1800

Rhaglen o Glanhau Prif Gyflenwad Dŵr Crai yn Eithinfynydd, Talybont, Gwynedd

Raw Water Mains Cleansing at Eithinfynydd, Talybont, Gwynedd

Lliniaru Archaeolegol a Dadansoddiad Paill

Archaeological Mitigation and Pollen Analysis

Heneb

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Heneb is the trading name of The Trust for Welsh Archaeology

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CRYNODEB

Cynhaliwyd rhaglen o liniaru archeolegol gan Ymddiriedolaeth Archeolegol Gwynedd cyn ac yn ystod glanhau prif bibell grai o Lyn Bodlyn i waith trin dŵr Eithinfynydd i'r dwyrain o Dal y Bont. Cynhaliwyd y gwaith ym mis Rhagfyr 2011 a mis Ionawr 2012.

Roedd y gwaith archeolegol yn cynnwys briff gwylio yn ystod y broses lanhau a'r gwaith o adeiladu merllynnoedd storio dros dro, yn ogystal â chanllawiau ar leoliadau merllynnoedd ar lwybrau trafnidiaeth. Darganfuwyd deg safle archeolegol newydd yn ystod y prosiect ar hyd y llwybr trafnidiaeth ac yn gyffredinol o amgylch y gwaith, ac roedd y rhain yn gysylltiedig yn bennaf â ffermio a rheoli tir, ac eithrio dwy gist gladdu wedi dymchwel, o bosibl.

Ynghyd â'r safleoedd, darganfuwyd un arteffact: crafwr Oes Efydd wedi ei naddu o fflint ar y llwybr prifol yn arwain i'r de-ddwyrain tuag at Bont Scethin. Cafodd dadansoddiad paill ei gynnal ar graidd o gors ger Pont Scethin, a gwnaeth yr astudiaeth rhoi dyddiad y cyfnod canoloesol hyd at heddiw, gan awgrymu bod amaethyddiaeth ar dir âr yn y canol oesoedd wedi digwydd ar yr uchder hwn.

SUMMARY

A programme of archaeological mitigation was undertaken by Gwynedd Archaeological Trust in advance of and during the cleansing of a raw mater main from Llyn Bodlyn to Eithinfynydd water treatment works east of Tal y Bont. The work took place in December 2011 and January 2012. The archaeological work included a watching brief during the cleansing process and the construction of temporary storage lagoons, as well as guidance on the location of lagoons and transport routes. Ten new archaeological sites were discovered during the project along transport routes and in the general vicinity of the works, these were generally associated with agriculture and landscape management with the exception of two possible collapsed burial cists. A flint Bronze Age thumbnail scraper, found on the main path leading south-east to Pont Scethin, was the only artefact discovered. Pollen analysis was carried out on a core from a bog near Pont Scethin. This covered the medieval period to the present and suggested medieval arable cultivation at this altitude.

INTRODUCTION

Gwynedd Archaeological Trust (GAT) (now Heneb: The Trust for Welsh Archaeology) was asked by Dŵr Cymru Welsh Water to undertake a programme of archaeological mitigation in advance and during works to cleanse the raw water from Llyn Bodlyn (SH 64655 23773) to the Eithinfynydd water treatment works at Eithinfynydd, Tal y Bont, Gwynedd (SH 60180 21690) (Figure 1).

The works were associated with the internal cleansing of an existing 12" / 300mm diameter raw water main from Llyn Bodlyn (SH 64655 23773) down to the water treatment works at Eithin Fynydd (SH 60180 21690). This was achieved by inserting foam swabs into the main, which were propelled through the pipeline before being retrieved at pre-determined locations along the route. It was necessary to construct temporary storage lagoons by forming topsoil into bunds at these swab exit locations to enable the monitoring and, if necessary, treatment of the effluent generated by the swabbing process before discharge into the adjacent water course. The project also involved some associated pipework arrangements, including the relocation of an existing valve complex to a new position near the face of the dam.

The scheme called for the construction of three storage lagoons. These were located near Pont Scethin (site 1) (SH 63550 23540), south-east of Pont Fadog (site 2) (SH 61520 22370) and adjacent to the water treatment works (site 3) (SH 60180 21730). The additional pipeworks were carried at the foot of the Llyn Bodlyn dam (SH 64647 23775), a little to the west of the dam (SH 64497 23760) and north-east of the water treatment works (SH 60386 21867). The locations of these work sites are indicated on figure 1 and shown in more detail on figures 2 to 5.

The fieldwork was carried out between 06/12/2011 and 31/01/2012. Initial data collation and report writing was done in 2012 and 2013, but delays to the completion of the report resulted in its long-term suspension. The report was completed in 2024 as part of a programme to deal with unfinished backlogged reports. The report was written by Iwan Parry, who carried out the fieldwork, and edited and combined with specialist reports by Jane Kenney.

Archaeological Aims

The original aim of the works was to mitigate the impact of the scheme on known and potential archaeological remains. This was achieved by undertaking a programme of works including preservation *in situ* and preservation by record.

The current objective is the long-term curation of the recovered data, and its dissemination in a form suitable to its academic value in line with nationally defined guidelines.

Specification and Project Design

A project design for archaeological mitigation, prepared by GAT, was submitted to Dŵr Cymru Welsh Water, and subsequently to Snowdonia National Park Authority for approval, in November 2012.

This outlined the identified archaeology in the vicinity of the scheme and outlined the proposed level of mitigation required for each of the lagoon locations, additional ground disturbance related to the scheme, peat deposits and access routes.

On completion of the fieldwork the data collected was assessed for potential and a project design for the completion of post-excavation programme was produced. Post excavation analysis was undertaken in accordance to the design resulting in the production of the current report, the long term archiving of finds and site records, and the dissemination of the results.

This project and the production of the current report have followed the standards defined in Management of Archaeological Projects (Second Edition, English Heritage, 1991), and Management of Research Projects in the Historic Environment Project Manager's Guide (English Heritage 2006).

METHODS AND TECHNIQUES

Introduction

A phased programme of work was undertaken. These included:

- Palaeoenvironmental assessment and analysis
- Archaeological controlled stripping
- Archaeological watching brief

Watching Brief and Controlled Stripping

The site work involved a watching brief on the excavation of the storage lagoons and on groundworks along the pipe route. It also involved establishing a route for vehicles that avoided known archaeological sites and the identification of possible archaeological sites, to ensure that no damage occurred. As the lagoon at site 3 was constructed in an area that had already been archaeologically surveyed no addition archaeological survey was required but the lagoons as dug were located using GPS and a total station theodolite.

The positioning of the lagoons was checked by the archaeologist to ensure that visible archaeological features were avoided. This was particularly important at site 3 where known archaeology surrounded the site. The lagoon areas were stripped under archaeological control. This involved stripping topsoil and ploughsoil with a 360 degree tracked excavator fitted with a toothless bucket under constant archaeological monitoring. Once the topsoil and subsoil was removed to the underlying glacial till, or when archaeological features were exposed, the stripped area was examined by the archaeologist to identify archaeological remains.

The stripping and removal of the overburden was undertaken in such as manner as to ensure no damage to surfaces already stripped. Any archaeological features identified were cleaned by hand as necessary, investigated and recorded.

Other groundworks were inspected by the archaeologist to identify and record any archaeological features that they might expose.

Where machines had to cross areas without well-made tracks the archaeologist checked the proposed route for visible archaeological sites and accompanied the vehicles to ensure that these sites were avoided and not damaged. The movement of vehicles was kept to a minimum and no stripping or benching was undertaken. A very small number of stones had to be moved but it was confirmed by the archaeologist prior to moving that the stones were not part of a potential archaeological site.

Cadw was consulted regarding the crossing of plant close to the Scheduled Ancient Monument of Pont Scethin. Cadw required that photographs were taken before any attempt and that damage to the path leading from the bridge should be minimised. A 13 tonne excavator crossed the river downstream of Pont Scethin, well outside the scheduled area.

Palaeoenvironmental Assessment and Analysis

Peat deposits at site 1 (Pont Scethin) appeared to be suitable to preserve an important environmental history. It was therefore agreed that prior to the excavation of the lagoon the peat would be investigated and sampled. This work was carried out by James Rackham of the Environmental

Archaeology Consultancy. The objective of the sampling would be to recover a sequence of deposits from which the vegetational history of the valley could be constructed so that the rich archaeological landscape, including prehistoric, Roman, medieval and post-medieval monuments could be placed within a palaeoenvironmental setting.

The depth of the peat was investigated in three transects in the area and the best location for taking a pollen core was located. Two pollen cores were taken. Two samples from Core 1 were submitted to radiocarbon dating to obtain range-finding dates on the peat development. A series of pollen samples were taken from Core 1 and a single sample from near the base of Core 2. These samples were submitted to an assessment study to ascertain the presence or absence of sub-fossil pollen and spores. For detailed methodology and results of the auger transects and pollen assessment see Appendix I.

Core 1 was then subjected to full pollen analysis and the peat development was dated by further radiocarbon dates (see below for full methodology).

Post-Excavation Analysis and Reporting

The post-excavation analysis, report and archiving has been carried out according to the post-excavation project design submitted in November 2012, all relevant information is included in the current report.

Data collection from site records

There were relatively few site records, but many photographs. A database of photographs was created to provide appropriate metadata to allow for the active curation of the digital photographs. Photographs were catalogued during the fieldwork phase, and were subsequently catalogued and formatted for archiving.

Newly identified sites have been assigned Primary Record Numbers (PRN) obtained from the Gwynedd Historic Environment Record (HER).

Full descriptions of the work undertaken have been written and plans produced from the survey data.

Finds

The single find from the project, a flint scraper, was cleaned, bagged and labelled.

Reporting and dissemination

The primary product of this project is the current report which will be held in the Gwynedd Historic Environment Record and made available for public and academic consultation. The report will also be available on the website of the Royal Commission on the Ancient and Historical Monuments of Wales. Copies of this report will be sent to the SNPA archaeologist. Due to the significant results produced by the pollen analysis of the core sample the academic community needs to be aware that the work has been carried out. a summary of the work will be published in Archaeology in Wales, the journal for the Council of British Archaeology Wales.

Archiving

The paper archive and a copy of the digital photographs are be held by Gwynedd Archaeological Trust under site code G2099. The single flint is kept with the archive. The digital photographs will be actively curated by the Royal Commission on Ancient and Historical Monuments of Wales.

TOPOGRAPHICAL, HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

Geology and Landscape

The project area lies in the Yscethin valley which is surrounded by the hills of Moelfre to the north-east, Diffwys to the south-east, and the Llawllech ridge to the south. Afon Yscethin flows west down the valley from Llyn Bodlyn, which now acts as the reservoir for Eithinfynydd water treatment works, onto the coastal plain at the village of Tal y Bont and finally feeds into Cardigan Bay.

The area lies on the edge of the Precambrian massif of the Harlech Dome. The Harlech Dome is bounded by the Dwyryd and Mawddach estuaries to the north and south, and by the alluvial and sandy plain of the Ardudwy plain to the west, and the Trawsfynydd depression to the east. The Dome and its immediate surroundings are the location of the thickest succession of Cambrian rocks in Britain which form a barren and desolate tract characterised by high, rugged block-like mountains where thick bands of grit and conglomerate come to the surface (Smith and George, 1961). Underlying bedrock in the study area is typical of the Harlech Dome with bands of mudstone, sandstone and siltstone of the Gamlan, Barmouth, Hafotty and Rhinog formations generally running from north to south (BGS). Subsoils overlying the bedrock in the area consist of superficial Devensian and Diamicton till formed during the last Ice Age, these are in turn overlain by blanket peat around the upper section of Afon Scethin and Llyn Bodlyn, changing to acidic loamy soils of low fertility further downhill.

The upper part of the scheme from Llyn Bodlyn to the rocky outcrop on which Craig y Dinas hillfort is located the scheme runs through open, fairly boggy moorland which slopes from 380m OD at the lake to 260m OD at the western base of Craig y Dinas. Continuing downslope to the east the landscape shows far more human interaction with varying degrees of improved pasture and better drained soils.

Archaeological Background

The water treatment works lies close to Tal y Bont in Ardudwy, in the former county of Merionethshire. The entire project area lies within a registered landscape of outstanding historic interest, described as ‘a large, exceptionally archaeologically rich and well-studied landscape, containing extensive relict evidence of recurrent land use and settlement from prehistoric to recent times’ (*Register of landscapes of outstanding historic interest in Wales*, Cadw/CCW 1998).

See Figure 6 for HER sites in the study area.

EARLIER PREHISTORIC

No evidence of Palaeolithic activity has ever been found in the vicinity of the project area, which is hardly surprising given the fact that the last remnants of glaciers from the last Ice Age only disappeared some 10,000 years ago (Crew and Musson, 1996).

No Mesolithic sites are known from the area either although it is likely that the area would have started to have been used for hunting and foraging by around 8,000 years ago when trees would have cover all but the highest peaks of Snowdonia. The ephemeral nature of sites from this period along with the relatively small amount of archaeologically observed excavations that take place in this type of upland environment means that many may yet be discovered.

Significant sites of Neolithic and Bronze Age date are found in the vicinity of the project area indicating relatively extensive habitation during this period.

Some of the most enigmatic and awe inspiring monuments found in the surrounding landscape are the enormous chambered long cairns of the early Neolithic. The burial chambers are characterised by huge raised capstones supported on stone uprights. Originally these would have been covered by a long cairn of smaller stones, the remnants of which can still be seen at some examples.

Six such monuments make up the Ardudwy group, all of which originally consisted of a long cairn of stones aligned roughly on an east-west axis covering one or more chambers.

The nearest example is located on one of the access routes used for the project. Cors y Gedol chambered tomb (PRN 1083) is generally in poor condition with only the capstone and two small uprights remaining from the chamber itself. A roughly rectangular mound which tapers to the east suggests the original dimensions of the cairn itself. The cairn is located on the western side of a trackway which leads from Cors y Gedol which was originally the main route across the mountains to Dolgellau, which may account to some degree for the poor condition of the monument (Bowen and Gresham, 1967).

Dyffryn Ardudwy (PRN 1067), lies west of the project area in a village of the same name and includes two chambers built at different periods.

The two multi chambered tombs at Carneddau Hengwm (south PRN 1081 and north PRN 1082) are arguably the most impressive in the area. They are likely to have been adapted over time in the similar way to Dyffryn Ardudwy, incorporating elements of earlier portal dolmens and later Cotswolds-Severn type tombs.

Gwern Einion (PRN 1057) is a portal dolmen which until fairly recently was built into the wall of a former outbuilding. Bron y Foel Isaf (PRN 1084) is also likely to be a portal dolmen but like Cors y Gedol is badly damaged.

Also of note is the Llanbedr incised stone (PRN 4782) which is said to have been found, '…in Dyffryn Ardudwy, on the hills near some early stone remains' (Bowen and Gresham, 1967). The stone is pecked with an intricate and well-defined spiral which is typical of motifs from Irish Neolithic tombs of the Boyne valley, few examples of which are found in Britain. It is not unreasonable to suggest that the stone came from another, now lost, Neolithic tomb in the area.

No definite evidence of domestic sites of the Neolithic has been found in the immediate area although some possible evidence, in the form of pits containing fire-cracked stones, was found at Moel y Gerddi, above Harlech (Kelly, 1988).

Where there appears to be a general focus on lowland areas during the Neolithic, the Bronze Age sees a shifting in focus, or at least expansion, into the uplands.

Although not much definite dating evidence has been found, somewhat due to a lack of recent study, it is likely that some of the hut circles and scattered settlements in the area date to the Bronze Age. Two hut circles, of probable Bronze Age date (PRN 1087 and PRN 1088) are located at Hengwm, about 800m north of the chambered cairns. These were excavated by O.G.S. Crawford in 1919 (Crawford 1920).

The monuments that can be firmly attributed to the Bronze Age, as with the Neolithic monuments, are related to death and ritual. During this period round barrows and cairns, generally located on prominent high points in the landscape, become the preferred burial monument. These initially acted as a grave for a single individual, positioned centrally and often within a stone cist, sometimes having other satellite burials and cremations being added at a later date.

A number of round cairns are located in this vicinity, the peaks of virtually all of the surrounding hills displaying examples, some also excavated by Crawford (Bowen and Gresham, 1967). A ring cairn at Hengwm was more recently excavated as part of the Ardudwy Early Landscapes Project (Johnston and Roberts 2009), two similar ring cairns excavated to the north at Moel Goedog (SH 610 324) revealed a number of cremation burials and pits of probable ritual significance (Lynch, 1984)

Three standing stones (PRNs 12897, 5124 and 5125) are located in the immediate vicinity of the scheme at SH 6410 2380, SH 6412 2385 and SH 6423 2417. All are believed to be genuine Bronze Age examples. Two standing stones (PRN 6446) stand close to the access route for the works; one of the stones may have formed part of a stone circle. There are also many cairns in the same area, some probably clearance cairns but also probable funerary cairns.

Two Bronze-Age standing stones (PRN 1059) stand on the banks of the Afon Artro just to the North of Llanbedr. Other Bronze Age activity is reflected by a scatter of finds, some of high status, within the general area (Bowen and Gresham 1967, 121-129). Most do not have accurate findspots so their context is lost. The most spectacular is a gold torque (PRN 2896) dug up in a garden somewhere near Harlech Castle. It is now in the National Museum of Wales.

LATER PREHISTORIC/ ROMANO-BRITISH

It is believed that much of the roundhouse settlements and early field systems in the uplands surrounding the project area have their origins in the Late Bronze Age and were in use throughout the Iron Age and Romano-British period, and possibly into the early Medieval.

The most obvious feature dating to the later prehistoric period in the area is the small hillfort of Craig y Dinas (PRN 1107) which is scheduled ancient monument (ME020). Another example, Pen y Dinas (PRN 1106, ME076), can be found approximately 1km south of the Eithinfynydd WTW at SH 6060 2086.

West of the Cors y Gedol burial chamber is an area of Prehistoric and Romano-British settlement and field systems. The features consist of a number of hut circles, possible homesteads and field walls all of which lie in an extensive area which has been scheduled as an ancient monument (ME128).

Excavations undertaken as part of the Ardudwy Early Landscapes Project at Hengwm between 2001 and 2004 revealed that a later prehistoric roundhouse settlement showed evidence of later re-use (Johnston and Roberts, 2009). Other settlement excavations in the general are have shown similar patterns, including Erw-Wen near Harlech where a roundhouse settlement dating to the first millennium BC, which was likely to have been in use through to the early medieval, was shown to have been re-used as an animal pen in the later medieval period (Kelly, 1988).

No features relating to Roman military activity have been discovered on the Ardudwy coastal plain and it is believed that the Roman road leading from Dolgellau to Tremadog, via Tomen y Mur, was situated about 8km east of the project area (Hopewell, 2013). It is suggested by Waddelove (1999) that the coach road from Dolgellau to Harlech which crosses Pont Scethin was the route of the Roman road, however no real evidence to support this claim has ever been presented.

Although no features have been found in recent years a number of small finds dating to the Roman period have been unearthed in relatively close proximity to the project area along the shore at Tal y Bont. These include a dolphin brooch (PRN 32679) from SH 5803 2098, a silver denarius of Hadrian (PRN 32678) from SH 5799 2094, a wheel or disc brooch (PRN 32680) from SH 5776 2125, and a little further south a finger ring in the form of a snake (PRN 24131) was found at SH 602 170.

RESULTS

Lagoon Locations

SITE 1 – PONT SCETHIN

Figure 2

The lagoon (Lagoon 1) was located approximately 100m east of Pont Scethin at SH 63556 23523, west of the existing pipe route close to an existing inspection chamber. The lagoon measured 7m x 7m and was located on a relatively flat, boggy, piece of ground. Excavation revealed that a layer of peat, 0.3m thick, overlay the underlying deposits of orange-grey glacial till. Small boulders were scattered within the till on the interface with the peat, but none appeared to have been intentionally placed and upon further excavation into the till it was clear that boulders were present throughout. The lagoon was excavated to a depth of approximately 1m (Plate 1). The boggy conditions in the area meant that the lagoon flooded almost instantly, to the point of overflowing when left overnight.

Additional excavation in the area took place over the line of the existing main, at SH 63550 23504, for a swabbing trench. The trench, measuring 5m x 3m on a roughly NE-SW alignment, was excavated so that the main could be accessed for the insertion and retrieval of the swab and to install associated components. The soils in the trench had clearly been disturbed and the upper peat layer was noticeably thinner than in the lagoon excavation. The backfill of the trench was not unlike the surrounding till but was noticeably mixed. The trench was ultimately excavated to a depth of approximately 1.5m.

During the excavation of the swabbing pit water ingress became an issue virtually instantly. Due to this it was decided that a gully should be excavated up-slope of the excavation to divert water. This was in an arc, approximately 15m long in total and at a depth of 0.3m – 0.5m, around the top side of the trench. The gully was entirely within the peat and subsoil was not encountered at any point.

The final excavation in the area took place over an overflow pipe leading from the existing inspection chamber towards Afon Ysgethin at SH 63539 23514. The trench measured 4.5m x 3m and was orientated roughly E-W. The peat deposit was again found to be relatively shallow at 0.2m – 0.3m and overlying orange-grey till which had clearly been disturbed by the pipe trench. The trench was excavated to a depth of approximately 1.4m and as with the other trenches water ingress was an issue.

None of the trenches in the area produced any archaeological evidence. As would be expected it appeared that peat deposits were thickest in areas which had not been directly impacted by previous excavations.

SITE 2 – PONT FADOG

Figure 3

The lagoon at Pont Fadog (Lagoon 2) measured 20m x 16m and was centred on SH 61525 22374. The area was clearly better drained than the previous location and had been improved to a greater degree, it appeared that the field had been partially cleared of boulders and formed into smaller fields by dry stone walls which are probably 19th century in date. At this location, which was further upslope from the river than at the Pont Scethin site, no peat was present. The topsoil was thin and consisted of 0.1m – 0.15m of light grey-brown sand rich silt which was overlying 0.2m of mid red-brown clay rich silt subsoil (Plate 2). The glacial subsoil in the area was orange-grey till with occasional boulders.

A long trench running E-W and measuring 20m x 1.5m was excavated down to the top of the glacial subsoil in order to try and identify the location of an overflow pipe which was believed to flow north of an existing inspection chamber. The soils in this trench were the same as those encountered in the lagoon excavation. The overflow pipe was not identified and there was no suggestion that the ground had been previously disturbed.

The swabbing trench was located at SH 61505 22355 and measured 4m x 3.5m on an E-W orientation. The ground in the area had clearly been disturbed previously by the installation of the existing main.

The only feature identified in this area was within the lagoon trench. A change in colour in the glacial subsoil appeared as if it may have been an archaeological feature, however upon investigation was found to be a glacial anomaly.

SITE 3 – EITHINFYNYDD

Figure 4

The lagoon at Eithinfynydd (Lagoon 3) was located in a field adjacent to the water treatment works which had already been subject to an archaeological investigation during the extension of the treatment plant.

The lagoon was located at SH 60159 21734 and measured 25m x 10m on a roughly NW – SE orientation. The fields in this area were smaller than those found higher up slope and may have much earlier origins, possibly being associated with small farmsteads that may have their roots in prehistory. Improvement of the land is evident in both the largely stone-free nature of the fields, much of which would have been used to build the extensive dry-stone walls, and in the small clearance cairns which dot the landscape.

The soils in the area were generally thin but thicker than those encountered further up-slope. The topsoil was very thin, only reaching a depth of 0.15m in a few locations and generally consisting of the turf mat and little else. The subsoil was thicker at 0.2m – 0.35m and consisted of mid brown-orange clay rich silt. The underlying glacial till was again orange-grey in colour and contained a fair amount of sub-rounded stones with occasional boulders (Plate 3).

The only feature identified in the trench was a group of stones which had no obvious structure, apparently randomly piled with frequent voids (Plate 4). No artefacts were found in association with the stones and no date can be reliably suggested. It is believed that the stones represent yet another clearance cairn associated with the improvement of the field. These stones had previously been recorded as seen on the surface as PRN 33924.

RESERVOIR EXCAVATIONS

Figure 5

All excavations in the vicinity of the reservoir were over the existing main and only affected ground which had previously been disturbed during the original installation of the main and subsequent alterations. It was however noted that beyond the affected area, where a large amount of the glacial stones had been moved to form a working corridor, archaeology appeared to be present on the southern (upslope) side of the main. A possible cairn PRN 112122 was noted south of the meter replacement trench at SH 64477 23719 (Plate 5), a brief look at aerial photographs suggests that a number of unrecorded features including possible enclosures and buildings may be present in the area.

ACCESS ROUTES

Figures 2 and 5

A number of new features were identified in the general vicinity of the works, largely whilst guiding machinery along new access routes. These were not investigated in any great detail but brief descriptions were written, photographs taken and their locations noted with a hand-held GPS. Where possible linear features were also plotted with a Total Station Theodolite.

PRN 112123 (SH 64345 23645) – A roughly 'D' shaped hut was built against a rock outcrop which occupied a flat, wet, but high position with good views down the valley. The low walls formed an enclosure of roughly 3m x 2m and were of dry-stone construction and it did not appear as if they had ever stood to any great height (Plate 6). It is likely that the feature was a small shepherd's hut or temporary shelter of unknown date.

PRN 112124 (SH 64118 23552) – A number of linear earthworks (Plate 7) were found in close proximity to a large sheepfold (PRN 98907). A stream ran along the edge of one of the linear earthworks suggesting that they may simply be channels formed by flowing water. The sheepfold consists of a sub-circular enclosure with remains of rectangular pen attached (Plate 8).

PRN 112125 (SH 64031 23486) – A possible cist was identified whilst tracking the excavator from the reservoir to Pont Scethin. The feature consisted of two stones which appeared to be set at right angles with a further aligned stone visible on the ENE-WSW axis (Plate 9). It is likely that excavation is the only way that the interpretation could be confirmed, it is possible that the feature was a natural anomaly.

PRN 112126 – A long linear feature (centred on SH 62970 23760) was identified whilst looking for an appropriate route for a dumper to travel from the formalised track running to the reservoir to Pont Scethin on the north-western side of the valley. A low stone bank, up to 3.5m wide, running for approximately 125m across the slope of the valley was interpreted as either a denuded boundary wall or revetment at the edge of a terrace (Plate 10). By looking at aerial photographs it was possible to see that the feature extended for at least another 50m to the west. Three clearance cairns which may be associated with the feature were also found in the same area, these were:

PRN 112127 at SH 63025 23768 (Plate 11)

PRN 112128 at SH 63028 23749

PRN 112129 at SH 62982 23706

PRN 98881 – A roughly 'D' shaped enclosure found in the middle of a concentration of glacial boulders (at SH 64162 24086), two previously recorded standing stones are also located at the edge of the concentration. The enclosure measured approximately 10m x 5m and was orientated NE-SW (Plate 12). The walls were of dry-stone construction, in places standing up to five courses high and to a height of 0.7m, and incorporated large glacial boulders. It is likely that the feature was associated with livestock management. The two standing stones (PRN 5125) were photographed for record (Plate 13).

PRN 98882 – A possible collapsed cist was identified at the side of the main track leading north-west from Pont Scethin at SH 63037 23639. The feature consisted of a fairly large, flat, stone, measuring 0.8m x 1.5m x 0.3m, set on edge which appeared to have been propped up by other stones (Plate 14).

PRN 98883 – A short distance south-east of PRN 98882, at SH 63045 23630, a section of curving wall was identified (Plate 15). Due to foggy weather conditions it was not possible to see the feature in a wider context, however aerial photographs appear to show a circular feature in the area. It is likely that the feature is a roundhouse, cairn or sheepfold but without further investigation a more definite interpretation is not possible.

PRN 98908 – Flint scraper found at SH 63211 23591. Small thumbnail scraper made on brown translucent pebble flint. Some of the original cortex remaining on dorsal side and ventral face unusually rather roughly knapped (Plate 16).

Palaeoenvironmental report on a core taken near Pont Scethin, on the Afon Ysgethin near Talybont, Ardudwy.

Dr Rob Scaife[1], Catherine Langdon[1] and James Rackham[2] (Feb 2014)

Introduction

The construction of temporary lagoons at Site 1 near Pont-Scethin (Figure 2) by Welsh Water led to an archaeological evaluation of the site and a palaeoenvironmental survey and core sampling (Appendix I) as one of the mitigations. An assessment of the recovered core of 2.74m of silts and peats established that these deposits represented much of the last millennium. On the basis of known archaeological and historical activity in the valley from prehistoric times this assessment recommended that the core was studied in detail to establish the vegetational history of the valley over the last thousand years and the impact of climate and human activity on it. Welsh Water kindly funded this further work which is reported below.

The site lies at 314m OD adjacent to the Afon Ysgethin in an upland valley of rough pasture and moorland looking down towards the sea to the west (Plate 17). The site lies on Devensian till, diamicton, over sandstones and mudstones of the Barmouth Formation

(mapapps.bgs.ac.uk/geologyofbritain/home.html). More extensive peats lie in a hollow/plateau a few hundred metres upstream of the site which may afford a much longer palaeoenvironmental sequence.

A roadway route, known as the Old Harlech Coach Road, travels through the valley and over the nearby 16th century pack horse bridge, Pont-Scethin, over the Afon Ysgethin, finally passing out of the valley south-east over a pass between the peaks of Llawlech and Diffwys in the Rhinog Range, and down into the west side of the valley of the Afon Hirgwm towards Llechfraith and finally Bontddu on the estuary of the Afon Mawddach.

The pollen core site lies within a landscape with a number of known archaeological sites, primarily of prehistoric, Roman and post-medieval date (Figure 6). Prehistoric sites occur upstream on higher ground, nearby and on a plateau of land north-west of the site, and a hillfort, Craig-y-Dinas, and other nearby prehistoric settlements approximately 1km west of the core site. There is a scatter of Roman settlements, and on the south facing slope a few hundred metres north of the site, at approximately 370m OD, occur a series of stone building and enclosure ruins, and others on the south side and upstream, that are testament to post-medieval occupation at this altitude on what must have been fairly marginal land. There are very few known finds of medieval date in this area and only one site, near the prehistoric hillfort, lies within 1.5km, although the Old Harlech Coach Road may have had a medieval precursor.

The dates established during the assessment for the peat and silt sequence and the indication that pollen survived well (Appendix I) makes this core an important source of information on the character of changes in this marginal upland landscape during the last millennium that can perhaps be related to the known distribution of archaeological sites.

SAMPLING

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After an initial auger survey across the area (Appendix I) a location was selected for the recovery of a core. This was an area of bog on the north side of the river approximately 40m across where the auger survey recorded an approximate depth of 3m of silts and peats (Figures 7 and 8). The coring was undertaken using a Russian corer.

Two adjacent boreholes were used with the 0.5m sampling being taken alternately from each borehole to avoid the disruption caused by the nose of the auger. The upper metre of the bog was extremely wet and the upper 0.25m of the first core (0-0.5m) was sampled poorly despite trying three times, although a complete sequence was recovered. The second sample (0.5-1.0m) was also less than perfect but once again some sample was recovered for the whole 0.5m. Below this the samples were extracted with no problems to a final recovered depth of 2.62m, although the basal 0.12m of the core could not be recovered with the Russian corer. Stone was hit by the auger at 2.74m depth.

The poor sampling of the upper 0.5m had implications for the radiocarbon dating of these upper sediments and the date obtained at 45-47cm (Table 1) with a clearly modern result indicates probable contamination rather than a real age for these deposits, although a 20th century date is probable.

DATING

A series of samples were submitted for radiocarbon dating. The initial two dates were designed to indicate the total date range of the deposits recovered, the upper sample (45-47cm) giving a modern date, and the basal silts (252-254cm) yielding a date at the end of the 1st millennium AD. Subsequent samples were submitted to target patterns identified within the pollen data (Figure 9). The samples were submitted to the Radiocarbon Laboratory of the Scottish Universities Environmental Research Centre (SUERC).

The dated fraction of the upper sample was the humic acid fraction rather than the fibrous fraction, this was chosen to avoid recent fibrous root material contaminating the date but it has produced a modern date and it is probable that the extremely wet nature of these upper peats (effectively a floating bog!) has resulted in particle settlement through the water matrix leading to modern material settling at depth or contamination during the coring. This upper part of the sequence is almost certainly 20th century (see below), with the deposits immediately below the dated horizon (45-47cm) perhaps dating to the 1st part of the 20th century.

Table 1. AMS Radiocarbon dates

Lab.no.	**context**	**material**	**13C/12C Ratio**	**Conventional Radiocarbon Age**	**Calibrated Age at 2 sigma**
SUERC-40152	45-47cm	Fibrous peat (humic acid dated)	-30.7 ‰	1.0719±0.0038 BP	Modern
SUERC-46543	116-117cm	Peat	-30.8 ‰	183±34 BP	cal AD 1649-1697 (20.4%) & cal AD 1725-1815 (50.5%) & cal AD 1835-1878 (5.8%) & cal AD 1917-1955 (18.8%)
SUERC-46542	195-196cm	Peat	-31.3 ‰	585±34 BP	cal AD 1298-1370 (64.9%) & cal AD 1379-1417 (30.5%)
SUERC-46541	209-211cm	Humic sediment	-29.4 ‰	1327±34 BP	cal AD 648-726 (73.3%) & cal AD 737-772 (22.1%)

SUERC-40151	252-254 cm	Organic silt (humic acid dated)	-29.8 $^{0}/_{00}$	1035±30 BP	cal AD 898-920 (5.7%) & cal AD 946-1036 (89.7%)

The pollen data (Figure 9) indicates a hiatus in the depositional sequence at 200cm so samples were submitted for dating immediately below and above this horizon. The results of the additional dates has established that the bulk of the core dates to the medieval and post-medieval period. Accurate resolution of calibrated dates in the late medieval and post-medieval is very difficult owing to the calibration curve during this period which allows several possible results for each measured age (Table 1) so the upper part of the sequence cannot been accurately dated without multiple sequential samples. The hiatus recorded in the pollen data suggests that the early medieval period between approximately 800 and 1200 AD is missing from the sequence. This is coincident with a change from pebbly organic sandy silts to humic silts and finally peats. The age of the base of the sequence has also been thrown into doubt by the result from humic sediment at 209-211cm. This has produced a date significantly older than the date obtained during the assessment on humic sediment 0.4m lower. Before the lower part of this sequence can be confidently dated a second sample, preferably identified macroscopic remains, from the base of the core will need to be submitted. The sequence may therefore either start at the end of the 1st millennium AD or may start much earlier, perhaps in the immediate post-Roman period.

PONT SCETHIN CORE

A 2.62m sequence of deposits was recovered. The upper 0.5-0.7m was extremely wet with a 'floating' sphagnum and sedge peat on the surface. The upper part of the core is therefore somewhat insecure and the Russian borer recovered a limited sample through this depth. The remainder of the core was recovered cleanly.

The sequence was as follows:

0-50cm very wet fibrous loose moss and sedge peat (45-47cm - 1.0719±0.0038 BP)

50-100 wet fibrous peat, with small platy stones at 96-100

100-166 fibrous slightly compacted peat (116-117cm - 183±34 BP)

166-173 organic silt

173-188 humified fibrous peat

188-200 organic silt (195-196cm - 585±34 BP)

200-240 slightly sandy organic silt with frequent small stones (209-211 - 1327±34 BP)

240-258 organic silt with rare sand grains

258-262 slightly sandy organic silt with occasional small stones (252-254 - 1035±30 BP)

262-274 silty sands

Stopped by stones at 274cm

On the basis of the lithology and the profile recorded in Figure 8 the deposit sequence appears to lie in a former channel of the Afon Ysgethin, or perhaps more probably an area seasonally incorporated into the channel during periods of high water. The lower sandy organic silts and small stones indicate a higher energy environment consistent with channel and channel margin sediments. The basal date (Table 1) is contradicted by the date at 209-211cm offering two potential age ranges for the lower river lain sandy silts. Either these were deposited between approximately 1000 and 1330 AD with a short hiatus in the late 12th-early 13th century or they were deposited during the early to middle 1st millennium AD with a much longer hiatus of several hundred years before peat began to form in the old channel. In the latter case the lithological change from sandy organic silts with small stones to a stoneless organic silt is likely to mark a erosional horizon which could account for the hiatus.

After the river flow ceased to impact at the site short episodes of organic silt and peat accumulation indicate changing conditions on the site from open water to bog, and back to open water, before a sequence of wet peats developed with occasional inwash of platy stones, presumably during later periods of high flow in the river or erosion of a scarp face around the bog on its north side. The top of the sequence is represented by a saturated sphagnum and sedge bog.

POLLEN ANALYSIS

Dr. C. Langdon and Dr. R. Scaife

Introduction

Pollen and studies of vegetational history in Wales have, in the past, tended to focus on last glacial (Devensian) and Holocene prehistoric peat sequences. In fact there have been relatively few studies of peat deposits of the historic period from throughout Britain as a whole when compared with pollen data relating to the prehistoric period. In North Wales early studies were seen at Cwm Idwal by Godwin (1955) and subsequently by Tipping (1990) and various archaeological sites (Chambers and Price 1985; Chambers *et al.* 1988), notably, Bryn y Castell, hillfort, Merioneth (Mighall and Chambers 1989, 1995, 1997). Studies of the historic environment have, however, also been carried out by Grant (2007) from the Afon Nug valley, Denbigh in North Wales and further afield in Central Wales by French and Moore (1986). These are important for our understanding of the changing environment and land use of the last two millennia, due to natural and anthropogenic causes.

At Pont Scethin, a peat and humic sediment sequence has been analysed with the aim of establishing such late historic land use, vegetation and environmental change, especially in the changing land use in this marginal upland zone.

Pollen method

Standard techniques for pollen concentration of the sub-fossil pollen and spores were used on sediment sub-samples of 1.5 ml. volume (Moore and Webb 1978; Moore *et al*. 1992). A pollen sum (dry land) of 400 or more grains per level was identified and counted. Taxa of wetland (primarily Cyperaceae) affinity, fern spores and miscellaneous geological palynomorphs were recorded outside of this sum. A pollen diagram (Figure 9) based on this data was produced using Tilia and Tilia Graph with percentages calculated as follows:

Sum =	% total dry land pollen (tdlp)
Marsh/aquatic herbs =	% tdlp + sum of marsh/aquatics
Ferns =	% tdlp + sum of fern spores
Misc. =	% tdlp + sum of misc. taxa.

Taxonomy used, in general follows that of Moore and Webb (1978) and Moore *et al.* 1991 modified according to Bennett *et al.* (1994) for pollen types. These procedures were carried out in the Palaeoecology Laboratory of the School of Geography, University of Southampton.

The Pollen data

Following an earlier assessment (Rackham *et al* 2009) which established that well preserved sub-fossil pollen and spores are present at this site, a more detailed analysis has been carried out. This study has delimited a number of palynological changes in the profile from which inferences on the past vegetation and environment can be made. These changes are recognised in four local pollen assemblage zones (l.p.a.z.) which are described in Table 2 below.

Table 2*:* Pollen zonation and description

Local pollen zone	**PALYNOLOGICAL CHARACTERISTICS**
l.p.a.z. TAL: 4 0.84m to 0.56m	This uppermost zone is delimited by small peaks of *Pinus*, *Quercus*, *Ulmus* and the expansion of *Rumex* (15%), *Dianthus* type (10%). Although remaining dominant, Poaceae decline in response (statistical ?) to the expansions of other taxa noted (to *c.* 45%). Cereal pollen increase in the upper level although numbers remain small. There are reductions in *Potentilla* type, *Plantago lanceolata* and in marsh and aquatic taxa and numbers of Cyperaceae and algal *Pediastrum*. *Botrychium lunaria* is present.
l.p.a.z. TAL: 3 1.16m to 0.84m	This zone is delimited by a further reduction of trees and shrubs including *Betula* (to 5%), *Alnus*, and *Corylus avellana* type. *Quercus* remains consistent at low levels from the preceding zone. *Pinus* (1-2%) and *Fraxinus* (1%) are consistent at low levels. Poaceae attains their highest values (to 80%) with continued *Plantago lanceolata* (*c*. 5%), *Ranunculus* type (5%), *Potentilla* type (4%), Rubiaceae (1%). Marsh/wetland taxa remain broadly as in the preceding zone with Cyperaceae dominant peaking to 28% but subsequently declining. Spores of ferns and *Sphagnum* decline to low levels.
l.p.a.z. TAL: 2 1.98m to 1.16m 116-117cm 183±34 BP 195-196cm 585±34 BP	This zone is delimited by a reduction of tree and shrub pollen which corresponds with a stratigraphical change to peat from mineral sediment (hiatus ?) and the first occurrence of cereal type pollen. Whilst *Betula* remains consistent from zone 1, other trees/shrubs (*Quercus*, *Alnus*, *Corylus*) decline followed by further expansion to *c*. 50% of previous levels. There are occasional occurrences of *Pinus*, *Ulmus*, *Fraxinus*, *Prunus* type and *Salix*. Herbs are more diverse and remain dominated by Poaceae (to 70%) with increased values of *Plantago lanceolata* (to 10%), *Potentilla* type (3-4%), *Ranunculus* type (8%) and Rubiaceae (1-2%). Cereal pollen (to 3%) occurs for the first time and also 'large Poaceae' (>40u size) to 9%. There is an increased range of marsh and aquatic taxa also with Cyperaceae increasing (to 30%) with occasional occurrences of *Caltha* type, *Hydrocotyle* type, *Potamogeton* type, *Typha latifolia* and *Typha*/*Sparganium*. The aquatic fern *Isoetes* and algal *Pediastrum* are also present. Other fern spores comprise reduced numbers of *Dryopteris* type, occasional *Pteridium* and *Polypodium*.
l.p.a.z. TAL: 1 2.56m to 1.98m 209-211cm 1327±34 BP 252-254cm 1035±30 BP	Humic mineral sediment containing greater numbers of trees and shrub pollen than in subsequent zone, especially in the basal levels. *Betula* (to 13%), *Alnus* (to10%) and *Corylus avellana* type (23%) are most important. Other trees include sporadic occurrences of *Populus*, *Tilia*, *Fagus* and *Ilex*. Dwarf shrubs/Ericales are most important in the upper part of this zone with *Calluna* to 5%. Herbs are, however, dominant with Poaceae (70%) most important. Other continuous but low records include *Ranunculus* type, *Potentilla* type, *Rumex* and *Plantago lanceolata*. There are few marsh/aquatic taxa with the exception of Cyperaceae (to 20%). The base of the zone has substantial numbers of monolete Pteropsida spores (*Dryopteris* type; to 55% sum + spores). There are also higher values of *Polypodium* (1-2%) and highest values of *Sphagnum* (16%) from 2.44m in this sequence.

Vegetation change

Interpretation of this pollen sequence can be seen from two aspects. First, is the development of the on-site mire vegetation and environment of this sediment basin, and second is the off-site, terrestrial zone. Whilst pollen from the mire itself comes from on, or close by the sample site (allochthonous component), that from the terrestrial zone (allochthonous component) is more complex. The latter has the possibility of input from the near local dry-land zone as well as longer distance components including up drafting from lower altitudes (Price and Moore 1984) and pollen fluvially transported. Furthermore, sediment stratigraphical change at 1.9m from humic mineral to peat is associated with a palynological change at the l.p.a.z. TAL: 1 to l.p.a.z. TAL: 2 boundary. This change may encompass a hiatus in the profile at a date sometime before the 14th century AD based on the radiocarbon date of 585±34 BP (Table 1) at a depth of 195-196cm. The initiation of sedimentation in this basin and this stratigraphical change appears to be a response to a change from fluvial and fluvial edge deposition to *in situ* peat growth. As such, the diagram and vegetation history encompassed in it may be considered as two sequences, the pre and post hiatus profiles.

The pre-hiatus (TAL: 1)

This phase is characterised by more minerogenic but humic sediment in which tree and shrub pollen are of greater importance than subsequently. An initial radiocarbon date of 1035 BP (SUERC-40151) from the basal part of this profile placed the early sedimentation of this zone in the medieval period but a subsequent date obtained for the top of the zone has produced a 7-8th century AD date (see above). Indications are that the wetland vegetation was probably *Sphagnum* dominated with grass and sedges. However, given the nature of the sediment, this may represent transported/inwash of pollen and spores from within the fluvial catchment or from the adjacent valley sides.

In terms of the dry-land vegetation, trees and shrubs, alder (*Alnus*), hazel (*Corylus avellana* type) and oak (*Quercus*) are more important than subsequently. Alder, a wetland tree is a high pollen producer and values here do not suggest local dominance although occasional local growth is likely. Birch (*Betula*) and hazel are of greater importance probably forming scrub woodland on the interfluves. Bog myrtle (*Myrica gale*) may also be expected as part of the acidophilous community. Because its pollen is not readily discernible from that of hazel, the *Corylus avellana* type record may be a composite of both taxa. Within this zone, a basal sub-zone (l.p.a.s.z. TAL: 1a) has higher values of trees and shrubs with birch, oak and hazel. The decline of these from *c.* 2.40m was associated with increases of the acidophilous plants, including *Sphagnum* (noted above) and Ericaceae (*Erica* and *Calluna*) suggesting development of heathland.

Post-hiatus pollen zones (TAL 2-4)

It is not clear what the time span of the hiatus was. It is possible that it was of short duration representing a change in the local hydrology. That is, from an initial phase of alluviation to one of a more stable, anaerobic, peat-forming environment. Alternatively the radiocarbon date for 209-211cm of 1327±34 BP (Table 1) would indicate a hiatus of some six hundred years with the start of the zone in the 13-14th century AD. The reduction in the mineral sediment budget is interpreted as resulting from the movement of the channel to the south or the cessation of the seasonal impact of high river levels on the site, leading to a stabilisation by peat and the expanding heathland. From this period, birch woodland or scrub remained and, due to high pollen productivity and anemophily, was probably a more regional rather than near local vegetation component. Other trees including the oak, alder and hazel, however, show reduced pollen input to the site. This is also concurrent with increasing evidence of human activity including the first occurrence of cereal pollen and also increases in grassland/pastoral indicators including, especially ribwort plantain (*Plantago lanceolata*). The onset of this activity is in the medieval period, but bearing in mind the potential hiatius of several hundred years both pastoral and arable activity may have been present for sometime. This agricultural activity is most apparent in l.p.a.z. TAL: 2.

The initial phase of agricultural activity appears to have declined, stratigraphically at 1.16m (changing into l.p.a.z. 3). A date of 16th/17th century is suggested, that is, prior to the introduction of pine from *c*. AD1650 –1700 which provides a useful datum/palynological marker (Long *et al.* 1999), but the radiocarbon date at this level has produced a result of 183±34 BP (Table 1) which when calibrated gives a range of date options with cal AD 1725-1815 having the highest probability.

This confirms the post-medieval date of this level but makes it difficult to tie down precisely. Pine is represented by a more continuous presence from the top of l.p.a.z. TAL:3 (Figure 9) suggesting that l.p.a.z. TAL:4 is post 1700 AD. This expansion of pine pollen has also been noted by Grant (2007). A decline in arable activity may have occurred through worsening climate at this time. Grassland, probably upland rough pasture remained important and some increase in grass pollen tentatively indicates some expansion in its area.

The mire: Unsurprisingly, during the early phase of peat accumulation, there is an increase in aquatic and wetland taxa. Sedges (Cyperaceae) remain dominant with reed mace and/or bur reed (*Typha* and *Sparganium*) and occasional aquatic macrophytes at the base of the zone (water milfoil and pond weed). Grass pollen of >50u with a thin exine (large Poaceae in Figure 9), may be attributed to cereals but may also come from a number of wild grass taxa, including *Glyceria fluitans,* which may have been part of this wetland habitat. It appears that the initial phase of increasing wetness became stabilised with a more consistent grass-sedge habitat in the upper part of TAL: 2 and through into pollen zones TAL: 3 and TAL: 4.

The start of the upper zone, TAL: 4, is marked by the increase of pine, albeit small, which may represent the flowering of introduced pine into estates and plantations after publication of *Sylva a Discourse of Forest-Trees* by John Evelyn (1664). Such increases in pine pollen, as noted, provide a useful datum (Long *et al.* 1999) as pine is a prolific producer of anemophilous pollen which may be transported over great distances. A change in the local herb flora occurred at this time with reducing grasses but increases in sorrel (largely *Rumex acetosa* type) and campions/catchflies (*Dianthus* type). This was undoubtedly on or very close to the site and such a change might suggest a reduction in grazing at least locally and possibly soil deterioration with more acidic, rough pasture plants becoming prominent. Contrasting with Grant's (op cit) Denbigh Moor study, there is no comparable expansion of Ericales at the Talybont site.

In the highest levels analysed, there also appears to have been some increase in trees as shown by increasing values of oak and hazel. This will have been within the region as a whole rather than in proximity to the site which remained open grassland/pasture and updraft from lower altitudes might be suspected as an important taphonomic factor.

Summary of events

*** Alluviation in the basin probably instigated by seasonal river flow and possible channel changes.

* Period of humic sedimentation (TAL: 1) in the basin from either the post-Roman period or *c*. AD 1000 to the 14th century. More woodland with birch, oak, alder and hazel probably of regional derivation. Local vegetation comprised grassland/pasture with areas of heathland and *Sphagnum* bog. The latter probably fringing the basin.

* A hiatus of unknown duration predating the 14th century. This was followed by initiation of wetter, anaerobic conditions resulting in accretion of peat.

* Subsequent to the hiatus, there was an expansion of both pasture and arable agriculture in the region, possibly a climatic response (medieval warm period?) (TAL: 2).

* There was decline in arable activity whilst there may have been an expansion of rough pasture/grazing (upper TAL: 2 and TAL: 3) in the late medieval/post-medieval period. Possibly a climatic response to the little Ice Age ?

* Further change in the character of pasture with change in flora to one of more impoverished grassland during the 18th Century (TAL: 4).

Discussion

The site lies in an upland part of the Ardudwy region, an area identified on the *Register of Landscapes of Outstanding Historic Interest in Wales* (Cadw: Welsh Historic Monuments, 1998). The studied sequence represents a small part of the valley landscape history. Exposures on the hill slopes and within drainage cuts beside the path show two phases of peat formation, an earlier thin blanket of peat now completely humified and oxidised to a black colour, covered by an upper fibrous brown turfy peat. This sequence suggests an extensive, though thin, blanket peat across the valley that has formed in two phases. An early phase of peat formation, overlying a palaeosol (ancient land surface), which dried out and humified during a period of drier climate, followed by a period of wetter conditions in which peat again formed. In south Wales similar sequences have suggested a late Iron Age or Roman date for the period of drier conditions (Rackham *et al* 2009; Rackham 2009).

Further upstream from the core site a fairly extensive peat bog spreads across several acres and might be expected to contain a much more comprehensive record of the palaeo-environmental history of the valley and region although this bog was not surveyed or explored being well outside the impact area of Welsh Water’s programme of works.

The core site represents a very local small scale bog, approximately 40m in diameter almost certainly formed within a previous channel or seasonal channel of the Afon Ysgethin, or perhaps a scour channel caused by erosion during a period of very high water flow either in the middle or the late 1st millennium AD. As such it contains only information on the last two millennia, and investigation of the prehistoric and Roman palaeo-environmental history of the valley would need to target the blanket peats and the large peat bog lying between Pont Scethin and the reservoir, Llyn Bodlyn.

Despite this absence of prehistoric and Romano-British period deposits the last fifteen hundred years has seen major changes in the marginal upland landscapes of Ardudwy. The potential impact of these changes on the vegetational history of the valley and local region is important and this is a period currently poorly studied through pollen analyses in Wales (Caseldine 2010).

The pollen analysis shows a series of zones that reflect changes in the landscape and its probable pattern of use over parts of the last two millennia. The immediate problem with relating this analysis to the historical story is the contradiction between the radiocarbon dates obtained from the basal 0.6m of the deposits. The initial sample from the base of the sequence submitted as part of the assessment programme yielded a date of 1035±30 BP (Table 1) from analysis of the humic acid fraction of the organic silts, while a subsequent date from 0.4m higher in the sequence gave a date of 1327±34 BP (Table 1) on the gross organic component of the sandy organic silts. The earlier date for this upper sample could be accounted for by assuming the inclusion of re-worked earlier peat contamination from deposits upstream, but it is difficult to explain the younger date of the basal sample since this was obtained on the humic acid component making the possibility of modern or recent contamination much less likely. We can briefly consider whether the pollen data can throw any light on this conundrum. There is a marked fluctuation in the frequency of alder and hazel pollen at the boundary between zones TAL: 1 and TAL: 2 where a depositional change occurs from sandy silts with frequent small stones to organic silts and is interpreted as representing a hiatus. This horizon is also co-incident with the appearance of cereal type pollen grains and large Poaceae, a rise in *Plantago lanceolata*, and the appearance of a series of marsh and aquatic taxa (Figure 9). These changes support the inference of a hiatus, which could account for the appreciable gap in time between the dates obtained at 195-196 and 209-211cm (Table 1), although whether a six hundred year hiatus is present is questionable. Are there any characteristics of zone TAL: 1 that could give us a clue, taking into account the potential difference in the pollen taphonomy between zones TAL: 1 and TAL: 2? There is a definite fall in tree pollen above the basal few centimetres of the sequence, associated with a rise in grasses (Figure 9). There is fairly extensive prehistoric activity in the valley with numerous small settlements and a hillfort (Figure 6). There is also a scatter of Roman activity in the form of several hut circles (Gwynedd HER - http://www.cofiadurcahcymru.org.uk/arch/gat/english/gat_interface.htm), both of which suggest a fairly well occupied landscape likely to be lacking much local tree cover. A relative lack of known early medieval sites in the valley other than sheepfolds and hoards (Figure 6 and Gwynedd HER) might indicate a retreat from these upland marginal areas in the post-Roman period, although four deserted medieval rural settlements or steadings are recorded on Craig y Dinas adjacent to the hillfort (Figure 6). Such a post-Roman desertion could easily have allowed woodland regeneration in the valley that could account for the higher tree pollen representation at the base of the sequence. Chambers and Price (1988) have inferred woodland recovery *c*. AD 800 at a somewhat lower elevation at Moel y Gerddi some ten miles to the north. If this was the case at Pont Scethin then the lowest deposits would be post-Roman in date, although whether 5-8th century or 11-14th century is problematic. A second sample will in due course (prior to publication) be submitted from the basal deposits for dating, using if possible identified macrofossil remains to finally establish which of these dates has an unexplained error.

Zone TAL: 1 represents a fluvial and fluvial edge depositional environment with the pollen assemblage perhaps derived from fluvial transport from upstream as well as aerial pollen falling on the muddy edges of the stream channel or seasonally exposed surfaces. The absence of cereal pollen in this zone, associated with the rise in *Plantago lanceolata* and Lactucoideae in the following zone (TAL: 2), and a generally higher, although falling, proportion of trees suggests a 'relative' lack of human occupation in this upland area during the deposition of these sediments. At present this is attributed to the latter half of the 1st millennium AD, but it could date to the early 2nd millennium AD. An early phase of landscape with hazel and birch woodland at the base of the sequence with some grassland/pasture indicated by *Plantago lanceolata*, *Ranunculus* type, *Rumex* undiff., is succeeded by a slight reduction in the woodland and expansion of grasses and other pastoral indicators, and the appearance of heath, with an expansion of areas of *Sphagnum* and sedges in the wetter areas. This clearly indicates some pastoral exploitation of these uplands, but a much lower human impact than is evident in the deposits above. Possibly exploitation of this landscape was seasonal.

Zone TAL: 2 is charactersised by the appearance of cereal pollen, large poaceae, and the expansion of *Plantago lanceolata* and *Ranunculus* type, associated with a marked fall in alder and hazel pollen. Increasing Cyperaceae, falling *Sphagnum* and *Calluna* suggest a reduction in very wet ground and heath, but expanding sedge communities. With cereal pollen rarely being transported far the implication is that cereal cultivation is occurring at these altitudes in the medieval period and more of the landscape is now pasture and rough pasture suitable for grazing. On the basis of these results we might revisit the distribution of known sites with some suspicion. This zone indicates agricultural activity in this area of the valley during the medieval period if we accept the bracketing dates of 584±34 BP and 183±34 BP (Table 1), a period for which there is very little known archaeological evidence. One wonders whether the so-called post-medieval sites (Figure 6), some of which are still clearly visible, may have an origin several centuries earlier than recorded. It would seem reasonable to equate some of this period of agricultural activity with the medieval warm period and active colonisation for year round occupation is suggested by the presence of cereal cultivation. The medieval agricultural landscape on the Berwyns (Silvester 2000) is clear testimony to occupation at altitudes similar to the sites in the Ysgethin valley, and there the occupation was attributed to the period before the down turn in climate in the 14th century. Here the dating would suggest that cereals were present in the deposits throughout the medieval and early post-medieval period from the 14th century to perhaps the 18th, a picture not dis-similar to the results Grant obtained in her diagram from a upland site of slightly greater altitude (approx. 384m OD) at Moel Rhiwlug, 40km north-east on the Denbigh Moors, where she records cereal type pollen throughout the medieval part of the sequence with what she interprets as a clear phase of cultivation activity in the late 12th to early 13th centuries. At Pont Scethin cereals present through at least the first half of zone TAL: 2 suggest cultivation in the area, perhaps upslope from the bog. There is a landscape of cultivated fields downstream west of the hillfort (http://www.eryri-npa.gov.uk/a-sense-of-place/snowdonia-from-the-air/patterns-of-prehistory/cors-y-gedol-a-multi-period-landscape) at an altitude between 220 and 250m OD that is tentatively attributed to the medieval period. While we might equate the upper part of this zone with the little Ice Age it is difficult to see its impact in the flora. Other upland sites have shown replacement of grassland by heathland in the early medieval period (Buckley 2000, cited in Walker *et al* 2001), perhaps reflecting increased grazing, while the re-establishment of *Calluna* dominated heathland in the post-medieval period may reflect a decline in pastoral activity as a consequence of the Little Ice Age (Walker *et al* 2001).

During the latter part of this zone a slight increase in oak pollen in the diagram might imply management of the surviving lowland oak woods and prevention, by the landed estates, of further woodland clearance in the earlier post-medieval period. This episode is perhaps associated with the building of Cors y Gedol House in 1576 and the consolidation by the 17th century of the land holdings into the Vaughan estate and its management (op cit).

The beginning of zone TAL: 3 marks a significant fall in birch, hazel and alder with an associated rise to a maximum for Poaceae (grasses). This indicates a period when the landscape was more open than at most other times represented in the diagram. The evidence for cultivation has diminished, but not disappeared, and the first appearance of pine in this zone suggests the start of planting associated with parks or plantations. The radiocarbon date at 116cm (Table 1) would suggest that this zone dates to the 18th and early 19th century. 18th century estate maps for Cors y Gedol show formal walks and plantations (http://www.heneb.co.uk/ardudwycharacter/ardudwy/ardudwy9.html) that could account for the appearance of pine and perhaps beech and *Prunus/Malus* (cherries and apples) in this part of the diagram, although pine pollen is transported long distances and at these concentrations need not reflect the local picture. Evidence of the planted lime avenue on the estate does not appear in the pollen spectrum although no samples were analysed from the top 56cm. This period probably saw the further clearance of scrub woodland, but possibly not the oak woodlands lower in the valley around the estate and Talybont, and exploitation of the valley uplands for grazing. The end of this zone is marked by a final fall in tree pollen, particularly oak, hazel and alder, producing an essentially treeless landscape in the upper valley except for some birch.

This significant absence of tree pollen characterises the start of zone TAL: 4. We cannot date this period with any precision but tentatively assign it to the 19th and early 20th century. A rise in several tree species, oak, birch, hazel and alder, at the top of the zone suggests a period of local woodland regeneration, probably in the lowland parts of the valley and perhaps associated with the First World War and its aftermath. The radiocarbon date for a point just above the top of the pollen diagram at 45-47cm yielded a modern date (Table 1), and the top half metre of very wet and unconsolidated *Sphagnum* peats of this part of the sequence may well have built up over no more than the last century.

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FIGURES

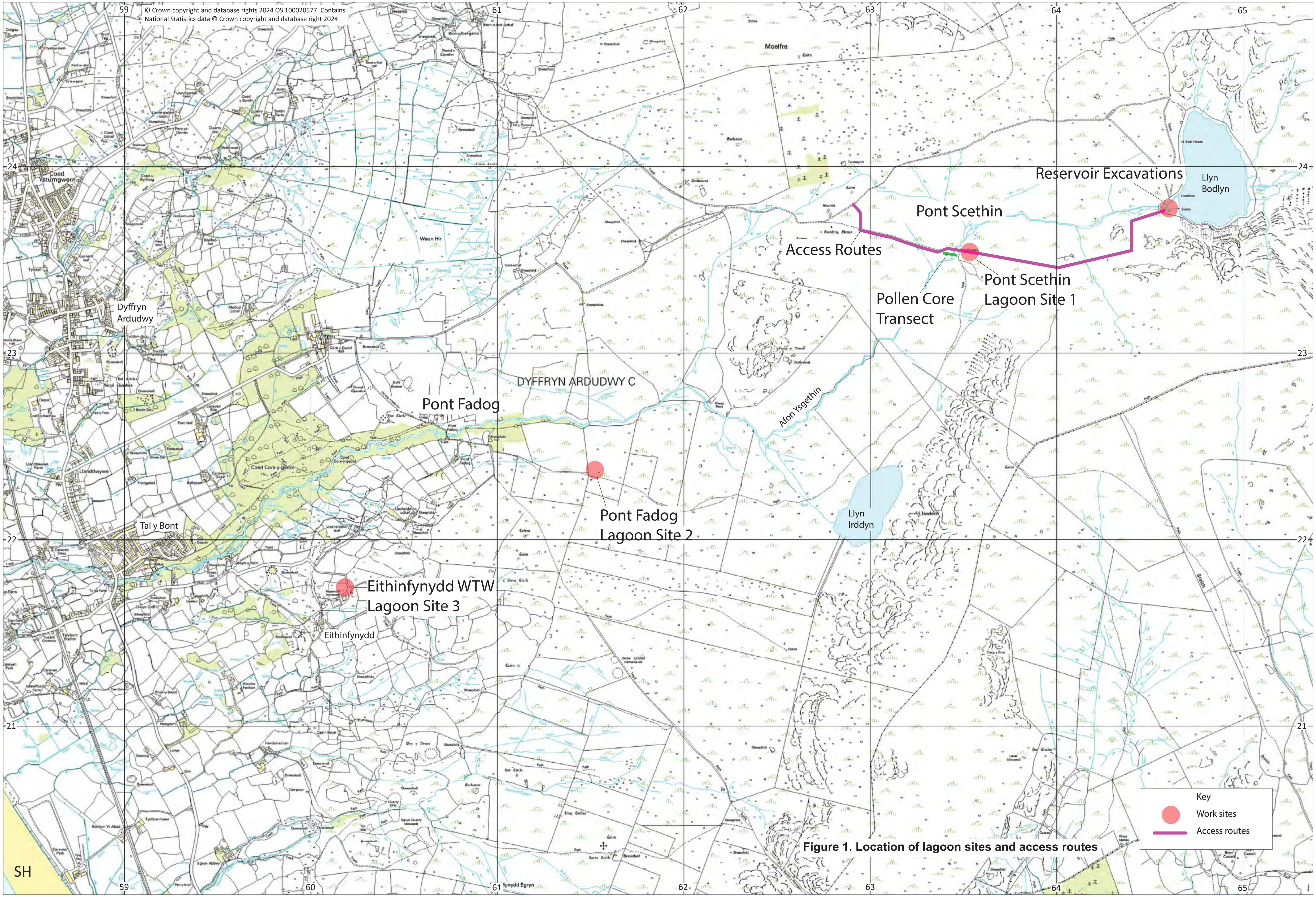


Figure 1. Location of lagoon sites and access routes

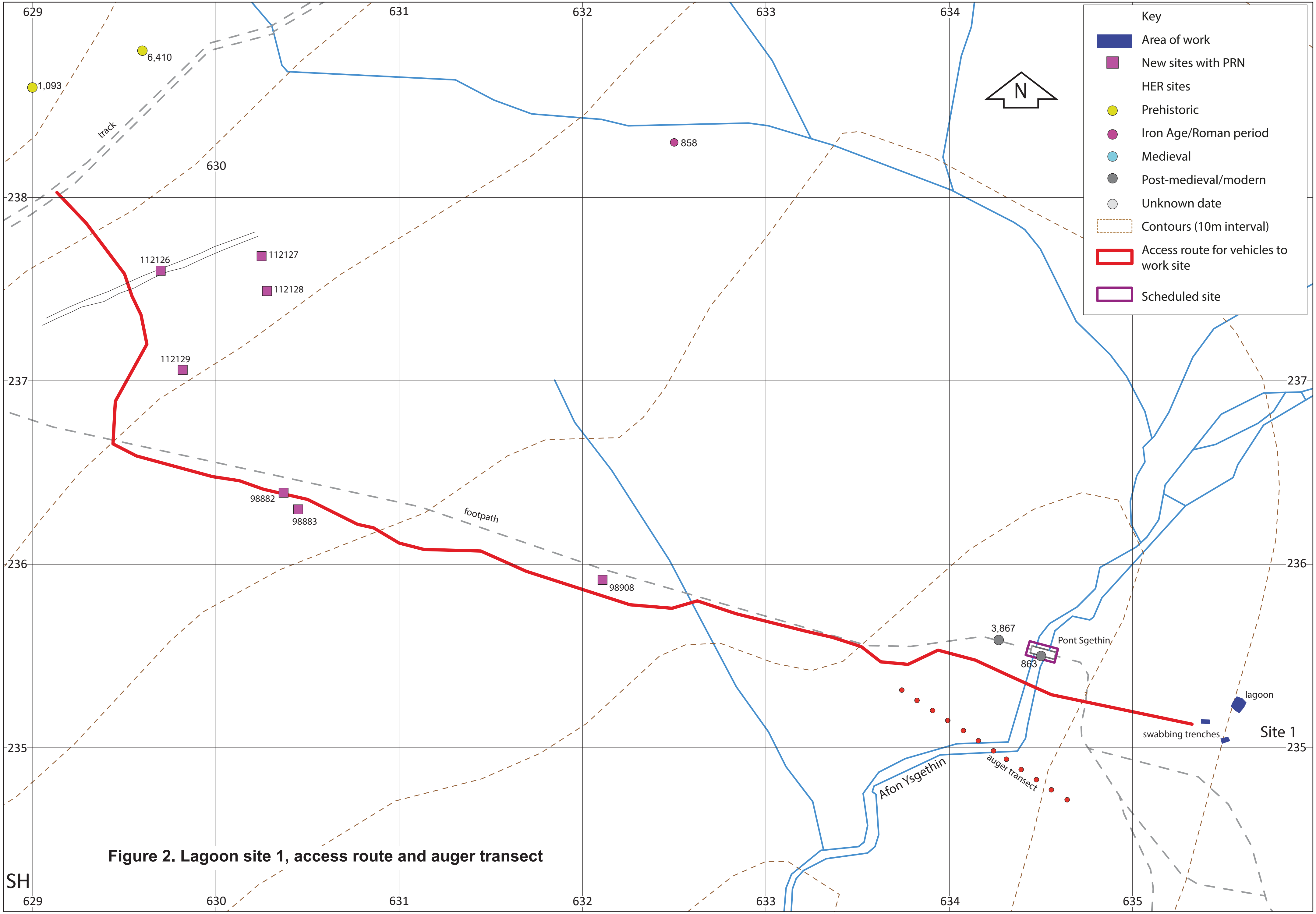


Figure 2. Lagoon site 1, access route and auger transect

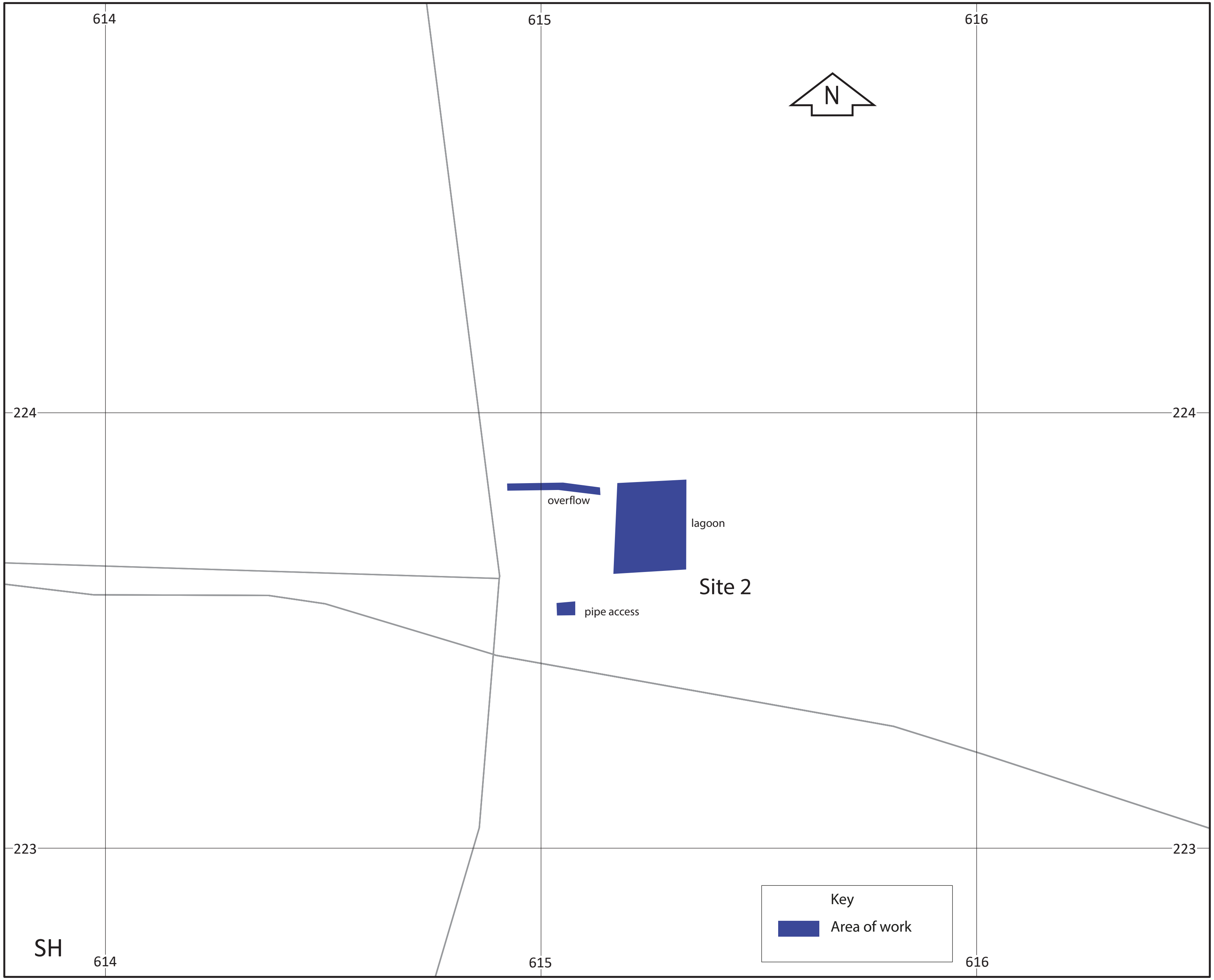


Figure 3. Lagoon site 2

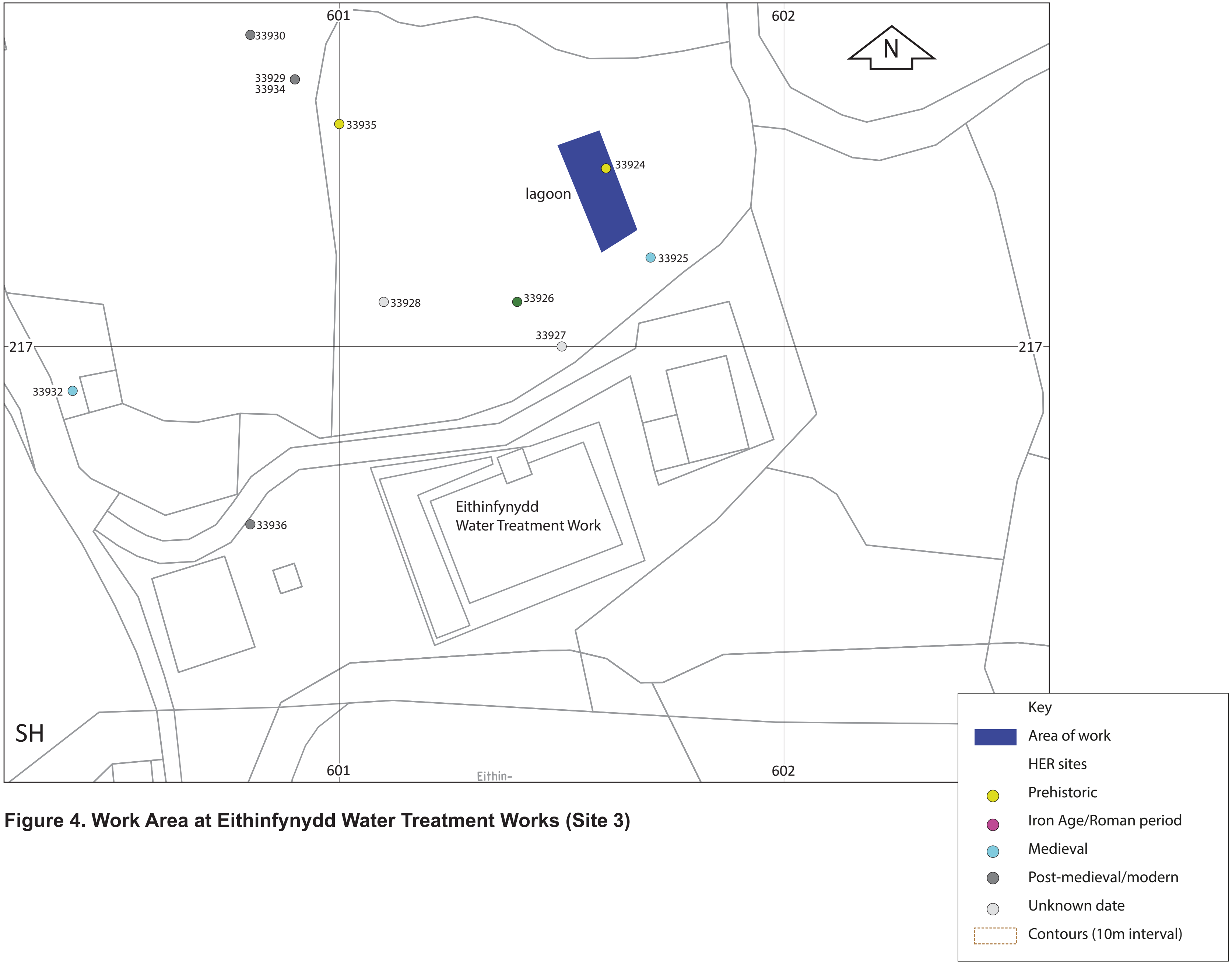


Figure 4. Work Area at Eithinfynydd Water Treatment Works (Site 3)

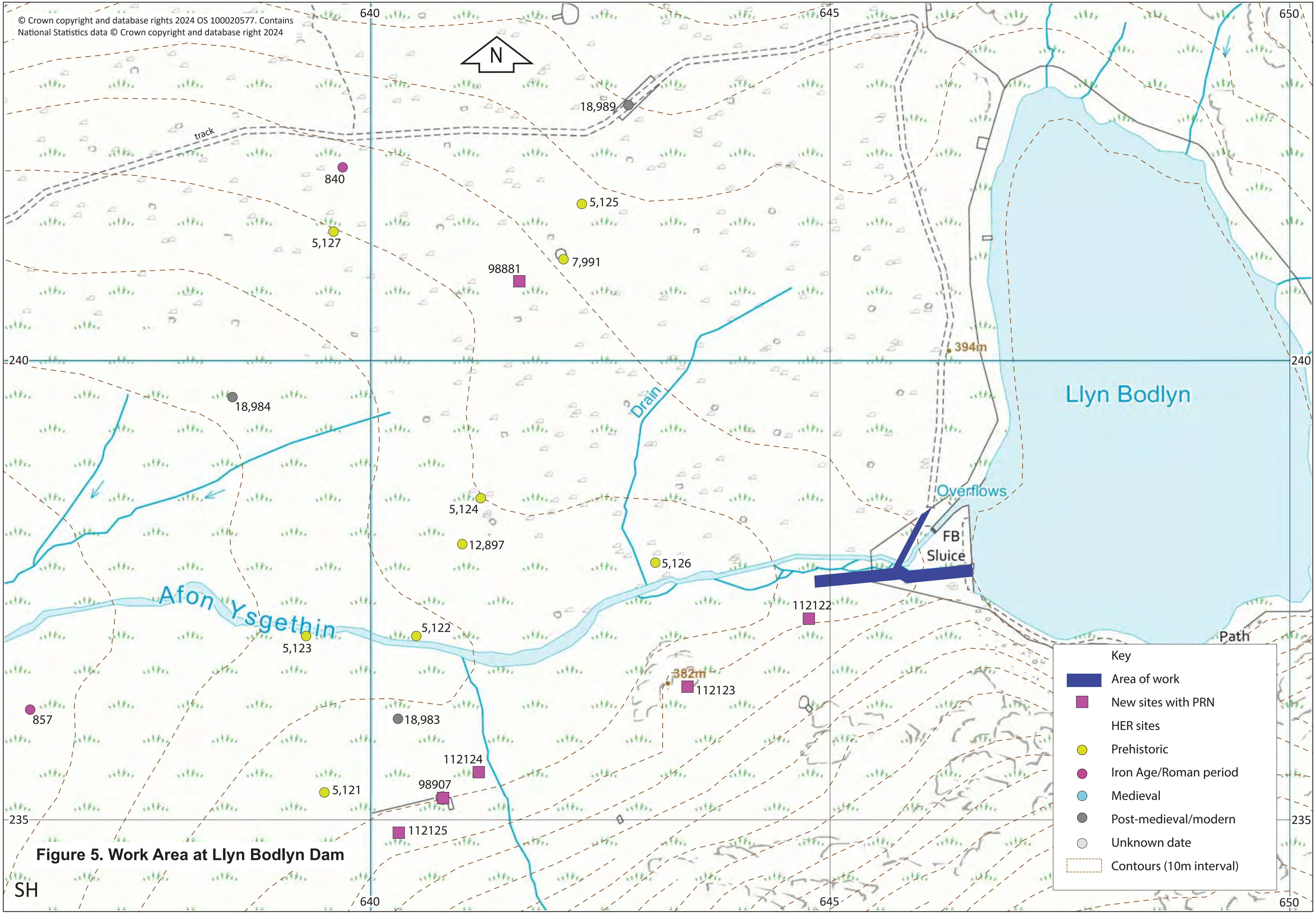


Figure 5. Work Area at Llyn Bodlyn Dam

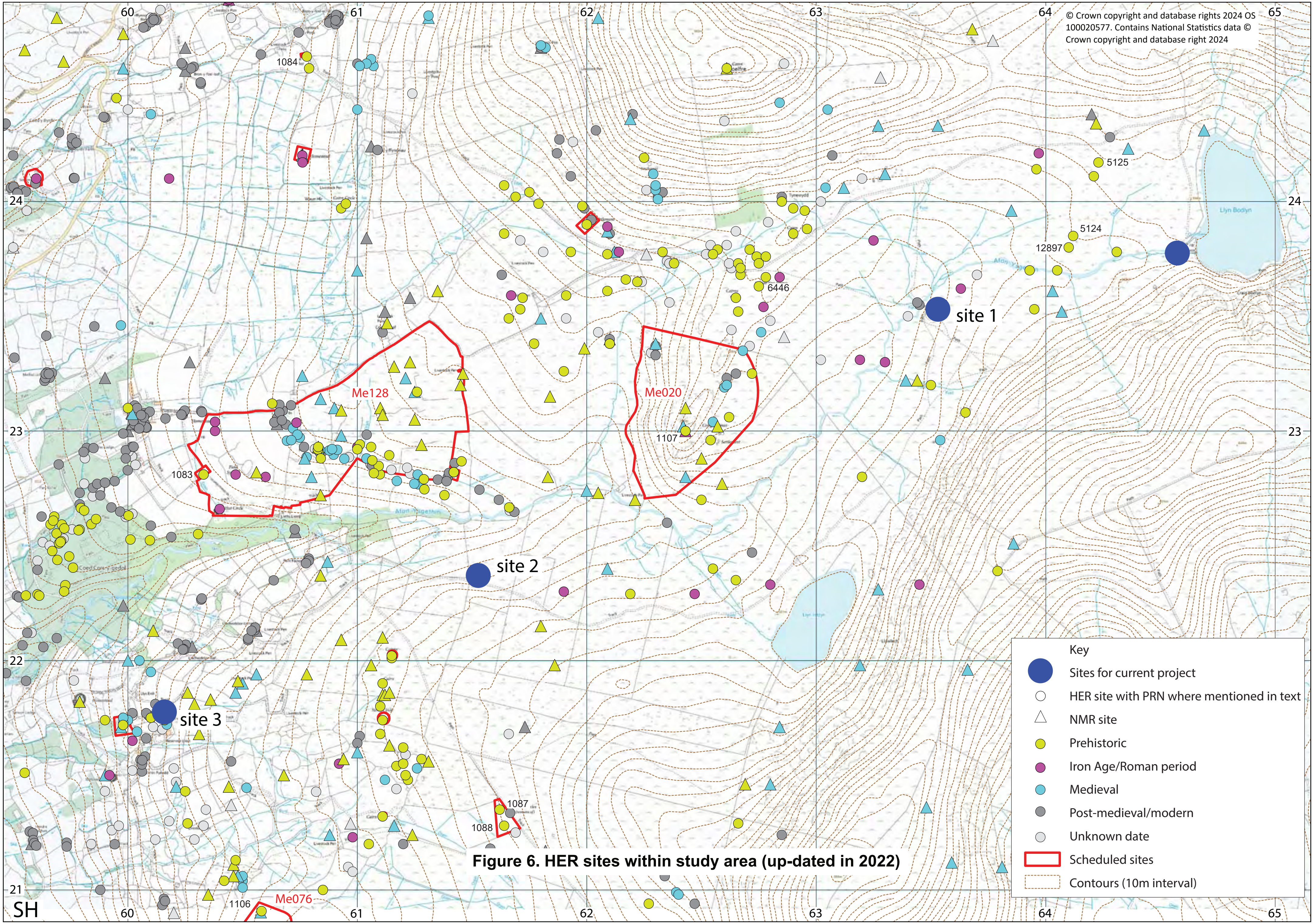


Figure 6. HER sites within study area (up-dated in 2022)

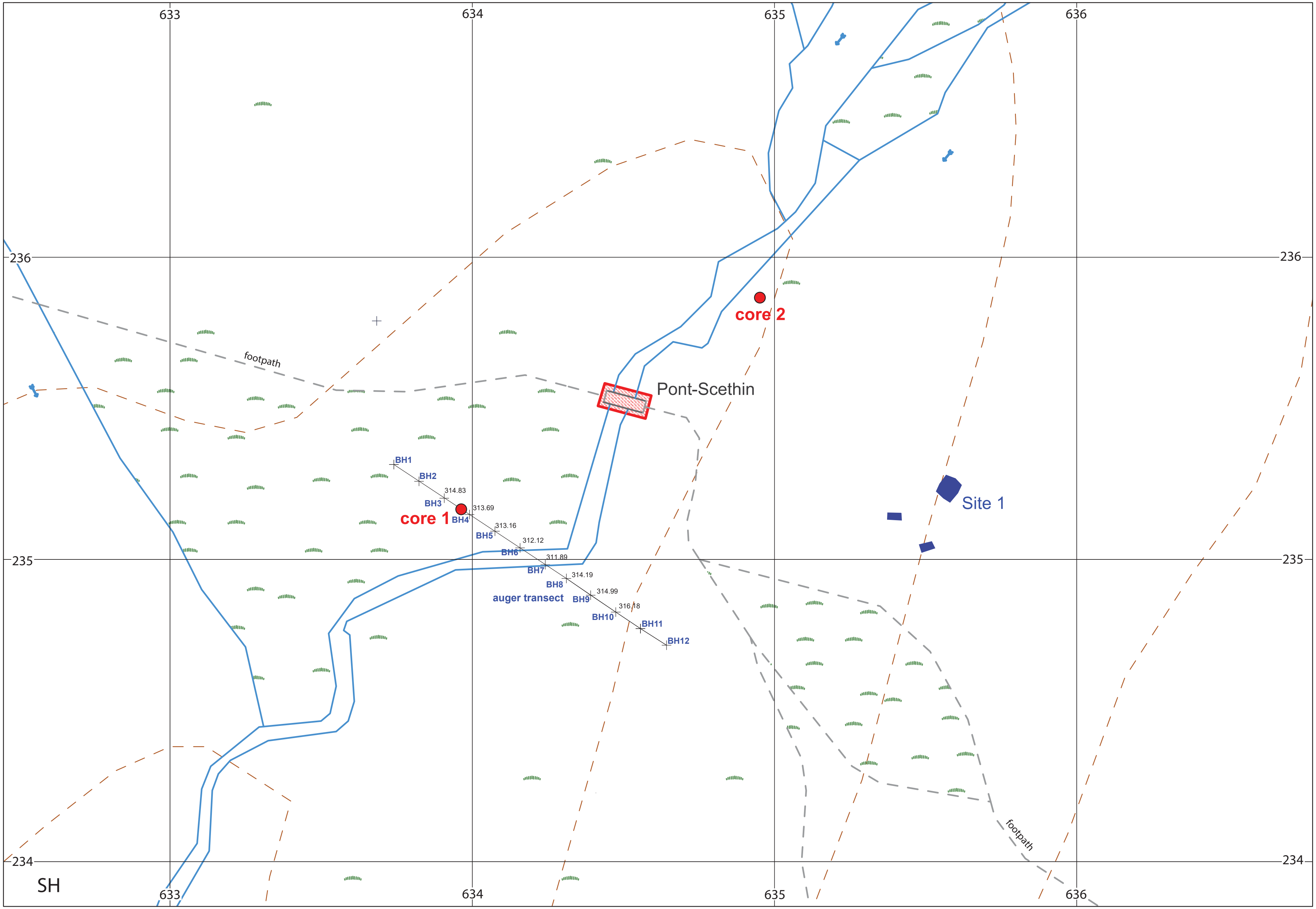


Figure 7. Locations of auger transect and cores 1 and 2

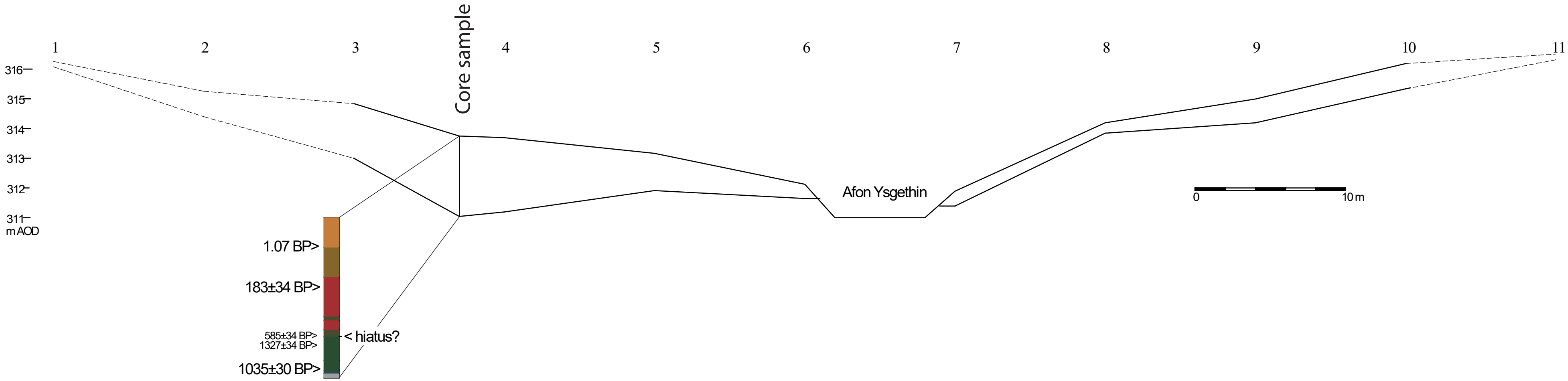


Figure 8. Reconstructed section of post-glacial deposits overlying diamicton (Devensian till) in Auger Transect. Location of Core 1 plotted and sediment sequence expanded with radiocarbon results (dotted lines indicate estimated levels)

Figure 9a. Pollen diagram for the core from Pont Scethin.

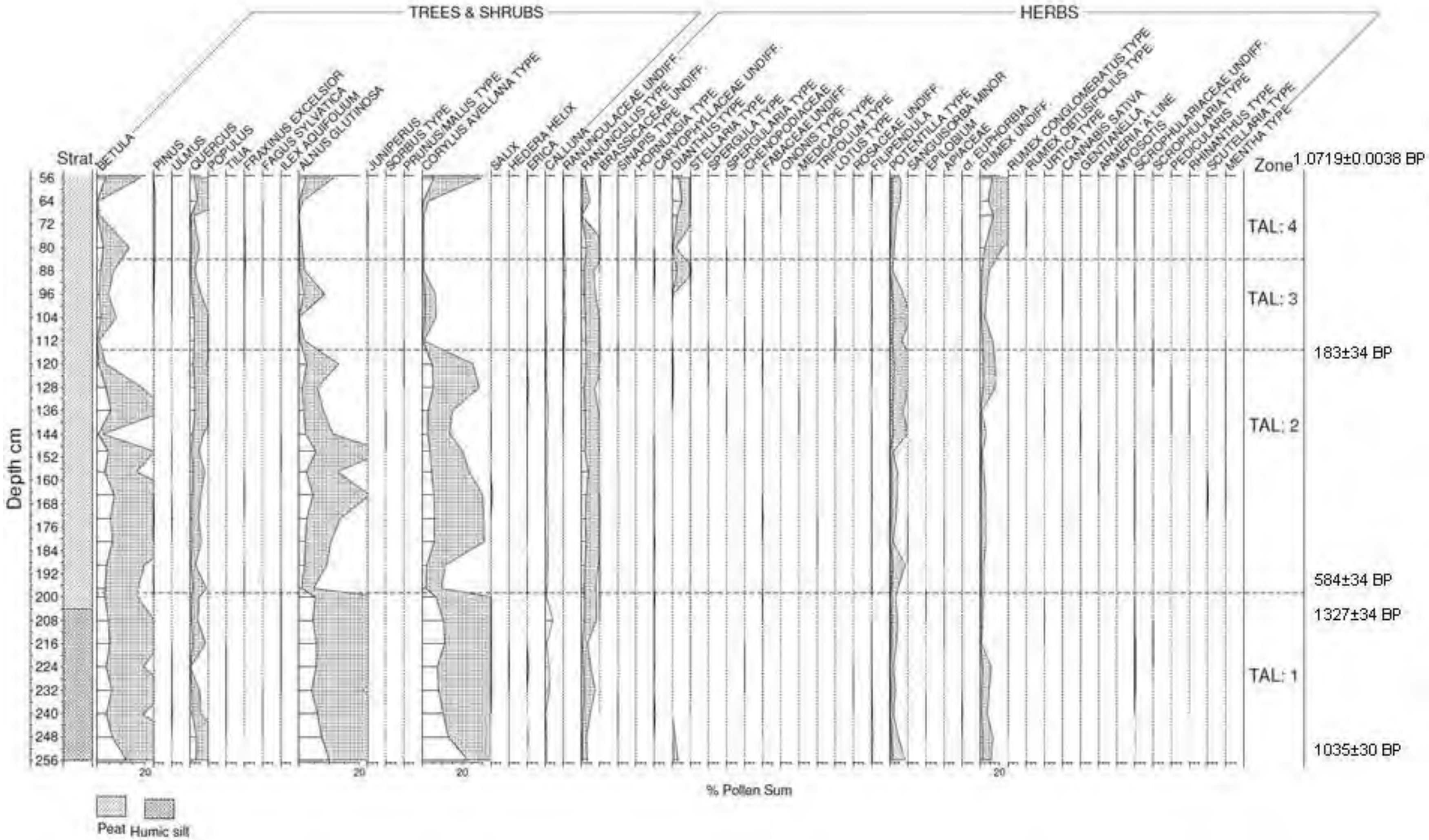
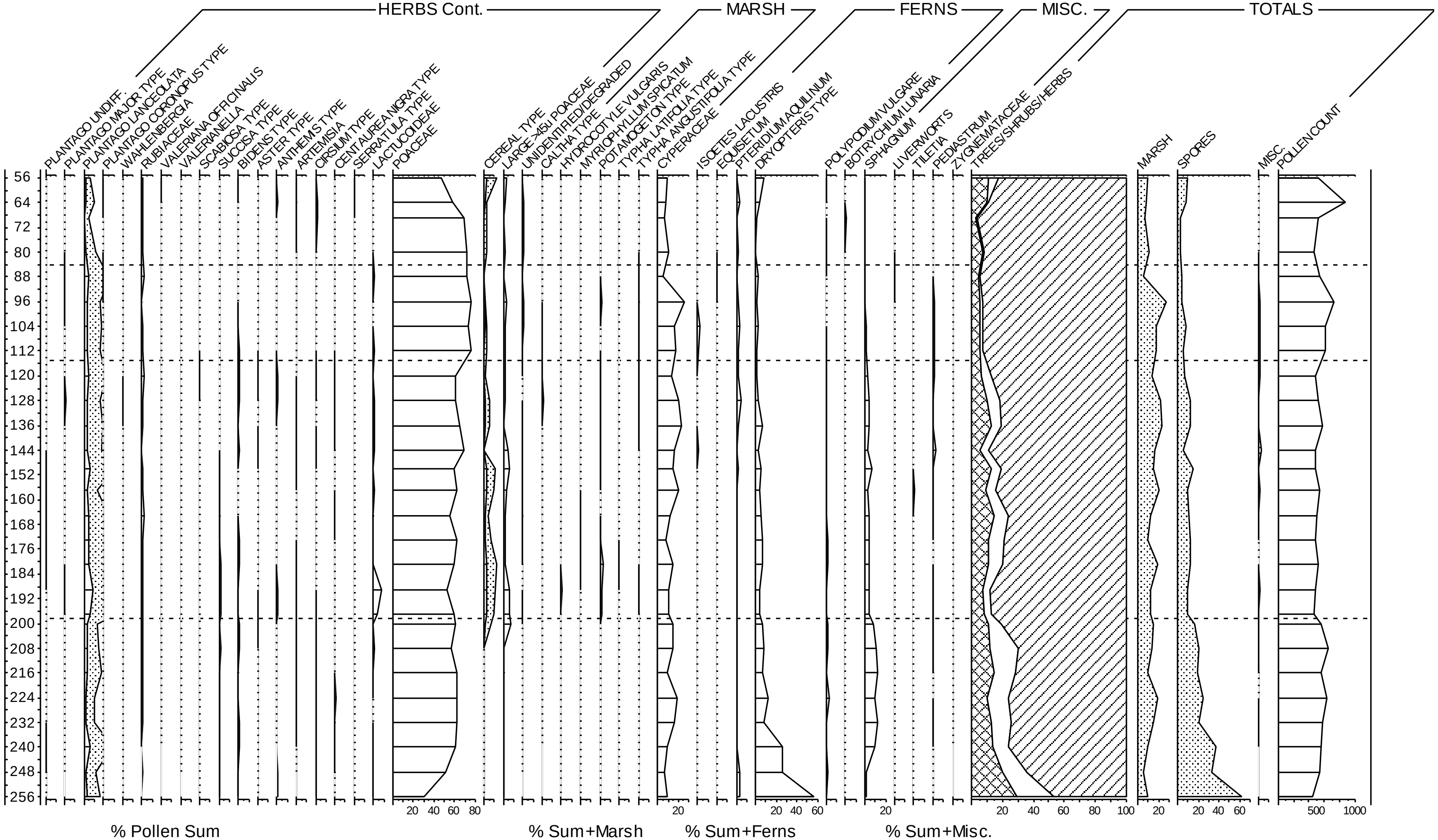


Figure 9b. Pollen diagram for the core from Pont Scethin.



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PLATES

Plate 1. Excavating lagoon 1 (photo no. G2099_2011_Watching_Brief_027.JPG)

Plate 2. Lagoon 2 after topsoil stripping (photo no. G2099_2011_Watching_Brief_096.JPG)

Plate 3. Lagoon 3 after topsoil stripping (photo no. G2099_2011_Watching_Brief_124.JPG)

Plate 4. PRN 33924, heap of stones originally thought to be a cairn, from the west (photo no. G2099_2011_Watching_Brief_134.JPG)

Plate 5. PRN 112122, possible cairn from the north-north-east (photo no. G2099_2011_Watching_Brief_012.JPG)

Plate 6. PRN 112123, shepherd's shelter from the north-west (photo no. G2099_2011_Watching_Brief_008.JPG)

Plate 7. PRN 112124, possible relict field boundaries near sheepfold PRN 98907, from the south-west (photo no. G2099_2011_Watching_Brief_011.JPG)

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Plate 9. PRN 112125, possible cist from the north (photo no. G2099_2011_Watching_Brief_021.JPG)

Plate 10. PRN 112126, denuded field boundary from the south-east (photo no. G2099_2011_Watching_Brief_049.JPG)

Plate 11. PRN 112127, clearance cairn from the south-south-east (photo no. G2099_2011_Watching_Brief_053.JPG)

Plate 12. PRN 98881, sheepfold from the south-west (photo no. G2099_2011_Watching_Brief_085.JPG)

Plate 13. PRN 6446, the two standing stones near Pont Scethin (photo no. G2099_2011_Watching_Brief_079.JPG; G2099_2011_Watching_Brief_084.JPG)

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Plate 15. PRN 98883, section of walling from the east-north-east (photo no. G2099_2011_Watching_Brief_118.JPG)

Plate 16. Thumbnail scraper PRN 98908, scale 2:1

Plate 17. Pont Scethin (PRN 863) and general landscape from the north-east (photo no. G2099_2011_Watching_Brief_067.JPG)

Plate 1. Excavating lagoon 1
(photo no. G2099_2011_Watching_Brief_027.JPG)

Plate 2. Lagoon 2 after topsoil stripping
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Plate 12. PRN 98881, sheepfold from the south-west
(photo no. G2099_2011_Watching_Brief_085.JPG)

Plate 13. PRN 5125, the two standing stones in boulder field
(photo no. G2099_2011_Watching_Brief_079.JPG; G2099_2011_Watching_Brief_084.JPG)

Plate 14. PRN 98882, possible collapsed cist from the north-west
(photo no. G2099_2011_Watching_Brief_117.JPG)

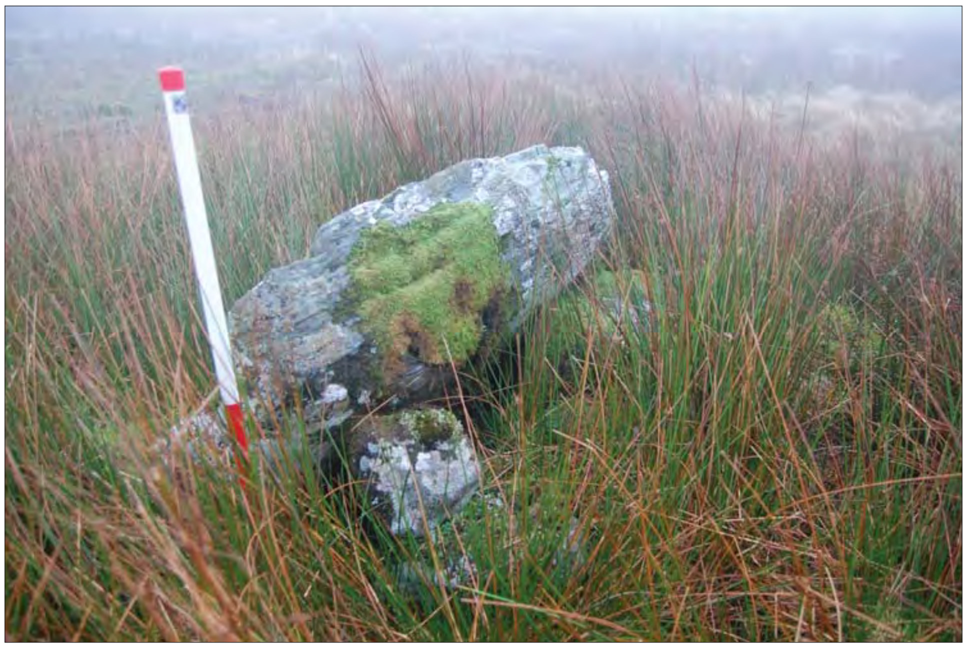

Plate 15. PRN 98883, section of walling from the east-north-east
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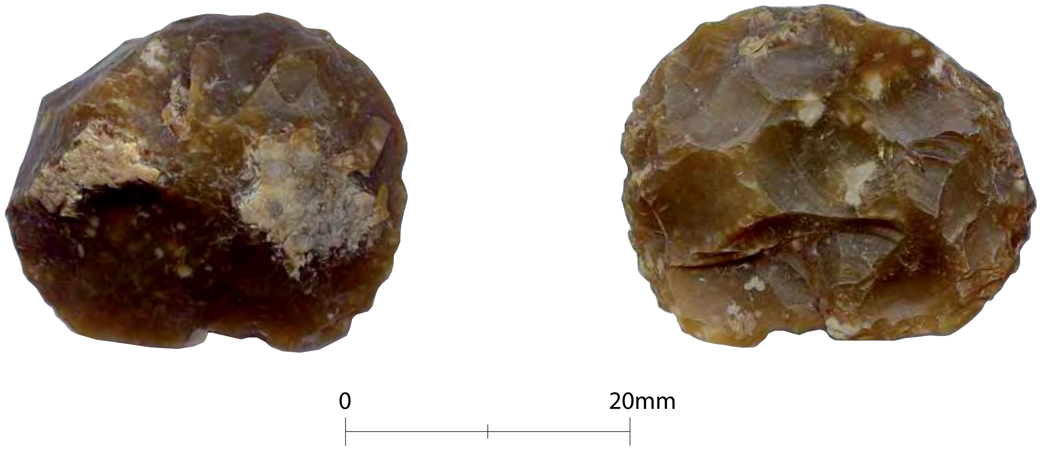

Plate 16. Thumbnail scraper PRN 98908, scale 2:1

Plate 17. Pont Scethin (PRN 863) and general landscape from the north-east
(photo no. G2099_2011_Watching_Brief_067.JPG)

APPENDIX I: PALAEOENVIRONMENTAL ASSESSMENT

Palaeoenvironmental Assessment of a core taken near Pont Scethin on 23rd November 2011

James Rackham[3], Catherine Langdon[4] and Dr Rob Scaife[4]

9th July 2012

Introduction

As part of the archaeological mitigation of the construction of the temporary lagoons at Site 1, near Pont-Scethin, it was agreed with Welsh Water that a survey of the peats should be conducted within the proposed development area of Site 1 and the immediate vicinity, with sampling undertaken of these deposits as appropriate depending upon the results of the survey. The site lies at 314m OD.

The objective of any sampling would be to recover a sequence of deposits from which the vegetational history of the valley could be constructed so that the rich archaeological landscape, including prehistoric, Roman, medieval and post-medieval monuments, could be placed within a palaeoenvironmental setting.

Initial prospection by the Gwynedd Archaeological Trust had suggested a depth of peats of perhaps 0.5m in the immediate area of the site.

Methodology

It was originally intended to conduct an auger survey, in three transects, using a gouge auger (a 1m long, 25mm diameter gouge) to extract a 25mm diameter core and log the stratigraphy at each borehole and use this data to select the best (ie longest/deepest) location for the extraction of the sample core. It was quickly apparent that the deposits were so wet that the cores washed out of the gouge and could not be recovered sufficiently intact to log the sediments. It was therefore decided that rather than record the stratigraphy the depth of superficial deposits, peats and silts, would be recorded at each location on the transects to give a guide to the most suitable locations, and that these would then be augered using the gouge to get as clear a picture as possible with this equipment of the deposits at that location and their suitability for sampling.

The depth was measured using a purpose made stainless steel handled spike 1.2m long. This was sunk into the ground until it was stopped by rock and the depth recorded. It was quickly found that in several places the depth exceeded the 1.2m of the spike and the gouge auger (which has extension rods) was used to measure depths in excess of this.

The first transect was laid from the access point to the water pipe at Site 1 down the slope, across the river just upstream of the bridge and up the opposite slope. The line was chosen to cross areas of visible vegetation change that reflected very wet ground conditions and three slight plateaus. The line was paced, and the spike pushed in every 10 paces. Depths were recorded from about 0.2m to 1.0m and locations over 0.8m deep were flagged. The second transect was located just downstream of the bridge (see Figure Appendix I.1), again located to cross areas of visible bog, and depths of soil and peat varied from 0.19m to 3m depth. The location of deposits that exceeded 0.8m were again flagged. The

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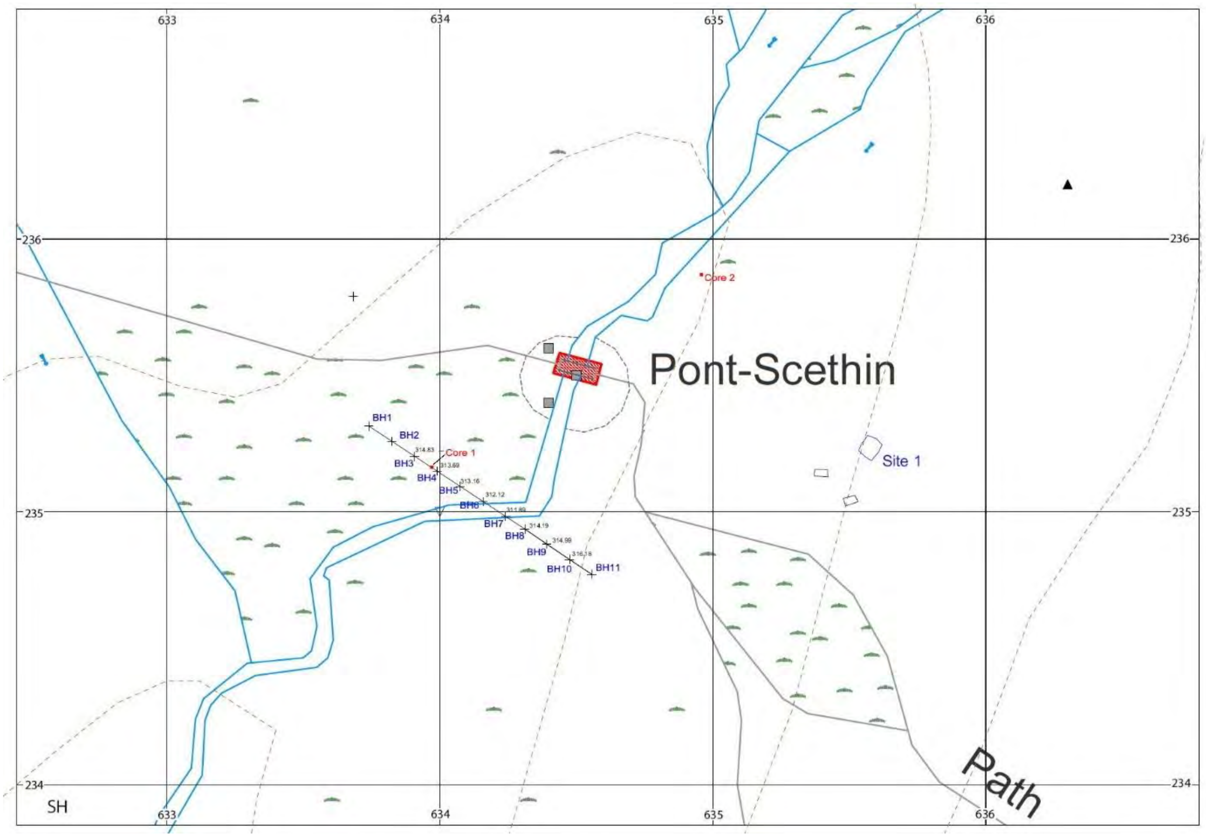
third transect was located a little further downstream to cross two plateau bog areas on the south side of the river that might have had a significant depth of peat. This transect was not taken across the river which was cutting into the valley side on the north bank.

Figure Appendix I.1. Locations of auger transect 2, and cores 1 and 2.



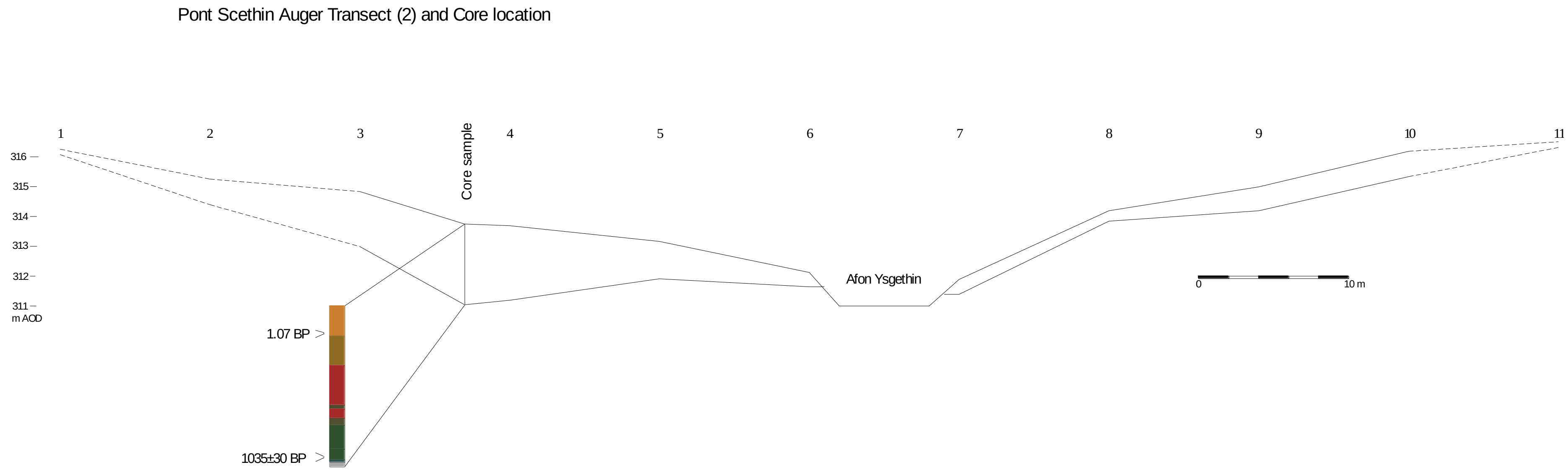


Figure Appendix I.2. Reconstructed section of post-glacial deposits overlying diamicton (Devensian till) in Auger Transect 2. Location of Core 2 plotted and sediment sequence expanded with radiocarbon results (refer to text for sediment description; dotted lines indicate estimated levels – see text)

The spike was also pushed into a few other areas off the line of the transects where surface vegetation indicated boggy conditions. Three areas were chosen for further prospection, a boggy plateau on Transect 1 below the proposed working area where depths of soft sediment of 1.0m were recorded, and two small plateau areas on the north side of the river on Transect 2 where depths of 2m and 3m were recorded using the gouge auger (see core locations on Figure Appendix I.1). Each of these locations was cored using the gouge in an effort to study the sediments. The gouge auger failed to hold the upper sediments in all boreholes due to their high water content, but the lower peats and underlying silts were recovered. The sequence is broadly very wet fibrous peats, overlying more compacted fibrous peats with variable silt content, in turn overlying dark grey or brown organic silts. The underlying geology is recorded as diamicton (Devensian till) over sandstone and mudstone of the Barmouth Formation (British Geological Survey) The cored location on Transect 1 obtained a depth of 1.5m and recovered medium sands at the base of the sequence with wood fragments in this and the overlying silts. The upper metre of peats were too wet at the cored locations on the north side of the river on Transect 2 to be recovered by the gouge but the lower peats and silts were present in both the areas prospected.

The longest sequence of silts and peats was therefore recorded in an area of very wet bog on the north side of the river some 60m downstream of the bridge. Although it had been agreed that a location beyond the limits of the working area of the site could be utilised for this sampling exercise it was felt that this was sufficiently remote from the proposed working area (some 150 metres from the proposed lagoons) that the client should be informed before sampling. The three metre depth is believed to be likely to represent a greater time span than the 1.5m sequence recorded below the proposed working area. In the event Welsh Water agreed to the sampling of the three metre location in Transect 2.

Sampling

Because of the condition of the sediments sampling had to be undertaken using a Russian corer which can recover peats from wet locations in a closed chamber 0.5m long. Unfortunately this limits the size of the sample and generally means that macrofossil studies for seeds, other plant macrofossils and insects cannot be undertaken, although pollen analysis and radiocarbon dating can be undertaken, as could diatom and loss on ignition studies if it was deemed appropriate. The Russian corer has a snub nose at its head which prevents the sampling of the basal 12cm of the sediment sequence immediately above the bedrock or rocky subsoil.

The selected location where the gouge auger recorded an approximate depth of 3m was sampled (Core 1, Figures Appendix I.1 and 2). Two adjacent boreholes were used with the 0.5m sampling being taken alternately from each borehole to avoid the disruption caused by the nose of the auger. The upper metre of the bog was extremely wet and the upper 0.25m of the first core (0-0.5m) was sampled poorly despite trying three times, although a complete sequence was recovered. The second sample (0.5-1.0m) was also less than perfect but once again some sample was recovered for the whole 0.5m. Below this the samples were extracted with no problems to a final recovered depth of 2.62m, although the basal 0.12m of the core could not be recovered with the Russian corer. Stone was hit by the auger at 2.74m depth.

The poor sampling of the upper 0.5m has implications for radiocarbon dating these upper sediments in that it may not be possible to extract a suitable sample from the top half of this core for dating purposes (see below).

In order to establish a profile for the valley floor at this location as a substitute for the recorded stratigraphic sequence which was not recoverable due to ground conditions the total depth of peats and silts was recorded at 10m intervals along transect 2 (Figure Appendix I.2) and a flag placed at each point of measurement for later surveying when the Gwynedd Archaeological Trust team were working on site. Unfortunately when the surveying team arrived on site the flags for Boreholes 1, 2 and 11 could not be located so the ground surface levels for these three boreholes have been estimated (see Figure Appendix I.2).

An additional 0.5m core was taken from the silts at the base of the deep sequence recorded in Transect 1 below the proposed working area (at a depth of 0.4-0.9m; Core 2 on Figure Appendix I.1). The 1.5m sequence could not be relocated in the bog but possibly the Russian corer would not penetrate the underlying sands that had been recorded in the gouge.

Dating

For this assessment two samples were submitted to the Radiocarbon Laboratory of the Scottish Universities Environmental Research Centre (SUERC). A sample from the base of the core at 252-254cm depth and a second sample from the upper part of the sequence at 45-47cm depth were submitted for dating. The results are presented in Table 1. The dated fraction of the upper sample was the humic acid fraction rather than the fibrous fraction, this was chosen to avoid recent fibrous root material contaminating the date. It has produced a modern date and it is possible that the extremely wet nature of these upper peats (effectively a floating bog!) has resulted in particle settlement through the water matrix leading to modern material settling at depth. Reliable dating of these upper peats can probably only be undertaken by selection of aerial plant parts from the selected levels, such as moss or sedge leaves, and dating should probably not be undertaken for the upper 0.5m.

Table 1. AMS Radiocarbon dates

Lab.no.	context	material	13C/12C Ratio	Conventional Radiocarbon Age	Calibrated Age at 2 sigma
SUERC-40152	45-47cm	Fibrous peat	-30.7 $^{0}/_{00}$	1.0719±0.0038	Modern
SUERC-40151	252-254	Organic silt	-29.8 $^{0}/_{00}$	1035±30 BP	898-920 (5.7%) & 946-1036 (89.7%) cal AD

The sample from near the base of the recovered sequence, at 252-254cm depth, has produced a calibrated age of early medieval date, with a high probability that it dates to the late 10^{th}-early 11^{th} century AD (Table 1). Again the humic acid fraction was dated from this sample, but the compacted silts will not have been affected in the manner of the upper sample.

The dating indicates that this 2.62m sequence of silts and peats has formed over the last thousand years.

Surveying

No surveying was undertaken on the day the transects were checked for peat depth and the sample cores collected. The flagged locations along Transect 2 were subsequently surveyed by members of the Gwynedd Archaeological Trust and plotted on Figure Appendix I.1 (except for BH1, 2 and 11, which had lost their flags). Core sample 1 was taken from a location 3m north of BH4 along the transect line (Figures Appendix I.1 and 2). The location of Core 2 is approximate and was not surveyed in. The recorded depths of silts and peats overlying the drift geology in Transect 2 have been used to reconstruct the profile of post-glacial deposits along the transect (Figure Appendix I.2).

CORE 1

A 2.62m sequence of deposits was recovered at Core 1 using the Russian corer. The upper 0.5-0.7m was extremely wet with a 'floating' sphagnum and sedge peat on the surface. The upper part of the core is therefore somewhat insecure and the Russian borer recovered a limited sample through this depth.

The sequence was as follows:

0-50cm very wet fibrous loose moss and sedge peat

50-100	wet fibrous peat, with small platy stones at 96-100
100-166	fibrous slightly compacted peat
166-173	organic silt
173-188	humified fibrous peat
188-200	organic silt
200-240	slightly sandy organic silt with frequent small stones
240-258	organic silt with rare sand grains
258-262	slightly sandy organic silt with occasional small stones
262-274	silty sands
	Stopped by stones at 274cm

On the basis of the lithology and the profile recorded in Figure Appendix I.2 the deposit sequence appears to lie in a former channel of the Afon Ysgethin, the lower sands and silts indicating channel and channel margin sediments. With a radiocarbon date of 1035±30 BP (SUERC-40151) this must have been the course of the river during the 10th and 11th centuries AD. After a period of channel margin silt deposition the location became a marsh, developing peat and finally a saturated sphagnum and sedge bog.

Core 2 was recovered from a depth of 40-90cm at the location marked on Figure Appendix I.1. This represents the lowest 0.5m of the peat and silty peat sequence overlying banded sands. The sequence was as follows:

0-40cm not sampled – very wet fibrous sedge and moss peat.

40-60	wet fibrous humified peat
60-90	slightly fibrous well humified slightly silty peat
90-100	sandy silt

Pollen assessment analysis

Dr C. Langdon and Dr R. Scaife

INTRODUCTION

A series of pollen samples were taken from Core 1 and a single sample from near the base of Core 2. The principal aims of this study were to ascertain the presence or absence of sub-fossil pollen and spores and, if present, to provide preliminary palaeo-environmental data for the site and suggestions as to the age of the sediment sequence. Pollen was recovered from all of the samples examined and this report details the findings of this preliminary study.

THE POLLEN DATA

Samples were prepared using standard extraction techniques for sub fossil pollen and spores (Moore *et al.* 1991). Pollen and spores were recovered from the six samples analysed. Five samples come from Core 1 and a single, lower, sample from Core 2, the latter as a comparison to the former.

Pollen is well preserved in these sediments but absolute numbers are not high although in sufficient numbers to enable counts to be made for construction of a preliminary pollen diagram (Figure Appendix I.3). Data from the single sample taken from the base of Core 2 are presented in Table 2. A pollen sum of 150 grains per level plus spores of ferns were counted for each level.

Overall, the pollen assemblages are dominated by herbs (80-90% except for the uppermost level) with very few trees and shrubs present (8-12% but to 55% in the upper sample).

Trees and shrubs: With the exception of the upper sample (28cm), there are only small numbers of trees and shrubs comprising largely *Betula* (birch), *Quercus* (oak), *Alnus* (alder) and *Corylus avellana* type (probably hazel but possibly bog myrtle). There are sporadic *Pinus* (pine), *Fraxinus* (ash), and *Fagus* (beech) in the upper levels, from 95cm. Values are highest in the top level (28-30cm).

Herbs: There is a moderately diverse range of herbs (27 taxa). Poaceae (grasses; to 75%) are most important with Cyperaceae (sedges; see marsh below). Other taxa include large Poaceae/Cereal type), *Ranunculus* type (buttercups), *Plantago* spp. (plantains including ribwort plantain), *Potentilla* type (cinquefoils) and Asteraceae types (dandelion/daisy family).

Marsh/wetland: Cyperaceae are dominant throughout peaking to 38% at 48cm. There are a small number of other taxa, *Potamogeton* type (pond weed), *Typha angustifolia* type (bur reed and/or reed mace) and *Pediastrum* (algae) in the lower levels. *Sphagnum* moss is also present, especially in the lower part of the profile.

Ferns and spores: There are small numbers of fern spores with monolete (*Dryopteris* type), *Pteridium aquilinum* (<1%), *Polypodium* (polypody fern; <1%) and an individual occurrence of *Lycopodium* (club moss). The former (*Dryopteris* type; typical ferns) have highest values in the lower and upper levels.

Pollen Interpretation

Although this is a substantial thickness of peat and silts, the pollen assemblages are broadly homogeneous throughout. Interpretation can be viewed in terms of the on and off- site flora.

The mire: Taxa are dominated by herbs with Poaceae (grasses) of notable importance. This implies that grassland was of importance. However, a proportion of this pollen may also have derived from the on-site marsh habitat along with sedges giving a grass-sedge habitat which existed throughout the period of peat/sediment accretion. Higher values of algal *Pediastrum*, *Potamogeton* type (pondweed), *Typha angustifolia* type (reed mace and/or bur reed) and *Sphagnum* moss in the lower part of the profile suggests that initially the site was a neutral to acid bog, probably with areas of standing water. This became drier and changed to a grass/sedge dominated marsh.

The terrestrial zone: With the exception of the uppermost level (30cm), there is little tree and shrub pollen. The dominance of herbs suggests that the local habitat at least was open and comprised grassland in the area local to the sample site. That is, as indicated by the dominance of grass pollen and other herbs such as *Plantago lanceolata* (ribwort plantain). There is little evidence of cereal cultivation which is not unexpected given the geographical location and height of this site. The uppermost sample (30cm) has the highest values of arboreal pollen. Without additional analysis it is not possible to ascertain if this expansion continued into the more recent period which will be represented above 30cm.

Trees and shrubs	
Betula	13
Quercus	11
Alnus	5
Corylus avellana type	15
Calluna	1
Herbs	
Poaceae	93
Cyperaceae	11
Brassicaceae	2
Caryophyllaceae	1
Filipendula ulmaria	3
Potentilla type	3
Rumex acetosa	3
Plantago sp.	1
Plantago lanceolata	2
Rubiaceae	1
Scabiosa	2
Bidens type	1
Lactucoideae	2
Ferns	
Pteridium aquilinum	2
Polypodium	4
Dryopteris type	67
Sphagnum	

Table 2: Pollen counts from Core 2 at 68-69cm

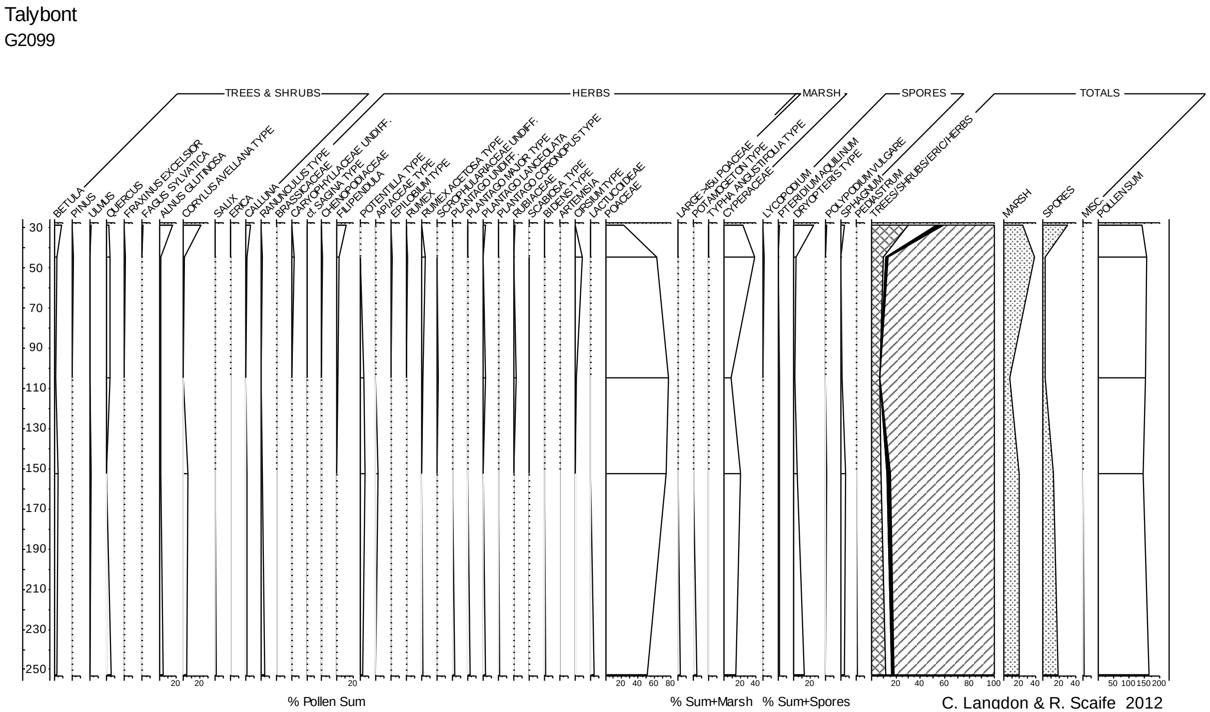
Suggested dating: The overall picture from the pollen data suggests that the profile is of historic date agreeing with the radiocarbon results (Table 1). This is based on the absence, in any significant numbers, of trees in the sequence. The small increase in pine pollen from 100cm is tentatively attributed to plantations from *c*. AD 1650, that is, with the introduction of pines into parks and gardens and later plantations for forestry.

Core 2: This individual sample was examined as a comparison to the Core 1 profile. From Table 2 (above), it can be seen that the sample has similar characteristics to Core 1 with relatively few trees and shrubs in relation to herbs. Grassland is similarly dominant. It is possible that this location also lies in or on the edge of a former course of the river.

Discussion

On the walk down to the site recent cuttings for drainage were observed on the north side of the valley. These showed a thin peat deposit no more than 0.2m thick overlying minerogenic soils. The lower half of this peat was humified and oxidised to a black colour, while the upper half was a fibrous brown peaty turf.

Figure Appendix I.3. Pollen assessment diagram for the core from Pont Scethin.



This sequence suggests an extensive, though thin, blanket peat across the valley that has formed in two phases. An early phase of peat formation, overlying a palaeosol (ancient land surface), which dried out and humified during a period of drier climate, followed by a period of wetter conditions in which peat again formed. In south Wales similar sequences have suggested a late Iron Age or Roman date for the period of drier conditions (Rackham *et al* 2009; Rackham 2009).

The selected core sites, both probably lying within a former channel of the Afon Ysgethin have no early peat deposits, and the prehistoric sequence in the valley is almost certainly contained within the thin blanket peats that cover the hillsides and probably the larger areas of peat bog on the north side of the valley between Pont Scethin and the reservoir, Llyn Bodlyn.

Despite this absence of prehistoric and Romano-British period deposits the last thousand years has seen major changes in the marginal upland landscapes of Ardudwy. Chambers and Price (1988) have inferred woodland recovery *c*. AD 800 at Moel y Gerddi in the north, although the limited assessment of the Pont Scethin core shows no significant woodland at its base in the 10-11th century AD. The desk based assessment (Madigan 2011, cited in Gwynedd Archaeological Trust 2011) notes one or two medieval and a number of post-medieval sites across the hillsides, and several earlier Roman sites. Enclosure of the sea facing upland wastes in the 16th century are chronicled in this region (Thomas 1967 cited in

http://www.heneb.co.uk/ardudwycharacter/ardudwyintro/ardudwythemeseng.html#Anchor-Themes-49575) and pollen analysis of the core may permit some consideration of changing land use and pressure on this upland landscape over the last 1000 years. Indications of some re-afforestation in the upper part of the sequence may relate to woodland plantations, parkland or more controlled management of the woodland resources in the area in the post-medieval period. A pollen study conducted by Grant (2007) from a peat core on Mynydd Hiraethog in the Denbigh Moors east of Snowdonia at a similar altitude to the Pont Scethin core, spanning a similar period (12th cent. AD to present) and with significant archaeology in the locality, revealed changes in pollen spectra and microscopic charcoal concentrations that permitted interpretations of the vegetational history of the peat bog and surrounding landscape in terms of local human activities, land management and utilisation, and climate. Grant (2007) records grazed pastures, woodland regrowth and expansion of heathlands, oat and cannabis cultivation, local burning events, reduced species diversity associated with a climatic downturn, expansion of heather moorland, 19th century pine plantations and intensive grazing among other events during the last eight hundred years. Other upland sites have shown replacement of grassland by heathland in the early medieval period (Buckley 2000, cited in Walker *et al* 2001), perhaps reflecting increased grazing, while the re-establishment of *Calluna* dominated heathland in the post-medieval period, perhaps also suggested by the Pont Scethin data (Figure Appendix I.3), may reflect a decline in pastoral activity as a consequence of the Little Ice Age (Walker *et al* 2001).

Recommendations

A peat and silt sequence of 2.62m built up in approximately 1000 years represents a fairly rapid rate of sediment accumulation and peat growth. Although an absence of sediments contemporary with the fairly extensive prehistoric and Roman activity in the valley is disappointing the representation of the last thousand years, a period including significant climate change and potentially major changes in land use affords an opportunity for studying the potential impact of these changes on the vegetational history of the valley and local region and is a period currently poorly studied through pollen analyses in Wales (Caseldine 2010).

Normally pollen samples are taken at 4 or 5cm intervals through a core, but because only a thousand years is represented in this 2.62m core it is recommended that pollen samples are taken at 8cm intervals (with one or two intermediate samples where the pollen spectra are changing) which at a uniform growth would represent a sample approximately every 30 years throughout the medieval and post-medieval period from around 1000 AD. Pollen counts should be in the order of 4-500 grains per sample and the microscopic charcoal in the samples should be quantified for plotting. Spheroidal carbonaceous particle analysis of the sequence may afford some dating evidence for the upper part of the sequence (Spheroidal Carbonaceous Particles (SCPs) are a component of fly-ash formed by the incomplete high-temperature combustion of fossil fuels - Swindles (2010)). Definable 'pollen' events should be radiocarbon dated to give an absolute chronology to the results. Dating precision is difficult during the medieval period but a series of dates will allow Bayesian analysis to refine the accuracy and establish a good chronology for the pollen diagram and its interpretive features.

The results of the pollen analyses need to be related to the archaeological landscape history of the valley.

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APPENDIX II: RADIOCARBON CERTIFICATES

Pollen assessment

Scottish Universities Environmental Research Centre

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Rankine Avenue, Scottish Enterprise Technology Park,

East Kilbride, Glasgow G75 0QF, Scotland, UK

Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

30 May 2012

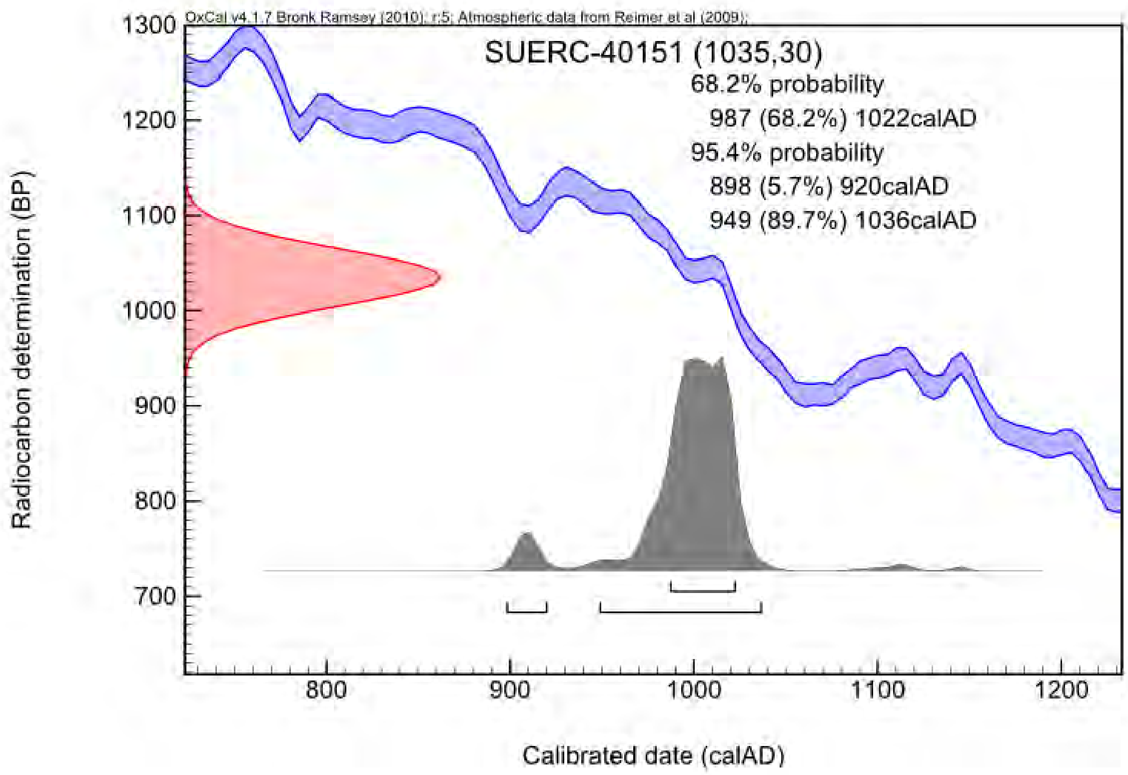
Laboratory Code	SUERC-40151 (GU27116)
Submitter	James Rackham Environmental Archaeology Consultancy 25 Main Street South Rauceby, Sleaford Lincolnshire NG34 8QG
Site Reference	Talybont G2099
Sample Reference	252-254
Material	Organic Silt : Humic Acid Dated
δ^{13}C relative to VPDB	-29.8 ‰
Radiocarbon Age BP	1035 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standards, background standards and the random machine error.

The calibrated age ranges are determined using the University of Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.1 (Bronk Ramsey 2009). Terrestrial samples are calibrated using the IntCal09 curve while marine samples are calibrated using the Marine09 curve.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Calibration Plot



Scottish Universities Environmental Research Centre

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RADIOCARBON DATING CERTIFICATE

30 May 2012

Laboratory Code	SUERC-40152 (GU27117)
Submitter	James Rackham
	Environmental Archaeology Consultancy
	25 Main Street
	South Rauceby, Sleaford
	Lincolnshire NG34 8QG
Site Reference	Talybont G2099
Sample Reference	45-47
Material	Organic Silt : Humic Acid Dated
$\delta^{13}C$ relative to VPDB	-30.7 ‰
Fraction Modern Fm	1.0719 ± 0.0038

N.B. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Full pollen analysis

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RADIOCARBON DATING CERTIFICATE

11 June 2013

Laboratory Code	SUERC-46541 (GU30413)
Submitter	James Rackham Environmental Archaeology Consultancy 25 Main Street South Rauceby, Sleaford Lincolnshire NG34 8QG
Site Reference	Talybont
Sample Reference	209-211cm
Material	humic sediment :
δ^{13}C relative to VPDB	-29.4 ‰
Radiocarbon Age BP	1327 ± 34

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

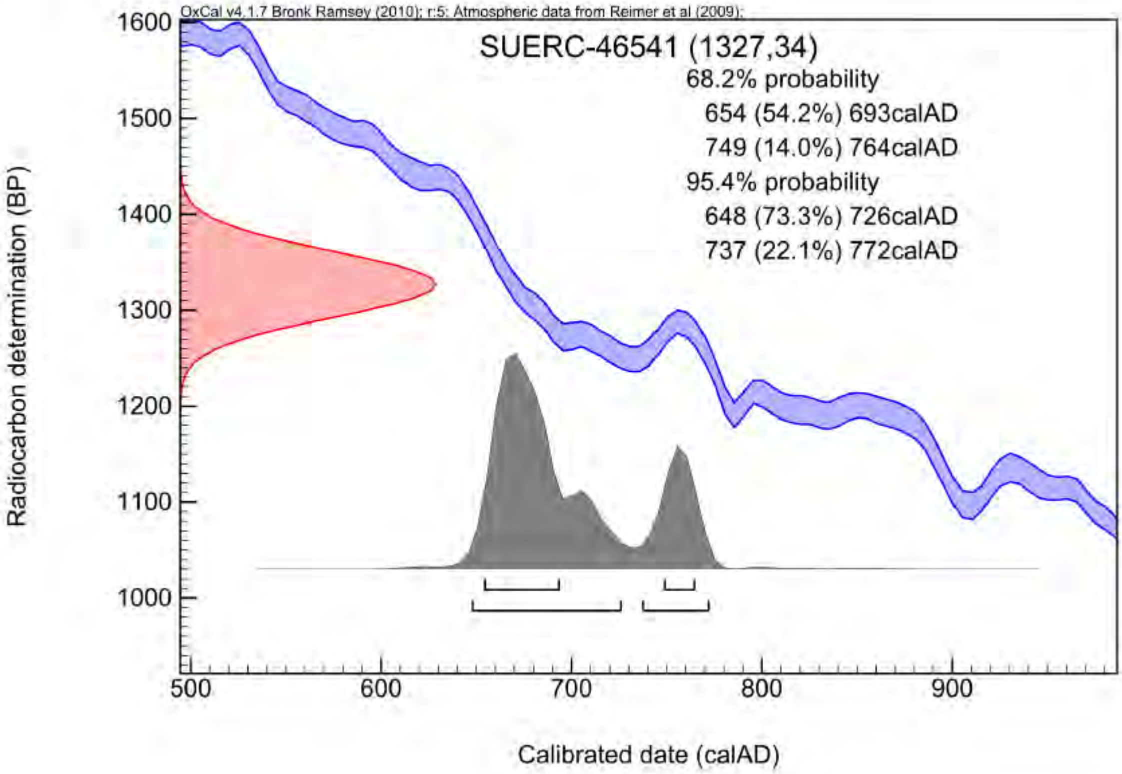
The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

11 June 2013

Laboratory Code	SUERC-46542 (GU30414)
Submitter	James Rackham Environmental Archaeology Consultancy 25 Main Street South Rauceby, Sleaford Lincolnshire NG34 8QG
Site Reference	Talybont
Sample Reference	195-196cm
Material	peat
$\delta^{13}C$ relative to VPDB	-31.3 ‰
Radiocarbon Age BP	584 ± 34

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

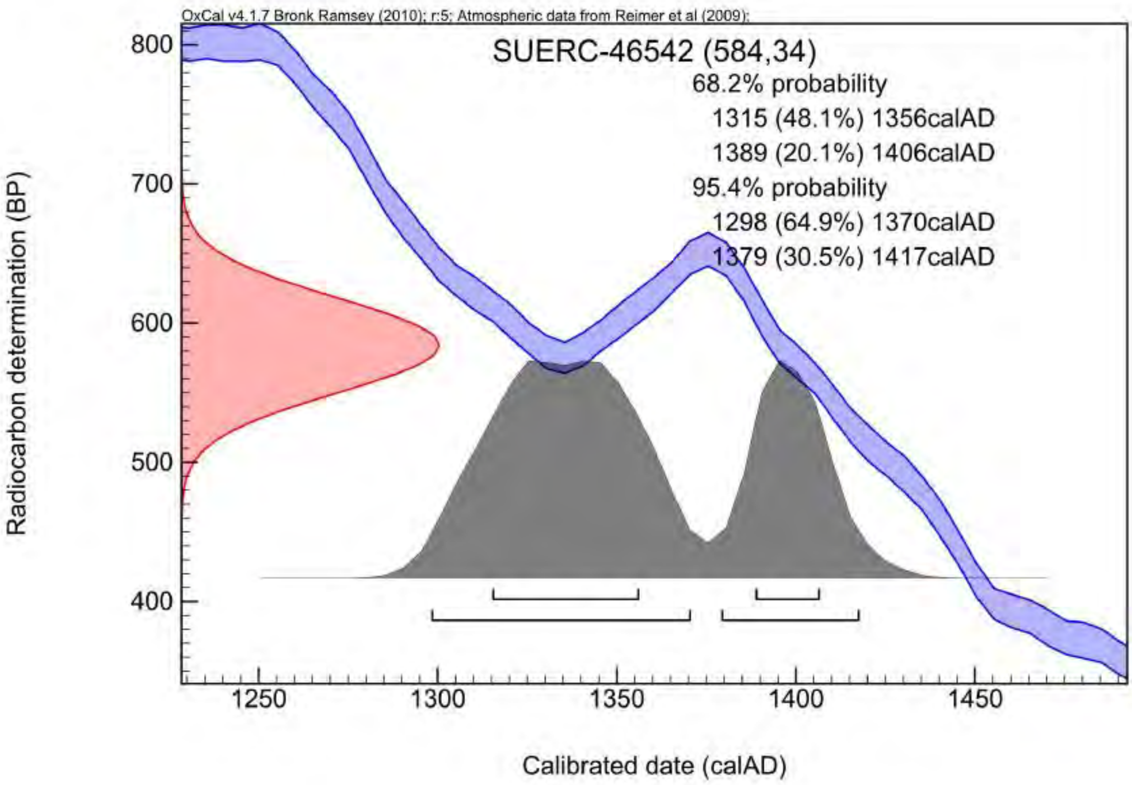
The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

11 June 2013

Laboratory Code	SUERC-46543 (GU30415)
Submitter	James Rackham Environmental Archaeology Consultancy 25 Main Street South Rauceby, Sleaford Lincolnshire NG34 8QG
Site Reference	Talybont
Sample Reference	116-117cm
Material	peat
$\delta^{13}C$ relative to VPDB	-30.8 ‰
Radiocarbon Age BP	183 ± 34

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

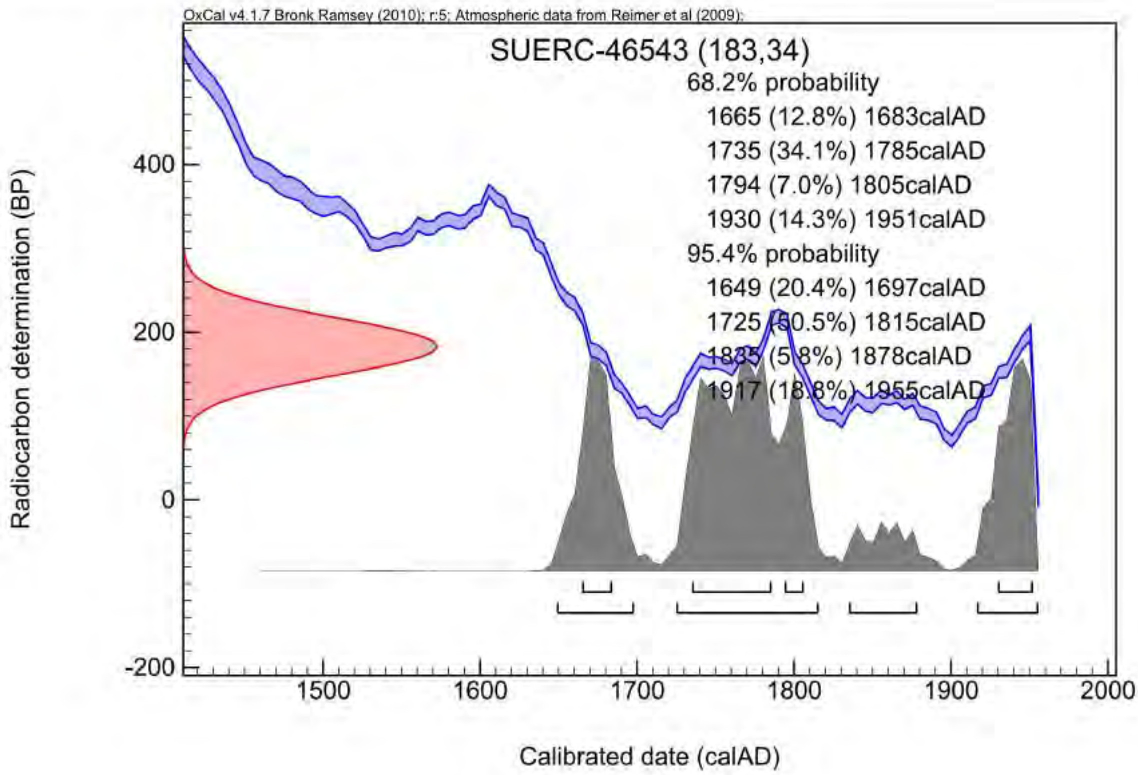
The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



Heneb

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