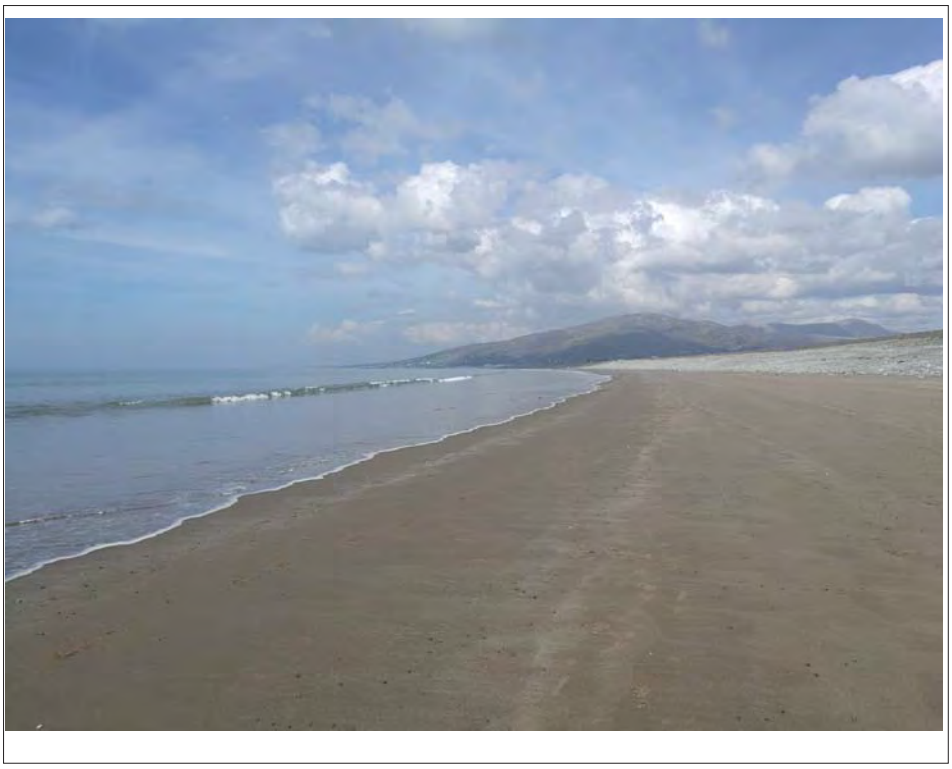
Archaeology Wales

A Palaeoenvironmental Investigation at Friog Corner, Fairbourne, Dolgellau

Final Report



By
Rhiannon Philp

Report No. 1708

Archaeology Wales Limited
The Reading Room, Town Hall, Llanidloes, SY18 6BN
Tel: +44 (0) 1686 440371
Email: admin@arch-wales.co.uk
Web: arch-wales.co.uk

REGISTERED CIfA ORGANISATION

Archaeology Wales

A Palaeoenvironmental Investigation at Friog Corner, Fairbourne, Dolgellau

Final Report

Prepared For: Natural Resources Wales

Edited by: Rowena Hart	Authorised by: Rowena Hart
Signed: 	Signed: 
Position: Project Manager	Position: Project Manager
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Summary

A palaeoenvironmental investigation was undertaken prior to the proposed works to repair tidal defences at Friog Corner.

Consultation with Natural Resources Wales' (henceforth NRW) Earth Sciences Team and Gwynedd Archaeological Trust (henceforth GAT) confirmed that submerged/buried peat deposits have been identified at Friog in the past, along with potential fossil forest remains within the intertidal zone. Similar deposits have also been identified further south at Tywyn and at Borth, where extensive investigations have been carried out. These deposits contain palaeoenvironmental remains that can provide information about the historic landscape development as well as any human interaction within it.

Archaeology Wales undertook an investigation involving radiocarbon dating and palaeoenvironmental sampling and analysis to gather information about the prehistoric environment represented by the now buried organic peat deposits.

The analysis has revealed the remains of a Neolithic fenland landscape under the modern beach surface, which was preceded by what appears to have been a marine transgression in the early Neolithic period. The presence of a significant microcharcoal signal within the environmental record suggests a sustained human presence throughout the period represented in the deposits.

All work was undertaken in accordance with the standards and guidelines of the Chartered Institute for Archaeologists (2014) and following Historic England's Guidelines for Environmental Archaeology (2002).

Crynodeb

Cafodd ymchwiliad paleoamgylcheddol ei ymgymerwyd ymlaen y gwaith arfaethedig er mwyn trwsio amddiffynfeydd llanw ym Morfa Friog.

Yn ystod ymgynghoriad gyda Chyfoeth Naturiol Cymru (CNC – o hyn ymlaen), Earth Sciences Team a'r Ymddiriedolaeth Archeolegol Gwynedd, cadarnhawyd fod yna dyddodion suddedig/claddedig o fawn wedi'i adnabyddi yn Friog yn y gorffennol, hefyd gyda'r' potensial o olion fforest ffosiledig o fewn yr ardal rynglanw.

Ymgymerwyd Archaeology Wales ymchwiliad yn cynnwys dyddio radiocarbon, samplu a dadansoddiad paleoamgylcheddol er mwyn casglu gwybodaeth ar yr amgylchedd cynhanesyddol a chynrychiolwyd gan y dyddodion claddedig mawn organig.

Wnaeth y dadansoddiad datguddio'r olion o dirwedd Ffendir Oes Newydd y Cerrig o dan wyneb modern y traeth, sef wedi'i blaenori gan gamwedd morol yn yr Oes Newydd y Cerrig cynnar. Mae'r presenoldeb o arwydd micro golosg o fewn y Cofnod Amgylcheddol yn awgrymu fod presenoldeb dynol parhaol trwy gydol y cyfnodau a chynrychiolwyd yn y dyddodion.

Cafodd y gwaith i gyd ei ymgymerwyd yn ôl y safonau a chanllawiau'r Chartered Institute for Archaeologists (2014) ac yn dilyn y canllawiau Historic England's ar gyfer Archeoleg Amgylcheddol (2002).

1. Introduction

1.1.1. A programme of palaeoenvironmental investigation was undertaken prior to the commencement of flood prevention works at Friog Corner, Dolgellau, (SH6109112019), which will involve the construction of rock armour on the existing sea defence alignment.

1.1.2. The peat deposits at Friog corner are known to become exposed intermittently. The deposits are also listed on the regional HER. No further investigation of these deposits has so far been undertaken. Along the west coast of Wales, a number of further intertidal deposits have been identified. The British Geological Survey (henceforth BGS) memoir identifies peat deposits along with tree remains to the south of Friog at Tywyn. These are suggested to be contiguous with the well-known, 4700-year-old deposits investigated at Borth, however caution should be taken when comparing intertidal deposits from separate locations without further investigation.

2. Site Description

2.1.1. The site is located at the southern (Friog) end of Fairbourne beach at approximate grid reference SH 61091 12019. The site is within the intertidal zone, which is gently sloping, with a shingle storm beach in the upper regions. The site occurs near to the mouth of the Afon Mawddach.

2.1.2. The underlying geology is defined by the Maentwrog Formation and consists of a sedimentary bedrock of mudstone and siltstone formed during the Cambrian Period (BGS 2017).

3. Archaeological background

3.1.1. Two Regional Historic Environment Records exist for the site under investigation:

- PRN 31910: Exposed peat deposit on beach containing roots, stumps, trunks and hazelnut shells.
- PRN 4880: Friog: Findspot: a Neolithic polished stone axe

3.1.2. Furthermore, NRW and GAPS have highlighted similar deposits on the west Wales coast at Tywyn and Borth. Further intertidal deposits have also been identified in both north and south Wales (Nayling 1998, Bell et al. 2000, Bell 2007, Brayshay et al. 2007, Bennet et al. 2010, Murphy et al. 2014.) Palaeoenvironmental investigations into these further known sites have revealed dates spanning from the Mesolithic period, through to the Bronze Age and provided valuable information regarding the development of the historic environment at each location. The variation in dates from one site to the next highlights the importance of treating each location as a separate entity until further investigations have been undertaken and not assuming similarities between sites.

3.1.3. The stone axe found at Friog suggests a Neolithic presence in the area, however without further contextual information, it is unclear whether the find was held within specific deposits and so cannot be reliably used to date the peat deposits present at the site. Evidence from other similar sites around the Welsh coast suggest that the deposits at Friog are most likely to range between Mesolithic through to Bronze Age in date.

4. Objectives

4.1.1. The objective of the palaeoenvironmental survey was to identify and record

any sediments within the intertidal zone representative of the prehistoric land surface, particularly those with an organic content, within the area selected for the proposed sea defence repairs work.

4.1.2. The objective of the sampling was to obtain material for both radiocarbon dating, to provide date ranges for the earliest and latest organic deposits, and palynological analysis, to provide information about environmental changes related to climate, sea level change and potentially human interaction with the environment.

4.1.3. The investigation addressed key points raised by the Research Framework for the Archaeology of Wales (2011-2017), which emphasises the need to develop new understandings on the prehistory of Wales, with particular mention to chronological refinement. Specific emphasis is also placed on improving the resolution of environmental record in Wales and gaining a better understanding of the evolution of Wales' estuaries and coastlines through mapping, sampling, dating and analysing intertidal deposits.

5. Methodology

5.1. Initial Prospection

5.1.1. Initially prospective cores were taken from 6 boreholes (see figure 1) through the beach at the base of the pebble storm beach using a 20mm gouge corer. Cores could not be taken any closer to the top of beach due to it not being possible to auger through the pebble bank. The prospective cores were then measured and the lithology at each site recorded. Cores 1-3 produced clear sediment sequences, but at borehole sites 4 and 5, coring was not possible due to a thick shingle layer beneath the sand. This suggests the storm beach extended further beneath the sand at this point.

5.1.2. Despite further prospection within a 5m radius, the organic deposits could not

be identified in this area. Borehole site 6 was therefore chosen to try and identify the most northerly accessible deposits on the beach. Prospection around site 6 indicated that no further deposits were accessible to the north. A GPS point was taken using a survey grade GPS to record position and surface height of each borehole site from which all depth measurements will related to.

5.2. Sample Extraction

5.2.1. The sample extraction technique initially proposed became problematic due to the level of sand on the beach and the high water table. Even at low tide, the water table level made digging a trench virtually impossible, with the trench continuously infilling with sand and water. This was noted as a potential problem in the initial methodology and led to the adoption of the second proposed approach; using the gouge corer. Once again this proved difficult, as the suction created by the high water table mixed with the highly friable nature of the peat led to cores not holding within the auger chamber. This is a common problem in intertidal investigations and success is dependent on the conditions encountered on the day, which cannot always be predicted. If lower levels of sand had been present on the beach, the initial methodological approaches may have been more successful.

5.2.2. A different approach was therefore adopted, in order to extract material from the beach. The Edelman auger was used to extract spot samples from each of the recorded deposits followed by the 20mm gouge corer when it became too difficult to extract using the Edelman.

5.2.3. Though not ideal, due to the possibility of sample contamination, this approach allowed for samples to be taken from each layer to provide material for radiocarbon dating and pollen analysis.

5.3. Radiocarbon Dating

5.3.1. 2cm3 bulk sub samples were extracted from the spot samples pertaining to top and bottom of each peat deposit from borehole sites 1, 2 and 6 for radiocarbon dating. Site 3 was not sampled as it was deemed close enough to site 6 to be related. Site 6 was chosen as it was deemed to have a longer sequence, allowing analysis of a wider timeframe. Radiocarbon dating was undertaken at the ^{14}CHRONO centre, Queen's University Belfast. Samples were pre-treated at the lab prior to radiocarbon dating to remove calcareous contamination and fulvic acids. 4% hydrochloric acid was added, and the sample heated to 80˚C for 2 hours prior to rinsing until the pH returned to neutral (Reimer et al. 2015, 5). Dates were calibrated using OxCal v4.3 (Bronk Ramsey 2009) and the IntCall13 and MARINE13 radiocarbon age calibration curves (Reimer et al. 2013). Calibrated dates were rounded to the nearest 10 years, as recommended by Mook (1986) due to the conventional radiocarbon ages having error margins greater than 25 years.

5.4. Pollen Analysis

5.4.1. Pollen grains are particularly resistant to decay due to the chemical structure of their outer walls, known as the exine. There are also clear variations in the form of the protective exine, which allows for identification to specific species (Moore *et al.* 1991, 2). These attributes make pollen a very useful tool in the reconstruction of past environments stretching back many thousands of years. Pollen can survive in any environment where microbial activity is suppressed, including waterlogged, saline, anaerobic or desiccated conditions (Moore *et al.* 1991, 2).

5.4.2. By analysing the species of pollen present within sedimentary deposits, it is possible to construct a picture of the environment, and how it changes through time. Changes in pollen levels for specific species can inform on both local and wider area changes in vegetation, which can include transitions

between open and enclosed, wet and dry and freshwater and saline environments.

5.4.3. In some cases, the pollen record can also indicate human interaction with the environment, through the introduction of domesticated plant species, such as cereals, or the growth/decline of certain species in archaeological record in conjunction with other factors such as charcoal or evidence of domesticated grazing.

5.4.4. Subsamples measuring $2cm^3$ were extracted from the sampled material and sent to Quaternary Scientific (Quest) at Reading University where the material was processed. Lycopodium tablets were added to samples prior to treatment to act as an exotic marker. Each tablet contains a known quantity of lycopodium spores. These are counted along with the native pollen and spores and used to indicate pollen concentrations. Samples were then sieved, subjected to heavy liquid separation and acetolysis to remove unnecessary organic and minerogenic components and then suspended in glycerol jelly prior to mounting on microscope slides.

5.4.5. Pollen were counted using an Olympus CH2 microscope at x400 magnification (or x1000 where needed for identification). A sum of Total Land Pollen (TLP) was obtained from each sample. This included arboreal, shrub and herb species, but excluded spores and aquatic species, which were counted alongside separately. From these counts, it was then possible to calculate pollen percentages. Three percentage sums were calculated using the Tilia software package (Grimm 2015): Total Land Pollen (herbs, shrubs and trees), Total Land Pollen + Spores and Total Land Pollen + Aquatics.

5.4.6. Pollen and spores were identified using a combination of Moore *et al.* (1991) and Beug (2004). The latter was not used for initial identification due to it being primarily designed for central European studies, however it served to provide

extra clarification where identity could not be acquired using Moore et al alone. Pollen and spore nomenclature used in this report follows Bennett (1994) and vascular plant nomenclature follows Stace (2010). In this investigation, *Corylus avellana* type is assumed to represent hazel in line with suggestions by Edwards (1981). Poaceae pollen grains with a diameter over 40µm are classed as cereal type (Andersen 1979), but it should be noted that these may also include some wild grasses such as Glyceria (Moore *et al.* 1991, 100). This is an important consideration due to the geographical context of this study, as Glyceria is a species native to coastal environments. Decisions regarding Poaceae vs Glyceria have been made based on the environmental context indicated by both the lithological and pollen record.

5.4.7. Microcharcoal also survives the preparation procedure and can be indicative of human presence in the environment. In accordance with Mooney and Tinner (2011), only completely opaque, black, angular fragments over 10µm in size were counted. Once again counting continued until the specified TLP had been reached. Microcharcoal results are expressed as counts rather than percentages.

5.4.8. Pollen diagrams were plotted using the TILIA and TILIA*GRAPH programmes (Grimm 2015) displaying pollen and microcharcoal values. Zoning was accomplished using the CONISS (Constrained Incremental Sum of Squares) function within the TILIA software package.

6. Results

6.1. Sediment Characterisation

6.1.1. A woody peat layer was identified overlying a mixed organic clay, likely to represent an interface layer between the peat and an underlying grey-blue clay at all sample sites chosen for further analysis. The deposits appeared to

be the same across the beach, but varied in thickness, with the most southerly core recording a much thinner peat deposit than those further to the north. This is probably due to the underlying topography, but further information regarding this was unobtainable within the confines of this investigation due to the difficulties faced during coring.

6.2. Radiocarbon Dating

6.2.1. The radiocarbon dates obtained are listed in table 1 below:

Position in Peat	Borehole 1	Borehole 2	Borehole 6
Top	2810-2680 cal BC	2920-2860 cal BC	3310-2900 cal BC
Bottom	3360-3100 cal BC	3370-3080 cal BC	3100-2900 cal BC

Table 1: Radiocarbon dates obtained from peat deposit at Friog Corner

6.2.2. The radiocarbon dates obtained suggest that the peat deposit encountered in each core is very likely to be of the same age and representative of one continuous deposit. The dates returned sit comfortably within the Neolithic period. The dates returned from borehole 6 appear to be inverted, suggesting that the material obtained from this core may have become contaminated. This is not unusual within a dynamic coring environment, such as the intertidal zone, particularly where deposits struggle to hold within the corer. Younger material can accidentally be dropped into the borehole and mix with the older material below. In this case it would be necessary to discount the results from borehole 6, as they are clearly contaminated. This is unfortunate, as it represented the longest sequence on site, but does not detract from the results of the other two cores, which complement each other well. Despite being inverted, the dates at borehole 6 are not far off those obtained from the other two sample sites, suggesting the material is still part of the same peat deposit.

6.2.3. Due to the inversion of the radiocarbon dates at site 6, subsamples from this borehole were not be included in pollen analysis, as the samples appear to

have become contaminated and would therefore not provide accurate data to the investigation. The remaining two cores were analysed in full, as detailed below.

6.3. Pollen

6.3.1. Raw pollen counts are displayed in Appendix 1 (Tables 4 and 5). Pollen diagrams displaying the results from the pollen analysis can be found in Figures 3 and 4. Descriptions of each of the pollen zones identified along with individual dates and interpretations can be seen in Tables 2 and 3 below:

Zone	Associated Radiocarbon Date	Description	Interpretation
FCD_1-1	3360-3100 cal BC	Levels of Poaceae (grass) increase from 20% to 40% of the Total Land Pollen (TLP), with Cyperaceae (sedge) levels falling slightly from 25% and 13%. Chenopodiaceae (goosefoot/fat hen) is present throughout, but in very low quantities (<5%). Further herbaceous species ae present throughout the pollen zone in trace amount only including Plantago (plantain) species and Achillea (yarrow). Other herbaceous species are present in very low quantities at singular locations within the zone and are too low to be significant within the sequence Tree species are less frequent in the environment, but dominant species include Alnus (alder) and Quercus (oak), which represent 10% of the TLP each. Corylus(Hazel) is also present at 14%. Species present in trace amounts include Betula (birch), Tilia (lime), Ulmus (elm), Fraxinus (ash), Salix (willow), Hedera Helix (ivy) and Ilex (holly). There is very low presence of Aquatic species including Typha Latifolia (bull rushes/reeds), Potamogeton (pond	**Environment**: The pollen present indicates an open fenland environment dominated by grasses, with the presence of sedges suggesting a damp potentially wetland environment. The presence, albeit small, of aquatic species suggests pooling water in the near vicinity, thought this is not a dominant signal. A background woodland signal is present dominated by oak, alder and hazel, suggesting a mixture of dry and wet woodland around the edge of the open grassland.
			Human Impact: There is a significant microcharcoal signature present in this zone, which is likely to be relate to human presence within the surrounding landscape. The high levels could potentially suggest vegetation clearance within the surrounding landscape, though direct evidence for this is not available.
			Sea Level: The presence, albeit low in quantity, of goosefoot/fat hen is suggested in this instance to be indicative of a potential marine influence.

Zone	Associated Radiocarbon Date	Description	Interpretation
		weed), Myriophyllum (watermilfoils), Nymphaea alba (water lily) and Lemna (duckweed). All are less than 5%.	
FCD_1-2	2810-2680 cal BC	Poaceae maintains dominance in the environment with a drop off in Cyperaceae to <5% TLP. Chenopodiaceae remains present in low quantities. Further herbaceous species are still present in very low levels including Achillea, Apiaceae (umbellifers), Rumex (docks) and Ranunculus (buttercups). The woodland signal is maintained at the same level as in FCD_1-1, as is the aquatic signal. Microcharcoal reduces significantly within this zone.	**Environment:** The environment continues as an open grassland, but sedge becomes less dominant suggesting the environment is drying. The background woodland signal remains the same suggesting the surrounding landscape is stable in its environment.
			Human Impact: The microcharcoal signal reduces significantly in this zone, which could suggest a reduction of human activity in the local area.
			Sea Level: The maintained low levels of Goosefoot/Fat Hen suggest a maintained marine source within the local area.

Table 2: Pollen Zone Descriptions for Borehole Position 1

Zone	Associated Radiocarbon Date	Description	Interpretation
FCD_2-1	3370-3080 cal BC	Poaceae dominates rising from 6-40% TLP within the zone. Cyperaceae are present at c.15-20% TLP. Chenopodiaceae are present in trace amounts throughout the sequence as are a number of herbaceous species including Apiaceae, Plantago species and Urtica (nettles). Potential Cerealia (cereals) have been identified as being present in very low levels, though this could also be identified as Glyceria (coastal grass) (see explanation in interpretation). Alnus and Quercus dominate the Tree species, with Alnus nearing 20% TLP in this zone. Low levels of Ulmus are also present throughout with a small peak	**Environment:** The pollen indicates an open fenland landscape dominated by grasses and sedge species.
			Human Impact: There is a significant peak in microcharcoal, which suggests human activity within the surrounding local area.
			Sea Level: The low level of goosefoot/fat hen could be indicative of a marine influence within the environment such as a tidal salt marsh or inlet.

Zone	Associated Radiocarbon Date	Description	Interpretation
		towards the centre of the zone. Corylus increases from 5-10% TLP. Very low levels <5% of aquatic species including Myriophyllum and Typha Latifolia are present throughout the zone. A significant peak in charcoal is present in this zone.	
FCD_2-2	2920-2860 cal BC	Poaceae remains dominant, maintaining levels between 30-40% and Cyperaceae remains stable between 15-20% TLP. Potential Cerealia or Glyceria maintains its presence at low levels. Further herbaceous species become less prominent within this zone. Quercus and Ulmus maintain their levels, but Alnus increases to 27% TLP. There is a significant drop in microcharcoal from the previous zone, but a small amount of microcharcoal is still present.	**Environment:** The open fenland appears to be maintained, but the slight reduction in sedge species could be indicative of a period of drying. **Human Impact:** The reduction in microcharcoal could be indicative of a reduction in local human activity. **Sea Level:** Low levels of goosefoot/fat hen are maintained suggesting a marine influence is still present in the wider vicinity.

Table 3: Pollen Zone Descriptions for Borehole Position 2

6.4. Environmental Summary

6.4.1. The analysis has shown that a Neolithic fenland landscape dominated by grass and sedges is represented in the organic layers and overlays evidence for a potential earlier saltmarsh environment indicating potential marine incursion. The marine indicators are in the form of the blue-grey clay lithology and the presence of Chenopodiaceae, one of the largest families of halophytic (salt loving) plants (Alghamdi 2012, 9) and which has been used regularly in Welsh intertidal contexts as an indicator of marine influence (Caseldine 2000; Dark 2007; Timpany 2007).

6.4.2. The pollen evidence also indicates a surrounding landscape consisting of a mixture of alder carr, alongside oak and hazel dominated woodland. The microcharcoal record suggests significant burning within the local vicinity

during the period related to salt marsh development, which decreases during the fenland period to a much lower background level. This would suggest human activity within the local vicinity may have been more persistent during the salt marsh period and then reduced to background domestic presence during the fenland phase. Burning could be representative of clearance of the local landscape or may be indicative of very localised domestic activity nearby.

7. Discussion

7.1.1. The dating suggests that the Neolithic stone axe identified at Friog Corner is very likely to be contemporary with the landscape represented by the peat deposit present under the sand.

7.1.2. The buried peat appears to be one single deposit representing a fairly stable fenland landscape during the formation of the deposit that is present for at least 120m along the beach from Friog Corner. The radiocarbon dating suggests the peat formed over a period of around 800 years between c. 3400 cal BC and 2600 cal BC, placing the formation of the deposits within the Neolithic period.

7.1.3. The underlying minerogenic sediments are indicative of a differing earlier environment. They suggest that prior to the onset of a grass and sedge fenland, a tidal environment existed at the site. This change occurred within the Early Neolithic, according to the lowest radiocarbon dates and suggest the minerogenic deposits developed within the late Mesolithic to early Neolithic periods.

7.1.4. The presence of this landscape ties in with the mythological Cantre'r Gwaelod story, which describes the submergence of lands belonging to Seithennin, caused by the misdemeanour of Mererdid, the "fountain cup-bearer," in the area now known as Cardigan Bay (Bromwich 1950, 222). Though supposedly

based in the 6th century the first versions appear to emerge in the 13th century and was heavily embellished during the 19th and 20th centuries to include themes of temperance (North 1957, 148). Similarities can also be drawn between the Cantre'r Gwaelod story and that of Llys Helig on the north coast of Wales (North 1940). It is likely these stories evolved from an attempt to understand the appearance of past landscapes within the intertidal zone after storms. During the early 12th century, a storm in St. Bride's Bay in south-west Wales led to the exposure of "the surface of the earth that had been covered from many ages and discovered the trunks of trees cut off, standing in the very sea itself" (Cambrensis 1189; 2001 edition, 37). Cambrensis recognised that the sea levels had risen and cited Noah's flood as a potential reason, but interestingly for the time also suggested it could have been caused by a gradual encroachment due to "the violence of the sea always overflowing its bounds and encroaching on the land" (Cambrensis 1189; 2001 edition, 38). It is likely that similar exposures occurred around the west coast of Wales due to the stormy weather of the time and it is not beyond reason that this may have led to local inhabitants trying to explain the unusual sites on their beaches.

7.2. Wider Context

7.2.1. The Neolithic fenland identified at Friog Corner appears to be very similar to deposits dated to the Neolithic at Port Eynon and Broughton Bay on Gower in south Wales (Philp in Prep.) and Goldcliff on the Severn Estuary.

7.2.2. Similar observations have also been made regarding the identification of marine transgressions and regressions during the Mesolithic to Neolithic transition, resulting in a change from minerogenic sediment to freshwater peat accumulation, on the south Wales coast at Port Eynon (Philp 2018), Goldcliff (Bell 2007) and Lydstep (Murphy et al 2014).

7.2.3. The findings of this investigation also prove the importance of researching

discreet deposits around a coastline. The deposits are older than those investigated nearby and show that interpretation should not be based on analogy alone.

7.3. Future Archaeological Potential

7.3.1. At all the comparative sites listed above, direct human interaction with the now buried or submerged landscapes has been identified through the presence of human footprints within earlier Mesolithic peat deposits. Though no Mesolithic deposits have yet been identified at Friog Corner, the potential for the presence of earlier deposits is still high. At most of the comparative sites, Mesolithic deposits have been found in the lower intertidal zone, which was not investigated during this study. The discovery of human footprints would rely on the natural exposure of peat deposits due to significant sand movement on the beach, as the depth of sand present during the investigation indicated any excavation would likely be futile in the conditions presented at the time.

7.3.2. The initial borehole survey undertaken on the current tidal defensive bank by Royal Haskoning DHV indicated the peat identified in this investigation extends beneath the shingle bank and may be encountered during further intrusive works. The potential for archaeological evidence on the surface and within this deposit should be noted and necessary steps taken during the tidal defence repairs to identify and record any archaeological evidence that is present.

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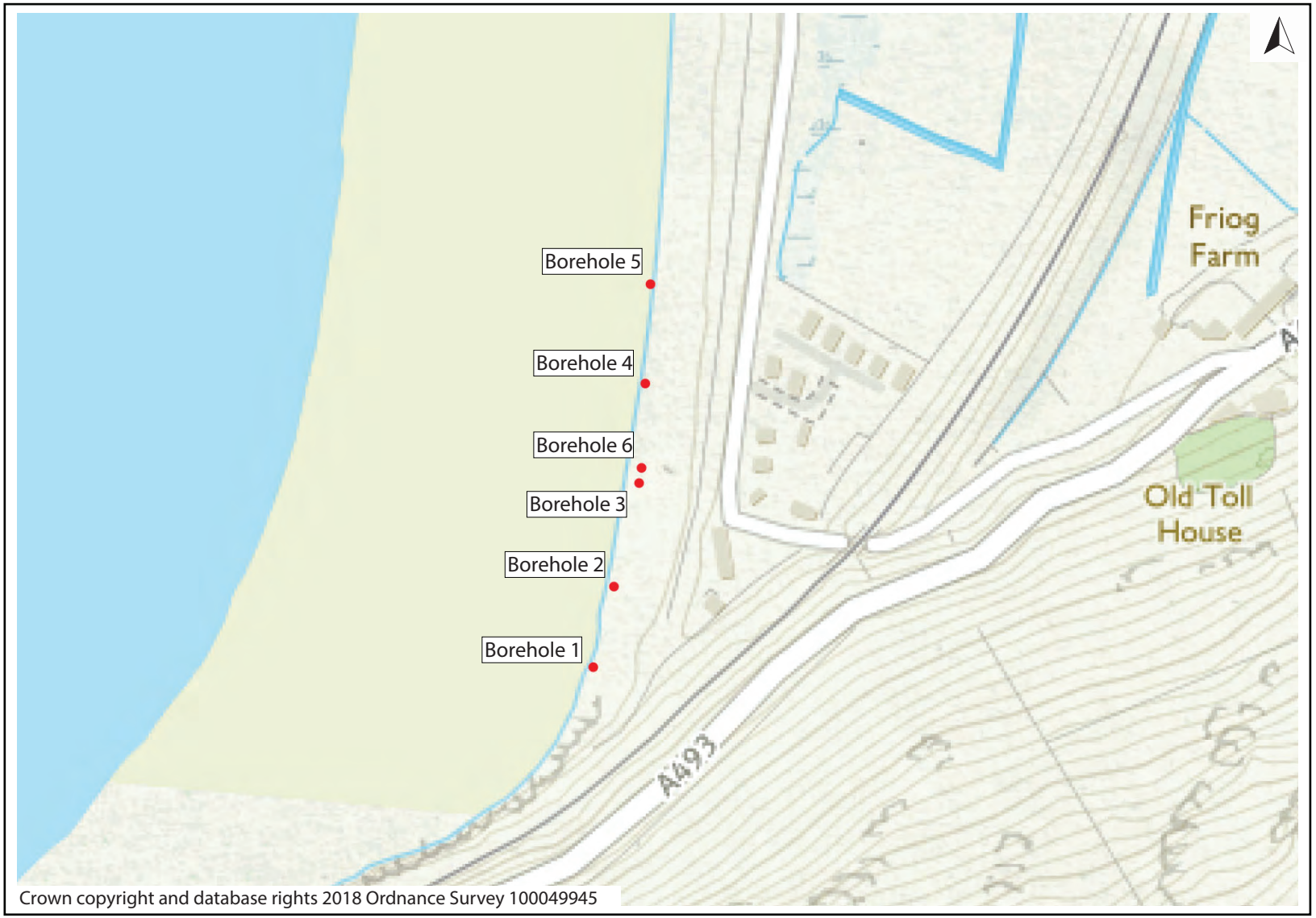

0 150m

Mean High Water Level (MHWL)

Borehole Site

Figure 1:
Plan showing location of boreholes

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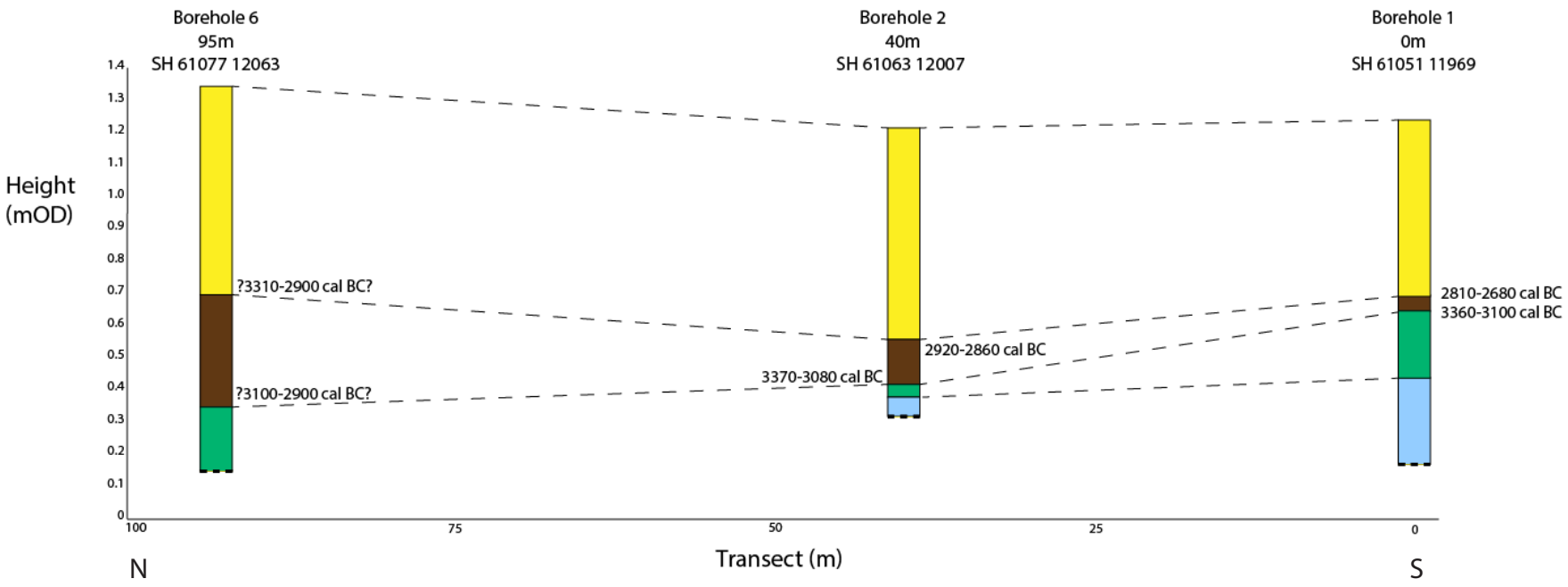

Sand

Woody Peat

Mixed Organic Clay

Grey-Blue Clay

Limit of investigation

Figure 2:
Diagram of sampled sedimentary deposits across transect

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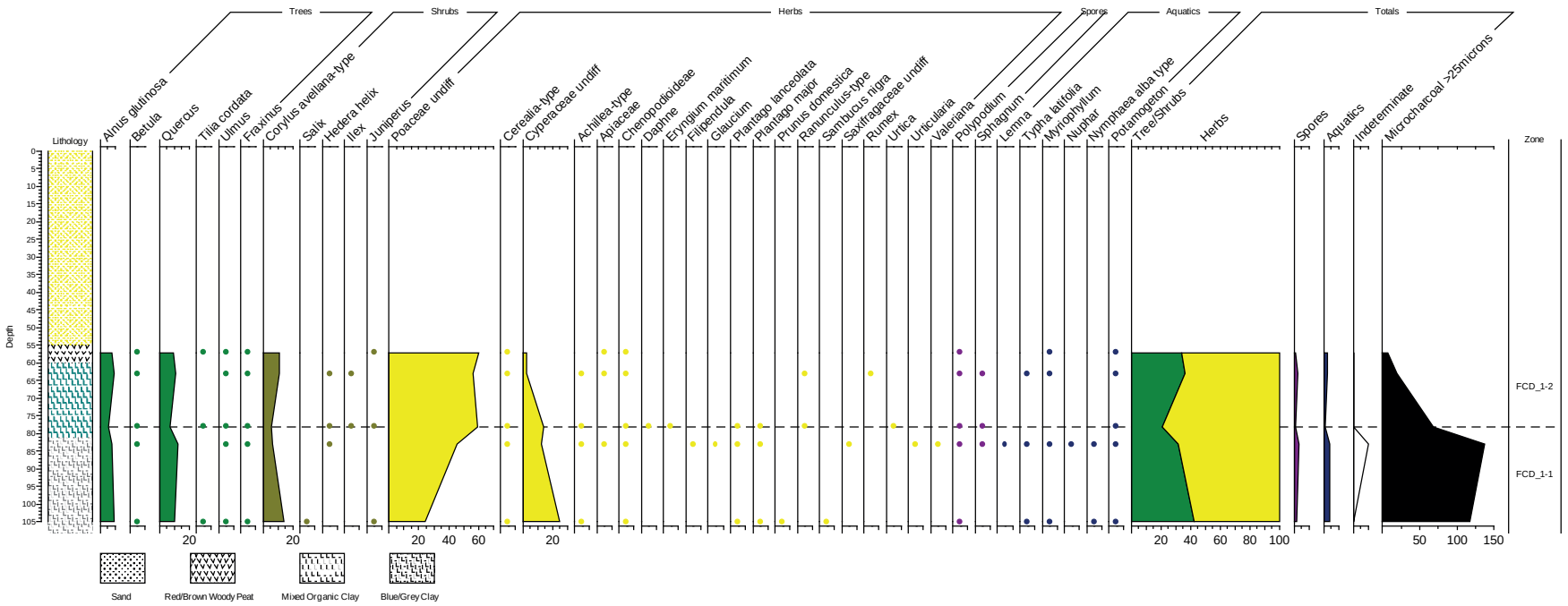

Figure 3:
Pollen Percentage Diagram for Borehole Position 1

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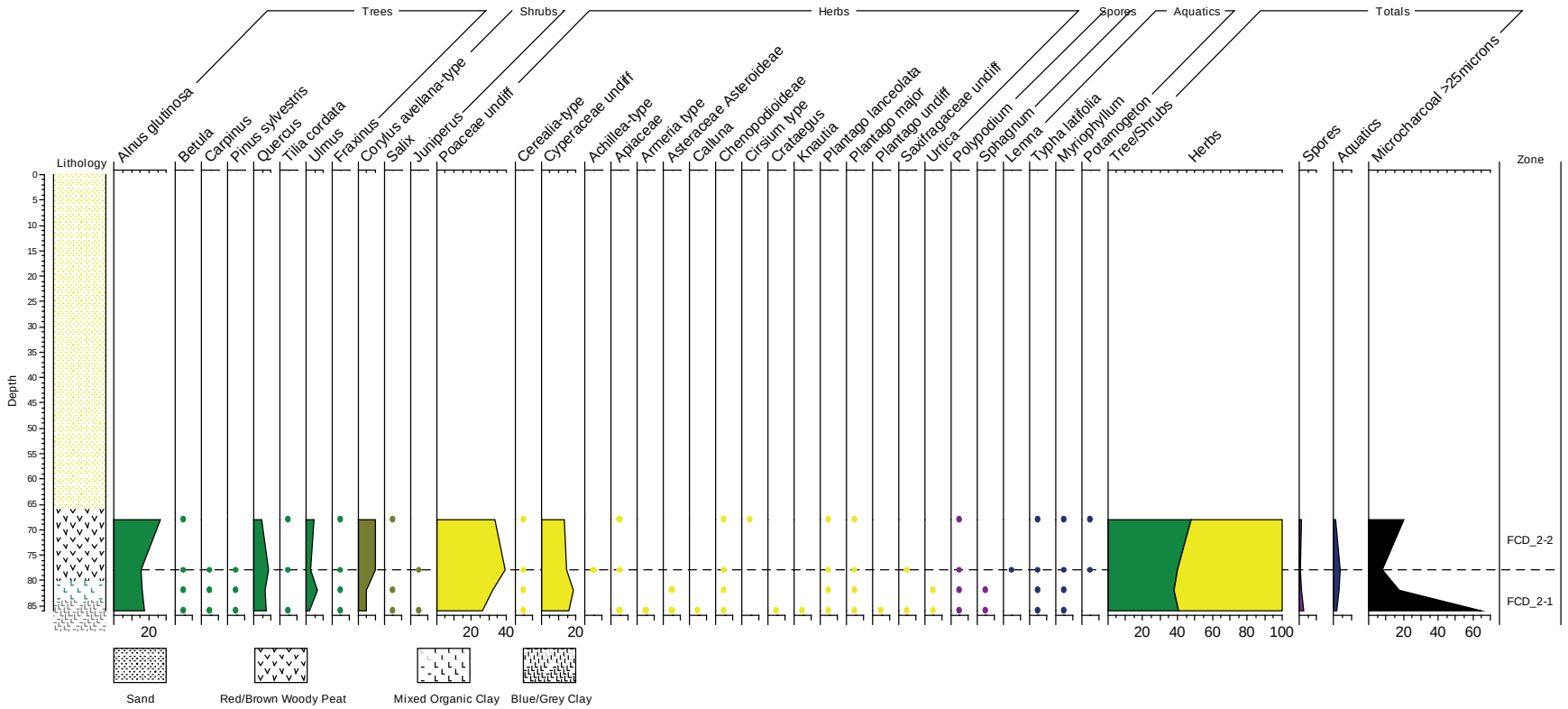

Figure 4:
Pollen Percentage Diagram for Borehole Position 2

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Plate 1: Using 20mm gouge auger to survey underlying deposits

Plate 2: Failed 6mm gouge core

Plate 3: Edelman auger in use for initial spot samples

Plate 4: Core taken with 20mm gouge auger

Archaeology Wales

APPENDIX I:

Pollen Counts

Table 4: Pollen Counts from Borehole Location 1

Pollen				Depth:	57	63	78	83	105
Code	Name	Element	Units	Group					
#Samp.Analyst	Rhiannon Philp								
Lyc.tab:quantity added:number	Lycopodium tablets	quantity added	number	CONC	1	1	1	1	1
Lyc.tab:concentration:number/tablet	Lycopodium tablets	concentration	number/tablet	CONC	20848	20848	20848	20848	20848
Lyc.spik:counted:number	Lycopodium counted	counted	number	CONC	50	54	222	149	103
samp.quant:mass:g	Sample quantity	mass	g	CONC	2	2	2	2	2
Aln	Alnus glutinosa	pollen	NISP	Tree/Shrub	31	38	23	30	37
Bet	Betula	pollen	NISP	Tree/Shrub	1	3	1	5	8
Querc	Quercus	pollen	NISP	Tree/Shrub	38	46	30	50	40
TilaCor	Tilia cordata	pollen	NISP	Tree/Shrub	2		1		2
Ulmus	Ulmus	pollen	NISP	Tree/Shrub	14	8	2	6	12
Cory	Corylus avellana-type	pollen	NISP	Tree/Shrub	45	45	22	25	53
Frax	Fraxinus	pollen	NISP	Tree/Shrub	4	4	1	4	7
Sal	Salix	pollen	NISP	Tree/Shrub					1
Heder	Hedera helix	pollen	NISP	Tree/Shrub		1	1	1	
Ilex	Ilex	pollen	NISP	Tree/Shrub		2	1		
Jun	Juniperus	pollen	NISP	Tree/Shrub	2		1		5
Poa	Poaceae undiff	pollen	NISP	HERB	243	229	235	177	95
Cereali	Cerealia-type	pollen	NISP	HERB	5	5	5	7	3
Cyp	Cyperaceae undiff	pollen	NISP	HERB	10	9	57	49	97
Achill	Achillea-type	pollen	NISP	HERB		1	1	7	1
Apia	Apiaceae	pollen	NISP	HERB	2	1		3	
Cheno	Chenopodioideae	pollen	NISP	HERB	5	10	4	7	4
Daph	Daphne	pollen	NISP	HERB			1		

Pollen				Depth:	57	63	78	83	105
Code	Name	Element	Units	Group					
ErynMari	Eryngium maritimum	pollen	NISP	HERB			1		
Fili	Filipendula	pollen	NISP	HERB				1	
Glau	Glaucium	pollen	NISP	HERB				1	
PlanLa	Plantago lanceolata	pollen	NISP	HERB			2	5	8
PlanMaj	Plantago major	pollen	NISP	HERB			2	3	9
PrunDom	Prunus domestica	pollen	NISP	HERB					4
Ranun	Ranunculus-type	pollen	NISP	HERB		1	2		
SambNig	Sambucus nigra	pollen	NISP	HERB					1
Sax	Saxifragaceae undiff	pollen	NISP	HERB				1	
Rumex	Rumex	pollen	NISP	HERB		1			
Urtica	Urtica	pollen	NISP	HERB			3		
Urt	Urticularia	pollen	NISP	HERB				1	
Val	Valeriana	pollen	NISP	HERB				2	
Poly	Polypodium	spore	NISP	SPORE	3	8	3	8	8
Sphag	Sphagnum	spore	NISP	SPORE		3	1	6	
Lemna	Lemna	aquatic	NISP	AQUATIC				2	
TyphaLat	Typha latifolia	aquatic	NISP	AQUATIC		3		1	1
Myrio	Myriophyllum	aquatic	NISP	AQUATIC	7	4		8	2
Nuph	Nuphar	aquatic	NISP	AQUATIC				1	
Nymph	Nymphaea alba type	aquatic	NISP	AQUATIC				3	1
Pot	Potamogeton	aquatic	NISP	AQUATIC	4	2	5	3	12
Indet	Indeterminate	Indeterminate	NISP	INDET				10	
Charcoal	Microcharcoal ≥25µm	Microcharcoal	NISP	CHAR	7	20	68	138	118

Table 5: Pollen Counts from Borehole Position 2

Pollen				Depth:	68	78	82	86
Code	Name	Element	Units	Group				
#Samp.Analyst	Rhiannon Philp							
Lyc.tab:quantity added:number	Lycopodium tablets	quantity added	number	CONC	1	1	1	1
Lyc.tab:concentration:number/tablet	Lycopodium tablets	concentration	number/tablet	CONC	20848	20848	20848	20848
Lyc.spik:counted:number	Lycopodium counted	counted	number	CONC	9	13	24	99
samp.quant:mass:g	Sample quantity	mass	g	CONC	2	2	2	2
Aln	Alnus glutinosa	pollen	NISP	Tree/Shrub	110	62	65	71
Bet	Betula	pollen	NISP	Tree/Shrub	4	3	1	11
Carp	Carpinus	pollen	NISP	Tree/Shrub		1	2	4
PinSyl	Pinus sylvestris	pollen	NISP	Tree/Shrub		2	8	8
Querc	Quercus	pollen	NISP	Tree/Shrub	19	35	27	30
TilaCor	Tilia cordata	pollen	NISP	Tree/Shrub	1	2		2
Ulmus	Ulmus	pollen	NISP	Tree/Shrub	19	10	27	8
Cory	Corylus avellana-type	pollen	NISP	Tree/Shrub	41	39	19	20
Frax	Fraxinus	pollen	NISP	Tree/Shrub	1	3	1	5
Sal	Salix	pollen	NISP	Tree/Shrub	1		2	2
Jun	Juniperus	pollen	NISP	Tree/Shrub		2		4
Poa	Poaceae undiff	pollen	NISP	HERB	136	157	130	107
Cereali	Cerealia-type	pollen	NISP	HERB	8	6	16	12
Cyp	Cyperaceae undiff	pollen	NISP	HERB	55	59	74	63
Achill	Achillea-type	pollen	NISP	HERB		1		
Apia	Apiaceae	pollen	NISP	HERB	2	2		2
Arm	Armeria type	pollen	NISP	HERB				1
AstAst	Asteraceae Asteroideae	pollen	NISP	HERB			1	1
Call	Calluna	pollen	NISP	HERB				1
Cheno	Chenopodioideae	pollen	NISP	HERB	2	7	4	12

Pollen				Depth:	68	78	82	86
Code	Name	Element	Units	Group				
Cirs	Cirsium type	pollen	NISP	HERB	1			
Crat	Crataegus	pollen	NISP	HERB				1
Knau	Knautia	pollen	NISP	HERB				1
PlanLa	Plantago lanceolata	pollen	NISP	HERB	5	6	7	12
PlanMaj	Plantago major	pollen	NISP	HERB	5	1	15	17
Plant	Plantago undiff	pollen	NISP	HERB				1
Sax	Saxifragaceae undiff	pollen	NISP	HERB		1		1
Urtica	Urtica	pollen	NISP	HERB			2	6
Poly	Polypodium	spore	NISP	SPORE	4	3	1	9
Sphag	Sphagnum	spore	NISP	SPORE			3	1
Lemna	Lemna	aquatic	NISP	AQUATIC		2		
TyphaLat	Typha latifolia	aquatic	NISP	AQUATIC	1	3	10	5
Myrio	Myriophyllum	aquatic	NISP	AQUATIC	1	7	1	1
Pot	Potamogeton	aquatic	NISP	AQUATIC	1	4		
Charcoal	Microcharcoal ≥25µm	Microcharcoal	NISP	CHAR	20	8	18	65

Archaeology Wales

APPENDIX II:

Data Management Plan

Data Management Plan

Section 1: Project Administration

Project ID
2599
Project Name
Friog Corner, Dolgellau
Project Description
A palaeoenvironmental investigation was undertaken prior to the proposed works to repair tidal defences at Friog Corner. Archaeology Wales undertook an investigation involving radiocarbon dating and palaeoenvironmental sampling and analysis to gather information about the prehistoric environment represented by the now buried organic peat deposits. The analysis has revealed the remains of a Neolithic fenland landscape under the modern beach surface, which was preceded by what appears to have been a marine transgression in the early Neolithic period. The presence of a significant microcharcoal signal within the environmental record suggests a sustained human presence throughout the period represented in the deposits. All work conformed to the standards and guidance set by the Chartered Institute for Archaeologists (2020). AW is a Registered Organisation with the CIfA.
Project Funder / Grant reference
National resources Wales
Project Manager
Rowena Hart
Principal Investigator / Researcher
James Evans
Data Contact Person
Rhiannon Philp (rhiannon.philp@arch-wales.co.uk)
Date DMP created
19/06/2025
Date DMP last updated
As above
Version
V1
Related data management policies
This DMP is guided by the Project Brief, CIfA Standards and guidance, trusted digital repository guidelines (RCAHMW) or other best practice guidance (see brief for details)

Section 2: Data Collection

What data will you collect or create?
The table below provides a summary of the data types, formats and estimated archive volume for data collected / created as part of this project. As the project progresses, more detail regarding files will be added to this DMP.

Type	Format	Estimated volume (Data Archived)
Text/documents	PDF (.pdf)	4

Images	Photographs (.jpg)	14
Spreadsheets	Excel spreadsheet (.xlsx) Comma deliminated (.csv)	1 1
GIS	Shapefiles (.shp plus associated files)	1

How will the data be collected or created?

Data Standards / Methods

- Standard methods of data collection will be applied throughout the project, working to best practice guidance where applicable / available. In general, data acquisition standards are defined against RCAHMW Guidelines. Specific or additional guidance relevant to this project are listed below, and will
- be updated as the project progresses.
- Methods of collection are specified within the Project Design and will meet the requirement set out in the Project Brief, the organisation recording manual and relevant CIfA Standards and guidance.
- Where appropriate, project contributors external to the organisation will be required to include data standards, collection methodology and metadata with individual reports and data.
- Specific guidance:
  - Chartered Institute for Archaeologists, 2020. Standard and guidance for the archaeological investigation and recording of standing buildings or structures.
  - Historic England, 2016. Understanding Historic Buildings: A Guide to Good Recording Practice

Data storage / file naming

- The data produced will be uploaded at regular intervals during the project as a way of backing up the information.
- The working project archive will be stored in a project specific folder on the internal organisational server. The internal organisation server is backed up to a cloud-based storage system to maintain an up-to-date security copy of the organisation wide data.
- Project folders are named following established organisational procedures and the folder hierarchy and organisation devised will be understood by all members of staff involved in the project.
- Data collected will be downloaded and raw data will be stored in the appropriate folder.
- File naming conventions following established organisational procedures, based on RCAHMW file naming guidance, and include version control management.
- The data stored will be checked by the project manager regularly as a means of quality assurance.

Section 3: Documentation and metadata

What documentation and metadata will accompany the data?

- Data collected will include standard formats which maximise opportunities for use and reuse in the future (see Section 2, above).

- A RCAHMW metadata document will be included with the digital archive and include all data types included within the archive. A working copy will be kept on the organisational server in the Project Folder. A copy of the form containing HER required data will also be created.
- Data documentation will meet the requirement of the Project Brief, Museum Deposition Guidelines, Digital Repository Guidelines and the methodology described in the Project Design methodology.
- An archive catalogue documenting both physical and digital archive products will be maintained and submitted with both the Museum and Trusted Digital Repository

Section 4: Ethics and legal compliance

How will you manage any ethical, copyright and Intellectual Property Rights (IPR) issues?

- The project archive will include the names and contact details of individuals who intend to volunteer or participate in the excavation and post excavation stages. We have a GDPR compliant Privacy Policy which underpins the management of personal data; any personal data is managed through a secure cloud-based database and not retained on the project specific folders.
- Personal data will be removed from the archaeological project archive and permission to include individual's names in any reporting is gained prior to use.
- Copyright for all data collected by the project team belongs to the organisation, and formal permission to include data from external specialists and contractors is secured on the engagement of the specialist or contractor.
- Where formal permissions and/or license agreements are linked to data sharing, they will be included in the project documentation folders and will accompany the archaeological project archive.

Section 5: Data Security: Storage and Backup

How will the data be stored, accessed and backed up during the research?

- Organisational IT is managed by an external data management provider, who is also responsible for the management and verification of our daily back-ups and who supports access to security copies as needed
- Sufficient data storage space is available via the organisational server, which includes permissions-based access. The server is accessible by staff on and offsite through a secure log-in
- Off-site access to the project files on the organisation's server is provided to support back-up of raw data while fieldwork is ongoing. Where internet access for data back up is not possible, the raw data will be backed up to a separate media device (such as laptop and portable external hard drive).
- Project files will be shared with external specialists and contractors directly using the same system, with the wider project team gaining access to only the files needed using permissions-based access

Section 6: Selection and Preservation

Which data should be retained, shared, and/or preserved?

- The Selection Strategy and DMP will be reviewed and updated as part of the Post Excavation Assessment and Updated Project Design and following full analysis. Updated documentation will be included in all reporting stages.

- Prior to deposition, the Selection Strategy and DMP will be updated and finalised in agreement with all project stakeholders (including the Local Planning Archaeologist, Client, Museum, RCAHMW).
- Selection will be informed by the Project Design, defined against the research aims, regional and national research frameworks, specialist advice and the significance of the project results.
- The project will be published as an online technical report (accessible via RCAHMW and as part of this archive), with full access to research data.
- The data archive will be ordered, with files named and structured in a logical manner, and accompanied by relevant documentation and metadata, as outlined in Sections 2 and 3 of this DMP.
- Deselection will be undertaken automatically on any duplicate or unusable files, such as blurry or superfluous photographs.

What is the long-term preservation plan for the dataset?

- The digital archive will be deposited with the RCAHMW, which is working towards becoming a certified repository with Core Trust Seal.
- The archive will be prepared for deposition by the project team and the costs for the time needed for preparation, and the cost of deposition have been included in the project budget.

Have you contacted the data repository?

- AW has an ongoing agreement with the RCAHMW who the intended repository for digital data are.

Have the costs of archiving been fully considered?

- A costing estimate has been produced to allow for the preparation of the archive and has been included in the project budget.

Section 7: Data Sharing

How will you share the data and make it accessible?

- The museum and digital archive repository and will be updated as the project progresses.
- The investigations have resulted in the following documents: Project Design, Palaeoenvironmental Investigation Interim Report, Palaeoenvironmental Investigation Final Report.
- A final version of the project report will be supplied to the Historic Environment Record, and any data which they request can also be provided directly.
- The location (s) of the final Archaeological Archive will be included in the final report

Are any restrictions on data sharing required?

- A temporary embargo may be required on the sharing of the project results. If this is the case, specific details once agreed will be included in the updated version of this DMP and will be documented in the overarching Project Collection Metadata.
- Data specific requirements, ethical issues or embargos which are linked to particular data formats will be documented within the relevant metadata tables accompanying the project archive

Section 8: Responsibilities

Who will be responsible for implementing the data management plan?
• The Project Manager and Post Excavation Manager will be responsible for implementing the DMP, and ensuring it is reviewed and revised at each stage of the project. • Data capture, metadata production and data quality is the responsibility of the Project Team, assured by the Project Manager and Post Excavation Manager. • Storage and backup of data in the field is the responsibility of the field team. • Once data is incorporated into the organisations project server, storage and backup is managed by an external company. • Data archiving is undertaken by the project team under the guidance of the Post Excavation Manager, who is responsible for the transfer of the Archaeological Project Archive to the agreed repository. • Details of the core project team can be found in the Project Design.

Archaeology Wales

Archaeology Wales Limited
The Reading Room, Town Hall, Llanidloes, SY18 6BN
Tel: +44 (0) 1686 440371

Email: admin@arch-wales.co.uk
Company Directors: Mark Houliston MCIfA & Jill Houliston
Company Registered No. 7440770 (England & Wales)
Registered Office: Morgan Griffiths LLP, Cross Chambers
9 High Street, Newtown, Powys, SY16 2NY