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# From Hunter-Gathering to the Roman Conquest:

## AN ARCHAEOBOTANICAL RESOURCE ASSESSMENT AND RESEARCH AGENDA FOR PREHISTORIC WALES

(c.8000 BC – AD 100)

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Submitted for the degree of MA by Research in Archaeology

Department of Archaeology, Durham University.

2015

## ABSTRACT

This thesis highlights the significance and potential of archaeobotanical research undertaken on prehistoric sites in Wales (c. 8000 cal BC – 100 cal AD), providing insights into agricultural practices, food, diet, woodland exploitation and environments. It represents the first comprehensive review of archaeobotanical evidence for prehistoric Wales in over two decades. A total of over 300 archaeobotanical records were collated and the focus of this research lies in providing an assessment of the quantity and quality of the current dataset to develop a resource assessment and research agenda. A critical review of the dataset is first provided focusing on its chronological and geographical coverage and the quality of the available evidence. Following this, a detailed chronological review of the evidence is provided from the Mesolithic to the Iron Age and for each major period the dataset is discussed in a wider context. A number of methodological issues with the dataset are outlined and major gaps in the current state of knowledge identified. On this basis, research priorities are recommended. Ultimately, it aims to stimulate further discussion and to highlight the significance and potential of archaeobotanical research to a wider archaeological audience.

From Hunter-Gathering to the Roman Conquest: An archaeobotanical resource assessment and research agenda for prehistoric Wales (c.8000 BC – AD 100)

MA by Research in Archaeology submitted by Edward R. Treasure

(2015)

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Front cover images: Charred hazelnut shells (top) from an Early Neolithic rectangular structure at Parc Bryn Cegin and an emmer wheat grain from an Early Neolithic structure at Gwernvale. Photographs by the author.

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## APPENDIX 1: Database

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## Chapter 1:

# INTRODUCTION

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This thesis presents a comprehensive and up-to-date review of archaeobotanical research undertaken on prehistoric sites in Wales ranging in date from the Mesolithic to the Iron Age (c. 8000 cal BC – 100 cal AD). The aims of this research are to produce a Resource Assessment (the current state of knowledge) and to develop a Research Agenda (priorities for future research). Specifically, this thesis aims to:

1. Critically review and summarise the current state of knowledge, focusing on the quantity and quality of the available evidence.
2. Identify major gaps in the current state of knowledge.
3. Highlight key priorities and potential for future research.

Since its development during the early 20th century, archaeobotany – the analysis of plant remains and charcoal (wood) from archaeological sites – has become a widespread and routine component of archaeological research within recent decades. Traditionally, archaeobotanical evidence has been presented as a ‘shopping list’ of plants presented in report appendices and rarely looked at again (Robb 2014: 25). However, archaeobotanical research is increasingly being integrated into wider archaeological discussions, providing insights into a wide range of areas such as agriculture, food, diet, woodland exploitation and environments. Within the last few decades, the nature and circumstances of archaeobotanical research undertaken throughout Britain have significantly changed. In 1990, the introduction of development-driven archaeology resulted in a major increase in the number of archaeological investigations undertaken throughout Britain and subsequently a significant expansion in the quantity of archaeobotanical research (Hall and Kenward 2006). Despite this, the majority of archaeobotanical evidence exists in the form of individual site-based studies due to the site specific nature of development-driven projects and the requirement for syntheses of existing datasets has been highlighted by other researchers (van der Veen et al. 2007, 2013). Archaeobotanical datasets can most effectively be used when evidence from a large number sites is drawn together (van der

Veen and Jones 2006). However, the main challenge is managing the ever increasing quantities of data.

It is 25 years since the publication of Astrid Caseldine's *Environmental Archaeology in Wales* which provided a review of archaeobotanical research from sites in Wales to develop a resource assessment and research agenda (Caseldine 1990a). In the time which has elapsed since this publication, the quantity of archaeobotanical evidence available for prehistoric Wales has significantly expanded, although, at present, there are no recent and comprehensive reviews of the state of archaeobotanical research for prehistoric Wales. Whilst it is recognised that viewing 'prehistoric Wales' as a geographical entity is a reflection of recent political expediency, archaeological (and therefore archaeobotanical) research in Wales is influenced by modern political borders. In England, English Heritage funded reviews of archaeobotany have been published for northern England (Hall and Huntley 2007; Huntley 2010) and are in preparation for central (Carruthers and Hunter forthcoming) and southern England (Pelling and Campbell forthcoming). However, there is no recent equivalent to these reviews for Wales. Recently, van der Veen et al. (2007, 2013) published comprehensive reviews of the state of archaeobotanical evidence for Roman and Medieval Britain, encompassing Wales, and a similar review of archaeobotanical evidence for prehistoric Wales is, therefore, both timely and long-overdue. The *Research Framework for the Archaeology of Wales* has begun to address some of the issues outlined above, however, there is requirement for a detailed summary of archaeobotanical research to understand in greater detail the current state of knowledge and identify specific priorities for research.

There is an ever-growing body of archaeobotanical evidence available for Wales, yet the suitability of the dataset for contributing to major research areas requires assessment. Detailed analyses using archaeobotanical evidence are entirely dependent on the quantity, quality and accessibility of the available evidence.

## STRUCTURE

This research examines evidence over a long period of time (c. 8000 BC – AD 100) and it covers many different themes. Therefore, an overview of the structure is necessary.

Chapter 2 presents the methodology used in reviewing the archaeobotanical evidence.

Chapter 3 provides a general overview of the dataset focusing on a number of areas ‘Sources of Archaeobotanical Evidence’; ‘Chronological and Geographical Coverage’; ‘Quality of the Dataset’; ‘Date of Excavation and Publication’. Following this recommendations for future research are outlined. This broadly follows the approach taken in recent reviews of archaeobotanical research for Roman and Medieval Britain (van der Veen et al. 2007, 2013).

Chapters 4 to 7 form the core of this research, providing a detailed chronological overview of the evidence for each major period: Mesolithic, Neolithic, Bronze Age and Iron Age. Each chapter is intended to be presented as a free-standing document. For each period an introduction and background is provided (to familiarise non-specialists) and is followed by an overview of the evidence. Some key themes are drawn out from the evidence and discussed in greater detail. Research priorities and potential are presented separately for each period in the form of ‘Research Questions’ and ‘Approaches and Techniques’. This format broadly follows that in similar regional reviews of environmental archaeology published by English Heritage (e.g. Smith 2002; Hall and Huntley 2007; Huntley 2007; Kenward 2010) and partly from the palaeoenvironmental review in the Research Framework for the Archaeology of Wales (<http://www.archaeoleg.org.uk/intro.html>).

Chapter 8 presents concluding remarks and highlights the key research findings.

## Chapter 2:

# METHODOLOGY

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### DATA SOURCES

This thesis has collated all published and un-published archaeobotanical evidence for prehistoric Wales (c.8000 BC – 100 AD) up to September 2015 (Fig. 1). For the purpose of this review, archaeobotanical evidence is taken to include macro-remains of plants (charred plant remains, waterlogged plant remains, pottery impressions) and wood charcoal. Sites were identified through systematic searches of major journals, regional journals, report/monograph series and archaeological unit reports. References were also identified from previous studies (Caseldine 1990a; Ghey et al. 2007), the ‘Archaeo-Botanical Computer Database’ (Tomlinson and Hall 1996), the ‘Environmental Archaeology Bibliography’ (Hall 2008) and the current palaeoenvironmental bibliographic review from the Research Framework for the Archaeology of Wales (Caseldine 2013a). The review of environmental archaeology published annually in *Archaeology in Wales* (1980-2014) was also consulted to identify forthcoming archaeobotanical evidence. Where possible, un-published or forthcoming data are included in this review and was obtained through personal communication (see acknowledgements). Whilst this review is very comprehensive, it is inevitable that a small number of reports have been overlooked, particularly unpublished ‘grey’ literature reports.

### DATA RECORDING

A database was created to record all the evidence containing background information on sites (location, site description, dating evidence, date excavated), sampling methods and a summary of the archaeobotanical evidence present. Two units of analysis are recorded: a ‘project’ and a ‘site’. A ‘project’ refers to the excavation of an area, whereas the term ‘site’ accounts for multiple periods of activity and/or different functional areas (i.e. settlement evidence, burials) at a single site. For example, Parc Bryn Cegin is a ‘project’

with multiple periods of activity (Neolithic to Iron Age), each of which represents a unique ‘site’.

Sites were assigned to accepted chronological periods (Table 1) on the basis of radiocarbon dating evidence and/or pottery chronologies. All radiocarbon dates are calibrated using IntCal13 (Reimer et al. 2013) and OxCal 4.2 (Bronk-Ramsey 2013). Calibrated dates are expressed at 95.4% probability with end points rounded out to 10 years for errors  $\geq 25$  years, and 5 years for errors  $< 25$  years (Mook 1986), unless otherwise stated. Where possible, radiocarbon dates were checked for accuracy against the ‘Wales and Borders Radiocarbon Database’. An example of the database is presented in Table 2. The database is presented in Appendix 1 (disc in back cover).

## Chapter 3:

# ARCHAEOBOTANICAL RESEARCH IN PREHISTORIC WALES

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### INTRODUCTION

In total, 315 sites with archaeobotanical evidence were identified for prehistoric Wales (Fig.2), give or take a small number of sites depending on the specific classification of how a 'site' is defined (for example, numerous Neolithic pit groups identified in a project at Parc Bryn Cegin (Kenney 2008a)). Whilst a substantial quantity of research has been undertaken on prehistoric sites in Wales, the quality and quantity of the available evidence is in many cases unevenly distributed, particularly in terms of both chronological and geographical coverage.

### RESULTS

#### SOURCES OF ARCHAEOBOTANICAL EVIDENCE

Table 3 presents an overview of the sources of evidence recovered from prehistoric sites in Wales. In British (and European) prehistoric archaeological sites archaeobotanical evidence is preserved through four processes: charring, waterlogging, mineralisation (mineral-replacement) and as plant impressions in pottery. Charring is by far the most common mode of preservation and charred plant remains have been recovered from 250 sites. In contrast, waterlogged plant remains have only been recovered from 23 sites, of which 6 sites date to the later Mesolithic in the Severn Estuary, south-east Wales. Pottery impressions of plant remains are rare and have only been identified at 4 sites. There are currently no records of mineralised plant remains from prehistoric contexts in Wales. However, this mode of preservation is rare in prehistoric contexts (Pelling and Campbell 2013) and only occurs in midden-type deposits (McCobb et al. 2001, 2003; for examples, see middens at Potterne and Chisenbury, south-west England (Carruthers 2000, 2010)).

There are 245 sites with charcoal analysis and this has often been undertaken in conjunction with analysis of charred plant remain. Despite the large number of sites, the quality of the charcoal evidence is extremely variable and generally low quality for most sites. There are only a small number of sites where large quantities of charcoal fragments have been identified (and fully published)<sup>1</sup>.

## CHRONOLOGICAL AND GEOGRAPHICAL COVERAGE

Tables 4 and 5 provide an overview of the geographical and chronological coverage of the archaeobotanical evidence by region, period and sources of archaeobotanical evidence. A map displaying the location of all the sites is presented in Figure 3. Analysis of evidence from different site-types (e.g. settlement contexts, funerary sites) is not outlined here and is considered in detail for each period separately in the chronological overview section.

In terms of chronological coverage, there are significant variations in the quantity of archaeobotanical evidence available between different periods and sub-periods. Only a small number of Mesolithic sites ( $n = 21$ ) and (to a lesser extent) Iron Age sites ( $n = 48$ ) were identified, while in comparison there are large numbers of sites for both the Neolithic ( $n = 118$ ) and Bronze Age ( $n = 128$ ). However, when the evidence is analysed at the level of chronological sub-periods, it is evident that the data is unevenly distributed, particularly for the Bronze Age. For example, there are a total of 127 Bronze Age sites; however, the vast majority of these sites date to the Early Bronze Age ( $n = 87$ ), whilst there are currently only a small number of Middle Bronze Age sites ( $n = 24$ ) and Late Bronze Age sites ( $n = 15$ ).

On a geographical basis, the number of sites with archaeobotanical evidence is variable between the five regions of Wales. The largest number of sites have been identified in North-West Wales, a factor which can be directly related to a number of large-scale development-driven archaeological investigations, in particular at Parc Bryn Cegin

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<sup>1</sup> e.g. Pentwyn (McKenna forthcoming), Snail Cave Rockshelter (McKenna 2014), Goldcliff Sites (W, J) (Caseldine 2000, Gale 2007), Borrass Quarry (ASUD 2010, 2013), Mynydd Mwyn Farm (McKenna 2010), Hindwell II Palisaded Enclosure (Johnson 1999), Ysgol yr Hendre (McKenna 2013), Malborough Grange (Davies 1969), Moel Goedog (Denne 1984), Blaen y Cae (Denne 2006).

(Kenney 2008a) and the Pwllheli to Blaenau Ffestiniog Pipeline (Kenney 2014). There are similar numbers of sites for North-East, South-West and Central Wales; however, there are currently only a small number of sites for South-East Wales.

## QUALITY OF THE DATASET

From the evidence outlined above, it is evident that there is a large and ever-growing archaeobotanical dataset, however, the quality of the dataset requires assessment in terms of its potential for large-scale comparative analyses. A number of factors influence the quality in of the dataset including the sampling and recovery methods used, number of samples analysed, quality of the dating evidence and the recording and presentation of evidence. It is difficult to provide a detailed quantitative assessment of the quality of the evidence (i.e. categorising evidence as ‘low quality’ or ‘high quality’) as the nature and circumstances of the archaeobotanical analysis being undertaken is to a large extent influenced by when a site was excavated, the level of preservation at a site in addition to the type of the excavation undertaken (i.e. large-scale development-driven archaeological investigations vs. small-scale research projects). Rather than addressing all of the problems with the dataset, of which there are many, two of the most problematic issues - sampling and dating evidence – are examined.

### *Quality of the Dataset: Sampling*

In terms of the number of samples analysed, the majority of sites would be classed as ‘low’ or ‘poor’ quality due to the small number of features/contexts sampled (c. <10 samples (cf. van der Veen et al. 2007, 2013)). However, this does not take into account the small-scale of excavation undertaken at many sites. For example, at Carrog, 17 samples were analysed from 9 Neolithic features (Caseldine et al. 2014a), equating to 100% sampling of the Neolithic features present at the site. Despite these factors, there are currently very few sites where large numbers of samples (> 30) have been assessed from a wide range of contexts/features (e.g. Parc Bryn Cegin (Schmidl et al. 2008), Upper Ninepence (3) (Caseldine and Barrow 1999), Woodside Camp (Caseldine and Holden 1998)). In some projects, a large number of samples have been analysed when features of

the same period are grouped together, for example, Late Neolithic burnt mounds and Middle-Late Neolithic pit groups at Parc Bryn Cegin (Schmidl et al. 2008) or Middle and Late Neolithic pit groups at Borrás Quarry (ASUD 2010, 2013).

#### *Quality of the Dataset: Dating Evidence*

In terms of dating evidence, a key factor influencing the quality of archaeobotanical datasets is the level of chronological resolution and the reliability of the dating evidence. There are large variations in the quantity and of quality radiocarbon dates available for sites depending on the date of excavation and whether a site was excavated as part of a development-driven investigation or a research project. In general, the quality of the dating evidence clearly increases for recently excavated sites, particularly sites investigated through development-driven projects. Between 1970 and 1990, only small number of radiocarbon dates are available for many sites, typically on charcoal and in some instances bulked-samples which may incorporate material of different ages and/or there could be a considerable age-offset due to the old-wood effect (e.g. Gwernvale (Dresser 1984), Plas Gogerddan (Murphy 1992), Rhuddlan Site M (Burleigh et al. 1976; Quinell et al. 1994)). In recent excavations, particularly development-driven investigations, large numbers of high quality radiocarbon dates (on short-lived samples) have been obtained, including multiple dates from individual contexts and direct AMS dating of plant remains is becoming more frequent. (e.g. Parc Bryn Cegin (Marshall et al. 2008), Pwllheli to Blaenau Ffestiniog Pipeline (Hamilton et al. 2014), Borrás Quarry (Grant and Jones 2009, 2011; Jones and Grant 2009; Grant 2011)).

Since 2000, a total of 66 direct AMS dates on charred hazelnut shell fragments from 15 sites/projects have been obtained, with approximately half of these dates ( $n = 32$ ) from Parc Bryn Cegin (Marshall et al. 2008). Currently, direct dating of cereal grains is rare, with 32 dates obtained from 8 projects, including 9 dates from RAF St. Athan (Barber et al. 2006) and 17 dates from Parc Bryn Cegin, of which two cereal grains were intrusive and one cereal grain was probably residual (Marshall et al. 2008). The small number of direct dates on plant remains obtained prevents an assessment of potential problems of contamination.

The quality of the dating evidence is poor for many sites and in many instances only a small percentage of the features identified in sites can be confidently phased due to a small number of radiocarbon dates being obtained (e.g. Cwm Meudwy B (Caseldine and Griffiths 2006a, b), Smithfield Livestock Market (O'Brien 2014), Yr Allor (Caseldine in Kirk and Williams 2000)). This problem appears to be particularly relevant to Iron Age and Romano-British settlements where dense spreads of occupation can span long periods of time (in addition to activity in later periods) making it difficult to precisely phase contexts (e.g. Berry Hill (Caseldine and Griffiths 2012a), Fynnonwen (Caseldine and Griffiths 2012a), Great Castle Head (Caseldine 2001a), Parc Bryn Cegin Roundhouse Settlement (Schmidl et al. 2008), Cefn Du (Ciaraldi 2012), Cefn Cwmwd (Ciaraldi 2012), Cefn Graenog (Hillman 1998)). For some sites, radiocarbon dating evidence is either not available or only a small number of dates were obtained and subsequently the archaeobotanical evidence has been predominantly phased on the basis of pottery present or by associated dated features, including some evidence which has been recovered from recent excavations (e.g. Later Neolithic pit groups (Parc Bryn Cegin II, III, IV (Schmidl et al. 2008), Upper Ninepence (Caseldine and Barrow 1999) and Earlier Bronze Age funerary sites (e.g. Church Road (Allen 2009), Goodwin's Row (Caseldine 1990b), Llanilar (Caseldine 1997), Ynys Hir (Hyde 1943), Penard Burch (Hyde 1945)).

#### DATE OF EXCAVATION AND PUBLICATION

To provide an indication of changes in the quantity of archaeobotanical research undertaken in Wales, particularly due to development-driven archaeological investigations since 1990, both the date of excavation and date of publication were recorded for all the sites. Figure 4 compares the total number of available sites with the date of excavation and publication. There was a gradual increase in archaeobotanical research from 1920 to 1960, with a significant increase from 1970 onwards and in particular from 2000 onwards. A large quantity of evidence has been analysed from sites excavated between 2000 and 2015, particularly 2010-2015, with many sites identified through large-scale development-driven archaeological investigations, particularly in north-west Wales at Parc Bryn Cegin (Kenney 2008a) and Pwllheli to Blaenau Ffestiniog Pipeline (Kenney 2014). A number of projects could be included in this review as the evidence is still in preliminary stages of analysis or reports were incomplete/in

preparation or (e.g. St George's Quarry (Wood 2009; Carrot 2013), Four Crosses (Jones and Grant 2011; ASUD 2012), Parc Cybi (Grinter 2011) and the Milford Haven to Brecon Pipeline. Figure 5 compares the total number of available sites with plant remains and charcoal by the date of excavation. It is clear that for earlier projects (pre-1970s) charcoal was more commonly analysed than plant remains, however, this trend is reversed post-1980 with plant remains being analysed at marginally more sites than charcoal.

From 1980 to 2015 the majority of archaeobotanical research was published in national Welsh journals, either *Archaeologia Cambrensis* or *Archaeology in Wales* (57 publications), with some research also reaching major journals (23 publications) and a small number of publications in monographs/reports (10 publications). It is difficult to directly assess the quantity of un-published 'grey' literature as a number of projects are planned for full publication in the future (e.g. Borrás Quarry (ASUD 2010, 2013), Pentrwyn (McKenna forthcoming), Nant Farm (Schmidl et al. 2009; Caseldine and Griffiths n.d.). In other instances summaries of the archaeobotanical evidence are included in published articles, with a full report on the evidence available online as an unpublished report (e.g. Parc Bryn Cegin (Kenney 2008a, b; Schmidl et al. 2008), Pwllheli to Blaenau Ffestiniog Pipeline (Kenney et al. 2013; Challinor et al. 2014), A497 Road Scheme (Berks et al. 2007; Davidson et al. 2007), Ysgol yr Hendre (Kenney and Parry 2012, 2013)). However, for a small number of sites, a full report on the archaeobotanical evidence is only available through the site archive or through the original author making access to reports difficult (e.g. Cwm Meudwy (Caseldine and Griffiths 2006a, b), Dyffryn Lane (Caseldine 2007a, b, 2010a), Porth y Rhaw (Caseldine and Griffiths 2011a)).

## RESEARCH AGENDA: POTENTIAL AND PRIORITIES

From the overview of the archaeobotanical dataset presented above it is evident that a substantial quantity of research has been undertaken on prehistoric sites in Wales, particularly within recent years. However, on closer examination, the quantity and quality of the archaeobotanical evidence is variable and limited for many periods and regions. With the exception of the Neolithic period, the quantity of available evidence has not significantly increased since Caseldine's review 25 years ago (1990a).

Interestingly, recently published reviews of the state of archaeobotanical research for Roman and Medieval Britain have identified a significant paucity of archaeobotanical evidence from sites in Wales (van der Veen et al. 2007, 2013). van der Veen and authors (2007, 2013: 175) note that the archaeological dataset for Roman and Medieval Wales is currently too restricted to begin examining even broad and relatively simple questions, such as which crops were present. A similar paucity of evidence from prehistoric sites in Wales is clearly evident, preventing detailed analyses of the archaeobotanical dataset being undertaken. Currently, it is not possible to directly compare the available dataset for prehistoric Wales with other areas of Britain as similar recent and comprehensive archaeobotanical reviews have not been published<sup>2</sup>.

The following section discusses in detail some of the areas outlined above, identifying research priorities in order to begin increasing the number high quality archaeobotanical datasets. Some of the issues and research priorities discussed overlap with those identified by van der Veen et al. (2007, 2013).

#### CHRONOLOGICAL AND GEOGRAPHICAL COVERAGE

The quantity and quality of archaeobotanical evidence available is unevenly distributed in terms of chronological and geographical coverage. At present, available evidence for the Mesolithic is insufficient for detailed overviews to be developed and there is a pressing requirement for new excavations of Mesolithic sites to generate new high quality datasets. In contrast, there are a large number of sites dating to the Neolithic and Earlier Bronze Age and there is significant potential for a detailed overview of charred plant remains for the Neolithic in particular. Recently, important reviews of plant remains dating to the Neolithic have been published for Scotland (Bishop et al. 2009) and Ireland (McClatchie et al. 2014) and a similar review should be undertaken using evidence from Neolithic sites in Wales. This view is supported by the current review document for the Neolithic and Earlier Bronze Age Wales under the Research Framework for the Archaeology of Wales<sup>3</sup>.

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<sup>2</sup> With the exception of Northern England (Hall and Huntley 2007; Huntley 2010)

<sup>3</sup> <http://www.archaeoleg.org.uk/pdf/neolithic/version2neolithicanearlybronze.pdf>

The large quantity, and in many cases high quality, of sites dating the Neolithic and Earlier Bronze Age can be primarily attributed to development-driven archaeological investigations which significantly expanded understanding of these periods, particularly at Parc Bryn Cegin, north-west Wales (Schmidl et al. 2008) and at Borrás Quarry, north-east Wales (ASUD 2010, 2013). However, despite the large quantity of sites dating to these period the evidence is unevenly distributed geographically, with a large number of sites for north-west Wales, yet there are currently very few sites for south-east Wales. It is not clear whether the smaller number of sites available for South-East Wales is due to less intensive archaeological research in this region (either through research projects or development-driven investigations) or alternatively whether this is a reflection of limited access to un-published grey literature.

For the Later Bronze Age and Iron Age, there are currently only a small number of sites, particularly when viewed in comparison to the preceding Neolithic and Early Bronze Age. Due to the small quantity sites and low quality of the evidence dating to these periods, there is only very limited potential for comparative analyses at present. This is not to state that the small number of sites where moderate to high quality archaeobotanical analysis has been undertaken (e.g. Glanfeinon (Britnell et al. 1997), Redwick (Caseldine et al. 2013a), Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/2 (Challinor et al. 2014)) cannot provide important information as evidence from a single site can still be informative. However, as noted above, it is necessary to move beyond site-based approaches which have dominated archaeobotanical research and begin to draw the wider picture using evidence from a large number of sites.

To summarise, the following recommendations are suggested:

1. Mesolithic evidence is extremely rare and substantially more archaeobotanical evidence is necessary.
2. There is a relatively large dataset for the Neolithic; however, it is unevenly distributed with most evidence from north-west Wales. There is extremely little evidence for south-east Wales.
3. There is a relatively large dataset for the Bronze Age; however, most the data is comprised of charcoal recovered from funerary sites.

4. The dataset for the Iron Age is small and unevenly distributed geographically, particularly for south-east Wales, and substantially more evidence is required.
5. Waterlogged evidence is extremely rare and where identified during excavation, large numbers of samples should be collected.

#### METHODOLOGICAL ASPECTS

As noted above, a large quantity of archaeobotanical research has been undertaken on prehistoric sites in Wales. Despite this, the quality of the evidence is very variable and if archaeobotany is to form an important element of wider archaeological research areas it is necessary to adopt rigorous methodologies to produce high quality datasets.

For the recovery of charred plant remains, sample sizes of 40 - 60 litres are recommended by English Heritage (2011) and other authors (van der Veen et al. 2007, 2013). The sample size should be clearly recorded on a sample-by-sample basis in published tables to examine the density of plant remains within context (i.e. cereal grain caches vs. low density dispersed grains). The sample size needs to be large enough to ensure that the range of plants recovered is representative of a feature/site and that sufficient numbers of plant remains (>100 remains/identifications) for meaningful analyses (van der Veen et al. 2007, 2013; Bishop et al. 2009: 62; Campbell 2011). For example, the requirement to take large samples is particularly relevant to the Neolithic and Early Bronze Age period where the density of plant remains may be very low, particularly cereal grains (Campbell 2011), emphasising the requirement to collect large samples. Due to the generally higher density of plant remains in waterlogged deposits, it has been recommended that smaller sample sizes (c. 10 litres) may be adequate (van der Veen et al. 2007, 2013); however, considering the rarity of waterlogged sites in prehistoric Wales, large samples (40 – 60 litres) should be collected.

At present, the quality of the charcoal evidence is extremely poor with only very small numbers of fragments being identified for most sites. Charcoal has primarily been identified to provide material suitable for radiocarbon dating. To move beyond simply recording the wood species present in assemblages and to begin addressing specific

research questions such as woodland composition, the management of woodlands (i.e. coppicing), fuel use (i.e. industrial processes) or ‘ritual’ use of wood species (i.e. cremations) it is necessary to generate higher quality datasets. Keepax (1988: 120) recommends that 100 charcoal fragments should be identified per sample in order to reliably characterise the diversity of wood species present in an assemblage. This quantity of charcoal has only been identified from a very small number of sites (Borras Quarry (ASUD 2010, 2013), Mynydd Mwyn Farm (McKenna 2010), Ysgol yr Hendre (McKenna 2013), Snail Cave Rockshelter (McKenna 2014)). OCarroll and Mitchell (2013) indicate that a smaller quantity of fragments can be identified, depending on the site type, provided that a *wide* range of features are sampled.

In order to recover archaeobotanical evidence which is representative of the plant remains/charcoal present, samples from a wide range of features and contexts must be analysed. For example, many authors have argued that cereals are often under-represented in Neolithic sites where only small numbers of samples are analysed (Legge et al. 1998: 90-91; Monk 2000: 75; Rowley-Conwy 2000: 43; Jones 2000: 82; Jones and Legge 2008: 476; McClatchie et al. 2014: 209). The analysis of only a small number of ‘rich’ samples (i.e. features clearly containing abundant charcoal/plant remains) may lead to unreliable interpretations, particularly for individual sites (Campbell and Straker 2003: 26; Campbell 2011: 34). It is not possible to provide a figure for how many samples should be taken as this is entirely dependent on the scale of excavation and in a best-case scenario all sealed features/contexts would be sampled (with samples discarded a later date if necessary). There is little value in undertaking full analysis of archaeobotanical evidence (as opposed to a preliminary assessment, see below) for a large number of samples if the features/context are not securely dated. Archaeobotanical research is generally conducted in two stages: (1) an initial assessment of the research potential of the evidence to select samples for full analysis; (2) full analysis of a selected number of samples (English Heritage 2011). Poorly dated/phased samples should be excluded at the initial assessment phase. Resources could be better directed towards taking large sample sizes from a small number of features/contexts and obtaining high quality dating evidence. Considering the paucity of archaeobotanical evidence for some periods, even the analysis of a very small number of well dated samples will provide valuable information.

The interpretation of archaeobotanical datasets is dependent on accurately phasing and dating the evidence. It goes without saying that only securely dated archaeobotanical

evidence can be used in comparative analyses, however, all too frequently it is difficult to precisely phase archaeobotanical evidence for sites. It is acknowledged that the quality of dating evidence at a site is largely a function of the nature and circumstances of the archaeological investigation undertaken (i.e. when a site was excavated, development-driven investigation vs. research project) and that radiocarbon dating is primarily undertaken with the aim of phasing features/contexts, rather than archaeobotanical evidence. For a site to have high quality dating evidence, direct dating should be undertaken on plant remains, particularly cereal grains and obtaining duplicate dates where possible. Sites with lower quality dating *can* still be used in comparative analyses; however, this should be undertaken with caveat that a small proportion of the archaeobotanical evidence recovered *could* be intrusive or residual.

The impact of contamination in archaeobotanical assemblages has been recognised for some time (see for example, Hillman (1982a)) and is widely acknowledged; however, it is only recently that its potential impact has begun to be considered in detail (Stevens and Fuller 2012; Pelling et al. 2015). It is very difficult (if not impossible) to demonstrate whether an archaeological deposit contains intrusive or residual material without directly dating the remains. A recent review of plant remains from archaeological deposits in central and southern England, Pelling et al. (2015) identified frequent evidence for intrusive and residual plant remains, noting that the problem of contamination is more widespread than generally considered. Contamination appears to be particularly problematic in multi-period sites and archaeological deposits containing low densities of remains, for example, cereals in Neolithic and Early Bronze Age contexts (Pelling et al. 2015). There are currently only a very small number of direct dates on Neolithic and Early Bronze Age cereals (Table 6).

Finally, archaeobotanical research must be published in a way which allows researchers to extract information from reports. This includes presenting quantified evidence on a context-by-context basis with the sample volume recorded and the feature/context sampled clearly noted. Due to the potentially large space requirements necessary for fully publishing archaeobotanical research, particularly where large numbers of samples are analysed, online reports may provide the most effective method of publication and these reports can also be quickly searched. For examples see Parc Bryn Cegin (Kenney 2008b; Schmidl et al. 2008) and Pwllheli to Blaenau Ffestiniog Pipeline (Kenney 2014; Challinor et al. 2014).

To summarise, the following recommendations are suggested for best practice:

1. Bulk samples of c. 40 – 60 litres should be taken to ensure the recovery of sufficient numbers of charred plant remains for detailed analyses (cf. English Heritage 2011; van der Veen et al. 2007, 2013). This is particularly the case for Neolithic and Early Bronze Age sites which tend to produce low densities of remains.
2. Collect larger numbers of samples from as wide a range of features/contexts possible to ensure that the plant remains recovered are (broadly) representative.
3. Directly date plant remains, particularly cereal grains. Where possible duplicate dates should be obtained. This is particularly important in complicated multi-period sites and for the Neolithic to Early Bronze Age where cereals typically occur in very low density (cf. Pelling et al. 2015).
4. The contribution of charcoal analysis has been undervalued. For detailed interpretations it is recommended to identify an optimum of 100 charcoal fragments per sample (Keepax 1988: 120). Smaller numbers of identifications (c. 20-30) may be sufficient providing that a wider range of well-dated contexts are analysed (OCarroll and Mitchell 2013). Charcoal analysis would be most effectively used to address a specific research question.
5. Archaeobotanical evidence needs to be fully published in two-way tables on a context-by-context basis to enable researchers to extract information from reports.

#### SUMMARY: ARCHAEOBOTANICAL RESEARCH IN PREHISTORIC WALES IN 2015

The archaeobotanical dataset for prehistoric Wales is relatively large and it is clear that within recent years there has been a substantial increase in the quantity of evidence. Firstly, the dataset is unevenly distributed chronologically and geographically. There are

very few sites for the Mesolithic, the Later Bronze Age and Iron Age. In comparison, there is a relatively large number of Neolithic sites and Early Bronze Age reflecting more intensive research on these periods and large numbers of sites identified in development-led projects (particularly for the Neolithic in north-west Wales). In terms of geographical coverage there are marked differences in the number of available sites for different regions with chronological variation also present. In particular, there are very few sites for south-east Wales. Secondly, a factor which emerged from the overview of the quality of the evidence is the requirement for the adoption of rigorous methodologies to ensure that published archaeobotanical evidence is accurate and reliable. In terms of sampling, there are very few sites where large numbers of samples have been analysed (due largely to the small-scale of many excavations). In terms of dating evidence, greater attention needs to be paid to establishing clear phasing for samples, even if this it at consequence of analysing a smaller number of samples. Recent development-led investigations have made the greatest difference to archaeobotanical research for the prehistoric period in Wales resulting in an increase in the number of sites and in many instances the generation of high quality datasets. For example, this is reflected in the large number of sites ( $n = 34$ ; 10% of the database) from the site Parc Bryn Cegin, north-east Wales. Moving forward, a number of recommendations have been made to improve the quality of the dataset and to ensure that archaeobotanical research can contribute to wider archaeological research.

## Chapter 4:

### MESOLITHIC WALES (c. 8000 – 4000 BC)

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#### INTRODUCTION AND BACKGROUND

Discussions of Mesolithic activity in Wales have traditionally been heavily dependent upon evidence from surface lithic scatters and unstratified lithic artefacts - the most durable aspects of the archaeological record (Olding 2000; Burrow 2003; David and Walker 2004; Walker 2004; Makepeace 2006; David 2007; Lillie 2015). Due to a rarity of recently excavated evidence – termed the ‘Mesolithic problem’ - understanding of subsistence practices has primarily been inferred from the dating and distribution of diagnostic lithic evidence (David 2007; see however, Bell et al. 2000; Bell 2007a; Smith and Walker 2014). The pattern of subsistence practices which has emerged from this limited and ephemeral dataset is one of a highly mobile population, seasonally occupying upland, lowland and particularly coastal zones with an emphasis on hunting and marine resources (Wainwright 1961; Jacobi 1980; David and Walker 2004: 333; David 2007: 190-194; David and Painter 2014: 43). The high availability of marine and terrestrial resources in coastal zones is considered to have significantly influenced Mesolithic occupation in Wales (Barton et al. 1995; Lynch et al. 2000: 26-27; David and Walker 2004: 333; Bell 2007b) and stable isotope analysis on human remains from coastal cave sites hints at the exploitation of marine resources (Schulting and Richards 2002; Schulting et al. 2013). Moreover, it is highly likely that many Mesolithic sites which were located in coastal zones are now submerged (Lillie 2015: 147).

Bell (2007b) suggests that coastal zones may have been a focus of Mesolithic activity due to the richness of these areas in terms of the availability of plants and woodland resources rather than purely for hunting and marine resource exploitation (see also Lillie (2015: 207, 215-221)). Palynological studies provide possible evidence for the deliberate alteration of natural environments by hunter-gatherers in Mesolithic Wales (e.g. Smith and Cloutman 1988; Barton et al. 1995; Walker et al. 2006; Fyfe 2007; Grant 2008; Caseldine 2014a), possibly relating to plant/woodland management practices to aid

hunting or to promote the growth of wild plants (cf Smith 2011). However, distinguishing between natural and anthropogenic vegetation changes is problematic (Brown 1997; Bell and Noble 2012) and palynological records lack the resolution to provide detailed information concerning which plant and woodland species were exploited (Regnell 2012). There is a requirement for the excavation of new sites in Wales to understand Mesolithic activity in Wales in greater detail.

## RESULTS

### OVERVIEW

In total, 21 sites were identified with archaeobotanical evidence dating to the Mesolithic period, comprising of 8 earlier Mesolithic and 13 later Mesolithic sites, including 5 late Mesolithic sites at Goldcliff in the Severn Estuary, south-east Wales. The quality of the dataset is generally very poor, reflecting the limited level of research undertaken on Mesolithic sites in Wales, particularly the fact that there have been few recent excavations on new sites. The quantity of available evidence has not significantly increased in the 25 years since Caseldine's (1990a) review. Despite this, recent research by Martin Bell and others in the Severn Estuary has provided a valuable archaeobotanical dataset for understanding wild plant and woodland exploitation (Bell et al. 2000; Bell 2007a).

### EARLIER MESOLITHIC SITES (c. 8000 – 6000 BC)

There has been very little systematic archaeobotanical research undertaken on earlier Mesolithic sites, with charred hazelnut shells recovery by hand or wet sieving at most sites (e.g. Nab Head I and Daylight Rock ((Hedges et al. 1989, 1994; David 2007)), Trwyn Du (Wainwright 1961; White 1979), Rhuddlan (Morgan 1988; Quinnell et al. 1994), Bryn Newydd (Clark 1938, 1939; Hedges et al. 1994)). Recent small-scale excavation at Snail Cave, north-west Wales, identified in-situ early Mesolithic deposits containing abundant charred hazelnut shell fragments and charcoal; however, there is clear evidence for mixing of the deposits (McKenna 2014; Smith and Walker 2014). At Pentrywn, north-east Wales, a single sample recovered a single hazelnut shell, although charcoal was more abundant (McKenna forthcoming; Smith forthcoming).

#### LATER MESOLITHIC SITES (c. 6000 – 4000 BC)

In comparison to the earlier Mesolithic, systematic sampling programmes to recover archaeobotanical evidence have been undertaken on a small number of sites, particularly in later Mesolithic sites at Goldcliff, south-east Wales, where plant remains (waterlogged and charred) and large charcoal assemblage were recovered (Caseldine 2000; Dark 2007; Gale 2007). Unfortunately, few direct dates have been obtained on the evidence from Goldcliff, and there is evidence for contamination (mixing of two episodes of activity) at site W<sup>4</sup>. Small-scale evaluation on a Late Mesolithic-Early Neolithic site at Llandeenny (also in the Severn Estuary) recovered waterlogged and charred plant remains (Brown 2005, 2007a), although it is unclear whether the plant remains were present naturally or due to human activity.

Late Mesolithic and Early shell middens at Nant Hall Road, north-east Wales, produced no evidence for charred plant remains, despite sampling, although a small charcoal assemblage was recovered (Caseldine 2007; Caseldine and Johnson 2007). At Hendre, north-east Wales, Mesolithic pits produced abundant charred hazelnut shell fragments, although frequent medieval cereal grains were also present (Hillman 1982a). Pits at Penrhos Road, north-west Wales (Bradley 2013) and Rough Close, central Wales (Caseldine and Barrow 1999) were sampled, although no plant remains were recovered. Charred hazelnut shell fragments have been dated to the late Mesolithic at Parc Bryn Cegin, north-west Wales (Kenney 2008a) and at Hindwell Farm Barrow II (Jones 2014), although these are probably residua. Evidence of possible Mesolithic date was recovered from beneath a Bronze Age cairn at Blaen Hepste, central Wales, (Jones 2011a; Caseldine 2014b). Recent excavations on a Later Mesolithic Burry Holms, south-east Wales, have produced archaeobotanical evidence; however, this has not been published to date (Walker 2004, pers comm.).

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<sup>4</sup> A charred hazelnut fragment dated to 4450-4040 cal BC ( $5415 \pm 75$  BP; OxA-6682) is significantly later than the main period of occupation (c. 5500 – 5000 cal BC) (Barton and Bell 2000).

## DISCUSSION

### WILD PLANT EXPLOITATION

It is almost 40 years since Clarke (1976) proposed that wild plants formed a major element of the subsistence base of European Mesolithic hunter-gatherers. Clarke (1976) listed a wide range of plants possibly exploited in Mesolithic Europe which had previously been overlooked in models of subsistence practices, although direct evidence to support his argument was largely absent. This work was later developed upon in an influential paper by Zvelebil (1994), incorporating archaeobotanical evidence alongside other sources of data, which highlighted evidence for intensive plant exploitation, including the potential existence of plant husbandry or management strategies in Mesolithic Europe. Despite significant advances in understanding of wild plant and woodland exploitation in Mesolithic Europe in recent years (e.g. Zvelebil 1994; Robinson 2007; Regnell 2012; Bishop et al. 2014, 2015; Warren et al. 2014), there has been limited discussion concerning the potential importance of wild plants and woodland resources in Mesolithic Wales and it is an area which requires further research. The current archaeobotanical dataset for Mesolithic Wales is very poor and understanding of wild plant exploitation is predominantly based on evidence from a small number of later Mesolithic sites in the Severn Estuary at Goldcliff (Caseldine 2000; Dark 2007). The following discussion stretches the current dataset to its interpretative limits, outlining the current state of knowledge within a wider north-western European context.

A common feature of Mesolithic sites in Wales is the ubiquitous evidence for charred hazelnut shell fragments (e.g. Clarke 1938, 1939; Morgan 1988; White 1979; Caseldine 2000; Dark 2007; McKenna 2014, forthcoming). Hazelnut shell is frequently recovered from Mesolithic sites across north-western Europe (Zvelebil 1994; Regnell 2012; Bishop et al. 2014; Warren et al. 2014; Fig.6) occasionally in extremely large quantities, for example at Staosnaig, Isle of Colonsay (Mithen et al. 2001) and at Howick, Northumberland (Cotton 2007). The frequent and abundant evidence for hazelnuts during the Mesolithic has prompted a number of discussions surrounding the systematic and intensive exploitation of hazel throughout this period (Zvelebil 1994; Robinson 2007; McComb 2008; Holst 2010; Regnell 2012; Bishop et al. 2014, 2015; Warren et al. 2014).

It is probable that hazelnuts formed an important component of Mesolithic diets (McComb 2008), however, interpreting their importance in diets is difficult as hazelnuts are probably over-represented in archaeobotanical assemblages as the shell has a greater probability of becoming charred and preserved than other more fragile plant remains (Jones 2000; Jones and Rowley-Conwy 2007; McComb 2008). Recovery biases will also have led to the over-representation of hazelnut shell fragments in archaeobotanical assemblages, particularly where sampling and flotation have not been undertaken, as hazelnut shells are relatively large and can be easily identified and recovered by hand (e.g. Rhuddlan (Morgan 1988), Trwyn Du (White 1979)).

Due to these taphonomic factors, the importance of hazelnuts in diets should not be over-estimated in comparison to other energy-rich plants resources, particularly roots and tubers which are more difficult to detect archaeologically (Mason et al. 2002; Kubiak-Martens 2002). There is considerable evidence from Mesolithic sites in Europe to suggest that a wide range of plant species were exploited (Zvelebil 1994; Kubiak-Martens 2002; Robinson 2007; Warren et al. 2014; Bishop et al. 2014). For example, in Late Mesolithic sites at Goldcliff, south-east Wales, charred plant remains include a possible crab apple seed, elder seeds, raspberry seeds and other fruits and plants, particularly reed (Caseldine 2000; Dark 2007). Many of the charred plant remains present at Goldcliff probably represent deliberately gathered wild plants, although some plants could have become incorporated into fires unintentionally or naturally (Bell 2007c: 238; Sievers Wadley 2008). Where waterlogged plant remains are recovered, it is difficult to distinguish if plants were present naturally or deliberately gathered (Cappers 1993: 179; Out et al. 2012).

In comparison to other areas of north-west Europe there are some clear similarities and differences in the range of plant remains recovered from Mesolithic sites (Fig. 6). Due to the very small number of Mesolithic sites analysed in Wales, it is not possible to make detailed comparisons; nevertheless it is possible to make a small number of observations. Evidence for hazelnut shells and fruit remains have been identified from Scotland (Bishop et al. 2014), Ireland (Warren et al. 2014), Scandinavia (Robinson 2007) and England (e.g. Vaughan 1987; Scaife 1992; Cotton 2007). There is no evidence for the exploitation of acorns or waterlily seeds in Wales although remains of acorns have been identified from Mesolithic sites in Scandinavia (Robinson 2007) and waterlily seeds have been identified in Ireland (Warren et al. 2014) and Scandinavia (Robinson 2007). It is possible that

evidence for acorns has not been preserved in charred form (Robinson 2007) or not identified (Kubiak-Martens 1999), although their absence from Mesolithic Wales (and also Britain and Ireland) cannot be reliably confirmed due to the paucity of available evidence. Roots/tubers have also not been identified in Mesolithic sites in Wales, although this is probably due to taphonomic factors (tubers are difficult to identify (Mason et al. 2002)) in conjunction with the small number of excavated sites in Wales where bulk-sampling and flotation have been undertaken.

#### USE OF WOODLAND RESOURCES

The analysis of charcoal can provide insights into the environmental context of Mesolithic occupation in addition to the specific woodland species exploited and how these were exploited (cf. Asouti and Austin 2005; see also Bishop et al. 2015 for a recent approach using charcoal evidence in Mesolithic Scotland). Identifying both the species present in charcoal assemblages in addition to the age and diameter of the charcoal to identify the age/size of the wood species exploited can potentially be used to identify evidence for woodland management practices such as coppicing (Asouti and Austin 2005; Dufraisse 2006; Out et al. 2013; Deforce and Haneca 2014). Charcoal analysis can also be integrated with evidence from plant macrofossils to provide detailed and accurate reconstructions of local environments and exploitation practices (Smith 2002: 15).

The contribution of charcoal evidence to understanding the exploitation of woodlands is undervalued and charcoal evidence from Mesolithic sites in Wales is limited in both the quantity and quality of the available dataset. A wide range of woodland species were exploited in Mesolithic Wales (Fig.7) including hazel, oak, Maloideae-type, willow/poplar, alder, pine, elm, beech/birch and blackthorn (Morgan 1988; Caseldine and Barrow 1999; Caseldine 2000; Caseldine and Johnson 2007; David 2007; Gale 2007; Bradley 2013; McKenna 2014, forthcoming). Oak, hazel and Maloideae-type are the most commonly exploited species which is probably a reflection of the natural abundance and availability of these species in woodlands and due to their good burning properties. The paucity of charcoal evidence from many sites restricts our understanding of woodland exploitation in Mesolithic Wales and current understanding is largely restricted to palynological evidence.

At present, detailed studies on charcoal remains have been undertaken on later Mesolithic sites at Goldcliff in the Severn Estuary, south-east Wales (Caseldine 2000; Gale 2007). At these sites, the most commonly represented species include hazel, oak, Maloideae-type and elm charcoal, with other species including elm, alder, ash, ivy, blackthorn, elder, willow/poplar and bramble less well represented (Caseldine 2000; Gale 2007). The identification of oak heartwood indicates the presence of mature oak woodland in the vicinity of the occupation sites (Gale 2007). Pollen evidence and plant macrofossil evidence associated with the Mesolithic sites closely parallel the charcoal data, indicating a densely wooded environment dominated by hazel, oak and elm (Caseldine 2000; Dark 2007). Wetland species such as alder and willow/poplar are not common in the charcoal assemblages although they are present in the pollen records (Caseldine 2000; Dark 2007) suggesting that these species were avoided as a fuel source due to their poor burning properties (Gale and Cuttler 2000). The high presence of hazel and Maloideae charcoal could indicate the presence of small-scale woodland openings, possibly deliberate clearances, or occupation at the woodland edge as both these species are light-demanding and could have colonised recently cleared areas

#### WILD PLANT AND WOODLAND MANAGEMENT?

Ethnographic frameworks of wild plant and woodland exploitation provide evidence for the potential role of hunter-gatherers in actively modifying environments to promote the growth of certain plant/wood species to increase their productivity for food or to facilitate hunting (Smith 2011; Rowley-Conwy and Layton 2011). A key challenge in understanding how wild plants and woodlands were exploited during the Mesolithic is the difficulty of identifying evidence for the manipulation and management of wild plants and woodlands on the basis of archaeobotanical evidence alone (Mithen et al. 2001; Bishop et al. 2014; Warren et al. 2014). As Warren et al. (2014: 637) note, there is considerable potential to develop understanding of plant manipulation or management strategies by hunter-gatherers through an integration of both palynological and archaeobotanical evidence.

In later Mesolithic sites (c.5500-5000 cal BC) at the wetland-dryland interface in the Severn Estuary, south-east Wales, archaeological and palaeo-environmental studies have

contributed to a detailed picture of wild plant use (Bell et al. 2000; Bell 2007c). Dark (2004, 2007) has drawn attention to the potential role of plant remains as indicators of seasonality and suggested that the occupation at Goldcliff occurred during the late summer-autumn. Using a combination of palynological and micro-charcoal alongside archaeobotanical datasets, Bell (2007c) has highlighted evidence for the potential impact of hunter-gatherers on the landscape at Goldcliff, particularly vegetation burning, and tentatively suggests that plant management practices may have been undertaken to promote the growth of wild plants at the woodland/wetland edge, for example hazel, blackberry/raspberry, crab apple and elder (Fig.8). Hazel charcoal, hazelnuts and blackberries/raspberries, crab apple and elder are present in Mesolithic occupation layers probably indicating that these species were exploited (Caseldine 2000; Dark 2007; Gale 2007). Similarly, at Llandeenny, south-east Wales, palynological, micro-charcoal and archaeobotanical evidence associated with a late Mesolithic-early Neolithic site identified evidence for vegetation burning which may reflect the active manipulation of the environment to promote the growth of plants at the edge of the woodland and wetland such as hazel and scrub plants including blackberries/raspberries (Brown 2005, 2007a).

The evidence from Goldcliff and Llandeenny provide possible evidence for existence of plant management or husbandry during the Mesolithic site, however, at present drawing the wider picture is largely conjectural due to the paucity of similar evidence from other Mesolithic sites in Wales.

## RESEARCH AGENDA: POTENTIAL AND PRIORITIES

There is a long tradition of studying Mesolithic activity in Europe using lithic evidence, yet the contribution of archaeobotanical evidence remains understudied and undervalued. Detailed discussions of wild plant use and woodland exploitation in the Mesolithic have often been constrained by the paucity of available archaeobotanical evidence (Mithen et al. 2001, 223-224). The last few decades have witnessed considerable advances in understanding of Mesolithic plant and woodland exploitation strategies in Europe, and there has been extensive discussion surrounding the potential role of hunter-gatherers in actively modifying altering environments to promote the growth of plants and hunting (e.g. Simmons and Innes 1987; Zvelebil 1994; Simmons 1996; Innes et al.

2010, 2013; Warren et al. 2014; Bishop et al. 2015). The increasing recognition that hunter-gathers may have deliberately altered environments is leading to a blurring of the traditional ideal-type dichotomy between ‘hunter-gathering’ and ‘farming’ and raises a number a questions concerning the Mesolithic-Neolithic transition (Zvelebil 1994; Smith 2001). For example, what role did Mesolithic plant management or husbandry practices have in the subsequent transition and diffusion of Neolithic agriculture? (cf. Barrett 2014).

At present, understanding of plant and woodland exploitation in Mesolithic Wales is extremely limited due to the paucity of archaeobotanical evidence available from excavated Mesolithic sites. At the most basic level, we do not have a clear understanding of which plant and woodland species were exploited, not to mention questions surrounding how plants and woodlands were exploited. Before detailed discussions of plant and woodland exploitation strategies can developed there is a pressing requirement for the excavation of Mesolithic sites to generate new archaeobotanical datasets.

#### CONCLUSIONS RECOMMENDATIONS

1. Bulk-sampling and flotation to recover plant remains and charcoal must be a high priority on any newly excavated Mesolithic sites in Wales.
2. Directly date plant remains from Mesolithic contexts to account for problems of contamination. Intrusive/residual plant remains have been identified in a number of Mesolithic sites in Wales indicating that contamination is a serious problem. For examples, see Snail Cave Rockshelter (Smith and Walker 2014), Bury Holms (Walker pers comm.), Goldcliff Site W (Barton and Bell 2000), Rhuddlan (Quinnell et al. 1994; David 2007) and Hendre (Hillman 1982b).
3. Sample and identify charcoal fragments from secure Mesolithic contexts. For detailed interpretations it is recommended to identify at least 100 (+) charcoal fragments per sample from a wide range of samples (Keepax 1988).
4. Analyse the age and diameter of charcoal fragments to identify the specific age/size of the wood species exploited to investigate woodland management

practices such as coppicing and fuel selection (cf. Asouti and Austin 2005; Dufraisse 2006; Out et al. 2013; Deforce and Haneca 2014)

5. Where suitable preservation conditions exist, an integration of palynological and archaeobotanical evidence should be used to explore evidence for the potential role of hunter-gatherers in actively managing wild plants and woodlands.

## Chapter 5:

# NEOLITHIC WALES (c. 4000 – 2200 BC)

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### INTRODUCTION AND BACKGROUND

The onset of the Neolithic in Wales is dated between the late 38<sup>th</sup> and early 37<sup>th</sup> centuries cal BC and perhaps a slightly earlier date for areas surrounding the Severn Estuary (Bayliss et al. 2011). The diffusion of the Neolithic into Wales has been subject to discussion to the position of south-western and north-western Wales on the Atlantic façade with connections to north-western Scotland, Ireland, south-western England and northern France (Lynch 2000). Sheridan (2010) argues that similarities in the construction of tombs and material culture between these areas indicate a connected Neolithic diffusion involving migration around the beginning of the 4<sup>th</sup> millennium BC. Within the first few centuries following 4000 cal BC, evidence for Early Neolithic material culture is widespread across Wales (Burrow 2003).

A number of palynological records across Wales have identified changes in the landscape at this period, including woodland clearances, increased disturbance phases and the presence of cereal-type pollen (e.g. e.g. Caseldine 1990a: 45-46, 2000, 2014a; Innes et al. 2006; Fyfe 2007; Caseldine 2014a). However, there have been very few attempts to examine the nature and significance of agricultural practices in Neolithic Wales (e.g. Webley 1976; Moore-Coyler 1998). It is difficult to relate palynological records with direct evidence for Neolithic activity as many pollen sites are situated in upland areas or coastal wetlands, whereas Neolithic sites are predominantly located in lowland areas (Caseldine 1990a; Brown 2005). It is probable that many clearances may also have been too small in scale to detect using conventional palynological analyses (Whitehouse and Smith 2010; Bell and Noble 2012) and there are a number of problems in using pollen evidence to examine agricultural practices, in particular, cereal-type pollen is poorly dispersed and it cannot be reliably distinguished from wild-grasses (Brown 2007b). Due to these limitations, it is necessary to analyse plant remains from archaeological sites to evaluate agricultural practices (Caseldine 1990a: 47).

One aspect of the Neolithic which has proved difficult to identify are occupation sites. Early Neolithic rectangular structures are relatively rare in Wales (Lynch 2003; Kenney 2008a), particularly in comparison to Ireland (Smyth 2014), although this may be due to a lack of large scale open area excavations (Kenney 2008a). Evidence for structures is increasing as reflected by a number of recent discoveries in north-west Wales (Kenney 2008a; Kenney et al. 2011; Rees and Jones 2015), perhaps reflecting influences from Ireland. In comparison to the Early Neolithic, there is substantially less evidence for structures during the Later Neolithic (Lynch 2003; Burrow 2012: 181-183), with the best known examples at Trelystan (Britnell 1982) and Upper Ninepence (Gibson 1999) in central Wales. These structures are very ephemeral (contrasting the Early Neolithic evidence) and their light construction has been associated with transient settlement (Peterson 2004). A number of large monuments were constructed during the Later Neolithic and amongst the most impressive are three palisaded enclosures in the Walton Basin, central Wales (Britnell 2013a).

The most striking feature of the increase in development-led investigations in Wales (e.g. Kenney 2008a; Grant and Jones 2009; Kenney et al. 2011; Pannett 2012), and across Britain (Anderson-Whymark and Thomas 2012), is the seemingly ubiquitous evidence for pits and pit clusters across the whole Neolithic period. These highly distinctive sites are typically comprised of small shallow pits, with single a single fill and contain material often interpreted as domestic waste (possibly from a midden), including pottery, bones and charred material, particularly hazelnuts (see contributions in Anderson-Whymark and Thomas 2012). The relationship between these sites and settlements is debated; however, the very high frequency of these sites suggests that they can be viewed as indicators of settlement activity, even though the precise nature of the associated settlements is as yet undefined (Thomas 2012). Within recent years there has been a substantial quantity of research relating to the Neolithic in Wales (Research Framework for the Archaeology of Wales 2011<sup>5</sup>), including the excavation of several Neolithic sites (e.g. Parc Bryn Cegin (Kenney 2008a), Borrás Quarry Jones and Grant 2009), Parc Cybi (Kenney et al. 2011)) and the datasets generated through these projects will provide (or have provided) substantial contributions to our understanding of Neolithic Wales.

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<sup>5</sup> <http://www.archaeoleg.org.uk/pdf/neolithic/version2neolithicanearlybronze.pdf>

## RESULTS

### OVERVIEW

In comparison to the preceding Mesolithic, a substantial body of archaeobotanical evidence exists for the Neolithic period (Table 4). The study period has benefitted from developer-driven archaeological investigations which have produced archaeobotanical evidence. For example at Parc Bryn Cegin, north-west Wales (Kenney 2008a), Borrás Quarry, north-east Wales (Grant and Jones 2011) and Cwm Meudwy B, south-west Wales (Murphy and Evans 2006) and to a lesser extent research projects, for example at Upper Ninepence, central Wales (Gibson 1999), which have generated large archaeobotanical datasets. In addition, archaeobotanical evidence from a number of recent large-scale developer-driven projects in the preliminary stages of assessment/analysis will help to expand and diversify the available dataset. This includes three (Early?) Neolithic rectangular structures and Later Neolithic pit clusters at Llanfaethlu, north-west Wales (Rees and Jones 2015) and an Early Neolithic rectangular structure and several pit clusters at Parc Cybi, north-west Wales (Kenney et al. 2011; Grinter 2011) in addition to pits/pit clusters identified at St. George Quarry, north-east Wales (Wood 2009; Carrott 2013) and along the route of the Milford Haven to Aberdulais Pipeline, south-west Wales (Barber and Pannett 2006; Carruthers 2008; Schimdl et al. 2009; Pannett 2012).

### EARLY NEOLITHIC SITES (c. 4000 – 3400 BC)

The majority of Early Neolithic evidence has been recovered from pits or pit clusters and large archaeobotanical assemblages have been analysed from these site-types across Wales (e.g. Borrás Quarry (ASUD 2010, 2013)), Parc Bryn Cegin (Schmidl et al. 2008), Cwm Meudwy B (Caseldine and Griffiths 2006a, b), Plas Gogerddan (Caseldine 1992a), Carrog (Caseldine et al. 2014a)). At present, archaeobotanical evidence has only been analysed from two rectangular structures: Parc Bryn Cegin, north-west Wales (Schmidl et al. 2008) and Gwernvale, central Wales (Britnell 1984: 141)<sup>6</sup>. At Parc Bryn Cegin an extensive sampling and radiocarbon dating was undertaken during a recent development-driven investigation (Kenney 2008a). A preliminary assessment of evidence has been

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<sup>6</sup> The evidence from Gwernvale remains unpublished.

undertaken for an Early Neolithic rectangular structure at Parc Cybi, north-west Wales (Grinter 2011).

There is currently very limited archaeobotanical evidence from funerary and ritual sites; this includes evidence from causewayed enclosures (Womaston (Caseldine and Griffiths 2009a), Ewenny (Caseldine and Griffiths 2009b), Norton (Gale 2004; Stevens 2004)), chambered tombs (e.g. Carreg Coetan Arthur (Griffiths 2012), Din Dryfol (Denne 1987), Pipton (Hyde 1956)), cursus monuments (e.g. Hindwell (Caseldine Griffiths 2012b, c)) and other sites (e.g. Lower Luggy (Francis 2006)).

#### MIDDLE TO LATE NEOLITHIC SITES (c. 3400 – 2200 BC)

As with the preceding Early Neolithic, the majority of archaeobotanical evidence dating to the Middle to Late Neolithic has been recovered from large numbers of pits and pit clusters (e.g. Parc Bryn Cegin, (Schmidl et al. 2008), Mynydd Mwyn Farm (McKenna 2010), Capel Eithin (Williams 1999), Hendre (Caseldine 1999), Upper Ninepence (Caseldine and Burrow 1999), Llanilar (Caseldine 1997), Buttington Cross (Clapham 2009), Borrass Quarry (ASUD 2010, 2013), Pant y Butler (Caseldine and Griffiths 2013b)). There is currently very little evidence from Middle-Late Neolithic structures, reflecting the rarity of structural evidence for this period (Lynch 2003), with archaeobotanical evidence only available for Late Neolithic structures at Trelystan, central Wales (Hillman 1982b) and Upper Ninepence, central Wales (Caseldine and Burrow 1999).

There is very limited evidence available from Later Neolithic funerary and ritual sites and in some instances sampling appears to have been undertaken with the primary aim of recovery material suitable for radiocarbon dating. This includes, Bryn Gwyn stone circle (Caseldine and Griffiths 2013a), Dyffryn Lane henge (Caseldine and Griffiths 2010a, b)), barrows (e.g. Corndon (Caseldine and Griffiths 2008), timber circles (Meusydd, central Wales (Caseldine and Griffiths 2009c), ring-ditches (e.g. Walton Court Farm, Causeway Lane, Dyers Hall (Caseldine et al. 2012), Sarn-y-bryn-caled Site 2 (Morgan 1994)) and palisaded enclosures (Hindwell II (Caseldine and Burrow 1999; Johnson 1999), Hindwell double-palisaded enclosure (Jones 2011b; 2012; Jones and Hankinson 2014), Walton palisaded enclosure (Dempsey 1998; Jones 2010)).

## DISCUSSION

### DATING THE INTRODUCTION OF CEREALS

Direct radiocarbon dating evidence for cereals places their introduction into Britain between 3950 – 3800 cal BC and at a slightly later date of c. 3750 cal BC for Ireland (Brown 2007b; Stevens and Fuller 2012; Whitehouse et al. 2014). Evidence for cereals in both Britain and Ireland is very limited between 4000 – 3700 cal BC and there is a significant increase in their presence in Neolithic sites from 3700 cal BC (Brown 2007b; Stevens and Fuller 2012; Whitehouse et al. 2014). In Scandinavia, cereals also appear to be rapidly introduced between 4000 – 3700 cal BC (Sørensen and Karg 2014). Recently, Oliver et al. (2015) have suggested that cereals were present in Britain at an earlier date of c.6000 cal BC on the basis wheat aDNA recovered from a Mesolithic palaeo-soil at Bouldner Cliff, Isle of Wight. The results do not necessarily indicate the introduction of agriculture and it is possible that cereals were traded amongst hunter-gatherer communities, although further evidence from other sites, including the recovery of cereal macro-remains, is necessary to validate this claim. In addition, the results should be set against the backdrop of hundreds of direct radiocarbon dates on cereals which provide firm evidence to indicate that cereals were present in Britain no earlier than c. 4000 cal BC in addition to other lines of evidence which indicate the onset of agriculture at this date (Brown 2007b; Whittle et al. 2011; Stevens and Fuller 2012).

The spread of cereals (and agriculture as a whole) appears to have been a rapid process across Britain and Ireland with some broad geographical patterning in the timing of this introduction (Whittle et al. 2011), suggesting a relatively rapid Neolithic transition involving a considerable degree of immigration (Brown 2007b; Stevens and Fuller 2012; Whitehouse et al. 2014; as per Rowley-Conwy 2004, 2011). However, it is inevitable that the error ranges accompanying radiocarbon dates have resulted in a blurring of a more complex process of introduction and diffusion (Whitehouse and Kirleis 2014), probably involving numerous introductions, re-introductions and failed introductions over a protracted period of time (Stevens and Fuller 2012; Bishop 2015: 845; cf. Boivin et al. 2011: 456). Moreover, it is clear that cereals did not immediately substitute the exploitation of wild plants which are frequently recovered from Neolithic sites in Britain and the importance of cereals probably varied chronologically and geographically

(Moffett et al. 1989; Robinson 2000; Brown 2007b; Bishop et al. 2009; Cummings and Harris 2011; Stevens and Fuller 2012, 2015; Bishop 2015). In order to examine the onset and subsequent diffusion of cereals (and other cultivated crops) during the Neolithic direct radiocarbon dating is necessary, particularly as in some instances cereals from insecure/poorly stratified contexts and multi-period sites may be intrusive (cf. Stevens and Fuller 2012, 2015; Pelling et al. 2015).

This section examines radiocarbon dating evidence for the introduction of cereals in Neolithic Wales. Situated at the intersection between Ireland, south-western England and northern France on the Atlantic coast and bordered by mainland England, Wales represents an important area for studying the introduction of agriculture during the Neolithic due to the influence of these areas to west, south and east (cf. Lynch 1989). The similarities in the Neolithic archaeology of these areas along the Atlantic coast are clearly apparent in tomb design and in material culture (Sheridan 2010), raising questions over whether the movement of cereals (and agriculture) followed a similar pattern.

At present, there is a relatively large number of direct dates on Neolithic cereal grains for Ireland (Whitehouse et al. 2014), Scotland (Ashmore 2009), England (particularly in the south) (Stevens and Fuller 2012) and Scandinavia (Sørensen and Karg 2014) (Table 7). However, there are currently only *three* published direct dates on cereal grains for Neolithic grains for Neolithic, all of which come from an Early Neolithic structure at Parc Bryn Cegin, north-west Wales (Kenney 2008a; Marshall et al. 2008). Table 8 summarises current radiocarbon dating evidence for the introduction of cereals in Wales, distinguishing between dates on cereal grains and associated dates on other material.

The earliest (potential) evidence for cereals in Wales has been identified in recently excavated Early Neolithic pits at Cwmifor, south-west Wales (Pannett 2012). Emmer wheat-type grains identified in pit fills are associated with a single radiocarbon date of 4040-3790 cal BC (Beta-257727;  $5130 \pm 40$  BP) on a charred hazelnut shell fragment (Pannett 2012), although the hazelnut shell could be residual and/or the cereal grains intrusive. It is anticipated that further radiocarbon dates will be obtained for the site and full analysis of the archaeobotanical evidence may reveal more evidence for cereal grains (Pannett 2012: 137). At Gwernvale, central Wales, an Early Neolithic structure produced cereal grains associated with a single radiocarbon of 3980-3670 cal BC ( $5050 \pm 80$  BP;

CAR-113) on unidentified charcoal. There may be a considerable age-offset due to the old wood effect.

Three direct radiocarbon dates on cereal grains from an Early Neolithic structure at Parc Bryn Cegin, north-west Wales provide the most reliable evidence for the introduction of cereals into Wales at present. (Kenney 2008a; Marshall et al. 2008). The date ranges cluster closely between 3720-3650 cal BC (Marshall et al. 2008). At other Early Neolithic sites with cereal grains, dates have been obtained on charcoal or charred hazelnut shell fragments in contexts associated with cereal grains. These dates are unlikely to incorporate an age-offset (excluding Plas Gogerddan) as single entity short-lived samples were dated (and assuming the cereals are intrusive). At Plas Gogerddan, south-west Wales, a pit rich in cereal grains/chaff and wild plants, particularly crab apples, is associated with a single radiocarbon date of 3640-3360 cal BC ( $4700 \pm 70$  BP; CAR-994) on mixed wood charcoal, providing a *terminus post quem* for the feature (Caseldine 1992a; Murphy 1992).

On the basis of the current evidence, a conservative (and pragmatic) interpretation would place the introduction of cereals into Wales from c. 3700 cal BC which is synchronous with Ireland (Whitehouse et al. 2014), although not as early as 3950 – 3800 cal BC as suggested for areas of Britain (Brown 2007b; Stevens and Fuller 2012). The evidence from Cwmifor may pre-date this; however, this needs to be validated through direct radiocarbon dating of the cereal grains. Modelling of radiocarbon dates for south Wales by Bayliss et al. (2011) places the beginning of the Neolithic at 3765 - 3655 cal BC (95% probability) or at 3725 – 3675 cal BC (68% probability). Although Bayliss et al. (2011) did not model dates for North Wales, these dates would agree with the current dating evidence for the introduction of cereals into Wales. There is a pressing requirement for further direct dates on cereals to be obtained from Neolithic sites in Wales to examine the introduction and diffusion of cereals and to account for potentially intrusive cereal grains in Neolithic contexts (cf. Stevens and Fuller 2012, 2015; Pelling et al. 2015). New radiocarbon dates could be obtained for some the sites listed in Table 8, particularly Gwernvale and Plas Gogerddan to enable a refinement of chronologies.

On a final note, there is potential to develop a combined ancient DNA analysis and radiocarbon dating on charred cereal cereals to investigate debates surrounding the introduction and diffusion of cereal crops during the Neolithic (cf. Brown et al. 2015).

For example, aDNA research on barley has indicated multiple introductions of this crop into Europe and a strain of barley better adapted to growing conditions in north-western Europe (Jones et al. 2012, 2013).

#### CEREALS, FRUITS AND NUTS IN THE WELSH NEOLITHIC

The dynamics of the Mesolithic – Neolithic transition in Britain have been the subject of intensive research for many years and continue to remain a contentious area of debate. One aspect in particular which has been rigorously debated is the nature and significance of early farming practice as agriculture is one of the defining elements of the Neolithic (Cummings and Harris 2011; Bickle and Whittle 2014: 11-12; Rowley-Conwy and Legge 2015). These debates have developed in Britain as the onset of the Neolithic is marked by the development of monuments and changes in material culture, whereas an abrupt economic shift – from hunter-gathering to farming – is perhaps less (immediately) apparent in comparison to other areas of Europe (Robb 2014: 22; Thomas 2014: 430).

Cereals were introduced into Britain at the onset of the Neolithic between 3950 – 3800 cal BC, becoming widespread within a relatively short period of time (Brown 2007b; Stevens and Fuller 2012). Despite this, there is substantial evidence for the continued exploitation of wild plants during the Neolithic, especially hazelnuts and wild fruits, whilst evidence for cereals is rare at many sites (Moffett et al. 1989; Robinson 2000; Stevens 2007; Pelling and Campbell 2013). Large caches of cereal remains are known for this period although they are rare and restricted to chance discoveries (Pelling and Campbell 2013). This patterning, in conjunction with often ephemeral nature of Neolithic settlement evidence, has led several authors to suggest a predominantly transient Neolithic population with wild foods continuing to remain significant in diets alongside cereals (if not of greater importance than cereals) (e.g. Moffett et al. 1989; Entwistle and Grant 1989; Robinson 2000; Thomas 1999, 2004, 2014). These viewpoints are synonymous with models of the Neolithic transition which prioritise cultural change rather than economic change and emphasise the role of indigenous hunter-gatherers in adopting the cultural and economic traits of the Neolithic (e.g. Thomas 1999, 2004, 2007, 2008 2014).

However, others have maintained that cereals were a major component of diets, in some areas at least. Taphonomic factors may have led to the significant under-representation of cereals in Neolithic sites relative to wild plants, especially hazelnuts. Firstly, cereals typically occur in very low densities in Neolithic sites and it has been suggested that cereals will be under-represented where only limited sampling and small sample sizes are used to recover archaeobotanical evidence (Legge et al. 1998: 90-91; Rowley-Conwy 2000: 43; Jones 2000: 82; Jones and Legge 2008: 476). Secondly, cereals and hazelnut shells have differing probabilities of coming into contact with fire and preserving. Hazelnut shell is a waste-product which may have been deliberately discarded onto fires or used as a source of kindling, whereas cereal grains are intended for consumption and are unlikely to become charred unless accidentally discarded onto fires or destroyed in a conflagration of a stored crop (Legge 1989; Jones 2000; Jones and Rowley-Conwy 2007; Jones and Legge 2008). On the basis of arable weed flora associated with cereal grain assemblages, Bogaard and Jones (2007) have argued that cereal cultivation in Neolithic Britain was comparable to that in central Europe, where small-scale intensive cultivation was practised (Bogaard 2004). Taking these factors into account, it has been suggested that the Neolithic transition was characterised by an abrupt shift to settled agriculture, involving the considerable immigration of farming communities (Rowley-Conwy 2004, 2011; see also Sheridan (2010) for a similar view).

It is difficult to disentangle the taphonomic filters which may have affected the relative proportions of cereals and wild plants in archaeobotanical assemblages. Moreover, geographical and chronological variation in the relative importance of cereals and wild plant foods are beginning to emerge. For example, research in Scotland has demonstrated that there may be significant regional and inter-regional differences in the trajectories of farming during the Neolithic and we cannot apply uniform models of Neolithic economies across Britain (Bishop et al. 2009; 2015).

Therefore, a synthesis of plant remains from Neolithic sites in Wales can provide a valuable contribution to these debates and it has been highlighted as a research priority in the Research Framework for the Archaeology of Wales. The current dataset is large enough to undertake a detailed review of the evidence for Neolithic Wales. The primary research questions are:

1. What was the relative importance of cereals and wild plants during the Neolithic?

## 2. Did the importance of cereals change throughout the Neolithic?

A systematic quantitative review of plant remains from Neolithic Wales was undertaken. To ensure the accuracy of the dataset, only evidence which met the following criteria was included:

- (i) Evidence recovered by sampling and flotation to ensure that the plant remains recovered are representative (cf. van der Veen 1984: 193).
- (ii) Securely dated plant remains. This includes directly dated evidence and evidence associated with radiocarbon dated material and/or pottery dating. Undated/poorly phased sites/sites and unsecure contexts containing inconsistent radiocarbon dating have been excluded.
- (iii) The exclusion of evidence from ditch-fills associated with monuments due to frequent inconsistencies in radiocarbon dating (see for example Hindwell Cursus (Jones 2012a) and Womaston Causewayed Enclosure (Jones 2009)).

There is increasing recognition that the application of strict dating controls is a necessary component of archaeobotanical research for the Neolithic period in particular to account for intrusive or residual plant remains (Stevens and Fuller 2012, 2015; Pelling et al. 2015). Whilst this rigorous selection methodology considerably reduces the size of the dataset it is considered to provide adequate dating controls. The quantity of plant remains present at each site were recorded numerically where possible or on a scale of abundance ('R', 'rare'; 'P', present; 'A', abundant). The dataset is presented in Table 9 and summarised in Figures 10-12. Photographs of the evidence from three sites is presented in Figures 13-13.

### *The Evidence for Cereals*

There are 19 sites with evidence for cereal grains, of which 11 date to the Early Neolithic (65% of EN sites), 4 date to the Middle Neolithic (19% of MN sites) and 4 date to the Late Neolithic (44% of LN sites) (Fig. 10). Cereal chaff is very rare, with 3 sites for the

Early Neolithic, 1 record for the Middle Neolithic and 2 sites for the Late Neolithic (Fig. 10). Evidence for non-cereal cultivated crops is extremely rare: a single flax seed for the Late Neolithic (not confirmed by direct <sup>14</sup>C dating) (Fig.10) and a Middle Neolithic pottery impression of a Celtic bean (not included in Table 9) from Ogmore, south-east Wales (Hillman 1981a; Gibson 1998). For most sites the level of preservation was too poor to enable identification of cereals beyond 'indeterminate'. In the Early Neolithic, wheat is the most common cereal being present in 8 sites (47% of EN sites) and followed by emmer wheat at 5 sites (29% of EN sites). Barley, hulled barley and naked wheat are also present in the Early Neolithic, although they are rare (3 barley sites (18% of EN sites); 2 sites with hulled barley (12% of EN sites); 2 sites with naked wheat (12% of EN sites). For the Middle and Late Neolithic the small number of sites with cereal remains make it difficult to reliably assess the presence of different cereal types. Wheat (including emmer wheat) and barley are present in the both periods. There is single Middle Neolithic record for naked wheat and a single Late Neolithic record for hulled barley. Naked wheat from prehistoric contexts in southern England frequently return medieval/later dates (Pelling et al. 2015) suggesting that naked wheat remains in Neolithic Wales are intrusive (none have been directly dated). Currently, there are no sites of naked barley or einkorn wheat. The size of the dataset is too small to enable the relative proportions of different cereals types to be examined in detail.

In terms of the quantity of cereal grains recovered it is evident that most sites from the Early Neolithic to Late Neolithic have produced extremely small assemblages of cereal grains consisting of between 1 – 25 grains, or in even smaller quantities in many instances. This pattern is particularly clear when the evidence is analysed at the level of individual context. Cereal grains are present in moderate quantities in Early Neolithic pits clusters at Carrog, north-west Wales (Caseldine et al. 2014), Cwm Meudwy B, south-west Wales (Caseldine and Griffiths 2006b) and at Borrás Quarry, north-east Wales, if the evidence from four pit clusters is combined (ASUD 2010, 2013), although all of these assemblages also contained large assemblages of hazelnut shells (Table 10). Moderate quantities of cereal grains have also been recorded from Early Neolithic rectangular structures at Gwernvale, central Wales (Hillman in Britnell 1984: 141; Caseldine pers comm) and Parc Bryn Cegin, north-west Wales (Schmidl et al. 2008). Extensive sampling at Parc Bryn Cegin (81 contexts/features sampled) produced hundreds of hazelnut shell fragments and a very low density of cereal grains (Schmidl et al. 2008). Currently, there is only one

record of a large cereal remain assemblage for Neolithic Wales at Plas Gogerddan, south-west Wales (Caseldine 1992a) (Table 11). A small sample (c. 4 – 8 litres) from a pit was rich in emmer wheat grains and chaff, indeterminate cereals and small quantities of barley in addition to wild plants including hazelnut shell and crab apple remains (Caseldine 1992a) (Table 11). Unfortunately, small plant remains are likely to be under-represented/not recovered as a large mesh size (1mm) was used and only the flot was analysed (Caseldine 1992a), subsequently, other remains in the residue (potentially hazelnut shells (cf. Monk and Pals 1985:79)) may also be under-represented/not recovered. A radiocarbon date on mixed wood charcoal returned a date of 3640-3360 cal BC ( $4700 \pm 70$  BP; CAR-994), providing a *terminus post quem* for the feature (Murphy 1992).

For the Middle and Late Neolithic (also referred to as the Later Neolithic), most evidence has been recovered from pits/pit clusters which tend to be dominated by large quantities of hazelnut shell and generally very rare evidence for cereals grains (Table 12). Similarly, evidence from Late Neolithic ephemeral structures at Upper Ninepence (Caseldine and Burrow 1999) and Trelystan (Hillman 1982b) in central Wales produced extremely sparse evidence for cereals. At Ogmere, south-east Wales, an emmer wheat grain impression (not included in Table 9) was identified on Middle Neolithic Peterborough ware (Webley 1976; Burrow 2003: 339). There appears to be less evidence for cereal remains during the Middle and Late Neolithic, although there are currently very few sites for the Late Neolithic and further evidence is required.

#### *The Evidence for Wild Plant Foods*

Hazelnuts are particularly frequent during the whole Neolithic period and there 11 Early Neolithic sites (65% of EN sites), 20 Middle Neolithic sites (95% of MN sites) and 7 Late Neolithic sites (78% of LN sites). Hazelnut shell fragments occur in greater quantities than cereal grains (Fig.11). The quantity of hazelnut shells will be under-represented at many sites as total number of fragments present is only rarely quantified. Where fully quantified, the quantity of hazelnut shell fragments can exceed >500 for an individual context and >1000 fragments for a record. Evidence for other wild plant foods is less frequent. There are 2 Early Neolithic sites (12% of EN sites) and 1 Late Neolithic record

for crab apple remains (11% of LN sites). An Early Neolithic pit at Plas Gogerddan, south-west Wales (see above) contained frequent seeds, stalks and fruit fragments of crab apple (Caseldine 1992a). A probable impression of a crab apple seed (not included in Table 9) was identified on Middle Neolithic Peterborough ware at Ogmere, south-east Wales (Burrow 2003: 339)<sup>7</sup>. An Early Neolithic cursus ditch at Hindwell, central Wales (not included in Table 9) produced crab apple seeds (Caseldine and Griffiths 2012b). Other wild plant foods have also been identified, including occasional blackberry/raspberry (Parc Bryn Cegin, north-east Wales (Schmidl et al. 2008); Gwernvale, central Wales (Caseldine pers comm.); Upper Ninepence (Caseldine and Burrow 1999); Trelystan (Hillman 1982b)). At Llandeenny, south-east Wales, 1000s of waterlogged raspberry/blackberry seeds (and 88 charred seeds) were identified (Brown 2005, 2007a), although these remains may be natural in origin. Very small quantities of acorn fragments and a single Rosaceae stone were identified at Upper Ninepence, central Wales (Caseldine and Burrow 1999)

*Discussion: the role of cereals and wild plants in Neolithic Wales and beyond*

Taken together, the number of Neolithic sites for plant remains in Wales provides an important contribution to our understanding of subsistence practices in Neolithic Britain. Whilst the dataset for Neolithic Wales is by no means complete there are a number of factors which can be discussed.

There is considerable evidence for the exploitation of wild plants, especially hazelnuts, throughout the whole Neolithic period, whereas some differences are beginning to emerge in the evidence for cereals between the Earlier and Later Neolithic. The current dataset may indicate that there is greater evidence for cereals during the Early Neolithic when compared to the Later Neolithic, although further evidence from Late Neolithic sites is necessary. Considering the rarity of cereals in Later Neolithic Wales, it is possible that the cereals at these sites are intrusive (cf. Kenney 2008a; Stevens and Fuller 2012: 711; Pelling et al. 2015). A reduction in evidence for cereals during the Later Neolithic has been noted in Ireland (McClatchie et al. 2014), potentially in certain areas of Scotland

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<sup>7</sup> The impression of a whole hazelnut is also recorded, however, an examination of the evidence by the author (Treasure) suggests that this identification is not reliable.

(for particular crops) (Bishop 2015) and in southern England (Robinson 2000; Pelling and Campbell 2013; see also Brown 2007b). Stevens and Fuller (2012) recently proposed a major decline in cereal cultivation during the Later Neolithic using  $^{14}\text{C}$ -summed probability distributions on cereal grains as a proxy record for examining changes in cereal cultivation. The methodological basis of this model has been convincingly critiqued elsewhere and such generalised modelling of Neolithic farming inevitably overlooks more complex processes and regional trajectories (Bishop 2015). For example, at Clifton Quarry, Worcestershire (not far from the Welsh border) a deposit >9000 barley grains of Late Neolithic date were identified (Jackson and Ray 2012). The possibility that cereal cultivation declined in the Later Neolithic is an avenue of research which would reward detailed analysis using archaeobotanical evidence.

A recent review of plant remains in Neolithic Ireland clearly demonstrated a decreasing crop diversity as agriculture diffused from south-eastern Europe and as it reached its north-western European limit a restricted range of crops remained (McClatchie et al. 2014). In particular, this is reflected the rarity of einkorn wheat in Britain (Pelling and Campbell 2013) and Ireland (McClatchie et al. 2014). There is currently no evidence for einkorn wheat in Neolithic Wales with the exception of occasional emmer/einkorn wheat identifications. Moreover, pulse crops are viewed as absent in Britain (Fairbairn 2000; Bogaard and Jones 2007; Jones and Rowley-Conwy 2007), Ireland (McClatchie et al. 2014) and north-western Europe (Salavert 2011; Kirleis et al. 2012). Within this context, the pottery impression of a Celtic bean on Middle Neolithic Peterborough Ware is very unusual (Hillman 1981a; Gibson 1998) and provides the earliest evidence for the introduction a pulse crop in Neolithic Britain (Treasure and Church submitted). There is currently a single record of flax in Wales from a Late Neolithic pit at Buttington Cross, central Wales (Clapham 2009), although direct dating is necessary to confirm its presence. Flax is very a rare crop in Neolithic Britain (Jones and Rowley-Conwy 2007; Pelling and Campbell 2013; Cobain 2014) and Ireland (McClatchie et al. 2014).

In evaluating the importance of cereals and wild plants during the Neolithic it is necessary to take into account a range of taphonomic factors which may have influenced the preservation of these remains. Firstly, as noted earlier, it has often been suggested that hazelnuts are over-represented in archaeobotanical assemblages (e.g. Legge 1989; Jones 2000; Jones and Rowley-Conwy 2007). However, other wild plants, particularly fruits, tubers and leafy vegetables are unlikely to become charred and preserved (Zvelebil 1994)

and it follows from this that we are probably witnessing the tip of the iceberg in terms of the range of wild plants exploited. In a comparison between charred and waterlogged archaeobotanical assemblages in central Europe, with potential wider applicability to other areas, Colledge and Conolly (2014) argue that the role of wild plants in subsistence strategies has been substantially under-estimated. There is increasing recognition of an intermediate stage between hunter-gathering and farming and the validity of such a categorical distinction has been critiqued (Smith 2001, 2011). The potential role of Neolithic ‘farmers’ in intensively exploiting, manipulating and managing ‘wild’ plants is beginning to emerge in the literature (e.g. Salavert et al. 2014: 90; Colledge and Connolly 2014; Antolín and Jacomet 2015). For example, in Britain Schulting (2008: 95) notes that hazel could have been managed during the Neolithic, whilst Jackson and Ray (2012: 156) hint at the potential management of ‘wild’ fruit. On the basis of the consistent evidence for hazelnuts in Neolithic Wales (and elsewhere in Britain) particularly in pits/pit clusters it is tempting to suggest that a degree of deliberate human manipulation was involved in their growth. A more detailed consideration of these points provides an interesting future direction for archaeobotanical research on the Neolithic in Wales and beyond.

In terms of the role of cereals during the Neolithic in Wales, a balanced view would argue for the importance of wild plant gathering alongside cereal cultivation. This view is encapsulated in the evidence from Plas Gogerddan: a large concentration of cereals *alongside* substantial evidence for wild plants. This assemblage is currently unique in a Welsh context; however, it has parallels with similar Early Neolithic pits in England which have produced dense concentrations of cereal remains (e.g. Jones and Legge 2008; Pelling 2011; Stevens 2011 and Pelling forthcoming b cited in Pelling and Campbell 2013: 45). Early Neolithic pits rich in crab apples are also known, although such an assemblage is more typical of the Late Neolithic (e.g. Druce 2007; Cobain 2014). There are currently no burnt down Early Neolithic rectangular structures in Wales containing abundant cereal grain such as at Balbridie (Fairweather and Ralston 1993) and Lismore Fields (Jones and Rowley-Conwy 2007). As Pelling and Campbell (2013: 45) note there remains an ‘element of chance’ in the discovery of large cereal grain caches, such as at Plas Gogerddan. The charring of large concentrations of cereals is not expected to occur at all sites, such ‘events’ would be rare (cf. van der Veen and Jones 2006) and large quantities of cereal grains may have been present which were never destroyed by fire, either deliberately or accidentally. With further sampling, rich deposits of cereal remains

are expected to be identified in Wales in the future. Taken together, although it is argued that cereal cultivation and wild plant exploitation were both significant dietary components in Neolithic (e.g. Jones and Rowley-Conwy 2007; Rowley-Conwy 2004; Rowley-Conwy and Legge 2015), there appears little evidence to suggest that cereals formed the mainstay of the economy for Neolithic Wales.

One aspect of the Neolithic which we know extremely little about is the nature of early farming practice, despite agriculture being a defining element of the Neolithic. Whilst we know that cereals were present from the onset of the Neolithic in Wales, the nature of cereal cultivation is as yet undefined. There is growing body of research in other areas to suggest that Neolithic cultivation was small-scale, fixed and intensive, akin to garden agriculture (Bogaard 2004, 2014; Bogaard and Jones 2007; Bogaard et al. 2013). Weed seeds associated with cereal crops have been used to examine agricultural practices in Neolithic Britain (Bogaard and Jones 2007) and central Europe (Bogaard 2004); however, weed seeds are extremely rare in Neolithic Wales (and few, if any, can be directly related to the cultivation of cereals). There is potential to undertake stable isotope analysis on charred cereal grains to directly investigate agricultural practices during the Neolithic, particularly the scale and intensity of cultivation (cf. Fraser et al. 2011; Bogaard et al. 2013; Bogaard 2014).

This review and analysis of plant remains from Neolithic sites in Wales provides an important contribution to debates concerning the relative importance of cereals and wild plant foods during the Neolithic in Britain. Despite this, the database is not complete and there is a requirement to generate more high quality datasets for this period with secure dating evidence. New datasets will enable a refinement in the discussion presented above.

#### CHARCOAL EVIDENCE: WOODLAND COMPOSITION AND EXPLOITATION

The Neolithic is traditionally associated with an expansion in woodland clearances coincident with the development of agriculture and a more densely settled landscape (Austin 2000). Cereals were introduced into Britain at the onset of the Neolithic, becoming widespread within a short period of time (c. 3800 cal BC) (Brown 2007b) and open conditions were necessary for their cultivation (Pelling and Campbell 2013: 59).

The majority of landscape is viewed as being covered in closed canopy woodland alongside a patchwork of small-scale, temporary and localised clearances resulting from a combination of autogenic (i.e. wind-throw) and anthropogenic factors (i.e. deliberate clearances for cultivation) (Brown 1997; Richmond 1999; Austin 2000; Bell and Walker 2005). Woodbridge and co-authors (2014) identified an abrupt phase of woodland clearance across Britain at the onset of the Neolithic, followed by a period of woodland regeneration in the Later Neolithic, although the reliability of this analysis is brought into question by the small number of pollen records analysed, particularly for Wales. Using evidence from beetles, Whitehouse and Smith (2010) indicate a more variable pattern of woodland clearance, with a general trend towards increasing human impact at the beginning of the Neolithic. A period of woodland regeneration was identified from c. 3500 cal BC (Whitehouse and Smith 2010) which could be linked to a decline in cereal cultivation (see also Stevens and Fuller (2012); Robinson (2014)). In Wales, a regionally variable pattern of clearance phases and human interference are present in the Early Neolithic, which in certain instances appears to have been followed by woodland regeneration (e.g. Caseldine 1990a: 45-46, 2000, 2014a; Innes et al. 2006; Fyfe 2007; Caseldine 2014a).

The degree of openness in the landscape is a debated area, with differing opinions on the extent to which autogenic and anthropogenic factors influenced woodland dynamics (e.g. Brown 1997; Whitehouse and Smith 2004, 2010; Bell and Noble 2012; Robinson 2014). In particular, the scale and impact of Early Neolithic farming communities on woodlands is closely related to debates surround the openness of the landscape. The traditional view of small-scale Neolithic clearances as the product of slash-and-burn or shifting agriculture is unlikely (Rowley-Conwy 1981; Bogaard 2002)). In contrast, there is a growing body of evidence to suggest that cereal cultivation was small-scale and intensive, akin to garden agriculture, and occurred in small woodland clearances (Bogaard 2004, 2005, 2014; Rowley-Conwy 2004; Bogaard and Jones 2007). However, whilst we know that cereals were present from the Early Neolithic in Wales, we currently have very limited understanding of the nature of farming practices (and in Britain as a whole) and further research is necessary to understand its scale and potential ecological impact. Small-scale clearances in woodlands are difficult to detect using palynological evidence alone (Fyfe 2007; Tipping et al. 2009; Whitehouse and Smith 2010; Bell and Noble 2012) and subsequently 'garden agriculture' may be effectively invisible in palynological records.

Charcoal evidence can provide an important contribution to these debates concerning human impact on woodlands and the degree of openness in landscapes. Charcoal provides a direct record of the wood species exploited during the Neolithic and this can be used to examine a range of factors including woodland composition, exploitation and human impact (Asouti and Austin 2005). The species present in charcoal assemblages reflect a combination of their abundance in woodlands and the deliberate selection of certain species for specific uses/properties (i.e. the suitability of different species for firewood or for structural timbers) (Asouti and Austin 2005; Théry-Parisot et al. 2010). Despite the potential contribution of charcoal analysis in understanding woodland dynamics during the Neolithic it is an under-valued form of analysis in Britain (Murphy 2001), particularly in comparison to the continent where it is more frequently used (e.g. Kreuz 2008; Jansen and Nelle 2014; Salavert et al. 2014; Ferme and Huerta 2014). In the Research Framework for the Archaeology of Wales, Caseldine (2013a) notes that the contribution of charcoal analysis has been under-valued and requires greater emphasis. A number of potential areas could be examined using charcoal evidence: Is there an increase in light-demanding species in the Early Neolithic suggesting an opening of the landscape? Is there evidence for woodland regeneration in the Later Neolithic? How were woodlands exploited? Is there evidence for management practices such as pruning or coppicing?

### *Results and Discussion*

The current charcoal dataset for Neolithic Wales is very limited in its quality and the evidence cannot at present be discussed in detail (Table 13). Despite these limitations, it is possible to extract some useful information concerning woodland composition and exploitation.

A wide range of wood species were exploited throughout the Neolithic and the main taxa recorded are hazel, oak and Maloideae. These three taxa are also commonly recorded in Mesolithic sites in Wales (see above) in addition to Neolithic sites in England (Murphy 2001; Smith 2002; Huntley 2010) and in north-western Europe (Jansen and Nelle 2014; Salavert et al. 2014). Pollen evidence for Neolithic Wales is generally dominated by oak-hazel woodland, with alder also frequent in the north (Caseldine 1990a) and the abundance of both these species in woodlands is clearly reflected in their frequency in the

charcoal evidence. Species such as alder and elm are rare in comparison in the charcoal records probably reflecting the poor burning properties of these species for firewood (Gale and Cuttler 2000: 34). Hazel is tolerant of shade and it often grows in the understorey of oak woodlands; however it also commonly grows on the fringes of woodlands and it could have quickly colonised openings (Gale and Cuttler 2000: 88; Grogan et al. 2007: 29-31). It is difficult to evaluate the abundance of Maloideae in woodlands on the basis of palynological evidence as it is a poor pollen producer, however, charcoal evidence suggests that this species may have been relatively common in woodlands. Maloideae and other species recorded (including ash, birch, and cherry/blackthorn) are light-demanding species and its growth may have been encouraged through woodland openings (Jansen and Nelle 2014).

Hazel and Maloideae may have formed a 'mantle vegetation' around Neolithic occupation sites situated in small woodland openings (Rowley-Conwy 2004: 90). Woodland fringes and openings may have been deliberately manipulated or managed to promote the growth of hazel which requires sunlight to produce hazelnuts, in addition to fruit-bearing species such as crab apple (a member of the Maloideae family) which also requires sunlight to produce fruit. Hazelnuts are particularly common in Neolithic sites in Wales and crab apples are also known, particularly at Plas Gogerddan, south-west Wales. (Caseldine 1992a). Hazelnut yields may also be improved through coppicing or pruning and the resulting wood may have been used as fuel, hence its frequency in the charcoal evidence (Bishop et al. 2015). Other authors have also suggested that the growth of 'wild' species may have been managed/manipulated during the Neolithic in Europe, blurring the traditional 'wild' versus 'domestic' dichotomy (e.g. Schulting 2008; Jackson and Ray 2012: 156; Salavert et al. 2014: 90; Colledge and Connolly 2014; Antolín and Jacomet 2015).

Woodlands were exploited as sources of both food and fuel; however, increasing emphasis is being placed on the symbolic significance of trees and woodlands during the Neolithic (and Earlier Bronze Age), particularly the use of wood in monumental architecture (Evans et al. 1999; Bell and Noble 2012; Millican 2012; Brophy and Millican 2015). The choice of wood species appears to have been an important consideration in the construction of wooden monuments and, in certain instances, charcoal evidence can be used to identify the wood species used. In Scotland research on Neolithic wooden monuments has identified evidence for the selective use of oak (Millican 2007, 2012;

Brophy and Millican 2015) and there is a growing body of evidence to suggest that oak was also specifically selected in Neolithic (and Earlier Bronze Age) monumental architecture in Wales.

For example, at Lower Luggy, central Wales, charred remains of oak posts were identified in a palisade trench of an earthen long barrow (Gibson 2000). A Middle-Late Neolithic timber circle at Meusydd, central Wales, was potentially constructed from oak (Caseldine and Griffiths 2009c) and at Sarn-y-bryn-caled Site 1, charred oak posts formed an Early Bronze Age timber circle (Morgan 1994). The use of oak in timber circles is paralleled elsewhere (Millican 2007). In Late Neolithic palisaded enclosures at Hindwell II and Hindwell double-palisaded enclosure, central Wales, the charred remains of oak posts were identified *in-situ* (Gibson 1999; Johnson 1999; Jones 2011b, 2012b; Jones and Hankinson 2014). These large enclosures are comprised of a broadly circular monument, a few hundred meters in diameter and defined by large wooden posts, which (where possible) have been identified as oak (Gibson 2002; Hale et al. 2009: 282; Noble and Brophy 2011a, b). It is estimated that c. 1100 posts were used at Hindwell II and c. 4500 posts in Hindwell double-palisaded enclosure. The impact of this on local woodlands was presumably significant, although it remains to be investigated whether all the posts were oak and whether these monuments were constructed in a single phase (cf. Millican 2012: 42). The specific selection of oak could have promoted the growth light-demanding species such as hazel or Maloideae which may have rapidly colonised cleared areas. This could be tested through a combination of palynological and charcoal analyses. It is interesting to note that oak, hazel and Maloideae were dominant in charcoal evidence from Late Neolithic occupation at Upper Ninepence situated in close proximity to these enclosures (Johnson 1999).

To summarise, the analysis of charcoal can provide valuable information to debates surrounding the degree of openness in woodlands and human impact during this period. Charcoal evidence should form an element of future research directed at understanding human impact on woodlands during this period.

## RESEARCH AGENDA: POTENTIAL AND PRIORITIES

The Neolithic period in Wales, as with other areas of Britain, has been subject to intensive research for a number of years and we are beginning to refine our understanding of what happened and when. The Neolithic is widely defined as the transition to agriculture, however, discussions of Neolithic activity in Wales have tended to be defined by monuments and material culture (Burrow 2003; Peterson 2004), some of the most visible elements of the archaeological record. There have been very few discussions concerning the nature and significance agricultural practices (e.g. Webley 1976; Moore-Coyler 1998) and current understanding of agriculture is largely based on palynological evidence. Twenty-five years ago, Caseldine (1990a: 47) highlighted the difficulties of reconstructing agricultural practices in Neolithic Wales using palynological records and emphasised the importance of analysing archaeobotanical evidence from Neolithic sites. The growth of archaeobotanical research in north-western Europe within recent years has resulted in a number of detailed discussions concerning the role of cereal cultivation and wild plant gathering (e.g. Bishop et al. 2009; Salavert 2011; Kirleis et al. 2012; McClatchie et al. 2014) and woodland exploitation (e.g. Dufraise 2008; Jensen and Nelle 2014; Salavert et al. 2014). The quantity and quality of the evidence for plant remains in Neolithic Wales adds an important contribution this area of research, although there still remain a number a lacunae in current understanding of agriculture during this critical period.

## CONCLUSIONS AND RECOMMENDATIONS

1. The relative importance of cereal cultivation and wild plant gathering needs to be examined in greater detail.
2. There is very little evidence from Early Neolithic rectangular structures. Extensive sampling should be undertaken at these sites when and as these sites are discovered.
3. There is very little evidence from Late Neolithic sites and more evidence needs to be generated. The possibility that there was a decline in cereal

cultivation during the Later Neolithic needs evaluation (cf. Stevens and Fuller 2012).

4. Sample a wide range of features in Neolithic sites to enhance the recovery of cereal grains which often occur in low densities to account for the chance element in the identification of cereal grain caches.
5. Directly date cereal grains to examine the timing of the introduction of cereals and to identify intrusive cereal grains (cf. Pelling et al. 2015).
6. There is potential to develop aDNA analysis on charred cereal grains to investigate the introduction and diffusion of cereals (cf. Jones et al. 2012, 2013; Brown et al. 2015).
7. The nature of agricultural practices and land-use patterns during this period should be evaluated through the analysis of weed seeds and stable isotope analysis on charred cereal grains (cf. Fraser et al. 2011; Bogaard et al. 2013, in press; Bogaard 2014).
8. Sample and identify charcoal fragments from secure Neolithic contexts. For detailed interpretations it is recommended to identify 100 charcoal fragments per sample (Keepax 1988). Smaller numbers of identifications (*c.* 20-30) may be sufficient providing that a wider range of well-dated contexts are analysed (O'Carroll and Mitchell 2013).
9. Analyse the age and diameter of charcoal fragments to identify the specific age/size of the wood species exploited to investigate woodland management practices such as coppicing and fuel selection (cf. Asouti and Austin 2005; Dufraisse 2006; Out et al. 2013; Deforce and Haneca 2014).

## Chapter 6:

### BRONZE AGE WALES (c. 2200 – 800 BC)

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#### INTRODUCTION AND BACKGROUND

The Bronze Age in Wales, as with other areas of Britain, is often viewed as a period of two halves – an Earlier (c. 2200-1500 BC) and a Later (c. 1500-800 BC) Bronze Age – with 1500BC representing the ‘great divide’ in British prehistoric studies (Lynch et al. 2000; Roberts 2013). Understanding of Earlier Bronze Age activity in Wales is predominantly based on the interpretation of funerary sites which dominate the archaeological record, particularly in upland areas (Lynch et al. 2000: 137-138). In comparison, settlements are rare and evidence is frequently comprised of ephemeral traces of activity (Hamilton 2004: 95-97; Ghey et al. 2007; Burrow 2012, 181-183), with very few roundhouses recognised (Benson et al. 1990; Sell 1998; Caseldine 2001d; Peterson 2007). Other evidence for activity in this period comes from burnt mounds, a common and distinctive site-type in Wales (Kenney 2012; Hart et al. 2014) characterised by a mound of burnt stone and associated trough to hold water and possibly related to heating water. Despite large numbers of these sites, their precise function remains enigmatic and their relationship to settlement sites is unclear (Halstead 2007: 174; Kenney 2012). Understanding of the nature of agricultural practices during the Earlier Bronze Age have subsequently been restricted by the limited available evidence from settlement sites (cf. Allen and Maltby 2012: 282) and off-site palynological records represent the primary source of evidence for assessing land use (Caseldine 2003b: 73-74). Pollen records are considered to indicate a predominantly pastoral economy, with some cereal cultivation (Caseldine 1990a) and funerary sites suggesting an expansion into the uplands which may be linked to pastoralism (Lynch et al. 2000: 138). It is, however, difficult to assess the arable component of economies using pollen evidence as cereals produce little, poorly dispersed pollen (Hall 1987) and cereal-type pollen is difficult to distinguish from wild grasses (Edwards and Hiron 1984; Brown 2007b).

In contrast to the Earlier Bronze Age, the Later Bronze Age in Britain is associated with significant changes in the archaeological record, including a decline in the use of funerary

monuments and in particular the development and expansion of settlements or roundhouses (Brück 2000). However, there are indications that transition from the Earlier Bronze Age to Later Bronze Age in Wales may not be as clear cut as it is for other areas of Britain. Settlement evidence increases in comparison to the Earlier Bronze Age, particularly in the wetland-dryland interface in the Severn Estuary (Bell 2013); although dryland settlements are less well represented in comparison to southern England, with many roundhouses in Wales dating to the Late Bronze Age-Early Iron Age rather than the Middle Bronze Age (Ghey et al. 2007). A small number of roundhouses have been excavated (Britnell et al. 1997; Crane 2004; Ghey et al. 2007), although many developer-driven projects have identified very limited evidence for settlement activity, with the exception of occasional pits containing domestic waste (e.g. Davidson et al. 2007; Kenney 2008a; Schlee 2009; Jones and Grant 2011; Grant and Jones 2011). Excavated roundhouses at Glanfeinon (Britnell et al. 1997) and Newton (Crane 2004) were chance discoveries and it possible that further excavations may identify greater evidence. Detailed archaeological and palaeo-environmental research in the Severn Estuary has developed a picture of seasonal transhumant pastoralism (Bell 2013), however, settlement and land-use patterns remain poorly understood across much of Wales. As most people during the Bronze Age were farmers, discussions of socio-economic change during this period need to be grounded within an understanding of agriculture.

## RESULTS

### OVERVIEW

There is a substantial quantity of archaeobotanical evidence for the Bronze Age, however, the majority of evidence dates to the Earlier Bronze Age and is predominantly comprised of charcoal recovered from funerary and ritual sites and burnt mounds. There is very little archaeobotanical evidence associated with Earlier Bronze Age settlement sites. For the Later Bronze Age, only a small number of sites were identified and little archaeobotanical evidence is clearly associated with settlement contexts and even less evidence is associated with roundhouses. As noted above, the period does not appear to have significantly benefitted from developer-driven archaeological investigations which tended to identify limited evidence for Bronze Age settlements.

Archaeobotanical evidence from recent excavations on a Later Bronze Age settlement at Llanmaes, south-east Wales, will provide a valuable contribution to understanding agricultural practices during this period, especially considering the rarity of contemporary settlement evidence in Wales (Caseldine and Griffiths 2005, 2006c, 2010b; Lodwick and Gwilt 2010).

#### BURNT MOUNDS (c. 2500 – 800 BC)

Archaeobotanical evidence (almost entirely charcoal) has been recovered from 33 burnt mound sites dating between the Later Neolithic to Later Bronze Age, particularly during recent large-scale developer-driven archaeological investigations in north-west Wales at Parc Bryn Cegin (Schmidl et al. 2008) and the Pwllheli to Blaenau Ffestiniog Pipeline (Challinor et al. 2014) (Table 15). There is currently no archaeobotanical evidence associated with burnt mounds for south-east, central and north-west Wales. A large number of burnt mounds have been excavated and sampled (c. 4000 litres of soil sampled) for archaeobotanical evidence in the Milford Haven to Aberdulais and Brecon to Felindre Pipeline; however, the results of this project have not been fully published (Hart et al. 2014) and could not be included in the database.

#### EARLY BRONZE AGE SITES (c. 2200 – 1500 BC)

A large quantity of Earlier Bronze Age archaeobotanical evidence has been recovered from funerary and ritual sites (64 sites out of a total 127 Bronze Age sites), particularly round barrows and sub-types (i.e. cairns, kerbed cairns, ring cairns) and cremation burials. This includes ring-ditches (e.g. Sarn-y-bryn-caled Site 3 (Morgan 1994)), isolated cremations (e.g. Borrass Quarry Group G (ASUD 2013), Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/27 (Challinor et al. 2014)), cremation cemeteries (e.g. Capel Eithin (Williams 1999), Llanilar (Caseldine 1997), Cefn Cwmwd (Gale 2012), Blaen y Cae (Denne 2006)), round barrows and sub-types with associated cremation burials (Carneddau (Caseldine 1993), Pant y Butler Barrow 1 and 2 (Caseldine and Griffiths 2013b), Fan Foel (Caseldine and Griffiths 2013c), Fan (Foster et al. 2012), Brenig (Lynch 1993a; Keepax 1977, 1979, 1993), Moel Goedog (Denne 1984)). Archaeobotanical

evidence has also been recovered from other funerary and ceremonial sites including timber circles (Sarn-yr-bryn-caled (Morgan 1994), Pont-ar-Daf (Morgan 1993)) and other ceremonial complexes (e.g. Yr Allor and Pantymenyn (Caseldine in Kirk and Williams 2000), Bryn Gwyn Stone Circle (Caseldine and Griffiths 2013a), Parc Maen (Nesbitt 1992)).

There is virtually no archaeobotanical evidence associated with Earlier Bronze Age structures (e.g. Stackpole Warren (Caseldine 1990c)) with some evidence possibly associated with settlement features (e.g. Woodside Camp (Caseldine and Holden 1998)). Archaeobotanical evidence is more typically associated with pit clusters (e.g. Parc Bryn Cegin (Schmidl et al. 2008), Hirdre-Faig (McKenna 2010), South Hook (Carruthers 2011a), Church Road (Allen 2009)) or with isolated pits and post-holes which could represent traces of settlement activity (e.g. (e.g. Four Crosses Site 2 (Milles 1986), Borrás Quarry (ASUD 2013), Afon Wen (Akeret 2007), Bryn Maen Caerau (Caseldine 2001b), Parc Bryn Cegin (Schmidl et al. 2008), Rhuddlan Pit C46 (Holden 1986)). A small quantity of archaeobotanical evidence (predominantly charcoal) is associated with mining at Great Orme (Caseldine 1994) and Copa Hill (Caseldine 2003a; Johnson and Nayling 2003)

#### MIDDLE TO LATE BRONZE AGE SITES (c. 1500 – 800 BC)

In comparison to the Earlier Bronze Age, there is greater evidence for settlement activity during the Later Bronze Age, although only a small number of later Bronze Age structures have been excavated and sampled for archaeobotanical evidence (e.g. Glanfeinon (Britnell et al. 1997), Mellteyrn Uchaf (Caseldine 2001c), Newton (Caseldine and Griffiths 2004)). In the Severn Estuary, south-east Wales, a small number of Later Bronze Age settlements and settlement features have been excavated and sampled, producing both charred and waterlogged plant remains. This includes Middle Bronze Age structures at Redwick (Caseldine et al. 2013a), a Middle Bronze Age occupation layer at Western Valley Trunk Sewer (Caseldine and Druce 2001) and a Middle-Late Bronze Age roundhouse at Chapelump I (Milles 1989).

At a number of sites, isolated features (pits, post-holes), possibly representing traces of settlement activity, have been sampled at a number of sites (e.g. Borrás Quarry (ASUD

2010, 2013), Plas Coch (Caseldine and Griffiths 2012d), Llwyngwyn Farm, north-west Wales (Akeret 2007), Glanllynau Farm (Akeret 2007), Parc Bryn Cegin (Schimdl et al. 2008)).

## DISCUSSION

### FUNERARY AND RITUAL SITES

Between the late 3<sup>rd</sup> millennium cal BC and early 2<sup>nd</sup> millennium cal BC there was a gradual change in mortuary practices with a shift from ‘Beaker’ inhumations to cremation burials (Garwood 2007). Whilst this change encompassed regional and chronological variability, a clear trajectory can be traced with cremation emerging as the dominant burial rite throughout the Early Bronze Age (c. 2200 – 1500 cal BC) and particularly towards the end of this period (Garwood 2007). The analysis of Early Bronze Age cremation burials has a long tradition; however, archaeobotanical evidence has rarely featured prominently in these discussions (Smith 2002: 41).

Firstly, one aspect of cremation burial rites in which archaeobotanical evidence can play an important role is understanding the wood fuel used in cremations. The choice of fuel is likely to have formed an important element of the cremation process and the presence of a particular species of wood could be used to infer deliberate selection (Thompson 2015). The materiality of the pyre will have been influenced by the fuel – its form, smoke, flames, smell, heat and sound – may all have been important consideration in selecting wood species (cf. Williams 2004: 276; Sørensen and Bille 2008). Historical and ethnographic evidence indicates that a symbolic significance was ascribed to some species of wood and these were specifically selected for cremations (e.g. Williams 2004: 276; Moskal-del Hoyo 2012: 3391-2; Hanson and Heiss 2014: 331). In Early Bronze Age funerary sites, the possibility that certain wood species were selected for cremations has been highlighted for some time. For example, in discussing the evidence recovered from the excavation of a cairn and associated cremation at Mynydd Epynt, central Wales, Dunning (1943: 185) notes:

“The presence of oak and of no other species in the material may probably be interpreted in terms of ritual performances at the cairn. It seems a reasonable assumption that the only source of burnt wood from which all the charcoal was taken, namely, the funeral pyre”

Interesting patterns are beginning to emerge in charcoal evidence in Early Bronze Age cremation burials suggesting the specific species of wood were selected (e.g. Thompson 1999; Gale 2006, 2008a) and Campbell (2007) suggest that this could be related to factors such as the age, sex, and/or status of the cremated individual.

The charcoal present in cremation burials is interpreted as pyre debris which was collected following the cremation and deposited along with the cremated human bones into the burial feature (McKinley 1997). This interpretation is supported by the evidence for charred remains of grasses, rhizomes and tubers, particularly onion-couch grass tubers in cremations (e.g. Hillman 1982b; Caseldine 1994, 1997; Campbell 2007; Stevens 2008; ASUD 2013) which may have become charred beneath pyres and were subsequently unintentionally collected along with charcoal and cremated bones and incorporated into burials (Campbell 2007: 30). It has been suggested that oak charcoal was predominantly used in Early Bronze Age cremation pyres (e.g. Smith 2002; Gale 2006, 2008a; Huntley 2010) and evidence from Wales supports this view. Oak charcoal is clearly dominant in Early Bronze Age funerary sites in Wales in both features containing cremated bones (i.e. cremation burials) and charcoal-rich pits (containing very little/no cremated bone) which are often interpreted as pyre debris (cf. McKinley 1997) (Fig.15). A small number of sites have diverged from this pattern and produced unusual assemblages, for example, at Aber Camddwr II, south-west Wales, a charcoal-rich pit containing traces of cremated bone was dominated by alder (Caseldine 1992b). In general, there is very little taxonomic diversity in Early Bronze Age funerary sites, particularly in comparison to burnt mounds (see below) and domestic contexts. For example, at Borrás Quarry, north-east Wales, cremation burial was dominated by oak charcoal, whilst broadly contemporary domestic pits contained a wider range of wood species (Table 14). Similarly, an Early Bronze Age roundhouse at Stackpole Warren, south-west Wales, produced a diverse range of wood species including alder, hazel, Maloideae, ash, oak and cherries (*Prunus* sp.) (Caseldine 1990c). In the absence of large charcoal datasets from more domestic sites it is difficult to provide a comparison with the evidence from cremation burials/funerary sites; nevertheless there appear to be marked differences between the assemblages.

At Brenig 44, north-east Wales, Lynch (1993b: 142-143) suggests subtle patterning in the deposition of charcoal where cremation burials contained oak whilst pits contained a range of wood species. Similar patterning has been suggested at Aber Camddwr II, south-west Wales (Caseldine 1992b) and Moel Goedog, north-east Wales (Denne 1984);

however, the differences in wood species between cremation burials and pits are not sufficiently clearly defined to support this interpretation. Moreover, oak was dominant in both cremation burials and pits in a flat cremation cemetery at Blaen y Cae, north-west Wales (Denne 2006).

The use of oak in cremation burials may be due to a combination of symbolic and functional factors. Oak is a good quality firewood with a high burning temperature necessary for full oxidisation of the bones during cremation; however, other wood species such as ash or blackthorn could also have achieved this (Gale 2012). Ash is not common in cremation burials and it has only been identified in appreciable quantities at small number of sites such as Church Farm Barrow (Caseldine and Griffiths 2009d) and Simondston Cairn (Hyde 1938) in south-east Wales. Taking a broader view, there is evidence for selective use of oak in ceremonial sites in Wales. For example, at Sarn-y-bryn-caled, central Wales, all of the posts used to construct a timber circle were oak (Morgan 1994). The consistent presence of oak in cremation burials, funerary and ceremonial sites as a whole, suggests that its use was more than purely functional.

There are other aspects of cremation burial rites which may also be approached using archaeobotanical evidence. For example, at Llanilar, south-west Wales, a cremation burial associated with a Food Vessel was rich in charred plant remains, including germinated emmer/spelt grains which could indicate malting for brewing (Caseldine 1997). Hillman (1982b) identified coleoptiles (sheathed sprouts) of cereals/large grasses in a charred residue adhering to a Food Vessel at Trelystan, central Wales, and suggested they could indicate brewing. There is very little evidence to suggest that food offerings were placed into cremations. In rare instances, it may be possible to identify other plant remains associated with cremation burials. For example, at Forteviot, central Scotland, charred seeds and flowers of meadowsweet were identified in an Early Bronze Age cist burial (Noble and Brophy 2011b). Meadowsweet produces sweet scented flowers and its smell may have been an important consideration in its inclusion in burials (Jones 2001: 349-350). The recovery of charred meadowsweet seeds and flowers at Forteviot suggest that similar remains could be recovered from burials (both inhumation and cremation burials) in the future. Interestingly, meadowsweet pollen has been identified in cremation burials at Fan Foel (Caseldine and Griffiths 2013c) and (possibly) at Buttington Cross, central Wales (Daffern 2010) and in an inhumation burial at Pant y Butler, south-west Wales (Caseldine 2013b) suggesting that the flowers were placed next into the

burials. Meadowsweet pollen has also been identified in a number of cist burials in Scotland (Tipping 1994, 2000; Clarke 1999; Davies and Tipping 2007). These examples serve to emphasise the potential role of both pollen analysis and archaeobotanical analysis to the study of Early Bronze Age funerary rites.

## BURNT MOUNDS

Burnt mounds are amongst the most common prehistoric site type across Wales (Kenney 2012; Hart et al. 2014) (Table 15), and throughout areas of Britain and Ireland (Hawkes 2014), and typically date from the Late Neolithic to Late Bronze Age. Burnt mounds are a highly distinctive site-type defined by a characteristic mound of burnt stone, associated pit or trough and a hearth (Kenney 2012). Despite, the large number of burnt mounds which have been excavated, the function of these features remains enigmatic and widely varying interpretations have been suggested, including cooking, bathing/saunas and industrial processes (Barfield and Hodder 1987; Ó Drisceoil 1987; papers in Hodder and Barfield 1987; Hawkes 2015 and references therein). The association between burnt mounds and settlements is unclear and these features have only rarely been identified with associated settlement evidence (Kenney 2012), for example at Stackpole Warren, south-west Wales (Benson et al. 1990). Whilst the function of burnt mounds remains uncertain, it is accepted that these features are related to the use of hot stone technology to heat water in a pit/trough (Kenney 2012; Hart et al. 2014; Hawkes 2014). This interpretation is supported by the relationship between burnt mounds and water sources such as streams or springs (Kenney 2012; Hart et al. 2014). Due to the highly distinctive nature of burnt mounds, this site type is considered collectively here, including sites which date to the Late Neolithic.

Charcoal is often abundant in burnt mounds due to the large quantities of wood for fuel necessary to heating stones to heat the water (Flook and Kenney 2008; Rackham and Challinor 2014). The large numbers of burnt mounds suggests that the sourcing firewood required substantial investment and this could have had a considerable impact on local woodlands (Rackham and Challinor 2014: 150). The analysis of charcoal from burnt mounds (and in some instances, plant remains) provides the opportunity to examine the local environmental context of these sites, to assess if specific wood species were

deliberately exploited and potentially to examine evidence for woodland management practices such as coppicing. From a palaeo-environmental perspective, pollen is commonly preserved in burnt mounds due their location in wet areas (e.g. Caseldine and Murphy 1989; OCarroll and Mitchell 2013; Grant 2014; Hart et al. 2014; Wheeler et al. in press) and a combination of palynological and charcoal analysis from burnt mounds may provide valuable records of woodland composition across wide areas of the landscape due to the large numbers of these site-types.

Taking a broad chronological view (c.2500 – 800 cal BC) there are some clear patterns in the wood species exploited in burnt mounds with oak, hazel and alder being the most common species present, with generally smaller quantities of other species such as blackthorn, ash, Maloideae-type, birch and holly (Caseldine and Murphy 1989; Thompson 1993; Denne 2002; Akeret 2007; Schmidl et al. 2008; Carruthers 2009a; Maynard 2012; Challinor et al. 2014; Rackham and Challinor 2014). Both oak and hazel would have provided good quality firewood with a high burning temperature and both these species are also common in domestic assemblages (Grogan et al. 2007). In comparison, alder is a poor quality firewood unless well-seasoned or converted to charcoal. (Gale and Cuttler 2000: 34). Alder grows in damp, wet soils (Gale and Cuttler 2000: 34) and considering that many burnt mounds are situated close to water sources it is likely to have been common in the vicinity of the sites. The charcoal species present do not give an indication of highly selective wood exploitation, rather wood species present in the local environments appear to have been exploited. The wood species present in burnt mounds in Wales are similar charcoal evidence from burnt mounds in Ireland (Grogan et al. 2007) and the West Midlands (Gale 2008b, c, d)

The majority of burnt mounds in Wales date between the Late Neolithic and Late Bronze Age and where detailed radiocarbon dating has been undertaken in recent developer-driven projects it has demonstrated that some burnt mounds were used and re-used intermittently over long periods of time (Flook and Kenney 2008; Kenney 2012, 2014; Hart et al. 2014). The long-duration of activity at some burnt mound sites in conjunction with the erosion and re-working of material forming the burnt mound has resulted in frequent mixing of deposits. Until recently, few burnt mounds had been subject to detailed programs of radiocarbon dating, with only a single radiocarbon date available for many sites which prevents an assessment of contamination (Kenney 2012: 265). Dating of charcoal remains from burnt mounds has frequently returned statistically inconsistent

dates due to mixing and contamination of archaeological deposits (Kenney 2012; see examples in Flook and Kenney 2008; Kenney 2014; Hart et al. 2014). The mixing of charcoal assemblages in burnt mounds, due to the presence of multiple episodes of activity, prevents detailed assessment of the wood species exploited and fuel sources used in burnt mounds over time.

Evidence for charred plant remains associated with burnt mounds is extremely sparse if not absent in most cases. Small quantities of hazelnut shell fragments have been identified (e.g. (Schimdl et al. 2008; Challinor et al. 2014) and occasional cereal grains have also been recovered (e.g. Schimdl et al. 2008; Maynard 2012; Challinor et al. 2014; Rackham and Challinor 2014)). The suggestion the burnt mounds were cooking or feasting sites seems highly unlikely considering the rarity of cereal remains/food plants at burnt mound sites (Kenney 2012). Cereals are also very rare in burnt mounds in the Midlands (Gray 2008a, b, c) and Ireland (McClathie et al. 2007).

Where direct dating has been undertaken on charred plant remains recovered from burnt mound contexts it has frequently highlighted evidence for contamination (Table 16). At Parc Bryn Cegin, a hazelnut shell from burnt mound 1097 is clearly residual, a cereal from burnt trough 2176 is probably intrusive and a poorly preserved/eroded cereal grain from feature 7055 was dated to the Romano-British period and is clearly intrusive. At Glan-Rŷn Bridge two dates on charcoal returned Middle Bronze Age dates, whilst a date on a charred wheat grain returned an Early Bronze Age date indicating that the cereal grain is residual. In contrast, at Upper Neeston, south-west Wales, two dates on charred cereal grains are statistically consistent with other results from the site, suggesting that the cereals are contemporary with the burnt mound activity.

The examples above (Table 16) indicate that contamination is potentially a serious problem in burnt mounds. It is probable that the cereal grains recovered from most burnt mound sites represent background settlement activity which may be unconnected to the use of the burnt mounds, although this requires further investigation. Despite these factors, a recently excavated Early-Middle Bronze Age burnt mound at Nant Farm, north-west Wales, has produced an unusually rich assemblage of cereal remains (Caseldine and Griffiths n.d.). The charred plant remains were rich in wheat chaff, barley chaff and small quantities of indeterminate cereal grains (Caseldine and Griffiths n.d.). At present, the

cereal remains have not been directly dated and their relationship to the burnt mound activity should be considered with caution until direct dating is undertaken.

To summarise, there is large quantity of archaeobotanical evidence from burnt mound sites in Wales; however, on closer inspection, it is evident that the quality of the dataset is often extremely limited, particularly in terms of dating evidence. Subsequently, only a portion of the evidence can be used in comparative analyses.

## AGRICULTURE DURING THE 2<sup>ND</sup> MILLENNIUM BC

In terms of settlement patterns and subsistence practices, the transition from the Late Neolithic to Early Bronze Age in Britain is to some extent characterised by continuity rather than change. Settlement evidence has proven difficult to identify – pits, post-holes and occasional fragmentary remains of structures represent the norm over much of the country, paralleling the Neolithic (Brück 1999, 2000; Halsted 2007). Equally, the exploitation of wild plants clearly persists, whilst evidence for large concentrations of cereals continues to remain rare (Campbell and Straker 2003; Pelling and Campbell 2013). In contrast, there is evidence for widespread changes in the social and economic organisation of the landscape by the Early-Middle Bronze Age transition (c.1500 BC) across southern England (Brück 2000), including the development of field systems and farmsteads which are considered to be coeval with or predicated upon an assumed major period of agricultural intensification (e.g. Barrett 1994:146-153; Richmond 1999:112-113; Yates 2007:120-121; Bradley 2007:181-93; Stevens and Fuller 2012). However, this generalised model is synonymous with southern England and the timing, nature and tempo of changes in agriculture between the Late Neolithic and Late Bronze Age are less clearly defined in other regions (Roberts 2013). The basis of this model is critically evaluated in a Welsh context, assessing the evidence for changes in agriculture and its relationship to wider societal changes.

It is accepted that most people during the Bronze Age were farmers and subsequently any interpretations of socio-economic change must by necessity take into account the nature of agricultural practices. However, understanding the nature of agricultural practices in Wales is problematic as despite a substantial quantity of evidence from funerary and burnt mound sites, particularly for the Earlier Bronze Age, there is a significant paucity of

comparative evidence from settlement contexts. Moreover, the acidic soil conditions present over much of Wales inhibit the survival of animal bone and subsequently pollen records and charred plant remains represent the primary mechanisms for understanding farming practices in this period.

Early to Middle Bronze Age pollen records are variable, although the available evidence is generally considered to reflect progressive woodland clearance and a predominantly pastoral economy with limited cereal cultivation (e.g. Caseldine 1990a, 2014a; Smith 1991; Brown 2013). Assessing the arable component of economies purely on the basis of pollen data is problematic as cereal-type pollen is likely to be underrepresented in pollen diagrams due to the poor production and dispersal of cereal pollen (Hall 1987) and the difficulty of distinguishing cereal-type pollen from wild grasses (Edwards and Hiron 1984; Brown 2007b). Charred cereal grains provide the most direct evidence for agricultural practices during this period.

Table 17 summarises plant remain evidence from Wales for the period c.2200 – 1150 cal BC (Early Bronze Age – Middle Bronze Age). Late Neolithic-Early Bronze Age evidence for Wales is restricted to occasional cereal grains, primarily barley, and hazelnut shell fragments from pits (Table 17) and this pattern is paralleled in contemporary sites across southern and central England (e.g. Ede 2005; Davies 2006; Giorgi 2006; Jones 2006, 2012; Hall and Huntley 2007; Clapham 2008; Monckton 2009, 2012; Fryer 2012; Stevens and Wyles 2015; see however, Carruthers 2009b). Burnt mounds provide a proxy settlement record for this period, although they have produced virtually no evidence for cereals<sup>8</sup> despite the ubiquity of the features and extensive programmes of sampling (Schmidl et al. 2008; Challinor et al. 2014; Hart et al. 2014). The relationship between burnt mounds and settlements is unclear (Kenney 2012) and, subsequently, the evidence from these sites cannot be considered representative of typical domestic settlement activity (cf. Halsted 2007: 176). Due to the rarity of cereals in Late Neolithic to Early Bronze Age contexts in Wales, it is possible that the cereal grains at some sites are intrusive (see Pelling et al. (2015)). Direct dating of cereal grains is necessary to

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<sup>8</sup> There is strong evidence to suggest that cereals in burnt mound sites are often intrusive or residual as noted above. For examples see, Parc Bryn Cegin Burnt Mound 2176 and Feature 7055 (Schmidl et al. 2008; Marshall et al. 2008) and Glan-Rŷn Bridge Burnt Mound 506012 (Hart et al. 2014)

understand the significance of cereals during this period, although there are currently only a very small number of dates on cereal grains for Wales (Table 6).

Early Bronze Age evidence for cereals is equally sparse in Wales, with small quantities of cereal remains, primarily barley, and hazelnut shells present (Table 17) and a similar pattern of low densities of cereal grains is evident for sites in England (e.g. Hinton 2004/05, 2006; Carruthers 2006a; Hall and Huntley 2007; Smith 2010), with some exceptions (e.g. Ratcliffe and Straker 1996; Carruthers 1990; Pelling and Campbell 2013). Occasional cereal remains have been identified in Earlier Bronze Age funerary and ceremonial sites (Jessen and Helbaek 1944; Briggs et al. 1990; Williams 1999; Foster et al. 2011; Caseldine et al. 2013b; Kirk and Williams 2000; Fig.16), probably reflecting unintentional incorporation resulting from background settlement noise. In contrast, a cremation at Llanilar, south-west Wales, was rich in cereals, including emmer/spelt wheat grains and spelt wheat chaff (Caseldine 1997). Spelt wheat is present in south-eastern England by the Early Bronze Age (Martin et al. 2012), although it typically dates to the Middle Bronze Age in southern England (Pelling and Campbell 2012) and the identification at Llanilar (Caseldine 1997) could therefore represent an early record which should be confirmed by direct dating. Cereals in funerary and ceremonial sites typical cannot be considered representative of agricultural practices, although their presence indicates their use and presumably cultivation even if settlement activity remains largely absent.

In comparison to the Early Bronze Age, there is greater evidence for settlement activity during the Later Bronze Age, although few settlements have been excavated (Ghey et al. 2007). Subsequently, there is little archaeobotanical evidence associated with settlement contexts, hindering detailed analyses of agriculture in this period. Cereal remains are present at a number of sites (Table 17) including middle-late Bronze Age roundhouses which have produced small assemblages of cereal grains, primarily barley (Caseldine 2001; Caseldine and Griffiths 2004). A roundhouse at Glanfeinon, central Wales, produced a large assemblage of cereal grains (Britnell et al. 1997), comprising of a cache of >5000 naked barley grains and smaller quantities of hulled barley, barley and emmer grains and chaff in addition to a possible flax seed and weed seeds (Britnell et al. 1997). Arable weed flora are sparse for this period and we have little understanding of how crops were cultivated. There is potential to undertake stable isotope analysis (nitrogen and carbon) on charred cereal grains with analysis of arable weed flora to investigate

cultivation practices and land-use patterns (Fraser et al. 2011; Bogaard et al. 2013; in press). For example is there a shift in the scale and intensity of cultivation?

The evidence from Glanfeinon displays some remarkable similarities to assemblages of cereal grains associated with roundhouses in south-west England at Rowden (Carruthers 1991), Trethellan (Straker 1991) and Bestwall Quarry (Carruthers 2009b) which all produced large concentrations of naked barley. The prevalence of barley in Later Bronze Age Wales is paralleled at a number of sites in south-western England (e.g. Carruthers 1991, 2009; Straker 1991; Ratcliffe and Straker 1996; Jones 2004; Pelling 2011), possibly contrasting contemporary settlements in south-eastern England dominated by emmer and spelt wheat (e.g. Pelling 2003; Carruthers 2006b, 2010), although there are some exceptions to this pattern (e.g. Hinton 1982, 2002; Jones 2012). Barley is more tolerant than wheat of environmentally marginal conditions present across these regions (Campbell and Straker 2003: 24), suggesting that farmers perceived and adapted to these different environmental conditions.

Wales has traditionally been viewed as an upland and marginal area of Britain (Fox 1932) and there is a prevailing view that pastoralism dominated the economy from the Later Bronze Age onwards (Briggs 1985; Lynch et al. 2000: 138). A pattern is emerging for the Later Bronze Age in the Severn Estuary where detailed archaeological and palaeo-environmental studies indicate intensive settlement and suggest the development of seasonal transhumant pastoralism (Bell 2013). Evidence for cultivated crops is very rare in settlement sites (Caseldine and Druce 2001; Caseldine et al. 2013), whilst pollen records (Nayling and Caseldine 1997; Caseldine 2000; Brown 2013) alongside other lines of evidence for animal husbandry support a view of a pastoral economy (Bell 2013). However, this pattern may not be applicable to other areas outside the wetland-dryland interface and the tendency to view Wales as agriculturally marginal and unsuitable for cereal cultivation is simplistic and overlooks the areas of Wales with soils suitable for cultivation (Lynch et al. 2000: 172; Roberts 2013: 532). The general paucity of evidence for cereals in Later Bronze Age Wales is probably linked to the limited evidence for settlement sites - roundhouses in southern England tend to produce large assemblages of cereal grains for this period (Campbell 2011). The attribution of a largely pastoral regime for Later Bronze Age Wales should, therefore, be treated with caution until larger numbers of well-dated roundhouses (on the dryland) are excavated and sampled for charred plant remains, as the example of Glanfeinon attests (Britnell et al. 1997).

There is currently little evidence for a widespread intensification of agriculture across the Early-Middle Bronze Age transition in Wales as has been postulated central-southern England (cf. Barrett 1994:146-153; Richmond 1999:112-113; Yates 2007:120-121; Bradley 2007:181-93; Stevens and Fuller 2012). There are indications of changes during this period, such as an expansion in the settlement record and hints of changes in the agriculture; however, at present the dataset for Wales is too limited to analyse in detail the nature of agricultural practices. Despite these limitations, some interesting questions and avenues for further research are beginning to emerge. The evidence from Wales may be at odds with the pattern for central-southern England: roundhouses settlements are generally not a feature of the Middle Bronze Age, with most dated to the Late Bronze Age-Early Iron Age (Ghey et al. 2007), whilst evidence for field-systems remains conspicuously absent (Makepeace 2006), with the exception of a few undated examples (Chadwick et al. 2003). Were settlement patterns and, therefore, farming practices less intensive in Wales than central-southern England? It remains to be tested whether this pattern is a true reflection of differences or whether further archaeological research and development-driven investigations will change this view.

The overview of evidence presented above is largely descriptive and has focused on identifying evidence for changes in agriculture and, as Brück (2000: 295) notes, it remains difficult to explain these changes within a wider social context and, subsequently, this section has perhaps raised more questions than it answers.

## RESEARCH AGENDA: POTENTIAL AND PRIORITIES

For the Earlier Bronze Age, a large quantity of archaeobotanical evidence has been analysed from funerary and ceremonial sites and there is a significant paucity of evidence from domestic sites. A relatively large quantity of archaeobotanical evidence has also been analysed from burnt mound sites; however, on closer examination much of the evidence is poorly dated and cannot be used in comparative analyses.

In terms of agriculture, we have a very basic understanding of the crops which were cultivated from the Early to Late Bronze Age in Wales, although variations in the relative importance of different cereal types (i.e. wheat vs. barley) both chronologically and geographically cannot be examined in detail as they have been for other areas of Britain

(cf. Campbell and Straker 2003). On a more detailed level, whilst we know that cereals formed an element of agricultural systems, the nature of farming practices is extremely poorly defined and current interpretations are overly reliant on evidence from pollen records. Evaluating the nature of farming practices is pivotal for understanding settlement patterns and how landscapes were exploited; for example - what was the relative importance of pastoralism and arable agriculture? Is there an intensification in arable and pastoral regimes in the early-mid 2<sup>nd</sup> millennium BC as suggested for southern England? Are there regional differences in the nature of agricultural practices? What is relationship between agricultural practices and settlement patterns? Detailed archaeological and palaeo-environmental research in the Severn Estuary have demonstrated the potential for detailed analyses of agricultural practices to be developed with implications for understanding the activities which structured daily life (Bell 2013).

It is this author's opinion that a detailed and accurate understanding of daily life during the Bronze Age must be grounded within a firm understanding of agricultural practices. We are currently a long way from achieving this aim in Wales, highlighting the requirement for the excavation of new sites and the generation of larger archaeobotanical datasets.

## CONCLUSIONS AND RECOMMENDATIONS

1. There is very little evidence from settlement sites. Bulk-sampling and flotation must be a high priority during the excavation of any new settlement sites. Large numbers of samples should be analysed from contexts associated with roundhouses as these have proved to be an important source of cereals in Wales (e.g. Glanfeinon (Britnell et al. 1997) and in southern England (Campbell 2011).
2. The possibility of agricultural intensification during the Later Bronze Age needs to be examined in greater detail (cf. Barrett 1994:146-153; Richmond 1999:112-113; Yates 2007:120-121; Bradley 2007:181-93; Stevens and Fuller 2012).
3. Direct dating of cereal grains is necessary to evaluate the importance of cereals during the Early Bronze Age and to assess the timing of the introduction of new crop species such as spelt wheat. Problems of contamination in archaeobotanical

assemblages, particularly for the Earlier Bronze Age, also need be evaluated through direct dating (cf. Pelling et al. 2015).

4. The nature of agricultural practices and land-use patterns during this period should be evaluated through the analysis of weed seeds and stable isotope analysis on charred cereal grains (cf. Fraser et al. 2011; Bogaard et al. 2013, in press; Bogaard 2014).
5. Archaeobotanical and palynological analyses may be combined in the investigation of Earlier Bronze Age funerary sites to identify plants placed with burials (such as meadowsweet (Noble and Brophy 2011b; Caseldine 2013b; Caseldine and Griffiths 2013c)).
6. Phasing for archaeobotanical evidence associated with burnt mounds needs to be established. These site-types have produced evidence for intrusive and residual cereal grains and inconsistent radiocarbon dates.
7. An integration of charcoal and palynological analyses in burnt mounds to provide detailed reconstructions of woodland composition and exploitation (cf. Caseldine and Murphy 1989; OCarroll and Mitchell 2013; Grant 2014; Hart et al. 2014; Wheeler et al. in press).

## Chapter 7:

### IRON AGE WALES (c. 800 BC – AD 100)

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#### INTRODUCTION AND BACKGROUND

The transition from the Late Bronze Age to Early Iron Age (c. 800 BC) was a period of climatic downturn, with a shift towards wetter and cooler conditions between 800 – 600 BC (Caseldine 1990a: 55-56; Brown 2008; Charman 2010). The impact of this climatic change on societies in Wales is poorly understood (Waddington 2013: 14, 66-67), and there was possibly a decline in agriculture with settlement abandonment, particularly in upland areas (Savory 1980: 33; Burgess 1985; Davies and Lynch 2000: 141). Pollen records suggest that responses to this climate change were varied, with some areas witnessing woodland regeneration and possibly settlement abandonment, particularly at higher (>150m) altitudes, whereas other records suggest continuity in land-use (Dark 2006; Woodbridge et al. 2012; Caseldine 2014a). It is difficult to identify and characterise earlier first millennium BC settlements in Wales, with most activity seemingly restricted to small hillforts/enclosed settlements (Davies and Lynch 2000: 152-154; Murphy and Mytum 2012; Waddington 2013: 97-102); however, unenclosed settlements (e.g. Hughes 1996), isolated post-built roundhouses (e.g. Locock et al. 2000; Kenney 2008) and other ephemeral traces of activity (e.g. Jones 2009; Groom et al. 2011) caution against this interpretation, indicating that there were also other, less visible, settlements. However, large-scale development-driven investigations in north-west Wales have identified limited evidence for Earlier Iron Age activity, compared to frequent unenclosed Later Iron Age settlements (e.g. Davidson et al. 2007; Kenney 2008; Cuttler et al. 2012). Taken together, this suggests that areas of Wales were probably less densely settled in the Earlier Iron Age as in the Later Iron Age. Due to the limited settlement record for the Earlier Iron Age, it has been noted that the social and economic organisation of the landscape is poorly understood (Gwilt 2003).

During the Later Iron Age, there is a marked increase in settlement sites across Wales probably reflecting a population growth and the increased visibility of settlements as many sites are enclosed during this period (Davies and Lynch 2000: 172; Ghey et al.

2007; Murphy and Mytum 2012; Waddington 2013: 102-106). In some areas, hillforts/enclosed settlements were constructed, or expanded upon, with seemingly dense spreads of occupation (Davies and Lynch 2000:154-155), although very few of these sites have been subject to large-scale detailed modern excavation and even fewer excavations have been published (Gwilt 2003). Cropmark and excavation evidence clearly indicate a densely settled landscape with small enclosed settlements/farmsteads representing typical settlement evidence, rather than hillforts, with some excavated examples indicating continuity into the Roman period (Davies and Lynch 2000: 162-172; Murphy and Mytum 2012) In North Wales, recent development-driven excavations have identified large numbers of well-preserved unenclosed settlements, with activity beginning around c.400 BC and in many instances continuing into the Roman period (Davidson et al. 2007; Kenney 2008; Cuttler et al. 2012). In South-East Wales, there is substantial evidence to indicate that wetland areas were more intensively settled and exploited by the Later Iron Age (Bell et al. 2000; Howell and Pollard 2004). It has been suggested that there was an expansion in agriculture and population growth during the Later Iron Age in Wales, which is reflected in the development of new settlements (Davies and Lynch 2000: 172; Hughes et al. 2012: 252), although it remains unclear whether there was a population growth or a shift in settlement patterns (Williams 1988; Murphy and Mytum 2012).

## RESULTS

### OVERVIEW

In total, 47 Iron Age sites were identified, comprising of 17 Earlier Iron Age sites, 21 Later Iron Age sites and 9 Late Iron Age to Romano-British sites. For all the sites, plant remains have been analysed and charcoal has been identified for most sites. The charcoal assemblages are too small and of poor quality to allow even basic discussions concerning the use of woodland resources.

For most Iron Age sites only very limited sampling for archaeobotanical evidence has been undertaken, although in some instances this can be related to an absence of large-scale modern excavations on Iron Age sites in Wales. Moreover, relatively little evidence has been recovered from sites investigated during development-driven projects (e.g. Vaughan-Williams 2006; Asouti 2006; O'Brien 2014; Challinor et al. 2014). An

exception to this is the recent excavation of well-preserved Late Iron Age to Romano-British settlements north-west Wales in advance of development projects (Davidson et al. 2007; Kenney 2008; Kenney et al. 2011; Cuttler et al. 2012). However, whilst it is possible to establish a broad chronology for these settlements (i.e. a start date and end date), it is far more difficult to establish an accurate chronology for many of the internal features (Hughes et al. 2012: 252) resulting in poor quality archaeobotanical datasets which cannot be reliably phased. Taken together, the archaeobotanical dataset for Iron Age Wales is very limited in terms of dating evidence and the number of samples assessed.

Recent (and some ongoing) excavations have been undertaken at a small number of Iron Age sites may provide valuable contributions to the current archaeobotanical datasets, this includes projects at Llanmaes, south-east Wales (Caseldine and Griffiths 2005, 2006c, 2010b; Lodwick and Gwilt 2010), Penycloddiau Hillfort, north-east Wales (Mason and Pope 2012, 2013), Moel y Gaer, north-east Wales (Lock and Pouncett 2013) and Caerau Hillfort, south-east Wales (Wessex Archaeology 2013; Davis and Sharples 2013, 2014). Unfortunately, archaeobotanical evidence from a number of Iron Age sites has never been published including Dinorben, Moel Hiradaug Castell Henllys and Caer Cadwgan, despite the inclusion of these sites in Caseldine's review (1990a) 25 years ago.

#### EARLIER IRON AGE SITES (c. 800 – 400 BC)

There is extremely limited archaeobotanical evidence, both in the quantity and quality of the dataset, from a small number of settlement sites and/or associated features (i.e. pits, post-holes, ditches) which can be reliably dated to the Earlier Iron Age. Archaeobotanical evidence has been recovered from small circular enclosed settlements (e.g. Carrog (Caseldine et al. 2014a), Erw Wen (Williams in Kelly 1988), Moel yr Gerddi (Williams in Kelly 1988)), roundhouses at Parc Bryn Cegin (Roundhouse E) (Schmidl et al. 2008) and Chapelump II (Milles 2000)), hillforts/coastal promontory forts (e.g. Caer Seion (Caseldine and Griffiths 2011b), Porth y Rhaw (Caseldine and Griffiths 2011a), Great Castle Head (Caseldine 2001a)) and some sites with hints of Earlier Iron Age activity (e.g. Ffynnonwen (Caseldine 2012a), Brownslade (Carruthers 2011b), Hindwell Trapezoidal Enclosure (Elliot 2014)), Cwm Meudwy B (Caseldine and Griffiths 2006a,

b) and possibly at Bryn Maen Caerau (Caseldine 2001b). In general, only a very small number of features/contexts in sites can be dated to the Earlier Iron Age due to a paucity of radiocarbon dating evidence at most sites and the small number of Earlier Iron Age features identified.

Even less evidence has been recovered from sites not directly related to settlement activity, for example, ring ditches at Cwm Meudwy A (Caseldine and Griffiths 2006a, b) and a standing stone at Llanfechel (Caseldine and Griffiths 2013d, e).

#### LATER IRON AGE SITES (c. 400 BC – AD 100)

In comparison to the Earlier Iron Age, archaeobotanical evidence has been recovered from a larger number of Later Iron Age sites, although the evidence from many sites is still very limited in terms of the quantity and quality of the evidence, although there are some exceptions. In particular, archaeobotanical assemblages recovered from Breiddin (Hillman 1991a, b), Collfryn I (Jones and Milles 1989), Smithfield Livestock Market (O'Brien 2014) and Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/2 (Challinor et al. 2014) provide valuable information concerning crop husbandry during in the Later Iron Age.

As with the Earlier Iron Age, it is difficult to reliably phase many of the features/contexts at sites due to a paucity of radiocarbon dating evidence. Archaeobotanical evidence has been recovered from enclosed settlements (e.g. Collfryn I (Jones and Milles 1989), Collfryn II (Caseldine et al. 2012), Pembrey (Hillman 1981b), Bryn Eryr (Longley 1988), RAF St Athan (Vaughan-Williams 2006; Asouti 2006)), hillforts/coastal promontory forts (Breiddin (Hillman 1991a, b), Great Castle Head (Caseldine 2001a), Caer Seion (Caseldine and Griffiths 2011b), Llwyn Bryn-dinas (Fitt 1992) in addition to settlement related features (e.g. Smithfield Livestock Market (O'Brien 2014), Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/2 (Challinor et al. 2014), Brownslade (Carruthers 2011b)). Despite large-scale investigation at RAF St Athan, very few samples were analysed (Vaughan-Williams 2006).

Charred plant remains have been recovered from nine settlement sites spanning the Later Iron Age – Romano-British period, although the quality of the evidence at these sites is

generally very low as it is very difficult to precisely phase samples due to the difficulty of establishing an internal chronology for these sites (cf. Hughes et al. 2012: 252). This includes: Parc Bryn Cegin (Schmidl et al. 2008), Ffynnonwen (Caseldine 2012a), Cefn Du (Ciaraldi 2012), Cefn Cwmwd (Ciaraldi 2012), Woodside Camp (Caseldine and Holden 1998), Dan-y-Coed (Caseldine and Holden 1998), Penycoed (Nye 1985), Cefn Graenog (Hillman 1998) and Gwinlin Glan Morfa (Akeret 2007).

## DISCUSSION

### AGRICULTURE DURING THE 1<sup>ST</sup> MILLENNIUM BC

The Iron Age period witnessed significant changes in the nature and organisation of agriculture, reflected in a shift in the crops cultivated and changes in the scale of cereal cultivation (Campbell 2000; van der Veen and Jones 2006, 2007; Robinson and Lambrick 2009). A general shift in the cereals cultivated - from emmer to spelt wheat - is associated with an expansion in cultivable areas which enabled an intensification of agriculture (Jones 1981; Campbell 2000; Robinson and Lambrick 2009). In central-southern England, differences in the scale of cereal cultivation and consumption also begin to emerge, with an increase cereal grain-rich assemblages, suggesting a shift from subsistence farming to surplus production (van der Veen and Jones 2006, 2007; see also Hill (1995: 60-62), Jones (1996), Robinson and Lambrick 2009)). As agriculture formed the basis of Iron Age societies, changes in the nature and organisation of agriculture subsequently influenced wider social and economic changes which are reflected in the archaeological record, perhaps most notably in the development of a densely settled and farmed landscape (Hill 1995). To this end, if we are to begin 'understanding the Iron Age' in Wales, we must first begin by examining agricultural practices. The aim of this section is to outline the evidence for agriculture in Iron Age Wales and to begin to characterise agricultural practices, assessing variability and providing baseline for further research to develop upon.

Iron Age in Wales is widely viewed as a mixed farming economy (e.g. Williams 1988; Kelly 1988: 141; Britnell 1989: 116; Caseldine 1990a: 67; Musson 1991: 186; Davies and Lynch 2000: 172-177; Cunliffe 2005: 434-439; Henderson 2008: 45; Brown 2008: 178;

Murphy and Mytum 2012; Hughes et al. 2012), as in other areas of Britain (e.g. Campbell 2000; Robinson and Lambrick 2009). Climate, soil and geography are considered to have exerted a considerable influence on agricultural regimes and Wales has been divided into broadly pastoral upland central zone and mixed farming zone in the lowlands, coastal areas and borders, although the micro-regions will contradict this pattern (Williams 1988; Cunliffe 2005: 434, fig.16.12). The applicability of this model of land-use, which is based on historical analogues of land-use patterns, requires validation through archaeological evidence. Whilst we can infer that agricultural practices were mixed from the available evidence, it is extremely difficult to evaluate the importance arable agriculture versus pastoralism (Caselaine 1990a; Musson 1991: 186), particularly as differences in the relative quantities of cereal grains between sites cannot be directly equated with their dietary significance (van der Veen and Jones 2007: 425). Moreover, animal bones have rarely been recovered from Iron Age sites in Wales due to acidic soil conditions. Despite these limitations, a degree of specialism in agricultural practices has been suggested for south-west Wales and in the Severn Estuary, south-east Wales.

In south-west Wales, most sites were engaged in cereal cultivation to some extent; however, the frequently low density of cereal grains at many sites has led to the suggestion of a predominantly pastoral economy (Caseldine 2001a, 2011a; Murphy and Mytum 2012). There is requirement for extensive sampling programmes at more sites to confirm this pattern. Moreover, evidence for cultivation marks have been identified in coastal lowlands at Stackpole Warren (Benson et al. 1990) and Brownslade Barrow (Groom et al. 2011) providing strong evidence for cereal cultivation. It is possible that there were micro-regional differences in agriculture; for example, coastal lowlands, as at Brownslade Barrow and Stackpole Warren, are particularly suitable for cereal cultivation, whereas inland areas may have favoured pastoralism (Williams 1988). These differences may in turn be reflected in different settlement types (Williams 1988).

Table 18 summarises plant remain evidence from Wales for the Iron Age. In the Severn Estuary, south-east Wales, archaeological and palaeo-environmental research have led to a detailed understanding of agricultural practices and land-use (Bell et al. 2000). Small rectangular structures on the wetland-dryland interface been interpreted as short-lived settlements focused around the exploitation of the salt marshes for seasonal grazing (Bell 2000: 343). A single emmer/spelt spikelet fork recovered from a structure suggests that cereals cultivation was undertaken on the dryland and pollen records support this

interpretation (Caseldine 2000). Research on the English side of the Severn Estuary has also led to interpretation that this area was predominantly exploited for pastoral agriculture (Gardiner et al. 2002; Allen and Scaife 2010). Individual sites probably formed small components of broader farming systems (cf. Campbell 2000).

Arable agriculture appears to be focused purely on cereals and there is currently no evidence for legumes in Wales during this period, although this could reflect a preservation bias (Treasure and Church submitted). In central-southern England spelt wheat is to have gained a gradual ascendancy over emmer wheat, enabling an expansion in cultivable areas as spelt wheat is tolerant heavy clay soils (Jones 1981; Campbell 2000; Clapham 2008 and references therein; Robinson and Lambrick 2009)). There is, however, a growing body of evidence to indicate variability in crops cultivated; for example, emmer wheat is important crop at some sites (e.g. Stevens 2006, 2008; Carruthers 2014; Pelling 2013 and references therein) whilst for other sites, hulled barley is the dominant crop (Moffett 2004; Hall and Huntley 2007). For the Earlier Iron Age in Wales, spelt wheat, emmer wheat and barley are the most common crops, although it difficult to assess the relative importance of these different crops due to the paucity of evidence (e.g. Caseldine 2001a; Caseldine and Griffiths 2011a, b; Carruthers 2011b; Caseldine et al. 2014a). There is a greater quantity of evidence for the Later Iron Age, including the Late Iron Age to Romano-British period, although very few sites have been subject to large-scale and systematic sampling programmes.

In south-west Wales, spelt wheat is dominant with smaller quantities of barley, emmer wheat, bread wheat and possibly oats also present (Caseldine and Holden 1998; Caseldine 2001a, 2011a; Murphy and Mytum 2012) and Late Iron Age to Romano-British settlements at Woodside Camp and Dan-y-Coed were dominated by spelt wheat chaff (Caseldine and Holden 1998). In south-east Wales, the only site investigated<sup>9</sup> is at RAF St Athan and only two samples were analysed, producing a small quantity of wheat grains and spelt wheat chaff (Vaughan-Williams 2006). In central Wales, very small assemblages of emmer and spelt wheat have been recovered from some sites (Fitt 1992; Caseldine 2010; Caseldine et al. 2012; Elliot 2014), although a chaff rich assemblage (emmer and spelt wheat) was recovered from Collfryn (Jones and Milles 1989). A burnt cereal grain deposit at Breiddin was dominated by emmer wheat (Hillman 1991b), whilst

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<sup>9</sup> With the exception of Later Iron Age sites in the wetland-dryland interface in the Severn Estuary (Bell et al. 2000).

a post-hole at Smithfield Livestock Market was in rich cereal grains and spelt wheat chaff (O'Brien 2014). This latter site also produced evidence for field systems and plough scarring (Jones and Gwilt 2014). In north-east Wales, there are very few sites with archaeobotanical evidence. At Caer Seion, a context dated to the Later Iron Age produced only three emmer/spelt wheat grains and a single spelt wheat chaff fragment (Caseldine and Griffiths 2011b), whilst a single free-threshing wheat grain was recovered from Moel y Gaer (Caseldine and Griffiths 2013f). Emmer wheat was reportedly dominant at Dinorben (Hillman unpublished in Caseldine 1990a: 76).

For north-west Wales, there is a greater quantity of archaeobotanical evidence, although the dataset is still small and its quality variable. A pit at Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/2 produced a dense concentration of cereal grains (113 grains/litre) and some chaff, with emmer wheat dominant and other cereals included spelt wheat, barley (naked and hulled) and two free-threshing wheat grains (Challinor et al. 2014). Later Iron Age to Romano-British settlements have produced varying evidence for cereals, although the poor dating evidence prevents detailed assessments of the evidence. Cereals were sparse at Parc Bryn Cegin, including emmer wheat, spelt wheat, free-threshing wheat, barley and oats (Schmidl et al. 2008) and at Cefn Cwmwd and Gwinlin Glan Morfa cereals were sparse (Akeret 2007; Ciaraldi 2012). In comparison, Cefn Du produced abundant cereal remains, dominated by spelt wheat, with considerable evidence for free-threshing wheat, although only three samples were analysed and these can only be tentatively assigned to this period (Ciaraldi 2012). Spelt wheat is also reported to be dominant at Cefn Graenog (Monk and Fasham 1998).

In general, spelt wheat appears to be the dominant crop, particularly for the Late Iron Age to Romano-British period; however, emmer wheat rich assemblages are present at Breiddin (Hillman 1991b), Collfryn (Jones and Milles 1989), Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/2 (Challinor et al. 2014) and possibly at Dinorben (Hillman unpublished in Caseldine 1990a: 76). It is difficult to assess the significance of these assemblages as they have been recovered from burnt deposits and subsequently the evidence could be atypical. There are few contemporary sites in the Marches to provide a comparison with this evidence. Emmer/spelt wheat was identified at Wrekin hillfort, Shrewsbury, although the two species could not be distinguished due to poor preservation (Colledge 1984), whilst at Eaton Camp, Herefordshire (Carruthers 2014) and Conderton Camp, Worcestershire (Monckton 2005) emmer wheat was an important crop. There is

also a growing body of evidence to suggest that emmer continued to remain an important crop in some areas of southern England (e.g. Stevens 2006, 2008; Pelling 2013 and references therein). The cultivation of emmer wheat in Wales may be related to its slower diffusion from central-southern England in addition to climatic factors and regional differences in socio-economic organisation.

There are some differences in the nature of archaeobotanical assemblages recovered from some sites in Wales - at Collfryn (Jones and Milles 1989), Woodside Camp and Dan-y-Coed (Caseldine and Holden 1998), the by-products of cereal processing (chaff) are dominant, whereas the assemblages from Pembrey (Hillman 1981b), Breiddin (Hillman 1991b) and Pwllheli to Blaenau Ffestiniog Pipeline Plot 3/2 (Challinor et al. 2014) are grain-rich. The interpretation of chaff-rich versus grain-rich assemblages has received considerable discussion and van der Veen and Jones (2006, 2007) have convincingly argued that proportion of grains and chaff in is not related to whether sites were producers or consumers of cereals (cf. Hillman 1984; Jones 1985) or differences in processing (cf. Stevens 2003) but rather the scale of production. Cereal-grain rich assemblages are interpreted as representing large scale production and/or consumption (van der Veen and Jones 2006, 2007). Whilst it is possible that the differences in the archaeobotanical assemblages above could reflect differing scales of production, it is impossible to assess the significance of these differences due to the very small number of samples analysed for most sites.

Taken together, we have a very limited understanding of agricultural practices during the Iron Age in Wales (cf. Gwilt 2003: 104). At the most basic level we do not yet have a clear understanding of which crops were cultivated. Emmer wheat appears to have been an important crop in some areas at least and there appears to be a shift towards spelt wheat with free-threshing wheat also becoming increasingly important, particularly by the Late Iron Age to Romano-British transition. We cannot yet begin examining questions relating to changes in the nature and organisation of agriculture of agriculture; it is necessary to substantially increase both the quantity and quality of the dataset.

## RESEARCH AGENDA: POTENTIAL AND PRIORITIES

“Most Iron Age people were farmers, therefore a detailed understanding of how landscapes around settlements were farmed is necessary, in order to provide accurate pictures of life during the Iron Age.”

(Understanding the Iron Age: towards an agenda for Wales (Gwilt 2003: 108))

In 2003, the first research agenda for Wales identified the nature and organization of farming regimes as a key area of research for understanding Iron Age communities in Wales (Gwilt 2003). However, despite this it was noted at the time that little was known of farming regimes across Wales (Gwilt 2003: 108; see also Cunliffe (2005: 434)) and in many respects there has been little change in broad models of agricultural practices since Caseldine’s review 25 years ago (1990a). A general view of a mixed agricultural economy across the country (see above), with a preference towards pastoralism in some areas, has been widely suggested and this has changed very little.

A key challenge in evaluating arable agriculture and pastoralism in Wales is the extremely poor survival of animal bone and we must, therefore, rely on evidence from charred plant remains to reconstruct agricultural practices. Extensive sampling programmes are necessary to prove the limited evidence for cereals at some sites, rather than assuming this, and it is necessary to analyse a wide range of samples, as opposed to ‘cereal rich’ deposits which may produce atypical assemblages. Overall, the current dataset for the Iron Age is very limited and there is a requirement to collect larger datasets to investigate agricultural practices in greater detail. For example: Are there regional differences in the nature and organisation of agriculture? What was the relative importance of arable agriculture versus pastoralism? What is the relationship between different settlement types and agricultural practices? Were cereals traded as part of wider distributive networks? Research in central-southern England serves to illustrate the potential role of archaeobotanical datasets in understanding the role of settlements within broader farming systems and ultimately discussions of Iron Age society (e.g. Campbell 2000).

## CONCLUSIONS AND RECOMMENDATIONS

1. Extensive programmes of sampling to recover archaeobotanical evidence in conjunction with good dating evidence on even a single site would provide significant contributions to the current dataset. Sampling only 'rich' features may lead to unreliable interpretations. The recovery of negative evidence is still valuable.
2. Phasing Iron Age contexts is particularly problematic due to the general absence of material culture making it difficult to establish a date for archaeobotanical samples. Greater priority needs to be given to establishing *clear* dating evidence for samples, even if it is at the consequence of analysing a small number of samples.
3. The timing and nature of the transition from emmer wheat to spelt wheat should be investigated. There appears to be evidence for the continuing importance of emmer wheat in Wales.
4. Differences in the importance of cereal cultivation between different site-types (i.e. small enclosed settlements versus hillforts) and for different geographical zones should be investigated.

## Chapter 8:

### CONCLUDING REMARKS: KEY RESEARCH FINDINGS

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This thesis represents the first comprehensive and up-to-date review of archaeobotanical research for prehistoric Wales in over two decades. A total of over 300 archaeobotanical records were compiled spanning the Mesolithic to Iron Age. The dataset presented in this research is not intended to be viewed as an end in itself, it has aimed to raise questions to stimulate further research and highlight the significance and potential of archaeobotanical research to a wider archaeological audience, both specialist and non-specialist.

Three research aims were presented at the beginning of this thesis and this concluding section presents the key research findings in relation to these aims:

1. Critically review and summarise the current state of knowledge, focusing on the quantity and quality of the available evidence.
2. Identify major gaps in the current state of knowledge.
3. Highlight key priorities for future research.

#### ARCHAEOBOTANICAL RESEARCH IN PREHISTORIC WALES: KEY RESEARCH FINDINGS

- There is a large quantity of archaeobotanical evidence for prehistoric Wales (>300 sites); however, the dataset is unevenly distributed in terms of chronological and geographical coverage. In particular, there are very few Mesolithic, Middle to Late Bronze Age and Iron Age sites, whereas there are relatively large numbers of sites for the Neolithic and Early Bronze Age.
- The majority of archaeobotanical evidence is comprised of charred plant remains and charcoal. There are very few sites of waterlogged plant remains (n = 23; c. 7%) and plant pottery impressions even rarer (n = 4; c. 1%).
- The quality of the dataset is very variable. Very few sites have been comprehensively sampled. Dating evidence for sites is often poor and direct

radiocarbon dating of plant remains has only been undertaken for a small number of sites, especially for cereal grains.

- There has been a substantial increase in the quantity of archaeobotanical research within recent years in addition to an increase in the quality of evidence. These factors can be attributed to development-led projects.

#### MESOLITHIC: KEY RESEARCH FINDINGS

- There are extremely few Mesolithic sites and the majority of these sites are poor quality.
- The current state of knowledge predominantly based on evidence from Later Mesolithic sites at Goldcliff, south-east Wales ( Caseldine 2000; Dark 2007; Gale 2007). The possibility of plant management practices has been suggested (Bell 2007c).
- We have a very limited understanding of which wild plants and wood species were exploited, let alone questions concerning how wild plants and woodlands were exploited.
- A key problem identified with Mesolithic archaeobotanical evidence are intrusive and residual plant remains which have been frequently identified, emphasising the requirement of obtaining direct dates on plant remains.

#### NEOLITHIC: KEY RESEARCH FINDINGS

- A large quantity of archaeobotanical evidence is available for the Neolithic, including a number of very high quality sites. The quantity of evidence for this period can be attributed to development-led investigations, especially at Parc Bryn Cegin, north-west Wales (Schmidl et al. 2008).

- Radiocarbon dating evidence for the introduction of cereals was critically examined, placing the introduction of cereals from *c.* 3700 cal BC, although there are too few direct dates on cereal grains to evaluate this in more detail.
- The well traversed debate concerning the importance of cereal cultivation and wild plant gathering during the Neolithic (e.g. Cummings and Harris 2011) was considered in a Welsh context. It was argued that both cereals and wild plants were an important component of diets, with a possible Later Neolithic decline in the importance of cereals. Further research needs to focus on understanding how wild plants were exploited and how cereals were cultivated.
- Charcoal evidence for the Neolithic was limited and the contribution of this form of analysis to understanding woodland exploitation has been under-valued.
- Recommendations for further research included: directly dating cereals to investigate the introduction and diffusion of cereals; stable isotope analysis on charred cereal grains to examine agricultural practices; aDNA analysis on charred cereal grains to examine the introduction and diffusion of crops.

#### BRONZE AGE: KEY RESEARCH FINDINGS

- The majority of evidence has been recovered from funerary and ceremonial sites (for the Early Bronze Age), followed by burnt mounds and there are very few domestic sites.
- Charcoal evidence from funerary and ceremonial was examined and clear evidence for the specific use of oak in cremations was identified, paralleling results from research elsewhere (e.g. Smith 2002; Gale 2006, 2008).
- For burnt mounds, the potential of undertaking charcoal analysis was outlined in terms of reconstructing woodland composition and exploitation. However, evidence intrusive/residual plant remains and charcoal appears to be frequent in

burnt mounds and this must be taken into account in the analysis of archaeobotanical evidence from these sites.

- In terms of agricultural practices, a period of continuity from the Late Neolithic to Early Bronze Age could be defined, with cereals remaining very rare. For the Middle and Late Bronze Age, evidence for cereals increases; however, there is little evidence to support a proposed agricultural revolution in the Middle Bronze Age (c. 1500 cal BC) (e.g. Barrett 1994:146-153; Richmond 1999:112-113; Yates 2007:120-121; Bradley 2007:181-93; Stevens and Fuller 2012). There is a requirement for further evidence from domestic contexts.

#### IRON AGE: KEY RESEARCH FINDINGS

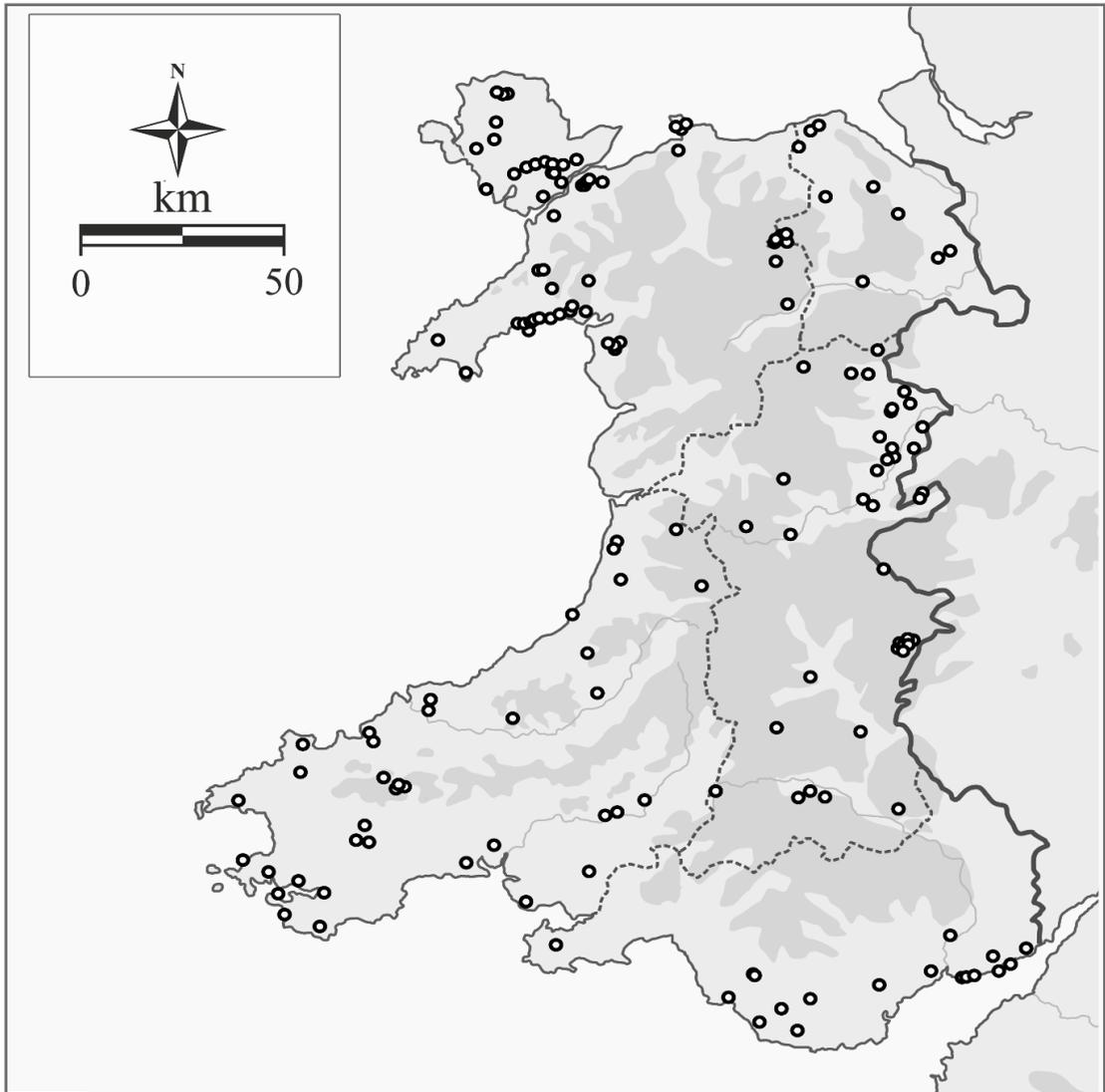
- There are only a small number of Iron Age sites and the quality of the dataset is generally very low. Very few sites have been comprehensively sampled.
- Phasing Iron Age contexts is very difficult due to the general absence of material culture and dense spreads of occupation over long time periods. Subsequently, establishing a date for archaeobotanical evidence is difficult.
- There appears to have been a gradual replacement of emmer wheat by spelt wheat in the Later Iron Age, especially for sites spanning the Later Iron Age to Romano-British period. However, emmer wheat continues to remain important in sites during the Later Iron Age.
- There is currently insufficient evidence to examine difference in crop husbandry between different site-types (i.e. small enclosed settlements compared to hillforts) and different geographical regions.

# FIGURES

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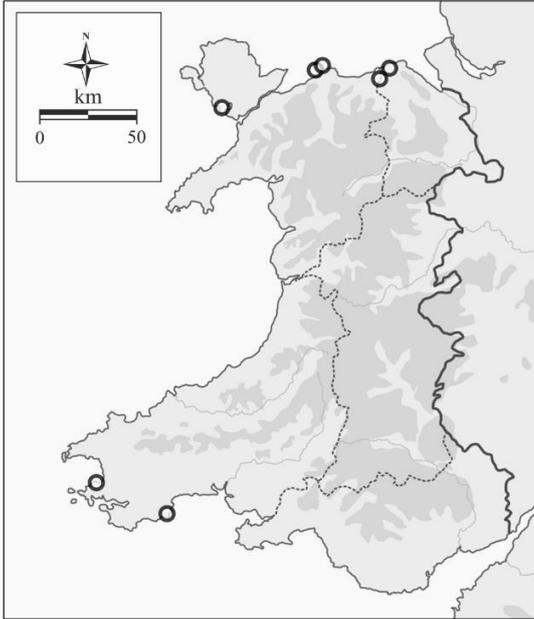


*Figure 1: Location of the study area.*

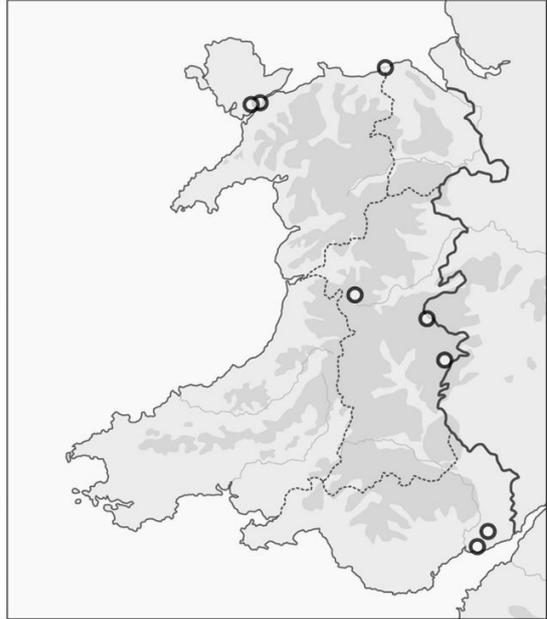


*Figure 2: The total database (315 sites).*

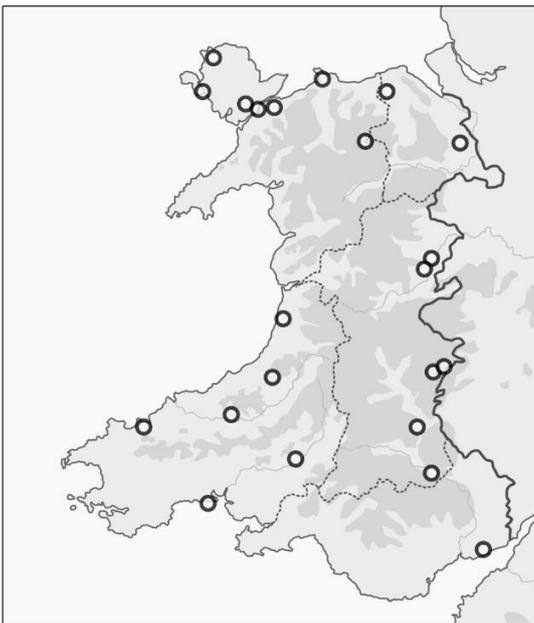
Early Mesolithic sites



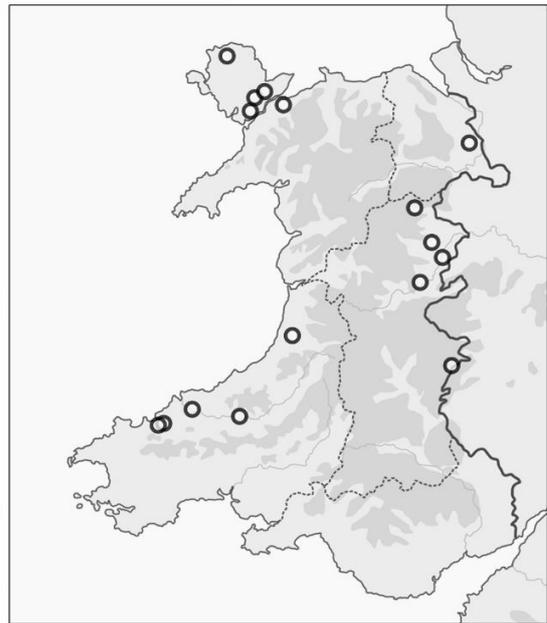
Late Mesolithic sites



Early Neolithic sites

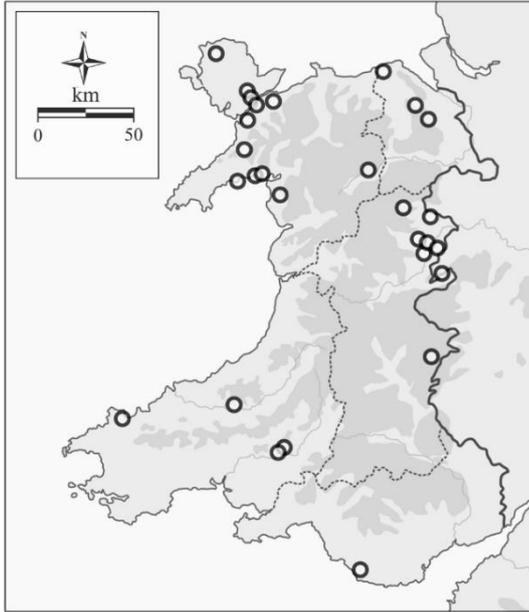


Middle Neolithic sites

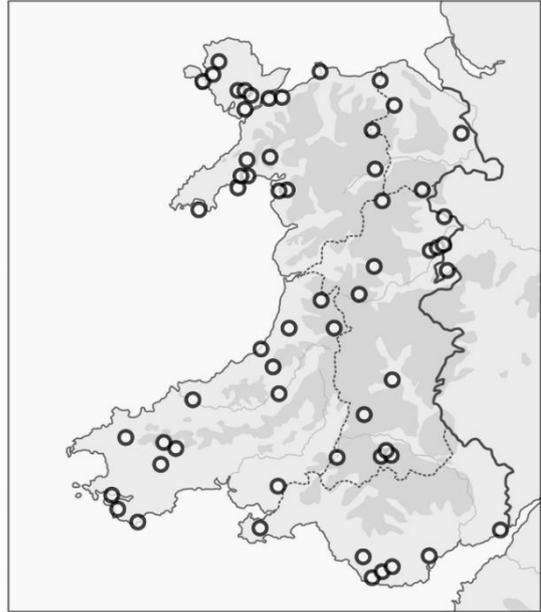


*Figure 3: The sites plotted by period.*

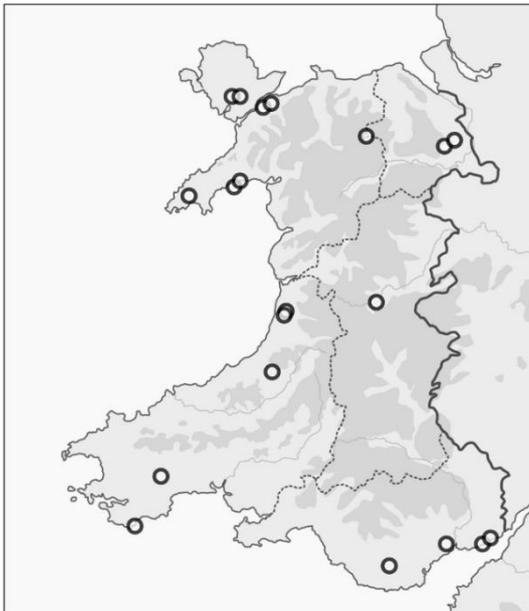
Late Neolithic sites



Early Bronze Age sites



Middle Bronze Age sites



Late Bronze Age sites

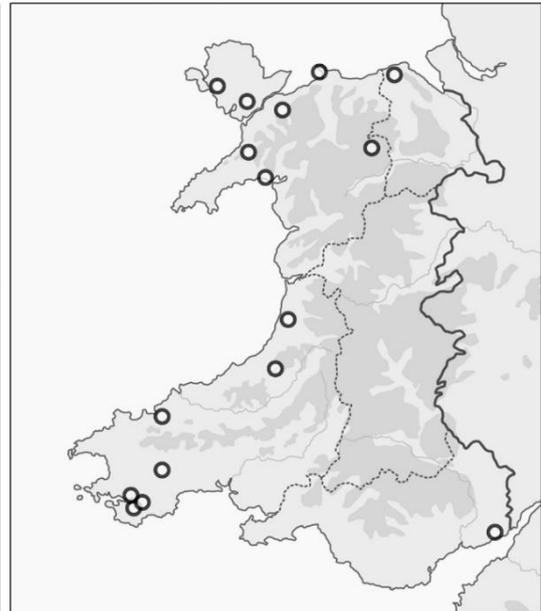
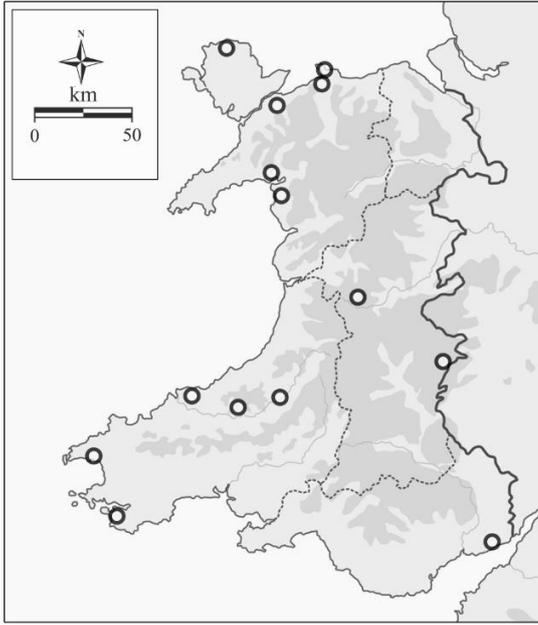


Figure 3 continued

Earlier Iron Age sites



Later Iron Age sites

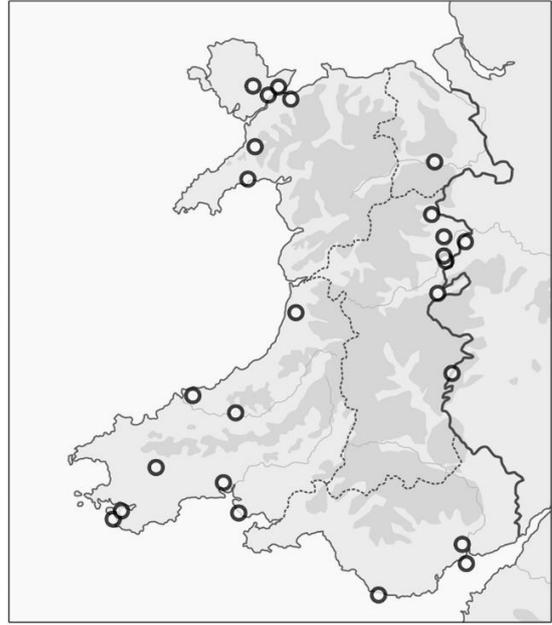
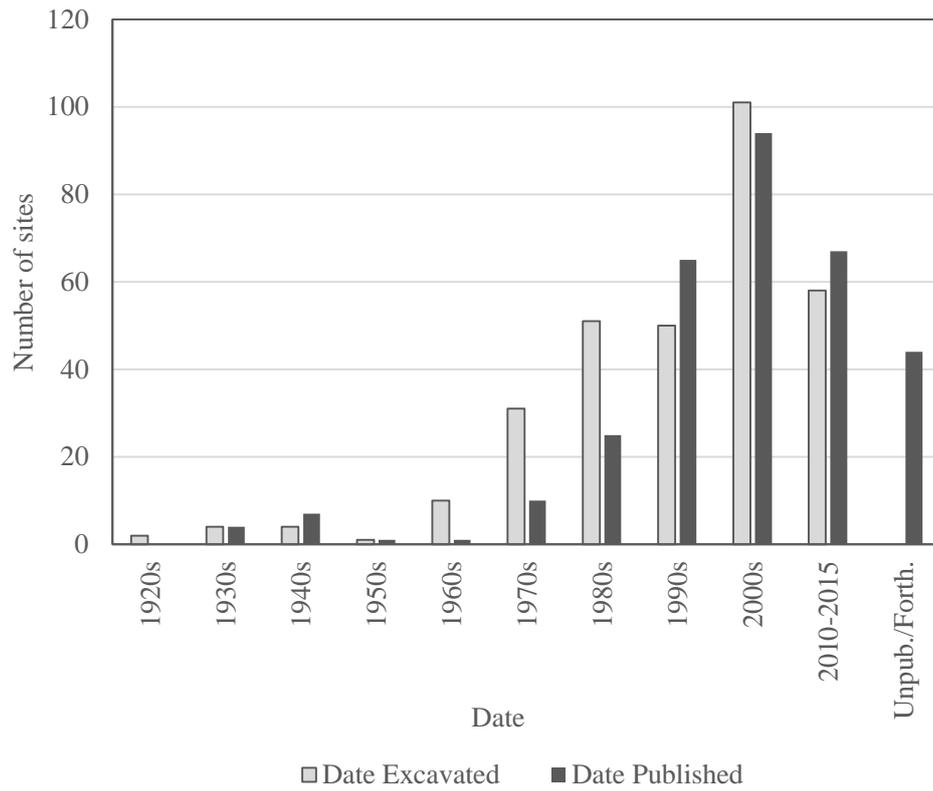
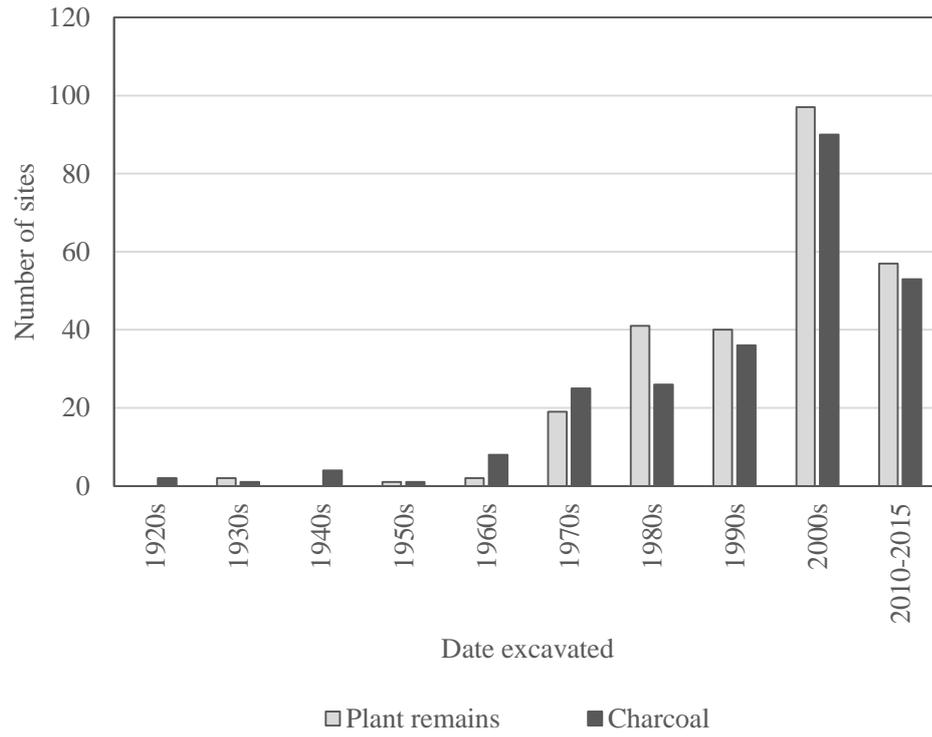


Figure 3 continued



*Figure 4: The quantity of archaeobotanical research undertaken by date of excavation and date published*



*Figure 5: The quantity of archaeobotanical research on plant remains and charcoal by date of excavation.*

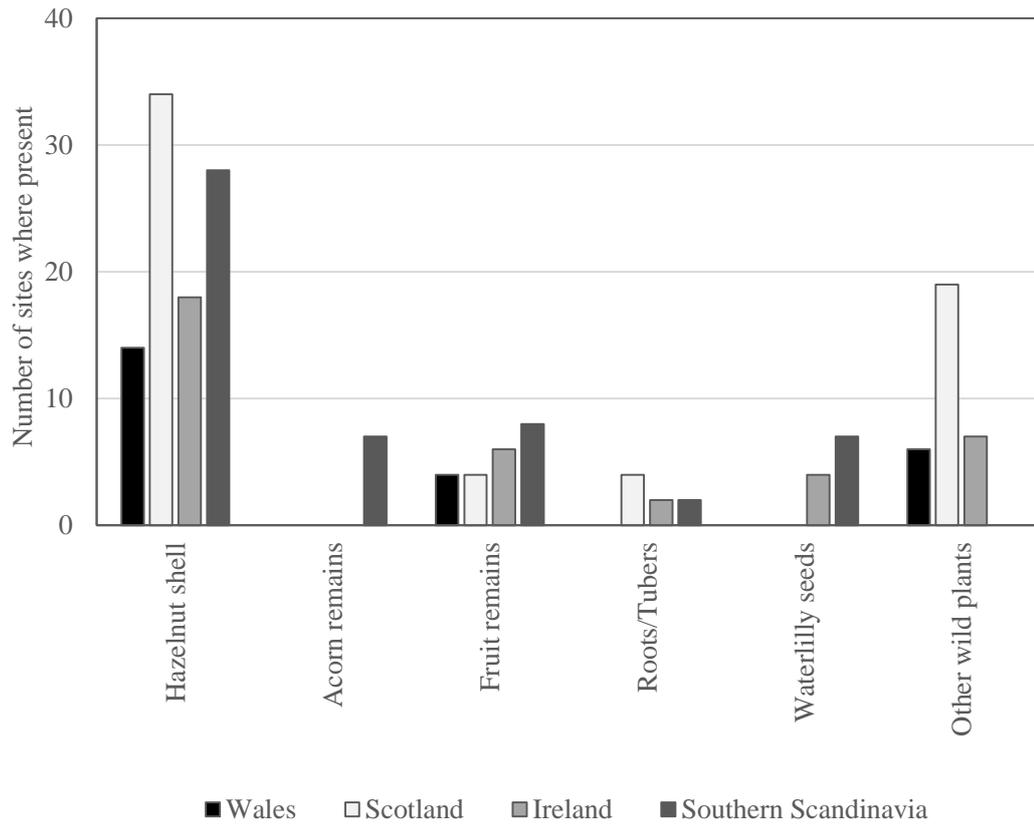


Figure 6: Plant remains from Mesolithic sites in Wales, Scotland (Bishop et al. 2014), Ireland (Warren et al. 2014) and southern Scandinavia (Robinson 2007).

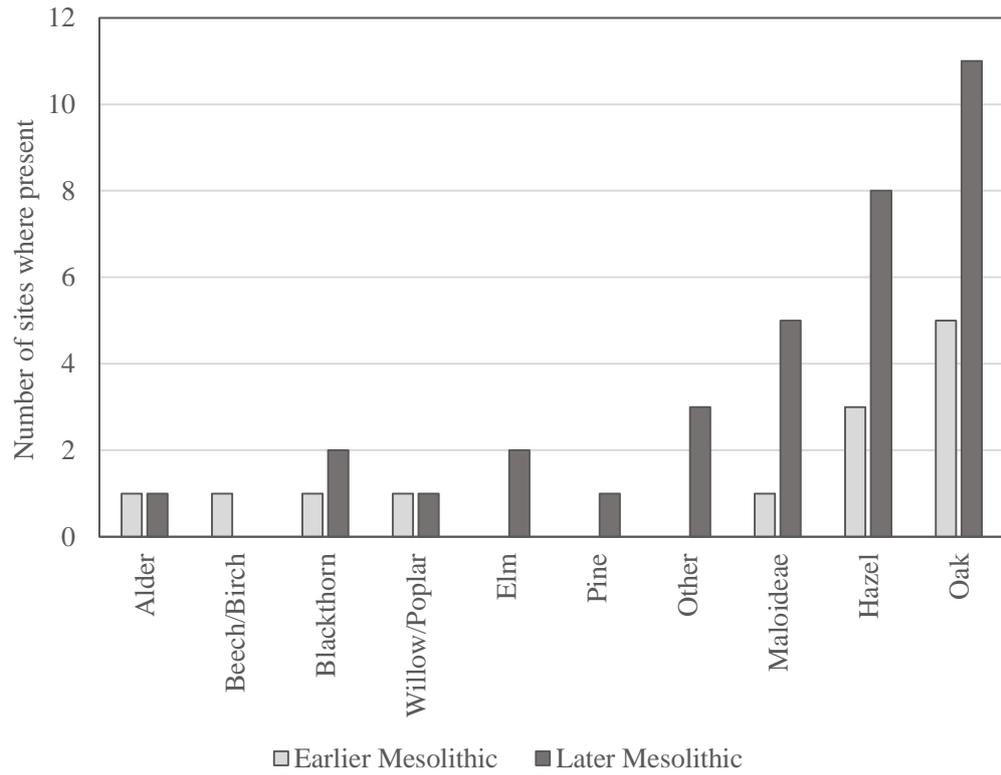
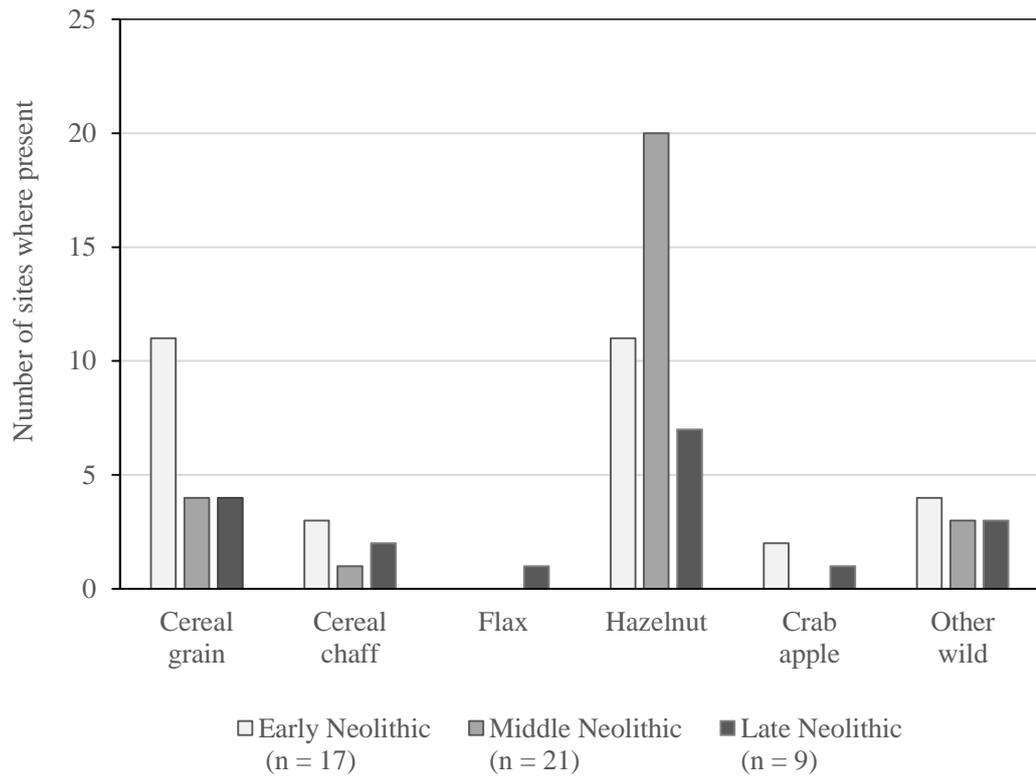


Figure 7: Charcoal evidence for the wood species exploited in Mesolithic sites.

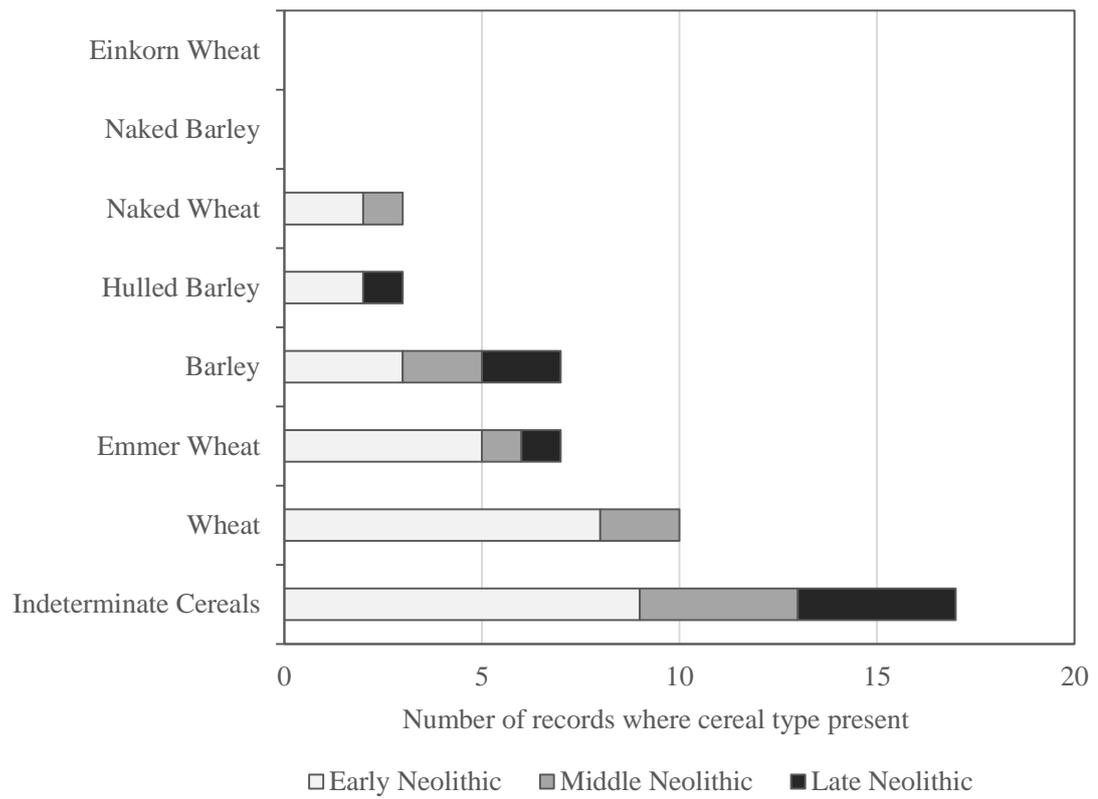


*Figure 8: Wild plant species present in the Mesolithic assemblages at Goldcliff, south-east Wales (Caseldine 2000; Dark 2007).*

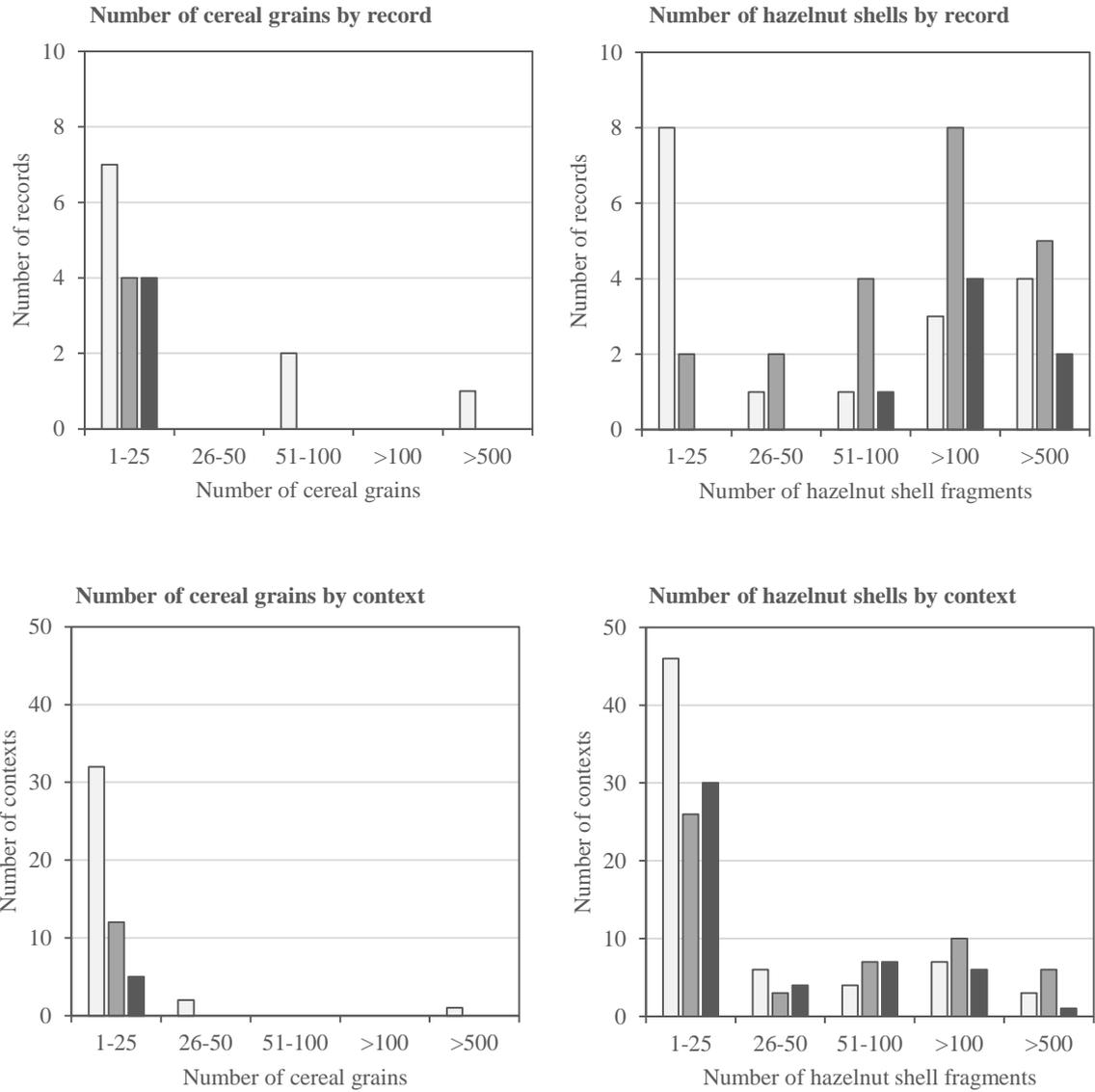
Top left: elderberries (*Sambucus nigra* L.). Top right: blackberries (*Rubus fruticosus* L. agg.); Bottom left: hazelnut shell (*Corylus avellana* L.). Bottom left: Crab apples (*Malus sylvestris* (L.) Mill.). These species may all have grown at the woodland edge/woodland openings and their growth could have been manipulated through deliberate clearances. Photographs by the author.



*Figure 9: Summary of plant remains recorded in Neolithic sites.*



*Figure 10: Cereal remains in Neolithic sites*

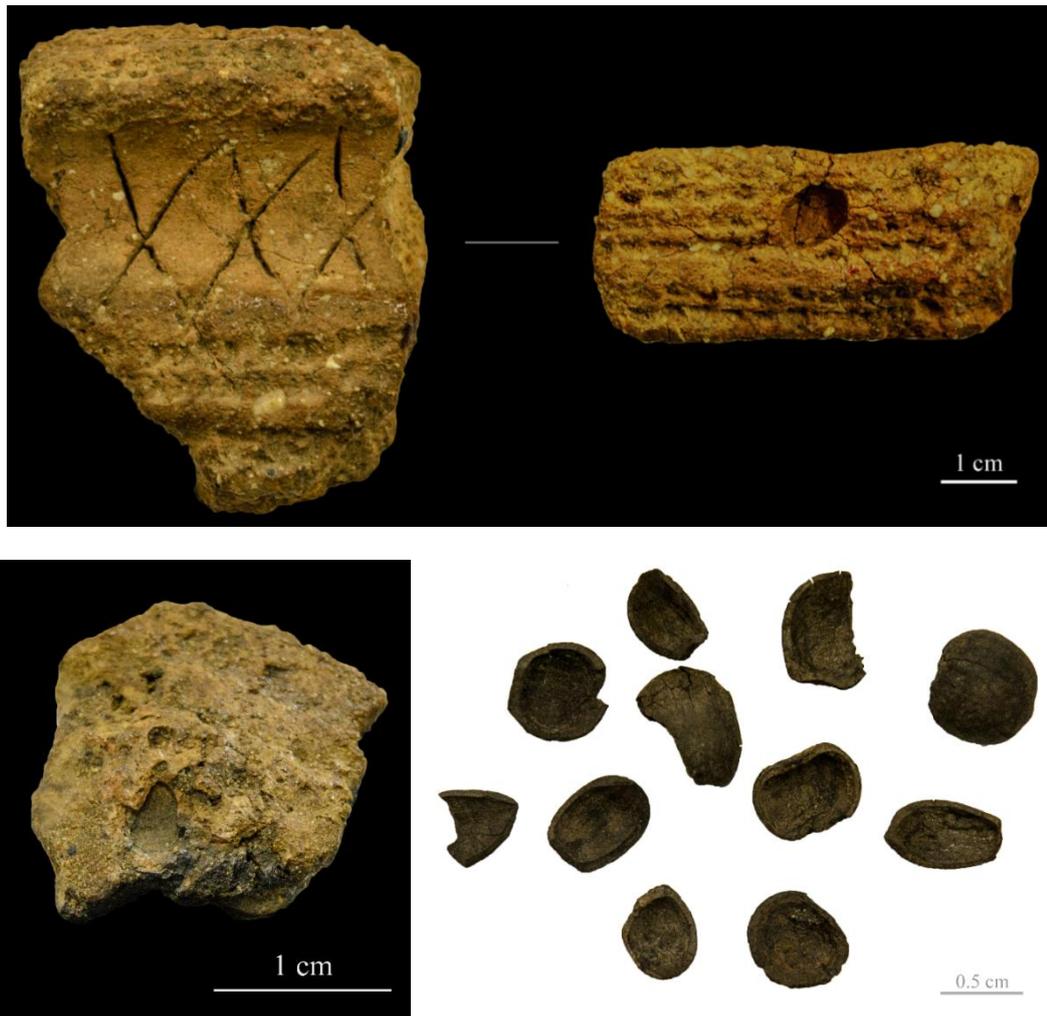


*Figure 11: Quantities of charred cereal grains and charred hazelnut shells in Neolithic sites on a site-by-site basis (top) and a context-by-context basis (bottom).*



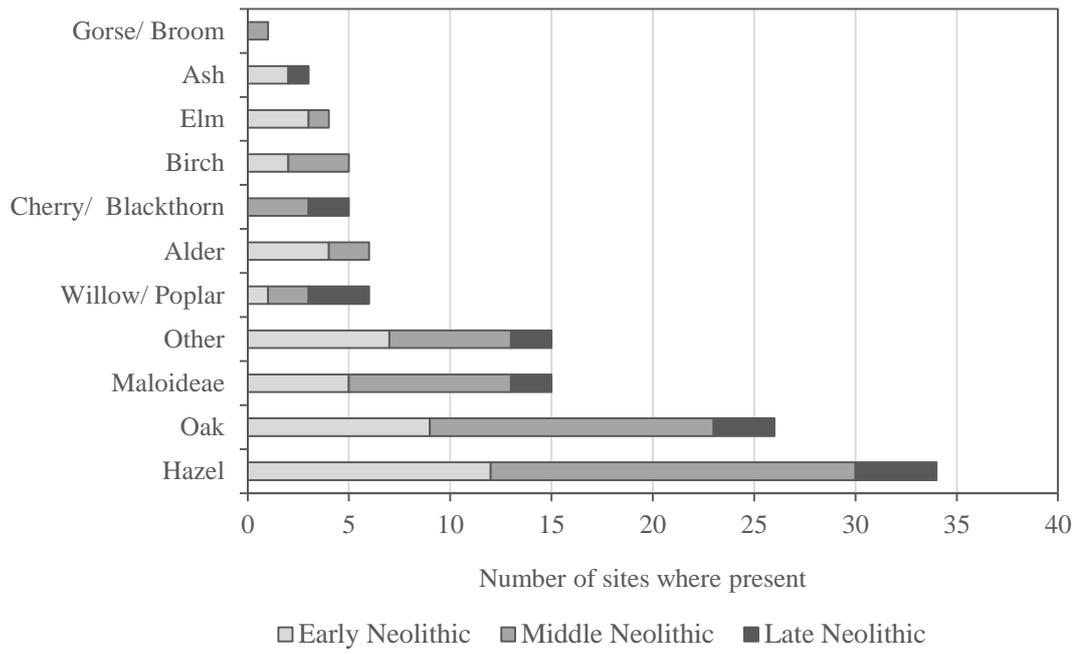
*Figure 12: Photographs of plant remains from Early Neolithic sites.*

Charred hazelnut shell fragments (left) (*Corylus avellana* L.) from an Early Neolithic rectangular structure at Parc Bryn Cegin, north-east Wales (Kenney 2008a). Charred emmer wheat grain (right) (*Triticum dicoccum* Schübl) from an Early Neolithic rectangular structure at Gwernvale, central Wales (Britnell 1984). Both photographs taken by the author with the permission of Gwynedd Museum and Art Gallery for Parc Bryn Cegin.

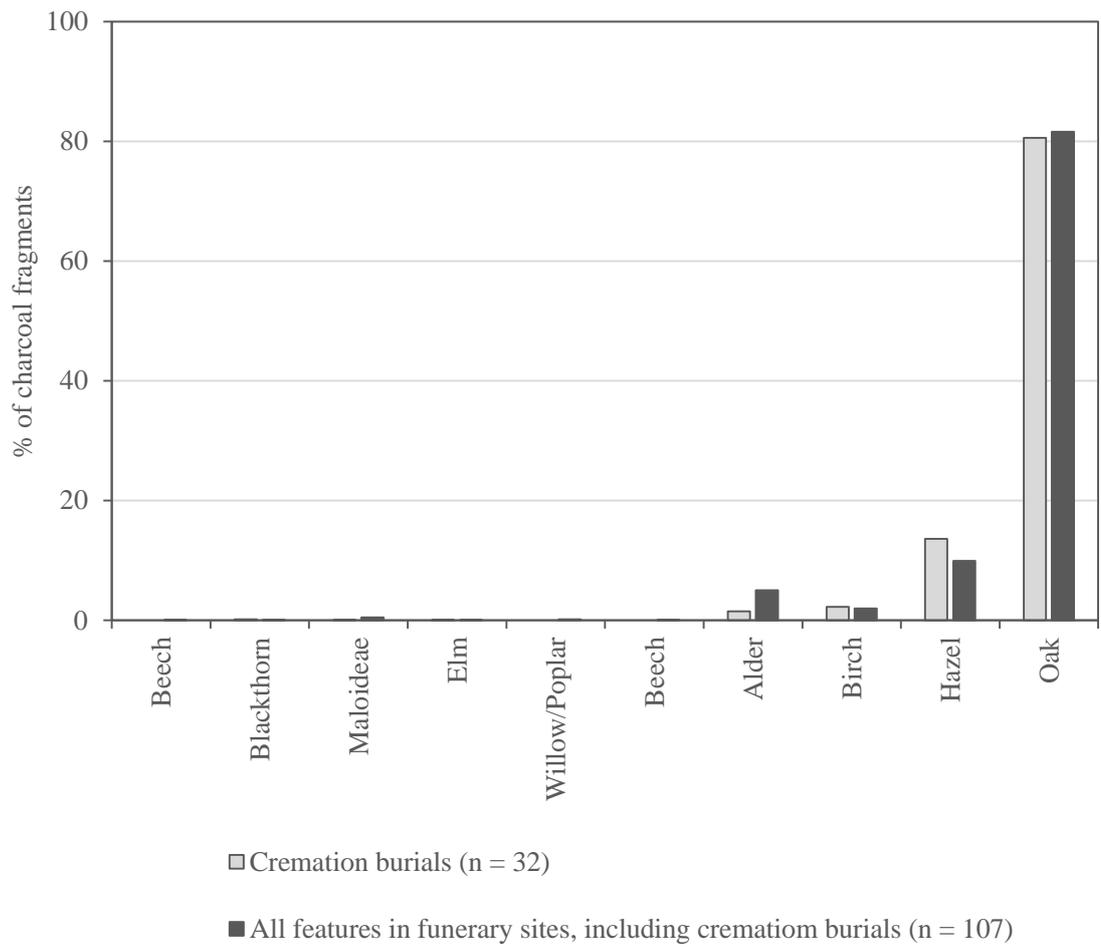


*Figure 13: Evidence from a Middle Neolithic site at Ogmere, south-east Wales.*

Pottery impression of Celtic bean (*Vicia faba* L.) (top) and probable crab apple seed (*Malus sylvestris* (L.) Mill.) (bottom left) on Middle Neolithic Peterborough Ware. Large fragments of charred hazelnut shell (*Corylus avellana* L.) (bottom right). A pottery impression of an emmer wheat grain is also recorded for the site (Webley 1976; Burrow 2003: 339). Photographs taken by the author with permission of the National Museum of Wales.



*Figure 14: Charcoal evidence for wood species exploited in Neolithic sites.*



*Figure 15: Charcoal evidence for the wood species exploited in Early to Middle Bronze Age cremation burials and associated features.*



*Figure 16: Cereal grain impression on an Early Bronze Age cremation urn.*

Impression of an emmer wheat grain (*Triticum dicoccum* Schübl) on the base of an Early Bronze Age cremation urn from Fan y Big, central Wales (Briggs et al. 1990). Photograph taken by the author with permission of Brecknock Museum and Art Gallery (Brecon).

# TABLES

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Broad Period	Sub-period	Date Range
Mesolithic	Earlier Mesolithic	8000 – 6000 cal BC
	Later Mesolithic	6000 – 4000 cal BC
Neolithic	Early Neolithic	4000 – 3400 cal BC
	Middle Neolithic	3400 – 3000 cal BC
	Late Neolithic	3000 – 2200 cal BC
Bronze Age	Early Bronze Age	2200 – 1500 cal BC
	Middle Bronze Age	1500 – 1150 cal BC
	Late Bronze Age	1150 – 800 cal BC
Iron Age	Earlier Iron Age	800 – 400 cal BC
	Later Iron Age	400 cal BC – 100 cal AD

*Table 1: Chronological periods used in this study (Mesolithic and Neolithic (Burrows 2003), Bronze Age (Roberts et al. 2013), Iron Age (Cunliffe 2005)).*

<b>Site Number</b>	061
<b>Site Name</b>	Pant y Butler (1)
<b>Area</b>	South-West
<b>NGR</b>	SN 21226 46614
<b>Period</b>	Middle Neolithic
<b>Site Description</b>	Pit and hollow. Preserved beneath BA barrow. Small shallow pit cut into the bedrock with a charcoal-rich lower fill which also contained a high proportion of heat-shattered stones. Patch of charcoal (infilling hollow) adjacent. Heat-reddening around both the features.
<b>Radiocarbon dating</b>	Pit dated. 3500-3100 cal BC (4570 ± 35 BP; SUERC-37910), charred HNS.
<b>Date Excavated</b>	2009
<b>Date Published</b>	2013
<b>Area Published</b>	National Welsh Journal
<b>Recovery Methods</b>	Bulk-sampling and flotation.
<b>Plant Remains</b>	CPR. Sparse in hollow, including a single possible tuber of less celandine, a single possible tuber of onion couch grass and a few fragments HNS. CPR abundant in pit, including HNS (339 fragments), 2 possible hazelnut kernel fragments and grass rhizome/stem fragments.
<b>Charcoal</b>	Small charcoal assemblage (10 fragments identified). Oak (2 fragments), hazel (8 fragments).
<b>Reference 1</b>	Murphy, K. and Murphy, F. 2013. The excavation of two Bronze Age round barrows at Pant y Butler, Llangoedmor, Ceredigion, 2009-2010. <i>Archaeologia Cambrensis</i> 162, 33-66.
<b>Reference 2</b>	Caseldine, A.E. and Griffiths, C.J. 2013. Charred plant remains and charcoal, pp.53-59 in K. Murphy and F. Murphy, The excavation of two Bronze Age round barrows at Pant y Butler, Llangoedmor, Ceredigion, 2009-2010. <i>Archaeologia Cambrensis</i> 162, 33-66.
<b>Reference 3</b>	n.a.
<b>Reference 4</b>	n.a.
<b>Reference 5</b>	n.a.

*Table 2: An example of the information reorded in the database.*

	Mesolithic	Neolithic	Bronze Age	Iron Age	Total
Charred Plant Remains	19	102	87	43	250
Waterlogged Plant remains	6	1	8	8	23
Charcoal	16	89	107	33	245
Pottery impressions	n.a.	1	3	0	4

*Table 3: Overview of the different sources of archaeobotanical evidence preserved.*

Chronological Period	Charred plant remains	Waterlogged plant remains	Charcoal	Pottery impressions	Total Number of Sites
Mesolithic (total)	19	6	16	n.a.	21
Early Mesolithic	8	0	5	n.a.	8
Late Mesolithic	11	6	11	n.a.	13
Undefined Mesolithic	0	0	0	n.a.	0
Neolithic (total)	102	1	89	1	118
Early Neolithic	29 (2)	1	24 (1)	0	30 (5)
Middle Neolithic	24 (4)	0	16 (5)	1	25 (7)
Late Neolithic	30 (10)	0	31 (9)	0	36 (11)
Undefined Neolithic	1 (2)	0	1 (2)	0	2 (2)
Bronze Age (total)	86	8	107	3	128
Early Bronze Age	49 (5)	4 (1)	64 (7)	3	80 (8)
Middle Bronze Age	16 (5)	3	15 (6)	0	17 (7)
Late Bronze Age	9 (3)	0	10 (4)	0	11 (4)
Undefined Bronze Age	0	0	1	0	1
Iron Age (total)	43	6	33	0	48
Earlier Iron Age	15	2	12	0	17
Later Iron Age	20	6	16	0	22
Later Iron Age–Romano-British	9	1	5	0	9
Undefined Iron Age	0	0	0	0	0
Total	250	23	245	4	315

Table 4: Chronological coverage of the evidence. Numbers in parentheses cover two periods.

	South- West	South- East	Central	North- West	North- East
<b>Charred Plant Remains</b>					
Mesolithic	2	6	1	3	7
Neolithic	11 (4)	3	20 (3)	40 (4)	17
Bronze Age	23 (2)	8 (1)	12	31	10
Iron Age	13	5	10	12	4
<b>Waterlogged Plant Remains</b>					
Mesolithic	0	6	0	0	0
Neolithic	0	1	0	0	0
Bronze Age	0	3	4	1	0
Iron Age	1	4	2	1	0
<b>Charcoal</b>					
Mesolithic	1	5	2	3	5
Neolithic	11 (2)	1	25 (4)	28 (4)	14
Bronze Age	21	13	18	38	17
Iron Age	7	3	10	10	4
<b>Pottery impressions</b>					
Mesolithic	n.a.	n.a.	n.a.	n.a.	n.a.
Neolithic	0	1	0	0	0
Bronze Age	1	0	1	1	0
Iron Age	0	0	0	0	0

*Table 5: Geographical coverage of the evidence. Numbers in parentheses cover two periods.*

Site	Chronological period	Lab Number	Material	Un-cal date	Cal date
Parc Bryn Cegin, north-east Wales (Early Neolithic structure)	Early Neolithic	KIA-31086	Charred wheat grain x 1	4912 ± 29 BP	3710-3650 cal BC
		KIA-30434	Charred emmer wheat grain x 1	4924 ± 30 BP	3720-3650 cal BC
		KIA-31087	Charred cereal grain x 1	4905 ± 34 BP	3710-3650 cal BC
South Hook, south-west Wales (Pit)	Early Bronze Age	Beta-255069	Charred barley grain x 1	3690 ± 40 BP	2140-2020 cal BC
Llanelwedd Rocks, central Wales (Cairn)	Early Bronze Age	Beta-290090	Charred barley grains x 4	3670 ± 35 BP	2140-1980 cal BC
Parc Bryn Cegin, north-east Wales (Burnt Mound)	Early Bronze Age*	KIA-30448	Indet charred cereal grain x 1	3636 ± 30 BP	2040-1950 cal BC
Parc Bryn Cegin, north-east Wales (Pit Group)	Early Bronze Age*	NZA-26682	Charred barley grain x 1	3474 ± 30 BP	1880-1740 cal BC
Glan-Rŷn Bridge, south-west Wales (Burnt Mound)	Early Bronze Age*	SUERC-52561	Charred wheat grain x 1	3285 ± 29 BP	1620-1520 cal BC
Parc Bryn Cegin, north-east Wales (Pit)	Early Bronze Age	NZA-26829	Charred barley grain x 1	3271 ± 35 BP	1610-1500 cal BC
Upper Neeston, south-west Wales (Burnt Mound)	Early-Middle Bronze Age	Beta-257710	Charred cereal grain x 1	3190 ± 40 BP	1500-1420 cal BC
		Beta-257711	Charred cereal grain x 1	3190 ± 40 BP	1500-1420 cal BC

*Table 6: Radiocarbon dates on Neolithic and Early Bronze Age cereal grains. The symbol “\*” denotes a date(s) which was either intrusive or residual. Sites: Parc Bryn Cegin (Hamilton et al. 2008); South Hook (Crane and Murphy 2011); Llanelwedd Rocks (Britnell 2013b); Glan-Rŷn Bridge and Upper Neeston (Hart et al. 2014).*

Location	Number of direct radiocarbon dates on cereal grains	Comments
Ireland	124	Includes 1 date on flax
Scotland	64	Includes 1 date on flax
England	42	Includes 2 dates on flax Includes 8 dates from Isle of Man
Scandinavia	62	
<b>Wales</b>	<b>3</b>	

*Table 7: Number of direct radiocarbon dates on cereal grains for Neolithic north-western Europe compared to Wales (cut off point of c. 2200 cal BC). See text for references*

Site	Cereal remains	Lab No.	Material	Un-cal date	Cal date
Cwmifor, south-west Wales (Pit group/cluster)	Emmer wheat.	Beta-257727	Charred hazelnut shell x 1	5130 ± 40 BP	4040-3790 cal BC
Gwernvale, central Wales (Early Neolithic structure)	Emmer wheat, barley, indet cereals.	CAR-113	Charcoal	5050 ± 80 BP	3980-3670 cal BC
Parc Bryn Cegin, north-east Wales (Early Neolithic structure)	Emmer wheat, barley, free- threshing type wheat, indet cereals.	KIA-31086	Charred wheat grain x 1	4912 ± 29 BP	3710-3650 cal BC
		KIA-30434	Charred emmer wheat grain x 1	4924 ± 30 BP	3720-3650 cal BC
		KIA-31087	Charred cereal grain x 1	4905 ± 34 BP	3710-3650 cal BC
Cwm Meudwy B, south-west Wales (Pit group/cluster)	Emmer wheat, barley, free- threshing type wheat, indet cereals.	Beta-185680	Hazel charcoal	4870 ± 50 BP	3780-3520 cal BC
		Beta-185679	Hazel charcoal	4840 ± 40 BP	3710-3520 cal BC
		Beta-185678	Alder charcoal	4800 ± 40 BP	3660-3380 cal BC
Fan (2), south-west Wales (Pit)	?Emmer wheat.	SUERC-42560	Indet. roundwood charcoal	4816 ± 29 BP	3660-3520 cal BC
Borras Quarry Group I, north-east Wales (Pit group/cluster)	Wheat, indet cereals.	Not available	Charred hazelnut shell x 1	Not available	3637-3364 cal BC
		Not available	Charred hazelnut shell x 1	Not available	3649-3526 cal BC
Borras Quarry Group J, north-east Wales (Pit group/cluster)	Wheat, indet cereals.	Not available	Charred hazelnut shell x 1	Not available	3641-3521 cal BC
		Not available	Charred hazelnut shell x 1	Not available	3637-3384 cal BC

Site	Cereal remains	Lab No.	Material	Un-cal date	Cal date
Borras Quarry Group L, north-east Wales (Pit group/cluster)	Wheat, indet cereal.	Not available	Hazel stem wood charcoal	Not available	3630-3374 cal BC
Borras Quarry Pit 3178, north-east Wales (Pit)	Wheat.	Not available	Charred hazelnut shell x 1	Not available	3631-3376 cal BC
Carrog, north-west Wales (Pit group/cluster)	Hulled barley, barley, wheat, indet cereals.	SUERC-33064	Hazel charcoal	4750 ± 30 BP	3640-3380 cal BC
Plas Gogerddan, south-west Wales (Pit)	Emmer wheat, wheat, hulled barley, indet cereals. Cereal chaff.	CAR-994	Mixed wood charcoal	4700 ± 70 BP	3640-3360 cal BC
Womaston, central Wales (Causewayed enclosure)	Indet cereal.	Beta-254593	Hazel charcoal	4660 ± 40 BP	3620-3360 cal BC

*Table 8: Radiocarbon dating evidence for the introduction of cereals in Neolithic Wales. Radiocarbon dates associated with contexts containing cereals grains and direct dates on cereal grains (in grey) are distinguished.*

Sites: Cwmifor (Pannett 2012); Gwernvale (Britnell 1987); Parc Bryn Cegin (Schmidl et al. 2008; Hamilton et al. 2008); Cwm Meudwy B (Caseldine and Griffiths 2006a, b; Murphy 2006); Fan (Schlee 2013); Borras Quarry Grant and Jones 2009, 2011; Jones and Grant 2009; Grant 2011; ASUD 2010, 2013); Plas Gogerddan (Caseldine 1992a; Murphy 1992); Womaston (Caseldine and Griffiths 2009a; Jones 2009).

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Site Type</i>	<i>Cereal indet.</i>	<i>Barley</i>	<i>Hulled barley</i>	<i>Wheat</i>	<i>Emmer wheat</i>	<i>Emmer/Spelt wheat</i>	<i>Free-threshing wheat</i>	<i>Cereal chaff</i>	<i>Flax</i>	<i>Hazelnut shell</i>	<i>Crap apple seed</i>	<i>Crab apple fruit</i>	<i>Other wild plants</i>	<i>Cereal grain total</i>	<i>Other</i>
Gwernvale	C	EN	1	P	R	-	-	P	-	-	-	-	A	-	-	P	n.a.	P
Parc Bryn Cegin Neolithic Structure	NW	EN	1	28	3	-	-	15	-	5	1	-	571	-	-	1	51	4
Carrog (1)	NW	EN	2	7	1	13	2	-	-	-	-	-	1680	-	-	1	23	2-
Nant Hall Road Site C	NW	EN	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parc Bryn Cegin Pit Group VIIIb	NW	EN	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parc Bryn Cegin Pit 6033	NW	EN	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parc Bryn Cegin Pit 3133	NW	EN	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Borras Quarry Group I	NE	EN	2	4	-	-	5	-	-	-	-	-	284	-	-	-	9	-
Borras Quarry Group J	NE	EN	2	4	-	-	8	-	-	-	-	-	567	1	-	-	12	-
Borras Quarry Group L	NE	EN	2	4	-	-	4	-	-	-	-	-	1600	-	-	-	8	7
Borras Quarry Group K (1)	NE	EN	2	1	-	-	1	-	-	-	-	-	56	-	-	-	2	-

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Site Type</i>	<i>Cereal indet.</i>	<i>Barley</i>	<i>Hulled barley</i>	<i>Wheat</i>	<i>Emmer wheat</i>	<i>Emmer/Spelt wheat</i>	<i>Free-threshing wheat</i>	<i>Cereal chaff</i>	<i>Flax</i>	<i>Hazelnut shell</i>	<i>Crap apple seed</i>	<i>Crab apple fruit</i>	<i>Other wild plants</i>	<i>Cereal grain total</i>	<i>Other</i>
Borras Quarry Pit 3178 (Area 2011B)	NE	EN	2	-	-	-	2	-	-	-	-	-	32	-	-	-	2	-
Plas Gogerddan	SW	EN	2	89 (+3.9g)	-	8	315	395	4	-	448	-	117	61	6.5g	-	722	1
Llandeenny	SE	EN	4	-	-	-	-	-	-	-	-	-	-	-	-	153	-	22
Fan (1)	SW	EN	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Fan (2)	SW	EN	2	-	-	-	-	1	-	-	-	-	P	-	-	-	1	2
Cwm Meudwy (1)	SW	EN	2	61	7	-	11	10	1	2	3	-	237	-	-	-	92	
Pant y Butler (1)	SW	MN	2	-	-	-	-	-	-	-	-	-	346	-	-	-	-	13
Carrog (2)	NW	MN	2	-	-	-	-	-	-	-	-	-	53	-	-	-	-	5
Upper Ninepence (1)	C	MN	2	1	-	-	1	2	-	-	22	-	1614	-	-	1	4	17
Dyffryn Lane (1)	C	MN	2	-	-	-	-	-	-	-	-	-	1568	-	-	-	-	4
Cwm Meudwy (2)	SW	MN	2	23	-	-	-	-	-	-	-	-	39	-	-	-	23	1

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Site Type</i>	<i>Cereal indet.</i>	<i>Barley</i>	<i>Hulled barley</i>	<i>Wheat</i>	<i>Emmer wheat</i>	<i>Emmer/Spelt wheat</i>	<i>Free-threshing wheat</i>	<i>Cereal chaff</i>	<i>Flax</i>	<i>Hazelnut shell</i>	<i>Crap apple seed</i>	<i>Crab apple fruit</i>	<i>Other wild plants</i>	<i>Cereal grain total</i>	<i>Other</i>
Borras Quarry Group A	NE	MN	2	-	-	-	-	-	-	-	-	-	35	-	-	-	-	13
Borras Quarry Group B	NE	MN	2	-	-	-	-	-	-	-	-	-	65	-	-	-	-	-
Borras Quarry Group D	NE	MN	2	-	-	-	-	-	-	-	-	-	65	-	-	-	-	-
Borras Quarry Group E	NE	MN	2	-	-	-	-	-	-	-	-	-	987	-	-	-	-	-
Borras Quarry Group F	NE	MN	2	-	-	-	-	-	-	-	-	-	669	-	-	-	-	-
Borras Quarry Group H	NE	MN	2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Parc Bryn Cegin Pit Group I	NW	MN	2	-	-	-	-	-	-	-	-	-	283	-	-	-	-	-
Parc Bryn Cegin Pit Group II	NW	MN	2	1	1	-	-	-	-	-	-	-	464	-	-	-	2	-
Parc Bryn Cegin Pit Group III	NW	MN	2	-	-	-	-	-	-	-	-	-	179	-	-	-	-	-
Parc Bryn Cegin Pit Group IV	NW	MN	2	-	-	-	-	-	-	-	-	-	460	-	-	-	-	-
Parc Bryn Cegin Pit Group V	NW	MN	2	-	-	-	-	-	-	-	-	-	482	-	-	-	-	-

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Site Type</i>	<i>Cereal indet.</i>	<i>Barley</i>	<i>Hulled barley</i>	<i>Wheat</i>	<i>Emmer wheat</i>	<i>Emmer/Spelt wheat</i>	<i>Free-threshing wheat</i>	<i>Cereal chaff</i>	<i>Flax</i>	<i>Hazelnut shell</i>	<i>Crap apple seed</i>	<i>Crab apple fruit</i>	<i>Other wild plants</i>	<i>Cereal grain total</i>	<i>Other</i>
Parc Bryn Cegin Pit Group VIb	NW	MN	2	-	-	-	-	-	-	-	-	-	250	-	-	-	-	-
Parc Bryn Cegn Pit Group VIc	NW	MN	2	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
Moel y Gerddi (1)	NW	MN	2	-	-	-	-	-	-	-	-	-	2	-	-	1	-	20
Berry Hill (1)	SW	MN-LN	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mynydd Mwyn Farm	NW	MN-LN	2	14	1	-	2	-	-	-	-	-	1620	-	-	1	17	29
Dyffryn Lane II	C	LN	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buttington Cross	C	LN	2	P	-	P	P	-	-	-	1	1	100+	-	-	-	n.a.	P
Trelystan I	C	LN	1	-	-	-	-	-	-	-	-	-	P	1	-	1	-	2
Nant Hall Road Site D (3)	NE	LN	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hirdre-faig Farm	NW	LN	2	16	2	-	-	-	-	-	-	-	252	-	-	-	18	14
Ysgol yr Hendre	NW	LN	2	-	-	-	-	-	-	-	-	-	168	-	-	-	-	1

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Site Type</i>	<i>Cereal indet.</i>	<i>Barley</i>	<i>Hulled barley</i>	<i>Wheat</i>	<i>Emmer wheat</i>	<i>Emmer/Spelt wheat</i>	<i>Free-threshing wheat</i>	<i>Cereal chaff</i>	<i>Flax</i>	<i>Hazelnut shell</i>	<i>Crap apple seed</i>	<i>Crab apple fruit</i>	<i>Other wild plants</i>	<i>Cereal grain total</i>	<i>Other</i>
Parc Bryn Cegin Pit Group VIII	NW	LN	2	-	-	-	-	-	-	-	-	-	267	-	-	-	-	-
Upper Ninepence (2)	C	LN	1	1	-	-	-	-	-	-	2	-	1376	-	-	6	1	71
Hendre	NE	LN	2	1	-	-	-	-	-	-	-	-	560	-	-	-	1	1

*Table 9: Plant remains from Neolithic sites in Wales. Site Type: '1' Associated with structural evidence; '2' Pit/Pit Cluster; '3' Shell midden. '4' Other. For references see Appendix 1.*

Site	Period	Site description	Cereals	Hazelnut shell frag	Comments
Carrog, north-west Wales	Early Neolithic	Pit cluster. Small-shallow, sub-circular pits with charcoal-rich fills. Pottery (Early Neolithic).	23	1680	
Borras Quarry, north-east Wales	Early Neolithic	Four pit clusters. Small, shallow sub-circular pits with charcoal-rich fills and some with evidence for heat-reddening. Pottery.	31	2507	Crab apple seed
Cwm Meudwy B, south-west Wales	Early Neolithic	Nine pits containing Early Neolithic pottery. Small, shallow sub-circular pits with charcoal-rich fills.	92 (+ 3 chaff)	237	
Plas Gogerddan, south-west Wales	Early Neolithic	Small (? isolated) pit. No other information available.	722 (+448 chaff)	117	Crab apple seeds (30 whole, 93 frags) and fruit frags (6.5g).

*Table 10: An example of typical assemblages of plant remains recovered from Early Neolithic pits/pit clusters. Four sites have been combined for Borras Quarry. For references see Appendix 1.*

Plant Remains	Quantity
<b>Cereal grains</b>	
Indeterminate cereals	89 (+ 3.9g frags.)
Barley	8
Wheat	315
Emmer wheat	395
Emmer/spelt wheat	4
<b><i>Cereal grain total</i></b>	<b>722</b>
<b>Cereal chaff</b>	
Indeterminate cereal basal internode	1
Wheat awn fragments	2
Emmer wheat spikelet forks	113
Emmer wheat glume bases	328
Emmer wheat rachis fragments	2
Emmer wheat basal internodes	2
<b><i>Cereal chaff total</i></b>	<b>448</b>
<b>Other plants</b>	
Hazelnut shell fragments	117
Crab apple    Seeds	30 (+ 93 frags.)
Stalks	59
Fruit (epidermal + endocarp) frags.	6.5g
Other (weed seeds)	1

*Table 11: Summary of plant remains recovered from an Early Neolithic pit at Plas Gogerddan, south-west Wales. Adapted from Caseldine (1992a).*

	Period	Site description	Cereals	Hazelnut shell frag	Other wild plants
Pant y Butler, south-west Wales	Middle Neolithic	Small, shallow sub-circular pit and hollow with charcoal-rich fills and containing heat-shattered stones. Heat-reddened soil.		346 (+ 2 cf. kernel frags)	
Carrog, north-west Wales	Middle Neolithic	Small, shallow sub-circular pit with charcoal-rich fill. Peterborough Ware present.		53	
Borras Quarry, north-east Wales	Middle Neolithic	Five pit clusters. Small, shallow, sub-circular pits with charcoal-rich fills. Pottery (Peterborough Ware)		1823	
Parc Bryn Cegin, north-west Wales	Middle Neolithic	Seven pit clusters. Small, shallow, sub-circular pits with charcoal-rich fills and containing heat-shattered stones. Some with evidence for heat-reddening. Pottery (Peterborough Ware).	2	>2218	
Upper Ninepence, central Wales	Middle Neolithic	Extensive spread of pits. Small, shallow, sub-circular/rectangular pits with charcoal-rich fills. Pottery (Peterborough Ware) and lithics.	4	1614	

Site	Period	Site description	Cereals	Hazelnut shell fragments	Other wild plants
Dyffryn Lane, central Wales	Middle Neolithic	Pit cluster. Three small, shallow, sub-circular pits with charcoal-rich fills. Heat fractured stones present. Pottery (Peterborough Ware).		1568	
Mynydd Mwyn Farm, north-west Wales	Middle Neolithic /Late Neolithic	Pit cluster. Small, shallow, sub-circular pits with charcoal-rich fills. Pottery (Peterborough Ware) and lithics.	17	1620	
Upper Ninepence (2), central Wales	Late Neolithic	Extensive spread of pits. Small, shallow, sub-circular/rectangular pits with charcoal-rich fills. Pottery (Grooved Ware) and lithics.	1	1376	
Hendre, north-east Wales	Late Neolithic	Pit cluster. Small, shallow sub-circular pits with charcoal rich lenses. Pottery (Grooved Ware) and lithic artefacts.		560	

*Table 12: An example of typical assemblages of plant remains recovered from Middle to Late Neolithic sites pits/pit clusters.. For Parc Bryn Cegin and Borrás Quarry, the evidence from a number of sites has been combined. For references see Appendix 1.*

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Alder</i>	<i>Ash</i>	<i>Birch</i>	<i>Cherry/ Blackthorn</i>	<i>Maloideae</i>	<i>Elm</i>	<i>Gorse/ Broom</i>	<i>Hazel</i>	<i>Oak</i>	<i>Willow/ Poplar</i>	<i>Other</i>	<i>Total</i>
Cwm Meudwy B (1)	SW	EN	3	-	2	-	1	-	-	12	27	-	-	45
Penymynydd (1)	NW	EN	-	-	-	-	-	-	-	P	-	-	-	n.a.
Parc Bryn Cegin ENeo structure	NW	EN	-	-	-	-	-	-	-	P	D	-	R	n.a.
Carrog I	NW	EN	-	-	3	-	-	-	-	23	18	3	-	47
Parc Bryn Cegin Pit Group VIIb	NW	EN	-	-	-	-	-	-	-	P	-	-	-	n.a.
Parc Bryn Cegin Pit 6033	NW	EN	-	-	-	-	-	-	-	D	P	-	-	n.a.
Parc Bryn Cegin Pit 3133	NW	EN	-	-	-	-	-	-	-	P	-	-	-	n.a.
Borras Quarry Pit I	NE	EN	-	-	-	-	130	1	-	58	23	-	1	213
Borras Quarry Group J	NE	EN	3	-	-	-	23	3	-	51	31	-	3	114
Borras Quarry Group K (1)	NE	EN	-	-	-	-	8	-	-	-	28	-	3	39
Borras Quarry Group L	NE	EN	1	1	-	-	-	1	-	42	-	-	1	46
Borras Quarry Pit 3178 (Area 2011B)	NE	EN	1	1	-	-	14	-	-	12	1	-	2	31
Fan (2),	SW	EN	-	-	-	-	-	-	-	P	F	-	P	n.a.
Land off Penrhos Road (2)	NW	EN	-	-	-	-	P	-	-	P	P	-	P	n.a.

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Alder</i>	<i>Ash</i>	<i>Birch</i>	<i>Cherry/ Blackthorn</i>	<i>Maloideae</i>	<i>Elm</i>	<i>Gorse/ Broom</i>	<i>Hazel</i>	<i>Oak</i>	<i>Willow/ Poplar</i>	<i>Other</i>	<i>Total</i>
Cwm Meudwy B (2)	SW	MN	-	-	1	-	-	-	-	24	3	-	-	28
Pant y Butler (1)	SW	MN	-	-	-	-	-	-	-	2	8	-	-	10
Carrog II	NW	MN	-	-	-	-	-	-	-	2	-	-	-	2
Penymynydd (2)	NW	MN	-	-	-	-	-	-	-	P	P	-	-	n.a.
Upper Ninepence (1)	C	MN	-	-	-	11	46	-	-	108	1	1	2	169
Dyffryn Lane I	C	MN	1	-	26	1	18	-	-	23	11	-	-	8-
Borras Quarry Group A	NE	MN	-	-	-	-	10	-	-	19	230	-	2	261
Borras Quarry Group B	NE	MN	-	-	-	-	1	1	-	124	66	-	-	192
Borras Quarry Group D	NE	MN	-	-	-	-	4	-	-	24	8	-	-	36
Borras Quarry Group E	NE	MN	-	-	-	-	15	-	4	86	61	-	1	167
Borras Quarry Group F	NE	MN	-	-	2	-	4	-	-	66	-	-	3	75
Borras Quarry Group H	NE	MN	-	-	-	-	-	-	-	35	247	-	-	282
Parc Bryn Cegin Pit Group IV	NW	MN	-	-	-	-	-	-	-	P	P	-	-	n.a.
Parc Bryn Cegin Pit Group V	NW	MN	-	-	-	-	-	-	-	D	P	-	-	n.a.

<i>Site</i>	<i>Area</i>	<i>Period</i>	<i>Alder</i>	<i>Ash</i>	<i>Birch</i>	<i>Cherry/ Blackthorn</i>	<i>Maloideae</i>	<i>Elm</i>	<i>Gorse/ Broom</i>	<i>Hazel</i>	<i>Oak</i>	<i>Willow/ Poplar</i>	<i>Other</i>	<i>Total</i>
Parc Bryn Cegin Pit Group VIb	NW	MN	-	-	-	-	-	-	-	P	-	-	-	n.a.
Parc Bryn Cegin Pit Group VIc	NW	MN	-	-	-	-	-	-	-	P	-	-	-	n.a.
Mynydd Mwyn Farm	NW	MN-LN	18	-	-	-	-	-	-	1149	578	-	12	1757
Trelystan I	C	LN	-	-	-	P	P	-	-	P	-	P	-	n.a.
Hirdre-faig Farm	NW	LN	-	19	-	-	-	-	-	69	12	-	-	100
Ysgol yr Hendre	NW	LN	-	-	-	-	-	-	-	135	40	4	21	200
Upper Ninepence (2)	C	LN	-	-	-	8	74	-	-	210	116	4	6	418

*Table 13: Charcoal evidence from Neolithic sites. For references see Appendix 1.*

	Oak	Hazel	Maloideae	Blackthorn	Birch
Domestic pit	87	103	17	15	2
Cremation burial	196	19	0	0	0

*Table 14: A comparison between charcoal evidence recovered from a domestic pit (F117) and a cremation burial at Borrás Quarry, north-east Wales (ASUD 2013).*

Period	South-East	South-West	Central	North-East	North-West	<b>Total</b>
Later Neolithic	0	0	0	0	11	<b>11</b>
Later Neolithic – Earlier Bronze Age	0	2	0	0	3	<b>5</b>
Earlier Bronze Age	0	0	0	0	6	<b>6</b>
Later Bronze Age	0	2	0	0	9	<b>11</b>
<b>Total</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>29</b>	<b>33</b>

*Table 15: Archaeobotanical evidence from burnt mounds, note the high number of sites for north-west Wales.*

Site	Context	Lab Number	Material	Un-cal date	Cal date
Parc Bryn Cegin Burnt Mound 1097	1158 -Primary fill of burnt mound trough	KIA-30443	Charred hazelnut shell	4034 ± 31 BP	2590-2480 cal BC
	1158	KIA-30444	Hazel charcoal	3216 ± 26 BP	1510-1440 cal BC
	1158	NZA-2665	Hazel charcoal	3270 ± 35 BP	1610-1500 cal BC
Parc Bryn Cegin Burnt Mound 2176	2200 -Main fill of burnt mound trough [2197]	KIA-30447	Possibly hazel charcoal	3904 ± 30 BP	2470-2340 cal BC
	2200	KIA-30448	Indet charred cereal grain	3636 ± 30 BP	2040-1950 cal BC
	2208 -Fill of burnt mound trough [2197]	NZA-26772	Hazel charcoal	3878 ± 40 BP	2460-2290 cal BC
Parc Bryn Cegin Feature 7055	7050 -Charcoal layer at base of [7055]	NZA-26762	Hazel charcoal	3132 ± 35 BP	1450-1310 cal BC
	7051 -Main fill of [7055]	NZA-26763	Indet charred cereal grain	1980 ± 35 BP	40 cal BC–60 cal AD
	7059 -Fill of stakehole in base of [7055]	NZA-26764	Charcoal, probably hazel	3087 ± 35 BP	1410-1290 cal BC
Glan-Rŷn Bridge Burnt Mound 506012	506012 –Burnt mound	SUERC-52559	Hazel charcoal	3192 ± 29 BP	1500-1430 cal BC
	506012	SUERC-52560	Maloideae charcoal	3180 ± 27 BP	1500-1420 cal BC
	506012	SUERC-52561	Charred wheat grain	3285 ± 29 BP	1620-1520 cal BC

Table 16: Radiocarbon dates from burnt mounds indicating intrusive/residual remains. The symbol ‘\*’ denotes an intrusive/residual date. Sites: Parc Bryn Cegin (Hamilton et al. 2008); Glan-Rŷn Bridge (Hart et al. 2014).

Blank

Site	Site description	Cereal grains	Cereal chaff	Hazelnut shell fragments	No. of samples/sample volume (l)
Late Neolithic – Early Bronze Age (Chalcolithic) (c. 2500 – 1800 cal BC)					
Hirdre-Faig, North-West Wales (McKenna 2010)	Small shallow pit, charcoal-rich fill. Early Beaker pottery. Date on hazel charcoal: 2460-2050 cal BC (3800 ± 40 BP; Beta-280899).	Barley x 2 Indet cereal x 16		252	1/?
Penrhosgarnedd, North-West Wales (Carruthers 2013)	Charcoal-rich pit containing Beaker pottery.	Barley x 7 cf. Naked barley x 3 Indet cereals x 3		26	
Four Crosses (Site 2), Central Wales (Milles 1986)	Pit containing Beaker pottery. Dates on mixed wood charcoal: 2910-2570 cal BC (4910 ± 70 BP; CAR-767) 2290-1890 cal BC (3690 ± 70 BP; CAR-810) 2570-2140 cal BC (3890 ± 70 BP; CAR-811)	Barley Indet cereals			1/?
Borras Quarry Group G, North-East Wales (ASUD 2010, 2013)	Post-hole containing Beaker pottery. Dated to 2200-2024 cal BC (no other information available).	Barley x1		8	4/29 litres

Site	Site description	Cereal grains	Cereal chaff	Hazelnut shell fragments	No. of samples/sample volume (l)
Church Road, South-East Wales (Allen 2009)	Two pits, one containing a large quantity of Beaker pottery (142 sherds) and one containing a smaller quantity of pottery (5 sherds).				2/?
Stackpole Warren (1), South-West Wales (Caseldine 1990c)	Post-hole associated with Beaker pottery.			P	2/?
Early Bronze Age (2200 – 1500 cal BC)					
South Hook (1), South-West Wales (Carruthers 2011a)	Pit containing fragments of an EBA urn. Date on charred barley grain: 2200-1950 cal BC (3690 ± 40 BP; Beta-255069)	cf. wheat Hulled barley Barley Indet. cereal			1/?
South Hook (2), South-West Wales (Carruthers 2011a)	Pits. Group of three pits (pit cluster?) containing charcoal, heat affected stones and flint. Date on charred HNS. 2020-1750 cal BC (3550 ± 40 BP; Beta-255072)	Emmer/spelt wheat grain x 1		P	

Site	Site description	Cereal grains	Cereal chaff	Hazelnut shell fragments	No. of samples/sample volume (l)
Stackpole Warren, South-West Wales (Caseldine 1990c)	Roundhouse. Probably burnt down. Two dates on charcoal from destruction layer. 2140-1700 cal BC (3570 ± 70 BP; CAR-475) 1880-1450 cal BC (3350 ± 70 BP; CAR-100)	cf. wheat x 3 Naked barley x 1 Barley x 13 Indet cereal x 20		P	6/?
Parc Bryn Cegin (VIIa), North-West Wales (Schmidl et al. 2008)	Pits (possible pit cluster). Five small pits with charcoal-rich fills and heat-altered stones. Four dates from two pits. Two dates from one pit (NZA-26682 on charred HNS; NZA-26690 on a charred barley grain): 1890-1690 cal BC (3474 ± 30 BP; NZA-26682). 2010-1770 cal BC (3552 ± 30 BP; NZA-26690).  Two dates from one pit on charred HNS. 1890-1690 cal BC (3476 ± 28 BP; KIA-30441), charred HNS. 1750-1620 cal BC (3388 ± 29 BP; KIA-30442), charred HNS.	Wheat x 1 Barley x 2		62	8/?
Borras Quarry Pit F119, North-East Wales (ASUD 2010, 2013)	Large pit interpreted as a 'rubbish pit'. Date on charred HNS. 2119-1893 cal BC (no other information available)	Indet cereal x 3		6	2/37 litres

Site	Site description	Cereal grains	Cereal chaff	Hazelnut shell fragments	No. of samples/sample volume (l)
Bryn Maen Caerau, South-West Wales (Caseldine 2001b)	Pit containing burnt stones and charcoal. Two dates on charcoal: 1950-1560 cal BC (3540 ± 70 BP; CAR-1497A) 1940-1560 cal BC (3440 ± 70 BP; CAR-1497B)		Emmer/spelt wheat x 1		1?
Middle Bronze Age (1500 – 1150 cal BC)					
Borras Quarry Pit F117, North-East Wales (ASUD 2010, 2013)	Large pit interpreted as a 'rubbish pit'. One date on hazel roundwood charcoal. 1500-1260 cal BC (3110 ± 40 BP; Beta-256753)	Wheat x 1 Barley x 26 Indet cereal x 13		2	2/37 litres
Plas Coch, North-East Wales (Caseldine and Griffiths 2012d)	Two small irregular pits. One pit produced Middle Bronze Age pottery.	Indet cereals. Wheat x 4		36	1

Site	Site description	Cereal grains	Cereal chaff	Hazelnut shell fragments	No. of samples/sample volume (l)
Glanfeinon, Central Wales (Britnell et al. 2007)	Roundhouse associated with pits. One pit produced a cache of naked barley. Two dates obtained on probable hazel charcoal. 1420-1130 cal BC (3040 ± 40 BP; BM-2971) 1400-980 cal BC (2960 ± 40 BP; BM-2972)	Wheat x 11 Emmer wheat x 23 Einkorn/emmer wheat x 1 Barley x 300 Hulled barley x 21 Naked barley x 5548 Indet cereal >87 ml (+ x2)	Einkorn/emmer x 47 Emmer wheat x 78 Wheat x 78 Barley x 6	15	
Newton, South-East Wales (Caseldine and Griffiths 2004)	Roundhouse associated with Later BA pottery. Two dates on wood charcoal. Pit located immediately outside roundhouse 1200-920 cal BC (2870 ± 40 BP; Beta-182944).  Post-hole cutting pit (see above) 1500-1270 cal BC (3120 ± 40 BP; Beta-182945).	Wheat x 1 Indet cereal x 3 Hulled barley x 9			

*Table 17: An example of typical assemblages of plant remains recovered from sites spanning the Late Neolithic-Early Bronze Age to Middle Bronze Age.*

Site	Site description	Cereal grains	Cereal chaff	No. of samples/ sample vol. (l)
Earlier Iron Age (800 – 400 cal BC)				
Carrog, North-West Wales (Caseldine et al. 2014a)	Circular enclosed settlement with post-holes forming a possible structure. Samples from post-holes. Five radiocarbon dates ranging between 810 – 410 cal BC	Hulled barley x 1 Indet cereals x 1 (+ 3 frags).	Emmer wheat x 1	4/ n.d.
Ffynnonwen, South-West Wales (Caseldine and Griffiths 2012a)	Curving gully, possibly forming an enclosure. Date on birch charcoal: 750-380 cal BC (2380 ± 40 BP; Beta-253728).	Wheat x 1 Barley x 1		1/ n.d.
Brownslade, South-West Wales (Carruthers 2011b)	Buried soil, with cultivation marks. Post-holes and linear gullies present. CPR recovered from gully and post-hole. Sealed beneath MIA buried soil. Date on cow tooth from gully: 760-390 cal BC (2410 ± 40 BP; Beta-228418)	Emmer/Spelt wheat x 2 Barley x 7 Hulled barley x 1 Indet cereals x 9		3/ 43 litres
Womaston, Central Wales (Caseldine and Griffiths 2009a)	Shallow pit in the interior of causewayed enclosure. Date on hazel charcoal: 750-390 cal BC (2410 ± 35 BP; SUERC-26461).	Indet cereals x 2		1/ 1 litre.

Site	Site description	Cereal grains	Cereal chaff	No. of samples/ sample vol. (l)
Porth y Rhaw, South-West Wales (Caseldine and Griffiths 2011a)	Coastal promontory fort, at least 8 roundhouses identified. Difficult to phase features. Summary of archaeobotanical evidence published. Four EIA dates on mixed wood charcoal from occupation area: 760-200 cal BC (2350 ± 80 BP; SWA-286). 770-400 cal BC (2430 ± 70 BP; SWA-287). 830-410 cal BC (2550 ± 80 BP; SWA-288). 760-180 cal BC (2320 ± 90 BP; Beta-124344).	Emmer wheat Spelt wheat (dominant) Hulled barley	Emmer wheat Spelt wheat (dominant)	n.d.
Caer Seion, North-East Wales (Caseldine and Griffiths 2011b)	Buried soil beneath hillfort bank, probably an occupation layer. One date on alder charcoal: 760-400 cal BC (2420 ± 40 BP; Beta-250542).	Emmer/Spelt wheat x 7 Wheat x 1 Barley x 3 Indet cereals x 19	Emmer/Spelt wheat 43 Spelt wheat x 24 Wheat x 11	1/ 6.7 litres.
Later Iron Age (400 – 100 cal BC)				
Caer Seion, North-East Wales (Caseldine and Griffiths 2011b)	Charcoal-rich layer beneath roundhouse (earlier destruction layer?).  One date on birch charcoal: 400-200 cal BC (2240 ± 40 BP; Beta-254607).	Emmer/Spelt wheat x 4 Indet cereals x 2	Spelt wheat x 1	1/ 0.5 litres

Site	Site description	Cereal grains	Cereal chaff	No. of samples/ sample vol. (l)
Moel-y-Gaer Hillfort, North-East Wales (Caseldine and Griffiths 2013f)	Hillfort. Two roundhouses and pits excavated. One roundhouse is cutting an earlier roundhouse. Three radiocarbon dates indicating occupation between 390-50 cal BC.	Free-threshing type wheat x 1		8/ n.d.
Pwllheli to Blaenau Ffestiniog Pipeline (Plot 3/2), North-East Wales (Challinor et al. 2014)	Two pits, one pit contained abundant cereal grains. No structural evidence identified in proximity. Four dates between 420-200 cal BC, two from each pit (inc. two dates on cereal grains).	Emmer/Spelt wheat x 17 Emmer wheat x 463 cf. Emmer wheat x 80 Wheat x 375 Free-threshing type wheat x 2 Naked barley x 52 Hulled barley x 55 Barley x 39 Indet cereals x 684	Emmer wheat x 66 Spelt wheat x 7 Wheat x 60 Barley x 5	5/ 40.75 litres
Bryn Eryr, North-West Wales (Longley 1998)	Enclosed settlement with roundhouses. Radiocarbon dates indicate Later Iron Age date. Only a summary report available.	Emmer wheat Spelt wheat	Present	n.d.

Site	Site description	Cereal grains	Cereal chaff	No. of samples/ sample vol. (l)
Breiddin, Central Wales (Hillman 1991a, b)	Large hillfort. Burnt deposit between two houses, probably associated with two radiocarbon dates between c.350-50 cal BC.	Emmer/Spelt Wheat x 560 Emmer wheat x 141 Spelt wheat x 28 Free-threshing type wheat x 2 Wheat x 80 Rye x 10 6-row hulled barley x 2 Indet cereals x 18  WPR inc. spelt wheat chaff	Emmer/Spelt wheat x 19 Emmer wheat x 59 Spelt wheat x 8 Wheat x 19	1/ 100 litres
Collfryn I Central Wales (Jones and Milles 1989)	Enclosed settlement with dense occupation spanning Later Iron Age. Romano-British activity also present.	Emmer wheat Spelt wheat/Free-threshing wheat Wheat Barley Indet cereals	Emmer/Spelt wheat (abundant) Emmer wheat Spelt wheat	
Pembrey, South-West Wales (Hilman 1981b)	Area of burning beneath bank on enclosed settlement. Later activity also present. Only a summary report published.  Date on charred cereal grains: 410-200 cal BC (2285 ± 45 BP; CAR-105).	Emmer and spelt wheat x 75 grains/kg of soil. 6-row hulled barley Rye x 1	Chaff x 1	n.d.

Site	Site description	Cereal grains	Cereal chaff	No. of samples/ sample vol. (l)
Brownslade, South-West Wales (Carruthers 2011b)	Buried soil with cultivation marks.  Date on charred emmer/spelt grain from cultivation marks: 360-60 cal BC (2130 ± 40 BP; Beta-229587).	Emmer/Spelt wheat x 3 Barley x 1 Indet cereals x 10	Emmer/Spelt wheat x 44 Spelt wheat x 3	2/ 39 litres

Late Iron Age – Romano British (100 cal BC – 100 cal AD)

Cefn Du, North-West Wales (Ciaraldi 2012)	Unenclosed roundhouse settlement dated between Late Iron Age and Romano-British period. Only three 'rich' samples assessed.	Spelt wheat x 7 Spelt wheat/Free-threshing wheat x 4 Free-threshing wheat x 10 Wheat x 8 Barley x 11 Hulled barley x 2 Indet cereals x 45	Emmer/Spelt wheat x 489 Emmer wheat x 52 Spelt wheat x 371 Free-threshing wheat x 113 Wheat x 7 Barley x 4 Indet cereals x 58	3/ 35 litres
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Site	Site description	Cereal grains	Cereal chaff	No. of samples/ sample vol. (l)
Woodside Camp, South-West Wales (Caseldine and Holden 1998)	Enclosed settlement (associated with c.6 roundhouses and four-post structures). Only summaries of evidence presented.	Wheat x 64 Emmer wheat x 10 Emmer/spelt wheat x 5 Spelt wheat x 34 Spelt wheat/Free-threshing wheat x 4 Free-threshing wheat x 6 Hulled barley x 10 Indet cereals x 29	Wheat x 216 Emmer wheat x 6 Emmer/spelt wheat x 2209 Spelt wheat x 61 Barley x 10 Indet cereals x 10	Large number of samples
Dan-y-Coed, South-West Wales (Caseldine 1998b)	Enclosed settlement (associated with roundhouses and four-post structures). Only summaries of evidence presented.	Wheat x 33 Emmer wheat x 1 Emmer/spelt wheat x 13 Spelt wheat x 25 Spelt wheat/Free-threshing wheat x 3 Free-threshing wheat x 1 Hulled barley x 19 Indet cereals x 51	Wheat x 2 Emmer wheat x 4 Emmer/spelt wheat x 178 Spelt wheat x 290 Spelt wheat/Free-threshing wheat x 2 Free-threshing wheat x 2 Hulled barley x 1 Indet cereals x 51	Large number of samples

*Table 18: An example of typical assemblages of plant remains recovered from sites spanning the Earlier to Later Iron Age and Romano-British period.*

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