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# A Cereal Problem? What the Current Chronology of Early Cereal Domesticates Might Tell Us About Changes in Late Fifth and Early Fourth Millennium cal BC Ireland and Britain

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In the years since the last volume on plant domesticates in Ireland and Britain in the fourth millennium cal BC, a number of significant changes have occurred in archaeological practice. These have included the routine application of a range of archaeological science techniques, including Bayesian statistical modelling. This paper will present a new analysis of radiocarbon results from direct measurements on domesticated plant remains from Ireland and Britain to explore what these can tell us about the nature of the changes in the archaeological record at this time. Cereals may appear after the introduction of practices including monuments in the form of causewayed enclosures, tombs and post-and-slot-built structures, in several regions. This approach unpacks the 'Neolithic package', by comparing direct estimates on plant domesticates with the appearance of other forms of material culture and new site types. As well as allowing us to examine the fine-grained nature of changes, developments in chronological modelling should cause us to re-examine how useful our existing terms of engagement are; we need to think not only about the changes we can produce in the sequence of archaeological knowledge, but also in the structure of it.

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## Introduction


The roles of the earliest cereals in different societies has been a subject of considerable archaeological research (Fairburn 2000). Domesticated plant remains (predominantly cereals) have been regarded as one element of a package of material culture which was introduced to Ireland and Britain as part of 'the Neolithic'. The suite of materials that appear to accompany the introduction of cereals includes domesticated animals, pottery, leaf-shaped arrowheads, monuments and post-and-slot-built structures, as well as, in Britain, polished stone axeheads. These have been seen as creating something distinctly different from previous lifeways, and have a history of being thought of as a series of sharp, punctuated changes since the work of Childe (e.g. Childe 1940; though see Pluciennik 1998; Thomas 1999). Similarities between early Neolithic activity and that of Mesolithic hunter-gatherer groups – including lithic reduction technology and locations of activity within the landscape – tend to be under-emphasised against these more obviously 'dramatic' novelties of Neolithic evidence. The shock of the new Neolithic to archaeologists, has at least in part come from the perception of the range and rate of changes, as well as a punctuated narrative within which these changes are

conceived. Recent work on the fine-grained chronologies of different site types in the early fourth millennium (Whittle, Healy, and Bayliss 2011) has done much to refine the sequence of this period. However, even at a relatively conservative estimate the overlap between the introductions of the Neolithic package and the latest uses of microlithic technologies (defined by archaeologists as a Mesolithic cultural trait) occurred over 60–470 years (95% probability), and more probably over 90–290 years (68% probability; Griffiths 2014a, 235). There was a considerable duration of overlap between people using late Mesolithic things and people using the earliest Neolithic things.

Within debates on the introduction of the Neolithic package, the role of domesticated plants and animals has received considerable attention. Despite this, the numbers of cereal macrofossils recovered can be highly variable, and many of these assemblages are recovered from placed or structured deposits that might suggest their presence in contexts as the result of special or ceremonial practices (Thomas 1999), or which might not reflect regular subsistence sources.

The presence of cereals (and more rarely other plant domesticates including flax) in post-and-slot-built structures and in pits is particularly interesting. The

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presence of domesticated plants in post-and-slot built structures like Lismore Fields, Derbyshire (Garton pers comm 2009; Griffiths 2011) as well as from Scottish timber ‘halls’ such as Balbridie, Aberdeenshire (Fairweather and Ralston 1993) may well have resulted from ceremonial activities rather than ‘simply’ domestic structures. Dense concentrations of cereals, such as that recovered from the ‘hearth’ associated with Carinated bowl fragments at Aston, Derbyshire (Reaney 1968, 77) are comparatively rare.

The interpretation of cereal remains has been tied up with the models that different archaeologists have applied to the ‘Mesolithic-Neolithic Transition’. Some researchers have seen the presence of cereals as part of colonisations at the start of the Neolithic (cf. Sheridan 2010), while others have seen their introduction and adoption as part of a slower process (Thomas 1999). Within recent revisions to the chronological sequences of the new types of sites of the early fourth millennium as a whole (Whittle, Healy, and Bayliss 2011), there is scope for more complex, non-linear movements of people and things. In highly simplistic terms, when archaeologists have been interested in cereal remains, they have often been interested in them as proxies for the ways in which the Neolithic might have begun in Britain and Ireland. The use by archaeologists of domesticated plants and animals as proxies for the spread of ‘the Neolithic’ has resulted in a series of specific questions – were cereals everywhere introduced as part of a package? Is there variation in the timing and duration over which cereals become present in the archaeological record? – with which to engage with the nature of the early fourth millennium cal BC.

Recent research into the chronology of the Neolithic package in Britain and Ireland has revolutionised our understanding of the timing and tempo of change during this period (e.g. Whittle, Healy, and Bayliss 2011; Whitehouse et al. 2014; McClatchie et al. 2016). With the exception of important work by Whittle, Healy, and Bayliss (2011) on the circulation of non-local axeheads, these projects did not examine the chronology of specific aspects of ‘the Neolithic package’ independent to each other within separate site-specific Bayesian modelling approaches. Beyond refining the sequence of the changes apparent in the archaeological record in the fourth millennium BC, ‘unpacking the Neolithic package’ is important for the ways we write archaeology in this period for three reasons.

Firstly, unpacking the package chronologically challenges essential concepts that structure how we write archaeological narratives of change; how we use different language to write about time, change and evidence for it from the archaeological record, and how this can impact on the kinds of narratives we write. Secondly, because the ‘Neolithic package’ of archaeological material culture and sites can assume canonical status, non-canonical evidence (whether in atypical sites,

regional variations, and so on) can become downplayed in narratives. Thirdly, because as archaeologists ‘the Neolithic package’ can take on a coherence or tangibility of its own, as a suite of material residues of practises and site signatures *that we expect* to identify in the field, and to uncover *on our own terms*.

Evaluating the chronology of domesticated plants offers the ideal means to approach the Neolithic package from a different, new way. This research will examine the chronology of the first cereal remains in Ireland and Britain against the background of the timing of the appearance of ‘the Neolithic package’ in different regions as calculated by Whittle, Healy, and Bayliss (2011) and Griffiths (2011). This approach is in contrast to approaches that define ‘the Neolithic’ as a suite of attributes to be checked off, and will allow discussion of the three ways in which chronology and narrative interplay.

Direct radiocarbon measurements on domesticated plant remains provide the perfect opportunity for this type of investigation, because the measurements are *sui generis* estimates for the age of these ecofacts and these measurements cannot be altered by taphonomic issues, or post-depositional disturbance.

This approach of looking at direct radiocarbon measurements on plant domesticates rather than simply detailing the chronology of the Neolithic package as a whole, was undertaken following the recognition that on some early ‘Neolithic’ sites, there was patterning in the appearance of the different aspects of the package, especially with regard to domesticate cereal remains (Griffiths 2011). For example, White Horse Stone, Kent is one of the earliest ‘Neolithic’ sites in Britain (Bayliss et al. 2011), but results from cereals from the site probably post-date the earliest activity. These include one of the results on cereal grains (NZA-21506), which was recovered from a hearth containing later Grooved ware pottery. By examining the results from White Horse Stone (Griffiths 2011), it became apparent that the first evidence for the introduction of cereals was not synonymous with the timing of the first appearance of ‘the Neolithic’ in Britain. In fact, here (see discussion below) there is a considerable difference between the estimate for the start of the Neolithic package as a whole, and the first evidence for cereals in southern England.

## Method

Direct radiocarbon measurements on domesticated plants (wheat, barley and flax) were collated from published sources from recent ‘big data’ projects that examined the timing of the early Neolithic package in Ireland and Britain (Whittle, Healy, and Bayliss 2011; Whitehouse et al. 2014) and from publicly accessible sources (Griffiths 2011). This comprised a sample of direct results on cereals or flax from 39 sites. Results on the Threeford structure, Northumberland were also contributed (Edwards pers comm). The results were modelled

using stratigraphic prior information where it existed, or based on the ‘neutral’ ‘bounded phase model’ for relating radiocarbon measurements from a single archaeological phase of activity in OxCal v4 (Bronk Ramsey 2009). Existing models were taken from Whittle, Healy, and Bayliss (2011) and Griffiths (2011), with data from new sites included as shown in the model code in the supplemental material. The island of Ireland, Wales and Scotland were modelled as separate spatial entities, while England was subdivided on the basis of Historic England regions. Estimates for the first dated event associated with cereal or domesticated plant remains were calculated from each region. In Ireland, calculations were produced to estimate the first dated event associated with cereals from burnt mounds and post-and-slot-built structures. Estimates for the first dated events associated with the appearance of plant domesticates were compared with regional estimates for the start of the Neolithic package in Ireland and Britain.

## Results and Discussion

Domesticated plants, when analysed independently from other ‘Neolithic’ material do not appear before the thirty-eighth century cal BC (Figure 1). When compared across different regions of Ireland and Britain, the first estimates for the presence of these remains seem to be reasonably spatially coherent; there does not appear to be a very clear geographically directional trend in the introduction of these resources at the available precision

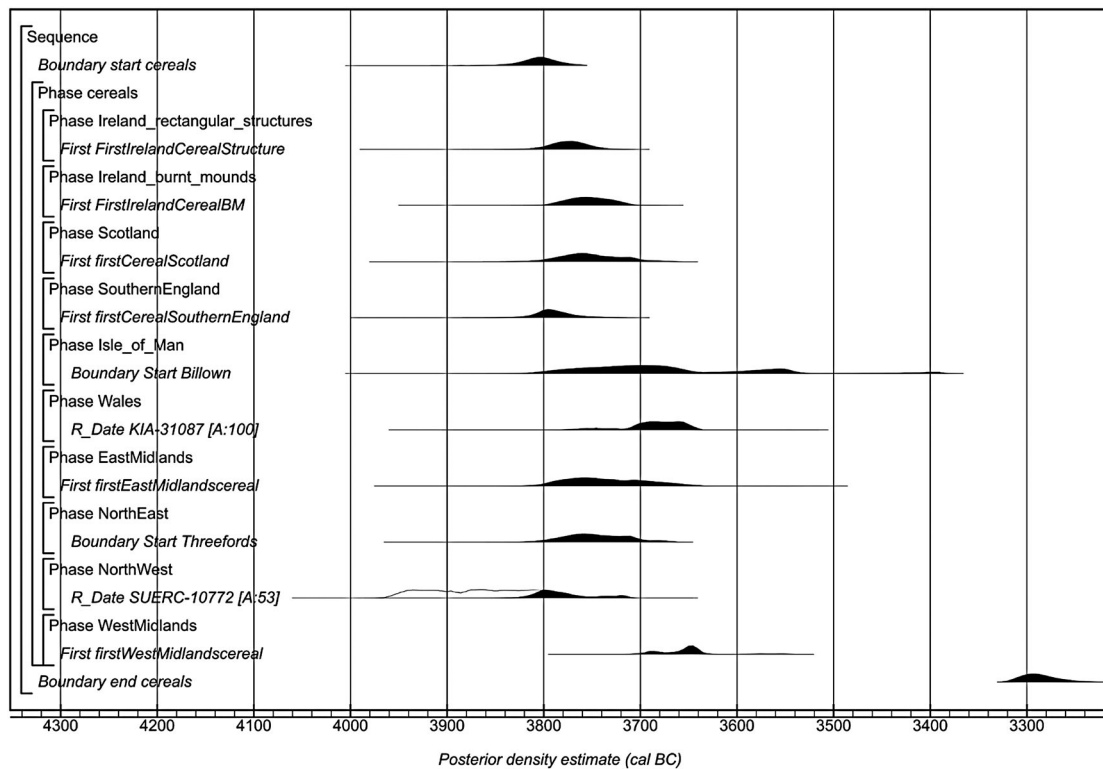
(Figure 2), though there may be some tentative indications that some coastal location saw the appearance of cereals early on (see below). When compared with the available evidence for the timing of the first Neolithic material culture and practices from these different regions, it is apparent that cereals post-date other evidence in a number of regions (Figure 3). This is most evident in southern England, and in Ireland (though dating of a number of earlier Neolithic sites here is problematic as at the Magheraboy enclosure, and the role of domesticates may be considerably more complicated as indicated by the Ferriter’s Cove evidence; cf. Sheridan 2010; Whittle, Healy, and Bayliss 2011). There are a number of possible interpretations of these results.

### Secondary cereals?

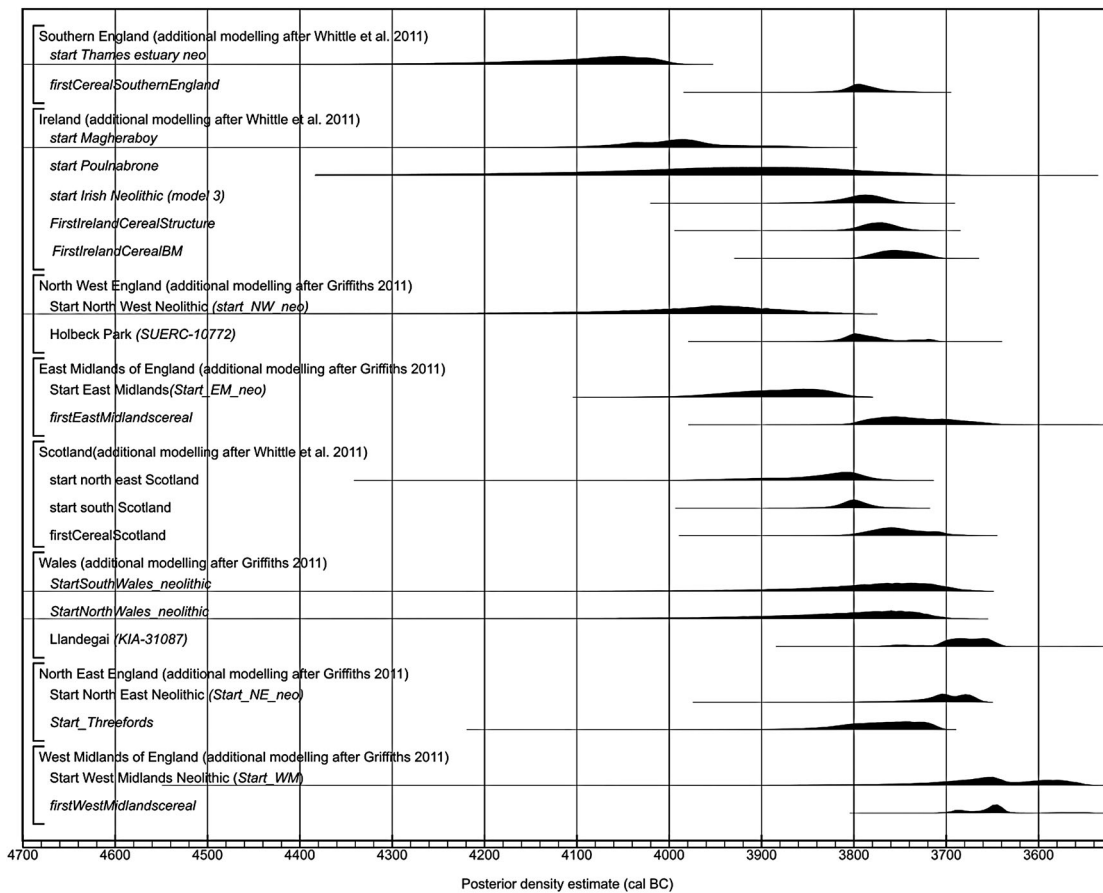
In archaeological terms, these results could indicate that domesticated plant remains formed part of ‘a subsequent Neolithic’, and that these resources were not necessarily part of the earliest Neolithic activity in all regions. This could be in keeping with a phased introduction or adoption of Neolithic lifeways, and would challenge the concept that the Neolithic package was introduced as a wholesale unit of practices and things. In this reading, cereals were not everywhere part of the earliest evidence we have for ‘the Neolithic’. This interpretation would suggest that in some regions – such as southern England, north west England and Ireland – burial practices,



**Figure 1.** Century time slices of sites in Britain and Ireland with direct radiocarbon measurements on domesticated plant macrofossils. The size of the markers represents the probability that a posterior density estimate for the presence of cereal macrofossils occurred at the date shown above each map.



**Figure 2.** Model output from modelling only radiocarbon results produced directly on domesticated plant remains.



**Figure 3.** Comparison of the output from the cereal model (shown as the lowest distribution in each set of regional results) and other relevant estimates for Neolithic activity. For the regional estimates for the start of Neolithic activity posterior density estimates are reproduced exactly from Whittle, Healy, and Bayliss (2011) and Griffiths (2011), readers are directed to these sources for the additional modelling to calculate these distributions. In many regions, early Neolithic activity pre-dates direct measurements on domesticated plant macrofossils from a region. Most direct radiocarbon measurements on domesticated plant remains do not pre-date the thirty-eighth century cal BC.

monuments and pottery were introduced *before* cereals and other plant domesticates enter the archaeological record. This evidence could be consistent with a phased introduction, perhaps by the sea (cf. Garrow and Sturt 2017) rather than a spread overland. In other parts of the study area – such as Scotland – there is much less difference between the timing of the appearance of cereals and the appearance of the Neolithic package as a whole. The evidence for lag could be indicative of a delay in the uptake of cereal cultivation as a result of incoming populations unfamiliar with environmental conditions or who put greater emphasis on the creation of monuments and the use of pottery, or perhaps the selective uptake of elements of these new resources by people who had always lived in the study area. If these results are not biased (see discussion below) they suggest that in many parts of the country the ‘Neolithic package’ and the idea of the Neolithic needs to be revised and qualified.

### *Under-sampling Early Cereals?*

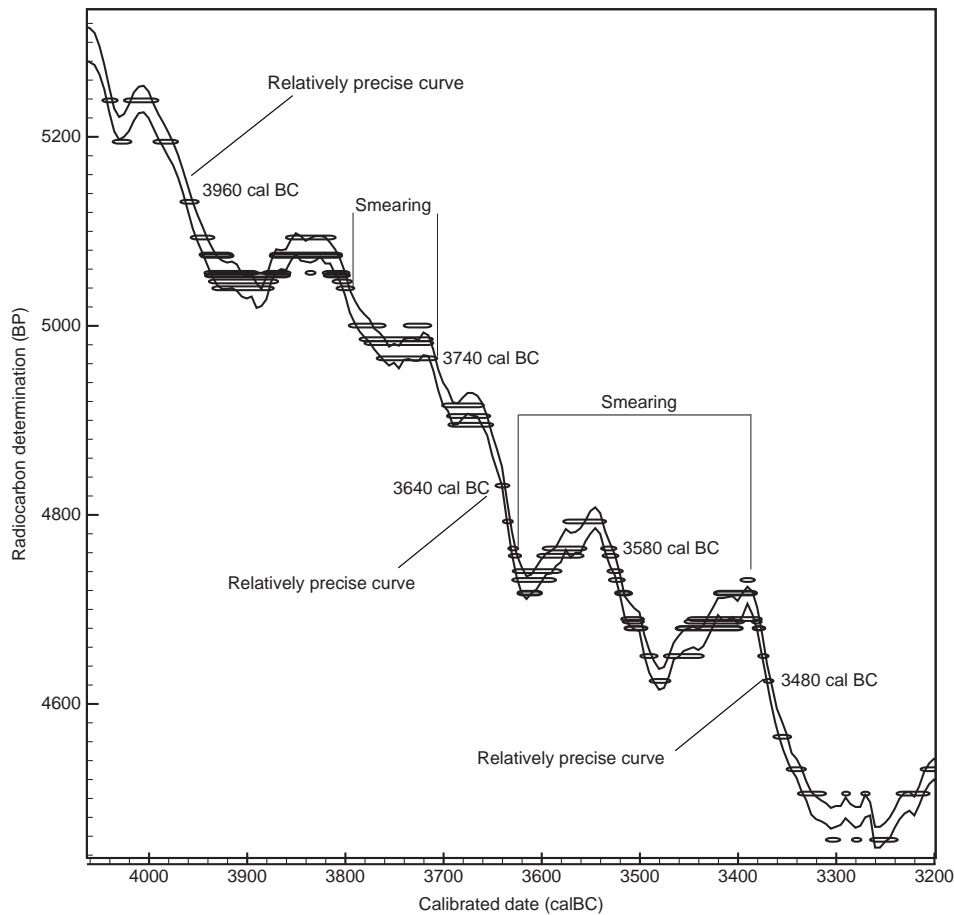
Whether or not cereals were introduced as part of a package of changes across Ireland and Britain at the same time, the earliest presence of these ecofacts may not be represented accurately, because not enough radiocarbon results exist on cereals. If cereals are not used systematically as samples for radiocarbon measurements (cf. Bishop 2015), the available estimates for the first presence of these things may not reflect their earliest appearance. This factor should emphasise the importance of producing radiocarbon measurements on intrinsically interesting material, such as cereals, which may provide estimates for the presence of the ecofact as well as an understanding of the age of deposit formation on a site. Sampling strategies for radiocarbon measurements should certainly emphasise this consideration in the future. This is also an issue of ‘big data’ approaches in studies of social changes in archaeology; small-scale, regional and site-specific evidence – which maybe fundamentally important to the processes by which practices and materials are adopted – tend to be down-weighted in favour of highly abstracted causal narratives.

In terms of the current data, the chronology of cereal macrofossils is certainly not represented by robust numbers of data in some regions. This is probably what is happening in the north west and north east of England where published radiocarbon measurements on early domesticated plant remains are relatively few. The lack of data is especially important in one key region, in Yorkshire, where we have the first evidence in Britain for chronological overlap between people using microliths (traditionally regarded by archaeologists as a Mesolithic cultural tradition) and aspects of the Neolithic package (Griffiths

2014a; 2014b; see discussion below). In order to subvert the traditional culture historic approaches to pre-history more considered sampling strategies need to be employed. For individual sites, sampling strategies must be representative of different feature types and the spatial extent of activity, but they should also aspire to interpretations that discuss change over time as part of a synthetic narrative, rather than attempting to quest for the earliest evidence for different phenomena or for culture historic-derived packages of changes.

### *Shape of the Calibration Curve?*

A compounding aspect of the interpretation of these limited data may be the shape of the calibration curve in the first quarter of the fourth millennium cal BC (Figure 4). The shape around the key period of the thirty-eighth century cal BC could be contributing to an appearance of more punctuated change than actually was the case. This would be augmented if the sample of radiocarbon measurements is not representative of the timing of the earliest appearance of cereals, and if there are relatively few data. Both of these factors are critical for the interpretation of early cereal domesticates in Ireland and Britain as a whole, and especially when comparing regions within this area. For example in the north west of England, within this published dataset, only one radiocarbon result on a domesticated plant exists from the early fourth millennium, on a cereal grain from a treethrow from Holbeck Park, Cumbria (Evans 2008; Evans, *Forthcoming*). This feature contained other material culture including early pottery. The radiocarbon result on the cereal from this feature (SUERC-10772; 3970-3770 cal BC; 95% confidence), produces a calibrated radiocarbon date range most probably before the relatively steep part of the curve equivalent to the first half of the thirty-eighth century cal BC. However, in the modelling solution of the study region overall, this distribution is constrained to be later, because of the absence of other cereal data from the region and an assumption that the results on cereal grains shown in this model are uniformly distributed. The feature at Holbeck Park is important as it includes new Neolithic things, but also continues practices that are also found in much older Mesolithic traditions (cf. Lamdin-Whymark 2008). In this specific case the impact of the shape of the calibration curve maybe marked, but the same underlying problems are evident in the White Horse Stone example discussed above, where examining radiocarbon distributions against the calibration curve can be informative. If we expect ‘the Neolithic’ to be a package that always post-dates ‘the Mesolithic’ we will ignore or gloss over potential nuances and variation in evidence and reproduce directional, simplistic causal narratives.



**Figure 4.** The shape of the calibration curve in the earlier fourth millennium cal BC could be contributing to apparent patterns in the data (adapted from Griffiths 2011).

### **The Nature of Change; Betwixt and Between Received Models**

Models of change in the early fourth millennium have variously emphasised indigenous adoption of continental European practices associated with distinct belief systems (e.g. Thomas 1999), and incoming colonists bringing materials and practices with them through a variety of mooted routes (e.g. Sheridan 2010), or stressed that there may be ‘middle ways’ between these extremes (Whittle, Healy, and Bayliss 2011). However, whichever emphasis these approaches take, they all rely on the idea of ‘the Neolithic’ generally and often specifically on the concept of ‘the Neolithic package’. As concepts that contemporary archaeologists apply to the past, ‘the Neolithic’ and ‘the Neolithic Transition’ has taken on the coherence and integrity of an analytical unit (cf. Clarke 1972). Indeed, in Ireland and Britain, the problem with the coherence of these analytical constructs has been highlighted by the creation of ‘various Neolithics’, ‘primary Neolithics’, ‘secondary Neolithics’ and so on (e.g. Pigott 1954; McClatchie et al. 2016). In thinking about such work, environmental archaeologists might be put in mind of the writing of the late John Evans on the concept of palaeoclimate in archaeology. Evans (2004, 96) emphasised the complex abstraction that

forms our ideas of climate. He noted that you ‘... cannot dig a hole in a peat bog and find an ancient climate like you can an ancient insect’ (Evans 2004, 96). Thinking about the role that ancient domesticated plants held in Ireland and Britain in the early fourth millennium BC in similar terms might be instructive. We should not expect to find fourth millennium cereals (or any of the material culture that is defined by archaeologists as part of the diagnostic Neolithic package) in archaeological deposits and expect to have ‘found’ the Neolithic. The Neolithic that we dig up may not conform to our expectations. More specifically, there is no such thing as the smoking-gun of the ‘Mesolithic-Neolithic Transition’ waiting to be found, and if there is it will almost certainly not conform to our expectations.

### **Conclusion**

In terms of this case study, cereals may not have been part of the first Neolithic presence in many regions of Ireland and Britain, instead of forming a subsequent development after practices including building monuments in the form of causewayed enclosures, tombs and in some regions post-and-slot-built structures. The current results suggest that cereals



were not introduced everywhere as part of a Neolithic package. A contributory factor to this pattern could be an under-sampling of the earliest cereal remains in different regions in terms of representative radiocarbon results. This is almost certainly what is happening in the north of England where published, early cereals which have been used as samples for direct radiocarbon measurements are relatively few. The shape of the calibration curve may also be contributing to an impression of changed focus on the 38th century, or differentiated either side of it.

In Ireland and Britain, an approach exists that privileges the Neolithic package or ‘culture’, and includes the seemingly neutral observation that the ‘Neolithic’ always post-dates ‘the Mesolithic’. By doing this we significantly over simplify the nature of change, and forcing our data into our interpretive units or ‘iconic analogues’ in Clarke’s (1972) terms. If this approach continues, rather than embracing the fully revolutionary (cf. Bronk Ramsey 2008; Bayliss 2009) potential of Bayesian statistics, we will only continue to refine the *sequences* of our narratives, and fail to engage critically with the revolutionary structural changes that these new approaches should offer (Griffiths 2017).

In this sense, when archaeologists attempt to write histories of things, and places, and people there is a need to go beyond simply writing about the timings of things (in this case study cereals), and to address more fundamentally questions of how we write our histories of previously prehistoric times. We need to use our new scientific data (including our chronologies) to push back against the suppositions that shape our fundamental models and in turn structure our narratives.

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