7	2.7	8.5	8.2	59.3	21.3	CL
95	1.02	0.410	0.112		0.8	6.2	8.5	70.2	14.3	ZL

* CL = Clay loam; SyZL = Sandy silt loam; ZyC = Silty clay; ZyCL = Silty clay loam; ZL = Silt loam

APPENDIX III: Analytical data for Column 1, TRENCH 1B.

Depth (cm)	LOI (%)	Phos-Pt (mg/g)	χ (μm³/kg)	pH (1:2.5, water)	Stones (%)	Coarse sand (%)	Medium sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture class*
4- 6	9.72	0.916	0.174		0.0	2.3	13.9	9.1	53.4	21.3	CL
9- 11	8.76	0.941	0.433	5.9	0.0	2.5	14.4	9.4	53.1	20.6	CL
14- 16	6.21	0.820	0.125		4.4	3.2	13.5	9.5	54.2	19.6	CL
19- 21	4.84	0.715	0.094	5.8	2.7	4.0	14.6	9.7	53.2	18.5	CL
24- 26	2.69	0.512	0.058		7.3	5.0	14.7	8.8	55.4	16.1	SyZL
29- 31	2.04	0.488	0.064	5.9	6.2	6.0	16.5	10.5	52.0	15.0	SyZL
34- 36	1.87	0.549	0.066		32.8	6.7	18.3	10.6	47.1	17.3	SyZL
39- 41	1.75	0.557	0.075	5.9	21.1	7.6	19.7	12.6	43.7	16.4	SyZL
44- 46	1.67	0.608	0.077		21.3	6.4	19.5	10.8	46.6	16.7	SyZL
49- 51	1.58	0.797	0.081	6.0	19.8	10.7	19.8	12.5	42.1	14.9	SyZL
54- 56	1.51	0.889	0.090		10.8	10.0	17.4	11.3	46.5	14.8	SyZL
59- 61	1.47	0.892	0.060	6.2	6.7	8.6	15.9	11.6	46.9	17.0	SyZL
64- 66	1.54	0.971	0.104		7.2	4.0	13.6	10.9	52.1	19.4	CL
69- 71	1.60	0.886	0.115	6.5	1.2	4.9	14.2	10.8	50.2	19.9	CL
74- 76	1.64	0.925	0.097		2.0	2.3	13.6	11.6	51.5	21.0	CL
79- 81	1.67	0.846	0.139	6.7	1.6	2.5	13.7	11.3	49.5	21.0	CL
84- 86	1.63	0.922	0.115		5.2	2.5	13.0	11.9	50.5	22.1	CL
89- 91	1.74	0.872	0.110	6.8	4.4	2.8	14.2	12.3	46.2	24.5	CL
94- 96	1.80	0.849	0.130		9.2	3.3	12.2	11.4	52.7	20.4	CL
99-101	1.66	0.762	0.147	6.9	7.2	2.1	12.6	11.5	53.3	20.5	CL
104-106	1.60	0.765	0.164		6.5	2.0	12.2	12.0	55.0	18.8	CL
109-111	1.51	0.761	0.174	7.1	2.3	2.0	13.0	13.0	52.2	19.8	CL
114-116	1.15	0.538	0.102		1.8	1.0	19.6	25.2	34.4	19.8	CL
119-121	1.15	0.510	0.094	6.9	2.5	0.7	18.5	22.6	41.8	16.4	SyZL
134-136	1.45	0.509	0.121		0.0	0.3	4.3	6.5	67.7	21.2	ZyCL
139-141	1.52	0.453	0.111	6.9	0.0	0.4	5.6	6.9	63.9	23.2	ZyCL
144-146	1.38	0.377	0.079		0.0	0.3	10.1	13.6	55.8	20.2	CL
149-151	1.18	0.335	0.080	6.9	0.5	1.5	14.5	17.8	49.1	17.1	SyZL
154-156	0.804	0.285	0.055		2.9	1.2	27.0	26.9	32.0	12.9	SyL
159-161	0.799	0.357	0.065	7.0	0.7	1.0	36.8	34.5	19.3	8.4	SyL
174-176	1.06	0.430	0.085		0.9	0.9	17.7	20.6	44.7	16.1	SyZL
189-191	0.760	0.258	0.063	7.1	20.7	5.2	33.2	28.5	24.1	9.0	SyL

* CL = Clay loam; SyL = Sandy loam; SyZL = Sandy silt loam; ZyCL = Silty clay loam

APPENDIX IV: Analytical data for Column 2, TRENCH 1A.

Depth (cm)	LOI (%)	Phos-Pt (mg/g)	χ (μm³/kg)	pH (1:2.5, water)	Stones (%)	Coarse sand (%)	Medium sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture class*
4- 6	6.51	0.702	0.351		9.0	3.2	19.9	14.4	45.2	17.3	SyZL
9- 11	4.81	0.684	0.398	6.0	8.1	5.0	22.8	15.9	39.1	17.2	SyZL
14- 16	4.58	0.648	0.340		13.1	4.7	22.0	15.3	41.5	16.5	SyZL
19- 21	3.57	0.586	0.227	6.6	13.1	5.1	21.9	15.4	39.9	17.7	SyZL
24- 26	3.13	0.511	0.156		28.6	5.9	19.6	14.4	43.9	16.2	SyZL
29- 31	2.34	0.581	0.181	7.4	19.1	7.7	23.4	15.6	40.1	13.2	SyZL
34- 46	1.97	0.583	0.144		18.9	8.3	24.7	16.1	39.6	11.3	SyZL
39- 41	1.96	0.669	0.114	7.6	23.1	4.9	21.4	15.4	41.6	16.7	SyZL
44- 46	2.07	0.643	0.115		31.7	6.2	19.7	14.6	42.7	16.8	SyZL
49- 51	2.13	0.736	0.209	7.7	16.3	5.5	19.5	14.0	43.1	17.9	SyZL
54- 56	2.27	0.733	0.187		10.8	5.4	17.1	12.9	44.4	20.2	CL
59- 61	2.15	0.717	0.165	7.8	12.5	3.8	15.3	12.7	48.4	19.8	CL
64- 66	2.03	0.679	0.178		15.2	2.7	12.6	11.6	53.8	19.3	CL
69- 71	1.90	0.681	0.126	8.0	10.6	2.8	12.5	11.0	58.7	15.0	CL
74- 76	1.67	0.548	0.112		3.0	1.3	6.8	7.9	66.8	17.2	ZL
79- 81	1.65	0.505	0.127	8.0	1.2	1.1	8.3	8.9	63.9	17.8	ZL
84- 86	1.59	0.491	0.102		4.7	1.1	10.6	12.3	53.4	22.6	CL
89- 91	1.54	0.529	0.081	7.9	5.2	1.2	14.2	15.2	51.3	18.1	CL
94- 96	1.42	0.516	0.087		16.5	3.2	16.0	16.8	43.6	20.4	CL
99-101	1.04	0.456	0.093	7.9	17.5	4.2	24.7	24.3	35.4	11.4	SyL
104-106	0.963	0.489	0.075		21.5	5.2	24.3	22.7	34.3	13.5	SyL
109-111	0.947	0.452	0.071	8.0	32.2	4.0	21.1	22.4	39.2	13.3	SyZL
114-116	0.871	0.473	0.085		24.7	3.6	21.6	26.2	35.9	12.7	SyL
119-121	1.09	0.496	0.068	8.0	36.6	5.5	25.2	24.3	27.9	17.1	SyL
124-126	1.08	0.468	0.070		31.8	7.8	29.1	23.8	23.2	16.1	SyL
129-131	0.961	0.395	0.066	8.0	24.3	6.4	31.8	29.4	18.7	13.7	SyL

* CL = Clay loam; SyL = Sandy loam; SyZL = Sandy silt loam; ZL = Silt loam

APPENDIX V: Analytical data for Column 3, TRENCH 1A.

Depth (cm)	LOI (%)	Phos-Pt (mg/g)	χ (μm^3/kg)	pH (1:2.5, water)	Stones (%)	Coarse sand (%)	Medium sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture class*
4- 6	6.48	0.771	0.453	6.2	6.6	6.8	22.5	14.9	37.1	18.7	CL
9-11	5.42	0.759	0.547		23.3	8.3	23.2	15.7	36.2	16.6	SyZL
14-16	4.39	0.700	0.292	6.5	16.6	6.7	23.7	16.1	35.5	18.0	CL
19-21	2.83	0.589	0.185		30.8	9.1	20.8	13.7	39.8	16.6	SyZL
24-26	2.56	0.615	0.137	7.0	20.3	7.5	20.8	14.6	39.4	17.7	SyZL
29-31	2.23	0.679	0.115		3.1	6.5	20.0	13.1	42.0	18.4	CL
34-36	2.17	0.640	0.100	7.3	4.6	5.0	17.7	13.0	45.0	19.3	CL
39-41	2.19	0.587	0.108		2.7	5.1	17.8	14.0	45.0	18.1	CL
44-46	2.15	0.561	0.099	7.2	18.5	5.3	18.2	15.1	44.9	16.5	SyZL
49-51	1.75	0.460	0.081		19.5	10.1	22.7	16.9	35.8	14.5	SyZL
54-56	1.68	0.417	0.079	7.1	32.4	11.3	22.9	18.4	32.1	15.3	SyL
59-61	2.65	0.214	0.128		28.7	6.0	12.3	14.0	34.7	33.0	CL
64-66	2.80	0.148	0.149	7.4	0.0	0.4	7.0	8.7	35.2	48.7	C
69-71											
74-76											
79-81	2.87	0.118	0.177		0.0	0.2	2.8	5.5	31.3	60.2	C

* C = Clay; CL = Clay loam; SyL = Sandy loam; SyZL = Sandy silt loam